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A model of the building society sector

by

J B Wilcox

August 1985

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A MODEL OF THE BUILDING SOCIETY SECTOR*

INTRODUCTION

Building societies are by far the most important source of lending for house purchase. During the period considered in this study, 1968-1984, the average share of mortgage lending accounted for by the societies was about 80%. While their assets are predominantly in the form of loans for house purchase, their liabilities are mostly shares and deposits, which compose part of PSL2 (and M2). As the societies have grown, so has the proportion of personal sector liquid assets held in the form of building society shares and deposits from 30% in 1968 to 50% last year.

This paper presents an econometric model of the building society sector over this period. The two major problems to be overcome are rationing in the mortgage market and structural change. The first is explicitly treated, the second proved difficult to identify. In the model here developed, the variables assumed to be determined by societies' decisions are the rates on shares and deposits, the rate on mortgages and the loan-to-value ratio of first-time buyers (which is a proxy for rationing). The societies' liquid assets are taken to serve as a buffer stock in the short run, but movements in this stock influence the societies' choice of rates and the loan-to-value ratio. Persons' demand for shares and deposits of societies is derived from a standard portfolio approach. The rationing proxy is used to obtain an estimate of the constrained demand for mortgages, from which it is possible to compute estimates of excess demand for mortgages and long-run gearing ratios.

MODELS OF RATIONING IN THE MORTGAGE MARKET

The proposition that the mortgage market in the UK has not been cleared by the mortgage rate but has been characterised more or

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* I am grateful to S Drayson for many helpful discussions on the research and to D F Hendry, D T Llewellyn and colleagues in the Economics Division of the Bank for comments on earlier drafts of this paper.

less continuously by rationing is supported by the empirical research, discussed below, of O'Herlihy and Spencer (1972), Hendry and Anderson (1977), Pratt (1980), Nellis and Thom (1983) and Anderson and Hendry (1984).

What is "rationing"? It is normally defined as:

(a) Borrowers queuing for mortgages.

(b) Borrowers being unable to obtain as large a loan as they would like.

As Stiglitz and Weiss (1981) have emphasised, however, in general, (b) should not be taken to constitute rationing, for that should involve situations in which consumers are quantity constrained in their demand for a homogeneous good. If the probability of default varies with the size of loan, then it is not to be expected that borrowers would be able to obtain any size loan they wished at a given rate of interest. Thus, if (a) and (b) are both to be considered as rationing, it is necessary to assume that there is no probability of default. This is a reasonable assumption for the period under review since the loans are secured and the operation of the social security system in the UK underpinned many mortgage payments.

Estimates of mortgage demand

O'Herlihy and Spencer (1972) estimated a mortgage demand equation for UK building societies using dummy variables for mild and strict rationing. These were significant and correctly signed, but no significant interest rate effect was identified. Hendry and Anderson (1977) estimated an equation for building society advances which included the explanatory variables of O'Herlihy and Spencer and in addition included supply side variables (such as the increase in shares and deposits and the liquidity ratio). They found that the rationing dummies used by O'Herlihy and Spencer were no longer significant in this reformulation.

An alternative approach, used by Ostas and Zahn (1975), in a study of savings and loan credit in the USA, and by Kent (1980) in a study of the mortgage market in the USA, is to assume the market is cleared by the loan-to-value ratio.

A more recent estimate of equations for mortgage demand is that of Nellis and Thom (1983), which distinguishes between loans to first-time buyers and existing owner-occupiers. They argue that non-interest rate terms (proxied by the loan-to-income ratio) influence both desired demand, and also the degree of rationing in the market.

Estimates of mortgage supply

It is sometimes argued that building societies have a desired supply function for mortgages, which supply function in turn may be influenced by the societies' estimate of 'underlying' mortgage demand. This was the approach adopted by Pratt (1980), who assumed that actual advances were a linear combination of supply and demand.

Anderson and Hendry (1984) present a model in which building societies choose the rate on deposits, the rate on mortgages and the stock of mortgages to minimise a cost function. This reflects costs associated with divergence from building society objectives which are assumed to be:

(i) To maintain advances as a given proportion of deposits.

(ii) To satisfy mortgage demand.

(iii) To avoid large changes in the stock of mortgages and the rates on deposits and mortgages.

(iv) To maintain a constant reserve ratio.

(v) To maintain a 'reasonable' rate of interest on mortgages.

It is clear that these objectives may conflict. In particular, the desire to maintain a 'reasonable' rate of interest may not be consistent with the desire to meet all mortgage demand. The minimisation of this cost function gives rise to equations for mortgage and deposit rates together with the stock of mortgages (all of which depend on the building societies' perception of excess demand).

A MODEL OF THE BUILDING SOCIETY SECTOR

In the model outlined below, the personal sector demands shares, deposits and mortgages. Persons' choice of assets is assumed to be separable in standard portfolio fashion. Firstly, the stock of liquid assets is chosen; secondly, the allocation between the different types of liquid assets is decided. Using the loan-to-value ratio as a proxy for rationing, a constrained demand for mortgages is derived.

The variables assumed to be determined by the building societies are the rate on shares and deposits, the rate on mortgages and the loan-to-value ratio. Societies' liquid assets serve as a buffer stock. Thus an exogenous decrease in the demand for shares and deposits would result initially in a fall in societies' liquidity ratio. However, this would subsequently influence the societies' choice of rates and the loan-to-value ratio.

The demand for building society shares and deposits

Chart 1 shows the personal sector's allocation of liquid assets. The main components are national savings, building society shares and deposits, and deposits with the banking/monetary sector. The share of national savings declined fairly continuously from 27% in 1968 to 15% in 1978. The decline continued until 1981, since when the share has increased slightly. The share of the banking/monetary sector rose from 35% in 1968 to 40% in 1974, but has declined slowly thereafter to stand at 35% in 1983. The share of the building societies increased from 30% in 1968 to reach 50% by 1983, rising steadily apart from a slight decline during the period 1978-1981.

In each of these broad groupings, several different types of assets are on offer, the mix of which has changed since 1968. Building society shares and deposits have undergone a number of changes: term shares, for example, were introduced in 1974, after the only occasion on which societies suffered net outflows from accounts; and more recently, in 1980, the building societies' introduced a range of new premium accounts in response to extended competition.

