

**CHAPTER 24**

**HOUSING CAREERS, ASSET ACCUMULATION AND SUBSIDIES TO  
OWNER OCCUPIERS: A MICROSIMULATION**

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# Housing Careers, Asset Accumulation and Subsidies to Owner Occupiers – A Microsimulation

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## Abstract

Owner occupiers in the UK housing market receive considerable central government subsidies, namely through provision of tax relief upon mortgage interest, through exemption of private house sales from capital gains tax and through tax advantages relative to those who pay rent out of their net incomes. This paper sets out a framework for assessing the incidence of these subsidies upon different groups of owner occupiers over time, and suggests how regional fluctuations in house price inflation, size of house purchase loan and residential mobility behaviour affect the incidence of exchequer subsidy.

## I Introduction

During the post-war period the owner occupier sector of the United Kingdom housing market has generally experienced sustained growth. This growth has taken place against the backcloth of changing yet consistently vigorous housing policy initiatives at central government level, and the chronology of these policy changes is now well documented in the literature (eg Daunton, 1987; Short, 1982; Holmans, 1987). Intervention in the housing market has taken the form of various fiscal subsidies, and the incidence of this benefit upon individuals has depended upon a variety of household characteristics and dwelling attributes.

A possibly curious yet certainly long-established consistency in housing policy is that it has been articulated along tenure-specific lines (Ball, 1983), and the issue of the distribution of subsidy between and within the major tenure categories has been a recurrent focus of debate. A particular characteristic of the

rise of owner occupation, however, has been that the subsidy system has permitted (notionally at least) many households to accumulate large amounts of equity as a consequence of house purchases. It can be argued that this relationship between subsidy and asset accumulation has been largely neglected in the investigation and analysis of dwelling choice and residential mobility behaviour, and is only now receiving selective attention in the literature (see Hamnett et al, 1989, for the case of inter-generational transfer of such assets through inheritance).

The main objective of this paper is to contribute to the housing choice and residential mobility literatures by illustrating how microsimulation may be used to quantify the incidence of housing subsidy within the UK owner occupier sector at the level of the individual household. The way in which this subsidy accrues over time will be assessed by focusing upon individual household 'careers', that is to say related changes in household characteristics (eg number of wage-earners,

household income) and dwelling characteristics (eg market value, number of rooms) as a household moves (or simply stays put) within the housing market (Forrest and Murie, 1988). This may provide a starting point for a more detailed quantitative analysis of the way in which housing policy impacts upon housing choice in general and trading behaviour in the owner occupier sector in particular.

Section II reviews the sources of potential gains within the owner occupier sector and formulates how flows of income tax relief on mortgage interest plus stocks of capital gains are generated within the housing system; Section III illustrates the differential impact of these gains and subsidies upon households which pursue different housing career trajectories over a period of years; and Sections IV and V develop and evaluate a preliminary empirical case study in order to illustrate the way in which microsimulation may be used to evaluate the more general incidence of subsidy. A concluding section emphasises that this work is at a preliminary stage and suggests directions for future development and refinement.

## II Home ownership, revealed preferences and fiscal subsidy

A consequence of government intervention in the housing market has been a burgeoning research literature which has attempted to assess the causes and consequences of housing policy from a variety of social, economic and political perspectives. Much empirical analysis has been structured along tenure-based lines, and in this paper we restrict our own attention to fiscal subsidy to, and household behaviour within, the owner occupier sector.

Three other characteristics of the housing choice literature are of particular relevance to this paper. First is the emergent realisation that revealed preferences such as housing choices can rarely be adequately explained with reference to cross-sectional data alone, since household characteristics and aspirations are rarely in equilibrium with the attributes of their dwellings. Common causes of disequilibria include changed financial circumstances and changes in family size and composition (see for example Dieleman, 1982). Second, objective association of household preferences with revealed choices is further clouded by residents' *ex post facto* rationalisation of their

revealed choices, forgetfulness, and so forth. Third, economic 'choice-based' formulations of revealed housing preferences have often deemed consumers to make trade-offs between a hopelessly small range of dwelling and neighbourhood attributes (classically just dwelling floorspace and distance to a CBD area) and there exists an evident need to accommodate a representative range of policy incentives and constraints upon behaviour at the individual household level. What is clear, therefore, is that a thorough analysis of housing choice and residential mobility behaviour can only be made on the understanding that housing policy fundamentally defines the terms and costs on which decisions are made. Analysis and explanation of housing careers in the more general sense requires a detailed quantitative understanding of the ways in which this occurs, and thus it can be argued that an assault upon the measurement task is a prerequisite to further progress. First, it is necessary to identify how fiscal subsidy accrues to home-owning households.

