Modelling the local impacts of national social policies: A Microsimulation Approach

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Abstract

During the last decades the inequalities in the distribution of income and wealth in the UK have grown and led to an increasing socio-economic polarisation and dualism (Atkinson, 1996; Hills, 1996; Joseph Rowntree Foundation, 1995). Although average real incomes have grown significantly, at the bottom of the scale there has been little or no rise in real income. In contrast, top incomes have risen a great deal faster than the average. This led to the highest level of income inequality recorded in the UK since the war (Atkinson, 1996; Green, 1996; Joseph Rowntree Foundation, 1995). In this context, there is a growing need for effective area-based and social policies to tackle inequalities in the levels of affluence or quality of life as well as for novel methodologies to estimate or predict the socio-economic and spatial impacts of such policies. The aim of this paper is to provide a new framework for the analysis and the evaluation of national social policies at the small area level. In particular, the paper shows how microsimulation modelling can be employed to shed new light on the local impacts of major national policy changes such as taxes, regulations, government consumption, unemployment benefits, job seekers' and housing allowances etc. Microsimulation modelling provides the possibility of defining the desired effects of economic and social policy, the instruments employed and also the structural changes of those affected by socio-economic policy measures (Krupp, 1986). This paper builds on traditional economic microsimulation frameworks by adding a geographical dimension. More specifically, it seeks to model national social policy impacts at a micro-spatial scale. First, microsimulation modelling is used to synthesise a household micropopulation geographical database for an entire city. GIS software is used to identify the size and spatial location of particular groups like the unskilled, low-waged, under-educated and lone-parents. In this manner, the paper presents a micro-spatial approach to estimating the degree of socio-economic polarisation. This micropopulation database has a wide range of demographic and socio-economic attributes that are relevant to national social and economic policies and which play a major role in the determination of eligibility of households for various benefits and allowances. It then explores potential social policies and demonstrates how microsimulation modelling can be used to perform *what-if* social policy analysis at the small area level.

1. Introduction

Although there have been a number of studies exploring the geography of the changing welfare state (Bennett 1980, Curtis 1989, Pinch 1997) there is a general paucity of information relating to the geography of household income, wealth, taxation and welfare benefits. This is surprising given the importance of these issues to the geography of well being and the geographies of consumer behaviour and consumption. The reason for this paucity is undoubtedly lack of information or data relating to these issues. There is little published beyond the scale of the region. For example UK national publications such as 'Regional Trends', the New Earnings Survey and the General Household Survey at best disaggregate to the level of 'Yorkshire and Humberside'. Green (1998) provides an excellent overview of available data sources.

The aim of this paper is to articulate a research agenda for on household income, wealth, taxation and benefits using the technique of microsimulation. In section 2 we briefly review some key works on incomes and the geography of social policy issues. In section 3 we outline *SimLeeds*, a microsimulation model for the Leeds labour market which includes household incomes, wealth, taxation and welfare benefits. In section 4 we look at the policy implications of such a model, presenting a small number of *what-if* scenarios as an illustration of the power of the technique. Some concluding comments are offered in section 5.

2. Income, wealth and labour markets

> By far the greatest part of the social and economic needs of inner city residents will not be met by urban specific policies but by mainline housing, health, income support and education provision
>
> (Edwards, 1995:701)

The above quote from Edwards (1995) suggests an agenda for urban and regional planning based on social policies rather than area-based policies. He suggests that the allocation of extra resources for areas deemed to be deprived may only ever lead to cosmetic improvements. Thus he calls for an alternative research agenda based on individual households and their incomes (earned or received as transfer payments). Thus he continues:

> Inner city residents and the urban poor do receive most of their welfare by way of mainstream programmes and we know precious little about the effectiveness of such programmes either in targeting the deprived, spatially or otherwise, or in providing for the (sometime) multiplicity of needs or the different or additional needs that may be found within individual households.
>
> (Edwards, 1995)

The aim in the rest of this paper is to begin to spell out such a research agenda based on microsimulation. The first step (1) in such an agenda is the estimation of household income. Green (1998) suggests that geographers and planners have devoted much less attention to the analysis of earnings and incomes than have economists. There are some notable exceptions. Birkin and Clarke (1989) modelled small-area incomes using microsimulation and this provides a useful starting point for us to build on in this paper. They modelled earned income and income from the two major transfer payments of unemployment benefit and state pension. More recently, Bramley and Lancaster (1998) also developed a small area income model based largely on the number of workers in a household, economic activity (particularly working versus non-working households) and household tenure. They present their results for postal sectors in Edinburgh.

The next stage (2) in the modelling procedure is to increase the number of welfare entitlements included in the model structure. Although unemployment benefit (now termed job seekers allowance) and state pensions are the two most important welfare payments there are many others which make a considerable difference to household income. Thus, it would also be useful to include:

- statutory sick pay/ incapacity benefits
- severe disablement/invalid payments

- maternity benefits
- widows benefit
- child benefit
- income-support
- family credit
- housing benefit
- council tax benefit

Studies of the distribution of these benefits simply do not exist. We explore just a few examples of this in section 4.

A more detailed exposition of household income (including these additional benefits) would then allow us to explore taxation issues in more detail, again an area under-researched in geography (stage 3). A notable exception here is the works of Higgs (1994) and Longley *et al* (1996). They examined the impacts of changes to the council tax in small-areas of Cardiff. This was a rare example of impact assessments relating to tax and benefits at the small area level.

Such a model of income, welfare and taxation would allow us to paint a new picture of small area social geographies. Interestingly, the New Policy Institute and the Joseph Rowntree foundation (Howarth *et al*, 1998) propose a new set of deprivation indicators based on household poverty, wealth and social exclusion. These are of great interest here and provide a useful alternative to traditional census based proxies for income and welfare such as car ownership and household tenure. Table 1 lists these indicators. A major aim of the microsimulation model must be to attempt to estimate these indicators at the household level (which can then be aggregated to whatever spatial scale deemed to be most useful).

Stage 4 in the process is to include more variables relating to household wealth. Caldwell *et al* (1998) review the geography of wealth and show how a US microsimulation model has already included many variables relating to assets and debts (see table 2). The task is now to translate this work in the US to British cities and regions.

The compilation of such household data sets offers not only the framework of a new type of social geography, it also offers a very powerful framework for what-if modelling. Changes to tax rates or changes to rules governing benefit payments are common tools used by the Chancellor to raise Government incomes and are thus crucial elements of any Government's economic and social policies. Such changes however provide dramatic differences to household incomes. The Low pay Unit (1999) remind us that between 1983 and 1995 tax as a percentage of gross household income fell from 41% to 36% for the top 20% of earners, but rose from 27% to 39% for the bottom 20% of earners. These dramatic changes in income, and their multiplier effects, have rarely been studies below the national level. A notable exception is the work of Hamnett (1997). He examined the regional impacts of the Conservative's 1988 higher rate tax cuts. Not surprisingly perhaps the southeast was estimated to be the major winner of this reallocation of finances.

Indicator (latest year in brackets) (Economic	Trend over medium term	Trend over last year
Income		
Gap between low and median income (1996/1997)	Improving	Worsening
Individuals with half av income (1996/7)	Improving	Worsening
Intensity of low income (<40% of av income 1996/7)	Steady	Worsening
Long-term recipients of benefits (1997)	Worsening	Steady
Individuals with spells of low income (1994)	Steady	Steady
Self-reported difficulty managing financially (%, 1996)	Improving	Improving
Children		
Children living in workless households (1997)	Steady	Steady
Children in households with <half income	Improving	Worsening
Low birth-weight babies (% 1996)	Worsening	Steady
Young adults		
Unemployed (1997)	Improving	Improving
On low rates of pay (1998)	Steady	Improving
On severe hardship payments (16/17 yr olds, 1997)	Worsening	Improving
Without a basic qualification (19 yr olds, 1996)	Improving	Improving
Adults aged 25 to retirement		
Individuals wanting paid work (1997)	Improving	Improving
Households without work for 2 yrs or more (1998)	Worsening	Steady
On low rates of pay (1998)	Steady	Improving
Insecure in employment (1997)	Worsening	Worsening
Without access to training (1997)	Steady	Steady
Older people		
Pensioners with no private home (1995/6)	Steady	Improving
Spending on essentials (1996/7)	Steady	Steady
Limiting long-standing illness or disability (1996)	Worsening	Worsening
Communities		
Polarisation of work (%, 1996)	Steady	n/a
Lacking a bank/building society account (1995/6)	n/a	Improving
Homes lacking central heating (1996/7)	Improving	Improving
Overcrowding	Improving	Improving

Table 1 – Summary of NPI povert and Social Exclusion indicators, Source: The New Review Mar/Apr 1999 (after Howarth *et al*, 1998)

Real assets	
Home (primary residence)	Business assets
Other real estate (including second homes)	Vehicles
Financial assets	
Stocks and mutual funds	Individual retirement accounts
All bonds	Whole life insurance
Checking and savings accounts	other financial assets
Certificates of Deposit	
Debts	
Mortgages on primary residence	All other debt
Other mortgages	

Table 2 – Assets and debts in the CORSIM wealth module, (after Caldwell et al, 1998)

A typical budget, however, does not simply influence tax rates. At the last budget in 1999 there were five major changes:

1) introduction of the minimum wage
2) introduction of working families tax credit
3) increases in child benefit
4) new 10p tax rate on first £1500 of earned income
5) changes in national insurance contributions

All these changes will have major implications for household incomes in certain areas. However, such changes are rarely worked through at the small area level. They do, however, provide a major research agenda and challenge in urban and regional modelling. We take up this challenge in the rest of the paper.

