# Bank of England

## Discussion Papers

*Technical Series*

No 42

**Expenditure on consumer durables in the United Kingdom**

by

N O Kennedy

*August 1991*

**No 42**

**Expenditure on consumer durables in the United Kingdom**

**by**

**N O Kennedy**

*August 1991*

The object of this Technical Series of Discussion Papers is to give wider circulation to econometric research work in the Bank's Economics Division, and to invite comment upon it; any comments should be sent to the author at the address given below.

The views expressed in this paper are those of the author and do not necessarily represent those of the Bank of England. The author would like to thank various members of the Economics Division for their comments, particularly Mr Cuthbertson, Mr Egginton, Mr Hall, Ms Moorhouse, and Mr Patterson; and Ms Spink for preparing the charts and to the Bulletin Group for editorial assistance in producing this paper.

Issued by the Economics Division, Bank of England, London, EC2R 8AH to which requests for individual copies and applications for mailing list facilities should be addressed; envelopes should be marked for the attention of the Bulletin Group. *(Telephone: 071-601-4030)*



ISBN 1 85730 015 7
ISSN 0263-6123

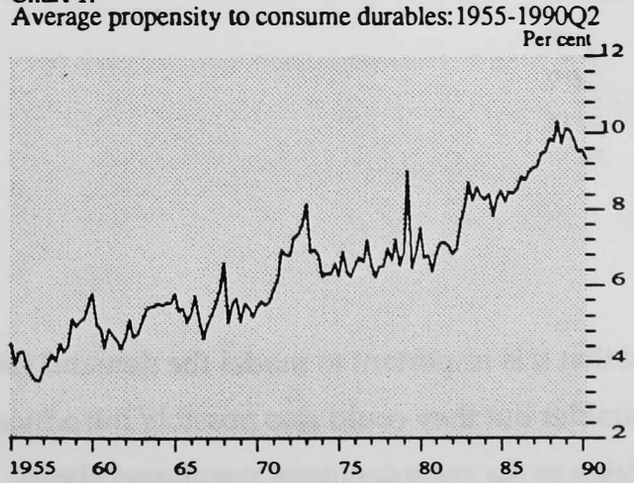
## CONTENTS

# THE DETERMINATION OF CONSUMER DURABLES EXPENDITURE IN THE UK

## I Introduction

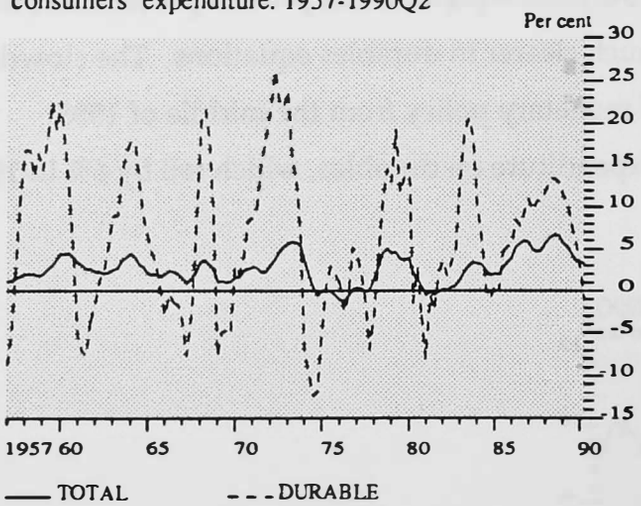
Although expenditure on consumer durables constitutes a relatively small fraction of the personal sectors' total expenditure on goods and services, currently around 10%, the sensitivity of this category of expenditure to fluctuations in the state of the economy and particularly to changes in monetary policy makes it an important, if perhaps somewhat neglected, area of study (two exceptions being Cuthbertson (1980) and Dicks (1988a)). For example, between 1978-80 and 1988-89, durables expenditure accounted for more than 20% of the decline in the rate of growth of total consumption, and for almost half of the slowdown in 1990. Consumer durables expenditure grew very strongly in the 1980s, averaging an annual rate of growth of 8 3/4% for instance between 1985-88, and reaching a peak of 15 1/4% in the first quarter of 1988. This made a substantial contribution to the excessive demand growth that occurred over this period. The ratio of consumer durables to RPDI has also risen in recent years (Chart 1), from around 5% in 1970 to 10% in 1990, making the durable component of consumption an increasingly important part of the whole. The large rise in this ratio in the second half of the 1980s also suggests that we must look beyond income growth for a full explanation of the strength of durable consumption during this period. While finding a negative interest rate elasticity in non-durables equations has proved problematic the evidence for such an effect has been much clearer in durables equations. The slowdown in demand following the tightening of monetary policy from the middle of 1988 onwards was particularly evident in expenditure on durables, which fell by 6% in 1990.

Chart 1:
Average propensity to consume durables: 1955-1990Q2



Spending on the durables component of consumers' expenditure has been historically more volatile than that on non-durables, as the accompanying Chart 2 (showing four quarter moving averages) illustrates. This volatility derives from several sources. First, durable goods are generally more expensive items. As a result of this, purchases are likely to be more sensitive to changes in credit conditions and to saving terms. Second, by their nature durables are goods which last for more than one period. Although there may be some depreciation to the value of the stock of durable goods over the period the service flow derived from the goods extends beyond the period in which it is bought. Thus, purchases may frequently be delayed or brought forward, at least to some degree, in response to perceived changes in the general economic climate or the financial situation of households. A fair proportion of durables are also considered luxury goods so that expenditure may be considered to be in some sense more postponable. It could therefore be argued that durables spending is a good indicator of the state of the economy. During recessionary periods or when these are anticipated, households may wish to delay purchases of major items because of uncertainty about future incomes and ability to repay the outstanding loans. Conversely, as the economy picks up there may be a sudden surge of durable goods spending as households rebuild their stock of durables to desired levels.

Chart 2:
The volatility of durable and non-durable consumers' expenditure: 1957-1990Q2




These features of durable goods suggest that it is important to model the demand for durables separately from that of non-durables but they could also possibly introduce complications in the modelling. In addition to the considerations mentioned above, there are quite well-developed second-hand markets for some durable goods, in

contrast to the market for non-durables. Consequently, consumers may not intend to hold on to their purchases as long as the life length of the good. This creates a number of distinct markets and means that those who purchase new goods are not always the same individuals as those who ultimately scrap goods at the end of their life. Also, although products when they are first introduced may be considered luxuries, as time progresses they may be perceived increasingly as necessities (many household electrical items may fall into this category). The market for durables is particularly susceptible to the introduction of new products. Their diffusion through the population may be quite rapid, in the process changing households tastes and preferences, but it is very difficult to see how this can be captured by econometric analysis. Deaton and Muellbauer (1980) demonstrate that the pattern of rising ownership may follow a sigmoid curve, for a number of reasons. One of these is the diffusion of knowledge. When the product is first introduced the number of households that can afford to buy it are relatively few. As real incomes grow, and it's relative price also possibly falls, the threshold at which purchases are made is reached for many more households. Eventually, a degree of saturation is achieved, at which point demand becomes less responsive to price and income changes. Finally, a distinction can also be made between new and replacement demand. The factors affecting such purchases may be slightly different.

## II The pattern of durables expenditure

In theory, once the time period has been specified it should be fairly simple to distinguish between durables and non-durables. In practice, the distinction made in the construction of the data is less clear cut. Durables are defined by the CSO as including "those goods which are relatively costly, long-lasting, and which are generally available on credit terms". Some goods, however, which might reasonably be thought to satisfy these criteria are nonetheless included in the non-durables component, ie expensive china, jewellery and watches. This has led to the suggestion that it would be better either to model total consumers' expenditure rather than the components or that there should first be some reclassification of the goods and services to construct a more theoretically rigorous time series. The most appropriate classification of products could be tested, see for example Bayus and Carlstrom (1990), for a discussion of the appropriate grouping of fifteen durable goods based on survey data on perceived product attributes. Without wishing to overlook these problems, it may be argued that the arguments advanced above for the different behaviour of durables make it important from a macroeconomic modelling point of view to retain some, even if only approximate, distinction.

The CSO measure of durable goods can essentially be classified into three broad areas: (1) Cars, motorcycles and other vehicles; (2) Furniture and Floor Coverings; (3) Other durable goods, frequently referred to as "brown" and "white goods". (Brown goods are essentially recreational durables, such as radios, TVs, PCs and calculators. White goods are major household appliances, such as cookers, refrigerators, washing machines etc.)