It has been argued that the policy of successive governments towards owner occupation has evolved in an essentially *ad hoc* manner, and that government policy has been guided more by fear of the electoral consequences of dismantling the existing system than the need to develop improved policies in order to further clearly defined goals (Daunton, 1987). What is rarely in dispute is the contention that owner occupation has long been the favoured tenure of central government, and that the relative attractiveness of this tenure has further increased in the wake of the successive waves of post-1979 Conservative government legislation which have been designed to foster the wider dissemination of property ownership. The majority of 'home owners' are in fact in the process of purchasing their dwellings, and such households receive three main fiscal benefits:

1. They receive tax relief on mortgage interest payments on the first £30,000 of their mortgage at their highest marginal tax rate: non tax payers are also presently allowed tax relief under the same scheme, known as MIRAS. Tax relief on borrowing has a long history, and the present day instrument has its origins in the 1974 Finance Act in which mortgage interest tax relief was one of a very few exclusions from legislation which

ended the favourable tax status of interest payments under other domestic loans, and the threshold below which relief is available has subsequently been raised by successive administrations. Historically this has sometimes meant that eligible borrowers have access to finance at what is effectively a negative rate of interest, but the subsidy invariably allows purchasers to access finance at a price well below money market rates: at the time of writing, for example, a first time buyer paying income tax at the standard rate who takes out a £30,000 mortgage at a 13.15 per cent interest rate would make monthly repayments of £272.60 after tax relief, whereas the before tax rate would be £344.50. This subsidy, at £71.90 per month, would of course be greater for higher rate tax payers.

2. Capital gains tax has not been levied on the proceeds of selling a primary residence since 1961. Given a general ability of property inflation to outpace rises in the retail price index, as well as periodic surges in regional housing markets, this has often enabled households to accrue large tax-free capital gains upon moving. In 1988, for example, UK average house prices rose by 30 per cent and in the ensuing 'depressed' housing market estimates of price rises for 1989 were generally of the order of 10 per cent. A home owner who purchased a primary residence for £100,000 at the beginning of 1988 and sold it for £130,000 at the end of that year would realise a tax-free gain of £30,000: all but the first £5,000 would be subject to capital gains tax had the 'investment' been in any commodity other than housing. Of course, the magnitude of capital gains on a housing 'investment' depends in large part upon the level of financial commitment (savings and mortgage payments) made to the purchase over time. Additional windfall gains also accrue as the consequence of complex supply-demand interactions within a regulated market, although these are beyond the scope of this present paper.
3. In 1963 Schedule A Tax was removed from the imputed rental income derived from owner occupied properties, which had previously been based upon dwelling rateable values. This is a source of inequity between tenures, since rents within all of the other rental tenures are levied upon incomes net of tax. Part of the reason for its abolition was

that imputed incomes were difficult to calculate precisely, given the need for periodic revisions in the rate register. Comparison of precise benefits accruing to residents of different dwelling types (eg purpose built flats versus traditional terraced dwellings) and regions is frustrated by disequilibria between these categories. For these reasons we will not consider imputed rental incomes in detail here.

There is of course some more general debate as to whether these sources of income are strictly benefits at all, and the degree to which they benefit some individuals or groups at the expense of others. Households purchasing their dwellings with the aid of a mortgage clearly do enjoy some form of subsidy, since each of the above items requires the Exchequer to forgo income which would otherwise be generated by taxation. The degree to which some groups in some other tenures may accrue offsetting benefits *in lieu* of the above is an important point, as are the ways in which the equivalent of interest relief is available to investors in other household assets: we hope to return to consider some of these in later work. What is important for present purposes is that housing provides a unique means of acquiring and holding an asset outside of the mainstream taxation system. This is particularly convenient for a wide range of households since it has an everyday use as well as an exchange value. In this paper it has proved expedient to focus upon the distribution of benefits *within* the owner occupied sector only.

We thus begin with two premises: first, that key dwelling attributes (eg regional and intra-urban location, dwelling condition, dwelling type, price at purchase) may control the amount of fiscal benefit which may be generated by its purchase; and, second, that through the related decisions of residential mobility behaviour and dwelling choice households are able to anticipate likely housing subsidies. It is likely that households living in depressed housing markets (such as much of the North of England throughout much of the 1970s and 1980s) will have been able to accrue only limited subsidies from owner occupation, whilst those in more buoyant markets (such as South East England during the same period) will have had the opportunity to accumulate quite considerable wealth through 'trading up' in the market (Whitehead, 1979). (Of course, in

either case the capital gains will only be notional in many circumstances.) These constraints and choices can thus be seen as central to analysis of dwelling choice and residential mobility behaviour.

We are now in a position to formulate how flows of income tax relief on mortgage interest plus stocks of capital gains are generated within the housing system in the general case. Let:

- P = mortgage advance;
- L(m) = amount of mortgage outstanding at end of period m;
- R(m) = amount repaid in period m;
- i(m) = average mortgage interest rate during period m;
- N = term of the mortgage;
- V(m) = value of dwelling at end of period m;
- V(0) = house purchase price;
- I(m) = amount of interest paid in period m;
- C(m) = capital accumulated by time period m;
- A(m) = assets accumulated by time period m;
- TXMI(m) = tax relief on mortgage interest in period m; and
- tx(m, p) = marginal rate of taxation for mortgagee with characteristics p in period m.