Relative Shares of Selected Liquid Assets of the Personal Sector

Relative Shares of Selected Liquid Assets of the Personal Sector

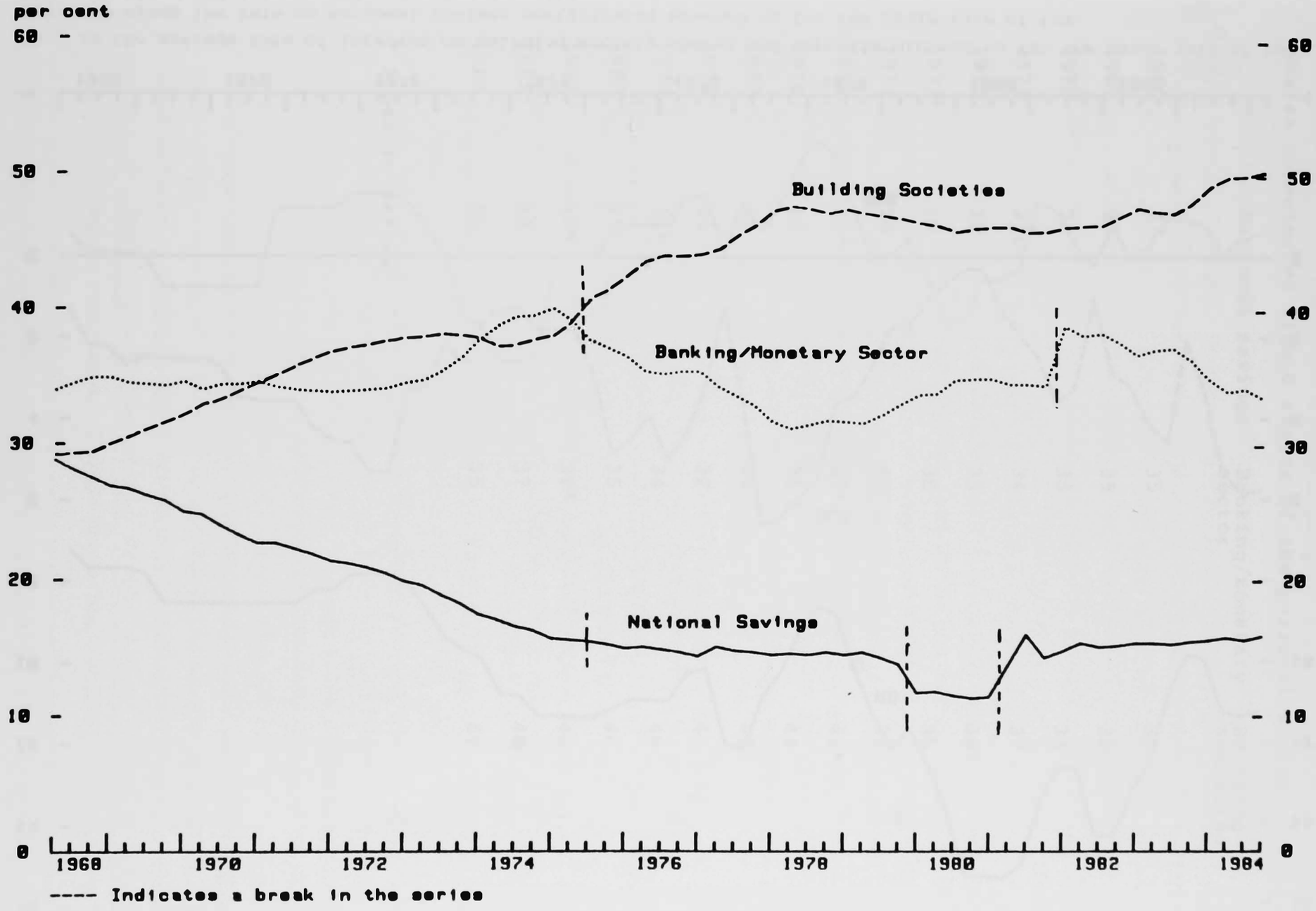
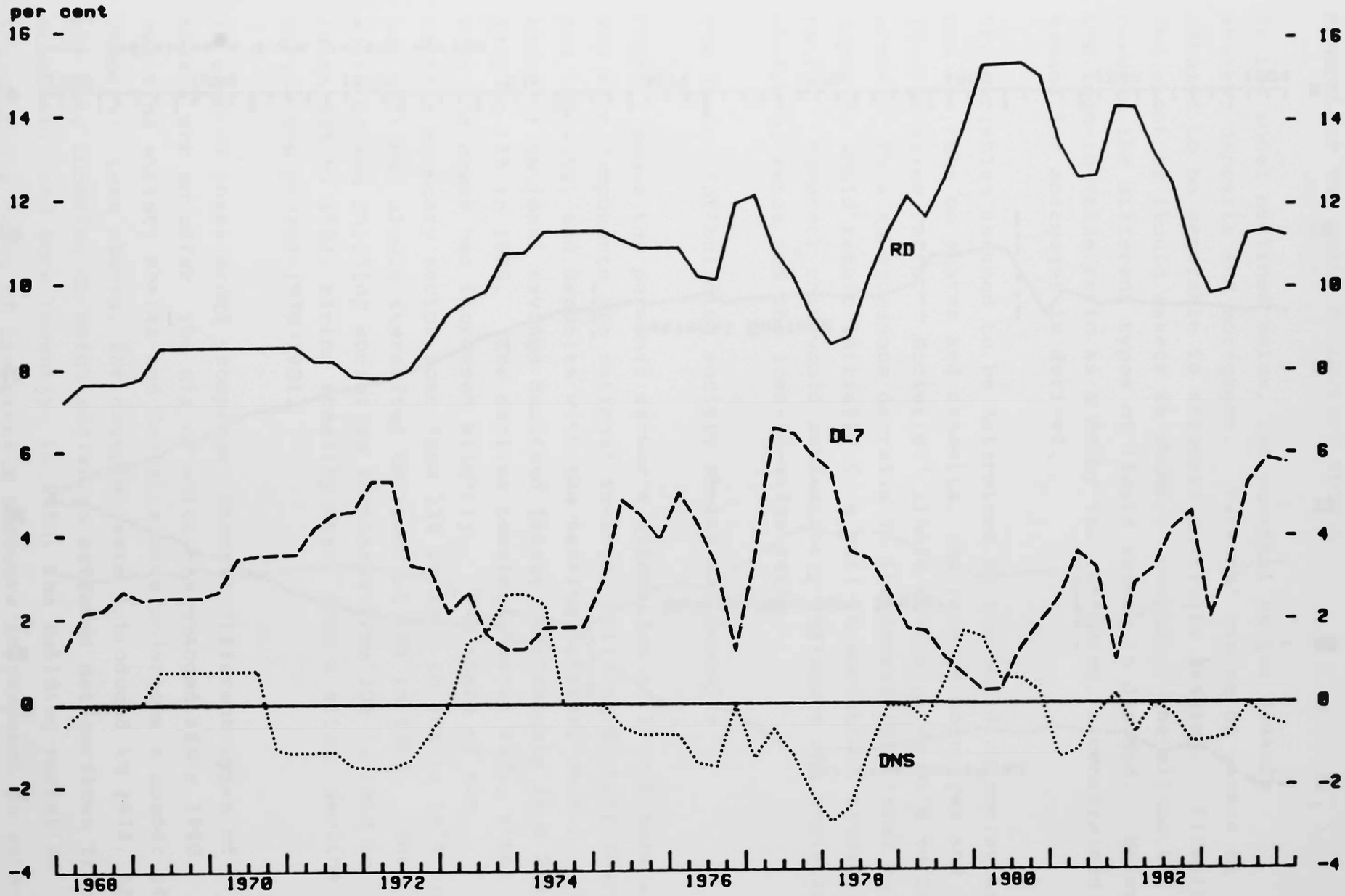


CHART 2

Comparative Interest Rates (average over the quarter)



RD is the average rate of interest on building society shares and deposits grossed up for the basic rate of tax.