3. A microsimulation approach to social policy analysis

3.1 What is microsimulation

Microsimulation is a methodology aimed at building large-scale data sets on the attributes of individuals or households and on the attributes of individual firms or organisations and at analysing policy impacts on these micro-units (Orcutt *et al*, 1986; Birkin and Clarke, 1995; Clarke, 1996). Because microsimulation models are concerned with the behaviour of micro-units (such as households or firms) they are especially well suited to estimate and analyse the distributional impacts of policy changes (Mertz, 1991). Further, microsimulation modelling frameworks provide the possibility of defining the goals of economic and social policy, the instruments employed and also the structural changes of those affected by socio-economic policy measures (Krupp, 1986).

As Clarke (1996) points out, in essence there are two major procedures to be carried out in microsimulation modelling. The first is the construction of a micro-data set. This can be a population of individuals or households or firms in a city or region along with their associated characteristics. This procedure usually involves the use of contingency tables or conditional probability analysis to estimate chain conditional probabilities. In particular, conditional probabilities are calculated from available known data and then they are used to reconstruct detailed micro-level populations. This process can be clarified with the use of an illustrative example related to the labour market. Lets assume that we wish to investigate the relationships between sex (*S*), age (*A*), educational qualifications (*Q*), economic position (*EP*) and socio-economic group (*SEG*) for a given population group X in location *i*. From the 1991 Census of the UK population we can obtain for the population in a specified area (e.g. at the ward level) separate tabulations of:

- sex by age by economic position (Small Area Statistics table 08)
- level of qualifications by sex (Small Area Statistics table 84)
- socio-economic group by economic position (Small Area Statistics table 92)

From these tabulations we could calculate the respective conditional probabilities, and then our problem would be to estimate the probability:

- $p(x_i, S, A, Q, EP, SEG)$

given a set of constraints or known probabilities:

- $p(x_i, S, A, EP)$
- $p(x_i, Q, S)$
- $p(x_i, SEG, EP)$

There are a number of ways to solve this problem such as linear programming models, discrete choice models, balancing factor methods in spatial interaction models (Wilson, 1970) and Iterative Proportional Fitting techniques (Birkin, 1987; Clarke, 1996; Fienberg, 1970; Norman, 1999; Williamson *et al*, 1996;Wong, 1992;).

There are also other approaches to microdata generating such as reweighting of a parent sample of microdata, which are available at a different (from the desired) spatial scale (Ballas *et al*, 1999; Williamson *et al*, 1998).

The second stage of the microsimulation procedure is to create a sample of individuals based on the estimated or computed set of probabilities. The creation of such a data set can be achieved by Monte Carlo simulation. Clarke (1996) illustrates how this procedure can be employed for the creation of a micro-level population with the following characteristics: age, sex, marital status and household tenure (see figure 2). Supposing that the age, sex, and marital status of the head of household, is available from the Census, it is possible, using one of the methods mentioned above, to estimate probabilities of household tenure given head of household's age, sex, and marital status (box 2 in figure 2). The first synthetic household in this example has the following characteristics: male head of household, aged 27, married. As it can be seen in box 2 the estimated probability that a household of this type would be owner-occupied is 70%. The next step in the procedure is to generate a random number to see if the synthetic household gets allocated to the owner occupied category. The random number in this example is 0.542 and falls within the 0.001 - 0.700 range needed to qualify as owner-occupied. The same procedure is then carried out sequentially for the tenure allocation to all the synthetic households (Clarke, 1996). It should be noted that the difficult task in microsimulation is to specify which variables are dependent upon others and to determine the ordering of probabilities (*Ibid.*).

The above procedures can be carried out for all the variables we wish to include in a microsimulation model. The advantages and drawbacks of the microsimulation method are presented in table 3 (for more details see Birkin and Clarke, 1995). As can be seen, one of the main advantages of microsimulation is the ability to link data sets from different sources. Figure 4 depicts the data sets that could be linked in the context of a labour market microsimulation model. All these data sources could be used for the generation of a new microdata set which would include attributes from all the original data sets. This microdata set could be then reaggregated to any spatial zoning system. It should be noted that in a microsimulation framework variables are specified as lists rather than matrices, which leads to very efficient data storage. In addition, data storage, manipulation and analysis can become even more efficient when an object-oriented approach to microsimulation modelling is adopted (Ballas *et al*, 1999). One of the biggest drawbacks of microsimulation frameworks is the difficulty in validating the model outputs, since microsimulation models estimate distributions of variables which were previously unknown. However, one way of validating microsimulation model outputs is to reaggregate estimated data sets to levels at which observed data sets exist and compare the estimated distributions with the observed.

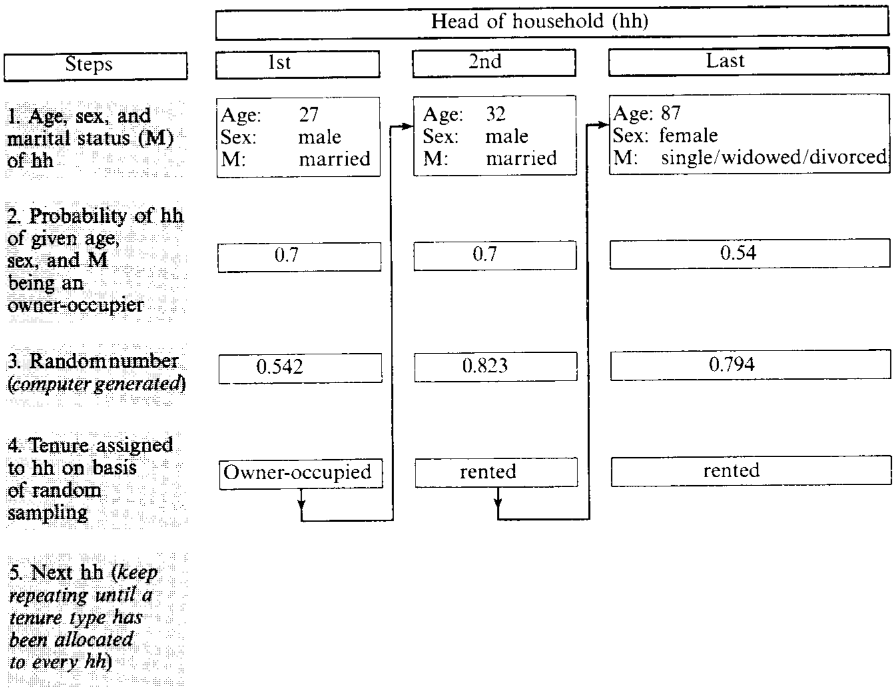


Figure 1 - An example of the microsimulation process: tenure allocation procedure (after Clarke, 1996:3)

Advantages	Drawbacks
Data linkage	Difficulties in calibrating the model and validating the model outputs
Spatial flexibility	Large requirements of computational power
Efficiency of storage	
Ability to update and forecast	

Table 3: Advantages and drawbacks of microsimulation

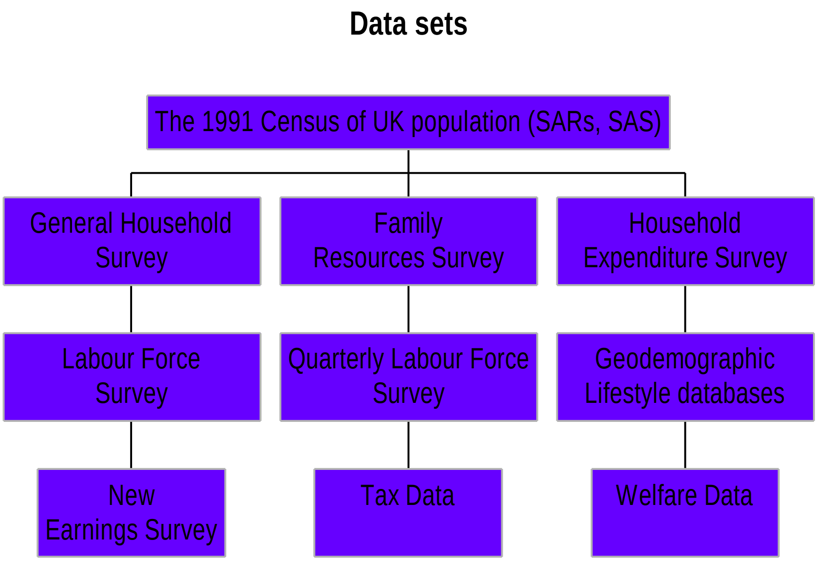


Figure 2 - Data sets that can be linked in a socio-economic microsimulation framework

3.3 SimLeeds: A spatial microsimulation model for Leeds

As aforementioned, the aim of this paper is to argue the case for a microsimulation approach to social policy impact analysis at the small area level. In this section we present *SimLeeds*, which represents a micro-analytical spatial modelling approach to social and regional policy analysis and to the prediction of the impact of major new expenditure injections into regional economies (such as area-based policies), as well as of the impact of national social policies.