We may write recursively:

$$L(m) = L(m-1) * [1 + i(m)] - R(m) \quad (1)$$

$m \geq 1; L(m=0) = P$

where

$$R(m) = L(m-1) * \frac{i(m)}{[1 - (1 + i(m))^{-N-m+1}]} \quad (2)$$

Under fixed interest rates (1) and (2) reduce to the following standard repayment schedules:

$$L(m) = P * (1 + i)^m * \left[ 1 - \frac{(1 - (1 + i)^{-m})}{(1 - (1 + i)^{-N})} \right] \quad (3)$$

and

$$R(m) = \frac{P * i(m)}{[1 - (1 + i)^{-N}]} \quad (4)$$

The loan paid off in period m is  $L(m-1) - L(m)$  and the interest paid in period m is approximately  $L(m-1) * i(m)$ . The allowable tax relief on the interest payments, subject to an upper limit of the first £30,000 of the mortgage, is given by

$$TXMI(m) = L(m-1) * i(m) * tx(m, p) \quad (5)$$

If a household moves after year m, its crude capital gains are simply the difference between the purchase price and the selling price:

$$C(m) = V(m) - V(0) \quad (6)$$

Asset accumulation is then the difference between the selling price and the amount of loan outstanding:

$$A(m) = V(m) - L(m) \quad (7)$$

In general, capital gains tax is levied on the difference between the sale price of an asset and the purchase price at the highest applicable rate of marginal income tax, although allowable expenses (in the above case, tax relief on the proportion of the loan repaid) would be deducted before the final calculation was made. The net capital gain which would accrue from investments at time m, (NCG(m)) would therefore be:

$$NCG(m) = A(m) * [1 - tx(m, p)] \quad (8)$$

In fact, there is a slight complication in that under current UK tax legislation the first £5,000 of capital gain in any one year is exempt from capital gains tax: for simplicity, we ignore this in our accounting framework and in our simulations. As we have already seen, capital gains on the principal residences of owner occupiers constitute a special case under the UK tax system in that no tax is levied. Thus, for such houses,

$$NCG(m) = A(m) \quad (9)$$

These equations suggest that, over time, households will accumulate an equity stake in the housing market since the value of dwellings will normally exceed the amount of the outstanding loan. If house prices inflate faster than other price indices then households will make relative gains. Moreover, upon realisation these gains will be exempt from capital gains tax. Given that some or all of the mortgage will fall beneath the tax relief threshold, investment in housing becomes still more advantageous by virtue of interest rate subsidy, and historically this has actually sometimes permitted access to housing finance at negative real interest rates (Whitehead, 1979). In the next section we investigate these phenomena and identify some hypothetical housing career trajectories. In so doing, we will use income, price and inflation figures which are

Fig. 1 Hypothetical housing careers of six households with different mortgage investments and residential mobility histories

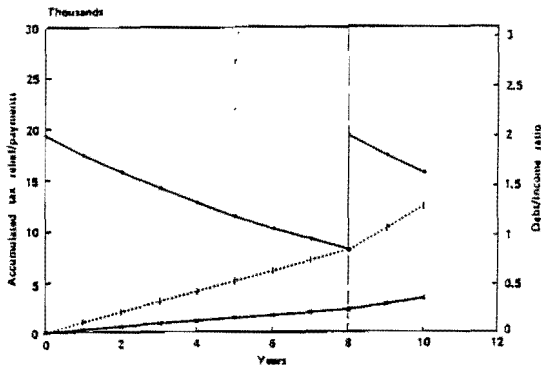


Fig. 1(a)

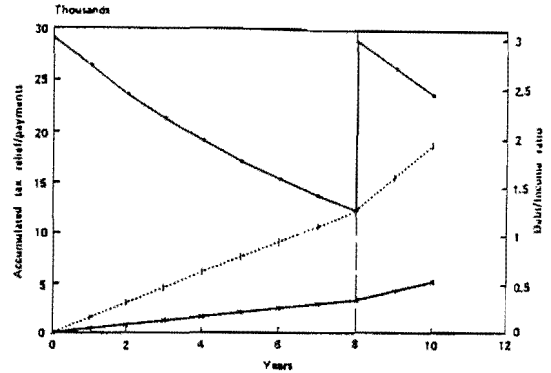


Fig. 1(b)

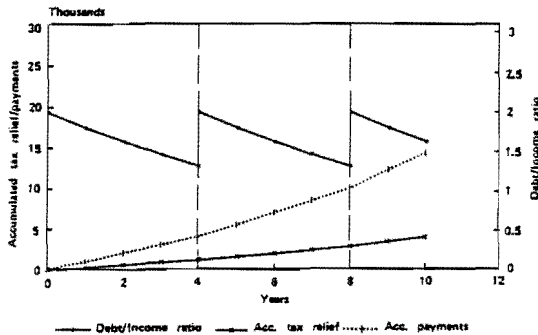


Fig. 1(c)

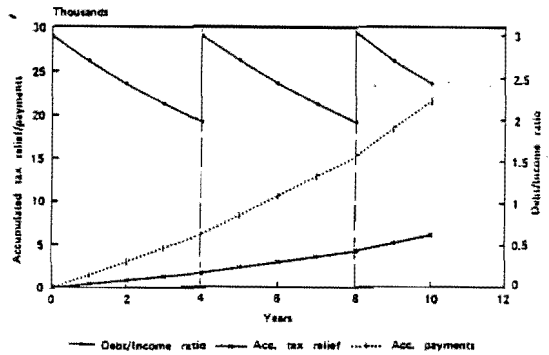


Fig. 1(d)

generally consistent with those in the empirical section of this paper.

