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14 Using a Spatial Microsimulation Model for the Estimation of the Geographical Impact of British National Government Policies

Dimitris Ballas, Graham Clarke, Danny Dorling and David Rossiter

14.1 INTRODUCTION

This chapter reports progress on SimBritain, which is an ongoing research project that aims at simulating a detailed social survey of households in Britain. The SimBritain project is based on data from various sources to develop and validate a microsimulation model of the life of households in Britain from 1991 to 2021. Microsimulation can be defined as a methodology that is concerned with the creation of large-scale population microdata sets for the analysis of policy impacts at the micro-level. In particular, microsimulation methods aim to examine changes in the life of individuals within households, and to analyse the impact of government policy changes for each individual and each household. Microsimulation methodologies have become accepted tools in the evaluation of economic and social policy and in the analysis of tax-benefit options and in other areas of public policy (Hancock and Sutherland 1992). Nevertheless, there are relatively few examples of spatial models that build on traditional economic microsimulation frameworks by adding a geographical dimension. Geographical microsimulation techniques involve the merging of census and survey data to simulate a population of individuals within households (for different geographical units), whose characteristics are as close to the real population as it is possible to estimate (Williamson et al. 1998; Ballas 2001; Clarke 1996). Dynamic micro-simulation involves forecasting key socio-economic variables into the future based either on current trends or the consequences of different policy scenarios.

One of the main objectives of the research presented in this chapter is to provide a tool that can be used to hold governments to account in terms of their long-term goals. It should be noted that the SimBritain model is based on an initial simulation of the city of York, and subsequently of the whole country of Wales. These simulations are being used as a base to build a national model. In this chapter, we give examples of the microsimulation results by showing some results on Welsh local authorities. We show how the model suggests that Wales has been changing during the 1990s and how it can be expected to change over the next 20 years. Further, we use the model to explore several aspects of life within each of these household groups throughout the simulation period, and attempt to identify the main future determinants of poverty. We also examine the importance of various sources of income for different household classes.

14.2 THE SIMBRITAIN MODEL

The SimBritain microsimulation model is produced by combining the census small-area data with the British Household Panel Survey (BHPS). The former has been used to produce many microsimulation data sets in the UK. The latter is a major national survey of household types and characteristics which has more detail on socio-economic lifestyles than is contained in the census data alone (see the full list of variables in Annex 14.A). As it is only a survey, it is important to re-weight households from this survey so that we have the correct number and type of households for small geographical areas. To model socio-economic variables, six constraint tables were created, each with three categories. The tables and their categories are listed in Table 14.1 for each of the six socio-economic variables.

It should be noted that the class composition table is actually a subset of the employment table, that is, class is allocated only to households with an economically active head. The three class categories are made up from the various BHPS Socio-Economic Group (SEGs) classifications: the *affluent* group comprises SEGs 1, 2, 3, 4 and 13; the middle group is SEGs 5, 8, 9, 12, 14, 16 and 17; and the *poor* group is made up of SEGs 6, 7, 10, 11 and 15 (see Taylor et al. 2001 for the full descriptions of the BHPS SEG classifications).

It should be noted that SimBritain is a spatial microsimulation model, aimed at generating and projecting small area microdata in Britain. It is geographical in the sense that it uses geographical population data as constraints in order to estimate additional variables at the small area level. It is also geographical in the sense that the model outputs can be used to estimate the spatial impacts of national social policies. However, it should be noted that spatial interactions between areas and similar spatial effects are not explicitly considered. Figure 14.1 illustrates the data and procedures that are used by SimBritain.

Table 14.1 Constraint tables for six socio-economic variables

Socio-economic variables	Category 1	Category 2	Category 3
Car Ownership	No cars	1 car	2+ cars
Class Composition	Affluent	Middle-class	Less affluent
Demography	1 child	2+ children	No children
Employment	Economically active	Retired	Inactive
Household Composition	Married couple	Lone parent	Other
Tenure	Owner occupied	Council tenants	Other

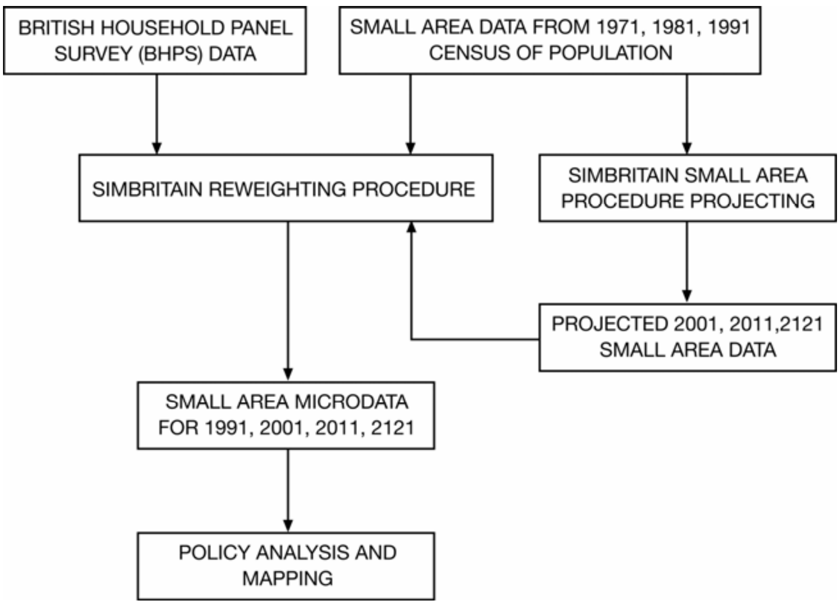

Figure 14.1 The SimBritain data and procedures

The first task is to estimate the appropriate weights for all BHPS households for each simulated geographical area, so that they would fit the Small Area Statistical descriptions given in Table 14.1. It should be noted that all BHPS households have already been given a weight that compensates for error, bias, refusals, and so on. In particular, in wave 1 of the BHPS, household weights were applied to compensate for the unequal selection probability arising from the two-stage stratified sampling design, to compensate for non-responding households, and to adjust for those individuals in a responding household who failed to give a full interview (Taylor et al. 2001). One of the tasks that we faced in this project was to readjust the original weights of BHPS households so that the new weights would add up to the small area constraints.

SimBritan adopts a deterministic re-weighting approach to readjust the given BHPS household weights so that when all household weights are added up they fit the small-area constraints described in Table 14.1. A particular characteristic of this method is that it does not use random number generators at any stage (hence the term ‘deterministic’), and it therefore produces the same results with each run. This is described in Tables 14.2–4. First, Table 14.2 gives a hypothetical individual BHPS microdata set comprising five individuals who fall within two age categories. Table 14.3 shows a census cross-tabulation table for a small geographical area such as a census ward. Table 14.4 depicts a cross-tabulation of the microdata set based on information from Table 14.2.

Table 14.2 A hypothetical microdata set

Individual	Sex	Age-group	Weight
1st	Male	Over-50	1
2nd	Male	Over-50	1
3rd	Male	Under-50	1
4th	Female	Over-50	1
5th	Female	Under-50	1

Table 14.3 Hypothetical small area data tabulation

Age/sex	Male	Female
Under-50	3	5
Over-50	3	1

Table 14.4 The hypothetical microdata set, cross-tabulated by age and sex

Age/sex	Male	Female
Under-50	1	1
Over-50	2	1

Using these data it is possible to re-adjust the weights of the hypothetical individuals, so that their sum adds up to the totals given in Table 14.3. In particular, the weights can be readjusted by multiplying them by the value in the cell in Table 14.3, divided by the respective cell in Table 14.4. This can be expressed as follows:

$$n_i = w_i x s_{ij}/m_{ij}, \tag{14.1}$$

where n_i is the new household weight for household i, w_i is the original weight for household i, s_{ij} is element ij of table s (small area statistics table, which is the equivalent of Table 14.3), and m_{ij} is element ij of table m (reproduced table using the household micro-data original weights from Table 14.4). Table 14.5 depicts how this simple formula is used to re-adjust the weights of the individuals in our example.

