Bank of England

Discussion Papers

Technical Series

No 6

A recursive model of personal sector expenditure and accumulation

by

E P Davis

February 1984

No 6

A recursive model of personal sector expenditure and accumulation

by

E P Davis

February 1984

The object of this Technical Series of Discussion Papers is to give wider circulation to econometric research work being undertaken in the Bank and to invite comment upon it; any comments should be sent to the author at the address given below. The views expressed are his own, and not necessarily those of the Bank of England.

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.

ISBN 0 903312 62 X
ISSN 0263-6123

Contents

1	Introduction	1
2	The data	3
3	Theoretical background	9
4	Equations	16
5	Tracking and Simulations	23
6	Variants	36
7	The sector incorporated into a macroeconomic model	48
Conclusions and further work		52
Appendix 1:	Charts	55
Appendix 2:	Equation Specifications	62
Appendix 3:	Tracking and simulation results	75
References		93

1

Introduction

This paper describes a quarterly model of personal sector expenditure and net (1) asset accumulation decisions. This sectoral model treats incomes, interest rates and prices (except house prices) as exogenous, and thus does not provide a full account of the behaviour of the personal sector in the economy, given the existence of feedbacks from consumer demand to incomes and prices. It also treats building society behaviour as exogenous, although in practice interest rates and mortgage lending are largely determined by the rate of inflow of saving from the personal sector. The deficiencies are remedied by incorporating this sub-model into the Bank's main macroeconomic model. The results in this paper, however, relate only to the manipulation of the free-standing sectoral model (2).

The basic structure of the personal sector model is as follows. Consumers decide initially on their consumption levels, mainly on the basis of their current incomes (adjusted for inflation losses on the real value of net liquid assets), past levels of consumption and real stocks of net liquid assets. Net saving, the difference between consumption and unadjusted current income, is then allocated between tangible and financial assets using rather arbitrary equations for personal sector stockbuilding and investment. The remainder, the net acquisition of financial assets, is allocated between net liquid and illiquid assets on the basis of relative interest rates and prices, and the ratio of net liquid asset stocks to net wealth, which gives a lagged adjustment to a desired portfolio composition where net liquid and illiquid assets are a certain proportion of total wealth, given prices and interest rates. Loans for house purchase and net contributions to pension funds are additional explanatory variables in the implicit illiquid assets equation. Changes in nominal net financial wealth are determined by revaluation of illiquid financial assets modelled by reference to the share price index, as well as by the net acquisition of financial assets. Changes in tangible wealth are determined by revaluations of the owner occupied housing stock as given by a house price index, as well as by stockbuilding, investment in housing and

---

The author is particularly grateful to C B Briault, G P Dunn, J S Flemming, N H Jenkinson, G Midgley, K D Patterson, A R Threadgold and J Townend for comments, advice and assistance. The errors remain his own responsibility.

(1) 'Net' assets are gross assets minus gross liabilities - for example in the case of liquid assets they are gross liquid assets minus bank borrowing.

(2) A description and reports of simulations of the full Bank model will be presented in a forthcoming Bank discussion paper.

consumers' expenditure on durables. Total wealth, given by the cumulation of changes in financial and tangible wealth, then feeds back to influence the choice between liquid and illiquid financial assets.

A simple example of the operation of the model is given by the effects of increases in asset prices. These increase total wealth, and thus lead to an increase in desired liquid assets which is slowly implemented, by transformation of illiquid financial assets to liquid form. This increase in liquidity raises the liquidity to income ratio, leading persons to increase their consumption.

The system thus basically involves a sequential choice process, with later decisions feeding back with lags earlier in the process. Both weak exogeneity and strong exogeneity (1) of these decisions is assumed. It should be emphasised that the alternative hypothesis of simultaneity has not been tested (2).

The rest of the paper is organised in six sections. First, the data which is to be explained is examined. Secondly, the theoretical background to the model is developed, followed by a description of the equations. The model's performance in simulations, both inside and outside sample, and the responses of key variables to shocks, are described in Section 5. Section 6 notes some problems with the model as it stands, with reference to the role of bank lending and stock prices, and the effect on income of interest rates, and assesses the performance of variants that try to take these into account. Section 7 briefly examines the behaviour of the sector in a macroeconomic model.

---

(1) Weak exogeneity is required for valid estimation of equations, eg for consumption, featuring lagged values of other variables, eg liquid assets. Strong exogeneity is needed for validity of simulations using such equations where, for example, the identity $Y = C + S$ links consumption to saving. See Hendry and Richard (1983) for a discussion of these concepts.

(2) Some work has been done on simultaneous models of consumption and accumulation - see, for example, Coghlan and Jackson (1979). It might be noted that simultaneity can arise both if consumers make simultaneous decisions, or if there are simultaneous feedbacks, eg from consumption to income, of which consumers may be unaware but which influence behaviour.

2

The Data

The data which the model seeks to explain are illustrated in Appendix 1, Charts 1-11, while the means, standard deviations and coefficients of variation of the series are shown in table 1, p61. Comments on the series, which are all shown at 1975 prices, follow.

Chart 1 shows income, consumption and saving. A first feature of note is the size of non durable consumption - it accounts for around 80% of personal disposable income, and indeed comprises over 60% of gross domestic product (as measured by expenditure). This aggregate has increased steadily through time, in line with real income, though subject to fewer fluctuations - a coefficient of variation (CV)(1) of 0.109 compared with 0.116 and 0.145 for the measures of income (2). The difference between income and consumption, saving, is as a result more variable (a CV of 0.389) - indeed it has been subject to much greater fluctuation than consumption, either of durables (CV = 0.246) or non durables. Moreover, the standard deviation of saving is half the size of that of non durable consumption, despite saving being less than one-fifth of the size on non-durable consumption.

Besides its variability, measured saving is shown to have increased in real terms over the 1970s relative to consumption (3) (an effect that can also be seen in Chart 2, which plots saving and consumption as proportions of income), though this trend has reversed since late 1980. It has been argued that this phenomenon is due to a mismeasurement in the National Accounts of income (and thus saving) over inflationary periods, when the inflation compensation element of nominal interest receipts effectively represent (real) capital repayments (4). It is for this reason that in Chart 1

---

(1) The coefficient of variation (= standard deviation/mean) is a statistic usable for comparing the variability of two series.

(2) The result that consumption is less variable than income about a trend is predicted by all three basic theories of the determination of consumption, viz the Absolute Income Hypothesis (see Keynes (1936)), the Relative Income Hypothesis (Duesenberry (1949) and the Permanent Income Hypothesis (Friedman (1957)). For a review of the various theories, see Ferber (1973).

(3) This is true even after deduction of contractual savings made through life assurance and pension funds. (For an analysis of the committed and voluntary components of saving, see Toland (1981).)

(4) The inflation adjustment of saving is discussed at length in Taylor and Threadgold (1979).

real household disposable income adjusted for losses on liquid assets is plotted as well as the conventional real personal disposable income. While the latter only deducts payments of income tax and employees' national insurance from total personal income, the latter makes further adjustments.

Deduction of estimated losses due to inflation on real net liquid asset stocks attempts to correct for the mismeasurement of income. This "adjusted personal disposable income" less consumption gives 'real' saving, ie that portion which represents an addition to wealth (1). In order to arrive at an approximation of household income, the net increase in life and pension funds (LAPFs) is also deducted (2). Since the increase in these funds form the bulk of committed saving, subtraction of consumption from household income adjusted for both real inflation losses and the increase in LAPFs gives voluntary (or "real household") saving which, as shown on Chart 1, has often been negative when borrowing has exceeded voluntary accumulation. This was so during the mid-1970s when the acceleration of inflation and inflation expectations was associated with negative real household saving, consistent with the view that consumers would bring forward purchase of consumption goods in inflationary periods. Such a response is, however, masked by the conventional measure of saving which increased with the acceleration of inflation.

Both of the measures of income have increased with economic growth, with slight falls over the recessions of 1975-6 and 1979-82. The gap between the measures has tended to increase in absolute and percentage terms. This widening gap is largely the result of inflation - the gap was greatest in 1974-81 - rather than the result of increases in LAPFs as a proportion of income (which rose only 1 1/2% to 7 1/2% of personal disposable income in 1972-79).

The gap has narrowed in the 1980s, as falling inflation has led to some growth in the adjusted measure relative to constant measured RPDI. The fluctuations common to both measures of disposable income appear to be correlated with such variables as changes in direct taxes and transfers, interest rates, economic fluctuations, wage bargaining, the influence of incomes policy and unemployment. It should be noted that disposable wages and salaries form over half of disposable income.

---

(1) These definitions of income and saving are in line with the definition of real income adopted by Hicks (1939):"the accrual that would leave real wealth intact".

(2) The net increase in LAPFs is the sum of contributions and other income of the funds less pensions paid. This quantity is the difference between personal and household income because pension funds are part of the personal sector but not the household sector. The household definition might be felt better for predicting consumption because of the contractual nature of the payments in all but the long run, which mean that they increase saving one-to-one, together with the imperfection of the capital market, which mean that equity cannot be borrowed against. This is supported by empirical evidence in Threadgold (1978).

A final track on Chart 1 is consumption of durables. Like non durables, this has been subject to secular growth, but a greater proportionate degree of variability - the second quarter of 1979, for example, involved a 30% increase in expenditure. Such fluctuations are a result of the nature of durables. Since they last for several periods, their purchase can be postponed or advanced in the light of current information - for example in 1979 an increase in the rate of VAT was announced in advance, which led to a short-lived but very substantial increase in purchases. The instability of durables (which can be regarded as saving in the form of tangible assets) is far less marked than that of financial saving, however (1).

Chart 2 shows consumption and saving as proportions of conventionally measured personal disposable income (pdi). It can be seen that expenditure on durables has been a relatively constant 7-8% of pdi, while non durables have declined. By contrast, Chart 3 shows consumption and real household saving as proportions of adjusted real household disposable income. The most striking feature is that real saving has often been negative, particularly in the mid 1970s. Durables expenditure has tended to increase as a proportion of adjusted income - a result that might be expected given their high income elasticity and a period of growing real income. The proportion of non durables is less trended, tending to rise and decline inversely with saving. It is notable, however, that in two periods in the mid 1970s non durables consumption alone exceeded adjusted income.

An analysis of the components of conventionally measured saving is shown in Chart 4. Capital account transactions (or the "gross acquisition of tangible assets") are fixed investment, principally in dwellings, and investment in inventories. Although this quantity has varied quite sharply from quarter to quarter, its instability is less than that of saving, a coefficient of variation of 0.194. The residual is the net acquisition of financial assets, which, as shown, is subject to extreme fluctuations, often of well over 100% in one quarter (CV = 0.558). The measure shown here excludes mortgage lending and life and pension fund transactions, leaving the quantity which is then subject to choice between accumulation in liquid and illiquid form. The track (and instability) of the 'conventional' measure is similar. As can be seen, both capital and financial account transactions have tended to increase over the long term, at 1975 prices, even after adjustment for growth, in line with saving. Financial asset acquisition

---

(1) For discussions of the theories of durables expenditure, see Cuthbertson (1980), Deaton and Muellbauer (1980).

was particularly high over 1973-6 and 1979-81. These periods featured rapid inflation, and hence the greatest degree of mismeasurement of saving, as defined above. Capital account transactions appear to follow the business cycle, particularly as it affects housing - one might instance the declines over 1973-4 and 1979-80.

Some of the variables underlying the capital account are shown in Chart 5, which shows the behaviour of the housing market. Private sector housing investment and council house sales are also the key components of the change in the owner occupied housing stock, a major component of wealth. Council house sales appear to respond principally to government policy - note the peaks during 1972-3 and 1980-2, though demand is obviously also important. The latter period has seen a greater increase in sales due to a greater desire for owner occupation, funds more freely available, and a higher opportunity cost (ie higher council house rents and subsidised prices of the council houses). Housing investment, as noted, is correlated with the economic cycle - housebuilding activity is a leading indicator (1) and, in some ways, can be held to cause fluctuations in output (via the multiplier-accelerator process). Most empirical studies (2) have found its determinants to be interest rates, costs and house prices, which proxy demand. House prices have been subject to two large cycles of inflation over the period analysed, with booms in 1972-3 and 1978-9, reflected in increases in the real value of owner occupied housing stock as shown in Chart 6. House prices appear to respond in the short run chiefly to changes in the determinants of housing demand, namely interest rates and income as reflected in mortgage flows (3) - note the increases in income and mortgage flows in 1972 and 1978, shown in Charts 1 and 9 - though, as with durables, the key to their instability is probably the discretionary nature of house purchase and sale. It can be advanced and postponed in the light of market conditions, thus producing periods of exceptional slackness and boom, 1981 and early 1982 being an example of the former.

The effects of these housing market variables on personal sector tangible wealth deflated by consumer prices are shown in Chart 6. The value of the owner occupied housing stock is revealed as the major component of tangible wealth. There is a trend increase in this aggregate, due to increasing home ownership over time, but the major movements reflect changes in relative house prices. The other components

---

(1) Housing starts are used as a component of the Central Statistical Office's index of longer leading indicators, see Ward (1980). However, this should be distinguished from housing investment as measured in the national accounts and used here which measures sales of houses to persons (after completion).

(2) See Savage (1978) for a survey of extant empirical work.

(3) For a series of articles on the determination and effects of house prices, see Building Societies Association (1981).

of tangible wealth include the stock of consumer durables and stocks of inventories. Compared with the company sector, the inventories of the personal sector have tended to be relatively flat - a CV of 0.178. (It should be remembered that the personal sector includes unincorporated businesses.) Agricultural land, other land and buildings, and plant and machinery form the rest of persons' tangible wealth portfolio. These are not illustrated above; their real value broadly follows the business cycle and trends in agricultural activity.

The other component of persons' net wealth is net financial wealth. Chart 7 shows this aggregate, and its liquid and illiquid components all deflated by consumer prices. Net liquid assets are gross liquid assets less gross liquid liabilities (bank borrowing excluding loans for house purchase), while net illiquid assets deduct mortgage borrowing. Net financial wealth is the sum of these. The most striking feature of this chart is the collapse of real net illiquid financial wealth during the 1973 to 1975 stock market collapse, which was itself associated with the first oil price shock. As a result of this, real net financial wealth is still 25% below the peak levels of 1969 and 1972. Apart from this, the overall stability of real net liquid assets compared with illiquid assets is also notable - a CV of 0.107 compared with 0.315: the latter account for most of the fluctuations in total financial wealth (again, principally via fluctuations in stock market values). The stability of real net liquid assets, despite the rapid inflation observed over the 1970s, may also illustrate the efforts made by persons to maintain their stocks of such assets. Although the net liquid asset stock fell relative to personal disposable income, it has been maintained relative to adjusted household income. The path of illiquid assets does not reveal the change in means of holding financial assets over the period: persons now tend to hold equities and gilts to a much greater extent via life insurance companies and pension funds and other institutions rather than directly, though the remaining stock of directly held illiquid portfolio capital should not be underestimated. It still accounts for a quarter of net financial wealth, and over half of net illiquid financial asset stocks.

Chart 8 brings together tangible and financial wealth to show the pattern of net wealth of the personal sector. It can be seen that increasing tangible wealth has offset declining financial wealth to give flat or slightly growing net wealth, subject to large fluctuations. The extent of the switch from financial to tangible wealth can be gauged by observing that, in 1967-70, they were each 50% of net wealth, while, now, tangible wealth is two-thirds and net financial wealth is only one-third of net wealth. Part of this shift is explicable by the fact that borrowing to finance tangible assets reduces net financial assets (1). But

---

(1) The data series used suggest that persons have no tangible liabilities. Nevertheless, the decline in financial wealth is also marked in gross terms, see Chart 11.

it is mainly a result of changing prices - the house price/share price ratio doubled between 1969 and 1982 - though the increasing owner occupied housing stock has also increased tangible wealth in real terms.

Charts 9-11 illustrate the gross components of the various real net wealth measures. The common features are a lower level of liabilities than assets - the personal sector is a net creditor in all these asset categories - and also a lower standard deviation, ie liabilities fluctuate less in an absolute sense than assets, ensuring that gross assets tend to follow broadly the same track as net assets.

Chart 9 shows real net and gross liquid assets and bank borrowing (gross liquid liabilities) - excluding bank loans for house purchase. Both assets and liabilities reached peak levels in 1973, and troughs in 1976-7, but real gross liquid assets have grown more strongly than real liabilities since then, except for the period since 1981. 1972-3 was, of course, the period of high bank borrowing following the 'competition and credit control' liberalisation, and growth since 1981 has followed the removal of the 'corset'. The decline in real gross liquid asset stocks in the mid 1970s coincides with a period of high inflation.

Chart 10 gives the corresponding levels for real illiquid financial balances. The 1973 to 1975 stock market collapse dominates the path of the gross as well as the net asset measure, while liabilities - mortgages - were unaffected. Real mortgage stocks have grown consistently but growth was most pronounced in 1970-3, 1977-9 and 1980-2. The first two of these periods have coincided with house price booms. Mortgages correspond to the growing gap between gross and net illiquid assets.

Chart 11 shows gross and net financial assets and gross financial liabilities. Again, gross and net financial wealth are dominated by the stock market collapse, though the subsequent recovery of gross liquid assets ensures that the current figure is higher relative to pre-1973 levels than in the case of illiquid financial assets alone. Combination of bank and mortgage loans give a steady growth of real debt over the period shown, less prone to fluctuations during periods of control than is bank lending alone. The chart also shows the summation of real tangible assets, real gross and net financial assets. Real gross wealth moves broadly in line with real net wealth though real liabilities represent a growing wedge between them.

The model described below attempts to explain the changes in the various series shown in the charts. The performance of the equations should be assessed in combination with these charts and diagnostics - for example, a large error in tracking the net acquisition of financial assets may be acceptable in the light of the high variance of the series.

The next section describes a theoretical structure underlying the empirical model used to explain these series.

3

Theoretical background

The section indicates the strands of economic theory which underlie the equation specifications chosen for the model. It does not attempt to survey the literature in depth, nor to make any theoretical developments. Also, the specifications themselves, which basically form a sector of a macroeconomic model, do not follow the theory outlined below with a high degree of rigour.

The basic Becker-Lancaster (1) neoclassical theory of consumer behaviour suggests that the individual consumer has a series of wants, whose ordering may be described by a utility function. Over a lifetime, there will be a set of exclusive choices, among which one is chosen to maximise satisfaction. The vector of attributes chosen as a result of this decision define lifetime demand for goods and services and for assets. In a pure lifecycle model, the only variable besides prices needed to determine the demand for goods and services is expected lifecycle wealth, both human and non-human; given perfect capital markets, the consumer can freely borrow against all of his assets. In the real world, the consumer faces several additional constraints on lifetime optimisation.

1 Capital markets are not perfect - this is particularly due to the difficulty of pledging the present value of the return on human wealth (ie future wage earnings) as a security on loans, though also due to asymmetries in information between lenders and borrowers which make the risks of lending to certain individuals too great. As a result, consumers often face limits on borrowing. Such consumers are liquidity constrained, see Tobin (1972), Flemming (1973), Pissarides (1978) and thus their consumption will be closely tied to receipts of income, though current non-human wealth (especially that which is most liquid, eg net liquid assets) will also be available for consumption. (See Townend (1976).)

2 The lifetime decision process is likely to be too complex to be carried out as a whole, and hence may be factored (2) so that, at each point of time, only a few alternatives need be considered. The information requirements postulated by the basic theory may be too great.

3 The consumer is likely to face shocks both to his or her levels of income, consumption and accumulation, and to the value of stocks of assets which have been accumulated. This suggests that, besides factoring the utility function,

(1) See, for example, Lancaster (1966), (1971).

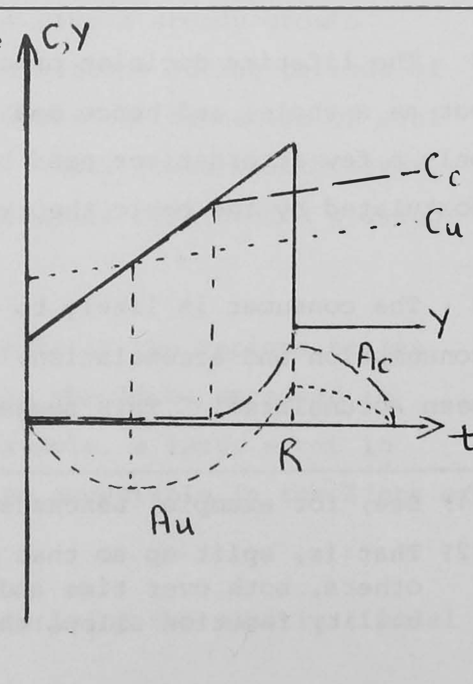
(2) That is, split up so that choices can be made which do not impinge on all others, both over time and at any given time. An additively separable utility function allows this type of restriction to hold.

the consumer will frequently wish to amend his allocation of income and wealth to consumption and further accumulation in the light of such unforeseen changes. Some expectational assumption is required to determine this response.

Besides the existence of these constraints, modelling of behaviour is made more complex by the fact that the population is not homogeneous in the constraints it faces, so simple aggregation may be invalid. The model is designed to take constraints 1-3 into account, though assuming a homogeneous population. The treatment of each constraint is discussed below.

Liquidity constraints imply that most consumers cannot consume at the level defined by their lifetime consumption plan, particularly at the points where heavy borrowing would be required early in the life span. Welfare losses are incurred by these consumers, even though consumption can be made up later in the life cycle, due to forced intertemporal rearrangement. This has two major implications for constrained consumers - first, their net asset holdings will tend to exceed those of unconstrained consumers with the same levels of income (1). Secondly, their marginal propensity to consume will be higher than unconstrained consumers - those able to borrow less than they wish will spend any increase in their resources in order to move towards their optimal consumption path, while those already on this path will save a proportion of the increase, distributing the resulting increase in consumption over the life cycle. This may apply even to consumers with substantial assets if these are illiquid, ie either costly to encash or unacceptable as collateral for short-term loans - pension rights, used consumer durables, houses, equities and most gilts fall into at least one of these categories. The treatment of liquidity constraints in this empirical work is to include in the consumption functions income (ie the return on human and non-human wealth) and net liquid assets (to the extent that they deviate from long run equilibrium

(1) This point is illustrated for the zero interest case in this diagram. The common life cycle earnings path of the constrained and unconstrained is Y. The unconstrained are able to borrow, making their assets Au negative early in the life cycle and hence their consumption Cu can be above their income. After Cu=Y the borrowing is paid back and net assets are built up to maintain consumption after retirement at R. The unconstrained are forced to consume Cc at a level equal to their income until income exceeds their modified optimal consumption path, with more consumption than the unconstrained later in the life cycle. To this point, net assets Ac are zero, ie greater than Au. After this point, saving is required, such as to give a higher level of net assets at retirement than the unconstrained, in order to continue the higher desired level of consumption.

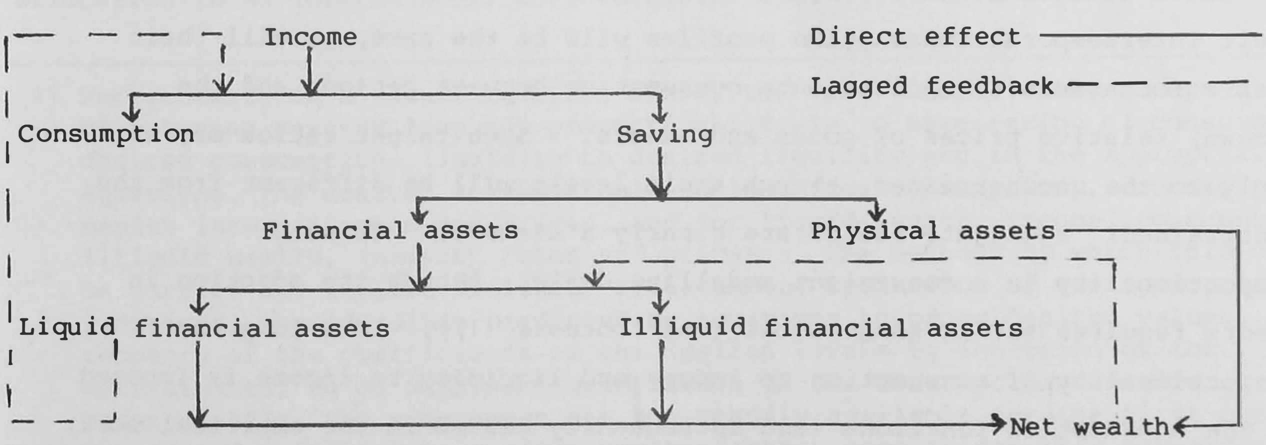


levels and thus represent deviations in resources from expected levels). The omission of other components of wealth from the consumption function is due to their illiquidity and hence near-zero elasticity with respect to consumption.