### III Some illustrative housing career trajectories

In our first example we assume that a household head has an income of £4,000 per annum, that the household enters the market at the beginning of a 10 year period and that it moves house once at the end of the eighth year. Incomes inflate at 10 per cent per annum, house prices inflate at 12½ per cent p.a. and mortgage interest rates remain constant at 12 per cent. The household is deemed to have zero assets at the beginning of the period and takes out a 100 per cent mortgage. Figure 1(a) illustrates how the household takes out a mortgage of twice the head's income (ie a debt/income ratio of two) and how the standard repayment mortgage formula (Equation (3)) erodes the debt/income ratio

in a non-linear fashion during the period following the mortgage advance. Accumulations of both payments and of tax relief accrue in a linear fashion during the period between house purchase and change of residence. On moving, the household head tops up the mortgage to twice his/her current income. This has a shift effect upon the debt/income ratio and introduces a non-linearity into the tax relief and payment schedules. A result of this is that greater amounts of subsidy henceforth accrue to the household.

Figure 1(b) depicts a similar housing career trajectory except that the household head is deemed to borrow three times his/her income, both at the start of the period and again upon moving after eight years. Greater receipts of tax relief accrue to this household as a consequence of higher 'investment', and the debt/income ratio tails off more rapidly than before. High gearing of investment in housing relative to income is thus evidently one way in which a household can attract

Table 1 *Accumulated gains and associated tax relief*

		Multiple of Income Borrowed					
		2		2.5		3	
		A	B	A	B	A	B
10%	Acc. Gain	11,123	9,887	13,908	12,358	16,687	14,830
	Tax Relief	3,337	2,966	4,172	3,707	5,006	4,449
12.5%	Acc. Gain	14,823	13,264	18,528	16,580	22,234	19,896
	Tax Relief	4,447	3,979	5,558	4,974	6,670	5,969
15%	Acc. Gain	19,074	17,210	23,846	21,512	28,613	25,815
	Tax Relief	5,722	5,163	7,154	6,454	8,584	7,745

greater fiscal subsidy, and this is well known.

Figures 1(c) and (d) introduce further residential mobility into these hypothetical housing careers. In these illustrations, the households borrow two and three times the head of household's income respectively, but the 'investment' is topped up after two moves (after year four and year eight) rather than just one. Consequently these households receive £578 (in the case of the twice income ratio household) and £865 (in the case of the three times income household) more accumulated tax relief by the end of the 10 year period than would have been the case had they not made the single additional move at the end of the fourth year. This gain accrues because of the timing of these households' higher accumulated payments, which are higher than those of the households depicted in Figures 1(a) and 1(b) by £1,892 and £2,840 respectively.

Table 1 introduces variation in spatial house price inflation rates into the example for those households in Figures 1(c) and (d) who move twice during the 10 year period. Thus, for example, subsidy accruing to a household with a low income multiple loan varies from £2,966 to £5,163 over the 10 year period, depending upon whether that household lives in a sub-market which is inflating at 10 per cent or 15 per cent per annum. This discrepancy will obviously be greater for households who take on a higher borrowing multiplier, and the corresponding figures for households borrowing three times head's income are £4,449 and £7,745 respectively.

Of course there are many ways in which these examples could be refined and made more realistic: interest and house price inflation rates fluctuate over time, tax relief thresholds rise and fall in relative terms, relative

house price inflation rates vary by dwelling type within a region, there exist numerous and varied pecuniary and non-pecuniary costs of moving, and so forth. Not all households (and indeed not all of those in our hypothetical examples) will gain from all of the sources of fiscal subsidies to owner occupation. However, the purpose of these examples is essentially to illustrate how housing choice and residential mobility behaviour have quantitatively different outcomes in terms of the dynamics of asset accumulation and flow of housing subsidy. Households vary in their receipt of mortgage interest relief streams over time (depending upon the size and timing of the mortgage), capital gains tax relief (depending upon the size of their 'investment' and the rate of house price inflation) and can increase receipts of both reliefs through residential mobility (ie by 'topping up' loans to higher income multiples and maximising the benefits of interest relief, since interest payments are 'front-loaded' to the early stages of loan repayment). Incremental annual changes in the levels of subsidies received (eg substantial real falls in mortgage repayments once the 'front-loaded' period is past and repayments are increasingly of capital) are likely to impact upon the timing of residential mobility by some households. This outcome is by and large intuitively obvious, and most of us will have experienced anecdotal stories of individual housing careers. Current research, such as the Rowntree Trust programme, is creating locality studies of housing careers. For the moment, however, the more general redistributive implications of these mechanisms tend to be shrouded in mystery. This is a pity, for existing government survey data, coupled with other understanding of housing market

transitions and other processes, gives scope for a broad assessment of the economic and fiscal consequences of housing careers at almost any spatial scale. In the following section we begin to show how this can be achieved using micro-simulation and begin the task of assessing the broad socially and economically redistributive nature of UK housing policy.

