CHAPTER 30

MODELS OF TRADING BEHAVIOUR AND ACCUMULATION IN STRATIFIED HOUSING MARKETS

(P Longley and H Williams)

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Abstract. In this paper the importance of a number of variables and assumptions in relation to subsidy and accumulation in the owner-occupied housing market is examined. First, a theoretical framework is established within which individual transitions relating to mobility and trading behaviour are expressed through market relations. Second, an English data set is used to examine the financial and demographic characteristics of owner occupiers and the nature of their trading behaviour. These households are then used in a number of numerical simulations over the period 1976-90 to relate economic outputs of subsidy and accumulation to assumptions about mover behaviour and the propensity to borrow for house purchase. Finally, some provisional empirical observations are made on the effects of inheritance over time and space.

1 Introduction

It is well known that the expenditure of households in the owner-occupier sector of competitive housing markets such as that in the United Kingdom is dependent upon a variety of factors including: their demographic and socioeconomic characteristics; the time at which the market was entered; their subsequent mobility and trading behaviour; and a variety of fiscal and monetary variables outside their control. The interdependency between such demographic, social, and economic processes has an important bearing on the temporal and spatial aspects of variability of housing costs and benefits within and between regions, and over time (HMSO, 1977). Moreover, the households' fortunes in the housing market depend crucially upon the incidence of various subsidies consequent upon the pervasive intervention of the state in almost all such housing markets.

It is also recognised that the proceeds from house sales through reinvestment and tax concessions have important implications for the accumulation of assets in that sector. One aspect of this wealth accumulation in the owner-occupier sector is the financial consequences of inheritance. As the first generation of homeowners in the United Kingdom (who are disproportionately represented in London and the South East) now transmits the accumulated wealth on death, the spatial ramifications of inheritance and reinvestment are issues of considerable interest, given the significant geographical differences in the housing market (Forrest et al, 1990).

Previously, we reported on the use and merits of microsimulation studies in a preliminary examination of the variability of the economic experience of households in stratified housing markets (Clarke et al, 1989; Longley et al, 1991). Such an approach is in the tradition of microanalytical studies of household income and expenditure over time, as pioneered by Orcutt in the USA (Orcutt et al, 1961; 1976).

In this paper we propose to extend our previous investigations and examine the influence of key variables and assumptions, particularly relating to mobility and trading behaviour, on subsidy and accumulation. More specifically, our objectives

are fourfold:
(a) to establish a theoretical framework within which individual transitions relating to mobility and trading behaviour are expressed through market relations;
(b) to examine the financial and demographic characteristics of owner occupiers and the nature of their trading behaviour;
(c) to determine in numerical simulations for the period 1976-90 the relationship between economic outputs of subsidy and accumulation to assumptions about mover behaviour and the propensity to borrow for house purchase; and
(d) to make some provisional observations of the effects of inheritance, both over time and within a spatial setting.

In the application, we use a primary data set to establish microlevel variability in a base year (1976) and implement the dynamic processes in conjunction with secondary data derived from a variety of regional and national sources. The present specification of the model provides a framework for the sensitivity analysis of heterogeneity of housing outcomes under different assumptions and market conditions. The spirit of our approach at this stage is to outline the contribution of this method to the longitudinal analysis of housing careers rather than to generate detailed empirical findings.

In section 2, we set up the framework for the analysis of household behaviour within a stratified owner-occupier sector. Stock-flow models are developed to exhibit the economics of exchange interdependencies between different classes of mover, and market relations are established. In section 3, we examine from primary and secondary data sources the characteristics of mortgage holders in the owner-occupier sector, and discuss aspects of trading between houses of different prices. The form of the dynamic model used to explore the economic aspects of residential mobility is summarised in section 4. This model involves the processing of households within a 1976 database over a fifteen-year period according to simple demographic and mobility rules in conjunction with the financial aspects of house sales and purchase. In section 5, some economic characteristics derived from the sample over the period 1976-90 are presented, and the sensitivity of model outputs under variation of the parameters of the trading model for owner occupiers is discussed. We emphasise the significant spatial differences in the accumulation of wealth and inheritance by adopting two samples derived from the 'north' and 'south' of the United Kingdom. An agenda for further research is presented in section 6.

2 Stratified stock-flow models of the housing market

2.1 *Notation*

Dynamical processes in the housing market are represented by transitions between states which characterise households, h, and dwellings, H. The former will be identified by sets of attributes $a_1, \ldots, a_n$, and the latter by $b_1, \ldots, b_M$. Each of the n household and M dwelling classes will be combinations of factors and their associated levels. For example, a_i might represent a particular combination of levels associated with household income and structure, and b_j might represent combinations of tenure, type, location, etc. To avoid repetition of subscripts, an arbitrary household state will be denoted by the vector $\boldsymbol{a}$ and an arbitrary dwelling state by $\boldsymbol{b}$.