The estimation of simple consumption function (which determines the basic choice between consumption and accumulation) across the whole population, implicitly assumes that a constant (and high) proportion of the population is liquidity constrained, since the coefficients are in fact the result of choices made by a mixture of constrained and unconstrained individuals. Lacking disaggregated data this is an assumption which is difficult to avoid. A further limitation on such equations is that other constraints besides liquidity constraints are being ignored - for example, constraints on employment, which might imply a role for unemployment, in addition to its association with liquidity constraints.

Liquidity constraints imposed alone on the life cycle structure would merely imply a complex simultaneous decision process based on income instead of life cycle wealth. To overcome this problem, the decision process at any given time may be simplified by use of a utility tree (see Strotz (1957, 1959), Gorman (1959)). A possible factorisation is shown below, in solid lines.

It is assumed that the consumer initially decides on the amount that he will consume and save in a given period. The proportion accumulated is then divided between physical assets and financial assets. The proportion left for financial asset accumulation is then divided between liquid and illiquid assets.



This construct is considered a plausible factorisation of the decision process and a useful simplification of the model for econometric purposes.

The basic assertion of the utility tree is that the utility function is additively separable. A utility function is separable if the marginal rates of substitution between any two items in the same group are independent of the consumption/accumulation of goods in other groups - thus, for example, the choice between current accumulation of liquid and illiquid financial assets is asserted to be independent of current accumulation of physical assets. It does not, however, rule out recursivity, where the lagged result of another choice process influences the choice. Obviously in certain cases these assertions may be incorrect - for example, for lumpy purchases of physical goods these choices may be interdependent. Additivity extends this postulate to the different groups; thus the current choice between financial assets is independent of current accumulation of physical stocks. This utility tree is broadly implemented in the model outlined below

(i) by use only of the prices and quantities of assets concerned in the choice between them - thus, for example, the rate of interest on gilts does not enter the choice between consumption and saving; and

(ii) by specifying most equations for binary choices only, rather than multiple choice - for example, between liquid and illiquid financial assets (though binary choice is not necessary for separability).

Even if liquidity constrained (and using a tree-type decision process) utility maximisation under certain conditions will lead homogeneous consumers to maintain constant proportions between consumption, income and categories of wealth in a long run steady state (where prices and risks do not change)(1). Their intertemporal consumption profiles will be the same, as will their desire for assets to redistribute consumption between periods and the (known) relative prices of goods and assets. Such target ratios may also apply to the unconstrained, though their levels will be different from the constrained; aggregate ratios are clearly a mixture. Constant proportionality is a convenient modelling device, though its adoption in theory requires strong assumptions (see footnote (1)). The long run proportionality of consumption to income and liquidity to income is imposed in the consumption functions (and subsequently tested in the empirical work)

(1) Strictly, constant proportionality of these variables over time requires isoelastic utility functions and a constant interest rate.

Similarly, long run proportionality of liquidity to wealth (implicitly at constant relative interest rate) is imposed in the liquid asset function (and also subsequently tested)(1).

In fact, of course, consumers are subject to shocks (a stochastic environment) so that deviations from these long run desired ratios can and do occur. For example, current real income may fluctuate due to unemployment, an unforeseen stock market collapse will reduce aggregate wealth, an unanticipated increase in inflation might reduce the stock of real net liquid assets, and temporary shortages of certain types of goods may reduce consumption below long run desired levels. Terms in the level of income, consumption and wealth in the consumption and liquid assets (difference) functions are proxying feedback mechanisms which explain how on average consumers change their behaviour when faced with such deviations from long-run desired proportions. There is an implicit loss function underlying these equations; consumers attempt to minimise costs, where they attach costs to deviations from equilibrium but also face adjustment costs. (For a discussion of such mechanisms, see Hendry and Von Ungern Sternberg (1980).) Underlying these mechanisms is an expectational assumption based on contingency planning - for a discussion see p17.

With the exception of non-durable consumption (although this may be regarded as having a "psychic stock"), the inclusion of these feedback or long-run equilibrium mechanisms highlight the importance of wealth and liquidity stocks in consumer allocation in an intertemporal and stochastic context. This implies a further

---

(1) Particularly in a single equation sense, the most theoretically acceptable way of entering desired long run proportionality is to have ratios of consumption to desired consumption, liquidity to desired liquidity etc in the appropriate equations. The desired levels should include (for consumption), income, parts of wealth interest rates and prices, and for liquid assets, income, consumption, illiquid wealth, interest rates and prices. The methods by which this could be carried out include nonlinear simultaneous estimation of the appropriate functions, use of values predicted by equations to proxy desired values, or recovery of the coefficients of the desired levels by inclusion of the determinants, eg of desired liquid assets in the consumption function. Unfortunately, the programmes are not readily available for the first option, and the second and third have given unsatisfactory results for this researcher in the limited time available. Nevertheless, they are recommended avenues for future research. The modelling device actually adopted implies that current adjusted income is an adequate proxy for desired consumption and liquidity in the consumption function, and current net wealth is a proxy for desired liquidity in the liquid asset function. This is clearly incorrect in a single equation sense, insofar as it leaves out interest rates, prices, parts of wealth etc, though these variables will have some (small) effect in the long run steady state reduced form of the whole system.

"inverse" structure shown by the dashed lines in the diagram where net wealth is built up from the different assets, and the resulting aggregate affects consumption. In the model presented here, only net liquid assets directly enters the consumption function (and thus influences the choice between consumption and saving). Indirectly, however, all other components of wealth affect consumption, reflecting their impact on the (prior) choices between holdings of net liquid and net illiquid financial assets. It should be noted that these feedbacks are always from net assets, with no independent effect, for example, of bank borrowing on consumption. This structure is based both on theory (in particular, that only net concepts measure wealth in the long term) and empirical evidence. This choice is discussed in more detail below (Section 6, part 1). There are also feedbacks within equations from deviations of past "stocks" of liquid assets, durables and non-durables from desired levels. These feedbacks do not violate the factoring of demand described above or make the model simultaneous, as the determining stocks are always lagged, ie the model is recursive. This is an assumption which involves restrictions on the implicit utility function (see Blackorby et al (1978)).

Although recursivity is assumed, the actual variables that feed back at each stage in the recursive structure can be empirically tested; this has been done in a crude manner(1). In the net liquid assets equation, use of net financial wealth instead of total net wealth as a feedback mechanism gave a perverse sign, perhaps because net financial wealth has tended to fall over the 70s (due to the stock market collapse) while liquid asset stocks rose. The results for the consumption functions are summarised in the table below.

(1) Thomas and Abdullah (1983) have also tested different definitions of wealth in the framework of an HUS consumption function and found a role for illiquid assets in annual equations.

Alternative feedback mechanisms in the consumption functions
(test period 1968 I - 1980 IV)

		Coefficients and 't' values	
		Equation:	
Feedback mechanism		Durables	Non-durables
1	Net liquid assets/income	0.242 (1.7)	0.0343 (2.0)
2	Net wealth/income	0.149 (1.2)	0.0174 (1.2)
3	Net financial wealth/income	0.0378 (0.8)	0.00926 (2.5)
4	Net illiquid wealth/income	-0.173 (0.7)	-0.0395 (1.4)
	and		
	Net liquid assets/income	0.431 (1.4)	0.0761 (2.2)
5	Net illiquid financial wealth/income	-0.073 (1.3)	0.0075 (1.5)
	and		
	Net liquid assets/income	0.532 (2.0)	-0.00904 (0.3)

These results justify the use of net liquid assets in the consumption functions (though net financial wealth also works well in the non-durables equation), besides the theoretical justifications cited above. It should be noted that these feedbacks may imply various constraints on coefficients. These have not been imposed in the empirical model below.

The discussion in this section has summarised the key theoretical issues in the model. The model assumes a constant proportion of liquidity-constrained consumers acting according to an additively separable utility function, such that, in a steady state, proportions of consumption and assets to adjusted household income are constant, and in a stochastic environment consumers will act to correct deviations in these proportions from equilibrium. The resulting model is recursive. There are some further issues, particularly in the housing market, but these are dealt with in the description of the equations below.

4

Equations

The specifications of the equations in the model are given in Appendix 2. The equation (i) for real consumption of non-durable goods (CND) is based on a specification proposed by Hendry and Von Ungern Sternberg (1980). It implies that the level of consumption is equal to its average level over the previous four quarters, modified

(a) by changes in households' disposable income (1) adjusted for inflation losses on persons' real net liquid asset holdings (equation (iii)) - which increase consumption;

(b) by whether income (as in (a)) was accelerating - since consumption adjusts slowly to changes in income, the consumption to income ratio is lower, the more rapid the acceleration of income;

(c) by the relationship between consumption and income over the previous year - a relatively high level of consumption in the previous year will induce persons to consume less next period;

(d) by the lagged real net liquid asset to income ratio - which has a positive effect;

(e) by dummy variables allowing for exceptional levels of expenditure prior to budgets in 1968, 1973 and 1979, when changes in taxation were anticipated.

Determinants (a), (c) and (d) correspond to derivative, proportional and integral (2) control mechanisms, see Hendry and Von Ungern Sternberg (1980), which act to correct the short run path of consumption towards a long run equilibrium path where the consumption/income ratio is stably related to income growth, price inflation and the liquidity/income ratio. As noted above, income is adjusted in this equation by the subtraction of inflation losses on net liquid asset holdings, thereby eliminating increases in 'income' associated with inflation

---

(1) Defined as personal disposable income less the net increase in assets of life and pension funds (LVJ) and a proxy for their administrative costs (0.34 WS).

(2) There is some debate concerning the definition of integral control mechanisms. Some economists would argue that a wealth-income ratio is an error correction mechanism giving stock-flow equilibrium, while an integral control mechanism would be wealth alone. See Davidson (1983) for a discussion of these issues, and Phillips (1954, 1957) and Salmon (1982) for examples of the alternative approach to Hendry.

induced increases in nominal interest payments, and which may be better regarded as representing accelerated capital repayments and not extra real income (1). In order to minimise any biases caused by seasonal adjustment of the data (and in particular inconsistent seasonal adjustment between series) and to smooth the forecast path given irregular back data, all of the lags in the equation are averaged over four quarters. There is no role for forward looking expectations in this equation, though the chosen specification (of this and other equations in this model) can be shown to be based on a one-period loss function where agents' behaviour is described by conditional expectations functions, but agents have no control over the variability around the function (Hendry and Von Ungern Sternberg (1980) pp 240-1). In certain cases, these fundamentally backward looking planning rules based on feedback mechanisms can be shown empirically to outperform rational expectations formulations - as shown in Davidson and Hendry (1981). It should also be noted that a real interest rate term is not present in the non durables equation, though as noted above it may be theoretically desirable (it implies changes in the opportunity cost of postponing consumption). In fact, a suitable significant and correctly-signed coefficient could not be found (this is contrary to a result of Hendry reported in Davis (1982)). For further discussion of the specification, see the papers referred to above.

Real expenditure on durables, like non-durables (equation (ii)), is principally determined by changes in households' real adjusted disposable income and the past ratios of consumption to income and net liquidity to income. Income is again adjusted to allow for effects of inflation on monetary assets and liabilities, and the lags are averaged over the previous four quarters. However, additional variables are also included, a measure of hire purchase controls (the effective minimum deposit on durables) and the flow of real mortgage lending (by banks, building societies, insurance companies and the public sector)(2) and of the real interest rate (banks' base rate relative to the rate of consumer price inflation over the previous year - a backward looking measure.)

The flow of mortgages is intended to capture both the fact that durables such as furniture are often purchased at the same time as houses are purchased and the fact that, at the time of property exchange, the personal sector is often able to extract equity from the value of the housing

(1) For a wider discussion of 'real' saving, see Taylor and Threadgold (1979).

(2) Objections can be made to the inclusion of current period mortgage lending in a consumption function on the basis of simultaneity. However, this objection does not apply when mortgages are supply-constrained, as they were for most of the data period. Lagging mortgages by one quarter in any case makes no change to the size or significance of the coefficient on mortgages (or any other coefficient).

stock (1), a proportion of which is spent on durables. (This process is a realisation of accumulated gross illiquid wealth.) The level of the real interest rate is intended to represent the opportunity cost of consumption, and also the real price of credit (markups on account of costs of intermediation and tax complications mean it cannot be an exact representation of these).

The determination of real consumption, given income prices and lagged net liquid assets in the consumption functions, gives a level of saving (2). Part of this quantity is allocated to tangible assets, part to liquid and part to illiquid financial assets, these quantities accumulating to form wealth; the determination of these quantities is described below.

Tangible wealth is determined partly by a series of technical equations. For example, the value of stocks of consumer durables is determined by an equation (x) based on durables purchases and an assumed depreciation rate (such that the goods have a life of four years, which may be excessively short). Stocks of inventories and work in progress are determined by the rate of stockbuilding and stock appreciation (xi). Since these are determined by economy wide economic variables (and are of relatively trivial size), they have not been determined endogenously in this model of the personal sector.

These parts of tangible wealth are determined in a fairly ad hoc manner. The housing market, however, is developed in some detail as a key part of personal sector wealth - at the end of 1982, the value of the owner occupied housing stock accounted for 67% of tangible wealth and 44% of personal sector net wealth. Also it is a key source of interaction between financial and physical assets, as mortgage lending reduces net financial wealth but increases tangible wealth via purchase of new houses (and of consumer durables, as noted above). House prices are determined by an error-correction equation (iv) based on a specification by D F Hendry (3) where there is a long-run equilibrium relationship with real

---

(1) This may occur directly (where individuals borrow more than is necessary to buy their fresh house) or indirectly (when the value of mortgages issued is realised for example at the end of a housing 'chain' by the heirs of a deceased owner occupier). For a discussion of this process, see Davis and Saville (1982) and for estimates of the magnitude of equity extraction, see Bank of England (1983).

(2) This division between consumption and saving is not without ambiguities. Expenditure on durables is a form of saving in that the asset purchased can be consumed in later periods as well as the current period - hence stocks of durables form part of wealth.

(3) Reference: Building Societies' Association (1981).

incomes, real mortgage stocks (deflated by house prices) excluding those issued to purchase council houses (v), post tax mortgage interest rates and the owner occupied housing stock. Obviously, an increase in real incomes and mortgage stocks tend to raise house prices, while an increase in interest rates or the housing stock reduce them. Past 'disequilibrium' increases in house prices feed back via a reduction in the real value of the mortgage stock. These relationships are modified by empirically determined short run dynamics of these variables and the dependent variable. The cube of the lagged dependent variable is included to amplify changes in house prices as a rough way of representing the extrapolative nature of house price expectations and associated speculative activity in the 'transfer market'. The cause of such surges is the discretionary nature of housing transactions, as discussed above and in Davis and Saville (1982): transactors can hold back their houses until market conditions are right, thus ensuring sudden peaks in activity. In practice, the cubed variable has little effect on the equation, since quarterly increases in prices are rarely sufficiently high to make it a significant determinant of future prices.

The reason why house prices are determined endogenously in this framework, while other prices, eg consumer prices, are predetermined, is that house prices are determined almost wholly within the personal sector expenditure account - persons are both buyers and sellers, they take out and receive mortgages on the basis of their incomes, while supply is relatively inelastic in the short run. This conclusion would be strengthened were the building society sector part of the Bank model (see Pratt (1980)) to be added, in which case inflows, mortgage interest rates and mortgage flows would also be broadly endogenous. In contrast, although consumer prices may be partly affected by consumer demand, the empirical evidence appears strongest for a cost-plus markup theory of consumer price determination. It is plausible that labour costs (on the income side of the personal sector account) would have a certain effect in this framework, there are a myriad of other determinants of such costs and markups - exchange rates, raw materials costs, profit rate, etc. It would be extremely different to endogenise these effects in such a partial model as this.

House prices feed into housing investment (vi). This is the purchase by the personal sector of completed houses and grant aided improvements (non grant aided improvements are part of consumption). Nevertheless, the decision to invest does not lie wholly with the personal sector - builders, some of whom are part of the company sector, are required to build the houses first. It is for this reason that the equation features supply side factors, viz builders' labour and raw materials costs, the clearing banks' base rate, and house prices entered positively (1).

(1) The particular form of the equation is due to G P Dunn at the Bank of England. For a survey of empirical studies of housing investment, see Savage (1978).

Housing investment feeds into personal sector fixed investment (vii) which is a technical equation by which 98% of private housing investment, council house sales at current prices and 3% of other non residential non North Sea investment are allocated to persons in a partial adjustment framework.

The owner occupied housing stock (viii) is determined by private sector housing investment, sales of council houses to the personal sector, a constant to proxy transfers from the private rented sector, and a lagged dependent variable whose value below one implies depreciation of the stock by slum clearance, etc. The implied life of a house is 43 years, which might be felt to be rather short. The value of the owner occupied housing stock (equation (ix)) is determined by multiplying the stock by the mix-adjusted house price deflator and a constant implying the value of the average house sold in 1975 (when the deflator was 1). Obviously there may be problems when the value of a stock is measured by a mix-adjusted deflator which depends on the price of houses sold - if the stock is devalued by, for example, an influx of low-valued council housing - but it should be a reasonable rule of thumb.

Thus the value of stocks of durables, stocks of inventories and work in progress and the housing stock are determined directly. Scaling factors on durables and stocks are to allow for differences in measurement between the Bank's proxies and the Personal Sector Balance Sheets (1), published in 'Economic Trends' each February. The other parts of tangible wealth (agricultural land, other land and existing buildings and plant and machinery) are crudely proxied by the consumer price deflator, and again a partial adjustment specification allows for depreciatio (xii). Fixed investment is not used directly in the determination of these elements of personal sector tangible wealth.

As described in the section above, the flows determining tangible wealth are the value of the increase in stocks, housing fixed investment and investment in durables, of which the last is classified here as consumption. Total personal sector capital formation is deducted from saving to give the net acquisition of financial assets. But in order to arrive at a definition of the net acquisition

(1) These discrepancies may imply that the depreciation rate chosen for these variables are too high. Some discussion of the method of evaluation of stocks of durables in the Personal Sector Balance Sheets is given in Calder (1978).

of financial assets that is subject to allocative choice in the short term (identity (xiii)), the sector unidentified (1) and stock appreciation (neither of which are 'available' for portfolio investment) are also deducted, and net capital transfers, which feed directly to financial assets and not income, are added. In addition, loans for house purchase and the net increase in LAPFs (both determined outside this sub-model) are also excluded and allocated directly to the stock of net illiquid financial assets.

After these adjustments, the residual net acquisition of financial assets is then allocated between liquid and illiquid financial assets by a net liquid assets equation (equation (xv)). This is in 'error correction' form, with levels in a difference equation, to capture short run dynamics, while allowing a coherent long run solution - in which the desired level of liquid asset stocks depends on relative interest rates, prices of goods, the flow of the net acquisition of financial assets and the total stock of wealth.

Unlike most equations of this type, the equation is linear, principally because the (adjusted) net acquisition of financial assets can become negative (though it has not over the estimation period). The interest rates on liquid and illiquid assets are proxied by a weighted average of clearing banks' base rates and rates on building society shares, and the yield on 20-year gilts respectively, and the inflation rates are those of durable and non durable goods. The own-interest rate and durables inflation have positive signs, the latter indicating some complementarity perhaps because liquid asset accumulation is required prior to purchase of durables when their inflation rate is high. However, the net effect of balanced inflation is to reduce liquid asset accumulation in real terms as is the effect of an equal absolute increase in all interest rates. The former effect is direct - higher inflation reduces the value of real liquid asset stocks, while the latter indicates a substitution to illiquid assets when real interest rates rise. The liquid assets equation's integral control term (the lagged ratio of liquid assets to total wealth (2)) implies a long-run desired relationship between liquid and total (financial and tangible) wealth, deviations from which cause changes in portfolio allocation to correct the discrepancy. Apart from the integral term, all the variables in levels are also fed in as differences (to capture the dynamics of adjustment), except that the inflation rates and interest

(1) The residual adjustment is deducted at this stage because of a judgement that measurement from the financial side (borrowing) of persons' transactions is more reliable than from the income-expenditure side (income).

(2) It may be that different deflators are appropriate for these variables, as housing, for example, may be held to generate specific rather than general services.

rates are made into weighted averages. Increases in both of these variables (ie a rise in nominal interest rates, but with constant real interest rates) increase illiquid asset accumulation, perhaps because these changes reduce the value of the illiquid asset stock without shifting the yield curve, thus causing an unwanted change in portfolio balance, which is rectified by greater illiquid asset accumulation.

Net financial wealth is formed by an identity (xvii) which adds to the existing stock the net liquid assets determined in equation (XV) to the other flows arising from the net acquisition of financial assets (mortgages, retail trade credit, notes and coin (1), loans from the public sector, purchases of public sector long debt, portfolio investment, life and pension funds, the accruals adjustment). While this identity allows for the flows into portfolio wealth, a further part of the equation is needed to proxy lagged illiquid wealth subject to revaluation (basically total net financial wealth minus liquid assets and mortgages) multiplying this by the increase in the share price index and an imposed scaling factor to allow for the imperfection of the proxies for assets and returns.

Net wealth is formed by the summation of net financial wealth and tangible wealth (xx). It feeds back into the structure as described above.

(1) Exclusion of notes and coin from net liquid assets is an oddity of the financial accounts, as summarised in table 9.4 of "Financial Statistics".

5

Tracking and Simulations

The personal sector sub-model was tested both within and outside sample, and various simulations were run to show the way in which changes in key economic variables feed through the structure. These exercises are crucial to an assessment both of the performance and the plausibility of the model.

(a) Tests of the tracking performance of the model

Table 1 in Appendix 3 reports the root mean square percentage errors (RMSE%) of static and dynamic within-sample simulations over 1975 I - 1980 IV and an outside-sample dynamic simulation over 1981 I - 1982 IV, plus other diagnostics for the outside sample simulation.

The static (or one step ahead simultaneous) simulation reproduces the errors obtained by OLS by feeding in the actual values of lagged variables in equations, subject to changes where variables are fed through simultaneously. It thus captures cross equation residual correlations, and gives an indication of the variance of the system. The OLS errors are shown for comparison - the simultaneous effects do not appear to significantly worsen the errors. Non durable consumption, net liquid assets and the owner occupied housing stock are tracked particularly well, although the last series in particular exhibits little variation. Of the other quantities which are determined directly in equations, expenditure on durables, tangible wealth and net financial wealth, which are more volatile series, had RMSE%s of less than 5%, while housing investment and personal sector fixed investment have errors exceeding this. The other variables are residuals or aggregates. As anticipated in the discussion of the data, the RMSE% in the adjusted net acquisition of financial assets, which is both highly variable and a residual, is quite large at 11.4%. The RMSE on net illiquid financial assets, which is also determined as a residual, is more encouraging at 7%.

For comparison, a dynamic in-sample simulation was run over the same period, thus allowing errors to cumulate by feeding in the predicted values of lagged variables in equations. For several variables, the results are highly encouraging. In particular, for consumption of durables and non durables, the RMSEs fell slightly compared with the static error, as did the net acquisition of financial assets and net financial wealth. This may imply that the dynamic structure was self-correcting in the manner intended by its design, despite small (perhaps offsetting) increases in the errors on the main determinants of consumption, namely net liquid assets and (as a result) adjusted real income. Among the other variables, most of the increases in RMSE compared with the static simulation were trivial; the exception is house prices, where the equation manifested some instability in its dynamic structure. Most notable was an overprediction of the housing boom of 1978-9, in excess of 18%. By the end of 1980, the error had returned to 2%, however. This error naturally feeds into the value of the housing stock, though, when subsumed into tangible wealth and net wealth, the discrepancy is of a relatively small magnitude. Curiously, the error does not induce a large increase in the RMSE% on private sector housing investment; the effect of house prices offsets pre-existing static errors in the equation.

There has been some debate about the usefulness or otherwise of in-sample tracking exercises. Hendry and Richard (1982, 1983) have demonstrated that in-sample dynamic tracking performance can show little of the 'truth' or otherwise of a model, but only the influence of 'outside' factors. Indeed, if any in-sample tracking tests are to be used, the one step ahead exercises are the most useful. For a good discussion of historical tracking tests, see Dunn, Jenkinson and Michael (1984).

A test of the model's ability to forecast, indicating parameter stability, is an outside-sample dynamic simulation. It was for this reason that the equations were estimated only up to 1980/4 - this leaves data for 1981 and 1982 as a testbed (1). Inspection of the charts reveals that, for some variables in particular, ability to forecast this period well is a severe test. Consumption increased sharply, despite stagnant real incomes and, as a corollary, the saving ratio declined to levels not observed since before the 1970s inflation. House prices stagnated and then recovered to some extent. All the definitions of wealth start the period in decline in real terms but end on an upward track, despite the fall in the conventionally measured saving ratio.

---

(1) Estimation only up to 1980 Q4 also avoids the problem of the high susceptibility of recent data to revision - though this problem thus weakens the forecasting results.