#### IV A more general projection of housing careers

The previous section was used to illustrate how three variables (regional house price inflation rates, residential mobility behaviour and magnitude of housing investment) could contribute towards quite different housing careers under a quite plausible market scenario. In this section we attempt to generalise this approach to a real world data set in order to forecast the financial and fiscal consequences of housing market behaviour by a large sample of households. In so doing our primary aim is to illustrate the potential of microsimulation to handle such problems, and this requires us to make a number of assumptions about household behaviour and dwelling attributes which require substantiation at the disaggregate scale. Nevertheless the data problems that we raise are all essentially tractable given an appropriate investment of effort, and in our conclusions we outline a research agenda for co-ordinating and resolving these essentially pragmatic difficulties.

Microsimulation has its origins in the work of Orcutt et al (1961) as a technique for the dynamic investigation of demographic and economic processes (see Clarke and Holm, 1987, for a review of this literature). The technique can be thought of as a kind of spreadsheet analysis in which household characteristics, dwelling attributes and market conditions are incrementally updated through time according to the processes involved. Transitions are introduced randomly at the individual level in accordance with probabilistic models. As such, it can be used to predict future conditions or to analyse retrospectively housing market transitions between two or more time periods. In the present example it will be used as follows. First, a sample of households and their dwellings will be identified and their characteristics and attributes as at 1976 will be noted; second, these character-

istics and attributes will be updated over a 10 year period; and third, the fiscal and financial implications of the housing careers of the sampled households will be assessed according to a number of geo-demographic criteria.

The data used to initiate this first simulation were derived from the 1976 *English House Condition Survey* (EHCS: Department of the Environment, 1978; 1979). This major English national survey visited approximately 8,700 dwellings and comprised three distinct stages: first, the physical condition of each of the selected dwellings was assessed; second, the resident household(s) of each were interviewed and a wide range of household characteristics and attitudes elicited; and, third, a follow-up local authority survey was completed in order to ascertain the precise policy status of each of the surveyed dwellings. Although now 14 years old, we use this series because of our interest in refining and updating our findings using subsequent EHCS surveys (which use, in part, the same dwelling sample), because of our previous experience in using the data (Longley, 1984), and because the survey was ahead of its time in both the quality of the data obtained (see O'Dell, 1980, for a discussion of error trains in the data) and the range of pertinent information collected.

We began by identifying the variables which would allow us to calculate the amount of mortgage interest subsidy and the capital gains relief as calculated using Equations (1)–(8), together with some additional household classification criteria for purposes of quantifying variation in household gains. These are listed in Table 2. Mortgage interest tax relief thresholds appropriate to each of the years of the simulation period are used in our analyses. The primary focus of our study was upon regional variations in the housing careers of owner occupiers, and so the next stage was to create two separate data bases for the 10 English Standard Planning Regions. The first was termed the 'southern' data base and comprised Greater London and the rest of the South East; the second was termed the 'northern' data base and comprised the Northern, North West and Yorkshire and Humberside regions.

Despite the general quality of the data, a number of deficiencies as regards the purpose of our particular study became apparent. First, there was the general problem of partial non-response, reflecting the sensitivity of some of the elicited information (eg

**Table 2** Variables used either as part of the microsimulation model or as means of classifying the model forecasts

Tenure	1	Own outright
	2	Mortgage
	3	Renting Local Authority
	4	Renting Housing Association
	5, 6	Renting Private
	8, 9	Other
Age of head	Continuous 0-99	
Sex of Head	1	Male
	2	Female
Marital Status of Head	1	Married
	2	Single
	3	Separated, Widowed or Divorced
Household Size	Continuous	
Seg of Head	Occupation Group	
	1	3, 4
	2	1, 2, 13
	3	5, 6
	4	8, 9, 12, 14
	5	7, 10, 15
	6	11
7	Others	
House Purchase Price	Amount in pounds	
Loan	Amount in pounds	
Year Mortgage Taken Out	Year	
Year of Final Mortgage Payment	Year	
Head's Annual Income	Amount in pounds	
Household Income	Amount in pounds	

income characteristics) and respondent forgetfulness (eg amount of mortgage advance and the year in which it was taken out). Second, the EHCS survey design did not make provision for recording house purchase price or housing finance information for respondents who purchased their dwellings prior to 1960. Our expedient response to this was to restrict our analysis to households who purchased their dwellings post-1960, although we envisage ways in which this constraint could be avoided in future work. Removal of those who had not moved post-1960 left 74.4 per cent (1,454 households) of the 'northern' sample

and 72.6 per cent (1,427 households) of the 'southern' sample. Filtering for bad values of age and sex of head of household and household size caused no further sample attrition although when house purchase price, loan amount, year of first and last mortgage payments, head of household income and household income are filtered only 51.2 per cent (1,007 households) of the 'northern' sample are left as are 52.9 per cent (1,033 households) of the 'southern'. Exploratory analysis of the effects of filtering by socio-economic super group did not give us any cause for concern, although there was evidence that households who owned their dwellings outright were under-represented in both filtered samples.