In terms of this state representation we introduce the following notation:
$\mathbf{N}_t(\boldsymbol{a})$ the number of households of type $\boldsymbol{a}$ at time t,
$\mathbf{N}_t(\boldsymbol{a}, \boldsymbol{b})$ the number of households of type $\boldsymbol{a}$ in dwellings of type $\boldsymbol{b}$ at time t,
$\mathbf{N}_{tt'}(\boldsymbol{a}, \boldsymbol{a}')$ the number of households of type $\boldsymbol{a}$ which make transitions to type $\boldsymbol{a}'$ in (t, t'),
$\mathbf{N}_{tt'}(\boldsymbol{b}, \boldsymbol{b}'|\boldsymbol{a})$ the number of transitions of households of type $\boldsymbol{a}$ between dwellings of type $\boldsymbol{b}$ and $\boldsymbol{b}'$,

$N_{tt'}(a, b:a', b')$ the number of transitions by households of type a living in dwellings of type b at time t, to households of type a' living in dwellings of type b' at time t'.

In a similar way, the notation $P(.)$ will be used to indicate the proportion of a relevant population making a transition. Thus

$P_{tt'}(a, b:a', b')$ represents the proportion of the population which makes a transition in the period (t, t') between $\{a, b\}$ and $\{a', b'\}$.

In the following analysis, we adopt a separable form for multiple transitions involving changes of both household and dwelling:

$$P_{tt'}(a, b:a', b') = P_{tt'}(a, a')\, P_{tt'}(b, b'|a'), \tag{1}$$

and, for a house move for the same household state a:

$$P_{tt'}(a, b:a, b') = P_{tt'}(b, b'|a). \tag{2}$$

Otherwise, we write for household transitions with no move:

$$P_{tt'}(a, b:a', b) = P_{tt'}(a, a'|b) = P_{tt'}(a, a'). \tag{3}$$

2.2 *Stock-flow models*

In stock-flow models of the housing markets the contributions to the potential demand for and supply of dwellings in a period (t, t') arise from familiar sources.

Demand	Supply
Formation of new households.	Additions to, conversions within, and reductions from the housing stock.
Household splitting and reformation.	Existing vacant stock.
In-migration.	Out-migration.
Transfers from other tenures.	Household dissolution.
Exchange movers.	Exchange movers

Exchange movers form an important source of dwellings for new households, and, typically, chains of movers are established involving several households and houses. The nature of vacancy chains and the establishment of exchange interdependencies within housing markets has been extensively discussed in the literature (for example, see Williams et al, 1986).

The vacancy chains are reflected in the following stock-flow equations representing the demand for and supply of housing of type b, in period (t, t') (which will be implicit below):

$$\sum_{a, b'} N(b', b|a) \leqslant S(b) + \sum_{a, b'} N(b, b'|a), \tag{4}$$

the left-hand side denoting the total transitions into state b, with the right-hand side expressing the total supply arising from exchange movers and other processes creating or releasing stock. New entrants may be identified by a separate class of households. In their contributions to both the demand side and the supply side of the housing market, the exchange movers have an important influence on the prices of new houses and the availability of dwellings for those entering the market for the first time. This is a general expression involving all tenures; we now confine attention to the owner-occupier sector.

2.3 *Probabilistic models and market relations*

We shall further decompose the transition matrix as follows (temporal subscripts being understood):

$$N(b, b'|a) = N(a, b)\, P^{m}(a)\, P(b, b'|a), \tag{5}$$

in which $\mathbf{P}^{m}(\boldsymbol{a})$ is the proportion of those households in state $\{\boldsymbol{a}, \boldsymbol{b}\}$ which moves, and $\mathbf{P}(\boldsymbol{b}, \boldsymbol{b}'|\boldsymbol{a})$ is the proportion which moves to $\boldsymbol{b}'$, given that a move is made.

The decision to move, and hence the probability $\mathbf{P}^{m}$ will, in general, depend on a number of demographic and socioeconomic variables together with the level of prices, interest rates in the markets, and the policies of credit institutions. The transition matrix $\mathbf{P}(\boldsymbol{b}, \boldsymbol{b}'|\boldsymbol{a})$ which governs the trading behaviour between houses of different types will also be a function of several households and economic variables.

Of particular interest will be moves between houses in different price categories, which we denote $[p(1) \ldots p(b) \ldots p(M)]$. The price of a dwelling randomly sampled from class b is thus $p(b)$, and this will be abbreviated to p in the following. Equation (4) may be used to express a relation between the market clearing prices $[p^{*}(1) \ldots p^{*}(b) \ldots p^{*}(N)]$, which equate the demand for and supply of houses in each market segment:

$$\sum_{a, p'} [N(a, p')P^{m}(a)P(p', p|a)] = \mathbf{S}(p) + \sum_{a, p'} [N(a, p)P^{m}(a)P(p, p'|a)] . \tag{6}$$

Here, $\sum_{p'}$ denotes summation over the price-range categories p'.

2.4 *Market relations and trading behaviour*

We shall later consider the trading behaviour of households between houses of different price classes, Δ denoting the difference between the price of the house bought (p') and that sold (p). Inequality $\Delta > 0$ thus identifies 'trading up' in the market, and $\Delta < 0$ 'trading down'.