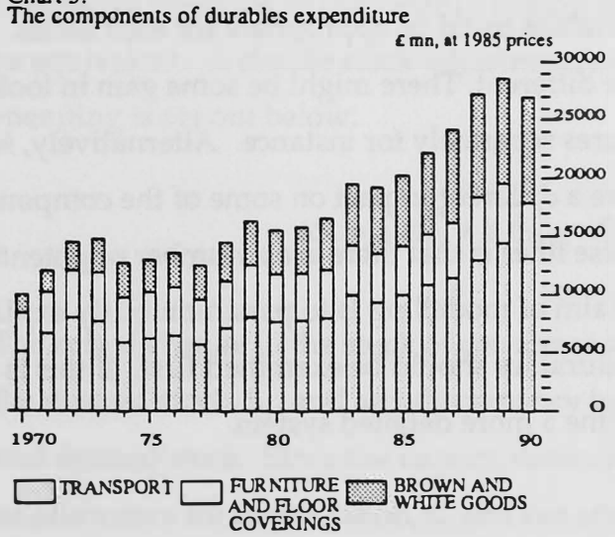
Over the last twenty years, the breakdown of durables expenditure between these different sub-categories has changed quite considerably, as Table 1 below illustrates.

**Table 1: The Structure of Consumer Durables Purchases**

| | 1970 | 1980 | 1990 |
|---|---|---|---|
| Transport | 54 | 50 | 49 |
| Furniture and Floor Coverings | 35 | 27 | 18 |
| Brown and White | 11 | 23 | 34 |
| | 100 | 100 | 100 |

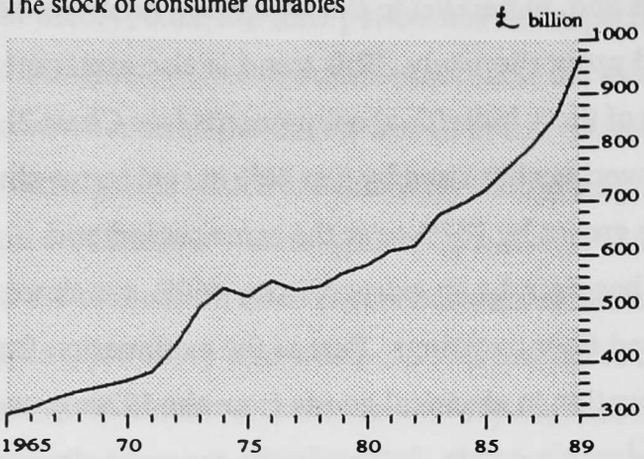
While spending on cars and other vehicles has remained a broadly constant fraction of total expenditure on durables there has been a consistent decline in the percentage spent on furniture and floor coverings and, in parallel to this, spending on so-called brown and white goods has increased proportionately. This trend is also apparent from a cursory glance at the rate of growth of these individual components (see Chart 3). Expenditure on furniture and floor coverings has risen by just 46% in real terms since 1970, while transport expenditure has grown by 157% over the same period and spending on brown and white goods has risen by an extraordinary 460%, ten times more quickly than that on furniture and floor coverings. Part of the explanation for this may well be a very rapid pace of innovation in electrical goods from the 1970s onwards, and the fall in prices relative to other durable goods. Interestingly, the most closely associated element of durables to the housing market has been declining throughout this period.

Chart 3:
The components of durables expenditure




The stock of consumer durables has also increased in real terms throughout this period, by around 60% between 1970 and 1980, and a further 50% from 1980 to 1989. The average rate of growth was particularly rapid from 1985 onwards, at almost 7% per annum, compared to average growth of around 3% per annum over the previous decade (Chart 4). In 1989, this amounted to around £4,800 per household.

Chart 4:
The stock of consumer durables




Again, it has been suggested that it would be advantageous to analyse an even more disaggregated breakdown, because of the heterogeneity of the goods which are classified as durable. The life lengths of these categories are quite different, suggesting that different lag structures on some variables could be appropriate for each series. In addition, the determinants may be quite different. There might be some gain in looking at the housing market related expenditures separately for instance. Alternatively, some variables such as interest rates, may have a different impact on some of the components. One reason for not proceeding along these lines is that there are a number of potential inaccuracies in the data. Of course, one aim of modelling is to parsimoniously explain the data, so the aggregate equation for durables should be examined first. If this is successful it seems unnecessary to examine a more detailed system.

## III Modelling Consumer Durables

There are two principal approaches to modelling the demand for durables. First, is to model the stock of consumer durables, and to then derive the flow of durables spending. This approach has previously been taken by H M Treasury. The second method, which has been applied at the Bank and by Cuthbertson (1980), is to estimate directly an equation for the flow of durables expenditure. The arguments for and against each method are finely balanced. There may be greater problems in measuring the stock of durables accurately, in part this is because estimates of durable stocks are not made directly but on the basis of depreciation rates applied to new purchases. Moreover, the stock data is not published to a regular, frequent schedule. Nevertheless, these problems may be of less significance given the size of the stock. According to the CSO, estimates of the expenditure flow are subject to a wide margin of error (in some cases up to 20%). Ultimately, there should be no contradiction between the two alternative methods as the identity linking stocks and flows suggests that these should be equivalent. A simple stock-adjustment model of the determination of durables spending is set out below.

$$\Delta S_t = a\, \Delta S_t^* + b\, (S_{t-1}^* - S_{t-1})$$

The actual change in the stock of consumer durables, S, is a function both of changes in the desired stock, $S_t^*$, and any discrepancy in the previous period between the actual and desired stock. Since the current stock of durables is equal to last period's stock plus an allowance for depreciation, d, and net additions, E,

$$S_t = (1 - d)\, S_{t-1} + E_t$$

We may rewrite the actual flow of expenditure, E, in each period as,

$$E_t = d\, S_{t-1} + a\, \Delta S_t^* + b\, (S_{t-1}^* - S_{t-1})$$

In practice, as Dicks (1988a) has pointed out, the lagged stock term has been found to be insignificant when the expenditure equation has been directly estimated. This possibly indicates that the coefficients b and d are approximately equal. The expenditure

equation above also implicitly assumes that the rate of depreciation remains constant through time. In fact, it may well be subject to some of the same influences that determine the desired stock. This just leaves the factors that determine the desired level of durables expenditure, which need to be considered in turn.

It should, however, be noted that there are a number of drawbacks to this simple model. It has been shown, for example by Bar-Ilan and Blinder (1988), that in the presence of lumpy transactions costs it may be optimal for agents to do nothing for long periods of time even if there is a gap between the desired and actual stock of durables. A frequent justification for this assumption is the cost of acquiring information about new products or housholds distaste for (awareness of the opportunity cost of the time spent) shopping. This means that explicit aggregation is necessary rather than the usual assumption of aggregating from the representative behaviour of an individual consumer. An alternative explanation, see P-s Lam (1988), looks at the irreversibility of much of consumer durable spending. It is argued that this can lead to serial correlation in the aggregate time series data.

Grossman and Laroque (1990) describe a model of optimal portfolio choice with illiquid durable goods in the presence of transactions costs. It is assumed that consumers have a target level consumption relative to wealth, but if this varies within a finite range, the limits of which will depend on the magnitude of the transactions costs, no purchases are likely to take place. It is shown that the expected length of time between purchases of durables can be very large, even decades, for the individual agent and thus the relationship between wealth changes and durables expenditure could be very weak in all but the long run. The average time between purchases rises as transactions costs and the discount rate increase. If, however, durable goods depreciate rapidly, consumers' expenditure on durables becomes more sensitive to wealth. At a macroeconomic level, much depends on whether consumers have the same preferences and initial state varibles. If they do not, there will be a "flow of arrivals at the barriers" generating a continuous demand for durables. If wealth increases rapidly, a high fraction of consumers will reach their boundaries and make new purchases. The number of purchases subsequently falling.

We may summarise the factors determining the desired real durable stock as,

$$S^* = S^* (y,\sigma,w,r,c,t,Psub,Pcom,HO)$$

where y is income, $\sigma$ is an uncertainty variable, w is wealth, r is the real rate of interest (and may be thought of as the user cost of durable goods), c is a measure of credit availability, t is the rate of tax or duty, Psub and Pcom are the prices of substitutes and complements of durable goods respectively, and HO represents factors such as the number of households and their movement. The income and wealth terms should strictly incorporate some element of forward-looking expectations on the part of households. This is generally side-stepped by assuming that future income and wealth can be proxied by the lags of these variables. This basic framework has been used by Lemmon (1985) for US consumer durable spending. The terms are basically demand-side variables on the assumption that supply can largely react quickly to extra demand. The addition of an explicit uncertainty or confidence variable may also be important and this is considered below.