DNS = RD minus the rate on national savings certificates grossed up for the basic rate of tax.

DL7 = RD minus the rate on LCB seven day deposits.

TABLE 1

Shares in selected liquid assets of the personal sector

	National savings	Banking/monetary sector	Building societies
1968	27	35	30
1969	25	35	32
1970	23	35	35
1971	21	34	37
1972	20	35	38
1973	18	38	38
1974	16	40	38
1975	15*	37*	42*
1976	14	35	44
1977	15	32	47
1978	15	32	47
1979	12*	34	46
1980	11	35	46
1981	15*	39*	46
1982	15	37	48
1983	16	35	49

* Break in series

By 1984, building societies were offering a wide variety of accounts, and it could be argued that the ordinary share rate was no longer a representative rate on shares and deposits offered by societies. It would be desirable to use a composite rate, similar to a price index. The approach adopted in this paper is to use the average rate paid on all shares and deposits. A problem with this, however, is that changes in the average rate may reflect switching between accounts rather than changes in the underlying rates of returns.*

The services offered by the building societies and public awareness of these services has altered throughout the period dealt with in this paper and particularly during the 1980s. In an attempt to capture this, the number of building society branches and advertising expenditure of the societies were entered into the demand equation but did not appear significant. The form of demand equation reported in the paper is:

$$D = F_1 (LA, rdg, rng, rb) \qquad (1)$$

Where:

D is the stock of building society shares and deposits

LA is personal sector holding of selected liquid assets

rdg is the average rate on shares and deposits grossed up at the basic rate of tax

rng is the rate paid on national savings certificates grossed up at the basic rate of tax

rb is the rate on LCB seven-day deposit accounts

The demand for mortgages

The form of households' desired or notional demand for mortgages may be deduced from considering a utility maximisation problem subject to a lifetime budget constraint. However, as we have argued above, other constraints besides the budget constraint

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* For a further discussion of this problem see Annex 1.

are important when considering the mortgage stock. The type of constraints usually imposed by building societies are restrictions on the loan-to-value ratio, the loan-to-income ratio, or a requirement that the household must queue to obtain a mortgage. For example, consider a household facing a restriction that the loan-to-value ratio is not greater than a given level, $\overline{LV}$. If the constraint is binding, then $\overline{LV}$ enters the effective demand function.

The above discussion suggests entering various measures of rationing into the demand function. Consistent information* on queues at building societies is only available since October 1983 and in any case is by nature somewhat impressionistic. Data on the loan-to-value ratio and the loan-to-income ratio exist since 1968. (Note, however, the observed values of such measures encompass both constrained and unconstrained households.) Data are available for both series for first-time buyers, existing owner-occupiers and for all buyers.

The loan-to-income ratio may be less reliable as a measure of rationing than the loan-to-value ratio because of problems in the construction of the income measure. Calculation of relevant income differs between societies and over time. The loan-to-value ratio for existing owner-occupiers is strongly influenced by house-price inflation. Thus, in times of house price inflation, it may be difficult to distinguish between a fall in the loan-to-value ratio which results from an increase in rationing and one which results from the desire of existing owner-occupiers to hold capital gains made in the housing market in the form of housing equity. This suggests the loan-to-value ratio of first-time buyers as the most appropriate rationing proxy.

Persons' demand for building society mortgages are likely to be affected by the availability of loans from other sources, eg the rapid growth in new lending by banks after the removal of 'corset' controls in 1980. Estimates of the demand for building society mortgages using other mortgage demand as an explantory variable

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*This information consists of loan availability at societies as reported in Blay's Mortgage Tables.

suffered however from structural instability and so the form of demand for building society mortgages reported in this paper is:

$$M = F_2 (Y, P, PH, rmn, LVF, VH) \qquad (2)$$

Where:

Y is real personal disposable income
P is the consumer expenditure deflator
PH is the DOE mix-adjusted house price index for all purchases
rmn is the average mortgage rate net of the basic rate of tax
LVF is the loan-to-value ratio for first-time buyers
M is the stock of building society mortgages
VH is the value of the owner-occupied housing stock

The choice variables of the building societies

The loan-to-value ratio

The loan-to-value ratio (for first-time buyers) imposed as a constraint by the building societies - should respond to their liquidity position. The work of Anderson and Hendry (1984) indicates that the measure of building society liquidity should reflect the asymmetric costs of shortfalls in, as opposed to excesses of, liquidity. It is noticeable that the liquidity ratio of the societies has been consistently higher in the period 1974 Q2 to 1984 Q1 than in the period 1968 Q1 to 1974 Q1.* This may reflect a reaction to 1974 Q1, the only quarter in which withdrawals from building society deposits exceeded receipts. The difference in the mean of the ratio of mortgages to total deposits over these two periods is 0.026.

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* There is a possibility that a further structural break in societies' attitudes to liquidity following the decision on the taxation of gilts profits on 23 February 1984.

The liquidity variable used below is therefore defined as:

$$ILR_t = \frac{1}{(1 - \frac{M_t}{TD_t} - 0.026\ C74)} \qquad (3)$$

Where:

TD is building society shares and deposits plus government loans to building societies plus wholesale funds raised by building societies

C74 is a dummy variable having the value zero in 1968 Q1 to 1974 Q1 and 1 thereafter

Besides lagged values of this liquidity variable use is made of a forward-looking measure of liquidity. Suppose that the building societies model of mortgage demand and deposit demand were given by equations (1) and (2), then the equations could be used to generate societies' conjecture of the level of liquidity if their rates and LVF remained unchanged. Discrepancies between this forward-looking measure of liquidity and desired liquidity would lead to societies changing rates and LVF.

Using the parameter estimates of equation (1) and substituting the lagged rate on deposits for the current rate gives an estimate of what the inflow of deposits would have been if societies' had not changed rates, D. A similar procedure provides an estimate of advances if societies' rates and LVF had remained unchanged, M. The forward-looking measure of liquidity is defined as

$$\hat{ILR}_t = \frac{1}{1 - \frac{\hat{M}_T}{\hat{T}D_t} - .026C74}$$

where:

$\hat{TD}$ is $\hat{D}$ plus government loans to building societies plus wholesale funds raised by building societies.

The actual loan-to-value ratio results from aggregating over both constrained and unconstrained demand. While the loan-to-value ratio for constrained consumers is set by the societies, the value for unconstrained consumers reflects their preferences and may be expected to be influenced by house prices, income, the general price level and the rate of interest on mortgages.

The equation for the loan-to-value ratio is therefore:

$$LVF = (\hat{ILR}, ILR, Y, P, PH, rmn) \qquad (4)$$

The mortgage rate

The mortgage rate may be best regarded as a mark-up on the rate on shares and deposits*, with the precise relationship being derived from the need for income to exceed expenditure in order to achieve the societies' desired reserve ratio. For this purpose, the income and expenditure position of the building societies may be summarised as:

Income	Expenditure
Interest on mortgages	Interest on shares and deposits
Interest on liquid assets	Income tax
Other income	Management expenses
	Other expenditure
	Surplus

It is then possible to derive an equation for the mortgage rate by combining the accounting identity for income and expenditure with a behavioural equation linking the desired surplus of the building societies to the reserve ratio.