It may be seen from equation (4) that the number of those who 'trade up' is limited by the interdependencies in the market, for equation (4) may be rearranged as follows, with summations over household classes implicit:

$$\sum_{p' < p} N(p', p) - \sum_{p' > p} N(p, p') \leqslant \mathbf{S}(p) + \sum_{p' < p} N(p, p') - \sum_{p' > p} N(p', p) . \tag{7}$$

The expression on the left-hand side of the inequality relates to those households trading up and that on the right-hand side to those trading down. Inequality (7) represents the aggregate characteristics of the chains of moves in the market, within which a household 'trading up' will be accompanied by another 'trading down', or a first time purchaser, or a vacant dwelling. Inequality (7) thus expresses a limit on trading up in the market. We shall consider some empirical aspects of trading behaviour in section 3.

2.5 *Demand-side models*

In the model to be discussed below we shall not consider in detail the supply side of the model but reflect this indirectly through the movement of market prices over the period of the simulation. Within this historic framework individual households are assumed to be price takers, and the transition probabilities are consistent with the availability of required houses.

The essence of the model, which simulates the demographic and mobility characteristics of a set of owner occupiers, is thus captured in the following expressions [essentially equation (5)]:

the number of demographic transitions between $\boldsymbol{a}$ and $\boldsymbol{a}'$ in the interval $(t, t+1)$ is equal to $\mathbf{N}_{t}(\boldsymbol{a})\ \mathbf{P}^{d}(\boldsymbol{a}, \boldsymbol{a}')$,

the number of moves from state $\boldsymbol{a}$ in time interval $(t, t+1)$ is equal to $\mathbf{N}_{t}(\boldsymbol{a})\ \mathbf{P}^{m}(\boldsymbol{a})$,

where $\mathbf{P}^{d}$ and $\mathbf{P}^{m}$ denote the probability of the relevant demographic transition and residential move occurring, respectively.

The probability of a transition between different house price categories, $\mathbf{P}^{d}(p, p'|a)$, will be established from the propensity to take out a mortgage of a particular magnitude and to deposit a given amount of accumulated savings for the transaction, in which individual moves are subject to:

$$\text{deposit from savings} + \text{loan} = \text{purchase price}. \tag{8}$$

In the present model we do not consider new entrants into the market through the period of the simulation, so that the deposits relate to the accumulated gain in the market. We adopt the following simplified model for deposit:

$$\text{deposit} = \phi\,(\text{selling price} - \text{outstanding loan}), \tag{9}$$

which implies that households plough back a given proportion, ϕ, of their accumulated gain into the next house. The relationship between loan, age, and income of the head of household will be established after the financial characteristics of the sample are examined in the next section.

3 Empirical aspects of housing finance and trading behaviour

We wish to establish for the period 1976–90 a simplified relationship between the expenditure on housing and a number of key variables which are subject to secular trends and/or external control, together with a previous history of moves in the market. To this end we have used as a primary data source the 1976 *English House Condition Survey*, which is carried out by the Department of the Environment every five years (DoE, 1978; 1979), and a variety of secondary sources.

3.1 *The primary data source*

The 1976 *English House Condition Survey* comprises separate physical and social survey components and includes information on a maximum of 8700 dwellings in England, across all tenure categories. Of particular interest in the present analysis is the information relating to the demographic and socioeconomic attributes of homeowners and the characteristics of their mortgages.

The survey was designed as part of a continuing investigation into the physical condition of permanent housing together with information about the characteristics and attitudes of households occupying the sampled dwellings (DoE, 1978). The sample was drawn from valuation lists and was stratified by region and by type of local authority. Within each stratum, all dwellings had an equal probability of selection, although a small number of dwellings (437) that had been identified in the previous (1971) survey as being in poor condition were revisited. Regional nonresponse rates ranged from 10%–30%, although most rates were clustered around the mean of 17.5% (DoE, 1979). In view of the small size of the supplementary sample relative to the main survey, and the fairly narrow range of nonresponses, we have not weighted our own results.

For purposes of our analyses, we have derived two subsamples: a 'northern' data set derived from owner-occupier records from the North, North West, and Yorkshire and Humberside regions; and a 'southern' data set comprising comparable records from Greater London and the rest of the South East. The basis for the intraregional groupings was predominantly the level and variation over time of house prices. Interregional differences are considered below.

Non-owner-occupiers (that is, those households who were neither purchasing their dwellings nor owned them outright) were removed from the samples, as were records including bad values and all households which had not moved during the fifteen years prior to the survey. Some information was synthesised for some partially incomplete records.

The primary focus of our analysis was upon the differing characteristics of the two subsamples at the time of the survey and how these differences could be seen to have evolved under various demographic and financial processes accompanying mover behaviour and characterising broader housing careers.

3.2 *The 'northern' and 'southern' samples compared in the base year (1976)*

There are significant differences between the demographic and socioeconomic characteristics of the two samples and the nature of the housing markets in the two regions. Head-of-household incomes were, as expected, considerably higher in the south (mean, £4413) compared with the north (mean, £3598). This variation was mirrored by differences in the historic post-1960 house purchase prices: a mean of £9778 in the south and of £5188 in the north. For those households which moved in 1976, the corresponding averages were £15 580 and £8306, respectively. Southern households had, on average, higher loans than their northern counterparts: the overall mean for the south was £5214 and for the north was £2996. Those southern households moving in 1976 borrowed an average of £9746, whereas northerners moving in the same year borrowed an average of £6027.