The demand for durable goods should be positively related to the income of households. However, there are a number of alternative measures of income that could be used. In particular, real personal disposable income (RPDI) may be adjusted for the effects of the inflationary erosion of holdings of net liquid assets (YDLH). This correction to income assumes that consumers maintain the net worth of their assets, for as prices rise the value of nominal assets is reduced. The precise definition of assets used for this purpose is open to question. The current Bank model, for instance, does not include the inflationary gains on mortgage debt. Moreover, the justification for such an adjustment is not so obvious in an equation where wealth terms are already present. Personal sector wealth may be included on the grounds that consumers adjust expenditure to ensure an equilibrium ratio of wealth to income. Commonly, durables equations only allow for the net liquid assets of the personal sector, although the life cycle hypothesis provides some justification for considering the total net financial assets (NFW) of households. It may be more appropriate, however, to allow the weights on these assets to vary as there might be different short-run propensities to consume out of different forms of wealth. Particular attention is focussed on the ratio of net liquid

assets (NLAY) and other financial assets (OFAY) to income of the personal sector. Finally, deregulation during the past decade, notably in the removal of constraints in the mortgage market, has been a significant factor behind changes in the housing wealth of the personal sector and has led to a greater ability of households to extract equity (MEWD). This enables households to more closely approach their desired level of lifetime consumption as the constraint on access to this form of asset accumulation is relieved.

Since the future stream of income both from labour and net assets is not known with certainty and durable purchases may entail subsequent interest payments on loans, changes in perceptions of income and even its volatility may be important. Although an increase in income uncertainty would be likely to lead to a reduction in non-durables spending, the effect on durables purchases is less clear, see for example Barrett and Slovin (1988). As durables yield a flow of future services an increase in uncertainty may lead to a reduction in current consumption but an increase in purchases of durables, which may be seen as a form of saving. However, because of the existence of only imperfect resale markets higher uncertainty could lead to possible distress sales of durables with a resulting loss of wealth. In a liberal financial regime where credit was easily available, the volatility of income may not be so relevant since the fluctuations could be smoothed. The variability of income could also be proxied by changes in the level of unemployment.

Revisions to expected income and confidence about the future may be even harder to identify. Permanent income is generally proxied by lags of past income. It has been argued, both by Katona (1971) and Pickering (1981) for example, that in addition to the ability of households to buy durable goods, some account should also be taken of their willingness to buy. Although this may be quite closely related to income it is possible that perceptions about the general state of the economy (which would include unemployment and inflation) and expectations about changes in personal financial circumstances may drive a wedge between income and consumption. Some of the factors affecting confidence may be social or political developments rather than economic - the threat of war - for instance. The most widely employed variable for such attitudes, at least in the United Kingdom, is the EC/Gallup consumer confidence index

(GCCI). This is a monthly survey which asks consumers five questions: about their financial situation in the preceding and forthcoming year; their evaluation of the general economic situation in the past year and coming year; and their attitude toward making major purchases. The consumer confidence index is an unweighted average of consumers responses to these five questions. In the context of analysing the demand for durables, a series based on a subset of the questions asked in this survey may be more relevant, the attitude towards making major purchases (MPCI). The mean of the broader measure is -9.3, while that of major purchases is +26.1. These two series are shown in Chart 4 after adjusting for this difference in the mean level. Not surprisingly, both series have declined sharply since the middle of 1988. The general consumer confidence index has been used, for instance, by van Raaij and Gianotten (1990) for the Netherlands. They concluded that it was mainly the financial situation of households that was contributing to an explanation of durable consumption. There was no evidence of more general factors being significant.

Although there should be little doubt that expectations are important, there is no presumption that this is best captured by the confidence indices described above. The factors that help form households perceptions, such as changes in disposable income and wealth, are already incorporated in the equation. Hymans (1970) found a role for a sentiment index in explaining US demand for automobile expenditure. However, this was only after the series had been 'filtered' to eradicate what appeared to be meaningless short-term movements in the index. Sentiment itself appeared to be largely determined by incomes, stock prices and inflation. In further work, however, Hymans failed to find a role for sentiment in other durables. It is also worth pointing out that the Michigan survey of consumer confidence is more detailed than most other polls. According to the Wall Street Journal (1991) students from the University of Michigan spend 26-28 days each month interviewing consumers in the United States chosen at random. The interview lasts around 25 minutes and covers 30 pages of questions.

Interest rates and credit conditions are a further influence on the demand for durables. In a survey of interest rate effects in UK macroeconomic models Easton (1985) found that all the existing models, with the sole exception of the National Institute, included a short-term interest rate. The Treasury model then embodied only a temporary impact on durable spending. More recently, Dicks (1988a) suggested on the basis of recursive estimation that interest rates were becoming increasingly significant. If real interest rates (RR) rise this may have a dual effect on purchases of durables. First, by making it more profitable to save in the form of interest-bearing financial assets, hence raising the opportunity cost of durables. Second, interest on borrowing rises too, raising the total cost of durables. The availability of credit affects the ability of households to reach their desired stock of durable goods. This can be measured by the minimum deposit rate (RMD) and by a more general term which also includes the impact of minimum monthly repayments (HP). The figures for the post 1982 period are, however, arbitrarily assumed to be constant, and should perhaps reflect an easing in credit conditions, at least to 1989.

Several relative price terms may be important. Non-durables goods may to some extent be a substitute for expenditure on durables. Thus their relative prices (RP) may be a determinant. As non-durable goods prices rise relative to the price of durable goods the demand for durable goods may rise. The price of non-durables has risen relative to that of durables quite sharply in the first half of the 1980s, which might have contributed to the faster growth of durables. It may be argued that energy prices (REP), in particular, which include electricity and gas prices and the price of fuel, is negatively related to durables consumption. Energy is a necessary complement to many durable items so that as fuel prices rise the cost associated with the service flow from durables increases which may lead to fewer purchases. On the other hand, this may be offset by premature scrapping, since more fuel-efficient models may be bought to replace less efficient models. The market for motor vehicles may be a good example of this. Energy prices rose substantially in real terms in the first half of the 1980s, but fell back in the second half of the decade.

In the context of changes in tax rates and duties, one feature of the demand for durables is the anticipation of budget changes. In a number of years these have had a significant distorting effect on purchases of durable goods. In the quarter prior to the Budget there has been a surge of spending, followed in at least the following quarter by a sharp decline in spending. Two particular periods in which dummy variables were found to be important were 1973 and 1979. These dummy variables are constructed as a simple 0-1 type (Dxx).

Finally, there are a number of demographic terms that could be considered. Over time the number of households changes and since the purchase of goods is often associated with household formation this could also be considered as a regressor. It may, however, have only a weak effect on demand. Some consumer goods, clothing for example, are bought by all the members of the resident population rather than by households. Many other components of expenditure may be equally sensitive to the composition of households, for instance, vehicles expenditure and recreational durables. Analysis suggests that population and household figures may be quite different so that one could not be used as a proxy for the other (see Dicks (1988b)). Between 1971 and 1986 the UK population rose by 1.6% while the number of households increased by around 15%. Although some part of household growth is determined by demographic factors, economic and social factors have also been found to be important, and these may already be taken into account.

The movement of households is frequently associated with the purchase of durables. This effect may be captured by data on housing turnover activity (HT), based on particulars delivered on stamp duty for England, Wales and Northern Ireland collected by the Inland Revenue (a different system exists in Scotland). Whenever an interest in real or leasehold property in England and Wales is transferred on sale, or a lease for 7 years or more is granted, the instrument effecting the transaction has to be produced to a District Land Registry or a Stamp Office, together with a completed "particulars delivered" form. Although a long time series of the figures is not available distinguishing between residential property, sales of land and other sales of property, around 90% of the total is transactions in residential property.

## IV Econometric Analysis: Co-integration Results

In this section we conduct an empirical analysis of the long-run behaviour of durable goods expenditure within the Engle and Granger two-step framework. This facilitates an explicit identification of the factors determining consumption of durables in the long run. In order to conduct such an analysis it is first necessary to examine the order of integration of the series. This is the number of times that a series needs to be differenced to make the series stationary. A variable which is I(1), for instance, means that it must be differenced once in order to make the series stationary. Most economic series are trended, and for a set of variables to provide an explanation for the long run of durables they must either be integrated of the same order or a subset of higher order variables must co-integrate to a lower order. Table 2 below summarises the results of such an analysis on the variables that were discussed in the previous section. The main variables used in the following analysis are also shown in Charts 5 - 9. The Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) test statistics are reported, where the number of lags up to a maximum of four needed to remove autocorrelation is also shown in the case of the ADF. The tests are all conducted with the inclusion of a constant and reported for the inclusion and exclusion of a time trend. The critical value for both the DF and ADF tests, without a trend, at the 5% level and on the basis of 100 observations is -2.89 (see Fuller (1976)). In the case where there is an included trend the critical value rises to -3.45.