The simulation procedure itself was, in part, a mechanistic accountancy exercise, since some variables (eg period and amount of mortgage outstanding) could be routinely updated by simple calculations augmented as necessary by appropriate published data sources (eg tax rates and thresholds). However, not all relevant information about the dynamics of housing careers could be imputed from our cross-sectional data (eg residential mobility behaviour, household dissolution, etc), and it was therefore necessary to impute missing information using probabilistic and/or behavioural rules (other practicable solutions to this problem are, however, available and will be discussed in our conclusions). The most problematic aspect of the 'northern' and 'southern' samples was that the residual sample was likely to be too small to capture the likely behaviour of small sub-groups of households. The most important of these was the process of moving house in any of the time periods, since one of the central dynamics to asset accumulation and realisation in the housing market involves trading up and trading down respectively. In order to capture the effects of the relatively small numbers of movers each year we therefore enhanced the sample size by simple successive duplication of the samples to sizes 3,021 ('northern') and 3,099 ('southern').

The objective of our illustrative example is to quantify the gains (or losses) accruing to each household in the sample over the 10 year forecasting period. For some households this will be complicated by the act of residential mobility, and in such cases assumptions about the consequences of the move will be made. In reality, of course, the simulation

period would be characterised by the constant processes of household formulation and dissolution: although in principle both of these processes could be built into our simulation, it was expedient in the present study to ignore them and concentrate purely upon the fortunes of the residents of the dwellings sampled at the beginning of the simulation period.

The microsimulation model involves the following three basic sets of calculations (see Clarke et al, 1989, for technical details).

**(i) Calculation of baseline data for each household at the start of the simulation period**

These include:

- (a) term of the mortgage: given by subtracting the year in which the mortgage was taken out from the year in which the final repayment is to be made
- (b) current house value: calculated by inflating the house purchase price by the average regional house price inflation in the period since purchase, ie

$$v_t = h \prod_{t_0}^t (1 + p_t) \quad (9)$$

where  $v$  = 1975 house value;

$h$  = house purchase price; and

$p$  = average house price inflation in the region during the period  $t$

House price inflation data were obtained from the *1986 Building Society Factbook* (Building Societies Association, 1987)

- (c) asset accumulation: taken to be the difference between the current value of a property and its purchase price
- (d) amount of mortgage outstanding: calculated using Equation (2).

**(ii) Annual updating of household characteristics and dwelling attributes throughout the simulation period**

- (a) age of head of household: incremented annually
- (b) head of household/household income: incremented by the annual average regional wage increase across all occupations, as documented in the New Earnings Survey (Department of Employment, 1987)
- (c) house value: incremented by the annual average regional house price inflation, as

documented in the *Building Society Factbook* (Building Societies Association, 1987)

- (d) mortgage repayments: annual capital and interest repayments were calculated using Equation (2) and historical mortgage interest rate data (*Social Trends*: Central Statistical Office, 1987) to yield a gross repayment figure (ie what mortgage repayments would be in the absence of any tax relief)
- (e) amount of mortgage outstanding: calculated by subtracting capital repayments from the amount outstanding at the beginning of each year
- (f) asset accumulation: calculated by subtracting the amount of mortgage outstanding from the value of the dwelling unit
- (g) mortgage tax relief: first, historical Inland Revenue data were used to calculate the marginal rate of taxation for each household for each year of the simulation, taking into account changing personal allowances. The highest marginal rate of taxation was then multiplied by the gross mortgage repayment figure identified in (d) above, in order to estimate the amount of subsidy received in each year
- (h) capital gains tax exemption: capital gains tax is currently levied on all capital gains EXCEPT for gains on a household's primary residence, and for the first £5,900 (for 1985/86) gained in each tax year. In our simulations we have ignored the annual tax allowance, and calculated the capital gains subsidy to each household to be the asset accumulation at the end of the simulation period as calculated in (f) above multiplied by the marginal rate of taxation at the end of the period. This is clearly a fairly crude treatment of a complex issue, and we hope to return to consider this in greater detail in future work.

**(iii) Residential mobility**

Residential mobility is an obvious and important process by which households realise accumulated gains and effectively set the trajectories for the next stage of their housing careers. In this study we have not modelled the influence of subsidy upon mobility, but rather attempt to analyse the implications of mobility for the levels of subsidy received by a wide range of household types. There are five components of residential mobility which are of interest in our simulation work: house-

hold formation in the owner occupied sector; mobility of existing households into owner occupation; mobility of households within the owner occupied sector; mobility of households out of owner occupation; and dissolution of owner occupier households. Modelling of these complex demographic and/or choice-based events presents a daunting task, as testified by a burgeoning literature on the subject (see Clark, 1982 for a review and interpretation).

For purposes of this preliminary study we make the following assumptions: household formation is ignored entirely and we concentrate exclusively upon the fortunes of households in our sample as initially generated; mobility of renting households into owner occupation is accomplished using aggregate probabilities derived from the 1977 *Housing Green Paper* (Department of the Environment, 1977); intra-sector moves are represented using another aggregate figure deriving from the same source; as are moves out of the sector and the probability of household dissolution for a number of common reasons (death, divorce, etc). Many of these assumptions are heroic indeed, and in future work we hope to refine them in the light of improved data sources and greater sensitivity towards subgroup behaviour.