The broad characteristics of household structure and the age distribution of their heads were similar. For example, the mean head-of-household ages for the two samples of owner occupiers differed by less than a year (approximately 42 in both cases). The grand mean household size was approximately 3.2. These apparent similarities may, however, mask interregional differences when considering all tenure categories together.

3.3 *Mortgage characteristics in the two samples*

In the present analysis, the income and age characteristics of the head of household play a pivotal role in determining the demand for housing and residential mobility. We recognise that these two variables represent very imperfect surrogates for a wide range of quantitative and qualitative correlates of social processes in the housing market. In this context we would note the importance of a broader range

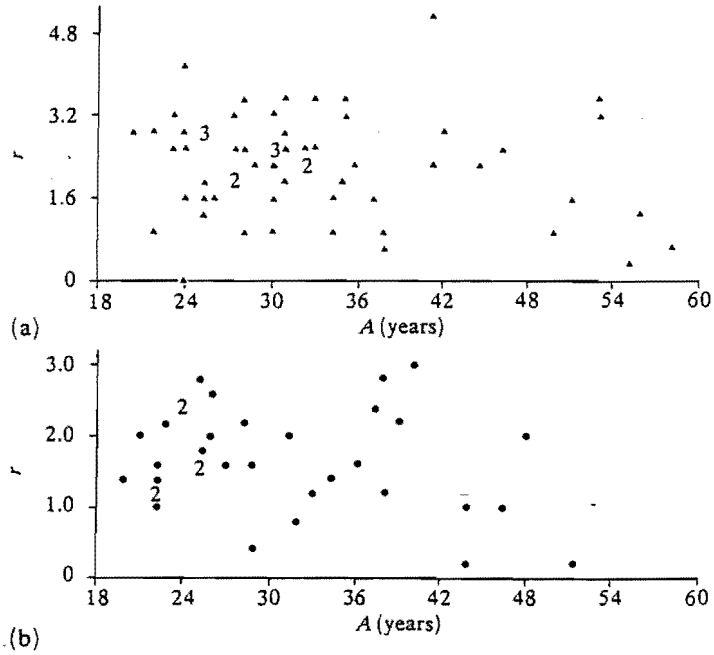

Figure 1. Relationship between the loan-to-income ratio, r, and the age of household head, A: (a) southern subsample, and (b) northern subsample (numbers represent multiple observations).

of household life-cycle characteristics, including the multiple earning capacities of household members. We recognise, however, that neither these socioeconomic and demographic characteristics nor their importance in securing access to mortgage finance have been constant over our entire simulation period. The improvement in specification which would result in switching from a simple head-of-household income specification to a range of sophisticated life-cycle considerations would entail a considerable increase in empirical complexity.

A priori, we might anticipate loans and deposits to be functions of age, income, and house price. These relationships have been examined by conducting, for each subsample, a statistical analysis of r, the ratio of loan to income, and of d, the ratio of deposit to price of house, as functions of I, the head-of-household income, and of A, the head-of-household age. Linear regressions involving the relations

$$r = \mathrm{r}(I, A),$$

and

$$d = \mathrm{d}(I, A),$$

have been computed by using MINITAB (Ryan et al, 1985).

We have in fact found no discernible relationship between r and head-of-household income. There is, however, a significant difference between the mean and range of r in the two regional subsamples (mean r of 2.41 and interquartile range 1.71–2.94 for the southern sample, and a mean of 1.68 and interquartile range 1.23–2.22 for the northern sample). There is also no clear relationship between r and the age of household head amongst younger households, although there is some evidence of a negative association between these variables beyond the age of 40, particularly in the southern region. Although there is no data from the 1976 movers pertaining to household heads approaching retirement, this nevertheless is consistent with an expectation that r will tend towards zero as retirement age approaches. The relationships between r and age are depicted in figures 1(a) and 1(b).

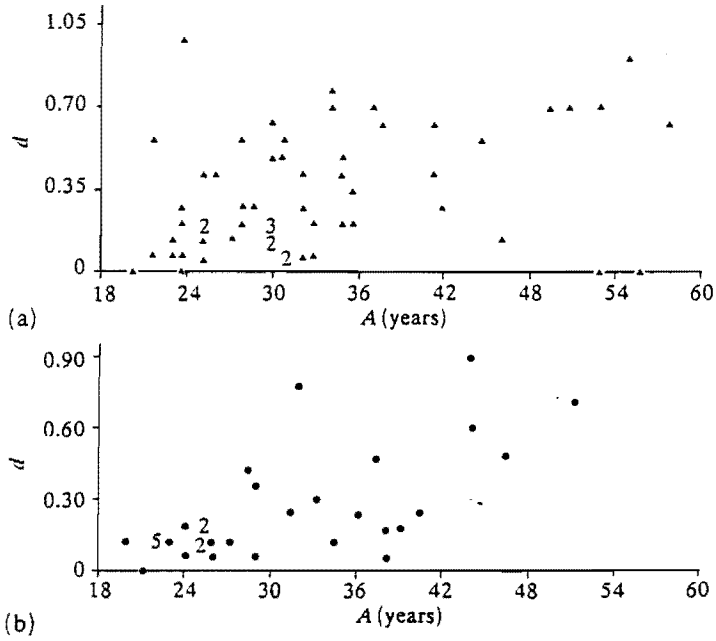

Figure 2. Relationship between loan-to-purchase ratio, d, and age of household head, A: (a) southern subsample, and (b) northern subsample (numbers represent multiple observations).