The conclusion to be drawn from Table 2 is that there is no reason why most of these variables should not be included within a co-integrating regression, since they all appear to be I(1), with the exception of the income volatility variable, which is borderline I(0) as perhaps one might expect.

Chart 5:
Log of real personal disposable income

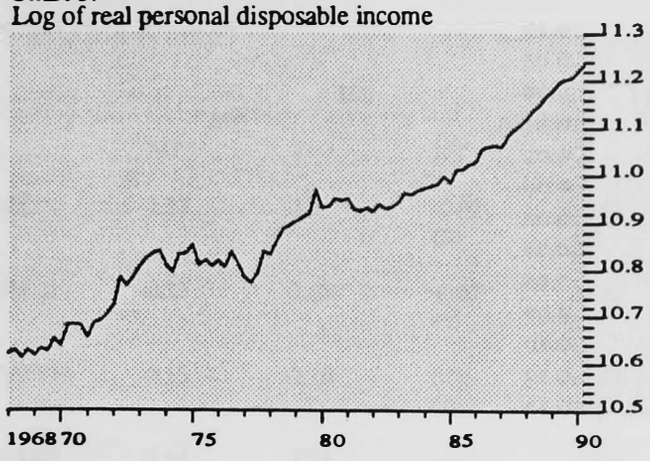



Chart 6:
Log of consumer durables expenditure

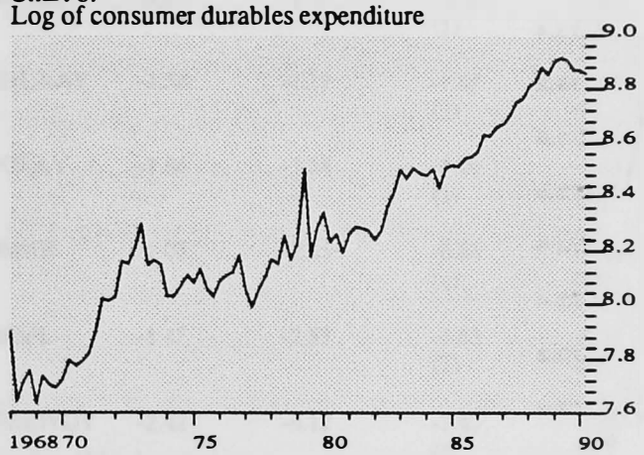



Chart 7:
Log of the ratio of net liquid assets to income

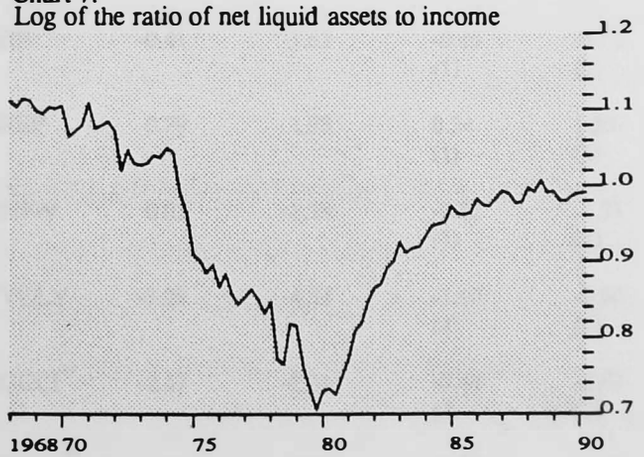


Chart 8:
Log of real interest rate

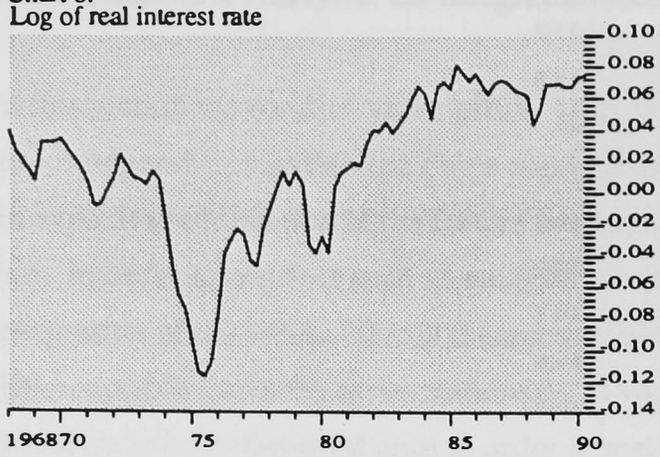



Chart 9:
Log of housing turnover

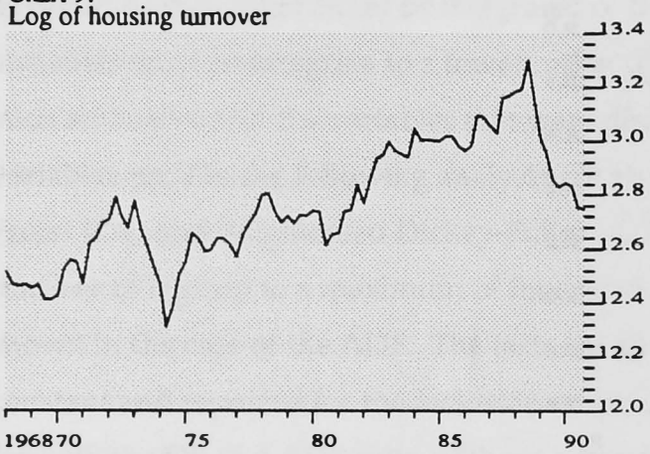


**Table 2: Univariate Time Series Properties of the Data**

| Variable Name* | I(0) | | | | I(1) | | | |
|---|---|---|---|---|---|---|---|---|
| | DF | | ADF | | DF | | ADF | |
| | NT | T | NT | T | NT | T | NT | T |
| CD | -1.23 | -3.3 | -0.87 (3) | -2.62 (3) | -12.61 | -12.52 | -4.82 (2) | -4.78 (2) |
| RPDI | -0.25 | -2.08 | -0.07 (1) | -1.71 (1) | -10.44 | -10.39 | -6.37 (1) | -6.34 (1) |
| YDLH | -0.15 | -2.15 | 0.21 (1) | -1.61 (1) | -11.28 | -11.27 | -6.26 (1) | -6.26 (1) |
| RMD | -1.86 | -2.09 | -2.63 (1) | -3.29 (1) | -5.84 | -5.81 | -5.85 (1) | -5.83 (1) |
| NLAY | -1.56 | -1.16 | -1.58 (1) | -1.17 (1) | -8.22 | -8.56 | -5.76 (1) | -6.13 (1) |
| NLAAY | -1.58 | -1.19 | -1.47 (1) | -1.00 (1) | -9.92 | -10.15 | -6.25 (1) | -6.49 (1) |
| OFAY | -1.86 | -1.14 | -1.90 (1) | -1.33 (1) | -7.41 | -7.63 | -5.62 (1) | -5.88 (1) |
| RMR | -1.05 | -2.45 | -0.95 (4) | -2.46 (4) | -5.48 | -5.50 | -6.40 (3) | -6.51 (3) |
| RML | -1.47 | -2.53 | -1.62 (1) | -3.06 (1) | -7.75 | -7.72 | -6.06 (1) | -6.04 (1) |
| MEWDY | -2.42 | -4.12 | -1.43 (4) | -2.55 (4) | -9.53 | -9.47 | -4.89 (4) | -4.85 (4) |
| HT | -1.92 | -2.15 | -1.99 (1) | -2.55 (1) | -8.20 | -8.25 | -5.80 (1) | -5.86 (1) |
| RP | -0.41 | -1.63 | -0.45 (1) | -1.72 (1) | -8.46 | -8.41 | -5.84 (1) | -5.81 (1) |
| REP | 0.79 | 1.95 | 0.34 (1) | 1.23 (1) | -6.35 | -6.41 | -5.21 (1) | -5.27 (1) |
| NFW | 0.03 | -1.18 | -0.32 (1) | -1.31 (1) | -7.41 | -7.68 | -6.05 (1) | -6.41 (1) |
| VOLY | -3.29 | -4.54 | -1.60 (4) | -3.60 (4) | -8.70 | -8.65 | -5.72 (4) | -5.74 (4) |
| GCCI** | -2.47 | -2.31 | -2.44 (3) | -2.63 (3) | -6.62 | -6.76 | -6.91 (1) | -7.12 (1) |
| MPCI** | -1.36 | -1.96 | -1.08 (1) | -1.66 (1) | -8.31 | -8.50 | -2.50 (4) | -4.95 (3) |

All regressions include a constant and are estimated over the period 1970 Q1 - 1989 Q4.