The diagnostics shown for outside sample simulation include Theil's (1) 'U', 'UM' and the mean percentage errors for each year (end-year percentage error for stocks and prices) as well as the root mean square percentage error. For most of the key variables, the RMSE% is similar to or smaller than in-sample, suggesting that the model does not break down outside sample; this is true of the consumption variables, liquid assets, other financial and total wealth (2). Again there are some problems in the housing market, associated particularly with private sector investment which is grossly overpredicted. This overprediction is partly caused by errors in the house price equation, which overpredicts the low rates of house price inflation observed over 1981-82. These lead to corresponding errors in 1981 in the aggregates determining tangible wealth (it should be noted that data for these aggregates had to be estimated for 1982, due to the long lags in the compilation of their source, the Personal Sector Balance Sheets). Theil's 'U' and 'UM' indicate respectively that most of the forecasts are not perfect, but that errors in central tendency (ie deviations between average predicted change and actual change) are relatively small.

These simulations overall suggest that the system follows and predicts the behaviour of the personal sector well, given the high degree of exogeneity in the model. This is particularly true of consumption and the main wealth aggregates, which was the intention of the exercise. The housing market (house prices and investment) is tracked more erratically, but these errors appear to have

---

(1) Theil's (1966) 'U' is defined as:

$$U = \frac{\sum_{t=1}^{T-1} (P_t - A_t)^2}{\sum_{t=1}^{T-1} A_t^2}$$

where A_t is the actual percentage change in the dependent variable and P_t is the corresponding predicted change. The measure is zero in the case of perfect forecasts. UM, which is a part of 'U' measures the errors in central tendency or bias proportion.

$$UM = \frac{(P - A)^2}{\frac{1}{T-1} \sum_{t=1}^{T-1} (P_t - A_t{}^2}$$

If it is large, it means the average predicted change deviates substantially from the average actual change. For further details, see Theil (1966) and Maddala (1977), page 38.

(2) Though as emphasised below, some components of tangible wealth had to be estimated over this period.

little additional effect on the disposition of personal sector funds (fixed investment, NAFA and the wealth aggregates) compared with a static simulation.

(b) Simulations

The following simulations were carried out over a five-year period. The results shown in Appendix 3 compare the "shocked" dynamic run with a dynamic base.

(1) Increase money incomes by 2.5% for one quarter.

(2) Increase persons' private pension contributions by 25%.

(3) Increase consumer prices by 3% per quarter with constant unadjusted real househ disposable income (and constant nominal interest rates).

(4) Increase mortgage lending by 10% per quarter.

(5) Increase house prices by 10%.

(6) Increase council house sales by £100 million (1975 prices) per quarter in volum terms.

(7) Increase the interest rate on gilts by 2 percentage points.

(8) Increase real interest rates by 2 percentage points (increasing nominal rates with no change in prices).

(9) Increase share prices by 10%.

The first three simulations have a primary effect via the personal income and consumption section of the model. These are followed by three simulations via the tangible wealth section, and three via the financial wealth section. All of the simulations are fairly symmetric and the response is linear to a reasonable approximation.

(1) Increase personal disposable income by 2.5% for one quarter
(£1,000 million in money terms)

This is also equivalent to an increase of 2.5% in real incomes, which is reflected in a 0.7% rise over the first year in adjusted real household income. The initial effect on consumption is to increase consumption of durables by 0.8% and non durables by 0.3%. This shows the former to have a much higher short run income elasticity, a feature of the model which is supported by experience of durables booms. In the long run there is unit elasticity in both the durables and non durables equations (this property having been accepted by the data), ie a 1% increase in income will lead to a 1% increase in each category of consumption, though this effect is slow to arise in the case of non durables.

The residue of the increase in income after a part has been consumed is fed via saving to asset accumulation. This results in a first-year increase in nominal net liquid assets of 0.3% and illiquid assets by 0.1%, while fixed investment increases by 0.3%. The response of tangible wealth is complicated by an increase of 1.4% in house prices following the increase in real incomes. This boosts tangible wealth directly via the value of existing houses, and stimulates housebuilding and thus personal sector fixed investment and the owner occupied housing stock. The result of these changes to wealth components is an increase of 0.6% in tangible wealth, and 0.2% in net financial wealth, giving a boost to net wealth of 0.5%.

These first year responses are followed by reactions as the dynamic structure of the model comes into operation to return the system to equilibrium. As there is no further boost to income (1), while liquid asset stocks increase, adjusted income falls marginally in the second and third years (as a result of increased losses due to inflation on these stocks, with no offsetting change in cash flow due to increased interest rates), though the change returns to zero in the fourth and fifth years. The chief influences on consumption in the later years are lagged income via lagged consumption, and liquid asset stocks. Non durable consumption continues to increase throughout the five year period, showing the long lags on the equation, while durables decline compared with base in the second year in response to the first year boost. This shows the implicit influence of increases in the stocks of durables in the first year, which discourage further expenditure, a feature which, of course, is absent in the case of non-durables. It can be argued that the negative second year response is too sharp, though this feature is in line with observed behaviour. In later years, durables expenditure again increases slightly - a "shocks and echoes" effect. Net liquid assets, having increased sharply in the first year, are run down over the five year period (as are illiquid assets), mirroring the increases in consumption, via declines compared with base in the net acquisition of financial assets. These decumulations erode the initial increase in financial wealth to only 0.1% by the end of the fifth year. Tangible wealth is again dominated by house prices - the error correction terms in the equation act to offset the initial increase in house prices, so after a period of decline house prices end as per base. Although the increase in the owner occupied housing stock is maintained (unsurprisingly given the long life of these assets), the final effect of the shock on the value of the housing stock is negligible. The main boost to tangible wealth in the longer term is via the stock of durables; but even this only raises tangible wealth by 0.01%. The final effect on net wealth is a mere 0.02%, giving a small increase in the wealth-income ratio. (£1 billion represents approximately 0.1% of net wealth.)

---

(1) This effect would be different in a full model where consumption acts to increase activity and hence income (multiplier effects).

The following table further illustrates these effects by showing the destination of the increase in income in an "accounting" sense, cumulating the changes in flows, and showing end-period stocks.

Cumulative effects of a £1,000 million one-period change in income

£ million

Current prices (1)	First quarter	After first year	After fifth year
YD	+1,000	+1,000	+1,000
CND£	+ 230	+ 390	+ 680
CD£	+ 50	+ 90	+ 110
NAFJ	+ 710	+ 500	+ 180
NIAJ	+ 230	+ 150	+ 90
NLAJ	+ 480	+ 350	+ 120
IFJ£	-	+ 20	+ 30

The short-run marginal propensity to consume of the system is 0.3, while, after one year, it is 0.5, and 0.8 after five years; these low responses are a result of the slow response of non durables to changes in its determinants, which one would also expect in theory. The marginal propensity to invest is low (unsurprisingly, given that it is supply determined with no feedthrough from the demand side except via increased house prices). The split of the increase in financial asset accumulation between liquid and illiquid assets is roughly in the ratio 7:3 in this simulation (it depends on market conditions in the base, and time). An interesting detail is that, after five years, the increase in net financial wealth exceeds the net acquisition of financial assets, due to increases in share prices in the base, acting on a larger portfolio of net illiquid assets.

The effects shown in this simulation suggest, as outlined in the theoretical discussion above, that any increase in income, though initially boosting asset accumulation due to a short run marginal propensity to consume of less than one, will, after a few years, be largely consumed. It has very little long run effect on asset stocks or values. Of course, results are different when the sector is embedded in a macroeconomic model, with endogenous wages for example and with consumption affecting activity (see section 7, p48).

This initial simulation has been described in some detail to introduce some of the distinctive features of the system. The other simulations are analysed in less detail below.

(1) The mnemonics are listed on pages 72-74.

(2) Increase persons' private pension contributions by 25%

The effect of this shock is to transfer money from personal income directly to persons' net illiquid assets. Since life and pension funds are part of the personal sector, personal income does not change. However, this model takes the view that saving is increased one-to-one by the quantity of income pre-empted by such contributions (a similar conclusion was reached by Threadgold (1978) after empirical testing) so the contributions are excluded from household income, the regressor in the consumption function. This effect results from imperfections in the capital market, in that it is virtually impossible to borrow against equity in pension funds. The case for this deduction is weaker in the long run, when contracts can change and part of pension rights encashed.

The effect of the increase is therefore to reduce household income, and thus consumption both of durables and non durables. The reduction in expenditure on durables reduces their stock compared with the base and thus tangible wealth. Besides reducing household income, the pre-emption of a quantity of personal income reduces the adjusted net acquisition of financial assets, which is defined as being subject to choice between disposition in liquid and illiquid form. This in turn reduces the flow to net liquid assets, despite the increase in net financial wealth and hence net wealth entailed by the much larger flow to illiquid financial wealth. The only effect of the increased imbalance between liquid and illiquid assets that the increase in contributions involves is to attenuate the reduction in net liquid assets that would otherwise occur; part of the reduction in NAFJ is taken by reduced accumulation of other illiquid financial assets. The portfolio balance effects in the model following an increase in flows to pension funds are thus shown to be fairly weak.

This simulation does not, of course, deal with the longer term effects of increased contributions arising, for example, from increased feelings of security due to higher expected pensions. These might entail higher consumption and a lower accumulation of other assets. The precise long-run effects will depend on the reason for increased contributions. Higher personal contributions imply either:

(a) Lower employer contributions
(b) Higher pensions, or
(c) The result of falsification of past actuarial assumptions.

If the last, the assumptions underlying the simulation, ie an increase in contributions with no corresponding increase in pensions, would be correct.

(3) Increase price inflation (such that prices are 3% higher throughout) with constant real household disposable income and constant nominal interest rates

The assumptions made in this simulation are that persons maintain real incomes, via pay claims, etc, and that pension contributions are a fixed proportion of pay, but inflation is allowed to affect the real value of assets, even though nominal interest rates are unchanged.

In line with recent experience, the key response is that when inflation increases so also does conventionally measured saving, as consumers strive to maintain the real value of their net liquid assets. The counterpart to increased saving is reduced consumption. This occurs to a greater extent for durables than non durables, because of the reduced purchasing power of mortgage funds extracted from the housing market, despite a lower real cost of credit. Of course in a full model, mortgage funds might increase in nominal terms due to increased saving, and the interest rate might be expected to rise.

The distribution of the increased saving is largely to nominal liquid assets, given persons' desires to maintain the real value of their liquidity in relation to income which underlies the structure of the model. The mechanism of this flow in the equation is via the terms in the net acquisition of financial assets - the net liquid assets/net wealth ratio and durables inflation. Nominal stocks of illiquid financial assets also increase as a result of increased pension contributions, and partly through increased net acquisition of financial assets, gilts and equities, as a result of increased non durables inflation, an effect which can be rationalised by the smaller proportionate fall in the real interest rate on long assets.

Tangible wealth is affected via the consumer prices proxy for the value of land, buildings, and plant and machinery in the tangible wealth equation, which ensures that the real value of these assets falls by less than the increase in inflation. This overcomes the reduction caused by smaller stocks of durables. Since nominal net financial wealth also increases, the effect on total nominal net wealth is positive: after five years it is 1% higher. Real wealth, however, falls by around 2% in this simulation, since prices are 3% higher throughout. The falls in the real value of the components are as follows: real tangible wealth falls by 2 1/2%, thus illustrating the slow adjustment of prices, rents, etc and the lack of adjustment of property prices (see below). Real net financial wealth falls by around 1%, as do its liquid and illiquid components. Persons' efforts to maintain the real value of their net liquid assets are two-thirds successful over a five year horizon, but the complete adjustment is clearly slow.

It is notable that the housing market is not affected by general inflation in this simulation. This assumption is validated by experience over the last decade when house prices have changed independently - some economists might argue that they have been a cause of general inflation. It could be argued that a term in consumer prices should be in the house price equation, to allow for changing real values of housing assets, but this is not implemented in this model. Also, unit labour costs and raw materials costs might be expected to change with inflation - depressing housebuilding activity.

(4) Increase mortgage lending by 10% throughout

The primary effects of this shock are naturally on housing, and also on the consumption of durables. The partial nature of this model means that the effects of increased interest payments on disposable income are omitted.

House prices are boosted by the increase in housing demand that mortgages facilitate, ending 5 1/2% higher than in the base. (It should be noted that the inclusion of mortgages in the house price equation implies a supply effect, ie that pent-up demand is only made effective by rationed mortgage lending. However, though frequent, this phenomenon has not been continuous - there was no rationing during 1981-2. Unsurprisingly, the equation tends to overpredict during such periods.) The increase in house prices has positive effects on housing investment and tangible wealth.

Durables consumption increases by 2% in the first year and 4% in the fifth. As noted in Chapter 4, the equation reflects the hypothesis that part of the flow of mortgage funds is extracted from the housing market, and spent on durables. Additionally, house purchase is also often combined with durables purchase (eg furniture). The short-run single equation elasticity of durables consumption with respect to mortgage lending is 0.24, rising to 0.32 in the long term. The system effects exceed this, due to indirect effects via net liquid assets etc - for mortgage lending has additional effects on the financial side. Net illiquid assets naturally fall, since mortgages are illiquid financial liabilities, but liquid assets increase as mortgage funds are extracted from the housing market (mortgages not used to finance increased stock of owner occupied housing must be extracted from the housing market). Also, the demand for liquid assets rises as increased house prices raise net wealth. The disposition of the £6,500 million in increased mortgage lending after five years is £2,650 to durables, £350 million to non durables, £2,500 million to net liquid assets, £400 million to personal sector residential fixed investment, and £600 million to gross illiquid financial assets.

(5) Increase house prices by 10%

This simulation is principally an examination of the dynamic behaviour of the house price equation. It should be noted that the increase in house prices is fed in alone without cause (mortgage lending, incomes, etc) so the simulation is not completely realistic in this respect.

House prices continue to increase for two years, then the error correction terms operate, first to cut back house prices to below the base, then to return the change to zero. This result might be criticised for the excessive speed and volatility of the changes, though recent behaviour does suggest a house price cycle lasting seven years from peak-to-peak, which would be in line with the period of five years shown here from peak to equilibrium.

The increase in house prices boosts tangible wealth initially via housing investmen (and thus the size of the housing stock) and the value of the housing stock. However, although the increase in the size of housing stock is positive throughout, this is later overwhelmed in value terms by the decline in prices. As a result, the change in tangible wealth is negative in the third and fourth years, finally returning with house prices towards zero.

The financial effects operate via the initial increase in net wealth that the increase in house prices induces. This stimulates a transformation of part of net illiquid assets to liquid assets (consumers reduce their illiquid financial assets due to an increase in illiquid real assets) which causes increases in consumption. This increase in consumption and the increases in personal sector fixed investment lead to a reduced net acquisition of financial assets, which, together with the lower level of share price gains on illiquid financial assets, gives a lower level of net financial wealth. (In the real world, higher mortgage borrowing would accentuate this result.) Net wealth is slightly reduced after five years, both because house prices are still in disequilibrium, and because a part of wealth has been consumed in the process.

(6) Increase council house sales by £100 million at 1975 prices per quarter (approximately 20,000 sales)

The primary effect of increasing council house sales is to increase the owner occupied housing stock and thereby reduce house prices. There are several mechanisms by which this result may arise. Since the houses are sold at a price below market clearing levels, this encourages individuals who would not otherwise purchase houses to buy and then sell their house, at a profit, before returning to renting, thus diluting the stock. Alternatively, an increase in owner occupation may be simply assumed to reduce the demand for housing. The fall in house prices, which would be accentuated in the real world by the price discounts on council houses, overwhelms the concomitant increase in the stock to reduce the value of the housing stock and hence tangible wealth. It may be that these dilution effects are too strong, and would be reduced if, for example, the owner occupied housing stock was measured in relation to the increasing population, or if council house sales were not fully included in the stock. The latter can be argued on the grounds that the marginal council house buyer, attracted by discounts and forced to stay in his house for several years, will have less effect on the market than the purchase of a private completion. The increase in personal sector fixed investment that selling council houses entails, leads to a reduction in the net acquisition of financial assets and hence the level of both liquid and illiquid financial assets.

These are not the only effects on the financial side, however, because mortgages are issued to pay for the council houses on the basis of a net increase in loans of 85% (1) of the value of the sales. This further reduces net illiquid assets directly. These mortgages are constrained not to feed into the house price equation, as they do not represent increases in demand for the existing owner occupied housing stock. (This deduction is in line with the arguments noted above for attenuating the effects of council house sales on the housing stock in the equation.) They also do not increase demand for durables, because there would be no equity extraction where all the proceeds of sales flow to the public sector, and very little extra purchase of furniture, since the purchasers are normally already resident in their council homes. Consumption is actually depressed by the fall in the liquid asset stock that a lower net acquisition of financial assets entails - persons are switching from consumption to investment. Due to this and the housing stock effects, net wealth also falls. One effect omitted here is an income effect, which might reduce disposable income if interest payments on mortgages exceed rent to local authorities.

(7) Increase the real return on gilts by 2 percentage points

This change directly affects only the financial and not the tangible wealth sector, though, as usual, there is a feedback into expenditure.

---

(1) This proportion is based on experience over the past four years.

Tobin (1958) gave an explanation of portfolio choice in terms of the risk and expected return on assets. Such a theory would suggest that an increase in the expected return on an asset with no increase in its risk would divert wealth into that asset. This is what happens here; financial assets are diverted from net liquid to illiquid assets. Net liquid assets stocks are 6% lower after five years, while illiquid assets stocks are 10% higher. This involves a larger increase in money terms in illiquid assets than is lost to liquid, for two reasons. Firstly, gains are made via unchanged share prices in the base on the increased illiquid asset portfolio; also, the higher return on saving reduces consumption and hence increases the net acquisition of financial assets to be distributed. Unfortunately, this simulation is unrealistic: an increase in the return on gilts implies a fall in their price and thus a direct fall in illiquid financial wealth (and if dividends do not change, a fall in share prices leading to a further fall in illiquid financial wealth stock); and there is no feedback to income of increased returns on assets. Atttempts are being made to rectify these omissions, which also apply to simulations (8) and (9) in Section 6.

(8) Increase all real interest rates by two percentage points

In addition to the return on gilts, this simulation involves an increase in the 'short' asset rate, the building society share rate, and in the short and long liability rates, viz clearing banks' base rate and the building society mortgage rate. As noted, the model omits the feedback of receipts and payments to income from increased interest rates and changes in asset prices.

The change in rates leads to a change in financial portfolio composition similar to that in the gilts rate case, ie the "Tobin effects" noted above operate to transfer funds to net illiquid assets, leading to a fall in consumption via the reduced liquid asset stock. One can argue that this is reasonable, as a 2% rise in real long rates is a great deal more significant than a 2% rise in the short rate. What <u>is</u> objectionable here is the fact that there is no offset for the long rate from the increased mortgage rate, ie the short rate is a composite of asset and liability rates while the long rate is only an asset rate (but it will be seen in Section 6 that the flow to illiquid asset continues even when this is taken into account).

The change in interest rates also has an effect on the housing market, reducing house prices and housing investment (the latter both as a result of falling house prices and increased borrowing costs for builders). More realistic results might be obtained using an explicit building society sector. Such a sector might accentuate this result via the effects of lower liquid asset accumulation on funds available for mortgage lending (for a discussion of building society behaviour and a model, see Pratt (1980), and for a more recent survey, see Davis and Saville (1982)). The reductions in house prices and investment reduce tangible wealth by the normal route. This fall is large enough to offset the increase in net financial wealth caused by a larger portfolio of illiquid assets, and hence to reduce net wealth.

(9) Increase share prices by 10%

This simulation proxies an increase in investors' confidence in the prospects for industrial and commercial companies, which increases share prices, so inducing an ex ante switch out of gilts and a fall in their price to equalise returns. This is in contrast to the simulation (7) which proxied increasing interest rates on gilts due, for example, to the desire of the authorities to sell a larger number.

The effects on illiquid assets are similar to simulation (7), an increase in the stock, though this is now due to increases in value as well as portfolio adjustment. This capital gain gives a higher level of net wealth in this simulation, which, in turn, leads to a smaller decumulation of liquid assets, and hence smaller falls in consumption. Again, there is no feed through to tangible assets apart from via stocks of durables - a possible criticism of the basic model.

6

Two Variants: Bank Lending and Stock Market Prices

The descriptions of the simulations above have indicated some deficiences in the sub-model as presented. In particular, the hypothesis that the influence of wealth on consumption is confined broadly to the effect of net variables is not tested. Secondly, the effects of changes in interest rates on stock prices and of changes in interest and dividend income on household income are omitted. This section presents variants of the main sub-model which seek to take these criticisms into account. The latter omission does not occur when this sub-model of the personal sector is integrated with the rest of the Bank's main macroeconomic model. However, it is emphasised that the equations now incorporated in this sub-model to overcome these deficiencies and presented below track the data poorly, partly as a consequence of the inherent difficulty of predicting some of the series. It is for this reason that these cases are presented as variants - it is felt that the basic model, however incomplete, is a better system for tracking and forecasting than when these extensions are included. The specifications of the equations used in the variants are given in Appendix 2, pages 67-71. It must be emphasised that these do not represent necessarily a considered view of the determinants of, say, gilt and equity prices, but are simple equations to assist in exploring the properties of other parts of the personal sector sub-model.

(a) Bank Lending

Discussion

The system above featured a feedback mechanism from net wealth via net liquid assets to consumption. The rationale for the use of <u>net</u> quantities is that this represents the permanent wealth of the personal sector; any gross asset which is offset by a liability is not wealth in the same sense. Net wealth can be varied only by saving and by (real) asset revaluations.

This structure implies that, for the personal sector as a whole, any bank borrowing is watched by an equivalent increase for a given level of financial assets. For a given level of net financial wealth, consumption is assumed to be the same whether the net value reflects high gross borrowing and high financial holdings, or low. This may appear counter-intuitive if the capital market is imperfect, with artifici constraints on borrowing (eg rationing). In this variant, an alternative hypothes that the lagged stock of bank borrowing has a different influence on consumption to gross liquid assets is explored. As a starting point, there follows a resumé of t rationales for the effects of bank borrowing in the basic structure and the variant

Bank borrowing to accumulate financial assets may occur for precautionary reasons - persons may fear future restrictions on borrowing and therefore accumulate debits, or they may fear the need to make unexpected expenditures and desire sufficient cash-on-hand to cover this. Of course, there are costs to this, equal to the difference between the borrowing and deposit rates, but one could argue that the benefits of reduced uncertainty offset this. The main sub-model assumes that persons are indifferent between using bank borrowing and running down both to finance expenditure. This is reflected in the use of the lagged stock of net liquid assets in the determination of consumption (1).

Bank borrowing to finance expenditure may occur because consumers who are liquidity constrained (as defined above, p9) may be able to relax the liquidity constraint by borrowing, and since they are, by definition, at suboptimal levels of consumption, the "marginal propensity to consume" out of borrowing should be high. Of course, there is a limit to the amount of borrowing that can be carried out, due to restraints on gearing (both in relation to wealth and income). Compositional effects will thus be important, there may be a group who hold only gross assets and few liabilities (the rich, the old) and others who have large debts and few financial assets. The banking system can then be seen as a method of recycling liquidity between these groups, and the higher the level of transfer as indicated by bank borrowing, the higher will be the rate of consumption if the debtor group would otherwise be liquidity constrained. This effect would not be captured by the use of net liquid assets alone in the consumption function, particularly if at various times the financial system has acted to ration loans to the household sector.

The main thrust of this paper assumes that for the personal sector as a whole additional bank borrowing effectively finances asset accumulation. This section attempts to allow for the possibility that higher borrowing for given net liquid assets also has some effect on consumption. The chosen structure is to have stocks of gross liquid assets (ie net liquid wealth plus borrowing) in the consumption function, though various other formulations with net liquid assets and the stock of bank borrowing are also tested. Separate equations for net liquid assets and lending, which take into account their different determinants are also required. Broadly this gives:

---

(1) An alternative possibility is that banks will only lend to persons if they have sufficient liquid assets to cover their borrowing - a supply side problem.

$$\Delta C = f(\overset{+}{Y}, \overset{+}{GL}, \overset{-}{C_{-1}})$$

$$Y - C = S$$

$$\Delta NLA = f(\overset{+}{S}, \overset{+}{W}, \overset{-}{p}, \overset{-}{r}, \overset{-}{NLA_{-1}})$$

$$\Delta BL = f(\overset{+}{C}, \overset{+}{W}, \overset{-}{p}, \overset{-}{r}, \overset{-}{BL_{-1}})$$

$$GLA = NLA + BL$$

Thus bank lending is determined by expenditure (and wealth, prices, interest rates) while net liquid assets are determined by saving (and wealth, prices, interest rates). A shock to consumption, for example, leads to a lower accumulation of liquid assets while bank lending increases to partly finance the increase. The fall in liquidity and increase in consumption set up forces to restrain consumption in later periods, allowing a rebuilding of liquid assets, while bank lending is itself restrained by the higher level of lagged borrowing and the fall in wealth (lower saving), both of which act to increase gearing. The mechanism as described appears to be plausible in theory: how it works with estimated equations is described below.