As seen in the previous section, microsimulation techniques can be used to combine data from different sources and to reconstruct detailed micro-level populations. Therefore, they can be used to combine detailed microdata sets such as the Samples of Anonymized Records (SARs) with less detailed but more spatially disaggregated data sets, such as the 1991 Census Small Area Statistics (SAS), in order to build a micro-level population. The SARs are samples of individual census records, which are anonymized in various ways to ensure that there is no breach of the confidentiality of the census and that no individual can be identified from the data (Middleton, 1995) and they are released at the national and regional scale.

Microsimulation frameworks have the advantages of a list-based approach to microdata representation. In such frameworks variables are treated as lists rather than matrices. For instance, in the context of a microsimulation approach a household or an individual has a list of attributes which are all stored as lists rather than as occupancy matrices (Clarke, 1996). From a computer programming perspective, the household or individual can also be seen as an object with its associated object variables (attributes). Therefore, it can be argued that an *object-oriented* language such as *JAVA* or *C++* is most suitable for microsimulation modelling. In the context of this paper we used *SimLeeds,* which is a spatial microsimulation model, built in JAVA for the Leeds urban system. *SimLeeds* is a product of on-going research and uses different approaches to conditional probability analysis for microsimulation modelling. In particular, it provides different options of microsimulation modelling ranging from Iterative Proportional Fitting (IPF) based microsimulation to *Simulated Annealing* reweighting approaches (for more details on the different methodologies employed by *SimLeeds* see Ballas *et al*, 1999). The nature and number of the variables of the household or individuals modelled by *SimLeeds* depend on the selected modelling method and on the needs of the user. They also depend on time constraints, given that microsimulation modelling is highly computationally intensive.

In the context of this paper we used *SimLeeds*, to analyse and combine conditional probabilities derived from the SARs and the SAS and to build a micro-population on the basis of random sampling from these probabilities. In particular, the outputs of *SimLeeds* were based on maximum likelihood estimates of conditional probabilities for the individual attributes of interest. These estimates were obtained with the application of the Iterative Proportional Fitting (IPF) technique on data from the Samples of Anonymised Records and from the Small Area Statistics (for more details on this methodology see Ballas *et al*, 1999). Moreover, the analysis micro-units were the household and the individual and the variables that were selected in the context of this paper are listed in table 4.

Micro-unit attributes
Location (place of residence) at the ED level.
Age
Sex
Marital Status
Tenure
Employment Status
Industry (SIC)
Number of dependent children
Number of qualifications
Estimated earned income

Table 4 – *SimLeeds* variables

Further, figure 3 depicts the estimated spatial distribution at the ED level of households classified as *professionals* that are *owner occupiers* and *have no dependent children*, while figure 4 shows the estimated distribution of households of the same social class that have *one dependent child*.

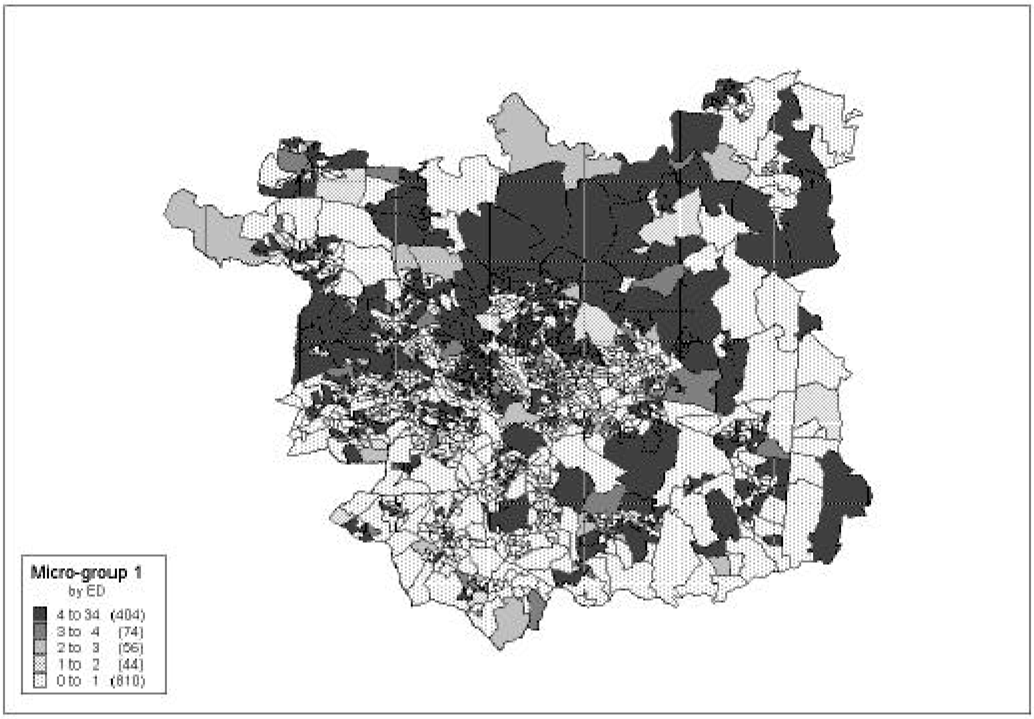


Figure 3- Spatial distribution of professionals, owner occupiers with no dependent children in Leeds Metropolitan District.

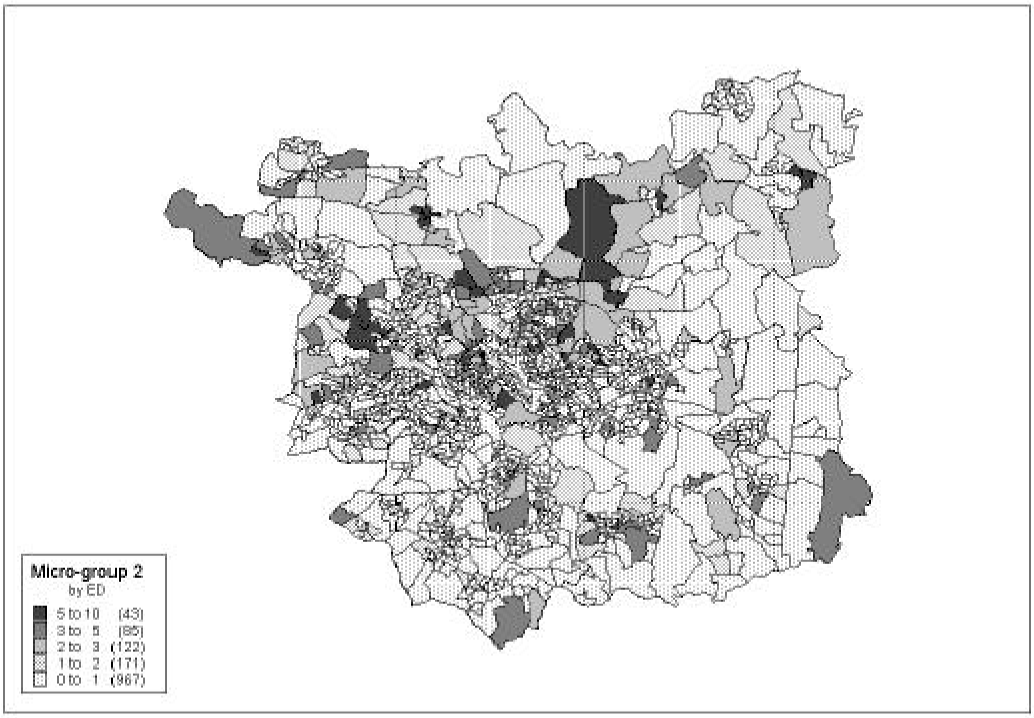


Figure 4 – Spatial distribution of professionals, owner occupiers, with one dependent child in Leeds Metropolitan District.

On the other hand, figure 5 depicts the estimated geographical distribution of *unskilled* households that live in rented accommodation and have no dependent children, whereas figure 6 shows the estimated spatial distribution of the *unskilled* households that live in rented accommodation and have 1 dependent child.