This leads to a mortgage rate equation of the form:

$$rm = F_4 (rd, CT, RR, CORT, ME, rl, LVF) \qquad (5)$$

Where:

rd is the average rate of interest on shares and deposits

CT is the composite rate of tax which building societies pay on behalf of depositors

RR is the building societies' reserve ratio

CORT is the rate of corporation tax payable by building societies

ME is management expenses

rl is the three-month local authority rate

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* See Pratt (1980) and Anderson and Hendry (1984).

The share and deposit rate

The rate on shares and deposits has traditionally proved difficult to model. Pratt (1980) estimated two equations in order to determine the share rate: one determined the timing of the change, the other the size. Anderson and Hendry (1984) concluded that the share rate equation was the weakest part of their building society model.

The discussion of competing liquid assets suggests the LCB seven-day deposit rate and a national savings rate as the most appropriate competing rates. It is assumed that the rate on shares and deposits responds to the liquidity position of the societies and in the work of Anderson and Hendry (1984) the rate is also affected by the level of excess demand. This suggests the equation:

$$rdg = F_5 (rb, rng, \hat{ILR}, ILR, LVF) \qquad (6)$$

The model does not attempt to explain the demand for wholesale funds by societies. Their access to wholesale markets is such a recent phenomenon that no such estimation is feasible. Given the developments in the mortgage market in the 1980s, structural breaks in the model might be expected, eg in the determination of the deposit rate. Such changes should, however, be detected by parameter stability tests carried out on the model.

EMPIRICAL RESULTS

The shares and deposits equation

Recall that the demand for shares and deposits is taken to be:

$$D = F_1 (LA, rdg, rng, rb)$$

Testing down from a general dynamic form of the equation produced the preferred equation.

$$\Delta_1 \ln D_t = \underset{(6.6)}{0.64}\Delta_1 \ln LA_t \underset{(4.5)}{-0.041} \ln\left(\frac{D_{t-3}}{LA_{t-3}}\right) + \underset{(7.7)}{0.010}\, rdg_t - \underset{(1.3)}{0.001}\, rng_t - \underset{(10.9)}{0.0066}\, rb_t - \underset{(3.4)}{0.018}\, D74 \underset{(4.0)}{-0.061} \qquad (7)$$

SE = 0.0047 $\quad X_1^2(6) = 5.0 \quad R^2 = .85 \quad X_2^2(4) = 1.44$

Where:

$X_1^2(6)$ is the Ljung Box chi-squared statistic

$X_2^2(4)$ is a test of post-sample parameter stability

D74 is a dummy variable for 1974 Q1 to capture the effect of exceptional net withdrawals of deposits in part due to the high yields offered on guaranteed income bonds issued by insurance companies (a tax loophole closed in the budget of 1974).

Unadjusted data for the period 1968 Q2 to 1984 Q1 were used for all the equations reported in this paper, the last four observations being retained for post-sample parameter-stability tests. Seasonal dummies were included in all the equations but are not reported.

A one percentage point (eg from 8% to 9%) increase in the gross rate paid on shares and deposits assuming that competing rates remain unchanged, leads to a one percent increase in shares and deposits in the same quarter. At 1984 Q1 levels, this represents an increase of about £820 million in a quarter. The small coefficient on D_{t-3} implies long adjustment lags before the stock of deposits adjusts to its static equilibrium value; for example, the mean lags on interest rate changes are five years. rng has been retained despite being statistically insignificant. This may be justified on the grounds that national savings have been more competitive since 1980. This tendency was clearly illustrated in further work on the equation which showed the semi-elasticity since 1980 to be significantly different from zero, but similar in size to the semi-elasticity estimated over the whole period.

The long-run static-equilibrium solution is given by:

$$\ln\left(\frac{D}{LA}\right) = 0.25\, rdg - 0.03\, rng - 0.16\, rb - 1.486 \qquad (8)$$

At sample means, this would give the building societies a 70% share of liquid assets. This is high relative to the largest value during the sample (50%). The difference results from lags of adjustment, which imply that deposits remain below the long-run static-equilibrium solution when liquid assets are growing.

This is illustrated by the steady-state growth solution:

$$\ln\left(\frac{D}{LA}\right) = 0.25\ rdg - 0.03\ rng - 0.16\ rb - 1.486 - 8.8\ \Pi_{LA}$$

Where Π_{LA} is the rate of growth of nominal liquid assets.

The mortgage demand equation

Recall that the demand function is assumed to be of the form:

$$M = F_2\ (Y,\ P,\ PH,\ rmn,\ LVF,\ VH)$$

Testing down from a general dynamic form of the equation produced the preferred equation:

$$\begin{aligned}\Delta_1 \ln M_t = {} & \underset{(4.86)}{0.36}\ \Delta_1 \ln M_{t-2} + \underset{(3.9)}{0.09}\ \overline{\ln Y}_t - \underset{(5.6)}{0.057}\ \ln (PH_{t-1}/P_{t-1}) \\ & + \underset{(5.5)}{0.12}\ \Delta_1 \ln PH_t - \underset{(6.1)}{0.036}\ \ln rmn_t + \underset{(2.6)}{0.016}\ \ln rmn_{t-2} \\ & + \underset{(6.9)}{0.15}\ (\ln LVF_t - \ln LVF_{t-2}) + \underset{(4.2)}{0.089}\ \ln LVF_{t-4} \\ & - \underset{(5.1)}{0.062}\ \ln (M_{t-1}/VH_{t-1}) - \underset{(2.3)}{0.53} \qquad (9)\end{aligned}$$

$SE = 0.0029 \qquad R^2 = 0.91 \qquad X_1^2(6) = 5.4 \qquad X_2^2(4) = 6.46$

KZNA.

Where $\overline{\ln Y}_t = \frac{1}{5} \sum_{i=0}^{4} \ln Y_{t-i}$

The adjustment of the mortgage stock to a change in any of the independent variables is slow: the mean lags on the independent variables are two to three years. This may in part reflect the fact that, although a household's desired mortgage stock may change as soon as one of the independent variables changes, it may be able to adjust the actual mortgage only when next moving house, or the shift in the desired mortgage may be conditional on moving house.

Consider first the response to a change in the mortgage rate. At 1984 Q1 levels, a 10% increase in the net mortgage rate (ie approximately a 1 percentage point change) would lead to a reduction in advances over the first year of £875 million. However, because of the long lags of adjustment, this is only 38% of the total effect of such a change. An increase in LVF of 1% leads to an increase in advances of £259 million in the first year. The long lags of adjustment are again important, the effect in the first year being only 25% of the final effect.