Table 14.5 Re-weighting the hypothetical microdata set in order to fit Table 14.3

Individual	Sex	age-group	Org. Weight	New weight
1st	Male	Over-50	1	1 x 3/2 = 1.5
2nd	Male	Over-50	1	1 x 3/2 = 1.5
3rd	Male	Under-50	1	1 x 3/1 = 3
4th	Female	Over-50	1	1 x 1/1 = 1
5th	Female	Under-50	1	1 x 5/1 = 5

One of the difficulties encountered with the re-weighting methodology described above was the high presence of BHPS households coming from geographical areas other than the simulated area (in particular, there was a high presence of households from the South East of England in the simulation of other regions). Table 14.6 shows the geographical distribution of the households in the BHPS wave 1. As can be seen, around 33 per cent of the households come from the South-East, whereas only about 10 per cent of households come from Yorkshire and the Humber.

Table 14.6 Origin of wave 1 BHPS households (AREGION)

Value Label	Frequency	Frequency (%)
Inner London 1	498	5.8
Outer London 2	597	7
Rest of South East 3	1611	18.9
South West 4	713	8.4
East Anglia 5	303	3.6
East Midlands 6	595	7
West Midlands Conurb 7	391	4.6
Rest of West Midlands 8	369	4.3
Greater Manchester 9	396	4.6
Merseyside 10	195	2.3
Rest of North West 11	363	4.3
South Yorkshire 12	197	2.3
West Yorkshire 13	299	3.5
Rest of Yorks & Humber 14	257	3
Tyne & Wear 15	202	2.4
Rest of North 16	293	3.4
Wales 17	392	4.6
Scotland 18	853	10

In the case of the simulation of the population in Wales, the initial geographical distribution of the BHPS households would result in the selection of large numbers of non-Welsh households from wave 1 who would populate the Welsh local authorities.

In order to deal with this problem, we explored a number of possible solutions and concluded that the best approach was to define the BHPS sample used in the simulation on the basis of the geographical area being simulated. For instance, in the simulation of Wales, we used only the BHPS households who lived in Wales (AREGION = 17).

After generating the BHPS household weights for each local authority in Wales, the next step was to select the appropriate households (or, in other words, convert the decimal weights or probabilities into integer weights[1]). Thus, we developed and tested different 'integer weighting' or *integerization* methodologies, and we concluded that the following methodology represented the best solution:

Define two variables named *counter* and *weight* and set them to zero, and then:

- Sort all households into ascending order of probability of living in the small area (which was calculated using the method described above) being populated.
- Increase cumulative *weight* by the weight (probability) of the next sorted household *h*(*counter*). For instance, if *counter* = 0, the *weight* is increased by the probability of the first household: *h*(0).
- If cumulative *weight* > 1, give to the household *h*(*counter*) an integer weight equal to the rounded *weight* value, and subtract this value from *weight* (for example, if *weight* = 2.05, set household *weight* = 2, and set *weight* = 2.05 – 2 = 0.05). Increase *counter* by 1 (move to next household).
- If *counter* < *total number of households in the small area*, return to step 2, otherwise exit.

The implementation of the above algorithm led to the creation of a local authority-level micro-data set for Wales. However, we observed that there were, in some areas, relatively high overestimates and underestimates of some variables, especially those that were not used as constraints in the simulation. In order to tackle this problem, we developed an algorithm aimed at swapping suitable simulated households between areas in order to further reduce the error. The steps taken to reduce the error were as follows:

- Identify areas with the highest overestimate and underestimates for each variable.
- Compare each household in the simulated database with all other households, and search for households that have all attributes in common but one.
- For each pair of almost identical households, swap the households between the areas with the highest overestimate and underestimate.
- Move to the next household and repeat the process.

The above reweighting and weight *integerization and adjustment* methods, as well as ways of validating their outputs, are discussed in more detail by Ballas et al. (2005).

14.3 PROJECTING SMALL AREA STATISTICS INTO THE FUTURE

14.3.1 Population Characteristics

This section provides more details on the procedures for estimating key variables that could be used by dynamic microsimulation models. The demographic variables can be updated by simulating the processes of mortality, fertility and internal migration. Other socio-economic variables have to be updated using trend analysis. These can then form the base scenarios for future predictions. A number of ‘what-ifs’ can be tested to analyse the stability of these forecasts (perturbations from existing trends caused by policy, and so on). First, we describe the traditional demographic updating processes.

The population variables can be updated based on probability analysis. For mortality, for example, we assume that the probability of an individual surviving within any five- or ten-year simulation period is a function of age, gender and location. Table 14.7 shows a stylized version of the dynamic microsimulation procedure adopted by the models, and details the method by which mortality is assessed. The first synthetic household in Table 14.7 has the following characteristics: male, aged 25, single, at work, and living in the first Census Enumeration District (ED1). As shown in Table 14.7, the estimated probability that an individual with these characteristics will survive in the period is 0.99. The next step in the procedure is to generate a random number to see if the synthetic individual is estimated to survive. The random number in this example is 0.5 and falls within the 0.001–0.99 range needed to survive.

In the models, fertility, like mortality, is based on location. Fertility is also assumed to be a function of age, marital status and location. Births can be modelled using five-year age groups and marital status data available for each ward/county from the Census. Every synthetic female in the database is tested for eligibility to give birth. Monte Carlo sampling against the fertility probabilities is used to determine which females give birth. If a birth is deemed to occur, the model creates a new individual. The new individual’s attributes are set as follows: age is zero, sex is determined probabilistically (50 per cent probability of each sex), marital status is single, social class and location are that of the mother and all other attributes are left blank. In the next simulation period, the new individual is simulated along with the other individuals in the location.

Table 14.7 A simple example of the microsimulation procedure for mortality

Steps	1st	2nd	…	Last
Age, sex and marital status, employment status and location (DED level) (given)	Age: 25 Sex: Male Marital Status: Single Employment Status: At work ED1	Age: 76 Sex: Female Marital Status: Married Employment Status: Other (for example, Retired) ED2	…	Age: 30 Sex: Male Marital Status: Married Employment Status: At work ED3
Probability (conditional on sex, age and county location) of survival	0.99	0.85	…	0.99
Random number	0.5	0.9	…	0.6
Mortality outcome	Alive	Dead	…	Alive

It can be argued that spatial microsimulation provides the ideal basis for the modelling of spatial transitions such as migration. In particular, the propensity to migrate is heavily dependent on household and individual attributes, and therefore a micro-level approach may be the most appropriate to estimate and model migration for different types of individuals. For instance, Rogerson and Plane (1998, p. 1468) emphasize the role of age and tenure in household mobility and migration decision making: 'It is well known that mobility rates are substantially higher among renters than among homeowners. Similarly, the age structure of migrants to and from neighbourhoods . . . is likely to be quite different in a neighbourhood . . . comprised primarily of homeowners in comparison with a renter-dominated neighbourhood.'