Specifications

The structure entails a net liquid assets equation, which is as described above, a bank lending equation and consumption functions. As noted, the chosen consumption specifications feature the level of gross liquid assets as a positive influence. Obviously this is not the only way in which bank lending can influence consumption. The tables on pages 70-71 present a "menu" of consumption functions, featuring various combinations of net liquidity, gross liquidity and bank borrowing.

Equation (1) in each table gives the basic functions as used above, while equation (2) gives the equations used below, featuring the lagged ratio of gross liquid assets to income in the consumption functions. Equation (3) features lagged gross liquidity and the lagged stock of bank borrowing to income ratios entered separately - a complex generalisation of equation (1). Equation (4) allows the current period flow of bank lending to enter the consumption functions, thus ensuring only a short-run effect, while the long-run feedback from the financial sector comes from net liquid assets(1). Equation (5) gives a nonlinear restriction

(1) This formulation may give rise to problems of exogeneity and causality (if bank lending and consumption are simultaneously determined) which will lead to inefficient estimates.

of equation (1), allowing the offset of bank lending from gross liquidity in the definition of net liquidity to be greater or less than one, and thus allowing an effect of bank lending on consumption. Finally (6) shows the result of entering net liquidity and bank borrowing to income ratios separately.

For non-durables, the lowest standard error was for the equation with the flow of bank borrowing, though the hypothesis that the coefficient was not zero could only just be accepted at the 95% level. For durables, an equation featuring the lagged stock of bank lending appeared to perform best. The differing results may be explicable in terms of the nature of durable goods, as an asset which is usable for several periods; indeed, the durables equation itself can be reinterpreted as a demand equation for a stock of durables (see Deaton and Muellbauer (1980) p 352).

The problem with simulating the 'best' equations is that they imply different theories of the determination of the two major elements of consumers' expenditure: in particular the best durables equation featured the ratio of gross liquid assets to income, while the best non-durables equation had the net liquid assets/income ratio. Nevertheless, simulations were run using these equations, but also using the equations (5) as the closest to the original equations, while relaxing a restriction that the coeffient on bank lending is minus the coefficient on gross liquidity and the equations (3) where at least similar explanations for consumers' behaviour are adduced. The results of these simulations were in each case to marginally reduce consumption when bank lending is increased, except in the case of the non-durables equation which included the current period flow as an explanatory variable of bank lending. These results run counter to the usual rationale for entering bank lending in the consumption function and suggest that bank lending, at least in these structures, has a net disincentive effect on consumption. Accordingly, the central case presented here features the equation (2) where gross liquid assets only enter the consumption functions; additional bank lending cet par will increase gross liquid assets. The specification and simulation results are detailed below.

The additional structure required here is an equation for bank lending. The Bank Lending Stock equation chosen is shown in the appendix, equation (xxi), where the variables are as defined on pages 72-74.

There is a long-run unit elasticity between stocks of bank lending and net wealth - a plausible restriction as the creditworthiness of persons depends on their net wealth, as also does their desire to take on extra debt (ie they will not wish to have an excessive level of capital gearing). Real bank lending is also related in the long run to the level of personal sector expenditure (current and capital) which it will help to finance, the post tax interest rate on bank lending (though the coefficient is insignificant) and the inflation rate. In the short run, disequilibrium effects similar to those in the net liquid assets equation adduce a negative influence to increases in the inflation rate and post tax base rate. The final determinant, besides the constant, is a dummy for restrictions on bank lending where periods of restraint are classified from 0 (no restraint) to 3 (severe restraint). The choice of numbers (which is subjective) is detailed on p74 in Appendix 2. Obviously it has a negative effect on lending.

The chosen consumption functions are those detailed in column (2) of pages 70-1. None of the signs of the existing variables are changed, their sizes vary little and all remain significant. Gross liquidity has a smaller coefficient than net liquidity, in line with their difference in magnitude. It is notable that the standard errors are higher than when net liquid assets alone are included in the consumption function (as in the main sub-model), suggesting that the addition of bank lending does not improve the ability of the specifications to track the data.

Simulations

One simulation only was run with this variant - an increase of £100 million per quarter in bank lending. The results are shown in simulation 10, p86. Consumption is boosted, though, by far less than the increase in bank lending. Net liquidity falls due to the increase in consumption; this is also reflected in the smaller monetary increase in gross liquidity than in bank lending. The changes involved in financial stocks by the end of year five are as follows:

£ million	
Bank lending	+1,790
Gross liquid assets	+1,567
Net liquid assets	- 222
Net illiquid assets	- 103
Net financial wealth	- 326
(Consumption of durables over five year period	+ 75)
(Consumption of non durables over five year period	+ 250)

The reactions in this simulation suggest that the personal sector as a whole does use the bulk of its additional bank borrowing to add to gross liquidity. Even over a five year period only 18% of an increase in bank lending is not used in this manner. This suggests that the net asset approach may be broadly correct.

The diagnostics of the bank lending equation in a tracking exercise (see page 76) were as follows:

	In sample static simulation RMSE%	In sample dynamic RMSE%	Outside sample dynamic RMSE%	U	UM	End-year % error 1981	1982
KBMS	2.4	7.3	2.1	0.28	0.06	-1.2	-4.1

Though not outstanding, the one-step ahead performance is reasonable, as is the outside-sample behaviour. The large error at the end of 1982 does not reflect the equations performance in the other three equations, when the errors were -1.0%, -2.4%, -0.7%. Also, to my knowledge, this is an unusual bank lending equation as it manages to overpredict lending over the recession (most tend to underpredict), though the equation will probably soon suffer the fate of most lending equations-breakdown. In the simulations, the tracking of certain quantities, particularly consumption, is slightly worse than in the main sub-model case.

Clearly, the choice made by modellers of the personal sector, whether to allow bank lending to influence expenditure must depend on their theoretical priors as well as the results of estimation and simulation. The results quoted here suggest both that bank lending has a fairly minor influence on consumption, and that different specifications of the consumption function, all freely estimated, give different signs to this effect. A 'most favourable case' for bank lending has been described in detail, ignoring the increase in the standard error of the consumption functions which result. This implies that, if gross liquid assets enter the consumption functions, bank lending has a positive but minor effect on consumption. This author feels that this additional feature is not worth the loss of explanatory power and the likelihood of breakdown of equations that using bank lending as a key variable implies; hence the retention of net liquid assets in the basic model.

(b) Stock prices and interest rates

The interest rate simulations described above are vitiated in several ways. Firstly, the feedback from increased net wealth to increased property income is omitted from the model. Secondly, there is no effect of changes in the return on gilts on the price of gilts, nor on share prices; indeed, gilt prices are omitted from the equation for net financial wealth. Thirdly, only the long-term asset rates enters the net liquid asset function. This variant seeks to allow for these criticisms in a rough and ready manner. It does not attempt to develop a model sufficiently sensitive to use in forecasting; hence this model remains a variant. It should be noted firstly that a high degree of disaggregation is required to adequately track the return on wealth, given the wide behavioural difference between such categories as rent and interest, and even between different interest rates such as the highly administered building society rates and the more market-sensitive local authority rate. Secondly, share and gilt prices are very difficult to model; some economists maintain that market moves are best described by a random walk (ie they are stochastic). Some attempt at modelling has been made below, but the tracking results are poor, as might be expected. Nevertheless, the underlying structure developed gives a more complete picture of personal sector reactions than the main sub-model.

The feedback equation from wealth to income incorporating interest, profits, dividends and rent(1) is relatively unsophisticated. It hypothesises that the rate of return on net liquid financial assets is equal to the short rate as defined above, while the return on illiquid financial assets is equal to a composite long rate, constructed similarly, where the asset rate, the return on gilts is weighted by the ratio of gross illiquid financial assets to net illiquid assets, and the liability rate, the mortgage rate, is weighted by gross illiquid liabilities relative to net illiquid assets. These assumptions are, of course, not strictly correct - consider for example notes and coin, equity (revaluations are obviously excluded) and sight deposits with banks. But an even greater problem is tangible assets - which have a return in rent (including imputed rent of owner occupiers) and profits of unincorporated businesses, but which cannot be held to follow perfectly the changes in financial returns. The arbitrarily chosen solution was to impose a return equal to half the average of the short and long financial rates, lagged four quarters, and excluding stocks of durables and inventories from tangible wealth. To capture the slow response of some returns, especially on tangible wealth, to periods of inflation, the equation also included an inflation rate, weighted by net wealth to reduce heteroscedasticity, and to allow for long-term changes in the pattern of returns a time trend was included. The equation is (xxii) in the Appendix.

The coefficient of 0.6 on 'returns' should be noted - it implies continued mismeasurement of rates of return. Incorporated into the model, the estimated return on wealth was fed back into disposable income, with the basic rate of income tax deducted (which is of course again an approximation). This structure imposes equal coefficients on the components of income in the consumption accumulation decision.

The equation for gilt prices is simple, setting the log of gilt prices equal to minus the change in the log of the return on gilts. In practice, this relationship would not hold exactly for dated gilts and accordingly estimation gave the equation (xxiii).

---

(1) In national accounts terms this is 'other personal income' less income of the self employed less corporate transfers to charities.

It should be borne in mind that this equation is only produced for use in simulations; a far more detailed specification would be required for forecasting.

The share price equation (xxiv) is slightly more sophisticated, but the low $\bar{R}^2$ emphasises the difficulty of tracking this magnitude. This equation suggests that changes in share prices are related to changes in gilt prices (as alternative assets with similar risk characteristics), economic growth and price inflation. They are also related to the level of dividends in relation to company income in the last quarter, and a long-run unit elasticity with the level of money GDP is imposed. The relationship to dividends is positive, despite some theoretical reasons for believing that dividends and share price increases are substitutes (see King (1977)). The low level of explanation of this equation suggests that it is dynamically misspecified and/or there are many other factors involved. The same caveats as those noted above for the gilts equation apply.

These new specifications require some modification to the net financial wealth equation, to allow gilt prices as well as share prices to affect the value of this aggregate. The resulting specification was (xxv) in the Appendix. The coefficients on the increase in share and gilt prices were imposed following examination of the shares of these assets in the personal sector's portfolio. The weight of 0.7 on these revaluations indicates the more sensitive tracking that inclusion of gilt prices allows.

A final modification to the model for an interest rate simulation is the replacement of the return on gilts as the competing long rate in the net liquid assets equation by a composite long rate (xxvii). The net liquid asset equation is not greatly altered by this modification - details of the specification are shown in equation (xxvi) but it should give more realistic responses to increases in all interest rates.

Simulations

Five simulations were carried out using this variant; changes in all interest rates, and changes in the long asset rate, both with and without the feedback of returns to income and a change in share prices. The speculative nature of the new equations involved here should be emphasised again at the outset - attention is directed to the direction of changes rather than their exact magnitudes.

1 A two percentage point increase in real interest rates

Considering first the simulation without the feedback to income, the results are broadly similar to those of the basic model, except for the endogenous fall in stock market prices as a result of the increase in the return on gilts. These lead to a devaluation of the stock of illiquid financial assets, and hence initial declines in wealth. As a result of these losses, demand for liquid asset is reduced relative to the 'base model' simulation, and consumption is lower. The lower level of liquid assets is also a consequence of their relatively large elasticity of demand with respect to changes in long rates compared with short rates. In the new liquid asset function described above, with a composite long as well as short rate, the ratio of the coefficients on short and long rates is -0.45 compared with -0.7 in the old function (xv). It would appear that this effect is data-coherent as well as being plausible. The results of this simulation can be criticised, particularly as a result of the increasing size of the fall in gilt prices below base; this is a consequence of the crude nature of the gilt price equation used. It may be reasonable however for share prices to fall less than gilt prices, as although they are competing assets they have other influences (growth, prices, etc) and characteristics (variable dividends, no redemption date).

A more realistic simulation features in addition the feedback of higher real returns on financial assets to real income, which, for persons, is positive as the personal sector is a net creditor. This effect completely transforms the simulation - since adjusted household income is boosted consumption of both durables and non durables increases. Durables increase less proportionately than non durables due to increases in the cost of credit. The increase in consumption is also aided by a boost to liquid asset stocks which stems from a higher net acquisition of financial assets (the mechanisms which distribute an increase in income to expenditure and accumulation are discussed in detail above, p26-8). The increase in income also boosts the housing market, raising house prices during the third to fifth years despite the initial negative effect of rises in the mortgage rate. Housebuilding shows a weak response to house prices compared with interest rates and still ends below base - a possible criticism of that equation. Lower levels of house purchase by persons help the large boost to financial asset accumulation that this simulation entails. The effect on gilt and share prices of the rise in interest rates is as in the previous simulation; this ensures a lower initial level of net financial wealth compared with the base, but which is overcome by the third year due to increased inflows.

This simulation is vulnerable to imperfections in the equation for the returns on net wealth. In line with the specification, the first-year response is relatively small, due to the restriction that returns on tangible assets only respond with a lag. The size of the change continues to grow after the second year, due to the growing size and value of the wealth portfolio; the first year response to higher interest rates, of the return on net wealth is equal to 0.4% of the stock, while the fifth year response represents 0.9% of the stock. These appear to be not unreasonable responses to a 2 percentage point rise in real interest rates, which is a sizeable shock by any measure. The fact that some of the increase in returns represent the increase in imputed rent on owner occupied houses may cause some concern however - to what extent does this represent a "real" increase in income and consumption?

2 A two percentage point increase in the real return on gilts

The results of these simulations are probably less plausible than those reported above, both because they ascribe an excessive role to the rate on gilts and because they assume that the long rate can be changed without any change in short rates.

Given these caveats, the responses are broadly similar to those where all interest rates are increased, except that the interest rate effects on the housing market are absent.

Consider first the simulation without the feedback of interest payments to income. Liquid assets fall sharply, due to an increase in the long asset rate without a response in the short rates or the long liability rate (the latter is at least plausible to some extent due to the administered nature of building society rates). This effect ensures a sharper fall in non durable consumption compared with a rise in all rates, while durable consumption is buoyed up to some extent by the constant cost of short term and mortgage credit. The fall in net liquid assets and consumption (higher saving) ensure a sharp increase in illiquid assets, despite the initial losses due to revaluations.

Turning to the income feedback simulation, the elasticity of all asset returns with respect to the gilt rate is perhaps unrealistically high - involving a rise which by the fifth year is equivalent to 0.8% of the net wealth stock. The increase would naturally be lower if the liability rate had also increased. The simulation is similar to the increase in all rates, except that the housing market receives an unequivocal boost due to the effects of income on house prices, without a rise in the mortgage rate. Since capital expenditure rises, the net acquisition of financial assets is lower than when all rates increase and so is net financial wealth. The processes in the simulation can be rationalised as persons rearranging their wealth portfolios towards both tangible wealth and illiquid wealth as a result of higher returns.

3 Increase gilt and share prices by 10%

This simulation proxies the effect of a spontaneous increase in market confidence. Since these confidence effects are not a part of the equations, the equations have been overwritten and residuals imposed. The effects on the system are small. The boost to the value of persons' illiquid assets feeds into net wealth, which stimulates transformation of some illiquid assets into liquid form, and hence leads to some increase in consumption. Over the five year period, consumption increases by £71 million at constant prices, despite a gain of £3,500 million in illiquid financial assets. This weak response is in line with one justification for excluding illiquid assets directly from the consumption functions - direct ownership of illiquid assets is heavily concentrated in a few wealthy individuals (those with low marginal propensities to consume) and much of the portfolio is held indirectly via life assurance and pension funds. It should be noted that this simulation holds the return on gilts constant, perhaps unrealistically - a more realistic analysis would have to include also effects on interest rates and dividend flows.

Assessment

This chapter has presented two variants on the basic model, where firstly the stock of bank borrowing is allowed to influence expenditure, and secondly the channels of influence of interest rates are better delineated. It is emphasised that these represent an early essay in modelling these areas, and are intended as bases to stimulate discussion and improvement of these areas rather than final specifications. Unlike the basic model presented in this paper, they are not incorporated in the Bank of England short term model of the UK economy.

Taking the specifications as given, the variants imply the following:

- That bank lending does not have a strong net effect on personal consumption, even when the specification of the model permits it to.

- That gilt and share prices have a weak effect on consumption, though they affect the disposition of financial assets.

- That the personal sector as a whole gains as a result of increases in real interest rates, via the increase in returns on net assets. Both consumption and wealth are boosted.

Obviously these results are dependent on the specifications, and their more glaring weaknesses have been pointed out above. Nevertheless, these results are not excessively out of line with observed behaviour of persons - consider for example the weak response of consumption to the stock market collapse of 1973-4, and to the boom in bank lending since 1979. Further work on these areas of personal sector behaviour is clearly warranted, in particular on the interest rate variant, where non labour income is endogenously determined, thus presenting a more complete analysis of persons' responses to economic stimuli than the basic model.

7

The sector incorporated into a macroeconomic model

An earlier version of the sub-model (1) is incorporated in the Bank of England macroeconomic model. In this full model, output is determined mainly by demand, and demand in turn is built up from the expenditure components, such as consumption, investment and government expenditure. Financial effects on real activity in the model arise through interest rates, for example in the consumer durables and residential fixed investment equations described above, and through financial flows, for example liquidity effects on consumption and stockbuilding, and mortgage flows' effects on housebuilding via house prices. The determination of prices other than house prices is in terms of cost-plus markups, with a key feedthrough from activity via a Phillips curve which relates wages (and hence labour costs and prices) to unemployment. The model is also equipped with an endogenous exchange rate sector, but there are doubts about its marginal properties, and it is not used in the simulation below which assumes a fixed exchange rate. The simulation base of the short term model only permits simulations over three years, so a complete simulation comparable with those detailed above is not possible.

The simulation carried out involved an increase of £1,000 million in personal income for one quarter (via an increase in current grants). The direct effects on the personal sector are naturally similar to those detailed in simulation 1 (page 77); broadly, an initial increase in consumption and financial asset accumulation, which in later period are decumulated to allow for continuing higher consumption, and a boost to the housing market and tangible wealth via house prices. Of interest, however, are the effects omitted from the partial model. For example, mortgage lending is boosted as a result of the increase in house prices and the increase in building society inflows that the initial boosts to income and saving induce. This has three important effects compared with simulation 1 - it prolongs (perhaps excessively) the higher level of house prices, thus prolonging the boost to net wealth, it induces increased durables spending and it raises the adjusted net acquisition of financial assets (NAFA) (though this remains negative). The boost to adjusted NAFA arises because very little leakage of the mortgage funds occurs via new house purchase, due to the sluggish response of housebuilding to increased house prices, so that most of the funds are available for consumption and/or financial asset accumulation.

---

(1) The house price, tangible wealth, net financial wealth and housing stock equations are slightly different.

The positive effects on adjusted NAFA eventually fade due to offsetting increases in contributions to pension funds. Of course unadjusted NAFA is similar in the full model to the partial case, as mortgage lending is not added to this measure. The effects on the levels of financial wealth and its main (net) components in the full model simulation are as follows:

£ million	After one quarter	One year	Three years
NFWJ	705 (705)	509 (532)	479 (584)
NLAJ	454 (447)	326 (283)	391 (282)
NIAJ	251 (258)	183 (249)	88 (302)

The switch in the portfolio from illiquid to liquid assets over time is notable; this is mainly due to increasing net wealth as a result of house price rises. (To prove this, the numbers in brackets show a simulation where house prices are constrained (1).) Of course mortgage borrowing, which is lower when house prices are constrained, is also a negative entry in net illiquid assets, though as noted this is offset in later years by increasing equity in life and pension funds. To have such a portfolio adjustment effect, whereby persons sell gilts and equities as a result of house price inflation is perhaps rather counterintuitive: it may suggest that tangible wealth should have a lower weight than financial wealth in determining the long-run level of net liquid assets.

Other effects in the full model include the familiar multiplier effects of increasing consumption; these give a boost to activity, which cause an increase in employment, and thus an increase in wages via the Phillips curve. However, this increase in wages leads to increases in prices, such that, although nominal incomes are at a higher level throughout the full model simulation, the difference is less marked for real income - indeed the levels are broadly similar. This effect is enhanced by the higher levels of liquid assets (on which adjustment must be made for inflation) in the full model simulation.

The boost to consumption causes a deterioration in the trade balance, which, with exchange rates free, would induce depreciation and hence greater activity and inflation. This feedthrough is closed in this fixed exchange rate case, however.

The chosen method of shocking income is via current grants. This boost naturally increases the PSBR, and hence long rates rise sharply in the short

---

(1) NFWJ is higher in this case due to less mortgage lending and no extra housebuilding.

run. In the long run all interest rates rise, mainly due to higher price expectations, but the magnitudes are not large. This effect accentuates the cyclical effect in the durables equation - in the full model simulation expenditures fall in the second and third years, while in the partial model this effect only arises in the second year. The increased interest rates give increases in "other personal income" which reinforce the rises in nominal personal disposable income from wages and employment noted above.

It is of interest to compare the table of cumulative income flows in the full model simulation with the partial model as shown on page 28, which are reproduced here in brackets.

Cumulative effects of a £1,000 million one-period change in income - full model

£ million	First quarter	After first year	After third year (fifth year)
YD	979 (1,000)	1,079 (1,000)	1,572 (1,000)
CND£	210 (230)	398 (390)	823 (680)
CD£	67 (50)	151 (90)	154 (110)
NAFJ	746 (710)	602 (500)	495 (180)
NLAJ	454 (230)	326 (150)	391 (120)
NIAJ	250 (480)	183 (350)	88 (90)
IFJ£	- (-)	15 (20)	113 (30)
LVJ*	5	33	108
KHL*	46	129	133

* These variables are constant in the partial model simulation.

The multiplier effects on nominal income over time are apparent. The first quarter effects of the shock are similar to the earlier case, except for the immediate response of mortgage lending. The MPC is 0.28 after one quarter, 0.51 after a year and 0.62 after three years, similar to the results for the partial model. The changes in financial stocks and flows are apparent, as is the slower decline in the net acquisition of financial assets, the rapid rise in mortgage lending and the increase in contributions to life and pension funds (which depend on income). The extent of switching between illiquid and liquid assets is also apparent - in the first quarter 36% of the boost to net financial wealth is in illiquid form, while after three years it is 18%.

In conclusion, this section has shown some of the differences made to the results of a simulation by incorporation in the full Bank model. The simulation highlights the feedthroughs via the building society sector, employment, wages, prices and interest rates that are omitted in such a partial sub-model as is presented in this paper. It also pinpoints certain shortcomings of the sub-model, particularly in the relationship between net liquid assets and tangible wealth.

Conclusions and further work

(a) Conclusions

This paper has presented a model of the personal sector which tracks the data fairly well, has reasonable theoretical properties and responds plausibly to shocks in certain key economic variables, though there are problems with some of the simulation properties, particularly in the housing market. There is a great deal of further work that could be carried out, notably experiments with disaggregated wealth in the consumption functions, and concerning substitution effects and expectations (see below). One could also experiment with more feedthroughs between the financial and real wealth sectors, assess the impact of simultaneity on the model and test the specifications further within a full model of the economy. Nevertheless, the model provides a useful base from which such further work can be developed.

The degree to which the model proves any linkages is not clear, since the basic structure has been assumed. Nevertheless, certain properties are accepted by the data, notably:

- Long-run static proportionality between consumption and income, liquidity and income, and liquidity and net wealth (1).

- A short-run marginal propensity to consume out of unadjusted income of 0.3 (0.5 after a year, 0.8 after five years).

- Inflation tends to increase financial asset accumulation (at current prices), though it takes a long period to regain previous real levels.

- Mortgage lending flows principally to durable consumption and net liquid assets, in the absence of a boom in housebuilding.

- An increase in the return on gilts increases the flow of saving to net illiquid assets, as (more tentatively) does an increase in general interest rates.

---

(1) When growth effects (see Currie (1981), Patterson and Ryding (1982)) are taken into account, the proportionality result will no longer hold.

While the variants also suggest:

- The existing stock of bank borrowing does not have a strong net effect on consumption. There is some evidence of a correlation between the flow of new borrowing and non-durable consumption.

- Gilt and share prices also have a weak effect on consumption.

- The personal sector gains (in both consumption and wealth) from increases in real interest rates. (Obviously deflationary effects on the macroeconomy may offset these gains.)

- The behaviour of the sector is somewhat different in the context of a macroeconomic model. In particular, the effects of shocks tend to persist.

The majority of the equations in the basic sub-model have been introduced into the Bank of England quarterly short-term model, thus providing for the first time in that model a behavioural explanation of liquid asset accumulation, and a wider role for wealth stocks.

(b) Further work

It may be illegitimate to exclude illiquid wealth from the consumption functions, even though it proves insignificant in a single-equation estimation. This is because simultaneous estimation is the correct estimation method for an expenditure and accumulation model that is not recursive (and recursivity here has been assumed and not tested), and such a model would also imply cross equation constraints that have not been imposed here.

Ideally, substitution effects between durables and non-durables should be allowed for in the consumption functions by, for example, including as independent variables the relative price of durables or non-durables to the aggregate consumer price deflator. However, results to date suggest explicit evidence for such an effect only in the durables equation and, in the absence of symmetric effects in the non-durables equation, this effect has not been included in the model.