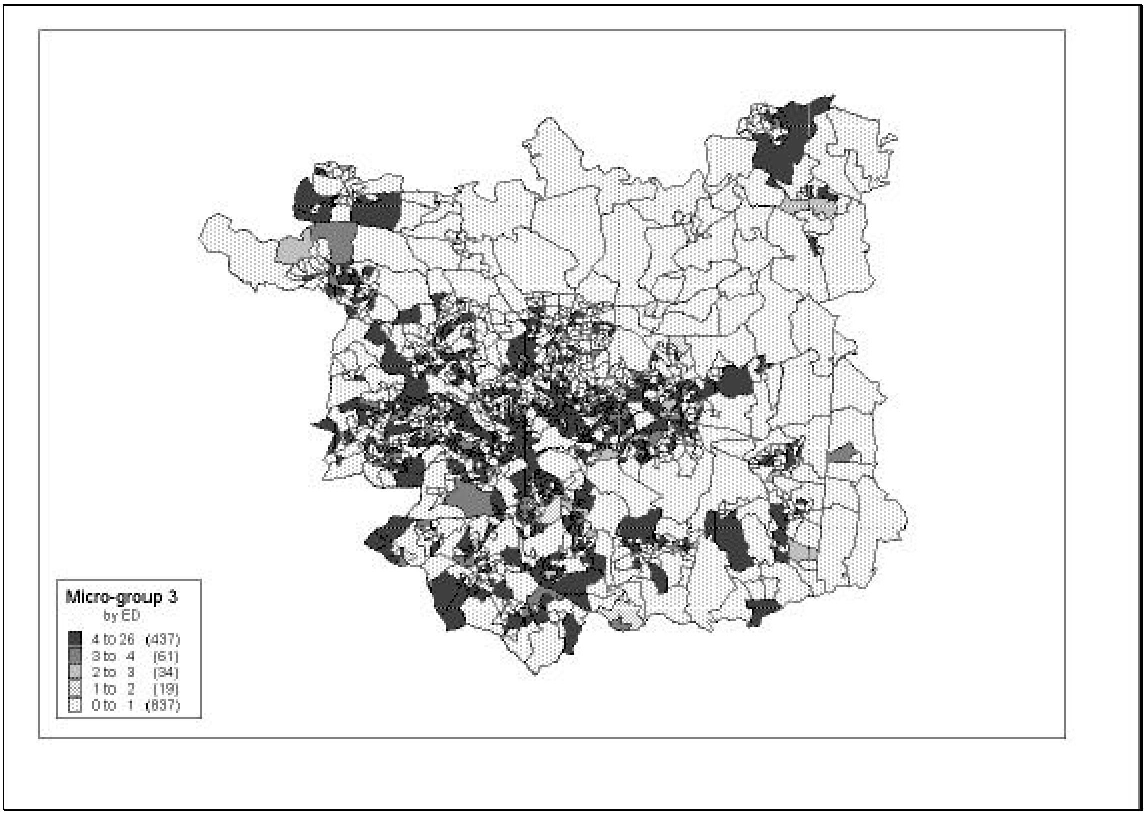


Figure 5 – Spatial distribution of *unskilled* households in rented accommodation, with no dependent children in Leeds Metropolitan District.

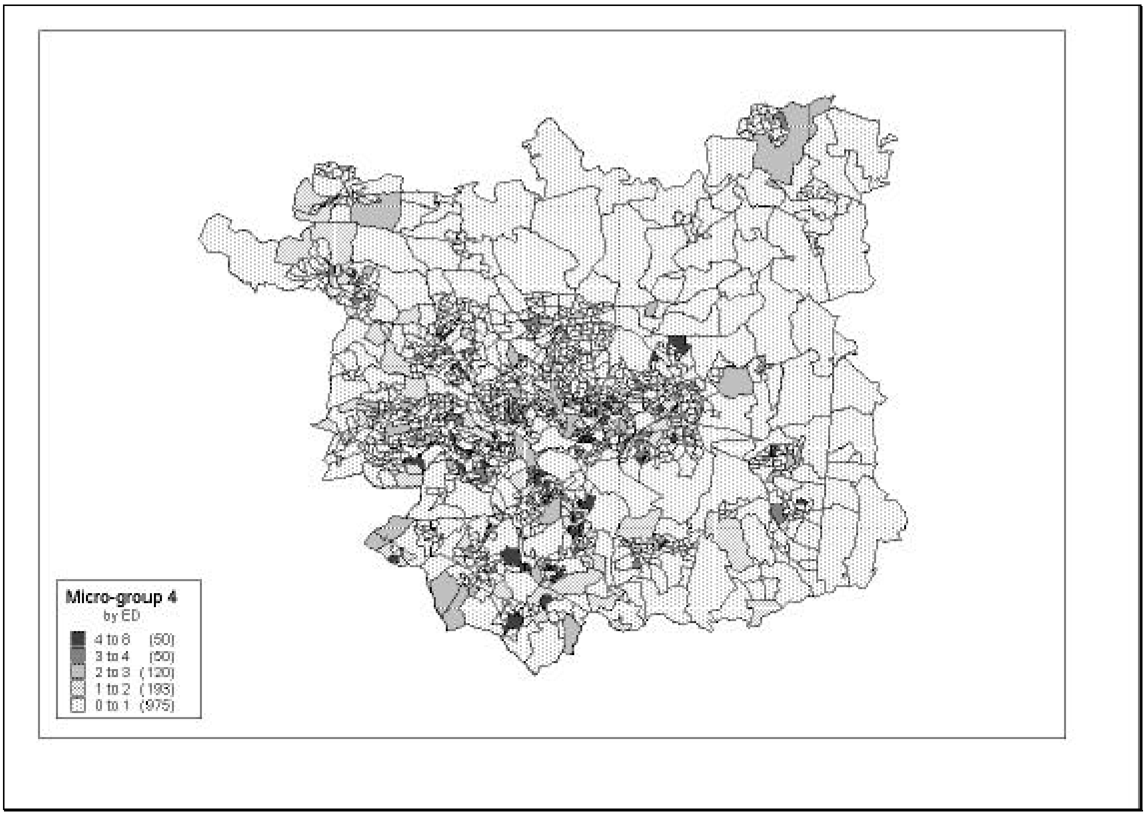
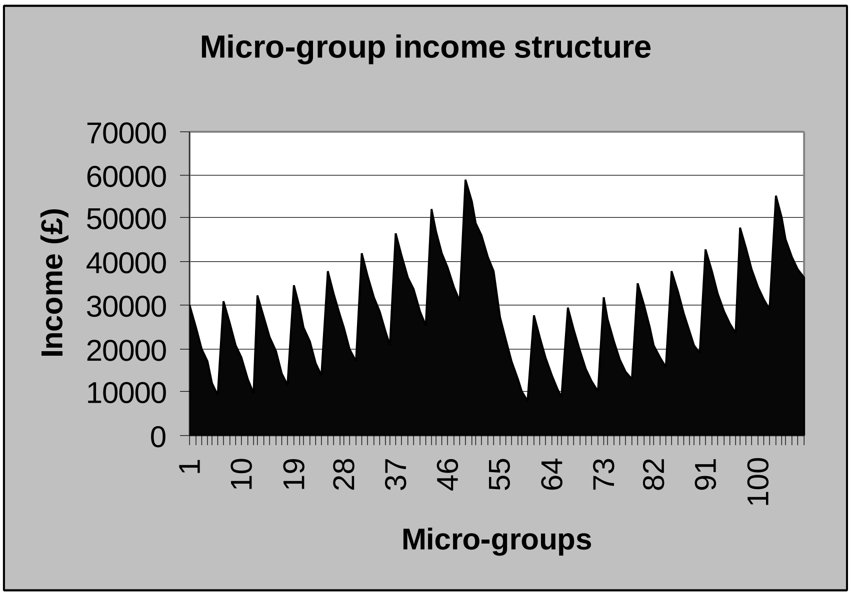


Figure 6 - Spatial distribution of Spatial distribution of *unskilled* households in rented accommodation,



with one dependent child in Leeds Metropolitan District.

Figure 7 – The hypothetical income structure of SimLeeds micro-groups

In the context of this paper we estimated the earned income of each household on the basis of the estimated household attributes. In particular, we made some assumptions about the total income that each different micro-group of our geographical database earns (see figure 7) and we generated the spatial distribution of earned income at the ED level. This distribution is depicted in figure 8 for the Leeds Metropolitan District, whereas figure 9 shows the distribution of income per household, giving a better account of the spatial dimensions of income inequalities in Leeds. As can be seen, the most affluent localities are concentrated mostly in the north of the city. However, it is interesting to see what are the earned income spatial patterns in inner Leeds areas. For instance, figure 10 depicts the distribution of income per household in the inner Leeds electoral wards of *Headingley*, *University* and *City and Holbeck*. It is noteworthy that the northern parts of Headingley and City and Holbeck seem to be more affluent than the other localities. Moreover, the same could be argued for the east and West areas of University. Therefore, there is considerable variation in the distribution of income not only at the intra-urban but also at the intra-ward spatial level.