In our microsimulation models, it is possible to model migration on the basis of random sampling from calculated migration probabilities derived from the 1991 Census of Population data at ward, district or county level. Given small number problems, a higher level of resolution is normally preferable. Probabilities of migrating from one district/county to another are calculated by age, gender and location. Every individual in the database can be assessed for migration using Monte Carlo sampling. The individuals who are assigned migrant status are allocated to an ED within the new district or county on the basis of its population size. Areas with the biggest populations have the highest probability of attracting migrants (the modelling of these procedures is discussed in some detail by Ballas et al. 2005)

14.3.2 Socio-Economic Variables

Traditionally, in the social sciences, it has been far more difficult to update or forecast other socio-economic variables, which may largely depend on a variety of external factors (factory closures, new housing development, and so on). In order to project the socio-economic characteristics of the population of Britain into 2001, 2011 and 2021, we used data from previous Censuses to understand the changing patterns or trends for every socio-economic variable under consideration. In particular, projections of a set of small area statistics tables (described in Table 14.1) were calculated using the 1971, 1981 and 1991 Census Small Area Statistics (SAS). Using these three time points, a trend curve was produced allowing tables to be predicted up to 2021. In particular, we first considered a 'gravity' model for projecting constraint variables of the form:

$$A = \exp(\ln W * (\ln w)^2 * \ln u / (\ln v)^3), \tag{14.2}$$

where u, v and w are the smoothed proportions in 1971, 1981 and 1991, respectively, W is the observed ward proportion in 1991, and A is the projected ward proportion in 2001. Nevertheless, concerns that this model was unduly affected by inflexions in the data (for instance, a decline in the value of a proportion during the period 1971–81 followed by a recovery during 1981–91 led to unrealistically high estimates for 2001) subsequently led us to investigate various other possible models for using with a time series of proportions. One methodology that seems to produce more conservative projections, while still fitting the 1971–91 data is offered by Holt's linear exponential smoothing (Holt 1957). This is an extension of exponential smoothing to take into account a possible linear trend. There are two smoothing constants α and β. The equations are:

$$\begin{aligned} L_t &= \alpha Y_t + (1-\alpha)(L_{t-1} + b_{t-1}) \\ b_t &= \beta(L_t - L_{t-1}) + (1-\beta)b_{t-1} \\ F_{t+m} &= L_t + b_t m, \end{aligned} \tag{14.3}$$

where L_t and b_t are, respectively, (exponentially-smoothed) estimates of the level and linear trend of the series at time t, whilst F_{t+m} is the linear forecast from t onwards. Some initial work has been undertaken to test the relative performance of the gravity and exponential smoothing models. The findings suggest that exponential smoothing avoids some of the less credible forecasts from the gravity model. This is partly because the model is intrinsically more conservative, but also reflects the fact that the choice of values for α and β is under user control. On that basis, we undertook projections of small-area statistics tables at the ward level. In order to avoid problems of wards with low populations, the ward data were smoothed. For the tables for each ward, we took the change that has occurred for the 20 000 population nearest to that ward. This change was then applied to the values for each ward.

Projections of small-area statistics tables were calculated using the 1971, 1981 and 1991 Census Small Area Statistics (SAS). Using these three time points, a trend curve was produced allowing tables to be predicted up to 2021. The projections of future small area statistics tables were undertaken at ward level.

Projections for 2001: $A = \exp(\ln W \times (\ln w)^2 \times \ln u / (\ln v))^3$ (14.4)

Projections for 2011: $B = \exp(\ln A \times (\ln x)^2 \times \ln v / (\ln w))^3$ (14.5)

Projections for 2021: $C = \exp(\ln B \times (\ln y)^2 \times \ln w / (\ln x))^3$, (14.6)

where u = smoothed proportion in 1971; v = smoothed proportion in 1981; w = smoothed proportion in 1991; x = smoothed proportion in 2001; y = smoothed proportion in 2011; W = ward proportion in 1991; A = ward proportion in 2001; B = ward proportion in 2011; C = ward proportion in 2021.

A key question is: How reliable are such estimates? Although we cannot compare model outputs to reality for 2011 and 2021, we can compare predictions based on 1971, 1981 and 1991 with official estimations or predictions for subsequent years. For instance, Figure 14.2 shows that our national projections made from the 1971, 1981 and 1991 Censuses for three categories of car ownership compare favourably with official predictions. The data against which the projections are compared are taken from the General Household Survey (GHS). By 1999 there is some divergence between the projections and the GHS data, with the GHS having a higher proportion of households with 1 car, but a lower proportion of households with 2+ cars. However, it should be noted that there are probably differences in the definitions used for car ownership in the GHS and the Census. The Census asks about car availability, whereas in the GHS the measurement is households with regular use of a car. This difference in definitions could account for the differences between the proportions from the GHS and the proportions in the projections.

Another way of checking the reliability of our projection methodology is by using past Census data to project distributions of populations into 1991, and then compare the projected values with the actual data from the 1991 Census (and from that of 2001 when the full UK census results are published).

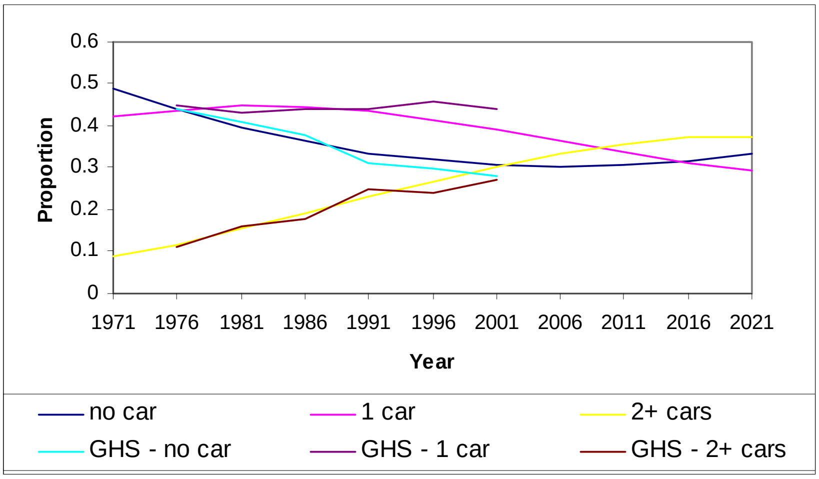

Figure 14.2 Car ownership in Great Britain, 1971–2021

It would be reasonable to expect that the performance of the model would vary from variable to variable, especially at smaller areas, which were not included as constraints in the simulation exercise. It should be noted that the model is more reliable when analysing socio-economic patterns at the level of the city rather than smaller areas. As has been demonstrated elsewhere (see for instance Ballas et al. 2005), the performance of the model at the electoral ward level varies considerably, and there is a need to introduce further constraints in order to perform analysis at the ward or sub-ward level for particular variables (this is ongoing research). Figures 14.3 and 14.4 show the scatter plot for two of these variables at the Welsh local authority level, the Census proportion on the vertical axis and the simulated proportion on the horizontal axis. A perfect match would find all points on a straight line of gradient 1. Three statistics help to measure the degree of departure from that pattern. As can be seen in Figure 14.3, there is a relatively good match of simulated and actual values for average age of residents across the 22 local authorities of Wales. Nevertheless, as Figure 14.4 demonstrates there is a relatively worse match for the values of actual and simulated rate of travel to work by public transport.

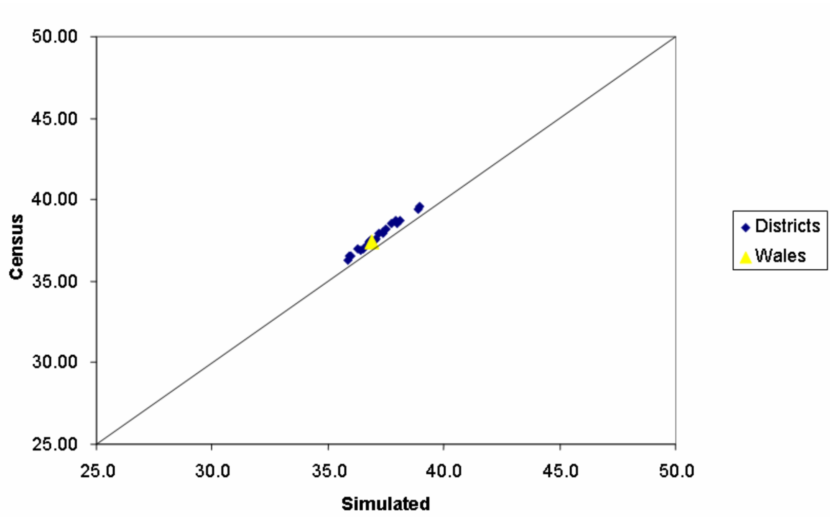

Figure 14.3 Simulated vs. actual average age of residents

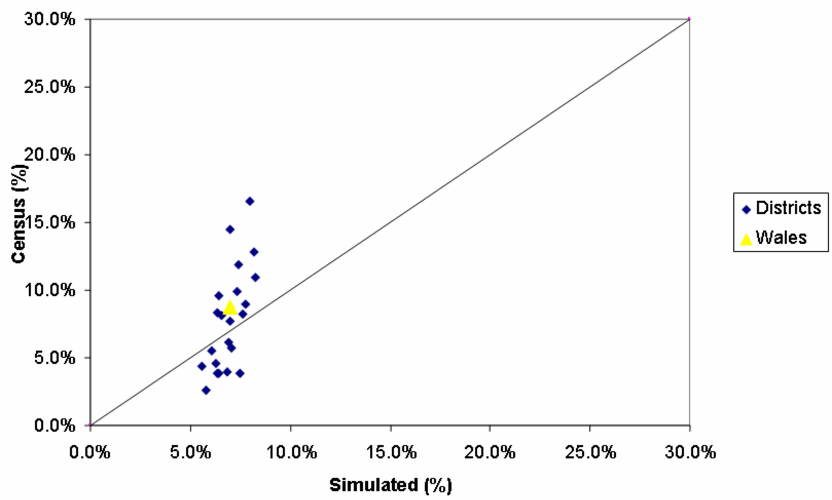

Figure 14.4 Simulated vs. actual rate of working population travelling to work by public transport