The long-run static-equilibrium solution of the equation is given by:

$$\ln (M/VH) = 1.5 \ln Y - 0.92\ln(PH/P) - 0.32 \ln rmn + 1.44 \ln LVF - 8.6 \qquad (10)$$

The effect of relative house prices is of interest. Consider, for example, an increase (ΔPH) in house prices holding other prices constant: taking into account the effect of the increase on VH, the long-run equilibrium effect on mortgage demand is $0.08\ \Delta PH$. An implication of this is that little of the capital gains in the housing market are spent outside the housing market, the personal sector continuing to hold 92% of any such gain in the form of equity in housing. This could reflect the current generation identifying with future generations, implying that the increase in current wealth is exactly offset by the increase in the cost of future housing requirements. It may, however, in part be capturing a type of rationing not reflected in the loan-to-value ratio of first-time buyers. During the 1970s, home-owners were unable to realise such capital gains, at least until they moved, and even then building societies could prevent them withdrawing funds from the housing market by changing the loan-to-value ratio for existing owner-occupiers.

The long-run dynamic solution to the equation is:

$$\ln \left(\frac{M}{VH}\right) = 1.5 \ln Y - 0.92\ln\left(\frac{PH}{P}\right) - 0.32\ln rmn + 1.44 \ln LVF - 8.6 - 16.6\,\Pi_Y - 8.6\,\Pi_P + 1.0\Pi_{HP} - 10.5\Pi_{NH} \qquad (11)$$

Where:

Π_Y is the growth rate of real income

Π_P is the growth rate of the general price level

Π_{HP} is the growth of house prices relative to the general price level

Π_{NH} is the growth in the number of owner-occupied dwellings

The long-run static-equilibrium mortgage stock implied by equation (10) at 1983 Q4 levels is 96,441. Evaluating the long-run dynamic equation at 1983 Q4 levels and using the mean rates of growth of the independent variables for the sample period gives a dynamic solution of 67,554 which is only 70% of the static long-run solution, the growth in the general price level accounting for about two-thirds of the difference. These growth coefficients probably reflect the constraint that the mortgagor cannot continuously adjust the actual to the desired mortgage stock (although the societies appear to be moving in this direction).

Rationed and unrationed mortgage demand

Given the estimate of the demand for mortgages, it is possible to consider a tentative answer to the question of the size of excess demand for mortgages over the recent past. The main problem to be faced in constructing unrationed mortgage demand is deciding which value of LVF corresponds to a situation of no rationing. The largest value of LVF, 0.87, occured in 1983 Q1, and it was decided to take this value as the one at which there was no rationing. The estimates of excess demand given below also assume that house prices and interest rates are exogenous, and no account is taken of the effect of the removal of rationing on these variables.

Given these assumptions, it is possible to consider the effect of the removal of rationing in any one year. Estimates below are

derived by comparing the within sample forecast of the year produced by the equation with the forecast produced if the actual value of LVF were replaced by our 'market clearing' value (0.87). The first series may be referred to as the rationed mortgage stock, the second the unrationed mortgage stock. These are given in Table 2. The major features illustrated in Table 2 are that the periods 1973-1975 and 1979-1980 show up as the times of most severe rationing. Since 1981, rationing is at its lowest level over the period.

It is also possible to use the long-run static-equilibrium solution of the equation to obtain an estimate of the long run static equilibrium excess demand. Table 3 compares the equilibrium rationed mortgage stock obtained from equation (10) with the equilibrium unrationed mortgage stock obtained by using equation (10) with the true value of LVF replaced by the 'market clearing' value. A comparison of the equilibrium excess demand with dynamic excess demand gives one an idea of the importance of the lagged adjustment involved. In the year of high excess demand, 1974, we see from Table 2 that, if rationing had been relaxed in this year, the stock of mortgages would have been 6.6% higher. From Table 3 we see that, if the independent variables remained at their 1974 Q4 levels, the equilibrium unrationed mortgage stock would have been 25% higher than that arrived at if rationing had persisted at the 1974 Q4 level. This difference draws attention to the distinction between a flow concept of rationing and a stock concept. Thus despite the assumption of no rationing in flow terms in 1983 Q1, given the restriction that most mortgages are only changed when moving house, there would have been many existing owner-occupiers who were nevertheless rationed.

Finally, it is possible to use the equation to examine changes in the gearing ratio. The ratio used here is restrictive in that it considers the ratio of building society mortgages, not all mortgages, to the value of owner-occupied housing. The rationed long run static-equilibrium values of M/VH (using the true value of LV), are denoted RE (M/VH). We also compute unrationed long-run static-equilibrium values of M/VH (using the 'market clearing' value of LV), denoted by UE (M/VH).

TABLE 2

DYNAMIC EXCESS DEMAND FOR MORTGAGES

	Rationed Mortgage Stock £m	Unrationed Mortgage Stock £m	Excess Demand £m	% Excess Demand
1969	7,747	8,019	272	3.5
1970	8,775	9,044	268	3.1
1971	10,413	10,675	262	2.5
1972	12,671	13,010	339	2.7
1973	14,617	15,309	692	4.7
1974	16,107	17,177	1,070	6.6
1975	18,882	19,747	864	4.6
1976	22,488	23,266	777	3.5
1977	26,655	27,630	976	3.7
1978	31,701	32,819	1,118	3.5
1979	37,048	39,141	2,093	5.7
1980	42,516	44,982	2,466	5.8
1981	49,151	50,792	1,641	3.3
1982	57,020	57,322	302	0.5
1983	67,827	68,600	773	1.1

Figures are for end year.