There is no role for forward looking expectations in the model - expectations are influenced by past changes in variables, though, as noted, the superiority of this contingency planning approach has been demonstrated (see Davidson and Hendry (1981)). It remains plausible, however, that consumption and saving may also be influenced by forward looking expectations of future levels of interest rates, and the speculative purchase or sale of an asset will be driven by expectations of its future value. Further testing of alternative expectational assumptions is clearly warranted.

It can also be argued that there should be a role for assets denominated in foreign currency and thus for the exchange rate and expectations thereof, given the increasing tendency for persons and companies to invest in such assets.

Finally, further work is clearly needed on the properties of the system in the context of a macroeconomic model.

APPENDIX I - CHARTS

Chart 1

Income, consumption and saving

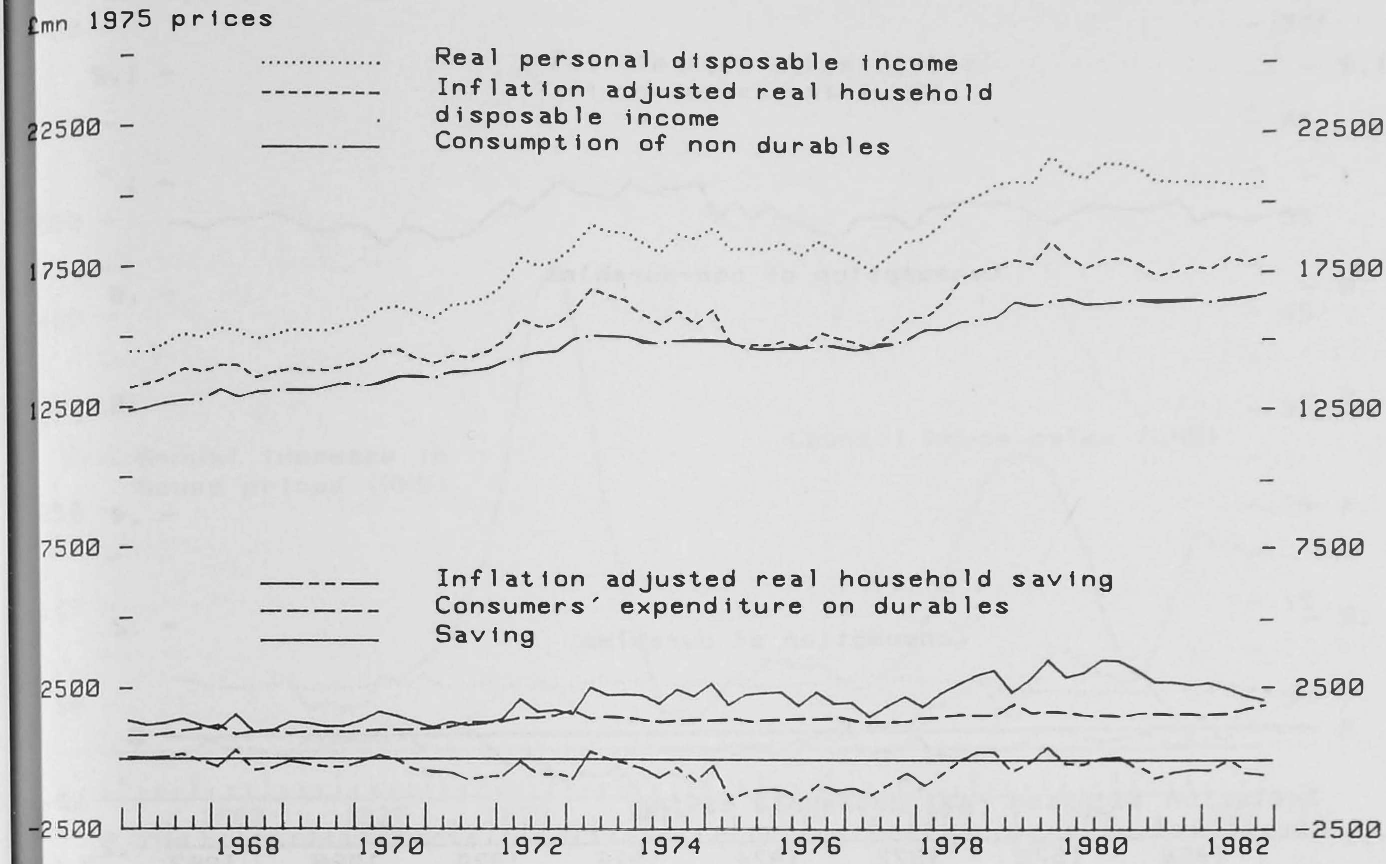


Chart 2

Consumption & saving as a proportion of personal disposable income

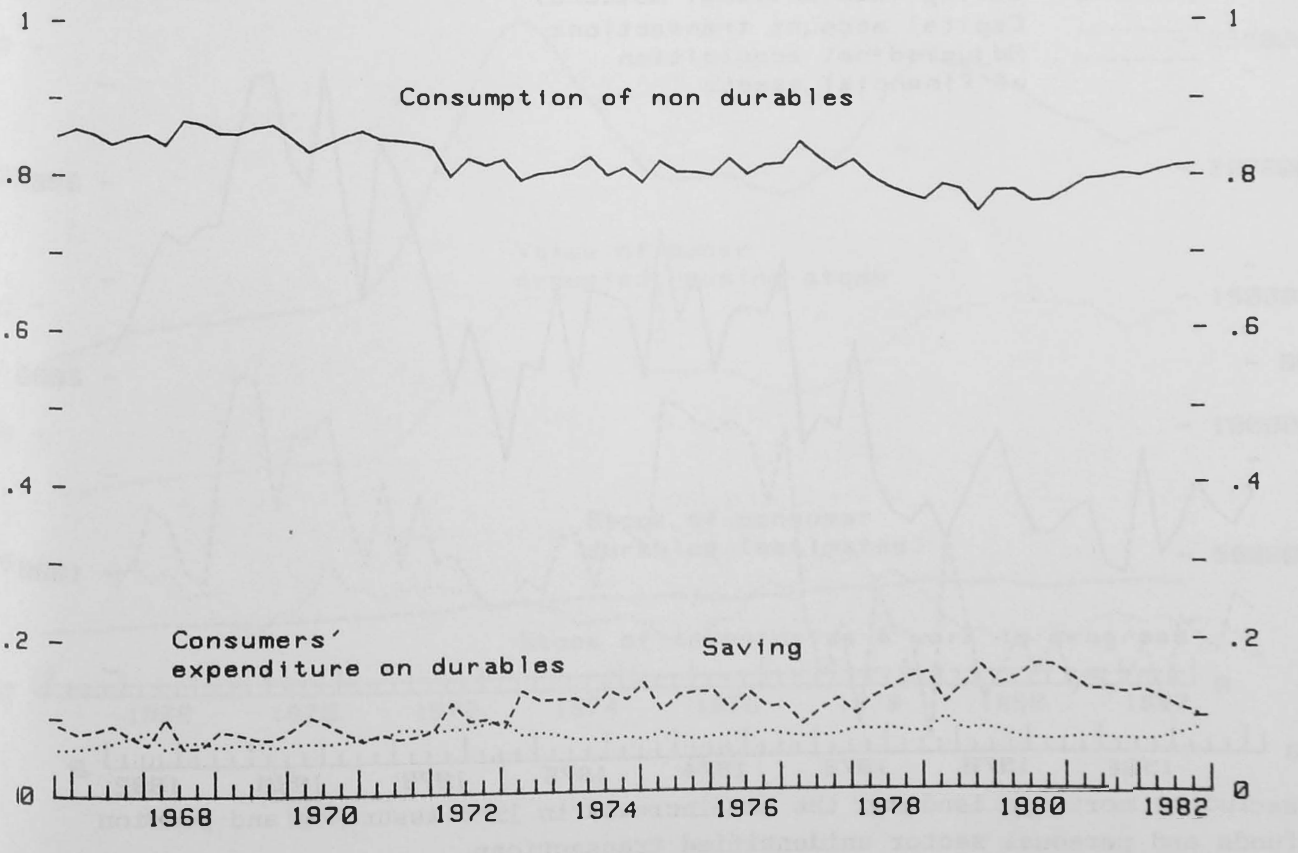


Chart 3

Consumption & saving as a proportion of adjusted household disposable income

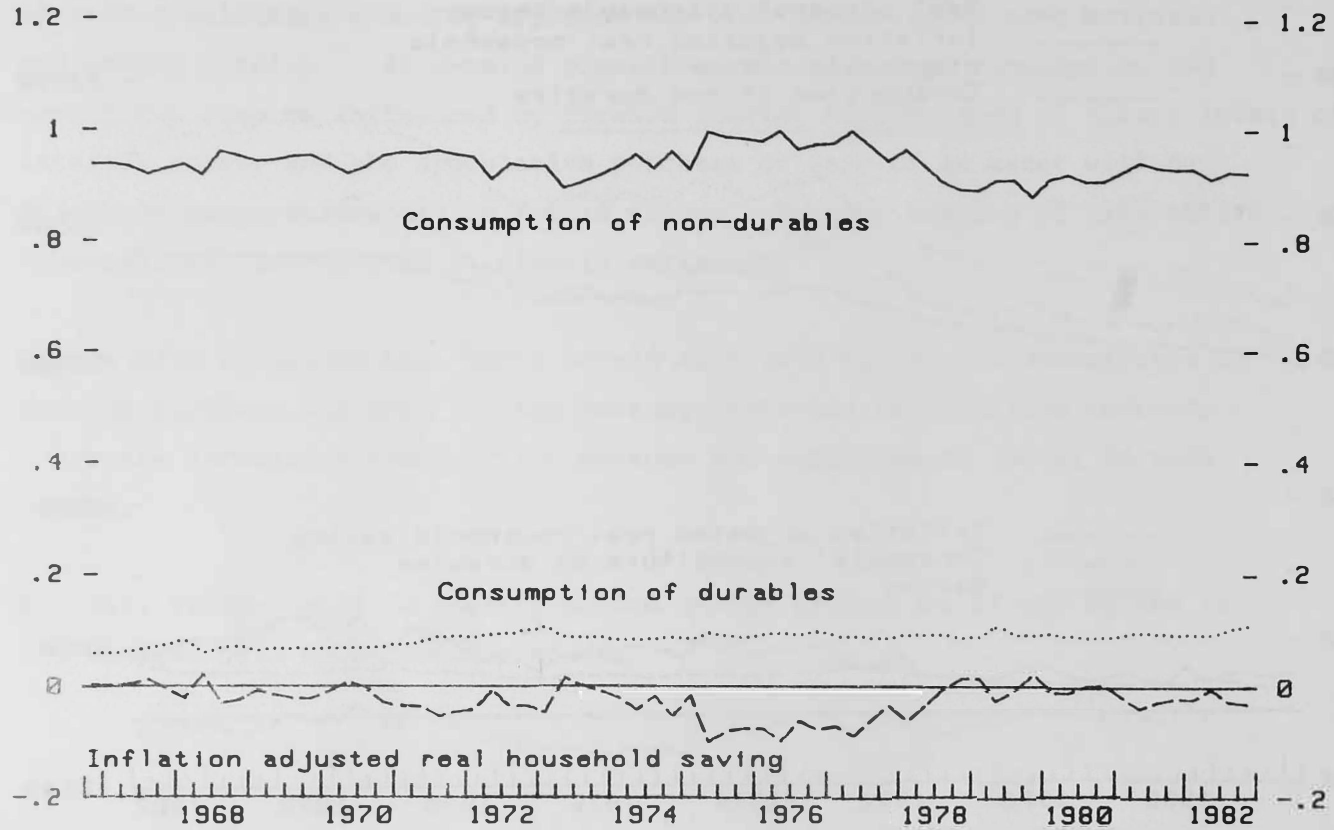
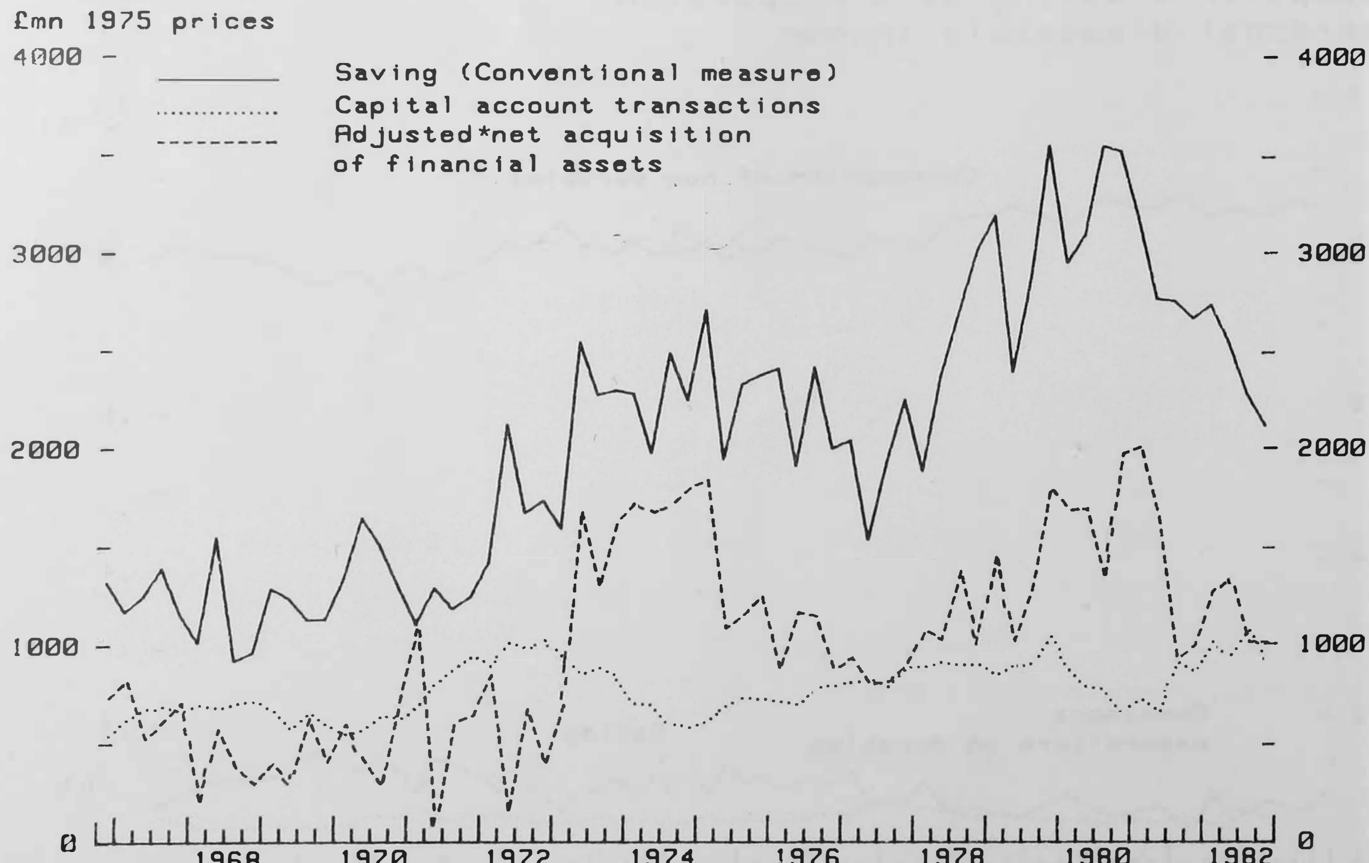


Chart 4

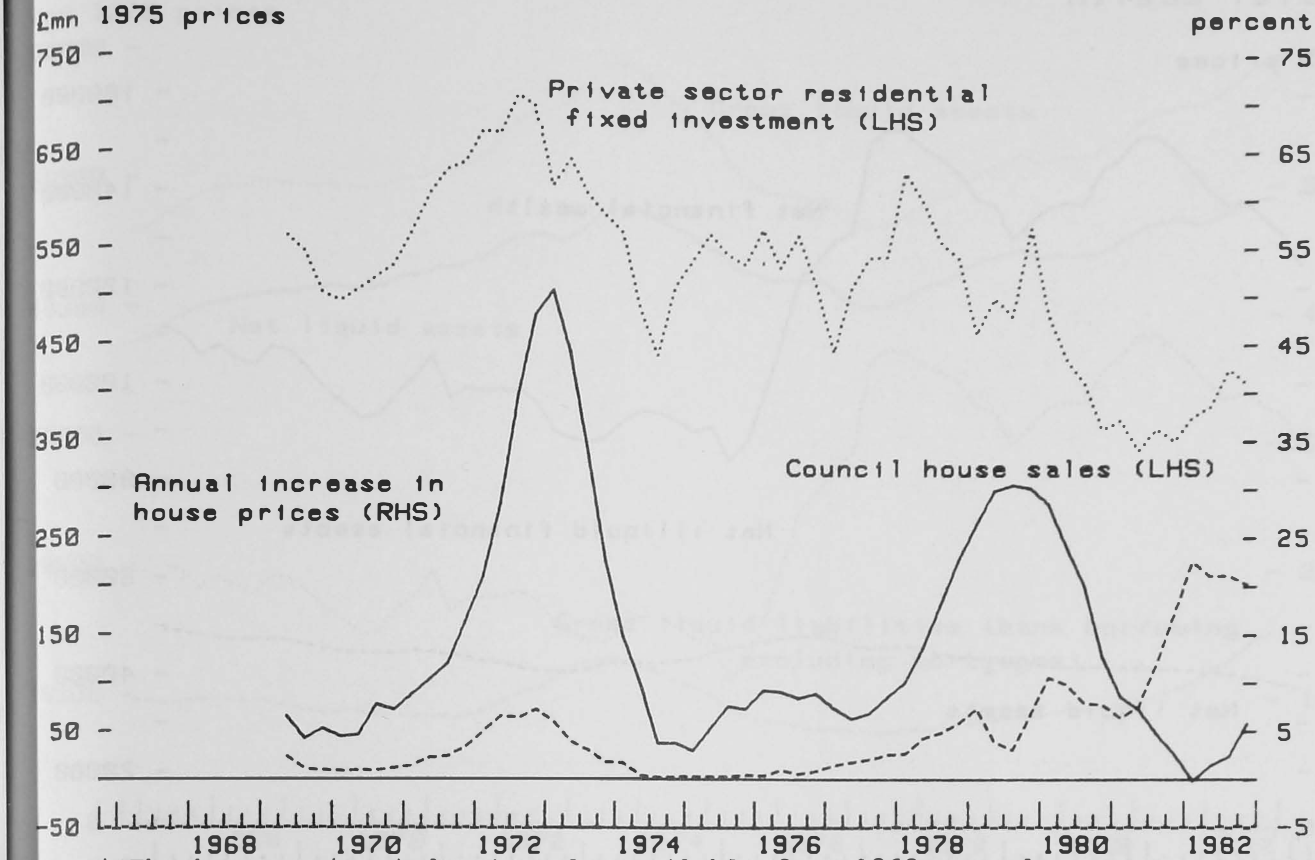
Saving and its components



* Excluding mortgage lending, the net increase in life assurance and pension funds and personal sector unidentified transactions.

Chart 5

The housing market *



* The house price index is only available from 1968 onwards.