14.4 SIMBRITAIN OUTPUTS

14.4.1 Predictions Based on Trend Analysis

In this section, we present some preliminary results of the SimBritain project. As noted above, the SimBritain model was based on a pilot study of the city of York and of the whole of Wales. This section discusses some of the results of the Wales simulation. First, we look at how the key variables may look for Wales over the next two decades, given the assumption that existing trends continue. Then, in Section 14.4.2, we look at how changes in key social policies are likely to influence the pattern of change.

In order to explore the likely changing social geography of Wales for both sets of scenarios, we classified the simulated households into the following five groups:

- *Very poor*, comprising all households with equivalized income below, or equal to, half of the median income of Wales;
- *Poor*, comprising all households with equivalized income greater than half of the median, and smaller than, or equal, to three-quarters of the median;
- *Below-average class*, comprising all households with equivalized income greater than three-quarters of the median, and smaller than, or equal, to the median;
- *Above-average*, comprising all households with equivalized income greater than the median, and smaller than, or equal, to the median plus a quarter of the median;
- *Affluent*, comprising all households with equivalized income greater than the median plus a quarter of the median.

Table 14.8 shows the absolute and relative sizes of each household class throughout the simulation period for the Wales.

It should be noted that the above classification encapsulates an implicit definition of poverty, by describing the lower income households as *poor* and *very poor*. This is a definition of *relative* poverty, as it is not directly based on the degree to which households are able to satisfy their physiological or other basic needs. However, given that the analysis presented here projects the population of Wales into the future, it can be argued that income should be used to define and analyse poverty, as it will be likely to keep its significance through time, whereas human needs and social roles will evolve.

In the remainder of this section, we explore the living standards of the simulated households throughout the 30-year simulation period.

Table 14.9 sheds more light on the prospects for households in the *very poor* category.

Table 14.8 The size of the simulated household classes, 1991–2021

Class size by year	Very poor	Poor	Below average	Above average	Affluent	Total number of households
1991	102156	193098	260137	104977	450413	1110781
2001	137736	246266	220517	99110	505409	1209038
2011	188746	260998	188556	161736	476563	1276599
2021	259584	255461	156055	173329	497771	1342200
Class size (% of all households) by year						
1991	9.2%	17.4%	23.4%	9.5%	40.5%	100.0%
2001	11.4%	20.4%	18.2%	8.2%	41.8%	100.0%
2011	14.8%	20.4%	14.8%	12.7%	37.3%	100.0%
2021	19.4%	19%	11.6%	12.9%	37.1%	100.0%

Table 14.9 Living standards of very poor households

Very poor households	1991	2001	2011	2021
Households (% of all households in Wales)	9.2%	11.4%	14.8%	19.3%
Individuals (% of all individuals in Wales)	10.0%	12.8%	15.6%	20.0%
Children (% of all children in Wales)	17.0%	21.1%	24.4%	30.4%
LLTI (as a % of all individuals in group)	20.3%	18.2%	19.0%	16.7%
Elderly (over 64 years as a % of all individuals in group)	17.2%	16.4%	29.2%	34.6%
Individuals who reported that they have no one to talk to	5.3%	5.0%	3.8%	7.8%
Promotion opportunities in current job (as % of individuals with a job)	14.8%	21.3%	20.0%	5.2%
Feeling unhappy or depressed	15.5%	18.1%	18.1%	20.2%
Home computer or equivalent in the future	12.7%	12.7%	16.1%	23.4%
House without central heating	24.2%	19.6%	30.3%	25.7%
Single-person households	21.7%	32.5%	40.5%	39.6%
Cars/Household ratio	0.45	0.55	0.53	0.88

As can be seen, the poorest segment of the Welsh society is predicted as a group to increase in size, from 9.2 per cent of total households in 1991 to 19.3 per cent in 2021. Further, the number of children living in *very poor* households rises significantly from 17 per cent in 1991 (as a percentage of all children in Wales) to 30.4 per cent in 2021. Likewise, the number of elderly people in this group increases from 17.2 per cent in 1991 to 34.6 per cent in 2021. However, the incidence of Limiting Long Term Illness (LLTI) is estimated to be 20.3 per cent in 1991 and is predicted to fall to 16.7 per cent by 2021.

It is also interesting to note that 5.3 per cent of individuals in the *very poor* group reported that they feel they could not count on anyone to listen to them if they needed to talk. It can be argued that this proportion can be seen as an index of 'loneliness', and it is noteworthy that it is projected to increase in 2021, when 7.8 per cent of the individuals in the *very poor* household group are estimated to have increased feelings of 'loneliness.' It is also noteworthy that there is a similar increase in the numbers of individuals who report that they feel *unhappy or depressed*.

A useful indicator of well-being and prosperity is the ratio of cars/household, especially given that there is a general increasing trend in car ownership across all households in the simulation period. The ratio for *very poor* households increases from 0.45 in 1991 to 0.88 in 2021. As will be seen later, in affluent households this variable increases from 1.33 to 2.00. Further, the percentage of households that have a home computer is estimated to be 12.7 per cent in 1991 and it is projected to increase to 23.4 per cent in 2021. But it should be noted that, given that home computers become increasingly common in households, it is likely that the rate of households with a home computer will be significantly higher than this prediction. However, the home computer here may be seen as the equivalent of a high-tech product at any time (for example, in 2001 it could be a DVD player or mobile phone with photo-messaging, and in 2021 it may be virtual reality facilities or some other product or service).

Table 14.10 and Figure 14.5 show the likely future breakdown of income for *very poor* households.

14.4.2 Predictions Based on Policy Change

14.4.2.1 Types of policy change

In this section we look at how key recent social policy/tax changes are likely to influence the nature of poverty over the next two decades. The power of microsimulation lies in its ability to handle such 'what-if' scenarios. The changes can be described as follows:

Table 14.10 Very poor households – sources of income

Very poor households	1991	2001	2011	2021
Mean household pension income	£304.44	£291.09	£633.02	£444.28
Mean household benefit income	£3,805.20	£4,117.74	£4,578.49	£4,684.20
Mean household income from investment	£60.92	£20.58	£75.69	£210.77
Mean household income from other sources	£27.49	£19.02	£20.33	£143.99
Mean household earned income	£277.54	£586.29	£448.49	£865.00

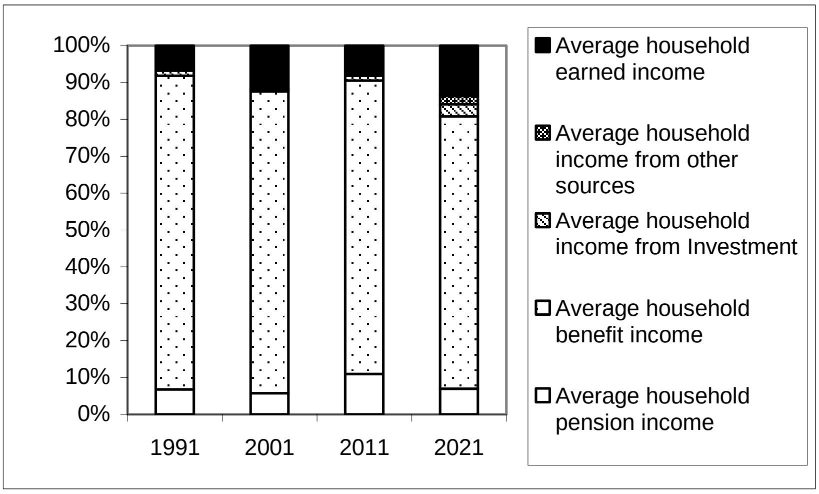

Figure 14.5 Very poor households, sources of income 1991–2021

- *Working families' tax credit:*

One of the major policy initiatives that was implemented in the 1990s was the Working Families' Tax Credit (WFTC), which is an allowance paid to low paid workers with children (Fitzpatrick et al. 2002; Inland Revenue Online[2] 2003). In order to qualify for WFTC individuals would have to fulfil the following criteria:

- They or their partner should work normally full-time (16 hours or more a week).