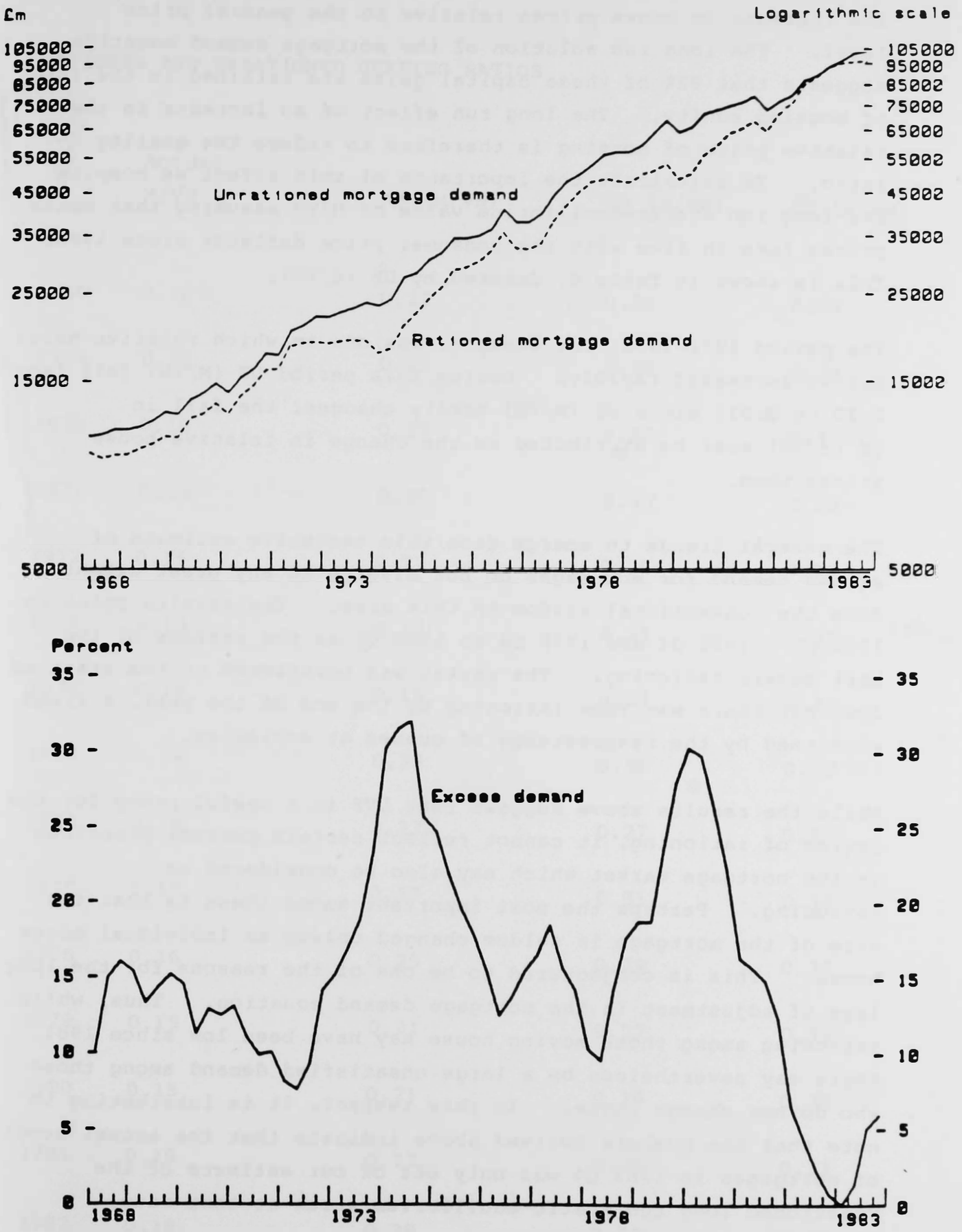
TABLE 3

STATIC EQUILIBRIUM DEMAND FOR MORTGAGES

	Rationed Equilibrium Mortgage Stock £m	Unrationed Equilibrium Mortgage Stock £m	Equilibrium Excess Demand £m	% Excess Demand
1968	9,681	11,232	1,551	16.0
1969	10,786	12,423	1,636	15.2
1970	13,049	14,678	1,629	12.5
1971	15,829	17,427	1,598	10.0
1972	18,941	21,616	2,675	14.1
1973	19,077	23,505	4,428	23.2
1974	22,232	27,927	5,695	25.6
1975	29,061	34,219	5,158	17.7
1976	32,579	37,590	5,011	15.3
1977	41,798	47,701	5,903	14.1
1978	48,125	56,561	8,436	17.5
1979	53,083	67,864	14,782	27.8
1980	58,935	71,923	12,988	22.0
1981	64,236	72,124	7,888	12.2
1982	87,691	88,279	587	0.7
1983	96,441	102,162	5,720	5.9

CHART 3

Static equilibrium excess demand for mortgages



A major influence on the gearing ratio over this period has been the increase in house prices relative to the general price level. The long run solution of the mortgage demand equation suggests that 92% of these capital gains are retained in the form of housing equity. The long run effect of an increase in the relative price of housing is therefore to reduce the gearing ratio. To illustrate the importance of this effect we compute the long run static-equilibrium value of M/VH assuming that house prices rose in line with the consumer price deflator since 1968. This is shown in Table 4, denoted by $\hat{UE}$ (M/VH).

The period 1971-1973, for example, was one in which relative house prices increased rapidly. During this period UE (M/VH) fell from 0.30 to 0.21; since $\hat{UE}$ (M/VH) hardly changes, the fall in UE (M/VH) must be attributed to the change in relative house prices then.

The general trends to emerge from this tentative estimate of excess demand for mortgages do not diverge to any great extent from the conventional wisdom in this area. The results point to 1973 Q3 - 1975 Q4 and 1978 Q4 to 1980 Q1 as the periods of the most severe rationing. The market was unrationed at the start of 1983 but there was some rationing by the end of the year, a trend confirmed by the reappearance of queues at societies.

While the results above suggest that LVF is a useful proxy for the degree of rationing, it cannot reflect certain current practices in the mortgage market which may also be considered as rationing. Perhaps the most important among these is that the size of the mortgage is seldom changed unless an individual moves house. This is conjectured to be one of the reasons for the long lags of adjustment in the mortgage demand equation. Thus, while rationing among those moving house may have been low since 1981, there may nevertheless be a large unsatisfied demand among those who do not change house. In this respect, it is interesting to note that the numbers derived above indicate that the actual stock of mortgages in 1983 Q4 was only 66% of our estimate of the unrationed long run static-equilibrium stock at that date.