There is a much less ambiguous relationship between d and age. Regression of d against age produces a statistically significant parameter estimate in both samples, with the higher coefficient for the northern region implying, other things being equal, a greater reliance upon accumulated deposits for house purchase in the northern region. The graphical relationship is shown in figures 2(a) and 2(b).

3.4 *Trading behaviour and housing careers*

It is well established that exchange movers constitute a significant proportion of movers in any time period, and that the motives for such mobility include 'trading up' to better housing amongst a wide variety of other economic and social reasons. The quantity ϕ, defined in section 2, has been used to characterise this behaviour. In table 1 we record evidence from the mid-1970s on the propensity to trade up and down as a function of house price (HMSO, 1977).

Table 1 is derived by aggregating the price classes from a more detailed analysis (HMSO, 1977), and the 'trading up' and 'trading down' categories are associated with significant differences in the buying and selling price, and 'no change' indicates that these are not very different. The quantitative features of this table will vary over time and are strongly dependent upon the definition of the price classes. (Later, in section 5, we present results for trading behaviour over the period 1976–90, in which the categories are defined more strictly.) The results indicate that the predominant direction of trading is strongly dependent on house price range. In the lowest range over half of the moving owner occupiers trade downwards, in contrast to the strong upward trading in the highest range.

We would anticipate that those who trade down, and who are associated, on average, with smaller incomes, are those households with the head near or past retirement age. We were not able to verify this in the present sample of movers in 1976 which contains virtually no household heads over the age of 55.

It has been widely observed that the demand to 'trade up' depends extensively on income, and this is reflected in work on the income elasticity of demand for owner-occupied housing defined as the proportional increase in the price paid for housing divided by a proportional rise in income. From cross-sectional information, elasticities in the range 0.6–0.75 have been established (HMSO, 1977).

By regressing the price of house paid against income in the sample of movers in 1976, we have obtained a value for the income elasticity of demand of 1.1. This is somewhat outside the usual range and this may be partly explained by a lack of control on other explanatory variables, notably the household structure and the proceeds from a previous sale. We are currently investigating this relationship in more depth. Nevertheless, the predictable influence of income on price is evident in the 1976 sample of movers and presumably this is so over the whole cross section of homeowners.

Table 1. Percentage of households 'trading up' and 'trading down' (sources: HMSO, 1977).

	Purchase price				
	<£8000	£8000–£12000	£12000–£16000	≥£16000	all price ranges
Trading up (%)	37	48	61	64	50
No change (%)	10	37	20	23	27
Trading down (%)	53	14	19	13	23
All	100	100	100	100	100

We also note here the importance of reinvestment of the proceeds from a previous sale for the price paid for the subsequent house, this constituting a major source of finance for the purchase. The Building Society Association *Mortgage Surveys* (BSA, 1969–76) indicate that the proportion of the average deposit to finance a house for owner occupiers moving ranged from 34% in 1971 to 49% in 1975.

In summary, the picture drawn is one of a significant proportion of households which progress in their housing careers through a series of increasingly expensive houses as income and/or household size increases. In later stages of the life cycle and particularly as retirement approaches, conventional wisdom has it that such households will trade to less expensive houses. These features will be reflected in an empirical model of trading behaviour discussed in the next section.

4 The form of the simulation model

4.1 *Model assumptions and exogenous inputs*

As we noted in section 2, the model of population development embodies demographic, mobility, and economic processes, and is subject to the exogenous movements of income, house prices, and interest rates and to the basic rules governing tax relief on mortgage interest. We now briefly describe the specification of the model.

4.2 *Demographic processes*

In the present application, we confine our attention to a set of households which were already established in the owner-occupied sector in 1976. No new entrants are considered in the present version. Values from 1976 of relevant characteristics are incremented annually until 1990 by using exogenous information obtained from a number of national and regional data sources (BSA, 1987; Council of Mortgage Lenders, 1990). Aggregate data were used for mortality calculations. In the present application, age-specific residential mobility rates were derived from the General Household Survey (OPCS, various years). No account has been taken in the present model of differential regional mobility rates, although, as we have noted above, there is prima facie evidence to suggest that such differences exist and are important. All demographic, mobility, and trading regulations which involved probabilistic transitions were implemented through Monte Carlo simulation.

4.3 *Exogenous economic information*

The following information was obtained from published regional sources and was weighted as appropriate to reflect the composition of the two 'super-regions': house price inflation rates; wage inflation rates; regional loan advances relative to the incomes of borrowers. Additional national information pertaining to mortgage interest rates, income tax bands, and mortgage interest tax-relief thresholds was also obtained from secondary sources.