Tests are carried out including (T) and excluding a time trend (NT).

* All variables in logs, ( ) indicates the number of difference terms.

** Data available only from 1974.

All of the UK macroeconomic models use broadly the same explanatory variables, the most important of which are income, some measure of credit availability (either a composite hire purchase variable including maximum monthly repayment or the effective minimum deposit rate (RMD)), a short-term interest rate (RR) and a number of dummies for Budget effects. The current Bank of England model, for instance, adjusts income for inflation losses on net liquid assets (YDLH) and also includes the ratio of net liquid assets to income (NLAAY) and the stock of real mortgage lending (RML). This latter term is lagged to avoid problems of simultaneity and its presence is attributed to a number of different influences on durable spending. The mortgage lending term proxies the extent of credit rationing in the mortgage market, the complementarity between housing and durable spending, and the effects of equity extraction. Dicks(1988a), attempted to separate these effects by constructing independently a measure of equity extraction and the number of houses sold (which was proxied by the flow of mortgage lending divided by the average house price). Although he could find no role for mortgage equity withdrawal, within an equation estimated up to 1985, the housing turnover variable was found to be significant. The final equation, however, retained the flow of mortgage lending term. The long-run solution for durable consumption (CD) in the Bank model equation is reported in Breedon et al (1990) as,

$$LCD = -11.3 + 1.7\,LYDLH - 0.1\,LRMD - 0.9\,LRR + 0.19\,LRML + 0.13\,LNLAAY$$

where the income elasticity of durable consumption exceeds that on non-durables and that on total consumption is constrained to be unity.

Table 3 below begins by reproducing the long-run solution of the current Bank model equation estimated over a more recent time period. It also tests several of the variables and considers some alternatives. This is shown to lead to a satisfactory co-integrating vector. The co-integrating properties of the current Bank model, shown in equation 3.1, would suggest that this specification passes the DF and ADF test statistics. However, the ratio of net liquid assets to income is wrongly signed. The other variables all appear to have plausible coefficients, although further analysis is useful to test the significance of using inflation-adjusted income against the alternative of RPDI, and to look more closely at the mortgage lending term.

In equation 3.2 adjusted income is replaced by RPDI. The equation now passes the co-integration tests more easily and the net liquid assets variable is now of the correct sign. In further equations, not reported here, tests for the inclusion of an inflation adjustment term were not found to be significant.

In equation 3.3 the mortgage lending term, which is regarded as a proxy for a number of separate effects, is replaced by a measure of housing turnover and an explicit measure of mortgage equity withdrawal. These two variables are in fact quite highly correlated, so it is not too surprising that they are not both significant. Indeed, the activity variable clearly dominates the equity extraction term. Although this could indicate that there has been little impact from equity extraction on durables spending, it is more likely to reflect the close association of durable expenditure to housing turnover. It is likely that most equity extracted for consumption is done when households move, so that our result may indicate that the definition of equity extraction needs to be more carefully defined.

The equity extraction variable is dropped in equation 3.4, and the resulting vector appears to be very reasonable. It contains terms in income, wealth, the real short-term interest rate, a proxy for credit rationing, and a linkage to the housing market. Although the coefficient on the interest rate is reduced, it is still significant and correctly signed. The coefficient on real personal disposable income is above unity (as one would expect), exceeding that found for similar research on non-durables equations.

Equations 3.5 and 3.6 re-examine the role of wealth, and test whether a broader measure of wealth is preferred. The variable for other financial assets has a smaller coefficient than net liquid assets, and the coefficient on net financial wealth clearly reflects this. However, the co-integrating properties of the equation are not improved. An alternative proxy for credit rationing is examined in equation 3.7. This includes the maximum monthly repayment period as well as the minimum deposit rate. The two proxies are in fact very similar and the HP variable is not preferred. It may be noted that both of these variables are assumed to be constant from 1982 onwards, whereas one might expect some further reduction in the required precautionary balances for credit purchases. Explicit regulations on HP credit were, however, abolished in 1982, making this point a watershed.

Finally, we also consider the choice of interest rate. Generally, the short-term interest rate is constructed using the base rate, but the mortgage rate is an obvious alternative variable to test. This reflects the fact that many durables are bought by homeowners whose disposable income is affected by mortgage interest payments. The different interest rates tend to move in line with each other, and this is more evident in recent years. This is shown in Table 4, equation 4.1. The mortgage rate appears to be preferred.

**Table 3: A co-integrating vector for durables expenditure**

Dependent variable: LCD

| | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 |
|---|---|---|---|---|---|---|---|
| CNST | -10.18 | -9.24 | -12.00 | -12.63 | -12.61 | -11.74 | -12.67 |
| | (7.65) | (12.83) | (11.29) | (23.53) | (21.70) | (12.02) | (9.14) |
| LRY | - | 1.53 | 1.69 | 1.70 | 1.70 | 1.65 | 1.67 |
| | | (19.28) | (26.57) | (34.16) | (31.94) | (16.67) | (17.55) |
| LRAY | 1.68 | - | - | - | - | - | - |
| | (11.15) | | | | | | |
| LNLAY | -0.05 | 0.16 | 0.21 | 0.24 | 0.25 | - | 0.19 |
| | (0.61) | (3.34) | (3.48) | (5.32) | (3.28) | | (2.22) |
| LOFAY | - | - | - | - | -0.00 | - | - |
| | | | | | (0.13) | | |
| LNFW | - | - | - | - | - | 0.06 | - |
| | | | | | | (1.38) | |
| LRMD | -0.83 | -0.77 | -0.15 | -0.84 | -0.84 | -0.83 | - |
| | (3.66) | (5.87) | (6.44) | (6.97) | (6.77) | (3.51) | |
| HP | - | - | - | - | - | - | 0.00 |
| | | | | | | | (2.07) |
| LRR | -0.81 | -0.14 | -0.23 | -0.24 | -0.24 | -0.13 | -0.18 |
| | (3.90) | (1.26) | (1.85) | (2.10) | (2.07) | (0.57) | (0.89) |
| LRML | 0.08 | 0.11 | - | - | - | - | - |
| | (1.76) | (4.37) | | | | | |
| LMEWDY | - | - | -0.01 | - | - | - | - |
| | | | (0.04) | | | | |
| LHT | - | - | 0.17 | 0.18 | 0.18 | 0.16 | 0.21 |
| | | | (3.00) | (4.60) | (4.49) | (2.04) | (2.49) |
| $R^2$ | 0.97 | 0.98 | 0.98 | 0.98 | 0.98 | 0.97 | 0.97 |
| DW | 1.77 | 1.88 | 2.00 | 1.94 | 1.94 | 1.72 | 1.70 |
| DF | -8.62 | -9.16 | -10.24 | -9.59 | -9.59 | -8.53 | -8.36 |
| ADF(4) | -4.03 | -3.94 | -4.22 | -4.21 | -4.30 | -3.15 | -3.28 |

All equations estimated for the period 1968 Q1 - 1990 Q2

West-corrected t-statistics in parentheses

Some of the additional factors discussed above are also tested in Table 4. In particular, the relative price of non-durables to durables, the real price of energy, and the variables for income uncertainty and confidence. Equations 4.2 and 4.3 consider the price terms added to the preferred equation 4.1. The relative price of non-durables to durables is wrongly signed. The energy price variable is correctly signed, albeit the coefficient is quite small. However, neither variable appears to improve the co-integrating vector. The volatility of income is tested in equation 4.4. This variable, together with the two confidence measures derived from the EC/Gallup survey fail to improve the basic vector. The coefficients on the two proxies for consumer confidence, reported in equation 4.5 and 4.6, are 0.0009 and 0.0011, for GCCI and MPCI respectively, both variables fail to improve the cointegrating properties of the equation. This may suggest that the equation already successfully incorporates the main influences on confidence. In fact, the only variable that seems to have any measurable effect on consumer confidence is the mortgage rate, see Chart 10, but this still leaves much of the behaviour of the variable unexplained. The correlation between the moving average of the general consumer confidence index and the mortgage rate has continued to remain close, but the decline in households attitudes to major purchases in 1989 was much greater than would have been implied by the rise in the mortgage rate. It is not surprising therefore that when confidence variables are included in the equation the interest rate term becomes less significant.