Chart 6

Tangible wealth

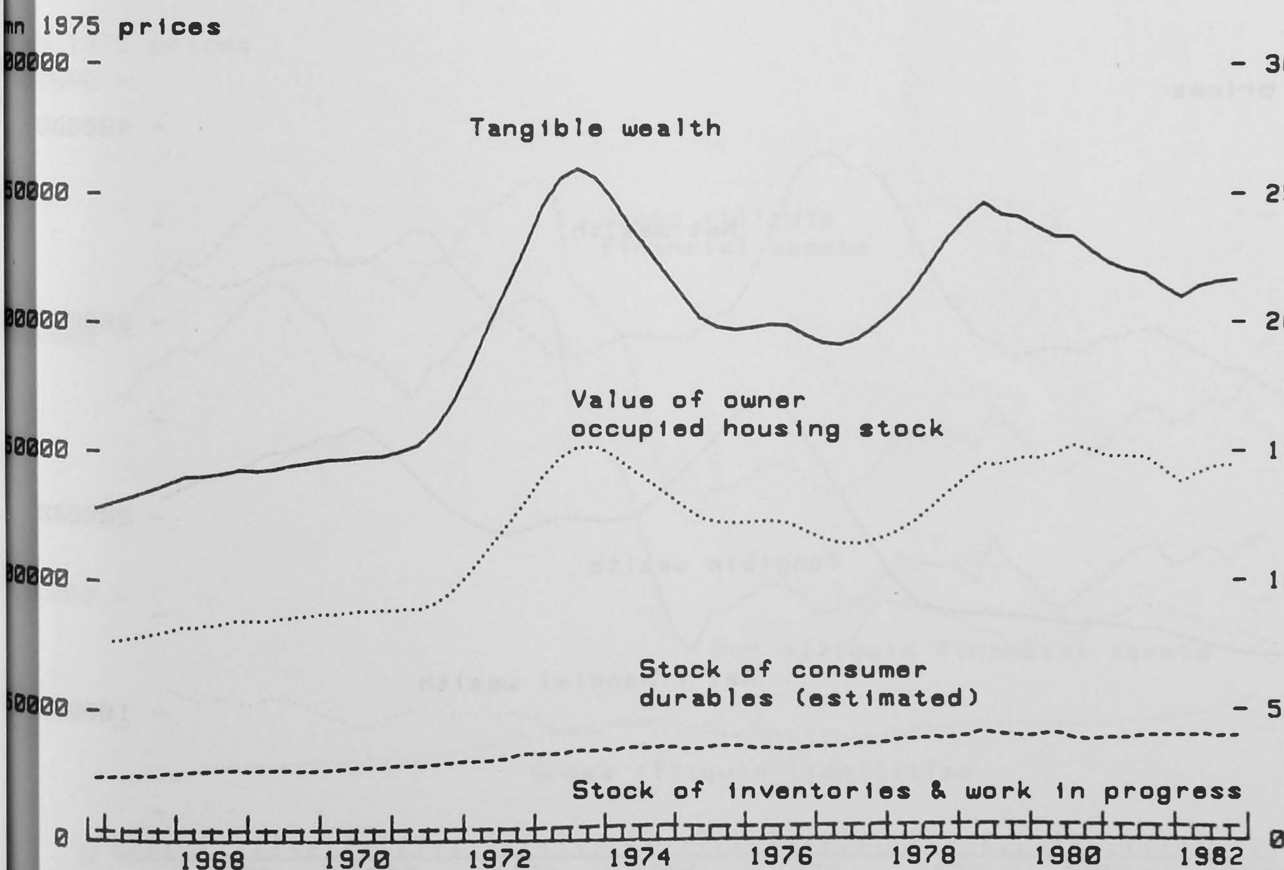


Chart 7

Financial wealth

£mn 1975 prices

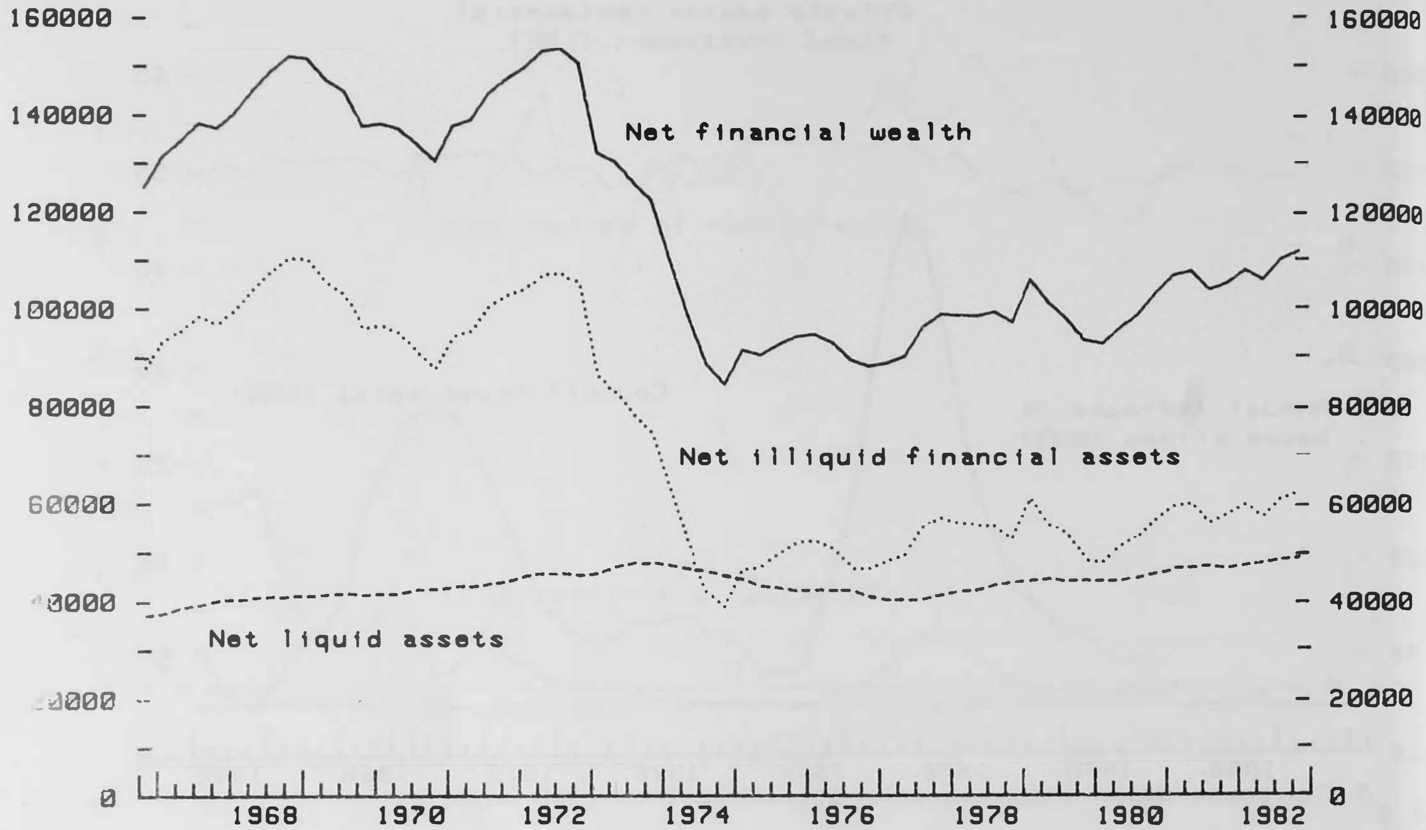


Chart 8

Wealth

£mn 1975 prices

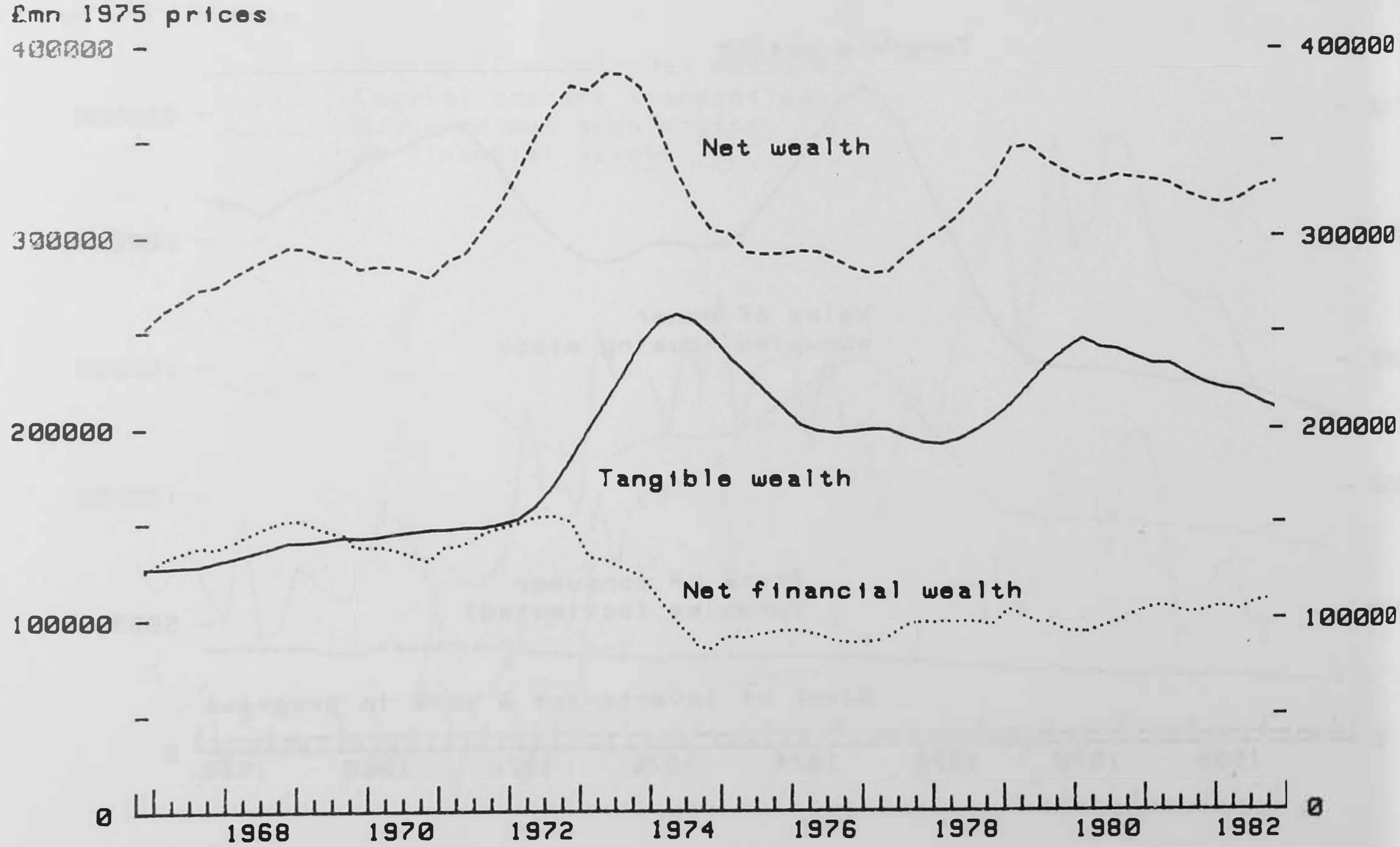


Chart 9

Gross and net liquid assets

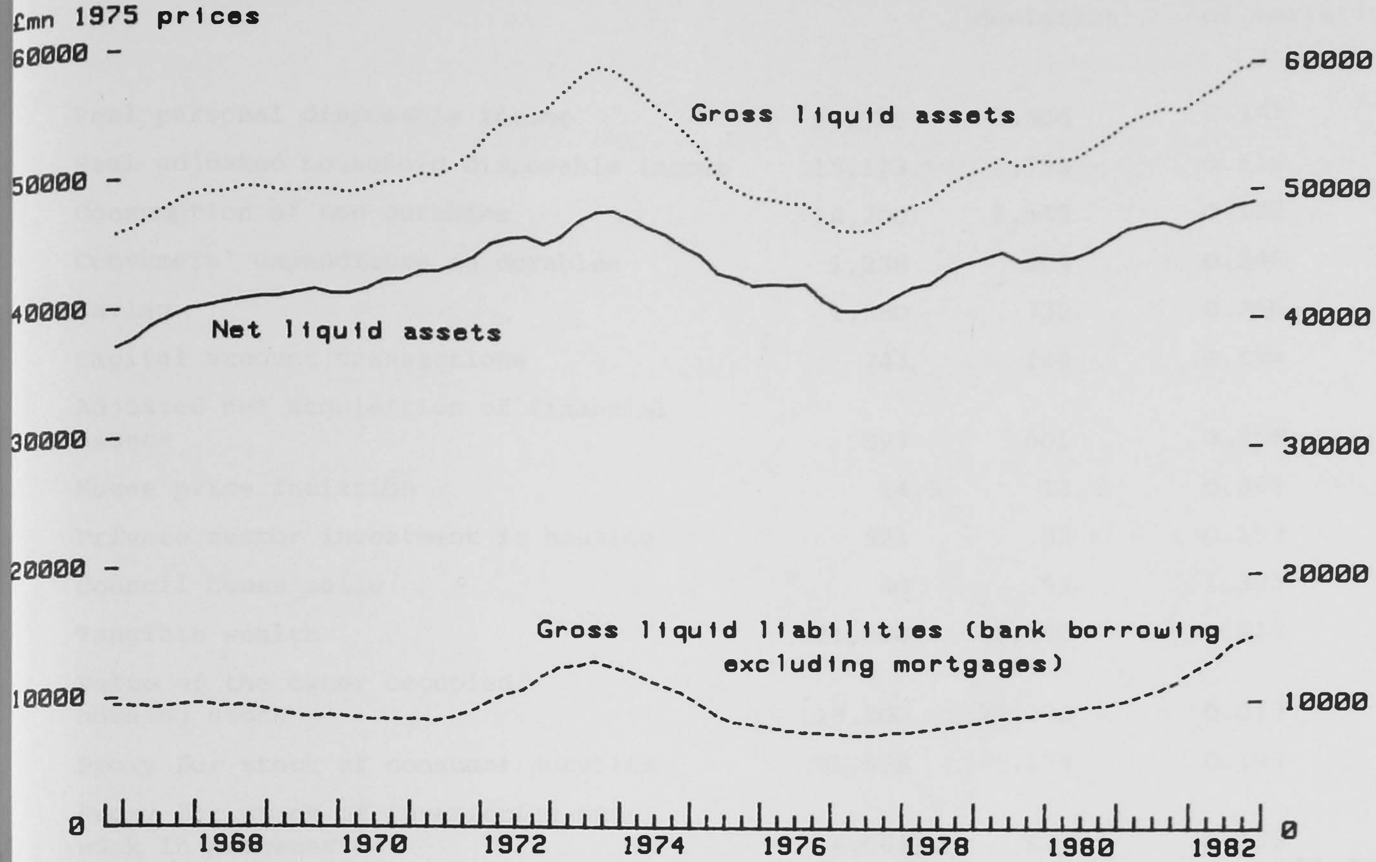


Chart 10

Gross and net illiquid financial assets

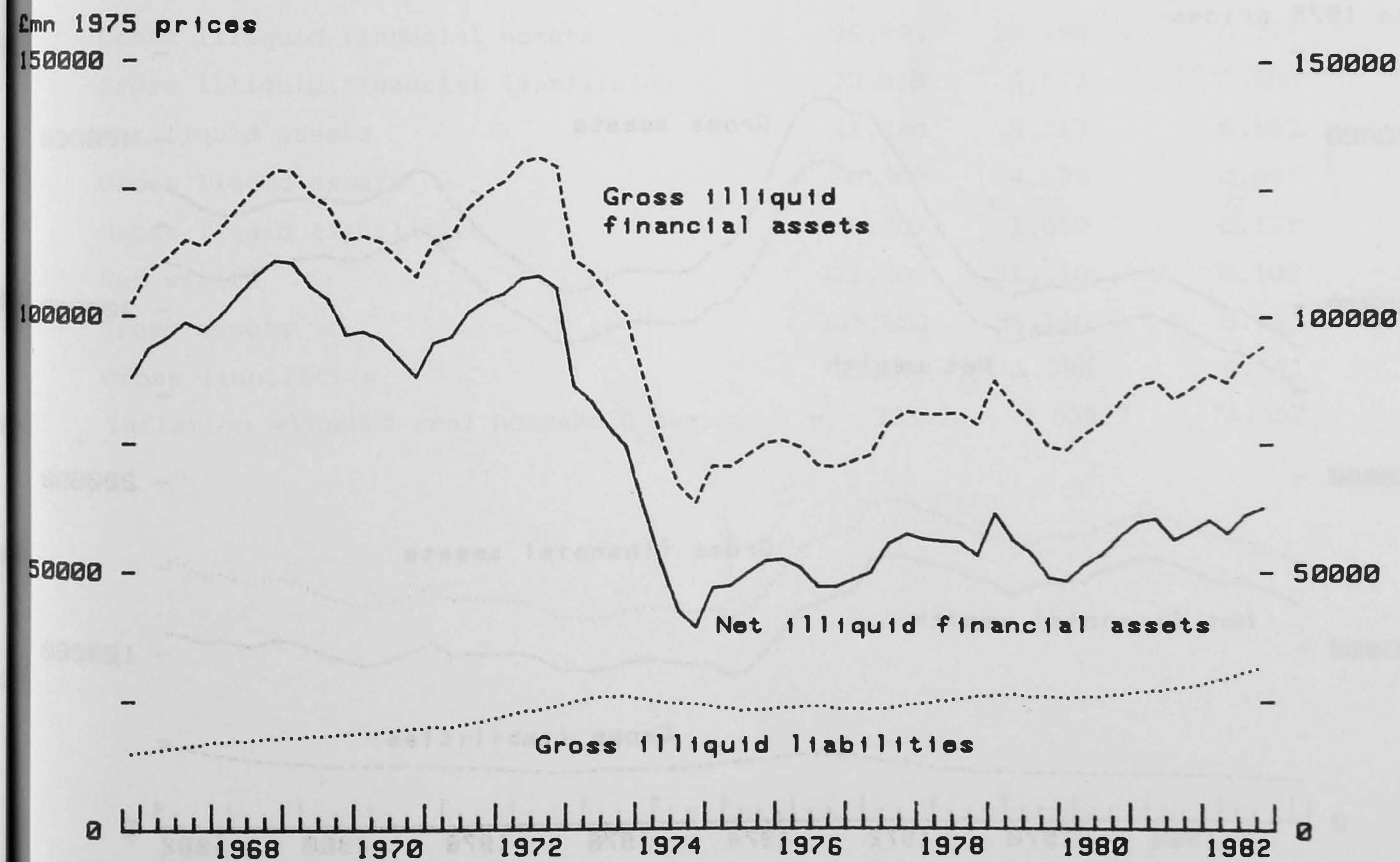


Chart 11

Gross and net financial assets and wealth

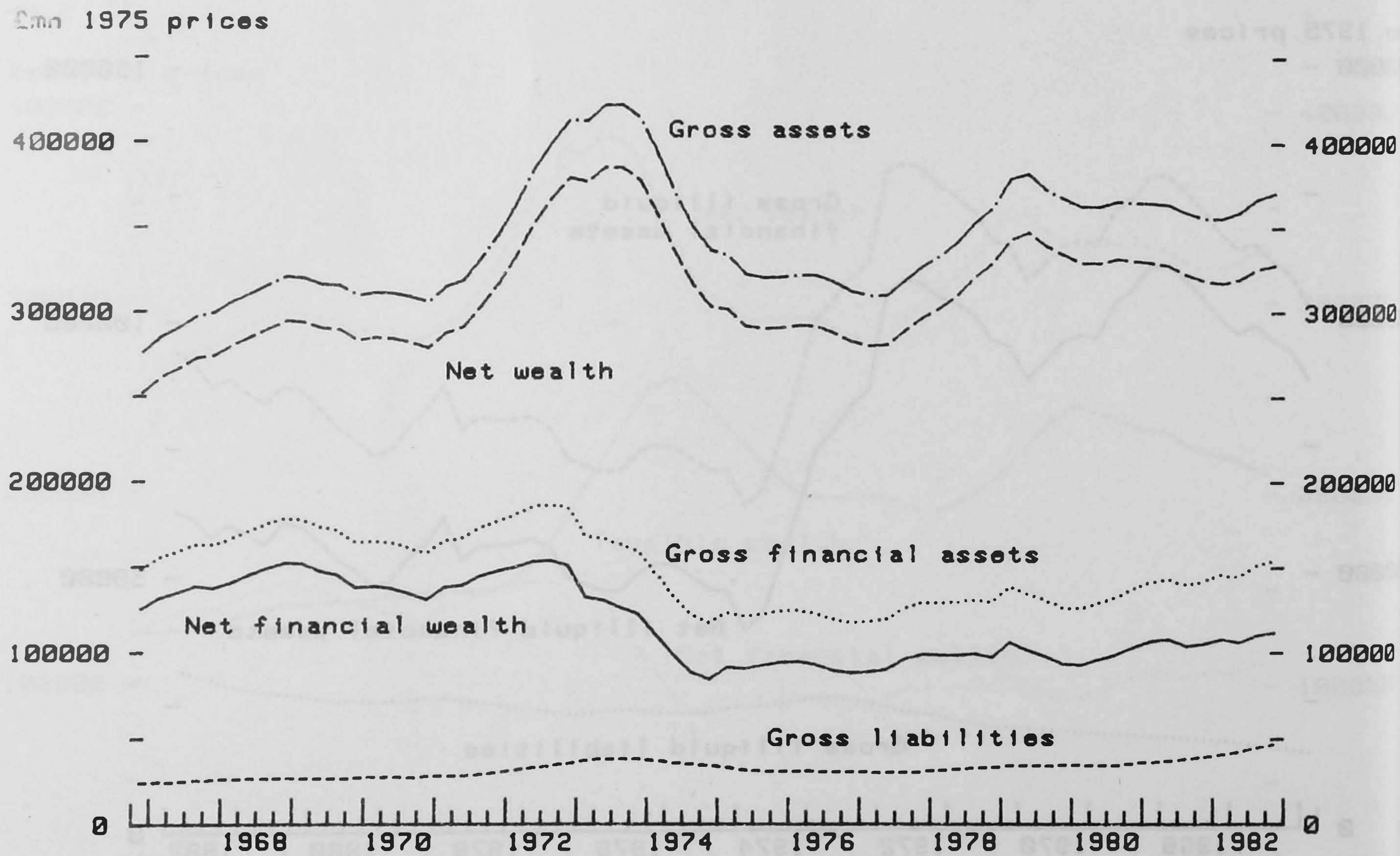


TABLE 1 DESCRIPTIVE STATISTICS OF CHARTED SERIES

At constant (1975) prices	Mean	Standard deviation	Coefficient of variation
Real personal disposable income	17,318	2,504	0.145
Real adjusted household disposable income	15,113	1,758	0.116
Consumption of non durables	14,200	1,549	0.109
Consumers' expenditure on durables	1,238	304	0.246
Saving	1,880	732	0.389
Capital account transactions	743	144	0.194
Adjusted net acquisition of financial assets	897	501	0.558
House price inflation	14.5	12.3	0.848
Private sector investment in housing	521	82	0.157
Council house sales	40	53	1.325
Tangible wealth	191,600	40,780	0.213
Value of the owner occupied housing stock	118,500	25,290	0.213
Proxy for stock of consumer durables	31,638	6,174	0.195
Proxy for stock of inventories and work in progress	4,661	829	0.178
Net financial wealth	116,800	22,540	0.193
Gross financial assets	148,000	20,770	0.140
Net illiquid financial assets	73,070	23,030	0.315
Gross illiquid financial assets	95,980	20,550	0.214
Gross illiquid financial liabilities	22,016	4,573	0.208
Net liquid assets	41,980	4,517	0.107
Gross liquid assets	50,509	4,678	0.093
Gross liquid liabilities	9,702	1,659	0.171
Net wealth	311,400	31,710	0.102
Gross assets	342,600	35,140	0.103
Gross liabilities	31,623	5,398	0.171
Inflation adjusted real household saving	- 325.3	439.7	1.352

APPENDIX 2

PERSONAL SECTOR EXPENDITURE AND ACCUMULATION MODEL - EQUATION SPECIFICATIONS

1 Consumption

Consumers' expenditure on non durables

$$\Delta^+ \log CND_t = \underset{(13.3)}{0.39467}\ \Delta^+ \log YDLH_t - \underset{(3.7)}{0.13838}\ \Delta_1\ \Delta^+ \log YDLH_t \qquad (i)$$

$$- \underset{(2.5)}{0.09303} \log \left(\frac{CND}{YDLH}\right)^+_t + \underset{(2.3)}{0.02821} \log \left(\frac{NLAJ/PC}{YDLH}\right)^+_t$$

$$- \underset{(2.0)}{0.02899} + \underset{(2.4)}{0.01386}\ \Delta^+ D681 + \underset{(3.6)}{0.02148}\ \Delta^+ D731$$

$$+ \underset{(2.5)}{0.01467}\ \Delta^+ D79$$

$\bar{R}^2 = 0.80$ SE = 0.00653 DW = 1.7 RSS = 0.002132 LM(8) = 11.5

1966 III - 1980 IV

Where $\log X_t^+ = \frac{[\log X_{t-1} + \log X_{t-2} + \log X_{t-3} + \log X_{t-4}]}{4}$

and $\Delta^+ \log X_t = \log X_t - \log X_t^+$

Consumers' expenditure on durables

$$\Delta^+ \log CD_t = - \underset{(5.0)}{0.70436} \log \left(\frac{CD}{YDLH}\right)^+_t + \underset{(4.6)}{0.22203} \sum_{i=0}^{2} (3-i)[\Delta^+ \log YDLH]_{t-i}$$

$$+ \underset{(4.0)}{0.08017} \sum_{i=0}^{2} \log \left(\frac{LHL}{PCD}\right)_{t-i} \qquad (ii)$$

$$- \underset{(2.6)}{0.1917} \sum_{i=0}^{2} [\log (1 + \frac{RCBR}{100}) - \Delta_4 \log PC_{-1}]_{t-i}$$

$$- \underset{(5.0)}{3.57506} + \underset{(3.3)}{0.17433}\ D681 + \underset{(2.1)}{0.11523}\ D731$$

$$+ \underset{(4.2)}{0.22235}\ D79 + \underset{(1.8)}{0.19852} \log \left(\frac{NLAJ/PC}{YDLH}\right)^+_t$$

$$- \underset{(3.0)}{0.16266}\ \Delta_1 \log RMD_t$$

$\bar{R}^2 = 0.736$ SE = 0.05 DW = 1.5 RSS = 0.119202 LB(8) = 13.3

1966 III - 1980 IV

Real household disposable income, adjusted for inflationary losses on net liquid assets

$$YDLH_t = \left[\frac{YD-LVJ-(0.34\ WS)}{PC}\right]_t - \left[\left[\sum_{i=0}^{8}\left[\frac{PC-PC_{-1}}{PC_{-1}}\right]_{t-i} \div 8\right]*\left(\frac{NLAJ}{PC}\right)_{t-1}\right] \quad \text{(iii)}$$

2 Tangible wealth

House prices

$$\Delta_1 \ln PAHM_t = \underset{(3.8)}{21.156}\left(\Delta_1 \ln PAHM\right)^3_{t-1} + \underset{(2.0)}{0.587}\ \Delta_1 \ln PAHM_{t-2} \quad \text{(iv)}$$

$$+ \underset{(5.7)}{0.532} \ln\left(\frac{RPDI}{OHS}\right)_{t-1} + \underset{(7.9)}{0.203} \ln\left(\frac{KHL*}{PAHM}\right)_{t-1}$$

$$- \underset{(5.2)}{0.774}\left[\left(\frac{RZMG}{100}\right)*\left(\frac{1-TRY}{100}\right)\right]_t$$

$$+ \underset{(2.1)}{0.191}\left(3*\Delta \ln RPDI_t + 2*\Delta \ln RPDI_{t-1} + \Delta \ln RPDI_{t-2}\right)$$

$$+ \underset{(0.8)}{0.251}\ \Delta_1 \ln\left(\frac{KHL*}{PAHM}\right)_{t-2} - \underset{(2.7)}{1.255}\ \Delta_1\left[\left(\frac{RZMG}{100}\right)*\left(\frac{1-TRY}{100}\right)\right]_t$$

$$- \underset{(8.1)}{2.289} - \underset{(0.4)}{0.0018}\ Q1 + \underset{(2.6)}{0.01275}\ Q2 + \underset{(4.8)}{0.02367}\ Q3$$

$\bar{R}^2 = 0.846$ SE = 0.0117 DW = 1.5 LM(8) = 17.1 1969 I - 1980 IV

Stock of mortgages outstanding, excluding those issued to finance council house sales

$$KHL*_t = KHL_t - \sum_{i=0}^{\infty}\left[0.9\ ICHJ.PILG - \sum_{i=0}^{\infty}\left[0.01 * 0.9\ ICHJ.PILG\right]_{t-i-}\right]_{t-i} \quad \text{(v)}$$

Private housing investment

$$IHP_t = \underset{(5.1)}{0.53211}\ IHP_{t-1} + \underset{(2.1)}{76.829}\ \left(\frac{PAHM}{0.556\ ULC + 0.444\ PIMN}\right)_t \qquad (vi)$$

$$- \underset{(5.0)}{12.09}\ RCBR_t + \underset{(4.9)}{280.874}$$

$\bar{R}^2 = 0.77$ SE = 34.4 DW = 1.9 LB(8) = 7.8 1966 III - 1980 IV

Personal sector fixed investment

$$\left[\frac{IFJ£ - 0.9747\ IHP£ - ICHJ.PILG}{INP£ - INS£}\right]_t = 0.03041 + 0.78366$$

$$\left[\frac{IFJ£ - 0.9747\ IHP£ - ICHJ.PILG}{INP£ - INS£}\right]_{t-1} \qquad (vii)$$

$\bar{R}^2 = 0.569$ SE = 0.024 DW = 2.2 1965 III - 1979 IV

Owner occupied housing stock

$$OHS_t - 0.07143\ IHP_t - 0.1988\ ICHJ_t = \underset{(553.4)}{0.9942}\ OHS_{t-1} + \underset{(4.12)}{74.58} \qquad (viii)$$