4.4 *Trading and mortgage repayments*

All borrowers were deemed to take out standard repayment mortgages with a maximum twenty-five-year term. New mortgages are subject to age dependence in both their magnitude and their term. The model of trading behaviour determines the price of house which a mover selects. This is based on the identity expressed in equation (8), in conjunction with specific assumptions about loan acquisition and reinvestment from a previous house sale. Symbolically we reexpress equation (8) in the form

$$p = \mathrm{L}(\boldsymbol{x}, y, \phi_1) + \mathrm{D}(\boldsymbol{x}, y, \phi_2) \qquad (10)$$

in which the loan, L, and deposit, D, on moving are considered as functions of demographic and socioeconomic variables (for example, income and age of the head of household) contained in the vector $\boldsymbol{x}$, and a set of market and exogenous

financial variables (for instance, interest rates, taxation policy, building society lending practices, etc) contained in the vector y. Sets of parameters ϕ_1 and ϕ_2 characterise these relationships.

In the simplified model for simulation over the fifteen-year historic period we take

$$L = \mathrm{L}(I, A, \phi_1), \tag{11}$$

in which ϕ_1 is used to absorb some of the temporal dependence associated with the movement of exogenous variables. Based on the empirical information of section 3, the following form has been selected:

$$L = g(A), \tag{12}$$

in which the multiplier of the loan-to-income ratio, $g(A)$, which is a random variable drawn from a normal distribution, has been expressed in two forms.

Form 1:

$$g(A) = \begin{cases} c_1 + e_1, & A < 65, \\ 0, & A > 65. \end{cases} \tag{13}$$

Form 2:

$$g(A) = \begin{cases} c_2 \left(\dfrac{65 - A}{65 - A^{\max}} \right) + e_2, & A < 65, \\ 0, & A > 65. \end{cases} \tag{14}$$

In equation (13) the multiplier is independent of age up to an age of sixty-five years, whereas in equation (14) a linear declining multiplier is taken which is zero at age sixty-five years. Parameters c_1 and c_2 are time-dependent and track the mean ratio of average loan to average income, derived from *Mortgage Survey* data over the simulation period. $A^{\max}$ is the age at which a household head can expect to receive, other things being equal, the maximum loan-to-income ratio. Variables e_1 and e_2 are random residuals. In a more ambitious causal model, these parameters would be used to reflect the changing pattern of house finance over the period and, in particular, assimilate the important changes arising from the deregulation of housing finance institutions.

The deposit on moving, expressed in equation (9) is written formally as

$$D = \phi_2(p - L^*), \tag{15}$$

where p is the selling price, and L^* is the outstanding loan on the currently owned house. The computation of the outstanding loan and other financial aspects of mortgage repayments have been dealt with in detail by Clarke et al (1989).

We have taken three values of the constant ϕ_2 to form the basis for the sensitivity tests. These are $\phi_2 = 0.5$, 0.85, and 1.0, a value of 1.0 implying that movers plough back the whole of the accumulated gain into the next house purchase. We have assumed in practice that ϕ_2 remains constant over the entire simulation period, although, in principle, temporal variation might be permitted (for example, to reflect change in the ease of equity withdrawal over time).

5 Trading behaviour, accumulation, and inheritance: an analysis for the period 1976–90

5.1 *Introduction*

In the model, the propensity to trade up or down as a function of age is determined by the joint effects of loan dependence and reinvestment as determined by equations (12) and (15), and by prevailing regional reinvestment rates.

We have undertaken a series of six sensitivity tests based upon hypothetical household reinvestment strategies and upon different age-dependence of loan finance, as embodied in equations (13) and (14). We indicate these six combinations in the following form:

$T[\phi_2$, tapered loan]..., $T[\phi_2$, fixed loan],

where ϕ_2 is the reinvestment ratio in equation (15) (taking values 0.5, 0.85, and 1.0), and the fixed and tapered multiplier is dependent upon age according to equations (13) and (14), respectively. (A 'fixed loan' is constrained to a constant regional multiplier for each time period, whereas a tapered loan has the same mean but is a declining linear function of head-of-household age, between 22 and 65 years.)

These tests are conducted in order to investigate the sensitivity of trading behaviour, asset accumulation, and mortgage interest tax relief to different assumptions which might arise out of different market circumstances or simply reflect different hypotheses about the propensity to incur loans and reinvest capital gains.

5.2 *Trading behaviour in an aging population*

Over the fifteen-year period, the 1626 households which constitute the southern data set recorded 1674 moves, whereas the 1485 observations from the northern set recorded 1214 moves. Approximately 60% of these moves constituted 'trading up' in the housing market, with 20% trading down, these largely being older households, as would be expected.

In table 2, we illustrate for three age-categories the trading behaviour of the southern sample for six combinations of parameters identified above. The 'no change' category corresponds to residential mobility between house prices within ±5% of each other. The table shows an anticipated significant difference between the extreme sets $T_1[\phi = 0.5$, tapered loan] and $T_6[\phi_2 = 1.0$, fixed loan]. For example, in the extreme case, 47% trade up, which is in contrast to nearly 90% for T_6. Conversely, 40% are down-traders in T_1, and only 2% trade down in T_6.

Table 2. Trading behaviour consequent upon different reinvestment and loan acquisition criteria.