TABLE 4

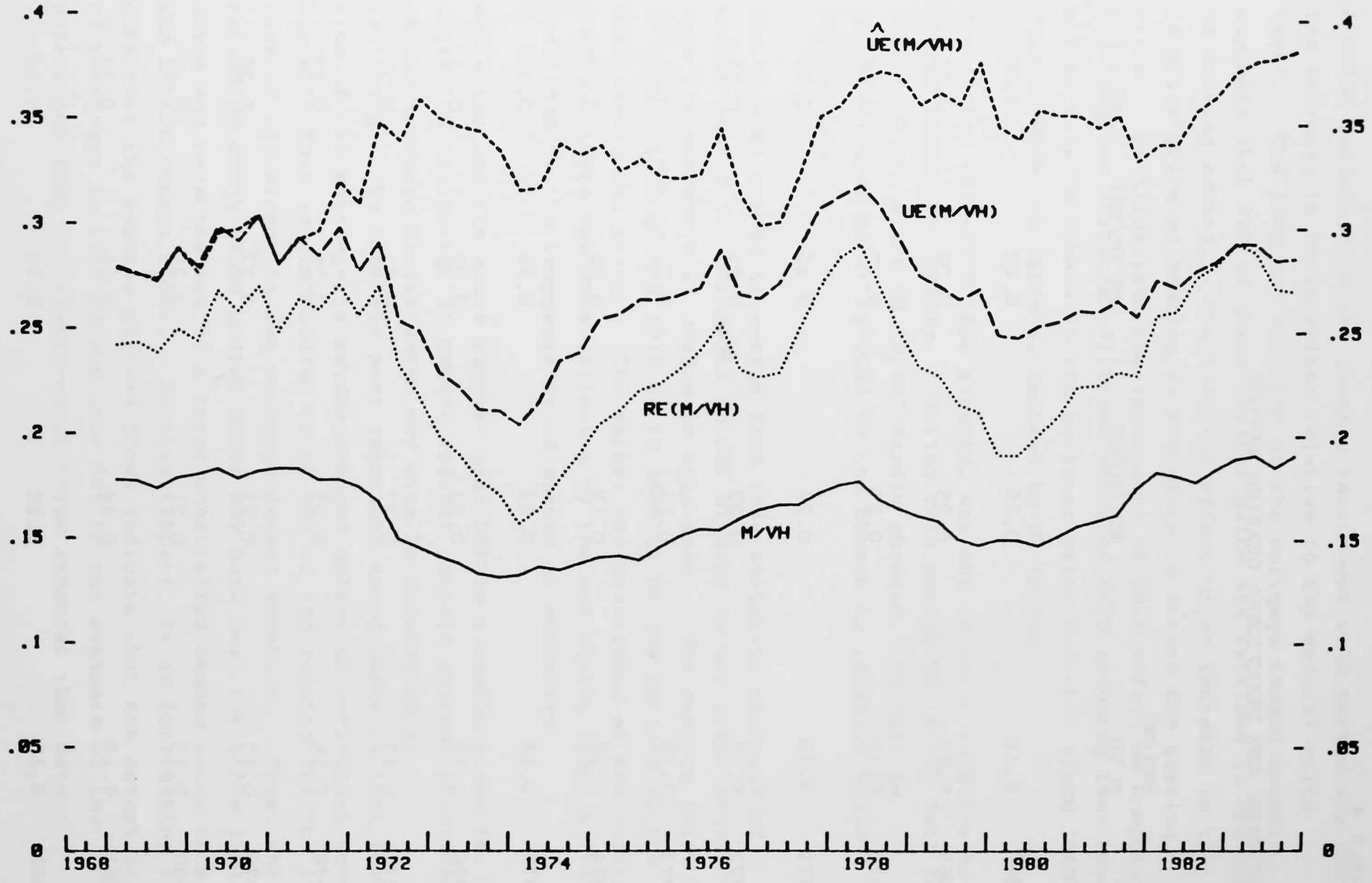
RATIONED AND UNRATIONED GEARING RATIOS

	Actual M/VH	RE (M/VH)	UE (M/VH)	$\hat{UE}$ (M/VH)
1968	0.18	0.25	0.29	0.29
1969	0.18	0.25	0.29	0.29
1970	0.18	0.27	0.30	0.30
1971	0.18	0.27	0.30	0.32
1972	0.15	0.22	0.25	0.36
1973	0.13	0.17	0.21	0.33
1974	0.14	0.19	0.24	0.33
1975	0.14	0.22	0.26	0.32
1976	0.16	0.23	0.27	0.31
1977	0.17	0.27	0.31	0.35
1978	0.16	0.25	0.29	0.37
1979	0.15	0.21	0.27	0.38
1980	0.15	0.21	0.26	0.35
1981	0.18	0.23	0.26	0.33
1982	0.18	0.28	0.28	0.36
1983	0.19	0.27	0.29	0.39

Figures are for end year.

CHART 4

Rationed and Unrationed Gearing Ratios



The loan-to-value ratio

The form of the equation is:

$$LVF = F(ILR, \hat{ILR}, Y, P, PH, rmn)$$

Testing down from a general dynamic form of the equation produced the preferred equation:

$$\begin{aligned}\Delta_1 \ln LVF = {} & \underset{(1.2)}{0.15}\,\Delta_1 \ln LVF_{t-1} \underset{(3.1)}{-0.31}\,\Delta_1^2 \ln LVF_{t-3} \underset{(4.1)}{-0.17} \ln LVF_{t-3} \\ & \underset{(2.9)}{-0.05}\,\Delta_1 \Delta_4 \ln ILR_{t-1} \underset{(2.2)}{-0.05}\,\Delta_1 \ln ILR_{t-4} \\ & \underset{(2.3)}{-0.03} \ln \hat{ILR}_t \qquad \underset{(3.2)}{-0.03}\ D74 \\ & \underset{(2.0)}{+0.01}\ D82 \quad \underset{(1.0)}{+0.02}\end{aligned}$$

$$SE = .009 \quad R^2 = .7 \quad \chi_1^2(6) = 4.2 \quad \chi_2^2(4) = 1.6$$

The long-run static equilibrium solution is given by:

$$\ln LVF = -.18 \ln ILR + .127 + 0.064 D82$$

at the sample mean of ILR this gives a value of 0.78 for LVF before 1982 Q1 and 0.83 thereafter.

The most significant influences on LVF are changes in the liquidity ratio in the previous quarter and the change four quarters ago, the latter perhaps reflecting the seasonal nature of the ratio. These changes are correctly signed, an increase in liquidity (a reduction in ILR) leading to a reduction in rationing (an increase in LVF).

Terms for demand side influences (Y, P, PH rmn) were entered, however the restriction that such variables should be omitted could not be rejected. This could be the result of most first-time buyers facing constraints for almost all of the sample period. An alternative explanation is that the desired loan-to-value ratio of first-time buyers is constant.

The mortgage rate equation

Rate changes by building societies during the 1970s generally took the following form: when a change was announced, it was to apply to new mortgages from the day of announcement, to existing mortgages and to shares and deposits from the first of the next month. While this was the general pattern, there were occasions on which the lag between an announced rate becoming effective were longer. The current convention is, however, that announced rates become effective immediately on new mortgages and shares and deposits.

The rate of interest on shares and deposits and on mortgages used throughout this paper are the average of the announced rates for that quarter. These rates are averages not only across the quarter but also across the different types of mortgages and deposits. As noted above, there are now many different types of shares and deposits. The rate used is the average over such accounts. Similarly, mortgages are also differentiated; for example, some societies charge a premium for large loans, premiums are also charged on endowment mortgages. The rate used in this paper is the average on all mortgages*.

The mortgage rate is modelled as a mark-up on the share rate, the mark-up depending upon the income and expenditure position of the societies. One might expect the mark-up to respond to management expenses, capital gains on gilts, the rate received on liquid assets, the rate of corporation tax paid by building societies and the reserve ratio. Anderson and Hendry (1984) suggest using the inverse of the reserve ratio in order to capture the asymmetric costs of reserve shortfalls as opposed to surpluses; they also find some evidence that the mark-up is influenced by the degree of rationing in the mortgage market (the mark-up increasing with the degree of rationing).

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* I am grateful to the BSA for making these data available.

Terms for management expenses, the return on liquid assets and changes in corporation tax all proved insignificant. Nor did the degree of rationing, proxied by LVF, enter significantly. It may be argued, however, that changes in management expenses, the return on liquid assets and corporation tax feed through by their effect on the reserve ratio.

The preferred mortgage rate equation is:

$$\Delta_1 rm_t = \underset{(33.4)}{0.99}\,\Delta_1 \frac{rd_t}{(1-CT_t)} \underset{(4.0)}{- 0.53}\, rd_t\left(\frac{1}{(1-CT_t)} - \frac{1}{(1-CT_{t-1})}\right) \qquad (14)$$

$$+ \underset{(2.1)}{0.035}\,\frac{1}{RR_{t-1}} \underset{(2.8)}{- 0.24}\left(rm_{t-1} - \frac{rd_{t-1}}{(1-CT_{t-1})}\right) \underset{(4.4)}{- 0.67}\, D73 \underset{(1.4)}{- 0.66}$$

$SE = 0.14 \qquad R^2 = 0.96 \qquad X_1^2(6) = 5.2 \qquad X_2^2(4) = 0.24$

D73 is a dummy variable for 1973 Q1, to capture the effect of societies' anticipating a fall in the composite rate of tax in 1973 Q2.