Chart 10:
Consumer confidence and the mortgage rate

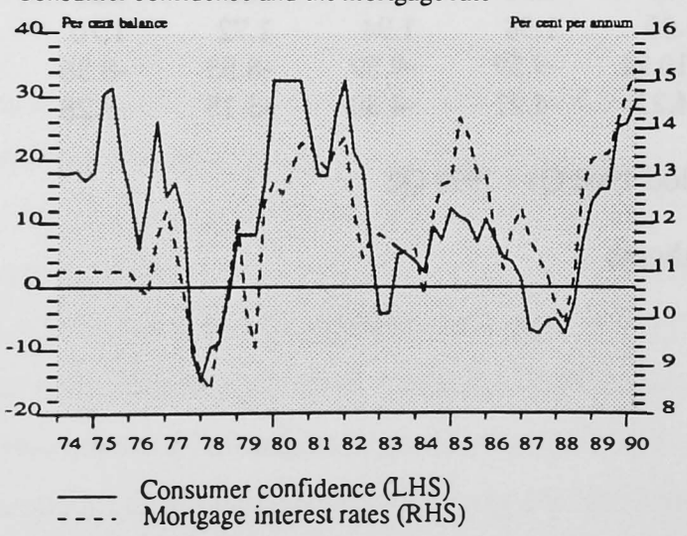


**Table 4: Testing for price terms and confidence effects**

Dependent variable: LCD

| | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 |
|---|---|---|---|---|---|---|
| CNST | -12.89 | -13.53 | -12.94 | -13.02 | -11.70 | -12.67 |
| | (34.75) | (21.49) | (34.90) | (32.99) | (15.43) | (14.07) |
| LRY | 1.69 | 1.73 | 1.68 | 1.71 | 1.69 | 1.77 |
| | (52.14) | (37.55) | (51.68) | (50.22) | (28.42) | (20.94) |
| LRMD | -0.91 | -0.90 | -0.90 | -0.94 | -0.99 | -1.00 |
| | (10.67) | (10.42) | (10.46) | (11.21) | (3.98) | (3.80) |
| LRMR | -0.46 | -0.44 | -0.43 | -0.42 | -0.34 | -0.42 |
| | (4.82) | (4.56) | (4.40) | (4.13) | (1.70) | (1.96) |
| LNLAY | 0.28 | 0.30 | 0.27 | 0.29 | 0.36 | 0.42 |
| | (8.55) | (8.35) | (7.29) | (8.89) | (6.27) | (5.96) |
| LHT | 0.21 | 0.22 | 0.22 | 0.20 | 0.12 | 0.11 |
| | (7.59) | (7.54) | (7.52) | (7.47) | (2.48) | (2.23) |
| LRP | - | -0.07 | - | - | - | - |
| | | (1.26) | | | | |
| LREP | - | - | -0.04 | - | - | - |
| | | | (0.91) | | | |
| VOLY | - | - | - | 0.73 | - | - |
| | | | | (1.45) | | |
| GCCI | - | - | - | - | 0.00 | - |
| | | | | | (1.87) | |
| MPCI | - | - | - | - | - | 0.00 |
| | | | | | | (2.05) |
| $R^2$ | 0.98 | 0.98 | 0.98 | 0.98 | 0.97 | 0.97 |
| DW | 2.09 | 2.10 | 2.09 | 1.94 | 2.16 | 2.18 |
| DF | -10.36 | -10.43 | -10.38 | -9.12 | -8.53 | -8.64 |
| ADF(4) | -4.69 | -4.88 | -4.79 | -4.49 | -3.60 | -3.40 |

Equations 4.1, 4.2 and 4.3 estimated over 1968 Q1 - 1990 Q2
Equation 4.4 estimated for period 1969 Q1 - 1990 Q2
Equations 4.5 and 4.6 estimated for period 1974 Q2 - 1990 Q2

West-corrected t-statistics in parentheses

Thus the preferred vector for the durables equation depends on RPDI, the minimum initial downpayment, the mortgage interest rate, the ratio of net liquid assets to income and housing turnover. As a further test of the long-run solution, the Johansen estimation procedure (see Johansen (1988)) was then applied to this set of variables. An unrestricted VAR with a maximum of up to two lags was assumed. The likelihood ratio test that there was at most r co-integrating vectors gave the following results;

| r | LR test | 5% critical value |
|---|---|---|
| 0 | 136.2 | 94.15 |
| 1 | 69.89 | 68.52 |
| 2 | 37.55 | 47.21 |
| 3 | 20.81 | 29.68 |
| 4 | 6.600 | 15.41 |
| 5 | 0.346 | 3.762 |

This suggests that there is at least one and possibly also a second co-integrating vector. The vector corresponding to the highest eigenvalue (0.529) yields the following implied consumer durables equation, where the coefficients are all correctly signed and close to the estimates derived from OLS estimation (yielding further support to the equation);

LCD = 1.659 LRY - 1.091 LRMD - 1.329 LRMR + 0.222 LNLAY + 0.199 LHT

The second vector, which has an eigenvalue of 0.308, is on the borderline of passing at the 5% critical value. However, this proved to be insignificant when included in the dynamic equation.

## V Econometric Analysis: A dynamic equation for durables expenditure

In this section we turn to the derivation of a dynamic equation, incorporating the lagged residual from the preferred co-integrating vector above (which was re-estimated over a smaller sample period to facilitate testing). The dynamic equation was estimated over the sample period 1970 Q1 to 1987 Q4, leaving eight periods for the forecasting performance of the equation to be tested. A general to specific modelling approach was followed, where the general equation included up to four lags of the differences of all the variables which were incorporated in the co-integrating regression. It was also necessary to include several dummies for the anticipation and unwinding effects of various budgets, in which the standard rate of Value Added Tax was changed. Changes in VAT rates may have the effect of bringing forward expenditure in anticipation of the change, as well as a depressing effect on expenditure following the introduction of the new rate. The general equation also included a number of lagged dependent variables.

The preferred equation is shown in Table 5 below. None of the lagged dependent variables are needed, but all of the factors that determine the long-run solution appear to be significant in the short term as well. Statistically significant and correctly signed effects were found from the change in real personal disposable income, changes in the ratio of net liquid assets to income, the change in the minimum deposit ratio, the real mortgage rate and housing turnover. The residual from the co-integrating regression (RES) is correctly signed and highly significant. The dummies for Budget effects in 1973 and 1979 were also significant.

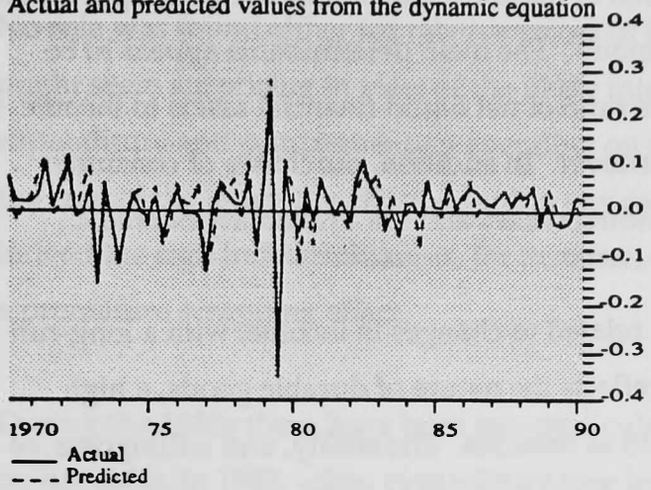
**Table 5: Durables consumption dynamic equation**

| Dependent Variable: | ΔLCD | |
|---|---|---|
| ΔLRY | 1.0046 | (4.92) |
| $\Delta LRY_{-3}$ | 0.6891 | (3.37) |
| ΔLRMD | -1.2084 | (6.17) |
| ΔLRMR | -0.6727 | (1.91) |
| $\Delta LNLAY_{-2}$ | 0.3773 | (2.02) |
| ΔLHT | 0.1897 | (2.70) |
| $RES_{-1}$ | -0.7395 | (7.47) |
| D732 | -0.0670 | (1.82) |
| D79 | 0.1972 | (7.10) |
| Sample period | 1970 Q1 - 1990 Q2 | |
| $R^2$ | 0.82 | |
| SEE (X100) | 3.40 | |
| DW | 1.94 | |
| Normality tests: | | |
| Skewness | -0.18 | |
| Kurtosis | 3.08 | |
| Bera-Jarque (2) | 0.42 | |
| Functional form: | | |
| Reset test | 3.39 | |
| Autocorrelation tests: | | |
| LM(1) | 0.09 | |
| LM(2) | 0.37 | |
| LM(4) | 4.01 | |
| LM(8) | 8.13 | |
| Ljung-Box (8) | 11.30 | |
| Heteroscedasticity: | | |
| ARCH | 0.23 | |
| Parameter stability: | | |
| Static 'Hendry' Forecast test (8) | 5.12 | |

t - statistics in parentheses above

The equation passes tests for autocorrelation, heteroscedasticity and normality of the residuals. The equation also passes the Hendry forecast test for up to eight periods ahead comfortably. The actual and fitted values of the equation are shown in Chart 11.