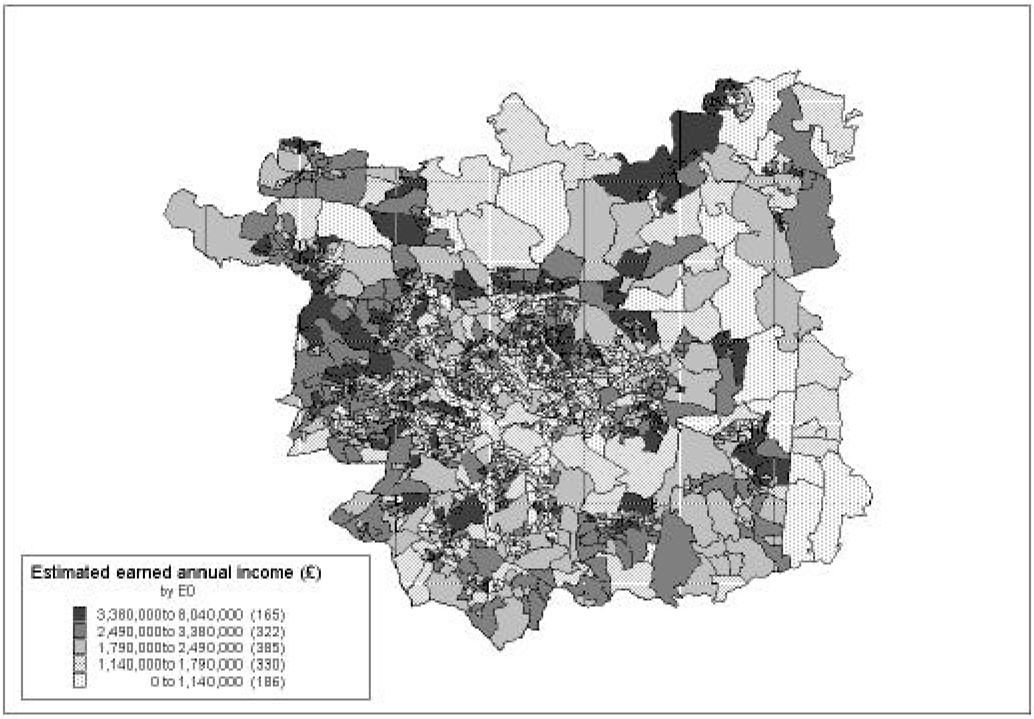


Figure 8 - Spatial distribution of total earned income by households in Leeds Metropolitan District.

Nevertheless, it has to be noted that the above income estimates are relatively crude and can become more realistic if some kind of survey (e.g. the New Earnings Survey) is used to formulate the assumptions about the earned income of each micro-group. In addition, the analysis can be enhanced if the income generated from other sources is taken into account (see for instance Caldwell *et al*, 1998).

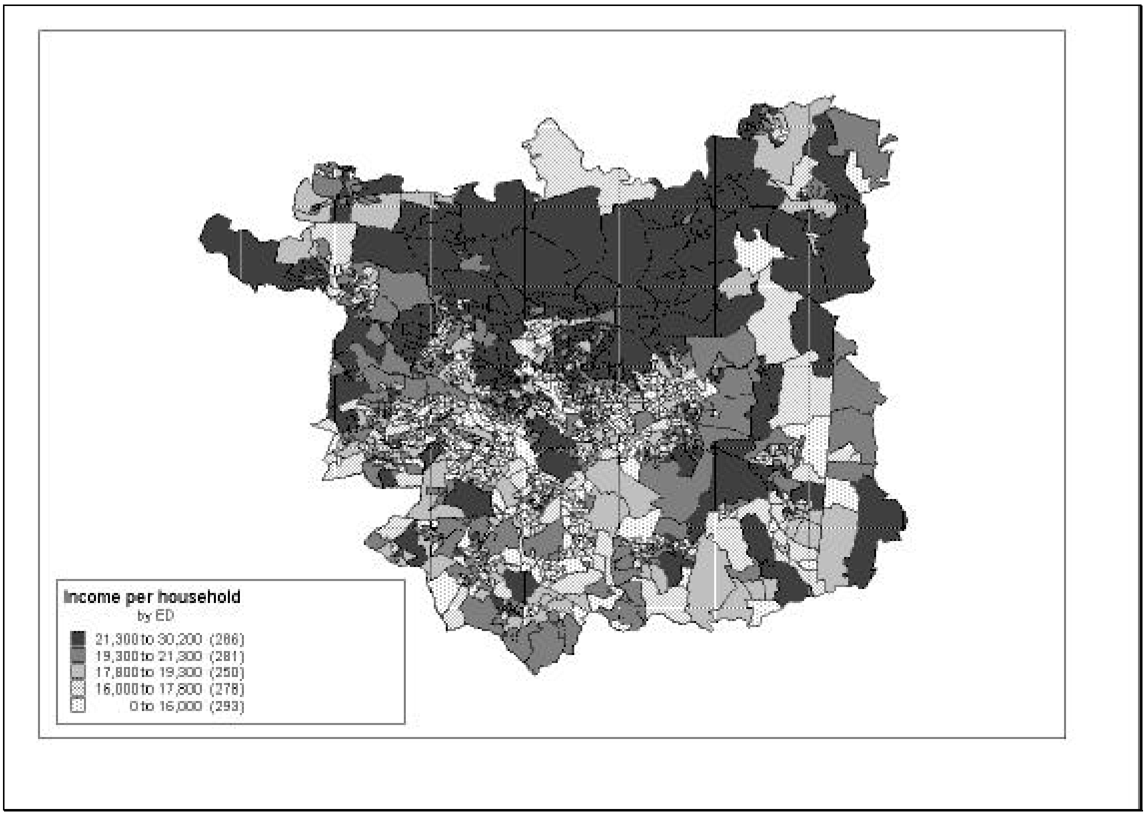


Figure 9 - Spatial distribution of estimated income per household.

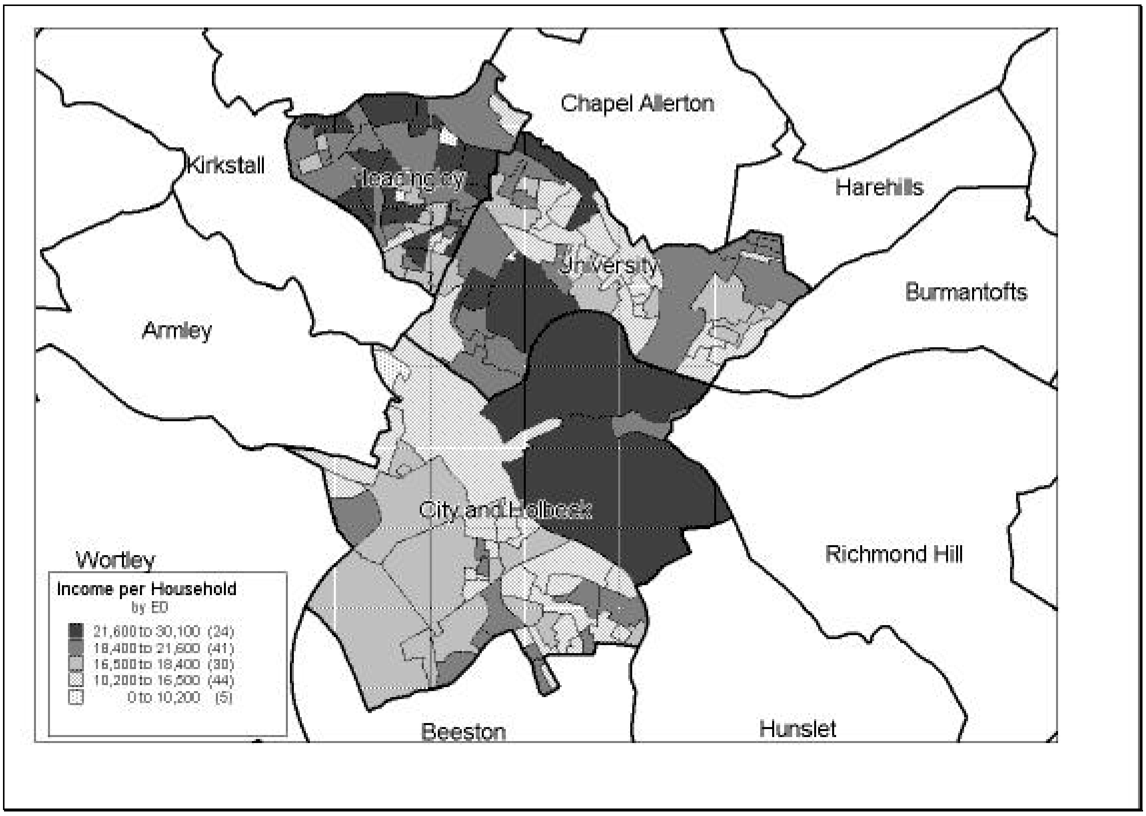


Figure 10 - Spatial distribution of estimated income per household in inner Leeds electoral wards.

Model outputs such as the above can be utilised for the spatial analysis of major national social policies. In the next section we give some examples of how this kind of analysis can be performed.

3.3 *What-if* micro-spatial social policy analysis

3.3.1 Introduction

In this section we use *SimLeeds* to model the possible impact of national social policies at the small area level. In particular, we first examine the spatial distributional effects of a possible change in the *income tax* policy. We then examine the micro-spatial impact of a change in the *Child Benefit* policy. Finally, we explore the spatial distribution of the *New Deal* policy target population group.