- They have at least one dependent child for whom they are responsible.
- They do not receive disabled person's tax credit.
- Their income is sufficiently low.
- Their savings and capital are not worth more than £8,000.
- They are present and ordinarily resident in Great Britain.
- They are not subject to immigration control.

WFTC is calculated by comparing the family income with the applicable amount or threshold figure, which in 2002 was £94.50. If the family income is less than the applicable amount, then the family receives the maximum WTFC. If the family income exceeds the applicable amount, the maximum WFTC is reduced by 55 per cent of the excess (Fitzpatrick et al. 2002). As noted above, in the context of the research reported here, all the relative amounts were adjusted to allow for inflation. In the case of WFTC, the applicable amount of £94.50 in 2002 was readjusted to its equivalent in 1991 on the basis of the RPI growth of 29.3 per cent. Thus, the adjusted applicable amount that we used was £66.77. Further, all the relevant credits were adjusted before allocating them to eligible households of the simulated database. Table 14.11 lists the actual (2002) and the adjusted (1991) amounts for the various credits.

Table 14.11 Working class tax credits

Working Families' Tax Credits	*Amount in 2002–3*	*Adjusted for 1991*
Couple or lone parent	£60.00	£42.39
Child aged		
under 16	£26.35	£18.62
16-18	£27.20	£19.22
30 hours credit	£11.65	£8.23
Disabled child credit	£35.50	£25.08
Enhanced disability credit		
Couple or lone parent	£16.25	£11.48
Child	£46.75	£33.03
Childcare credit		
One child	70% of up to £135	70% of up to £95.39
Two or more children	70% of up to £200	70% of up to £141.31
Additional partners in a polygamous marriage	£22.70	£16.04

- Minimum wage & income guarantee

Another related major policy development in the 1990s was the introduction of the minimum wage. The minimum wage in October 2002 was £4.50 per hour for individuals at work who are over 21 years old, and £3.80 for individuals aged 18–21. These were adjusted to £2.97 and £2.54, respectively, for 1991. The introduction of the minimum income guarantee was another major policy development that occurred in the late 1990s. This guarantee aimed at topping up the income of elderly individuals or couples to a minimum level (aged 60 or over and with savings of less than £12,000). This minimum level is currently (March 2003) £98.15 for a single person and £149.80 for a couple. These figures were adjusted for 1991 on the basis of RPI growth to £69.35 and £105.84.

- Winter fuel payment and free TV licence for the elderly

Another policy initiative which aimed at boosting the incomes of the elderly was the Winter Fuel Payment, which is given to individuals aged 60 or over. This amount was £200 in 2003, and was adjusted to £141.31 for 1991. Further, a similar government initiative was the provision of free TV licences to all individuals. In the case of the TV license, there is no need to readjust the 2002–03 figure to 1991 as data exist on the TV licence across time. The TV licence was £112 in 2002, whereas in 1991 it was £77.

14.4.2.2 Impacts of policy changes

Once all the figures were adjusted, the next step was to estimate the redistributive effects that these policies would have if they had been implemented in each of the simulation years. Table 14.12 summarizes the estimated increase that would occur to the average incomes of households by class, as defined in the previous section.

Table 14.12 Simulated impact of policy changes by household class and simulation year

1991	*Extra income (in 1991 terms)*	*Extra income (in 2003 terms[3])*	*Income increase*	*Income increase as % of all income in Wales*
Very poor	£102,430,639.31	£132,442,816.63	22.0%	0.64%
Poor	£71,628,478.41	£92,615,622.58	6.29%	0.44%
Below-average	£75,728,198.28	£97,916,560.38	3.12%	0.47%

Table 14.12 (cont.)

Above-average	£13,143,570.42	£16,994,636.55	1.00%	0.08%
Affluent	£28,493,348.46	£36,841,899.56	0.27%	0.18%
2001				
Very poor	£111,729,022.82	£144,465,626.51	16.6%	0.58%
Poor	£81,454,567.98	£105,320,756.40	4.37%	0.42%
Below-average	£43,986,555.48	£56,874,616.24	2.04%	0.23%
Above-average	£16,283,846.40	£21,055,013.40	1.20%	0.08%
Affluent	£11,572,001.88	£14,962,598.43	0.09%	0.06%
2011				
Very poor	£156,935,725.73	£202,917,893.37	14.5%	0.82%
Poor	£80,457,683.40	£104,031,784.64	3.51%	0.42%
Below-average	£9,033,724.56	£11,680,605.86	0.45%	0.05%
Above-average	£34,390,515.72	£44,466,936.83	1.40%	0.18%
Affluent	£2,936,752.80	£3,797,221.37	0.03%	0.02%
2021				
Very poor	£180,029,490.51	£232,778,131.23	11.8%	0.75%
Poor	£58,584,519.12	£75,749,783.22	2.96%	0.24%
Below-average	£14,503,876.08	£18,753,511.77	0.79%	0.06%
Above-average	£36,052,728.18	£46,616,177.54	1.50%	0.15%
Affluent	£5,035,330.62	£6,510,682.49	0.03%	0.02%

As can be seen, the policy changes would contribute to a significant increase of the average income of the very poor households. In particular, according to the simulation outputs, the income of these households would, on average, increase by 22 per cent in 1991. Further, the income of poor and below average households would also increase by 6.29 per cent and 3.12 per cent, respectively. On the other hand, there would be very small proportional increases to the incomes of above-average and affluent households. Similar redistributive patterns are observed in all simulation years. It should be noted that, although the increases to the average incomes of very poor households tend to be relatively high, these are very small when seen as a proportion of the sum of all household incomes in Wales (see last column of Table 14.12). Nevertheless, it should be noted that the above estimates of income increases for different household classes are based on the assumption of full benefit take-up. Further, any previous benefits that were substituted by the new policy measures were not taken out of the original household income.[4]

It is interesting to note that the suggested policies would have a great impact on families with children. Table 14.13 lists the estimated average increase to the incomes of households with one or more dependent children in all simulation years.

Table 14.13 Average income increase in the income of households with dependent children

Year	Average Increase	Increase as % of income in Wales
1991	3.6%	0.84%
2001	2.0%	0.71%
2011	3.0%	0.61%
2021	3.2%	0.61%

It is also interesting to note that our model suggests that several households would change class (for example, from *very poor* to *poor*) under the suggested changes. Table 14.14 lists the class transitions by year.

As can be seen, the largest number of class transitions would occur had the policies been adopted in 1991, when 46 558 households would have moved from the *very poor* to *poor*.

Table 14.14 Class transitions triggered by policy changes

Class Transitions in 1991	Households	% of all households
From *very poor* to *poor*	46 558	4.19%
From *poor* to *below average*	11 385	1.02%
From *below average* to *over average*	21 901	1.97%
From *above average* to *affluent*	6 409	0.58%
Class Transitions in 2001		
From *very poor* to *poor*	43 878	3.63%
From *poor* to *below average*	38 412	3.46%
From *below average* to *over average*	11 037	0.99%
From above *average* to *affluent*	5 600	0.50%

Table 14.14 (cont.)