Chart 11:
Actual and predicted values from the dynamic equation




The co-integrating regression from the first stage was recorded and corrected from the dynamic equation (on the assumption that a unique cointegrating vector exists). The purpose of the third step, recently proposed by Engle and Yoo (1989), is to correct the coefficient in the static regression and the standard errors for small sample bias. This is achieved by simply regressing the variables from the co-integrating regression multiplied by the error correction parameter derived from the second step on the residuals from the dynamic equation. The resulting estimates are reported in Table 6, and are asymptotically equivalent to FIML. All the variables appear to be significant and the only real difference is a slightly stronger interest rate term.

**Table 6: Three stage correction for cointegrating regression (a)**

| Variable | Coefficient | | Standard | t-ratio |
|---|---|---|---|---|
| | Original | Adjusted | error | |
| CNST | -12.8900 | -12.6300 | 0.7865 | 16.05 |
| LRY | 1.6870 | 1.6650 | 0.0902 | 18.46 |
| LRMD | -0.9121 | -1.0060 | 0.1491 | 6.75 |
| LRMR | -0.4567 | -0.5506 | 0.1659 | 3.32 |
| LNLAY | 0.2832 | 0.2888 | 0.0637 | 4.53 |
| LHT | 0.2116 | 0.2110 | 0.0646 | 3.26 |

(a) Sample period 1970 Q1 - 1988 Q2

## VI Conclusions

The empirical results indicate that expenditure on consumer durables in the United Kingdom can be accounted for by a relatively small set of variables. This is despite the fact that the national accounts definition of durables may not be the most appropriate classification from an economic standpoint. The main determinants appear to be personal sector disposable income, the ratio of net liquid financial assets to income, the mortgage rate and housing market turnover. In addition, purchases of consumer durables also respond to changes in indirect taxes and the availability of credit.

Expenditure on durables is positively related to changes in income, with a long-run elasticity above unity. This possibly reflects the nature of durable goods, a high proportion of which may be considered as luxuries. The ability, and willingness, of households to defer expenditure or to bring it forward is partly what distinguishes durable from non-durable goods. The net liquid assets term may be interpreted as an integral control mechanism, such that past discrepancies between income and expenditure feed through to affect current spending. The impact of interest rates derives from both the cost of borrowing and perhaps the additional sensitivity of homeowners to changes in their mortgage repayments. Finally, it comes as no surprise, in view of the complementarity of housebuying and durables expenditure, to find an important influence from housing turnover. This is likely to be strengthened by the occurrence of equity extraction.

In view of the widespread recognition of confidence and income uncertainty as potential factors in the decision to purchase durables, the lack of such effects in the equation may need some justification. One reason may simply be the inadequacy of the actual measure used to exactly capture how consumer confidence and expectations about future income move. Another is the possibility that the same economic arguments that determine sentiment also enter directly into the equation, thus the addition of a confidence measure is not significant. Some evidence for this is that there appears to be a close relationship between interest rates and the EC/Gallup measure of consumer confidence. There may also be some suggestion that the period under consideration has not featured any significant non-economic factors which might have

affected consumers perceptions about the suitability of buying durables. The finding is not, however, without precedent, as was noted in section III above. This does not, of course, mean that a significant effect could not necessarily be found on some of the components of total durable spending.

No role was found either for relative prices or energy prices in the equation. Again, this might seem surprising in view of the likely inter-relatedness both of non-durables expenditure and complementary spending on energy products. However, at least in the case of the latter, the effect would in any case be expected to be quite small and indeed the sign indeterminate as, for instance, an increase in energy prices could lead to a premature scrapping effect.

During the 1980s there have been two particular periods of rapid growth in expenditure on durables, in 1983, when expenditure rose by over 18%, and in 1988, when the rate of growth was nearly 13%. The equation estimated in this paper suggests that the explanation for these two periods are slightly different. In the early 1980s, the sharp increase, which took place over several quarters, was the result of a combination of rapid housing market turnover and a rise in net liquid assets, but the two most important factors were the reduction in minimum deposit requirements and income growth. In the late 1980s, the more prolonged buoyancy of durable consumption was driven by income growth (in common with the earlier period), housing turnover and reductions in the rate of interest. Similarly, the recent slowdown can largely be attributed to the direct and indirect effects of monetary policy, through raising the cost of borrowing, and by reducing the disposable income of homeowners and activity in the housing market.

## VII DATA APPENDIX

CD — Consumers' durables expenditure (at constant 1985 prices)
Source: CSO code CCBW

GCCI — General consumer confidence indicator
An unweighted average of households responses to five questions
Source: EC/Gallup survey

HP — Hire purchase credit
defined as RMD + (1 - RMD)/M, where M is the maximum monthly repayment period
Source: HMT, Allum(1986)

HT — Housing turnover (particulars delivered on stamp duty in England and Wales), seasonally adjusted
Source: Inland Revenue

MEWDY — Ratio of mortgage equity withdrawal to income
Equity extraction is defined as net new mortgage lending less private sector investment in housing (new dwellings and improvements) and council house sales
Source: Financial statistics, Table 9.5, Economic trends, Table 14, Housing and construction statistics, Part 2, Table 2.12 and 2.13

MPCI — Attitudes to major purchases
Source: EC/Gallup survey

NFW — Net financial wealth
comprises net liquid assets, other financial assets, mortgage lending and LAPF assets
Source: Financial statistics, Table 14.5

NLAY — Ratio of net liquid assets to income
comprises Bank deposits, national savings, LA temp deposits, Building Society deposits and UK notes and coins less Bank lending and loans and advances by credit companies and retailers
Source: Financial Statistics, Tables 9.5, 14.5

OFAY — Ratio of other financial assets to income
comprises public sector long-term debt, UK shares, Unit trust and property unit trust units, overseas assets less other domestic loans
Source: Financial statistics, Table 14.5

RMD Effective minimum deposit rate for durables
Source: Bank of England, defined as 1+RMD/100

RML Total Mortgage lending deflated by consumer price deflator
Source: Financial statistics, Table 9.2

REP Energy prices deflated by consumer price deflator
Source: energy price deflator for consumers' expenditure on energy

RP Relative prices of durables to non-durables

RMR Actual mortgage rate less consumer price inflation
Source: Bank of England

RPDI Real personal disposable income (1985 prices)
Source: Economic Trends, Table 4

RR Real interest rate, clearing banks base rate less consumer price inflation
Source: model variable RCBR

VOLY Volatility of personal sector income
constructed as the standard deviation of personal disposable income from its average over the previous four quarters
Source: Bank of England

YDLH Real personal disposable income adjusted for inflows to LAPF and the inflationary erosion of net monetary assets
Source: Bank of England

## VIII References

Allum, P. (1986)."Consumers' expenditure on durables goods", HMT Academic Panel Paper.

Bar-Ilan, A. and Blinder, A. (1988)."Consumer durables and the optimality of usually doing nothing", National Bureau Economic Research, WP 2488.

Barrett, W. B. and Slovin, M. B. (1988)."Economic volatility and the demand for consumer durables", Applied Economics, vol. 20, No. 6, pp. 731-738.

Bayus, B. L. and Carlstrom, C. C. (1990)."Grouping durable goods", Applied Economics, Vol. 20, pp. 759-773.

Breedon, F., Murfin, A. and Wright, S. (1990)."The Bank of England Model 1989: recent developments and simulation properties", Bank of England Technical Paper No. 29.

Burch, S. W. and Wernecke, D. (1975)."The stock of consumer durables, inflation and personal saving decisions", Review of Economics and Statistics, Vol. 57, pp. 141-154.

Cuthbertson, K. (1980)."The determination of expenditure on consumer durables", National Institute Economic Review, No. 94, pp. 62-72.

Deaton, A. and Muellbauer, J. (1980)."Economics of consumer behaviour", Cambridge University Press.

Dicks, M. (1988a)."The interest rate elasticity of consumers' expenditure", Bank of England Technical Paper No. 20.

Dicks, M. (1988b)."The demographics of housing demand; household formation and the growth of owner-occupation", Bank of England Discussion Paper No. 32.

Easton, W. W. (1985)."The importance of interest rates in five macroeconomic models", Bank of England Discussion Paper No. 24.