3.3.2 Modelling a change in *Income Tax*

The level of income tax rate for each taxpayer depends on his/her income level. In this section we examine the spatial impact of a change in these rates. Table 5 shows the different bands of taxable income for the tax year 1999-2000.

Bands of taxable income (£)	1999/2000
Lower rate – 10%	£0-£15,000
Basic rate – 23%	£15,001-£28,000
Upper rate – 40%	Over £28,001

Table 5 – Source: Welfare Benefits Handbook (1999:p. 1:xxix)

As seen in the previous section there are considerable variations in the estimated distribution of income between different socio-economic groups and localities. Having estimated the earned income for each different household type we can compute the tax paid by each household in each locality. Figure 11 shows the estimated spatial distribution of tax paid from all households at different localities (EDs) in Leeds. Further, figure 12 shows how this distribution would change if the tax rates were altered, under a more progressive tax policy, to these depicted in table 6.

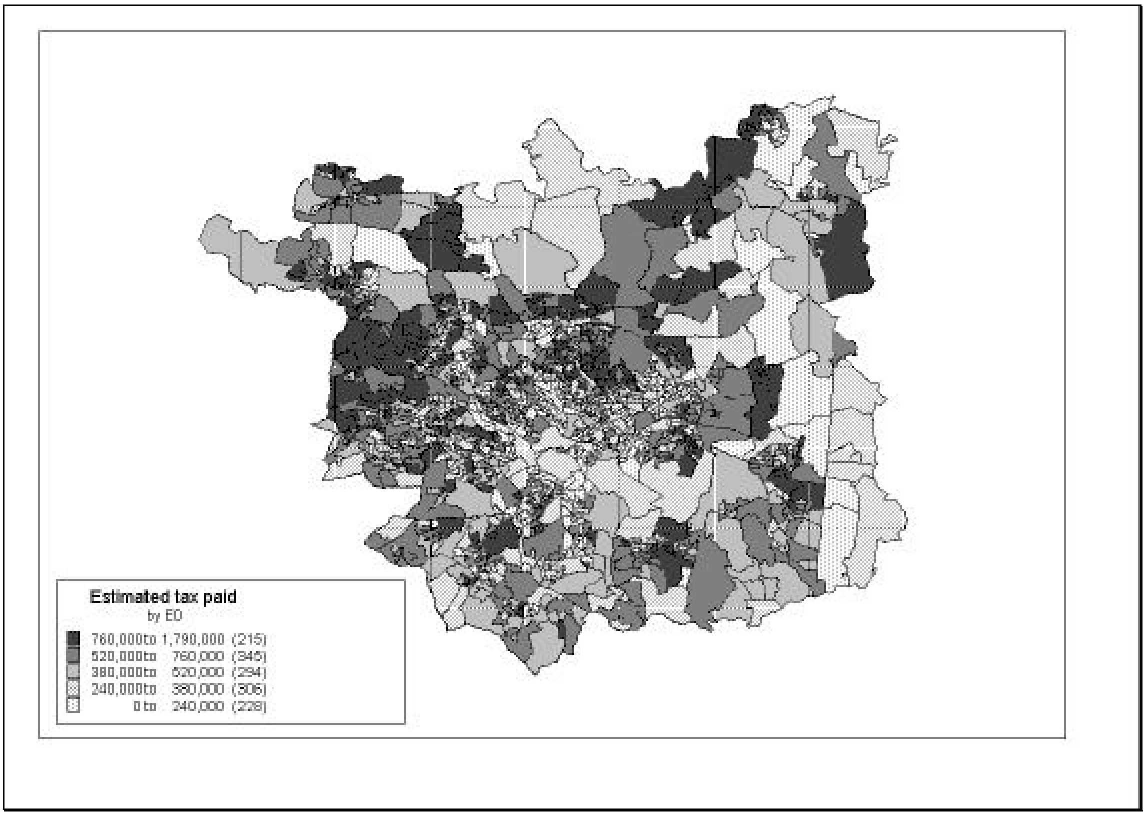


Figure 11 - Spatial distribution of estimated total income tax paid in Leeds Metropolitan District.

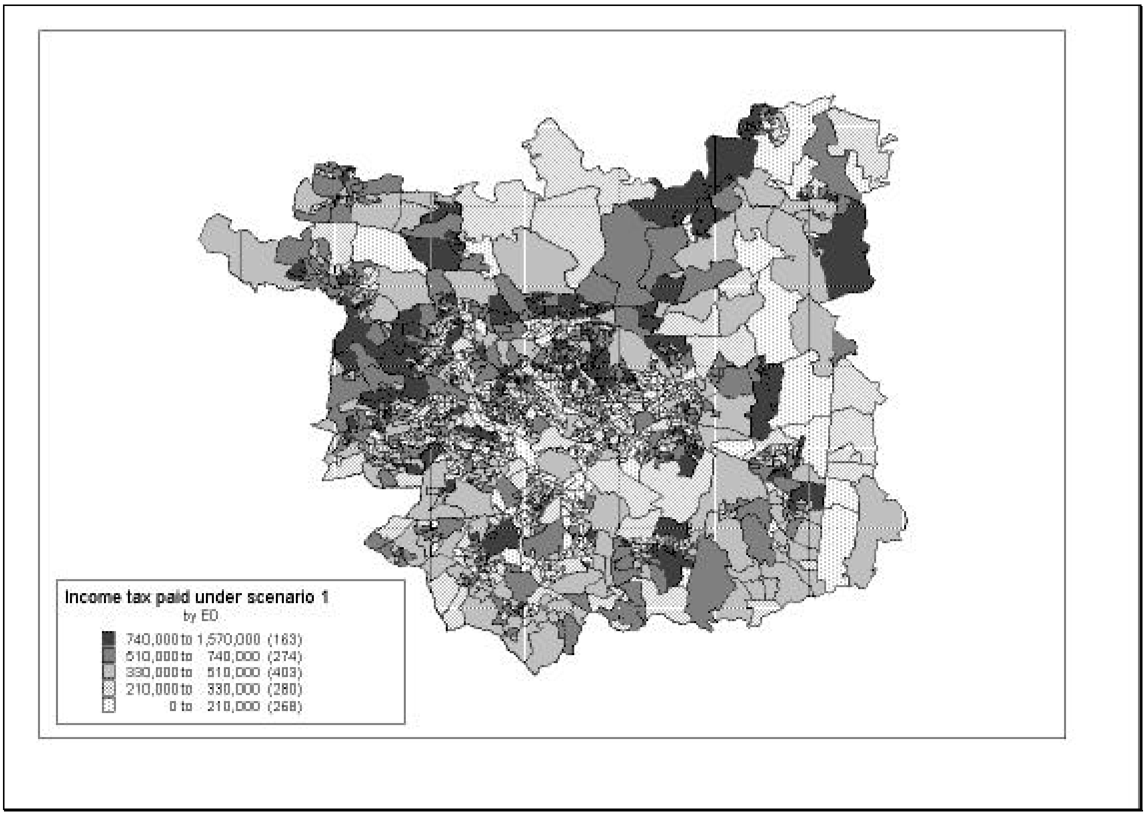


Figure 12 - Spatial distribution of total income tax paid under scenario 1

In contrast, figure 13 depicts the income tax spatial distribution if a less progressive tax policy scenario was adopted (see table 7).

Bands of taxable income (£)	Scenario 1
Lower rate – 5%	£0-£15,000
Basic rate – 20%	£15,001-£28,000
Upper rate – 43%	Over £28,001

Table 6 - Tax rates under scenario 1

Bands of taxable income (£)	Scenario 2
Lower rate – 10%	£0-£15,000
Basic rate – 20%	£15,001-£28,000
Upper rate – 30%	Over £28,001