Class Transitions in 2011		
From *very poor* to *poor*	27 739	2.17%
From *poor* to *below average*	19 993	1.57%
From *below average* to *over average*	1 561	0.12%
From *above average* to *affluent*	9 484	0.74%
Class Transitions in 2021		
From *very poor* to *poor*	12 867	0.96%
From *poor* to *below average*	22 111	1.65%
From *below average* to *over average*	5 731	0.43%
From *above average* to *affluent*	6 954	0.52%

Another way of examining the impact of the above policy change is by analysing the effect of these changes upon the income distribution across household deciles. It is useful at this stage to utilize research on the income distribution in Britain carried out by the Institute for Fiscal Studies (IFS). Table 14.15 describes the monthly income levels for different household types (Shephard 2003), by the income decile in which they fall in.

Table 14.15 Where do you fit in? (*after Shephard 2003, p. 5*)

	Single person, no children	Couple, no children	Couple with two children (aged 4 and 13)
Bottom Decile	£0 to £400	£0 to £700	£0 to £1,000
Decile 2	£400 to £500	£700 to £900	£1,000 to £1,200
Decile 3	£500 to £600	£900 to £1,000	£1,200 to £1,500
Decile 4	£600 to £700	£1,000 to £1,200	£1,500 to £1,700
Decile 5	£700 to £800	£1,200 to £1,400	£1,700 to £2,000
Decile 6	£800 to £900	£1,400 to £1,600	£2,000 to £2,300
Decile 7	£900 to £1,100	£1,600 to £1,800	£2,300 to £2,600
Decile 8	£1,100 to 1,300	£1,800 to £2,100	£2,600 to £3,100
Decile 9	£1,300 to £1,700	£2,100 to £2,800	£3,100 to £4,000
Top Decile	£1,700+	£2,800+	£4,000+

Source: Author's calculations using Family Resources Survey.

Notes:
Incomes are monthly incomes measured before housing costs and are expressed in 2001–2 prices. The income differences across family types reflect the 'equivalence scales' used. Income ranges within each decile group are the same once adjusted for household size and composition.

It is interesting to examine the numbers of households in Wales that fall into the different national income distribution deciles. Table 14.16 shows how many of the simulated households (in 2001) of each type in Wales fall into the IFS estimated income distribution.[5] Table 14.17 shows these households as a proportion of all households of each type in Wales.

Table 14.16 Where do households in Wales fit in?

Decile/Household type	Single person	Couple with no children	Couple with two children
Bottom Decile	50 627	18 934	27 815
Decile 2	43 403	16 598	3 611
Decile 3	55 849	8 674	7 678
Decile 4	10 204	28 508	23 637
Decile 5	26 083	24 812	35 800
Decile 6	11 301	12 088	1 881
Decile 7	24 016	19 912	-
Decile 8	23 146	29 591	6 435
Decile 9	30 374	58 067	18 757
Top Decile	90 873	92 064	-
Total	365 876	309 248	125 614

Notes: * Households in 2001, before policy changes.[6]

Table 14.17 Household type by decile as a proportion of all households of this type (2001, before policy changes)

Decile/Household type	Single person	Couple with no children	Couple with two children
Bottom Decile	13.8%	6.1%	22.1%
Decile 2	11.9%	5.4%	2.9%
Decile 3	15.3%	2.8%	6.1%
Decile 4	2.8%	9.2%	18.8%
Decile 5	7.1%	8.0%	28.5%
Decile 6	3.1%	3.9%	1.5%
Decile 7	6.6%	6.4%	0.0%
Decile 8	6.3%	9.6%	5.1%
Decile 9	8.3%	18.8%	14.9%
Top Decile	24.8%	29.8%	0.0%

Further, Tables 14.18 and 14.19 show how this distribution would be affected by the policy changes described above.

Table 14.18 Where do households in Wales fit in?[*]

Decile/Household type	Single person	Couple with no children	Couple with two children
Bottom Decile	–50 627	–8 811	–6 068
Decile 2	47 884	8,811	–2 146
Decile 3	–3 472	–1,834	3 611
Decile 4	2 154	1,834	-
Decile 5	4 061	–3,233	4 603
Decile 6	-	3,233	-
Decile 7	-	–3,581	-
Decile 8	-	3,581	-
Decile 9	-	-	-
Top Decile	-	-	-

Notes: [*] Transitions in 2001, after policy changes.

Table 14.19 Household type by decile as a proportion of all households of this type in Wales (2001, after policy changes)[*]

Decile/Household type	Single person	Couple with no children	Couple with two children
Bottom decile	0.0%	3.3%	17.3%
Decile 2	25.0%	8.2%	1.2%
Decile 3	14.3%	2.2%	9.0%
Decile 4	3.4%	9.8%	18.8%
Decile 5	8.2%	7.0%	32.2%
Decile 6	3.1%	5.0%	1.5%
Decile 7	6.6%	5.3%	0.0%
Decile 8	6.3%	10.7%	5.1%
Decile 9	8.3%	18.8%	14.9%
Top decile	24.8%	29.8%	0.0%

14.4.3 Estimating the Impact of Welfare Reforms Introduced in April 2003

So far, we have presented the estimates of some of the major welfare reforms that were implemented in the late 1990s. Nevertheless, it should be noted that the Working Families Tax Credit scheme, discussed above, was replaced in April 2003 by a new set of tax credits: the *Child Tax Credit (CTC)* and the *Working Tax Credit (WTC)*. The former aims at providing support for families within a common framework, in which the same rules apply to all households, whether in or out of work.[7] In particular, CTC can be claimed by all persons who are responsible for at least one child under 16 years of age or under 19 years and in full-time non-advanced education. CTC comprises five elements which are listed in Table 14.20.

Table 14.20 Child tax credits, weekly (April 2003)

Elements of Child Tax Credit	Amount in April 2003	Adjusted to 1991 prices
Family element	£10.45	£7.38
Family element baby addition	£10.45	£7.38
Child element	£27.75	£19.61
Disabled child element	£41.30	£29.18
Enhanced Disabled Child Element	£16.60	£11.73

The CTC is calculated in a similar way to the WFTC. In particular, the family income is compared with the threshold figure, which is currently £13,230 per year, for those who do not claim WTC as well.[8] If the family income exceeds the threshold amount, the maximum CTC is reduced by 37 per cent of the excess.

Further, the *Working Tax Credit (WTC)* aims at providing a top-up to the wages of low income workers. In particular, WTC can be claimed by all those with dependent children and/or a disability who work for 16 hours a week. Further, it can also be claimed by all those who do not have dependent children and do not have a disability, provided that they are aged 25 years or more and work at least 30 hours a week. The WTC elements are outlined in Table 14.21.

The WTC is calculated by comparing the maximum amount with the threshold figure, which is £5,060 per year. As was the case with the CTC, if the income exceeds the threshold amount, the maximum WTC is reduced by 37 per cent of the excess. If a family claims both the WTC and the CTC then the threshold amount to be compared with the maximum amount for all credits is £5,060 per year.

Table 14.21 Working tax credits per week (April 2003)

Working Tax Credit	April 2003	Adjusted for 1991 earnings
Basic element	£29.20	£20.63
Couple or lone parent element	£28.80	£20.35
30 hours credit	£11.90	£8.41
Disability element	£39.15	£27.66
Severe disability element	£16.60	£11.73
50 plus element	£16.25	£11.48
Childcare credit		
one child	£135.00	£95.39
two or more children	£200.00	£141.31

In the context of this report, we readjusted the threshold amounts for the above credits to their equivalent in 1991 on the basis of the RPI growth. Further, we adjusted all the relevant elements of these credits, before allocating them to eligible households of our simulated database. The actual (2003) and adjusted (1991) amounts for the various credits are shown in Tables 14.20 and 14.21.

The following sub-section presents the estimated impact of the new tax credits upon the *SimWales* households.

14.4.3.1 Estimated policy impacts

Once we had adjusted all the figures, the next step was to estimate the redistributive effects that the recently introduced policy reforms would have if they had been implemented in each of our simulation years, assuming full take-up. Table 14.22 summarizes the estimated increase that would occur to the average incomes of households by class.