The following mechanisms are used to ascertain the characteristics of post-move purchases:

- (a) House price: this depends crucially upon whether a household is a first time buyer or an exchange mover. For *first time buyers* we assume a fixed multiple of 2.5 times income of head of household plus a deposit of 10 per cent of the house purchase price. For *exchange movers* we assume:

$$P = x * HHY + \theta * A \quad (11)$$

where

P = new house purchase price;  
 HHY = head of household income;  
 x = a proportion, drawn from a probability distribution, which assigns income to a mortgage;  
 A = asset accumulation from previous purchase(s); and  
 $\theta$  = a constant proportion of assets deemed to be ploughed back into exchange house purchase, taken to be 0.85 for all exchange movers in this study.

Size of mortgage is thus given as 2.5 times income of head of household in the case of first time buyers, and  $(x * HHY)$  for exchange movers.

- (b) Term of mortgage: determined on the basis of the age of head of household, using information from the 1978 Nationwide Building Society survey of movers. Once amount and term of mortgage have been identified, amount outstanding after each successive time period and annual repayments can be ascertained using Equations (1) and (2) respectively.

## V Outputs of the simulation exercise

The primary focus of our case study has been to quantify a range of characteristics of housing careers and to then mount a preliminary *inter-regional* comparison between northern and southern households over the period 1975-84. A range of assumptions were made in order to implement this labour-intensive process: in particular, our sample of owner occupiers excluded those who had not moved house during the 15 years prior to the start of the simulation period, and no attempt was made to accommodate the effect of household formation during the simulation period. Our empirical results are framed within a familiar 'north-south' framework, but in general terms we can assess the usefulness of the exercise in three ways.

First, microsimulation can be used to make projections of 'unknown' variables such as the cost of exempting house sales from capital gains tax (Figures 2 and 3) or of maintaining (or, hypothetically, increasing) mortgage interest tax relief (Figures 4 and 5) at any time or over any simulation period. It is interesting to note that the anticipated differences in the distribution of capital gains are largely consequent upon the regional dynamics of house price change. The more similar characteristics of the two tax relief distributions arise from two reasons. First, a sizeable proportion of households in both regions own their houses outright and therefore do not benefit from tax relief: in this context it is important to note that we have not at this stage attempted to model household formation into our microsimulation, and thus the sub-sample who repay their mortgages within the simulation period are

Fig. 2 Distribution of cost of capital gains tax relief - north 1984

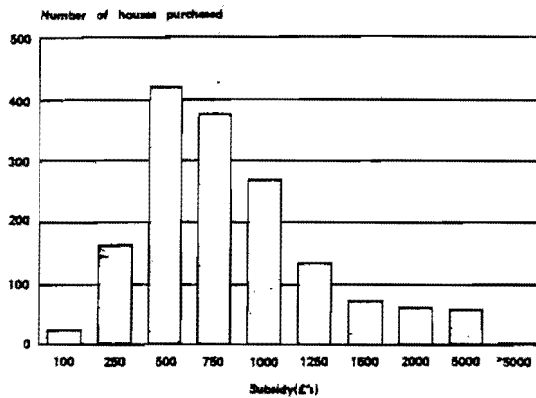


Fig. 3 Distribution of cost of capital gains tax relief - south 1984

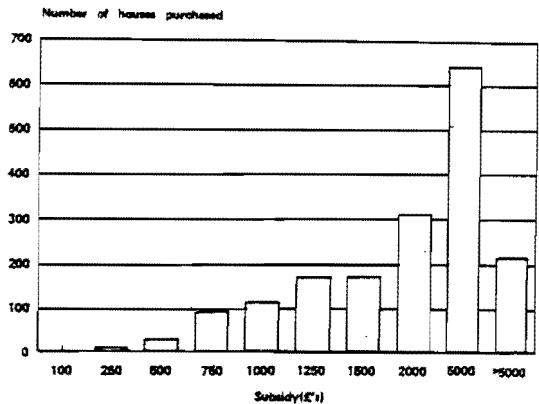


Fig. 4 Distribution of cost of mortgage tax relief - north 1984

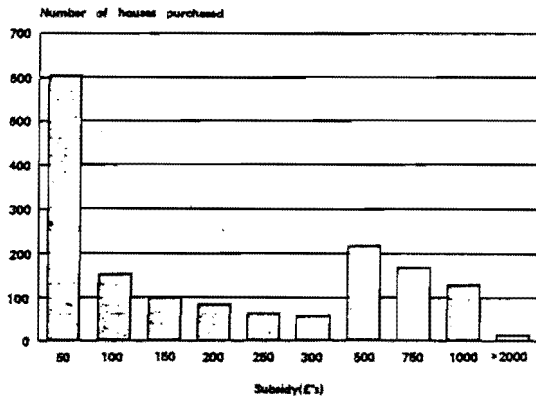
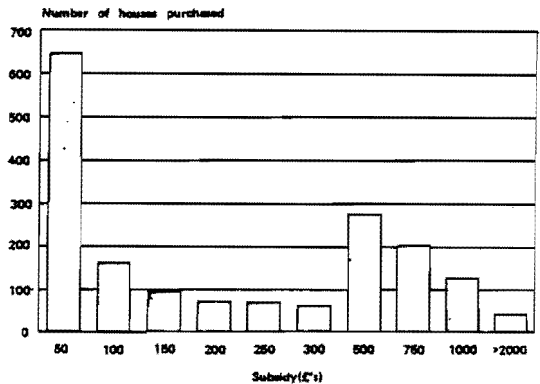