Age-group	Tapered loan				Fixed loan			
	down-traders	no change	up-traders	total	down-traders	no change	up-traders	total
$\phi = 0.5$:								
<35	13.9	15.0	71.1	481	16.2	20.3	63.5	469
35-50	41.1	13.3	45.6	829	24.8	20.2	55.0	909
>50	82.8	5.4	11.8	279	39.8	9.4	50.8	266
Total	40.2	12.4	47.4	1589	24.8	18.5	56.8	1644
$\phi = 0.85$:								
<35	3.6	11.7	84.8	506	4.3	14.8	80.9	486
35-50	8.1	19.7	72.2	912	5.1	13.0	81.8	913
>50	41.8	17.6	40.6	256	22.3	5.4	72.3	260
Total	11.9	17.0	71.1	1674	7.6	12.4	80.0	1659
$\phi = 1.0$								
<35	1.6	6.2	92.2	503	1.4	6.5	92.1	492
35-50	0.8	11.8	87.5	885	0.2	6.7	93.0	841
>50	7.6	36.0	56.4	275	7.7	16.4	75.9	311
Total	2.2	14.1	83.7	1663	2.0	8.5	89.5	1644

Note: ϕ, reinvestment parameter.

Table 2 also reveals a strong dependence of trading proportions across age-bands on the reinvestment parameter ϕ. This is true for both fixed and tapered loan structures. As anticipated, there are for the tapered loan considerably more up-traders in the young age-category and, conversely, less in the over-50 age-group than with the fixed loan.

5.3 *Accumulation and tax relief in a geographical context*

We have computed the accumulation per household $[a^{\text{year}}]$, defined by the excess of house value over outstanding loan, for all observations, both in the base time period and across the entire span of the simulation. There is a strong statistical relationship between accumulation and income in the base year of the simulation, recorded quantitatively in the following regression equations:

$$a^{1976} = \underset{(8.84)}{5334} + \underset{(8.04)}{0.842} I^{1976}, \quad \text{south}, \tag{16}$$

$$a^{1976} = \underset{(6.73)}{3592} + \underset{(8.24)}{0.891} I^{1976}, \quad \text{north}. \tag{17}$$

The t-values are included in brackets, and values of head-of-household income are for the year 1976, (I^{1976}).

The corresponding results for 1990 are:

$$a^{1990} = \underset{(7.15)}{31\,156} + \underset{(22.32)}{3.90}\, I^{1990}, \quad \text{south}, \tag{18}$$

$$a^{1990} = \underset{(6.13)}{15\,310} + \underset{(18.72)}{2.66}\, I^{1990}, \quad \text{north}. \tag{19}$$

Summarising these relationships, we see that the average excess of value over outstanding debt in 1976 in the south (£9857) is 1.29 times that in the north (£7665), whereas the corresponding multiplier in 1990 is 1.65, indicating the compounding effects of the higher price inflation in the south up to the late 1980s.

The relationship between accumulation and age of head-of-household reveals a less obvious picture over time, although a strong correlation is observed in the base time period:

$$a^{1976} = \underset{(-4.89)}{-4009} + \underset{(17.42)}{363} A^{1976}, \quad \text{south}, \tag{20}$$

$$a^{1976} = \underset{(-1.79)}{-1452} + \underset{(11.55)}{244} A^{1976}, \quad \text{north}. \tag{21}$$

The relationship between tax relief, T, on mortgage interest has also been computed for 1976 and 1990 as a function of age and income. The relevant regression equations are:

$$T^{1976} = \underset{(-3.42)}{-74.6} + \underset{(21.17)}{0.0802} I^{1976}, \quad \text{south}, \tag{22}$$

$$T^{1976} = \underset{(-0.91)}{-11.9} + \underset{(17.85)}{0.0472} I^{1976}, \quad \text{north}, \tag{23}$$

$$T^{1990} = \underset{(8.02)}{403} + \underset{(17.34)}{0.0349} I^{1990}, \quad \text{south}, \tag{24}$$

$$T^{1990} = \underset{(3.58)}{142} + \underset{(18.33)}{0.0416} I^{1990}, \quad \text{north}. \tag{25}$$

These results are consistent with an increasing proportion of southern households breaking the current threshold for mortgage interest tax relief (£30 000).

5.4 Fiscal subsidy and capital accumulation over time

In a given year, the subsidy accruing to owner occupiers through tax relief and the capital accumulated by the entire sample were determined. The results are shown in figures 3 and 4. Figure 3 illustrates the higher levels and rates of capital accumulation in the southern submarket, and the slower, lagged, nature of accumulation in the north. The total value of housing 'investments' increases smoothly over time because a rise in building society loans is concomitant with the inflation in house prices. Figure 4 depicts the increasing burden on the Exchequer of the tax relief on mortgage interest payments. Throughout the study period, these subsidies cost around 50% more for the southern sample than for the northern sample. Figures 5 and 6 illustrate the different rates of capital accumulation and the differential Exchequer burden of mortgage interest tax relief consequent upon different reinvestment scenarios and loan-gearing strategies.