Engle, R. F. and Yoo, B. S. (1989)."Cointegrated economic time series: a survey with new results", University of California, San Diego.

Fuller, W. A. (1976). Introduction to statistical time series, New York, Wiley and Sons.

Grossman, S. J. and Laroque, G. (1990)."Asset pricing and optimal portfolio choice in the presence of illiquid durable consumption goods", Econometrica, Vol. 58, No. 1, pp 25-51.

Hymans, S. (1970)."Consumer durable spending: explanation and prediction", Brookings Papers on Economic Activity, No. 2, pp 173-199.

Johansen, S. (1988)."Statistical Analysis of Cointegrating Vectors", Journal of Economics and Dynamics, Vol. 12, No. 2/3, pp. 231-254.

Katona, G. (1971)."A communication: consumer durable spending", Brookings Papers on Economic Activity, No. 1.

Kennedy, N. O. (1990)."A three-step estimation approach to UK non-durable consumption", Bank of England, mimeo.

Lam, P-S. (1988)."Irreversibility and consumer durables expenditures", Journal of Monetary Economics, Vol 23, pp 135-50.

Lemmon, R. (1985)."Investment in consumer durables" in P Hendershott, The level and composition of household saving.

Patterson, K. D. (1985)."Income adjustments and the role of consumers' durables in some leading consumption functions", Economic Journal, Vol. 95, pp 469-479.

Patterson, K. D. (1989)."The service flow from consumption goods", Bank of England, mimeo.

Pickering, J. (1981)."A behavioural model of the demand for consumer durables", Journal of Economic Psychology, Vol. 1, pp. 59-77.

van Raaij, W. F. and Gianotten, H. J. (1990)."Consumer confidence, expenditure, saving and credit", Journal of Economic Psychology, Vol. 11, pp. 269-290.

Wall Street Journal (1991)."Academic becomes economic guru in US", 7 May 1991, p8.

# Bank of England Discussion Papers

| | Title | Author |
|---|---|---|
| 1-5, 8, 11-14, 16-17, 19-22, 31 | *These papers are now out of print but photocopies can be obtained from University Microfilms International* (a) | |
| 6 | 'Real' national saving and its sectoral composition | C T Taylor<br>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<br>A R Threadgold |
| 15 | Influences on the profitability of twenty-two industrial sectors | N P Williams |
| 18 | Two studies of commodity price behaviour:<br>Interrelationships between commodity prices<br>Short-run pricing behaviour in commodity markets | <br>Mrs J L Hedges<br>C A Enoch |
| 23 | A model of the building society sector | J B Wilcox |
| 24 | The importance of interest rates in five macroeconomic models | W W Easton |
| 25 | The effects of stamp duty on equity transactions and prices in the UK Stock Exchange | Mrs P D Jackson<br>A T O'Donnell |
| 26 | An empirical model of company short-term financial decisions: evidence from company accounts data | Mrs G Chowdhury<br>C J Green<br>D K Miles |
| 27 | Employment creation in the US and UK: an econometric comparison | I M Michael<br>R A Urwin |
| 28 | An empirical model of companies' debt and dividend decisions: evidence from company accounts data | Ms G Chowdhury<br>D K Miles |
| 29 | Expectations, risk and uncertainty in the foreign exchange market: some results based on survey data | M P Taylor |
| 30 | A model of UK non-oil ICCS' direct investment | E J Pentecost |
| 32 | The demographics of housing demand; household formations and the growth of owner-occupation | M J Dicks |
| 33 | Measuring the risk of financial institutions' portfolios: some suggestions for alternative techniques using stock prices | S G F Hall<br>D K Miles |
| 34 | An error correction model of US consumption expenditure | I R Harnett |
| 35 | Industrial structure and dynamics of financial markets; the primary eurobond market | E P Davis |
| 36 | Recent developments in the pattern of UK interest rates | D K Miles |
| 37 | Structural changes in world capital markets and eurocommercial paper | J G S Jeanneau |
| 38 | Stockbuilding and liquidity: some empirical evidence for the manufacturing sector | T S Callen<br>S G B Henry |
| 39 | The relationship between employment and unemployment | M J Dicks<br>N Hatch |
| 40 | Charts and fundamentals in the foreign exchange market | Mrs H L Allen<br>M P Taylor |
| 41 | The long-run determination of the UK monetary aggregates | S G Hall<br>S G B Henry<br>J B Wilcox |
| 42 | Manufacturing stocks; expectations, risk and co-integration | T S Callen<br>S G Hall<br>S G B Henry |
| 43 | Instability in the euromarkets and the economic theory of financial crises | E P Davis |
| 44 | Corporate governance and the market for companies: aspects of the shareholders' role | J Charkham |
| 45 | Stock-flow consistent income for industrial and commercial companies:the UK experience | K D Patterson |
| 46 | The money transmission mechanism | D K Miles<br>J B Wilcox |
| 47 | Monetary aggregates in a changing environment: a statistical discussion paper | R D Clews<br>Ms J E C Healey<br>Glenn Hoggarth<br>C R Mann |
| 48 | A model of manufacturing sector investment and employment decisions | J W Lomax |
| 49 | A simple model of the housing market | M J Dicks |
| 50 | An industrial approach to financial instability | E P Davis |
| 51 | International financial centres—an industrial analysis | E P Davis |
| 52 | A model of ICCs' dividend payments | J W Lomax |
| 53 | The determination of average earnings in Great Britain | M A S Joyce |
| 54 | Cross-border savings flows and capital mobility in the G7 economies | Shelley Cooper |

## Technical Series

| | Title | Author |
|---|---|---|
| 1-11,14,20 23 | *These papers are now out of print but photocopies can be obtained from University Microfilms International* (a) | |
| 12 | The development of expectations generating schemes which are asymptotically rational | K D Patterson |
| 13 | The arch model as applied to the study of international asset market volatility | R R Dickens |
| 15 | International comparison of asset market volatility: a further application of the ARCH model | R R Dickens |
| 16 | A three sector model of earnings behaviour | D J Mackie |
| 17 | Integrated balance sheet and flow accounts for insurance companies and pension funds | Raymond Crossley |
| 18 | Optimal control of stochastic non-linear models | S G Hall<br>I R Harnett<br>M J Stephenson |
| 19 | A multivariate GARCH in mean estimation of the capital asset pricing model | S G Hall<br>D K Miles<br>M P Taylor |
| 21 | Modelling of the flow of funds | D G Barr<br>K Cuthbertson |
| 22 | Econometric modelling of the financial decisions of the UK personal sector: preliminary results | D G Barr<br>K Cuthbertson |
| 24 | Modelling money market interest rates | J S Flemming<br>D G Barr |
| 25 | An independant error feedback model of UK company sector asset demands | D G Barr<br>K Cuthbertson |
| 26 | A disequilibrium model of building society mortgage lending | S G Hall<br>R A Urwin |
| 27 | Balancing the national accounts: an asymptotically maximum likelihood approach using trends | G P Dunn<br>D M Egginton |
| 28 | Testing a discrete switching disequilibrium model of the UK labour market | S G Hall<br>S G B Henry<br>M Pemberton |
| 29 | The Bank of England Model 1989: recent developments and simulation properties | F J Breedon<br>A J Murfin<br>S H Wright |
| 30 | A data-based simulation model of the financial asset decisions of UK, 'other' financial intermediaries | D G Barr<br>K Cuthbertson |
| 31 | The demand for financial assets held in the UK by the overseas sector: an application of two-staged budgeting | D G Barr<br>K Cuthbertson |
| 32 | A note on the estimation of GARCH-M models using the Kalman Filter | S G Hall |
| 33 | Modelling the sterling effective exchange rate using expectations and learning | S G Hall |
| 34 | Modelling short-term asset holdings of UK banks | D G Barr<br>K Cuthbertson |
| 35 | A Monte Carlo study of alternative approaches to balancing the national accounts | D M Egginton |
| 36 | Sterling's relationship with the dollar and the deutschemark: 1976–89 | A G Haldane<br>S G Hall |
| 37 | Using and assessing CBI data at the Bank of England | Bahram Pesaran<br>C B Wright |
| 38 | A system approach to consumption and wealth | S G Hall<br>K D Patterson |
| 39 | Exchange rate equations | Helen Allen<br>Brian Henry<br>Bahram Pesaran |
| 40 | Inventories, technological change, financial effects and risks | Keith Cuthbertson<br>David Gasparro |
| 41 | News effects in a high frequency model of the sterling-dollar exchange rate | C A E Goodhart<br>S G Hall<br>S G B Henry<br>Bahram Pesaran |
| 42 | Expenditure on consumer durables in the United Kingdom | N O Kennedy |

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