Fig. 5 Distribution of cost of mortgage tax relief - south 1984



over-represented, particularly relative to households which are at an earlier stage in their housing careers. Second, there exists an upper limit of loan size above which neither households in the 'north' nor households in the 'south' can benefit from further tax relief. (Note that the 'saw tooth' shape in Figures 4 and 5 is an artefact of the scale taken.) We contend that microsimulation is an appropriate technique to generate information about housing distributions where the variables considered are strongly dependent upon the processes of change over time, such as the case here with housing subsidy. Microsimulation retains the individual household as the unit of analysis and forecasting and, as a consequence, these forecasts have a less ambiguous

theoretical basis than those generated using some other more aggregate models and techniques.

Second, the microsimulation technique allows a detailed insight into how the variation at any cross-section has evolved over time, and how future cross-sections will be sensitive to the parameters which describe and explain individual behaviour. Ideally we would like to specify and estimate models which pertained to individual housing careers which could be evaluated with reference to repeated measurement survey designs such as the *English House Condition Survey*. For the present, however, validation entails a comparison of synthesised and observed distributions in individual cross-sections.

Third, and most important, it is possible to disaggregate microsimulation forecasts according to the widest range of pertinent socio-economic and demographic characteristics, behavioural indices and dwelling attributes. This advantage also accrues as a consequence of retaining the individual household as the unit of analysis. So, for example, forecasts might be disaggregated according to income, socio-economic group, race, family type, dwelling type, relative location (eg inner city versus suburb), number of moves or any other variable deemed relevant to a particular study. The spirit of this present study is essentially both pedagogic and exploratory and thus we have not attempted detailed reproduction of the wide range of forecasts that were made using the microsimulation model. Elsewhere (Clarke et al, 1989), however, we have investigated such phenomena as: the distribution of capital gains and mortgage interest tax relief subsidy according to number of moves; the distribution of this subsidy according to household income at both the beginning and the end of the simulation period; and the changing 'north-south' relationship between house value and amount of capital gains tax relief over the same period. Outputs such as these are a routine output of microsimulation, and any number of low- and high-dimensional cross-classifications can also be produced as needs arise.

## VI Conclusions and some directions for future developments

The central contention of this paper is that microsimulation offers a practical and rewarding way of quantifying the incidence of fiscal subsidies within the UK housing system, and that this information is of considerable importance to the housing choice and residential mobility literatures. That said, the process of assembling appropriate data sets and devising appropriate models is of necessity very time-consuming and, as a consequence, our empirical example necessarily remains crude in the assumptions it invokes and the aggregate quantitative measures it generates. These remain essentially practical problems which will require resource inputs in the future. In conclusion, we identify the range of technical and substantive points and issues which might be addressed in further work.

First, it is clear that the definitions of subsidy that we have made are far from uncontentious and are certainly not in any way exhaustive. Sharp et al (1989) have recently reviewed a wide range of plausible subsidies and hidden costs of home ownership, almost all of which could be incorporated within our accounting identities: these include renovation grants (and the means testing thereof); rent and rate rebates; discounts on the purchase price of former local authority dwellings and low cost home ownership initiatives; stamp duty; exemption from value added tax; employer subsidies; maintenance costs; and the costs of buying and selling a house.

Second, from a technical point of view, there is a need for a more comprehensive and realistic approach to the dynamics of household formation and dissolution over the simulation period. Other variables which are worthy of more detailed consideration include: household tax status and exemptions; the propensity of different household types to move house (using available data from existing longitudinal samples); the propensity for inter-tenure moves; the propensity of households with differing income characteristics and living in different dwelling types to apply for means-tested home maintenance grants; the particular sub-group behaviours of first time buyers and those likely to participate in various low-cost home ownership schemes; the likely impact of changes in the supply and type of subsidised sales under 'Right to Buy' legislation; greater sensitivity analysis of the propensity of different exchange mover households to reinvest their gains in the housing market; greater disaggregation of income and house price inflation figures according to occupation and dwelling type, respectively; and the perceived fiscal implications of new mortgage schemes.

Finally, a particular interest of the authors is the geographical variation in the economic fortunes of different households within the housing system. There exists the prospect of identifying more coherent spatial sub-markets at the intra-regional and intra-urban scales which might permit a longitudinal perspective upon the financial and fiscal implications of phenomena such as gentrification and urban renewal on the one hand, and the development of 'packaged' lifestyle estates at suburban locations on the other. Microsimulation also offers the prospect of visualisation of the likely consequences of housing careers at the

intra-urban scale using emergent geographical information systems (GIS) technology. These and other developments are on our research agenda.

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