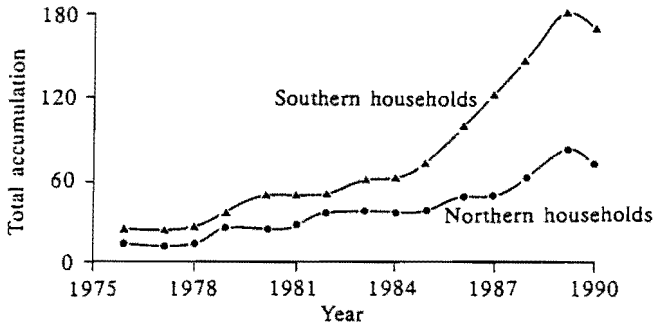

Figure 3. Amount of capital accumulation (in £millions) over time.

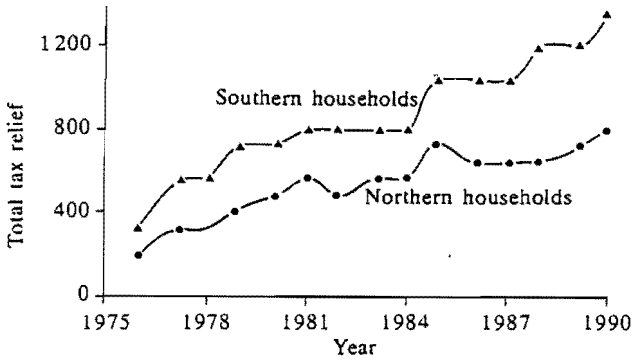

Figure 4. Amount of mortgage interest tax relief subsidies (in £thousands) over time.

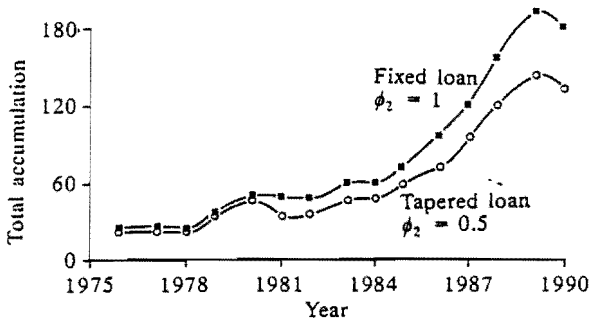

Figure 5. Capital accumulation (in £millions) based upon different reinvestment (ϕ = 0.5, 1.0) and loan (fixed, tapered) strategies.

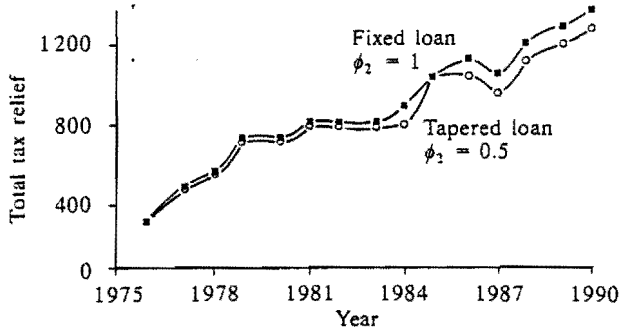

Figure 6. Increase in mortgage interest tax relief (in £thousands) based upon different reinvestment (ϕ = 0.5, 1.0) and loan (fixed, tapered) strategies.

5.5 *Accumulation, household dissolution, and inheritance*

Conventional wisdom has it that the next decade will see the dissolution of the first generation of UK homeowners. There are stark geographical consequences to the likely pattern of inheritance, as the majority of long-established homeowners are resident in London and the South East of England. In view of the likely profound implications of such dissolution for the ownership and concentration of wealth, we simulated the likely pattern of household dissolution in our northern and southern samples, and determined the average valuation of inherited property per deceased household head.

The numerical results of our simulation anticipate the dissolution of 138 households from our southern sample, and 102 households from the northern sample. There was some tendency for larger numbers of households to dissolve in later time periods, consequent upon the aging of our samples. The results indicate that over the 1980s decade the mean size (unadjusted for inflation) of estates attributable to housing was £67436 in the south compared with £38022 in the north.

6 Conclusions

In this paper, we have developed a framework for the analysis of transactions in the housing market in which the importance of exchange movers and their trading behaviour is recognised explicitly. Our simulation model has been developed with no explicit representation of supply and this is clearly a direction for further research activity in order that consistency between the availability of and demand for stock in different categories might be established.

For the purposes of an historical analysis of trading behaviour and its financial consequences, the demand-orientated model has been sufficient to draw out the dependency of economic outputs, such as capital accumulation in the market, upon behavioural parameters associated with the age and income dependence of mortgage transactions and the propensity to reinvest in the housing market. This model also provides a framework within which it is possible to investigate the regional inequalities in housing inheritance, with regard to both the value of dwelling legacies and the differential regional rate of household dissolution within the owner-occupied sector.

In extending this work, we would identify two primary objectives. First, there is an obvious need to refine the specification of the model to incorporate a range of household formation processes and to improve the specification of the housing-demand relations. This will enable a satisfactory reconciliation of certain items of exogenously and endogenously generated information, (for example, the ratio of deposit to price and of loan to income over time). Second, there is a need to develop the model so that it can be used to investigate scenarios concerning house prices, inflation rates, movements of income and interest rates of accumulated wealth, and

Exchequer tax subsidies over the next decade. Additionally, we intend to test various policies relating to the thresholds for tax relief and more general taxation policy. In all these investigations we anticipate that regional differentials will be as important as they have proved to be in the current historical simulations.

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