$\bar{R}^2 = 0.999$ DW = 1.7 SE = 13.8 1964 I - 1980 IV

Value of owner occupied housing stock

$$VOHS_t = 11.4577 * PAHM_t * OHS_t \qquad (ix)$$

Stock of consumer durables

$$SCD_t = 0.9409\ SCD_{t-1} + 0.968\ CD_t \qquad (x)$$

Stock of inventories and work in progress

$$KIIJ_t = \sum_{i=0}^{\infty} (IIJ£ + YSAJ)_{t-i} \qquad (xi)$$

Tangible wealth

$$TWJ_t - VOHS_t - (1.807*SCD_t) - (1.406*KIIJ_t) = \underset{(16.1)}{0.95628}(TWJ - VOHS - (1.807*SCD£) - (1.406*KIIJ))_{t-1} + \underset{(1.1)}{1957.16}\ PC_t \qquad \text{(xii)}$$

$\bar{R}^2 = 0.994$ SE = 2522   DW = 1.2   LB(8) = 29.1   1967 II - 1980 IV

3 Financial wealth

Adjusted net acquisition of financial assets

$$NAFJ_t = YD_t - C£_t - LVJ_t - IFJ£_t - IIJ£_t + LHL_t - RESJ_t - YSAJ_t + FTKJ_t \qquad \text{(xiii)}$$

Net flow of mortgage lending

$$LHL_t = LZNA_t + LHBB_t + LHPG_t + LHPV_t \qquad \text{(xiv)}$$

Stock of real net liquid assets

$$\Delta_1\left(\frac{NLAJ}{PC}\right)_t = \underset{(4.3)}{0.67572}\ \Delta_1\left(\frac{NAFJ}{PC}\right)_t$$

$$- 19996\ \Delta_1 \left[\frac{PC - PC_{-4}}{PC_{-4}}\right]_t \qquad \text{(xv)}$$

$$- \underset{(2.1)}{229.004}\ \Delta_1 \left[\frac{RSHT + RUKG}{2}\right]_t$$

$$+ \underset{(2.0)}{95.7119}\ RSHT_{t-1}$$

$$- \underset{(3.3)}{135.71}\ RUKG_{t-1}$$

$$+ \underset{(3.0)}{3978.5} \left[\frac{PCD - PCD_{-4}}{PCD_{-4}}\right]_{t-1}$$

$$- \underset{(4.8)}{9549.4} \left[\frac{PCND - PCND_{-4}}{PCND_{-4}} \right]_{t-1}$$

$$+ \underset{(2.8)}{0.56552} \left[\frac{NAFJ}{PC} \right]_{t-1}$$

$$- \underset{(1.9)}{11872.67} \left(\frac{NLAJ}{NWJ} \right)_{t-1} \qquad + \underset{(2.1)}{2659.56348}$$

$\bar{R}^2 = 0.744$ SE = 305.0 DW = 2.0 LB(8) = 9.6 1968 I - 1980 IV

Composite short interest rate

$$RSHT_t = \left[\bar{R}ZSG_t * \left[\frac{NLAJ + KBMS}{NLAJ} \right]_t \right] + (RCBR + 3.1)_t * \left[\frac{KBMS}{NLAJ} \right]_t \qquad \text{(xvi)}$$

Net financial wealth

$$NFWJ_t = NFWJ_{t-1} - LHL_t + \Delta_1 \, NLAJ_t - \Delta_1 \, KRTC_t + NCJ_t + LGJ_t + BLGJ_t$$

$$+ IPJ_t + LVJ_t + AAJ_t + \left[\left[NFWJ - NLAJ + KHL + KRTC \right.\right.$$

$$\left. - 0.85 \, KNCS \right]_{t-1} * 0.45 \left. \left(\frac{SPUK_t - SPUK_{t-1}}{SPUK_{t-1}} \right) \right] \qquad \text{(xvii)}$$

Stock of mortgage loans outstanding

$$KHL_t = KHBB_t + KHPG_t + KHPV_t + KZNA_t \qquad \text{(xviii)}$$

Net illiquid financial assets

$$NIAJ_t = NFWJ_t - NLAJ_t \qquad \text{(xix)}$$

4 Net wealth

$$NWJ_t = NFWJ_t + TWJ_t \qquad \text{(xx)}$$

Bank Lending Variant

Stock of real bank borrowing

$$\Delta_1 \log\left(\frac{KBMS}{PC}\right)_t = \underset{(1.9)}{-\ 0.07645} \log\left(\frac{KBMS}{NWJ}\right)_{t-1} + \underset{(1.4)}{0.17011} \log\left(\frac{C£ + IIJ£ + IFJ£}{PC}\right)_{t-1}$$

$$- \underset{(5.4)}{0.6538}\ \Delta_4 \ln PC_{t-1} - \underset{(0.1)}{0.01884} \ln RCBT_{t-1}$$

$$- \underset{(0.7)}{0.3284}\ \Delta_1 \ln RCBT_t - \underset{(1.7)}{0.01195}\ CBAD_t - \underset{(1.7)}{1.8482}$$

$$- \underset{(2.2)}{0.623}\ \Delta_1 \Delta_4 \ln PC_t \qquad \text{(xxi)}$$

$\bar{R}^2 = 0.564$ SE = 0.0264 DW = 1.83 LB(8) = 8.2 1968 I - 1980 IV

Stock prices and interest rates variant

Net Income from rent, interest, profits and dividends

$$YNWJ_t = \underset{(20.2)}{0.61221} \left[\left(\frac{RSHT}{400} * NLAJ\right)_t + \left(\frac{RLNG}{400} * NIAJ\right)_t \right. \qquad \text{(xxii)}$$

$$\left. + \left(\frac{RSHT + RLNG}{1600} * (TWJ - 1.406\ KIIJ - 1.807\ SCD£)\right)_t \right]$$

$$- \underset{(1.5)}{0.00263} \frac{\Delta PC}{PC_{-1}} * NWJ_t - \underset{(6.5)}{36.04}\ TIME - \underset{(6.4)}{254.4}$$

$\bar{R}^2 = 0.98$ SE = 170.4 DW = 1.5 LB(8) = 6.1 1967 IV - 1980 IV

Gilt prices

$$\Delta_1 \log GLTP_t = \underset{(6.4)}{-\ 0.55559}\ \Delta_1 \ln RUKG_t \qquad \text{(xxiii)}$$

$\bar{R}^2 = 0.36$ SE = 0.0437 DW = 3.1 LB(8) = 31.8 1963 II - 1980 IV

Share prices

$$\Delta_1 \log SPUK_t = \underset{(3.5)}{0.73677} \Delta_1 \log GLTP_t + \underset{(0.5)}{0.50646} \Delta_1 \log GDP_t$$

$$- \underset{(0.6)}{0.69972} \Delta_1 \log PC_t + \underset{(1.9)}{0.0961} \log \left(\frac{ECDV}{YITP}\right)_{t-1}$$

$$- \underset{(2.1)}{0.08854} \log \left(\frac{SPUK}{GDP£}\right)_{t-1} - \underset{(1.4)}{0.25031} \qquad \text{(xxiv)}$$

$\bar{R}^2 = 0.2$ SE = 0.09347 DW = 1.5 LB(8) = 14.2 1963 II - 1980 IV

Net financial wealth

$$NFWJ_t = NFWJ_{t-1} - LHL_t + \Delta_1 NLAJ_t - \Delta_1 KRTC_t + NCJ_t + LGJ_t + BLGJ_t + IPJ_t$$
$$+ LVJ_t + AAJ_t + [[NFWJ - NLAJ + KHL + KRTC - 0.85\ KNCS]_{t-1}$$
$$* 0.7 * [[0.75 * \frac{SPUK_t - SPUK_{t-1}}{SPUK_{t-1}}]$$
$$+ [0.25 * \frac{GLTP_t - GLTP_{t-1}}{GLTP_{t-1}}]]]$$

(xxv)
(replacing (xvii))

Net liquid assets

$$\Delta_1 \left(\frac{NLAJ}{PC}\right)_t = \underset{(4.7)}{0.71391} \Delta_1 \left(\frac{NAFJ}{PC}\right)_t - \underset{(7.3)}{18869.74} \Delta_1 \left[\frac{PC - PC_{t-4}}{PC_{t-4}}\right]_t$$

$$- \underset{(2.6)}{209.27} \Delta_1 \left(\frac{RSHT + RLNG}{2}\right)_t + \underset{(1.2)}{46.82} RSHT_{t-1} - \underset{(3.5)}{102.09} RLNG_{t-1}$$

$$+ \underset{(3.3)}{4318.96} \left(\frac{PCD - PCD_{t-4}}{PCD_{t-4}}\right)_{t-1} - \underset{(4.9)}{9222.7} \left(\frac{PCND - PCND_{t-4}}{PCND_{t-4}}\right)_{t-1}$$

$$+ \underset{(3.1)}{0.61629} \frac{NAFJ}{PC}_{t-1} - \underset{(1.5)}{9741.96} \frac{NLAJ}{NWJ}_{t-1} + \underset{(2.4)}{2294.35}$$

$\bar{R}^2 = 0.75$ SE = 292.9 DW = 2.0 LB(8) = 8.3 1968 I - 1980 IV

(xxvi)
(replacing (xv))

Composite long interest rate

$$RLNG_t = \left(RUKG_t^* \left(\frac{NIAJ + KHL}{NIAJ}\right)_t\right) - \left(RZMG_t^* \left(\frac{KHL}{NIAJ}\right)_t\right) \qquad \text{(xxvii)}$$

ALTERNATIVE CONSUMER DURABLES FUNCTIONS FEATURING NET AND GROSS LIQUID ASSETS AND BANK LENDING

Specification of integral control	Basic L/Y*	G/Y*	G/Y* & K/Y*	L/Y* & $\Delta^+ K$	$\alpha \ln \frac{G-\beta K}{Y^*}$	L/Y* & K/Y*
Variable						
ALY*+	0.22203 (4.6)	0.2344 (4.6)	0.15327 (2.9)	0.2121 (3.4)	0.171 (3.3)	0.15766 (3.0)
CD*/Y*+	-0.70436 (5.0)	-0.7178 (5.0)	-0.8628 (6.2)	-0.71465 (5.1)	-0.8215 (6.0)	-0.8525 (6.1)
DLHL	0.08017 (4.0)	0.07798 (3.8)	0.0983 (5.0)	0.07836 (3.8)	0.0919 (4.8)	0.0965 (4.9)
DRR	-0.1917 (2.6)	-0.2064 (2.7)	-0.0579 (0.7)	-0.19356 (2.3)	-0.084 (1.1)	-0.06505 (0.8)
68	0.17433 (3.3)	0.175 (3.3)	0.173 (3.6)	0.176 (3.4)	0.175 (3.6)	0.1737 (3.6)
73	0.11523 (2.1)	0.121 (2.2)	0.118 (2.4)	0.109 (2.0)	0.118 (2.3)	0.11814 (2.4)
79	0.22235 (4.2)	0.2203 (4.1)	0.2068 (4.2)	0.227 (4.3)	0.448 (5.9)	0.2073 (4.2)
	$\frac{G}{Y^*}^+$ +	0.15135 (1.4)	0.768 (3.6)		α 0.40447 (3.0)	
		$\frac{K}{Y^*}^+$	-0.311 (3.3)	Δ+K 0.05525 (0.4)	β 2.448 (5.9)	$\frac{K}{Y^*}^+$ -0.18098 (2.7)
(L/Y*)+	0.19852 (1.8)			0.27002 (2.1)		0.61996 (3.5)
Δ_1 RMD	-0.16266 (3.0)	-0.1674 (3.0)	-0.0951 (1.7)	-0.15358 (2.7)	-0.1008 (1.8)	-0.09586 (1.7)
$\bar{R}^2$	0.736	0.731	0.777	0.739	0.777	0.775
SE	0.05	0.050339	0.045861	0.049539	0.046516	0.04605
DW	1.5	1.5	1.6	1.6	1.6	1.6
LB(8)	13.3	13.1	13.2	13.9	13.3	13.2
RSS	0.0119202	0.121631	0.098853	0.115342	0.10168	0.099667
t	58	58	58	58	58	58
k	10	10	11	11	11	11

Key to mnemonics G = Gross liquid Assets L = Net liquid Assets
K = Stock of bank lending (excluding house purchase loans)

$$DLHL = \sum_{i=0}^{2} \ln \frac{LHL}{PCD} \qquad DRR = \sum_{i=0}^{2} \ln \left(1 + \frac{RCBR}{100}\right) - \Delta_4 \ln PC_{-1}$$

$$ALY^{*}+ = \sum_{i=0}^{2} (3-i)\, \Delta + \ln Y^*$$

ALTERNATIVE CONSUMER NON-DURABLES FUNCTIONS FEATURING NET AND GROSS LIQUID ASSETS AND BANK LENDING

Specification of integral control	Basic L/Y*	G/Y*	G/Y* & K/Y*	L/Y* & $\Delta^+ K$	$\alpha \ln \frac{(G-\beta K)}{Y^*}$ +	L/Y* & K/Y*
$\Delta_1 \Delta^+ Y^*$	-0.13838 (3.7)	-0.14231 (3.7)	-0.1296 (3.3)	-0.11809 (3.0)	-0.1315 (3.4)	-0.13037 (3.4)
CND^+/Y^{*+}	-0.09303 (2.5)	-0.07991 (2.1)	-0.1575 (2.7)	-0.07606 (1.9)	-0.1466 (2.7)	-0.15283 (2.7)
73	0.02148 (3.6)	0.022 (3.6)	0.021 (3.5)	0.018 (3.0)	0.02 (3.4)	0.02052 (3.4)
79	0.01467 (2.5)	0.014 (2.4)	0.014 (2.4)	0.015 (2.6)	0.014 (2.4)	0.014 (2.4)
68	0.01386 (2.4)	0.014 (2.3)	0.015 (2.1)	0.014 (2.5)	0.015 (2.5)	0.015 (2.5)
CNST	-0.02899 (2.0)	-0.025 (1.6)	-0.121 (2.1)	-0.03302 (1.9)	-0.046 (2.3)	-0.07912 (2.0)
DY*+	0.39467 (13.3)	0.400 (13.0)	0.3875 (12.4)	0.3357 (7.5)	0.3896 (12.6)	0.38836 (12.5)
$(L/Y^*)^+$	0.02821 (2.3)			0.03515 (2.2)	α 0.0525 (2.4)	$(\frac{L}{Y^*})^+$ 0.06739 (2.2)
$(G/Y^*)^+$		0.0236 (1.8)	0.0843 (2.2)		β 1.8737 (4.2)	
$(\frac{K}{Y^*})^+$			-0.0261 (1.7)			-0.01176 (1.2)
$\Delta^+ K$				0.03174 (1.9)		
$\bar{R}^2$	0.8	0.790	0.798	0.806	0.877	0.798
SE	0.00653	0.006646	0.006524	0.006405	0.006531	0.006527
DW	1.7	1.7	1.7	1.8	1.7	1.7
LB(8)	11.5	7.7	10.7	12.1	10.5	10.6
RSS	0.002132	0.002208	0.002086	0.00201	0.00209	0.002087
t	58	58	58	58	58	58
k	8	8	9	9	9	9

VARIABLES LIST (current prices unless otherwise stated)

AAJ	Accruals adjustment; persons
BLGJ	Long debt; persons
BSGJ	Other short debt; persons
C£	Consumption
CBAD	Dummy for periods of credit restraint
CD	Consumers' expenditure on durables (1975 prices)
CD£	Consumers' expenditure on durables
CND	Consumption of non durables (1975 prices)
CND£	Consumption of non durables
D681) D731) D79)	Budget dummies for 1968, 1973, 1979
ECDV	Payments of dividends on ordinary shares
FTKJ	Net capital transfers, persons
GDP	Gross domestic product, average measure (1975 prices)
GDP£	Gross domestic product, expenditure measure
GLTP	Gilt price index
HS	Housing stock, thousands
ICHJ	Personal sector purchases of council houses (1975 prices)
IFJ£	Personal sector fixed investment
IIJ£	Personal sector stockbuilding
IHP	Private sector residential fixed investment; dwellings (1975 prices)
IHP£	Private sector residential fixed investment; dwellings
IPJ	Portfolio investment: persons
KBMS	Stock of bank advances to persons excluding loans for house purchase
KHBB	Stock of bank loans for house purchase
KHL	Stock of loans for house purchase
KHL*	Stock of loans for house purchase excluding those issued to purchase council houses
KHPG	Stock of public sector loans for house purchase
KHPV	Stock of OFIs loans for house purchase
KIIJ	Value of personal sector stocks
KRTC	Stock of retail trade credit
KZNA	Stock of building society loans for house purchase
LHBB	Flow of bank loans for house purchase

LHPG	Flow of public sector loans for house purchase
LHPV	Flow of OFIs loans for house purchase
LVJ	Receipts in life and pension funds: persons
LZNA	Flow of building society loans for house purchase
NAFJ	Adjusted net acquisition of financial assets: persons
NCJ	Notes and coin: persons
NFWJ	Net financial wealth: persons
NLAJ	Net liquid assets: persons
NWJ	Net wealth: persons
OHS	Owner occupied housing stock (thousands)
PAHM	Price deflator for all houses, mix adjusted
PC	Price deflator for consumption
PCND	Price deflator for consumption of non durables
PCD	Price deflator for consumption of durables
PIMN	Imputed wholesale price index of manufacturing output (net of tax)
PILG	Price deflator for public sector sales of land and existing buildings
RCBR	Clearing banks' base rate
RCBT	Post tax clearing banks' base rate to persons (1+((RCBR + 3.1) * (TAXJ + (((1 - TAXJ) * (1 - TRY/100))/100))
RESJ	Unidentified financial transactions: persons
RLNG	Composite long interest rate
RMD	Effective minimum deposit rate for durables
ROOT	Ratio of owner occupied to total dwellings
RPDI	Real personal disposable income
RSHT	Composite short interest rate
RUKG	Rate on 20-year gilts
RZMG	Interest rate on building society mortgages
RZSG	Gross rate of interest on building society shares
SCD£	Stock of consumer durables
SPUK	UK share price index
TAXJ	Proportion of bank interest charges not offsettable against personal tax
TIME	Time Trend
TRY	Standard rate of income tax
TWJ	Tangible wealth: persons

ULC	Unit labour costs
VOHS	Value of owner occupied housing stock
WS	Actual average weekly wages and salaries (£/quarter)
YD	Personal disposable income
YDLH	Real household disposable income adjusted to allow for effects of inflation on liquid assets
YITP	ICCs' gross trading profits
YNWJ	Personal sector net receipts of rent interest,profits and dividends (= Other personal income - corporate current transfers to charities - income of the self employed)
YSAJ	Stock appreciation: persons

CBAD: Controls on Bank Lending - Data Series

	Q1	Q2	Q3	Q4
1968	1	2	2	3
1969	3	3	3	3
1970	3	2	2	2
1971	2	1	1	0
1972	0	0	0	0
1973	0	0	1	2
1974	2	2	2	2
1975	0	0	0	0
1976	0	0	0	1
1977	1	1	0	0
1978	0	0	1	1
1979	1	1	1	1
1980	1	1	0	0
1981	0	0	0	0
1982	0	0	0	0

APPENDIX 3 TRACKING AND SIMULATION RESULTS

SIMULATIONS - KEY TO MNEMONICS

YDLH	Real household disposable income adjusted for inflationary losses on net liquid assets	
CD	Consumers' expenditure on durables, 1975 prices	
NLAJ	Stock of net liquid financial assets	
CND	Consumption of non durables, 1975 prices	
OHS	Owner occupied housing stock, thousands	
VOHS	Value of owner occupied housing stock	
TWJ	Tangible wealth	
SCD	Stock of consumer durables, 1975 prices	
NFWJ	Net financial wealth	
NAFJ	Adjusted net acquisition of financial assets	
PAHM	Price deflator for all houses, mix adjusted	
IHP	Private sector investment in dwellings, 1975 prices	
IFJ£	Personal sector fixed investment	
NWJ	Net wealth	
NIAJ	Stock of net illiquid financial assets	
KBMS	Stock of bank lending to persons	Only used in the variants, simulations (10) - (15)
GLAJ	Stock of gross liquid financial assets	Only used in the variants, simulations (10) - (15)
GLTP	Gilt price index	Only used in the variants, simulations (10) - (15)
SPUK	Share price index	Only used in the variants, simulations (10) - (15)
YNWJ	Net receipts of rent, profits, interest and dividends	Only used in the variants, simulations (10) - (15)

DIAGNOSTICS OF SIMULATION TRACKS OF THE BASIC MODEL

		Simulation						
Variable	Single equation (4) RMSE %	In-sample static (4) RMSE%	In-sample dynamic (4) RMSE%	Outside-sample dynamic (5) RMSE%	U	UM	Mean % error (*End-year % error)(1) 1981	1982
YDLH	0.0	0.1	0.2	0.1	0.04	0.02	0.04	- 0.04
CD	3.7	3.8	3.7	3.7	0.52	0.02	0.76	- 4.17
NLAJ	0.7	0.8	2.7	0.8	0.29	0.01	- 0.04*	- 0.34*
CND	0.7	0.7	0.6	0.6	0.76	0.04	0.25	- 0.71
OHS (2)	0.2	0.1	0.2	0.3	0.22	0.02	0.47*	0.24*
VOHS (2)	3.2	3.2	7.6	2.5	0.67	0.06	- 0.67*	- 5.09*
TWJ (2)	1.4	2.5	3.5	3.9	0.61	0.15	- 3.26*	- 6.37*
SCD	1.0	0.9	2.2	1.4	0.81	0.08	0.54*	- 0.31*
NFWJ	3.5	3.8	3.5	2.9	0.66	0.01	3.92*	2.25*
NAFJ	-	11.4	10.2	10.5	0.34	0.04	- 1.44	13.4
PAHM	1.2 (3)	1.8	8.3	2.7	0.74	0.07	- 1.14*	- 5.35
IHP	7.5	7.1	7.1	22.1	1.34	0.05	-23.6	-18.0
IFJ£	4.5	5.7	9.5	5.4	0.71	0.00	- 3.7	1.52
NWJ	-	2.0	2.6	1.8	-	-	- 0.89*	- 3.44*
NIAJ	-	7.0	7.4	5.2	0.87	0.01	7.13*	4.3*

(1) For mean and end year errors, a minus sign denotes an overprediction.
(2) No data is available yet for 1982, so the numbers were estimated.
(3) The equation used in this case is slightly different.
(4) Simulation period 1975 I - 1980 IV.
(5) Simulation period 1981 I - 1982 IV.