Where:
CT is the composite rate of tax payable by building societies
RR is the building society reserve ratio

The long-run static-equilibrium solution is given by:

$$rm = rd/(1-CT) + 0.15\ 1/RR - 2.75 \qquad (15)$$

At the sample mean of 1/RR = 27.63, we have:

$$rm = rd/(1-CT) + 1.4 \qquad (16)$$

In the dynamic equation the term
$rd_t\ (1/(1-CT_t) - 1/(1-CT_{t-1}))$ is used to allow for a lag in the building societies' response to changes in CT, indeed in some quarters the composite rate to be applied is not announced until the following quarter. The long run static-equilibrium solution shows the mark-up to be a constant plus an allowance for the level of reserves. At the sample mean of 1/RR = 27.6, the mark up is 1.4 percentage points.

The rate on shares and deposits

Candidates for inclusion in this equation are competing rates, the liquidity ratio and the level of excess demand.

The preferred equation for shares and deposits is given by:

$$\Delta_1 rdg_t = \underset{(5.2)}{0.30}\,(rb_t - rdg_{t-1}) + \underset{(5.3)}{0.20}\,(rng_{t-2} - rdg_{t-2})$$
$$+ \underset{(3.2)}{0.21}\Delta_1 rng_t - \underset{(3.7)}{0.07}\, rb_t \qquad (17)$$
$$+ \underset{(1.5)}{0.10}\, \hat{ILR}_t + \underset{(.9)}{0.70}$$
$$SE = .30 \quad R^2 = .86 \quad X_1^2(6) = 2.2$$

Giving the long run static-equilibrium solution:

$$rdg = 0.46\, rb + 0.4\, rng + 0.22\, ILR + 1.16 \qquad (18)$$

It is worthwhile considering in detail the forecasting performance of this equation during the 1980s. Estimating the equation up to 1980 Q4 and forecasting 1981 gives:

Forecasts for 1981

	Q1	Q2	Q3	Q4
Actual	-1.59	-0.83	0.04	1.66
Forecast	-0.61	-0.71	0.03	1.31
Forecast error	-0.97	-0.11	0.01	0.35

$X_2^2(4) = 15.32$

Estimating up to 1981 Q4 and forecasting 1982 gives:

Forecasts for 1982

	Q1	Q2	Q3	Q4
Actual	-0.01	-1.07	-0.76	-1.63
Forecast	-0.17	-0.97	-0.67	-1.05
Forecast error	0.16	-0.10	-0.10	-0.58

$\chi^2_2(4) = 3.44$

Forecasts for 1983

	Q1	Q2	Q3	Q4
Actual	-1.00	0.12	1.33	0.09
Forecast	-0.20	0.31	0.27	-0.50
Forecast error	-0.8	-0.19	1.06	0.59

$\chi^2_2(4) = 25.77$

The chi-squared forecasting test is significant for both 1981 and 1983, providing evidence of lack of parameter constancy. For the years 1981 and 1982, the equation captures the major changes in the deposit rate with the exception of 1981 Q1. The equation fails to predict the two major changes in 1983. These may, however, reflect to some extent a tendency for building societies to maintain relatively low rates before a general election (the rate then increased after the election in 1983 Q2).

CONCLUSION

The results for the mortgage demand equation indicate that the loan-to-value ratio for first-time buyers is a useful proxy for the degree of rationing. The parameters indicate that 90% of capital gains made in the housing market are retained in the form of housing equity, and it was conjectured that this might reflect a type of rationing not captured by the loan-to-value ratio of first-time buyers. The long adjustment lags implied may result from lending arrangements which have tended to restrict households to adjusting their mortgage stock only when moving house. The estimates of excess demand indicate that although the building societies moved towards market clearing in the 1980s there was still some rationing in 1983.

As might be expected, given recent changes in their functioning, equations for the building societies' decision variables are more problematical. Modelling their decision on the mortgage rate conditional on the deposit rate is straightforward. The loan-to-value ratio and the rate on deposits are more difficult to model, the preferred equations for both variables have large standard errors and deposit rate equation fails the forecasting test. Given the conventional wisdom that building societies have become more competitive of late, one might expect the deposit rate equation to have systematically underpredicted during the 1980s. However, there are no signs of a systematic error in the forecasts of the equation over that period.

ANNEX 1

THE AVERAGE RATE ON SHARES AND DEPOSITS

The rate on shares and deposits used in this paper is the average over all types of accounts.* This average is a more accurate guide to the societies' cost of funds than the ordinary rate. One problem with the average rate is that movements in the rate may reflect switching between accounts rather than changes in underlying rates of return. This problem is illustrated by expressing the average rate as a weighted sum of the rates on ordinary and other accounts.

$$rd_a = rd_o S_o + rd_h(1-S_o) \qquad (19)$$

Where:
rd_a is the average rate on shares and deposits
rd_o is the ordinary share rate
rd_h is the average rate on other accounts

S_o is the share of ordinary accounts in total deposits.
Equation (19) may be rewritten as:

$$rd_h - rd_o = (rd_a - rd_o)\frac{1}{1-S_o} \qquad (20)$$

which enables one to deduce the average mark-up on high interest accounts over ordinary accounts.

Table 5 gives the proportion of total deposits held in the form of ordinary accounts. This proportion has declined rapidly since 1980 when premium accounts were introduced. Table 5 shows that, although $(rd_a - rd_o)$ increases continuously over the period 1980-1983, $(rd_h - rd_o)$ remains virtually unchanged, and thus the increase in $(rd_a - rd_o)$ is attributable to the reduction in the percentage of ordinary accounts.

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* I am grateful to the BSA for making these data and data on the proportion of shares and deposits held in ordinary accounts available.

Replacing $\frac{rd_a}{I-T}$ in equation (7) with $\frac{rd_o}{I-T}$ and the mark-up $\frac{rd_a - rd_o}{I-T}$ provides grounds for rejecting the exclusion of the mark-up from the equation. One cannot reject the restriction that both terms enter with the same coefficient however. This justifies the use of $\frac{rd_a}{I-T}$ in the reported equation

If $\frac{rd_h}{I-T}$ and $\frac{rd_o}{I-T}$ are used in place of $\frac{rd_a}{I-T}$ then $\frac{rd_o}{I-T}$ is insignificantly different from zero and the resulting equation has a larger standard error than equation (7).

TABLE 5

	Ordinary shares and deposits as a percentage of total	$\frac{(rd_a - rd_o)}{1 - T}$	$\frac{(rd_h - rd_o)}{1 - T}$
1974	87.4	0.12	0.93
1975	85.6	0.14	0.96
1976	84.6	0.15	1.00
1977	83.2	0.17	0.99
1978	83.1	0.19	1.15
1979	80.5	0.27	1.39
1980	79.0	0.40	1.90
1981	68.3	0.60	1.89
1982	54.2	0.91	1.99
1983	45.5	1.07	1.96

T is the basic rate of tax.

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