As can be seen by comparing Table 14.22 with Table 14.12, the new tax credits would result in a more significant increase of the average income of the *poor* and *very poor* households. For instance, in 1991 the increase of the income of the *very poor* households is estimated to double with the implementation of the new tax credits, compared with the respective increase presented in Table 14.12. Similar differences can be observed in all of our simulation years. These large differences may be explained by the fact that the child tax credits can be claimed by unemployed individuals with children. Further, it should be noted that the working tax credit can be claimed by individuals in poor households without children, whereas the previous credits under WFTC were only aimed at households with dependent children.

Table 14.22 Simulated impact of April 2003 policy changes by household class and simulation year

1991	Extra income (in 1991 terms)	Extra income (in 2003 terms[9])	Income increase	Income increase as % of all income in Wales
Very poor	£195,310,812.70	£252,536,880.82	41.9%	1.21%
Poor	£145,305,746.76	£187,880,330.56	12.21%	0.90%
Below-average	£158,177,034.60	£204,522,905.74	6.15%	0.98%
Above-average	£25,750,488.19	£33,295,381.23	1.96%	0.16%
Affluent	£65,768,471.91	£85,038,634.18	0.63%	0.41%
2001				
Very poor	£251,832,036.13	£325,618,822.72	37.5%	1.31%
Poor	£173,645,776.03	£224,523,988.41	9.32%	0.90%
Below-average	£114,336,478.10	£147,837,066.18	5.31%	0.60%
Above-average	£27,175,715.94	£35,138,200.71	2.00%	0.14%
Affluent	£12,249,338.28	£15,838,394.40	0.09%	0.06%
2011				
Very poor	£289,201,903.16	£373,938,060.79	28.7%	1.33%
Poor	£175,634,243.96	£227,095,077.44	8.02%	0.81%
Below-average	£50,875,118.48	£65,781,528.19	2.37%	0.23%
Above-average	£54,228,783.24	£70,117,816.73	2.20%	0.25%
Affluent	£33,000,527.16	£42,669,681.62	0.24%	0.15%

Table 14.22 (cont.)

2021				
Very poor	£346,622,697.99	£448,183,148.50	22.7%	1.44%
Poor	£108,402,508.48	£140,164,443.46	4.86%	0.45%
Below-average	£33,068,774.96	£42,757,926.02	1.80%	0.14%
Above-average	£43,197,826.58	£55,854,789.77	1.73%	0.18%
Affluent	£38,662,684.38	£49,990,850.90	0.25%	0.16%

14.4.4 Estimating the Geographical Impact of Welfare Reforms

One of the major advantages of spatial microsimulation models such as the *SimWales* model is the ability to estimate the impact of social and economic policies upon different places. Further, it can be argued that identifying the geographical impact of national social policies is particularly important when these policies are aimed at breaking vicious circles of poverty in particular localities. As McCormick and Philo (1995) point out, much of the poverty in the UK is hidden, in the sense that *poor* people in average localities are largely invisible. Further, they argue that poverty in these localities is not only the result of economic decline reflected as shift in demand for specific labour market skills but also the cause of some of the decline. Moreover, Darton et al. (2003, p. 28) point out that the distribution of disadvantage in the UK has a strongly geographical dimension: '[A] world of difference separates the poorest neighbourhoods where jobs are scarce and where poverty and associated social problems are the norm, from booming areas where the greatest difficulty is the shortage of staff for domestic and public services.'

However, one of the difficulties associated with impact analysis at the small-area level has been the lack of data pertaining to quality of life, such as household income and wealth. As Goodwin (1995, pp. 66–7) put it, '. . . an immediate problem faced by those attempting to assess the extent and the shape of urban poverty is the difficulty of obtaining reliable data on variables such as income, especially at those geographical scales which allow comparisons to be made within, as well as between, urban areas.'

Despite these difficulties there have been a few attempts to address the geographical complexity of poverty (see, for instance, Dorling and Tomaney 1995; Dorling and Woodward 1996). Further, it has long been argued that spatial microsimulation can, and should be, used to fill in these data gaps in order to enable the analysis of the geographical dimensions of poverty and the evaluation of the spatial impacts of relevant social policies (Ballas 2004; Ballas and Clarke 2001).

Amongst the strengths of spatial microsimulation models is the ability to examine the impact of policy changes at the intra-district level. In this section, we present the geographical distribution of the simulated policy impacts within Wales. Figure 14.6 depicts the spatial distribution of the average additional household income which would result from the policy reforms discussed above. Moreover, Figure 14.7 depicts the spatial distribution of this additional income as a proportion of the average household income in each area.

It is also interesting to examine what would have been the geographical impact of the new tax credits that were introduced in April 2003 and were briefly discussed above. Figure 14.8 shows the spatial distribution of the average additional household income which would result from the policy reforms discussed above, assuming that the April 2003 tax credits were implemented in 1991. Furthermore, Figure 14.9 depicts the spatial distribution of this additional income as a proportion of the average household income in each local authority.

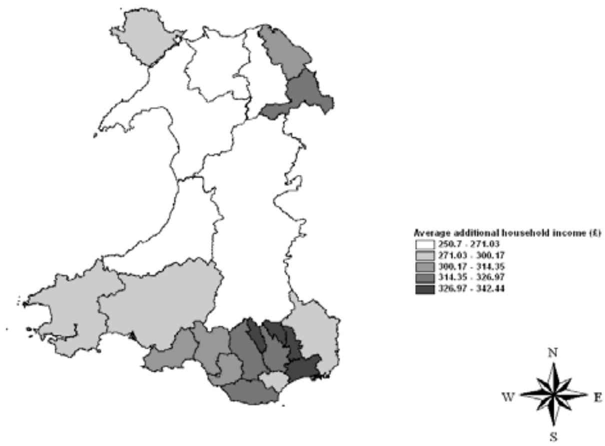

Figure 14.6 Estimated spatial distribution of additional income per household in 1991

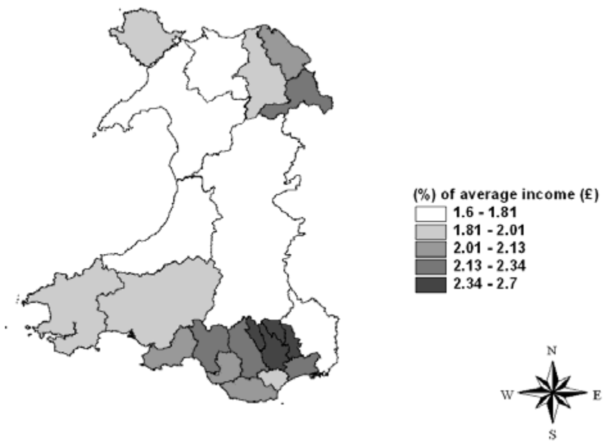

Figure 14.7 Spatial distribution of additional income per household as a proportion of average household income by district in 1991

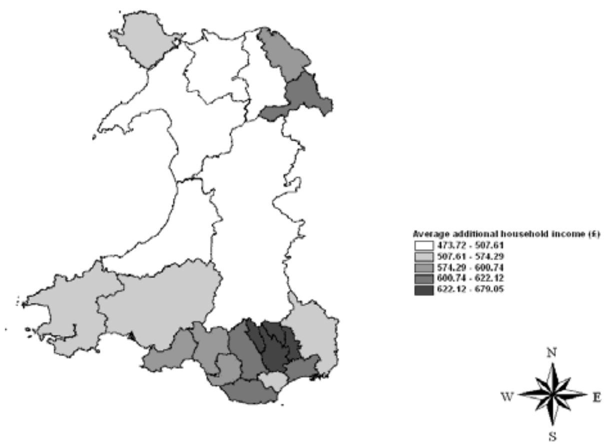

Figure 14.8 Estimated spatial distribution of additional income per household in 1991, after the implementation of the April 2003 Tax Credits