Table 7– Tax rates under scenario 2

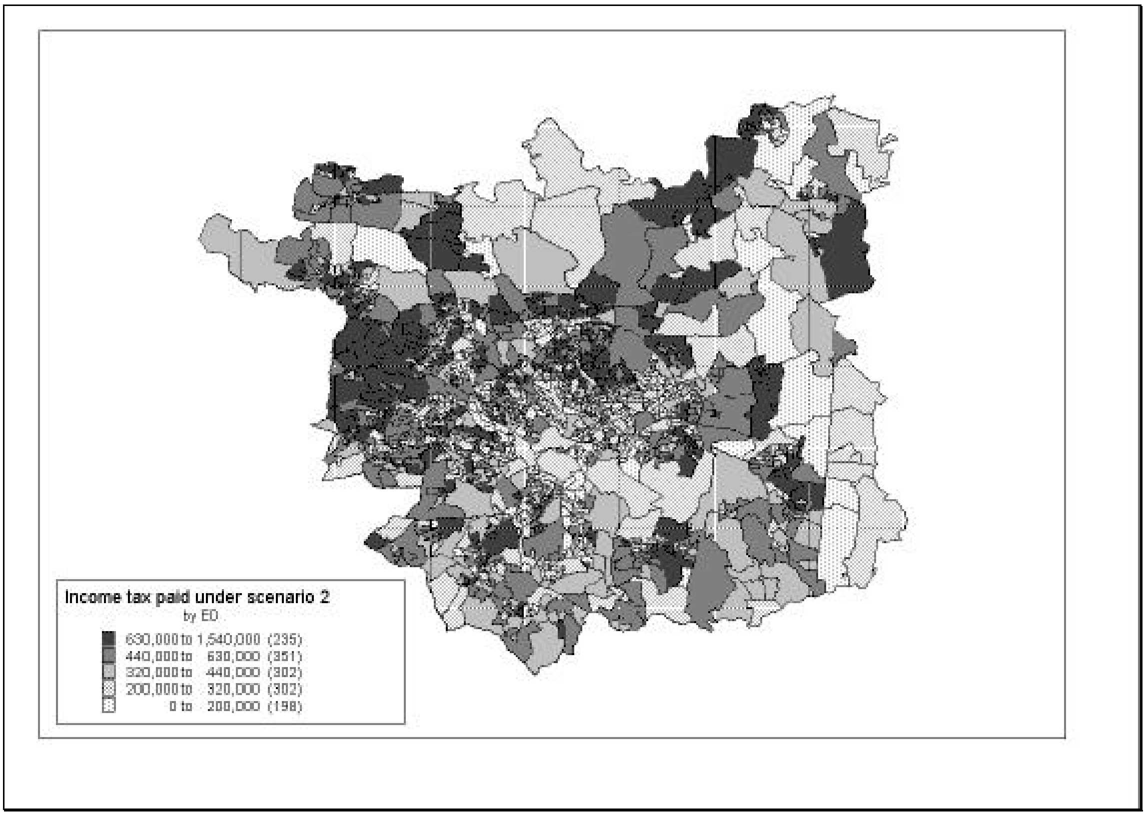


Figure 13 - Spatial distribution of total tax paid under scenario 2.

In addition, figures 14 and 15 depict the difference between the tax paid in each locality *before* and *after* the potential scenario 1 and scenario 2 policy changes respectively.

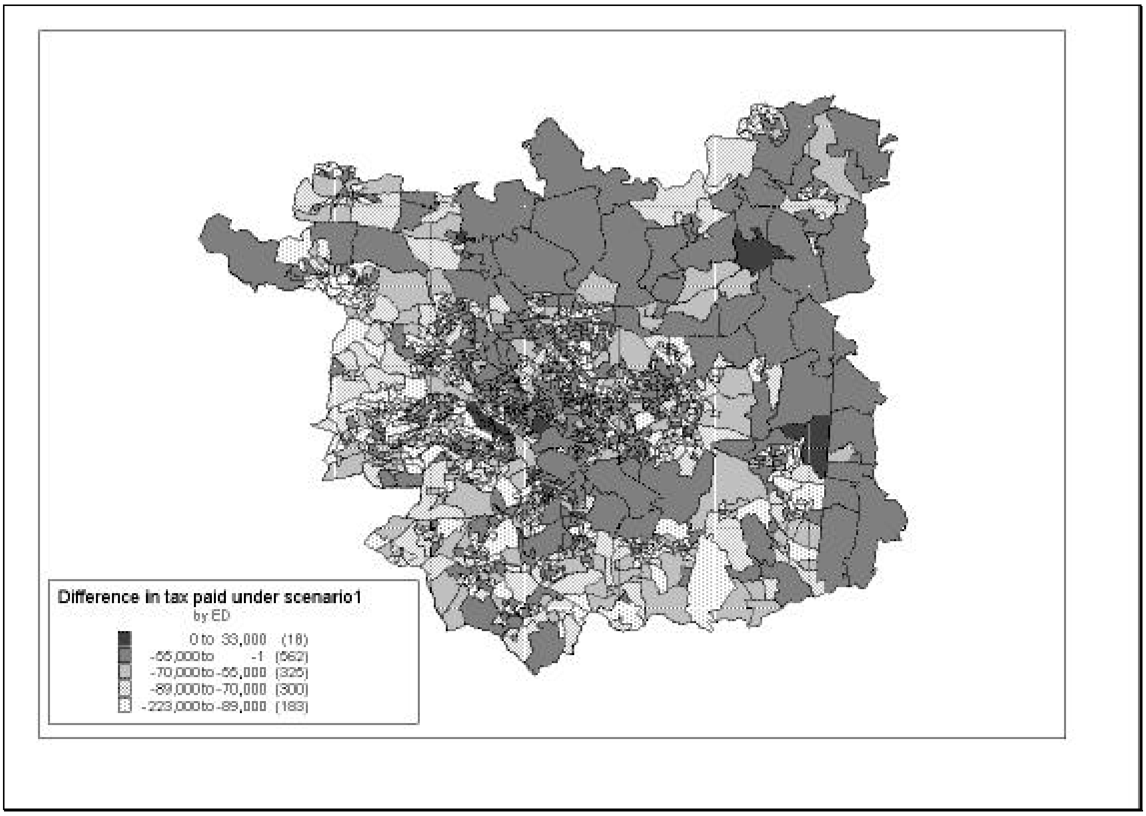


Figure 14 - Spatial distribution of difference in tax paid under scenario 1.

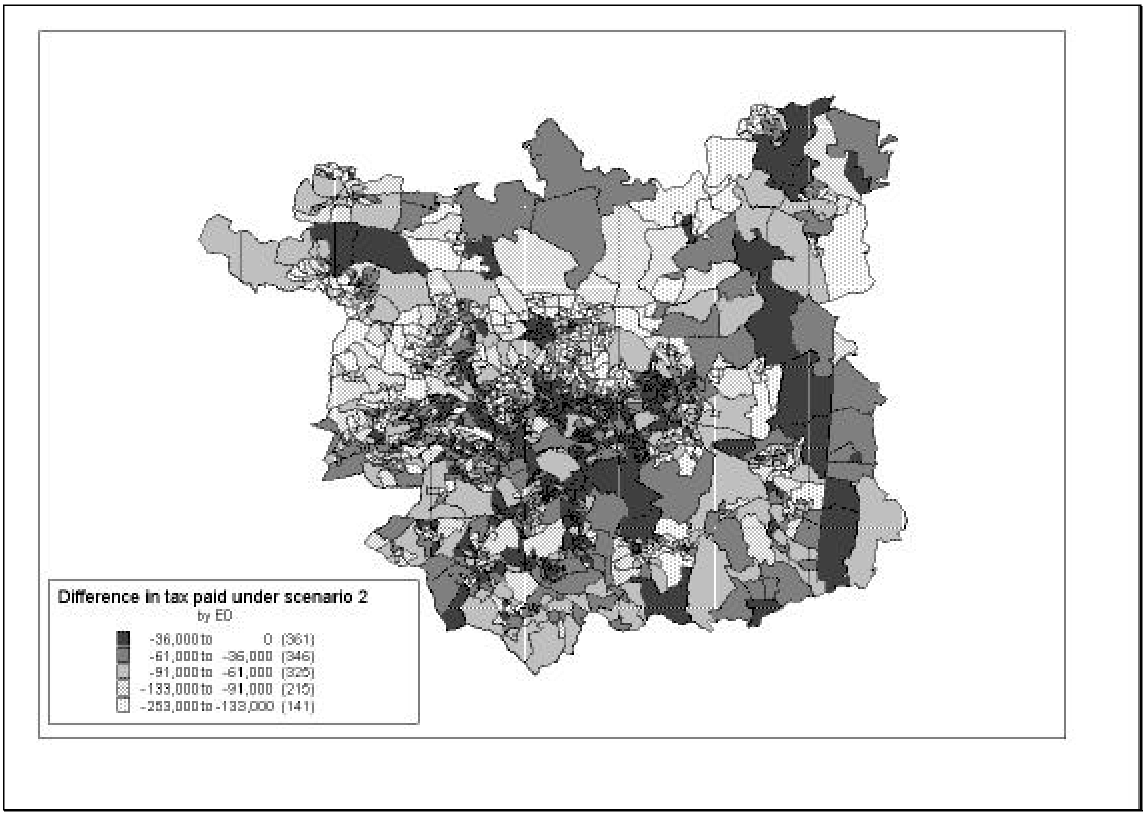


Figure 15 - Spatial distribution of difference in tax paid under scenario 2.

As can be seen in figure 14, there would be 18 localities that would pay more tax if scenario 1 was adopted. In contrast, there would be 183 enumeration districts that would have to pay significantly less income tax. These localities are mostly concentrated in the south of Leeds, whereas the areas that would be benefited less from the scenario 1 policy change are mostly located in the north of the city. On the other hand, the picture would be much different if scenario 2 was adopted. As can be seen in figure 15 all areas would have to pay less income tax under this scenario. However, the localities that would have the most significant gains under scenario 2 are concentrated mostly in the affluent north of the city.