(b) Simulations

(1) Increase money incomes by 2.5% for one quarter

% changes on base	Year 1	2	3	4	5
YDLH	+0.67	-0.02	-0.01	-	-
CD	+0.79	-0.14	+0.03	+0.05	+0.04
NLAJ (end year)	+0.34	+0.29	+0.20	+0.13	+0.08
CND	+0.29	+0.04	+0.05	+0.05	+0.05
OHS (end year)	+0.01	+0.01	+0.01	+0.01	+0.01
VOHS (end year)	+0.96	-0.03	-0.14	-0.04	-
TWJ (end year)	+0.65	-	-0.08	-0.01	+0.01
SCD (end year)	+0.17	+0.10	+0.08	+0.07	+0.06
NFWJ (end year)	+0.23	+0.19	+0.15	+0.11	+0.08
NAFJ	+2.44	-0.44	-0.92	-1.81	-3.55
PAHM (end year)	+1.43	+0.25	-0.14	-0.08	-0.02
IHP	+0.51	+0.23	-0.02	-0.04	-0.13
IFJ£	+0.27	+0.11	-0.01	-0.02	-0.01
NWJ (end year)	+0.52	+0.06	-0.02	+0.02	+0.02
NIAJ (end year)	+0.13	+0.10	+0.10	+0.09	+0.07

(2) Increase pension contributions by 25% throughout

% changes on base	Year 1	2	3	4	5
YDLH	- 2.34	- 1.91	- 1.76	- 1.75	- 1.75
CD	- 2.26	- 1.88	- 1.65	- 1.72	- 1.76
NLAJ	- 1.0	- 1.51	- 1.75	- 1.84	- 1.83
CND	- 0.83	- 0.93	- 0.98	- 1.09	- 1.19
OHS	-	-	-	-	-
VOHS	-	-	-	-	-
TWJ	- 0.1	- 0.15	- 0.17	- 0.19	- 0.2
SCD	- 0.5	- 0.9	- 1.1	- 1.2	- 1.4
NFWJ	+ 0.6	+ 1.4	+ 2.1	+ 2.9	+ 3.8
NAFJ	-15.7	-15.7	-15.1	-23.1	-39.1
PAHM	-	-	-	-	-
IHP	-	-	-	-	-
IFJ£	-	-	-	-	-
NWJ	+ 0.14	+ 0.35	+ 0.51	+ 0.68	+ 0.87
NIAJ	+ 2.1	+ 3.9	+ 5.7	+ 7.8	+10.4

(3) Increase prices by 3% per quarter, holding real household disposable income constant

% changes on base	Year 1	2	3	4	5
YDLH	- 0.81	- 0.91	+ 0.01	+ 0.01	+ 0.01
CD	- 0.74	- 0.89	- 0.8	- 1.0	- 1.15
NLAJ	+ 0.5	+ 1.9	+ 2.0	+ 2.1	+ 2.2
CND	- 0.33	- 0.49	- 0.2	- 0.18	- 0.18
OHS	-	-	-	-	-
VOHS	-	-	-	-	-
TWJ	+ 0.6	+ 0.6	+ 0.6	+ 0.6	+ 0.6
SCD	- 0.2	- 0.4	- 0.5	- 0.6	- 0.7
NFWJ	+ 0.6	+ 1.1	+ 1.4	+ 1.8	+ 2.1
NAFJ	+ 8.3	+12.0	+ 7.0	+12.6	+25.6
PAHM	-	-	-	-	-
IHP	-	-	-	-	-
IFJ£	-	-	-	-	-
NWJ	+ 0.6	+ 0.8	+ 0.8	+ 0.9	+ 1.0
NIAJ	+ 0.6	+ 0.5	+ 1.0	+ 1.5	+ 2.0

(4) Increase mortgage lending by 10% per quarter

% changes on base	Year 1	2	3	4	5
YDLH	- 0.02	- 0.04	- 0.05	- 0.06	- 0.07
CD	+ 1.89	+ 3.15	+ 3.46	+ 3.58	+ 3.65
NLAJ	+ 0.41	+ 0.83	+ 1.16	+ 1.39	+ 1.56
CND	-	-	+ 0.03	+ 0.06	+ 0.10
OHS	-	-	+ 0.02	+ 0.05	+ 0.07
VOHS	+ 0.67	+ 2.37	+ 4.34	+ 5.18	+ 5.59
TWJ	+ 0.52	+ 1.76	+ 3.29	+ 4.00	+ 4.39
SCD	+ 0.47	+ 1.16	+ 1.76	+ 2.21	+ 2.55
NFWJ	- 0.11	- 0.28	- 0.52	- 0.82	- 1.15
NAFJ	+ 6.25	+ 8.95	+ 7.64	+ 8.08	+ 8.14
PAHM	+ 0.27	+ 1.68	+ 3.60	+ 4.89	+ 5.37
IHP	+ 0.19	+ 0.74	+ 1.52	+ 1.95	+ 2.19
IFJ£	+ 0.04	+ 0.25	+ 0.64	+ 1.06	+ 1.26
NWJ	+ 0.32	+ 1.11	+ 2.16	+ 2.64	+ 2.91
NIAJ	- 0.57	- 1.21	- 2.06	- 3.10	- 4.33

(5) Increase house prices by 10% in the first quarter

% changes on base	Year 1	2	3	4	5
YDLH	- 0.02	- 0.04	- 0.03	- 0.02	- 0.01
CD	-	+ 0.07	+ 0.15	+ 0.14	+ 0.10
NLAJ	+ 0.42	+ 0.68	+ 0.55	+ 0.36	+ 0.23
CND	-	-	+ 0.03	+ 0.05	+ 0.06
OHS	+ 0.04	+ 0.07	+ 0.07	+ 0.06	+ 0.06
VOHS	+10.21	+ 2.28	- 0.91	- 0.63	- 0.14
TWJ	+ 6.64	+ 1.51	- 0.62	- 0.43	- 0.09
SCD	-	+ 0.02	+ 0.05	+ 0.07	+ 0.08
NFWJ	- 0.06	- 0.15	- 0.19	- 0.28	- 0.27
NAFJ	- 1.37	- 1.33	- 1.00	- 1.45	- 4.32
PAHM	+10.93	+ 5.08	- 0.1	- 0.90	- 0.35
IHP	+ 3.73	+ 2.92	+ 0.41	- 0.30	- 0.19
IFJ£	+ 1.98	+ 1.33	+ 0.20	- 0.18	- 0.11
NWJ	+ 4.53	+ 0.97	- 0.49	- 0.37	- 0.14
NIAJ	- 0.48	- 0.84	- 0.87	- 0.83	- 0.85

(6) Increase council house sales by 20,000 per quarter

% changes on base	Year 1	2	3	4	5
YDLH	-	+ 0.01	+ 0.01	+ 0.01	+ 0.02
CD	- 0.01	- 0.01	- 0.03	- 0.06	- 0.09
NLAJ	- 0.07	- 0.14	- 0.25	- 0.37	- 0.5
CND	-	-	-	- 0.01	- 0.02
OHS	+ 0.65	+ 1.26	+ 1.81	+ 2.32	+ 2.8
VOHS	+ 0.13	- 0.74	- 2.0	- 2.77	- 3.38
TWJ	+ 0.09	- 0.49	- 1.39	- 1.96	- 2.43
SCD	-	-	- 0.01	- 0.02	- 0.03
NFWJ	- 0.4	- 0.7	- 1.0	- 1.2	- 1.4
NAFJ	- 1.15	- 1.16	- 0.7	- 0.12	0.0
PAHM	- 0.23	- 1.41	- 3.1	- 4.6	- 5.6
IHP	- 0.1	- 0.43	- 1.1	- 1.6	- 2.1
IFJ£	+11.9	+ 9.75	+ 8.4	+ 7.2	+ 6.0
NWJ	- 0.1	- 0.6	- 1.3	- 1.7	- 2.1
NIAJ	- 0.68	- 1.1	- 1.6	- 2.0	- 2.4

(7) Increase the return on gilts by two percentage points

% changes on base	Year 1	2	3	4	5
YDLH	+ 0.11	+ 0.20	+ 0.22	+ 0.24	+ 0.26
CD	- 0.03	- 0.40	- 0.86	- 1.20	- 1.40
NLAJ	- 2.10	- 3.75	- 4.88	- 5.63	- 6.10
CND	+ 0.03	- 0.01	- 0.13	- 0.29	- 0.47
OHS	-	-	-	-	-
VOHS	-	-	-	-	-
TWJ	-	- 0.02	- 0.05	- 0.08	- 0.11
SCD	- 0.01	- 0.12	- 0.31	- 0.53	- 0.73
NFWJ	- 0.03	+ 0.18	- 0.39	+ 0.71	+ 1.18
NAFJ	- 0.33	+ 0.79	+ 4.59	+14.92	+43.73
PAHM	-	-	-	-	-
IHP	-	-	-	-	-
IFJ£	-	-	-	-	-
NWJ	- 0.01	+ 0.04	+ 0.08	+ 0.14	+ 0.23
NIAJ	+ 1.78	+ 3.44	+ 5.19	+ 7.27	+ 9.72

(8) Increase real interest rates by two percentage points

% changes on base	Year 1	2	3	4	5
YDLH	+ 0.09	+ 0.09	+ 0.08	+ 0.07	+ 0.07
CD	- 0.86	- 1.57	- 1.79	- 1.88	- 1.91
NLAJ	- 1.22	- 1.50	- 1.65	- 1.70	- 1.69
CND	+ 0.02	- 0.02	- 0.08	- 0.13	- 0.18
OHS	- 0.10	- 0.23	- 0.36	- 0.48	- 0.60
VOHS	- 4.21	- 4.29	- 4.99	- 4.65	- 4.46
TWJ	- 2.78	- 3.59	- 3.60	- 3.46	- 3.40
SCD	- 0.21	- 0.56	- 0.88	- 1.13	- 1.31
NFWJ	+ 0.21	+ 0.63	+ 1.03	+ 1.47	+ 1.97
ÑAFJ	+ 4.57	+ 8.34	+12.13	+24.28	+53.20
PAHM	- 2.97	- 4.92	- 4.85	- 4.35	- 4.00
IHP	- 9.54	-12.66	-11.14	-10.01	- 9.46
IFJ£	- 5.07	- 5.84	- 5.79	- 5.83	- 5.68
NWJ	- 1.84	- 2.23	- 2.22	- 2.07	- 1.96
NIAJ	+ 1.46	+ 2.39	+ 3.46	+ 4.75	+ 6.27

(9) Increase return on gilts and share prices by 10%

% changes on base	Year 1	2	3	4	5
YDLH	+ 0.07	+ 0.12	+ 0.12	+ 0.12	+ 0.12
CD	- 0.02	- 0.28	- 0.53	- 0.65	- 0.7
NLAJ	- 1.43	- 2.33	- 2.67	- 2.79	- 2.78
CND	+ 0.02	-	- 0.09	- 0.18	- 0.27
OHS	-	-	-	-	-
VOHS	-	-	-	-	-
TWJ	-	- 0.01	- 0.03	- 0.05	- 0.06
SCD	- 0.01	- 0.08	- 0.2	- 0.3	- 0.4
NFWJ	+ 3.3	+ 3.4	+ 3.4	+ 3.6	+ 3.8
NAFJ	- 0.23	+ 0.54	+ 2.98	+ 8.9	+23.5
PAHM	-	-	-	-	-
IHP	-	-	-	-	-
IFJ£	-	-	-	-	-
NWJ	+ 1.03	+ 1.08	+ 0.99	+ 0.97	+ 0.97
NIAJ	+ 7.4	+ 8.1	+ 9.0	+10.2	+11.5

(10) Increase bank lending by £100 million per quarter

% changes on base

	Year 1	2	3	4	5
YDLH	-	-	-	-	0.01
CD	-	0.04	0.09	0.12	0.15
NLAJ	-0.01	-0.02	-0.06	-0.1	-0.15
CND	-	0.01	0.02	0.04	0.06
OHS	-	-	-	-	-
VOHS	-	-	-	-	-
TWJ	-	-	0.01	0.01	0.01
SCD	-	0.01	0.03	0.06	0.08
NFWJ	-	-0.01	-0.03	-0.06	-0.12
NAFJ	-0.02	-0.21	-0.76	-2.76	-1.50
PAHM	-	-	-	-	-
IHP	-	-	-	-	-
IFJ£	-	-	-	-	-
NWJ	-	-	-	-0.01	-0.02
NIAJ	-	-	-	-	-0.01
KBMS	2.0	3.1	3.5	3.5	3.4
GLAJ	0.25	0.5	0.65	0.72	0.73

(11) Increase real interest rates by 2 percentage points

% changes on base

	Year 1	2	3	4	5
YDLH	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1
CD	- 0.7	- 1.4	- 1.8	- 2.0	- 2.1
NLAJ	- 1.2	- 1.8	- 2.2	- 2.4	- 2.5
CND	-	-	- 0.1	- 0.1	- 0.2
OHS	- 0.1	- 0.2	- 0.3	- 0.5	- 0.6
VOHS	- 3.6	- 5.3	- 5.1	- 4.7	- 4.5
TWJ	- 2.4	- 3.5	- 3.7	- 3.5	- 3.4
SCD	- 0.1	- 0.5	- 0.8	- 1.1	- 1.4
NFWJ	- 1.5	- 1.3	- 0.7	+ 0.2	+ 1.1
NAFJ	+ 7.0	+ 9.0	+11.0	+13.0	+15.0
PAHM	- 3.6	- 5.1	- 4.8	- 4.3	- 4.0
IHP	- 8.0	-12.0	-11.0	-10.0	- 9.0
IFJ£	- 4.4	- 5.6	- 5.8	- 5.8	- 5.7
NWJ	- 2.1	- 2.8	- 2.7	- 2.4	- 2.1
NIAJ	- 1.6	- 1.0	+ 0.3	+ 1.9	+ 3.5
GLTP	- 6.5	- 8.6	-10.2	-10.8	-11.2
SPUK	- 4.0	- 4.5	- 4.1	- 3.3	- 2.6

(12) Increase real interest rates by 2 percentage points, with returns on net assets fed back into income

% changes on base

	Year 1	2	3	4	5
YDLH	+ 1.1	+ 2.1	+ 2.8	+ 3.0	+ 3.2
CD	+ 0.4	+ 0.6	+ 1.0	+ 1.0	+ 1.2
NLAJ	- 0.8	- 0.3	+ 0.6	+ 1.4	+ 2.1
CND	+ 0.3	+ 0.8	+ 1.2	+ 1.4	+ 1.6
OHS	- 0.1	- 0.2	- 0.3	- 0.4	- 0.5
VOHS	- 2.0	- 0.4	+ 2.0	+ 2.6	+ 2.9
TWJ	- 1.3	- 0.3	+ 1.4	+ 1.9	+ 2.2
SCD	+ 0.1	+ 0.2	+ 0.4	+ 0.6	+ 0.7
NFWJ	- 1.2	- 0.4	+ 0.9	+ 2.3	+ 3.7
NAFJ	+10.0	+20.0	+23.0	+24.0	+25.0
PAHM	- 1.9	- 0.3	+ 2.3	+ 3.0	+ 3.4
IHP	- 8.1	-10.1	- 8.7	- 7.3	- 6.7
IFJ£	- 4.2	- 5.1	- 4.5	- 4.2	- 4.0
NWJ	- 1.2	- 0.3	+ 1.3	+ 2.0	+ 2.6
NIAJ	- 1.4	- 0.5	+ 1.1	+ 2.9	+ 4.8
GLTP	- 6.5	- 9.0	-10.2	-10.8	-11.2
SPUK	- 4.0	- 4.5	- 4.1	- 3.3	- 2.6
YNWJ	+ 7.9	+20.3	+29.6	+35.5	+39.9

(13) Increase real return on gilts by 2 percentage points

% changes on base

	Year 1	2	3	4	5
YDLH	0.1	0.2	0.3	0.3	0.3
CD	+ 0.1	- 0.2	- 0.7	- 1.0	- 1.2
NLAJ	- 2.0	- 4.2	- 5.9	- 7.3	- 8.4
CND	-	-	- 0.1	- 0.2	- 0.4
OHS	-	-	-	-	-
VOHS	-	-	-	-	-
TWJ	-	-	-	- 0.1	- 0.1
SCD	-	-	- 0.1	- 0.3	- 0.5
NFWJ	- 1.6	- 1.7	- 1.2	- 0.4	+ 0.5
NAFJ	- 1.0	+ 1.0	+ 4.0	+ 7.0	+10.0
PAHM	-	-	-	-	-
IHP	-	-	-	-	-
IFJ£	-	-	-	-	-
NWJ	- 0.5	- 0.6	- 0.4	- 0.2	+ 0.1
NIAJ	- 1.3	-	+ 1.9	+ 4.1	+ 6.5
GLTP	- 6.5	- 9.0	-10.2	-10.8	-11.2
SPUK	- 4.0	- 4.5	- 4.1	- 3.3	- 2.6

(14) Increase real return on gilts by 2 percentage points, with returns on net assets fed back into income

% changes on base

	Year 1	2	3	4	5
YDLH	+ 1.0	+ 1.8	+ 2.8	+ 3.0	+ 3.1
CD	+ 1.0	+ 1.8	+ 2.0	+ 1.7	+ 1.7
NLAJ	- 1.6	- 2.7	- 3.2	- 3.7	- 4.2
CND	+ 0.4	+ 0.8	+ 1.1	+ 1.2	+ 1.3
OHS	-	-	-	+ 0.1	+ 0.1
VOHS	+ 1.7	+ 4.9	+ 7.1	+ 7.1	+ 7.1
TWJ	+ 1.1	+ 3.4	+ 5.1	+ 5.1	+ 5.2
SCD	+ 0.2	+ 0.6	+ 1.0	+ 1.2	+ 1.3
NFWJ	- 1.3	- 0.8	+ 0.3	+ 1.6	+ 2.9
NAFJ	+ 6.0	+15.0	+20.0	+20.0	+20.0
PAHM	+ 1.7	+ 4.9	+ 7.0	+ 7.0	+ 7.0
IHP	+ 0.3	+ 1.2	+ 2.2	+ 2.7	+ 2.7
IFJ£	+ 0.2	+ 0.6	+ 1.2	+ 1.6	+ 1.6
NWJ	+ 0.4	+ 2.0	+ 3.5	+ 4.0	+ 4.5
NIAJ	- 1.1	+ 0.4	+ 2.6	+ 5.1	+ 7.7
GLTP	- 6.5	- 9.0	-10.2	-10.8	-11.2
SPUK	- 4.0	- 4.5	- 4.1	- 3.3	- 2.6
YNWJ	+ 7.4	+15.6	+23.7	+30.1	+34.5

(15) Increase gilt and share prices by 10%

% changes on base	Year 1	2	3	4	5	
YDLH	-	-	-	-	-	(-)
CD	-	-	-	-	-	(+21)
NLAJ	+ 0.1	+ 0.2	+ 0.3	+ 0.2	+ 0.3	
CND	-	-	-	-		(+50)
OHS	-	-	-	-	-	
VOHS	-	-	-	-	-	
TWJ	-	-	-	-	-	(+)
SCD	-	-	-	-	-	(+)
NFWJ	+ 4.2	+ 4.1	+ 4.1	+ 4.1	+ 4.1	
NAFJ	-	-	-	- 0.1	- 0.1	
PAHM	-	-	-	-	-	
IHP	-	-	-	-	-	
IFJ£	-	-	-	-	-	
NWJ	+ 1.3	+ 1.3	+ 1.2	+ 1.1	+ 1.1	
NIAJ	+ 7.6	+ 7.2	+ 7.0	+ 7.2	+ 7.8	
GLTP	+10.0	+10.0	+10.0	+10.0	+10.0	
SPUK	+10.0	+10.0	+10.0	+10.0	+10.0	

(16) Increase income by £1,000 million in one quarter, Bank of England short term model

	Year 1	2	3
YDLH	+0.63	-	-0.02
CD	+0.9	-0.07	-0.03
NLAJ	+0.25	+0.25	+0.27
CND	+0.27	+0.05	+0.04
OHS	-	-	-
VOHS	+0.93	+0.81	+0.55
TWJ	+0.07	+0.59	+0.42
SCD	+0.22	+0.15	+0.12
NFWJ	+0.18	+0.17	+0.16
NAFJ	+4.94	-0.72	-0.96
PAHM	+0.93	+0.81	+0.55
IHP	-	+0.18	+0.09
IFJ£	+0.15	+0.42	+0.42
NWJ	+0.5	+0.45	+0.35
NIAJ	+0.12	+0.11	+0.06

References

Bank of England (1983) "Economic Commentary", Bank of England Quarterly Bulletin, 23, 326-336.

Blackorby, C et al (1978) "Homethotic separability and Consumer Budgeting", Econometrica, 38, 468-72.

Calder, A R (1978) "The Stock of Consumer Durables in the United Kingdom", Economic Trends, 293, 111-124.

Coghlan, R T and Jackson, P M (1979) "The UK Personal Savings Ratio: Past, Present and Future", Scottish Journal of Political Economy, 26, 307-324.

Currie, D (1981) "Some Long Run Features of Dynamic Time Series Models", Economic Journal, 91, 704-715.

Cuthbertson, K (1980) "The determination of expenditure on Consumer Durables", National Institute Economic Review, 94, 62-72.

Davidson, J E H and Hendry D F (1981) "Interpreting Econometric Evidence; Consumers' Expenditure in the UK", European Economic Review, 88, 661-692.

Davidson, J E H (1983) "Error Correction Systems", International Centre for Economics and Related Disciplines (LSE), Discussion Paper No 83/79.

Davis, E P (1982) "The Consumption Function in Macro-Economic Models: a comparative study", Bank of England Technical Paper No 1.

Davis, E P and Saville, I D (1982) "Mortgage Lending and the Housing Market", Bank of England Quarterly Bulletin, 22, 390-398.

Deaton, A S and Muellbauer, J (1980) Economics and Consumer Behaviour, Cambridge University Press.

Duesenberry, J S (1949) Income, Saving and the Theory of Consumer Behaviour, Harvard University Press.

Dunn, G P, Jenkinson, N H and Michael, I M (1984) "Some properties of the Bank of England Short Term Model", forthcoming Bank of England discussion paper, technical series.

Ferber, R (1973) "Consumer Economics: a survey", Journal of Economic Literature, 11, 1303-1342.

Flemming, J S (1973) "The Consumption Function when capital markets are imperfect: the permanent income hypothesis reconsidered", Oxford Economic Papers, 25, 160-72.

Friedman, M (1957) A Theory of the Consumption Function, National Bureau of Economic Research, Princeton.

Gorman, W M (1959) "Separable utility and aggregation", Econometrica, 27, 469-81.

Hendry, D F and Von Ungern Sternberg, T (1980) "Liquidity and inflation effects on consumers' expenditure", In Essays on the Theory and Measurement of Consumers' Behaviour, ed A S Deaton, Cambridge University Press.

Hendry, D F and Richard, J F (1982) "On the formulation of empirical models in dynamic econometrics", Journal of Econometrics, 20, 3-34.

Hendry, D F and Richard, J F (1983) "The Econometric Analysis of Economic Time Series", forthcoming in International Statistical Review.

Hicks, J R (1939) "Value and capital: An enquiry into some fundamental principles of economic theory" 2nd Ed (1950), Clarendon Press, Oxford.

Keynes, J M (1936) "The General Theory of Employment, Interest and Money", Macmillan.

King, M A (1977) "Public Policy and the Corporation", Cambridge Studies in Applied Econometrics, 3.

Lancaster, K (1966) "A new approach to Consumer Theory", Journal of Political Economy, 74, 132-57.

Lancaster, K (1971) "Consumer demand: a new approach", Columbia University, New York.

Patterson, K D and Ryding, J (1982) "Deriving and testing rate of growth and higher order growth effects in dynamic economic models", Bank of England Discussion Paper, No 21.

Phillips, A W (1954) "Stabilisation policy in a closed economy" Economic Journal, 64, 290-323.

Phillips, A W (1957) "Stabilisation policy and the time forms of lagged responses", Economic Journal 67, 265-277.

Pissarides, C A (1978) "Liquidity considerations in the theory of consumption" Quarterly Journal of Economics, 82, 279-96.

Pratt, M J (1980) "Building Societies, an econometric model", Bank of England, Discussion Paper No 11.

Salmon, M (1982) "Error Correction Mechanisms", Economic Journal, 92, 615-29.

Savage, D (1978) "The channels of monetary influence: a survey of the empirical evidence", National Institute Economic Review, 83, 73-89.

Strotz, R H (1957) "The Empirical implications of a Utility Tree" Econometrica, 25, 269-80.

Strotz, R H (1959) "The Utility Tree: Correction and further appraisal" Econometrica, 27, 482-8.

Taylor, C T and Threadgold, A R (1979) "'Real' national saving and its sectoral composition", Bank of England Discussion Paper, No 6.

Thomas, R L and Abdullah, S (1983) "The role of wealth variables in the UK consumption function", Salford University papers in Economics, No 83-4.

Threadgold, A R (1978) "Personal savings: the impact of life assurance and pension funds", Bank of England Discussion Paper No 1.

Tobin, J (1958) "Liquidity Preference as behaviour towards risk", Review of Economic Studies, 25, 65-86.

Tobin, J (1972) "Wealth, liquidity and the propensity to consume", in ed Strumpel et al "Human Behaviour in Economic Affairs", Elsevier, Amsterdam.

Toland, S (1981) "Committed and discretionary saving", Economic Trends, 337, 109-135.

Townend, J C (1976) "The Personal Saving Ratio", Bank of England Quarterly Bulletin, 16, 53-73.

Ward, V (1980) "Cyclical indicators: some developments and an assessment of performance", Economic Trends, 319, 82-87.

Bank of England Discussion Papers

	Title	Author
1-5, 8, 11-14, 16 & 17	*A list of these papers can be found in the December 1981* Bulletin, *or can be obtained from the Bank. These papers are now out of print, but photocopies can be obtained from University Microfilms International (see below).*	
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
20	A portfolio model of domestic and external financial markets	C B Briault Dr S K Howson
21	Deriving and testing rate of growth and higher order growth effects in dynamic economic models	K D Patterson J Ryding

Technical Series

	Title	Author
1	The consumption function in macroeconomic models: a comparative study*	E P Davis
2	Growth coefficients in error correction and autoregressive distributed lag models	K D Patterson
3	Composite monetary indicators for the United Kingdom; construction and empirical analysis	T C Mills
4	The impact of exchange rate variability on international trade flows	G Justice
5	Trade in manufactures	A C Hotson K L Gardiner
6	A recursive model of personal sector expenditure and accumulation	E P Davis

Papers presented to the Panel of Academic Consultants[a]

	Title	Author
8	International monetary arrangements the limits to planning*	P M Oppenheimer
9	Institutions in the financial markets: questions, and some tentative answers*	M V Posner
10	The arguments for and against protectionism*	M Fg Scott The Hon W A H Godley
14	The usefulness of macroeconomic models*	Prof W H Buiter T F Cripps Prof Angus Deaton Prof A P L Minford M V Posner
15	Factors underlying the recent recession*	G D N Worswick Dr A Budd
17	Why do forecasts differ?*	Prof M J Artis
19	Bank lending, monetary control and funding policy*	Prof A D Bain
20	The economics of pension arrangements	Prof Harold Rose J A Kay
22	Monetary trends in the United Kingdom	Prof A J Brown Prof D F Hendry and N R Ericsson

* These papers are no longer available from the Bank, but photocopies can be obtained from University Microfilms International: enquiries regarding the service provided should be made to the company at one of the addresses shown on the reverse of the contents page.

(a) Other papers in this series were not distributed.