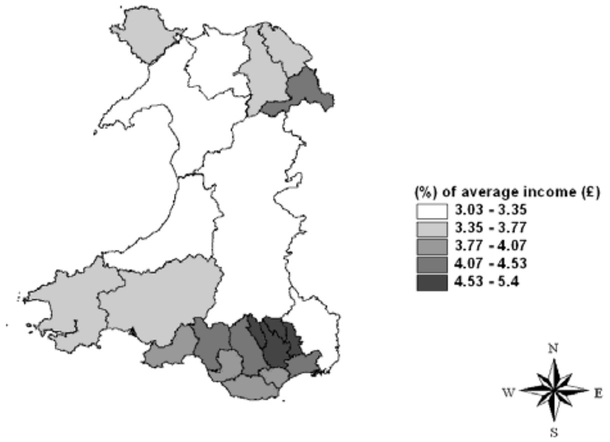

Figure 14.9 Spatial distribution of additional income per household as a proportion of average household income by Local Authority, after the implementation of the April 2003 Tax Credits

14.5 CONCLUDING COMMENTS

The research presented here aims at building a national dynamic spatial microsimulation model of Britain (*SimBritain*), that would be capable of simulating the changing population of the whole of Britain into the future, first, under the assumption that it continues to change in the same way as it has done in the past, and then under different scenarios. It should be noted that the *SimBritain* model is the first of its kind, and there is a lot of potential for further improvement. It is useful at this stage to outline the ways in which the model, in its current form, can or cannot be used.

SimBritain can be used to paint a picture of one possible future of a city or region, based on past trends. This is demonstrated in this chapter that has shown how the model has been used to paint a picture of Wales, in which there is near full employment with fewer poor people but more poor children (this is the picture that the default simulation produces). *SimBritain* is also suitable for the estimation of variables such as household income at the small-area level. Such estimations can provide helpful insights into the analysis of spatial and socio-economic polarization within cities. *SimBritain* can also be used to paint a picture of the life of households of different income categories. In this respect, the *SimBritain* outputs are very similar to large-scale survey outputs and qualitative research findings. *SimBritain* is useful in modelling the socio-economic and spatial effects of policy change

One of the biggest problems associated with both spatial and non-spatial *dynamic* microsimulation is that they can be extremely complex and difficult to develop, implement and explain to policy practitioners who may be interested in using them. It has often been argued in the microsimulation literature that there is a need for transparency and simplicity in the construction of models.

Overall, tools such as the *SimBritain* model can be used to provide useful information on socio-economic trends, as well as on the possible outcome of policy reforms, at different geographical scales. It can be argued that the analyses presented in this chapter could stimulate debate about the future and, possibly, the future educational divide.

Nevertheless, it should be noted that *SimBritain* performs better at the metropolitan district and parliamentary constituency level, rather than at the most disaggregated ward level. It is therefore more suitable for the prediction of a wide range of socio-economic variables at the coarser geographical level of cities and regions, but it is less suitable to analyse most variables at small-area levels such as wards and enumeration districts. S*imBritain* is thus also not suitable for the prediction of rare or badly reported events, such as drug use. It is also unsuitable for the prediction of variables that are affected considerably by external and localized factors, such as transport networks and public transport services.

As noted above, *SimBritain* has been used in this chapter to provide estimates of the redistributive impacts of some of the policy changes that have occurred within the last ten years. However, these estimates can only be seen as an illustration of the type of analysis that can be performed and should only be used as indication of the initial impact of policy change upon different types of households in various localities. *SimBritain* cannot be used in its current form to analyse the longer-term behavioural responses to policy changes. For instance, *SimBritain* cannot be used, in its current form, to predict how many unemployed individuals would decide, if they could, to enter the labour market as a result of increases in the minimum wage, or welfare-to-work policies such as the ‘Working Families’ Tax Credit’. Behavioural modelling is an extremely difficult task, and this is reflected in the relatively small number of dynamic microsimulation models to be found worldwide. The task becomes even more difficult when there are attempts to introduce geographical detail. However, the model estimates presented in this report show a situation where the natural dynamics suggest a more polarized population in terms of income and wealth. In that sense, these results back up more qualitative studies such as those by Bradshaw (2000), Dorling and Tomaney (1995), Dorling and Woodward (1996) and Walker (1999). Thus, the estimation of the impacts of changing social policy is crucially important if we are to offer our future children a decent standard of living.

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NOTES

1. This is a very important stage in the reweighing exercise to avoid having fractions of households and individuals as simulation outputs.
2. http://www.inlandrevenue.gov.uk
3. Assuming that the growth of income for all household groups was equivalent to the RPI growth for the period 1991–2003.
4. For example, Family Credit was replaced by WFTC in 1999. The estimates presented here did not take the Family Credit amounts out of the original household incomes of eligible households. Therefore, the real effect of the policy changes will be less than that presented here. Nevertheless, it should be noted that, under the previous Family Credit scheme, there were far fewer eligible households compared with the WFTC scheme.
5. In order to carry out these calculations, we used the RPI growth rate to readjust the *SimWales* household incomes for 2001.
6. We are currently investigating how we could tackle the problem of under-estimating couples with two children in the 7th and 9th deciles.
7. Inland Revenue website: http://www.inlandrevenue.gov.uk/taxcredits/changes.htm#ctc.
8. http://www.inlandrevenue.gov.uk/rates/taxcredits.htm.
9. Assuming that the growth of income for all household groups was equivalent to the RPI growth for the period 1991–2003.

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ANNEX 14.A

Table 14.A1 Details of the core, rotating core, and variable component question subject areas from the BHPS Individual Questionnaire

BHPS Individual Questionnaire			
Core	*Neighbourhood and individual*: Demographics, Birthplace, Residence satisfaction with home, Neighbourhood, Reasons for moving, Ethnicity, Educational background and attainments Recent education, Training, Partisan support, Changes in marital status, Citizenship	*Current Employment*: Employment status: Not working, Seeking work, Self Employed, Sector: Private, Public, SIC, SOC, ISCO, Nature of business, Duties, Workplace, Size of firm, Travelling time, Means of travel, Length of tenure, Hours worked, Overtime Union membership, Prospects, Training, Ambitions, Superannuation, Pensions, Attitudes to work, Incentives, Wages, Salary, Deductions, Childcare provisions, Job search activity, Career opportunities, Bonuses, Performance related pay	*Finances*: Incomes from: Benefits, Allowances, Pensions, Rents, Savings, Interest, Dividends Pension Plans, Savings and investments, Material well-being, Consumer, Confidence Internal transfers, External transfers, Personal spending, Roles of partners, Spouses, Domestic work, Childcare, Bills, Everyday spending, Car ownership, Use, Value of car, Interview, Characteristics, Windfalls

Table 14.A1 (cont.)

Rotating Core	*Health and Caring*: Personal health condition, Employment constraints, Visits to doctor, Hospital, Clinic use, Use of health, Welfare services, Social services, Specialists, Check-ups, Tests, Screening, Smoking, Caring for relatives, others Time spent caring for others, Private medical insurance, Activities in daily living	*Employment History*: Past year, Labour force status, Spells, Size, Sector, Nature of business, Duties, Wages, Salary, Deductions, Reasons for leaving or taking jobs	*Values and Opinions*: Partisanship, Interest in politics, Religious involvement, Parental questionnaire

Table 14.A1 (cont.)

Variable Components	*Lifetime Marital Status History (Wave 2)*: Number of marriages, Marriage dates, Divorce, Widowhood, Separation dates, Cohabitation before marriage *Lifetime Marital Status History (Wave 3)*: Start and finish dates, Labour force status, Sector, Nature of business, Duties	*Lifetime Fertility and Adoption History (Wave 2 and Wave 8 catch-up)*: Birth dates, Adoption dates, Sex of children, Leaving or mortality dates *Lifetime Cohabitation History (Wave 2 and Wave 8 catch-up)*: Start and finish dates, Number of partners	*Lifetime Employment Status History(Wave 2)*: Start and finish dates, Employment status *Values and Opinions*: Aspirations for children, Important events, Quality of life *Credit and Debt*: Investment and savings, Commitments

Source: Taylor et al. (2001).