It should be noted that the above changes in the income tax paid would have different local multiplier effects on each locality. In particular, lowering the tax level that specific households have to pay would mean higher disposable income levels for them with subsequent increases of local demand in the various localities. These changes would possibly lead to further changes in consumer preferences and to further multiplier effects. The latter can be addressed and analysed in spatial microsimulation frameworks (Ballas and Clarke, 1999). On the other hand, the scenario 1 policy change in the bands of taxable income would possibly provide a disincentive for high-income households to increase their earnings and consequently to a possible decrease of demand from these households (with subsequent negative multiplier effects) and to a potential loss of government revenues from taxes (for a more detailed discussion of taxation and incentives see James and Nobes: 48-72; Blundell, 1992). The volume of the impact of this disincentive on the high-income households' behaviour would depend on their characteristics and it could possibly be modelled in a microsimulation framework.

It should be noted that the above geographical analysis of tax policy can be expanded with the use of more detailed information on taxation (for instance, information from sources such as the Tax Framework Finance Act, 1997).

3.3.3 Modelling the *Child Benefit* policy

Another social policy area in which *SimLeeds* can be employed for spatial socio-economic impact analysis is the *Child Benefit.* According to the Welfare Benefits Handbook (vol.1, 1999) child benefit is a benefit paid to people who are responsible for a child. A higher amount of benefit is paid for the eldest eligible dependent child and the amount of benefit paid is £14.40 per week (standard rate) for the eldest child and £9.60 per week for each other child.

As seen above, there are interesting differences in the spatial distribution of different household groups with dependent children. Figure 16 focuses on the inner Leeds area and depicts the spatial distribution of skilled manual workers who live in rented accommodation and have 3 dependent children. As can be seen there are relatively large concentrations of this socio-economic group in the localities located in south *City and Holbeck*. It is noteworthy that these areas have relatively high concentrations of council houses and, as seen in the income analysis above, they are low-income areas.

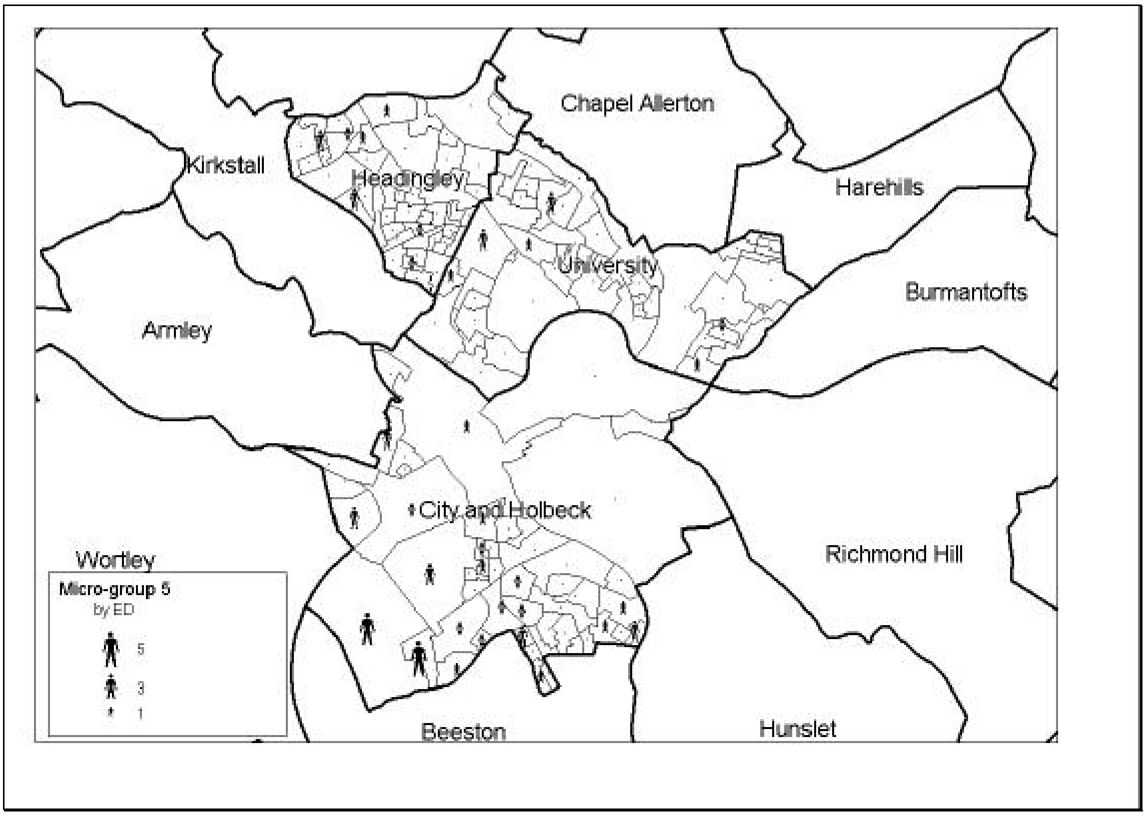


Figure 16 – Spatial distribution of skilled manual workers, in rented accommodation with 3 dependent children in inner Leeds.

Further, figure 17 shows the spatial distribution of the estimated total child benefit paid out weekly in inner Leeds. This estimate was based on the number of children of each different household type and using the current official child benefit that is £14.40 per week. As it was the case with the income tax policy, we could use our model outputs to examine the potential spatial impact of an increase or decrease of the child benefit. Clearly, the localities that have the highest paid child benefit would be affected the most.

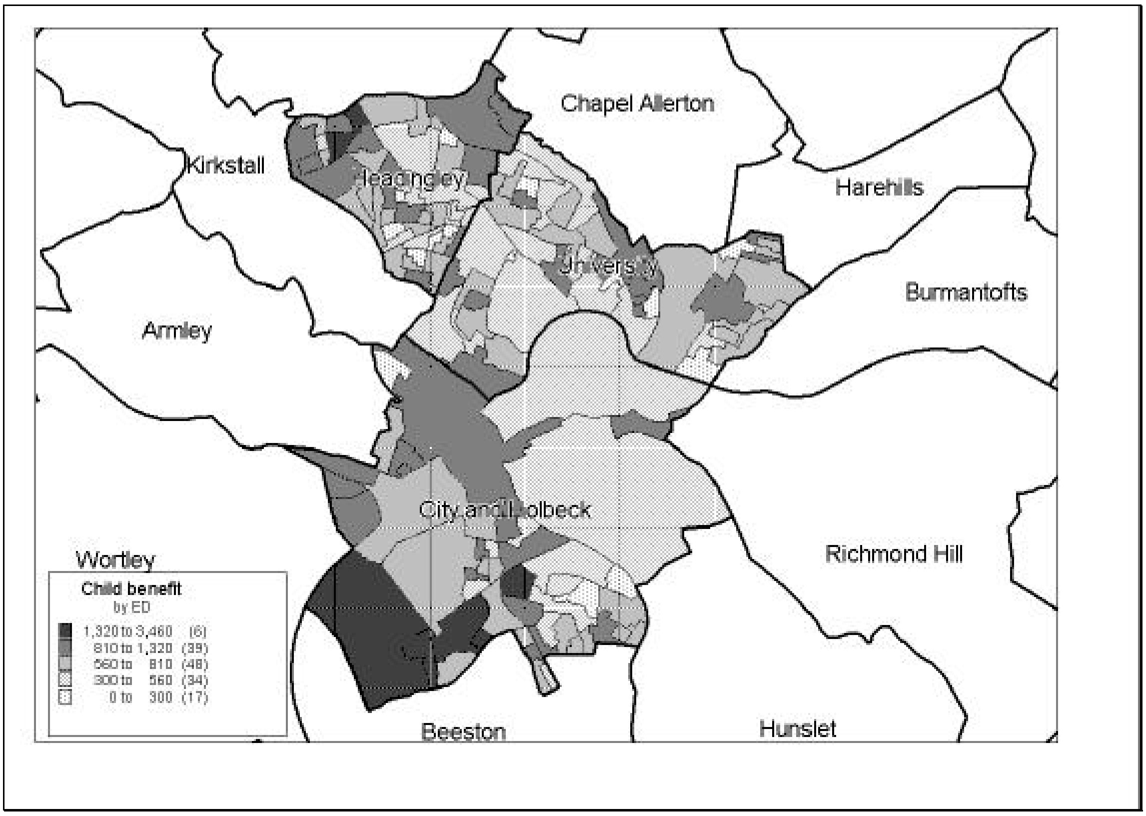


Figure 17 – Estimated spatial distribution of Child Benefit in inner Leeds.

However, if we assumed that the policy maker wanted to increase the child benefit for a specific socio-economic group then the spatial impacts of this policy change would be much different depending on the spatial distribution of these groups. For instance, if we assume that the child benefit for the unskilled workers (for the eldest eligible child) socio-economic group was increased to £20 per week then we could predict the possible spatial impact of this change. Figure 18 depicts the estimated spatial distribution of the increase in benefits that would result from such a policy change. This kind of modelling can provide insights to the design of social policies so that they can take the spatial implications into account. In this context, social policies can be the alternative to traditional area-based policies. In particular, if the national or local authority decides that it wants to help specific localities within the city this can be done with spatially oriented social policies rather that with traditional urban regeneration schemes and other area-based policies. Spatial microsimulation modelling frameworks can provide the basis for the design, testing and application of geographically oriented social policies.

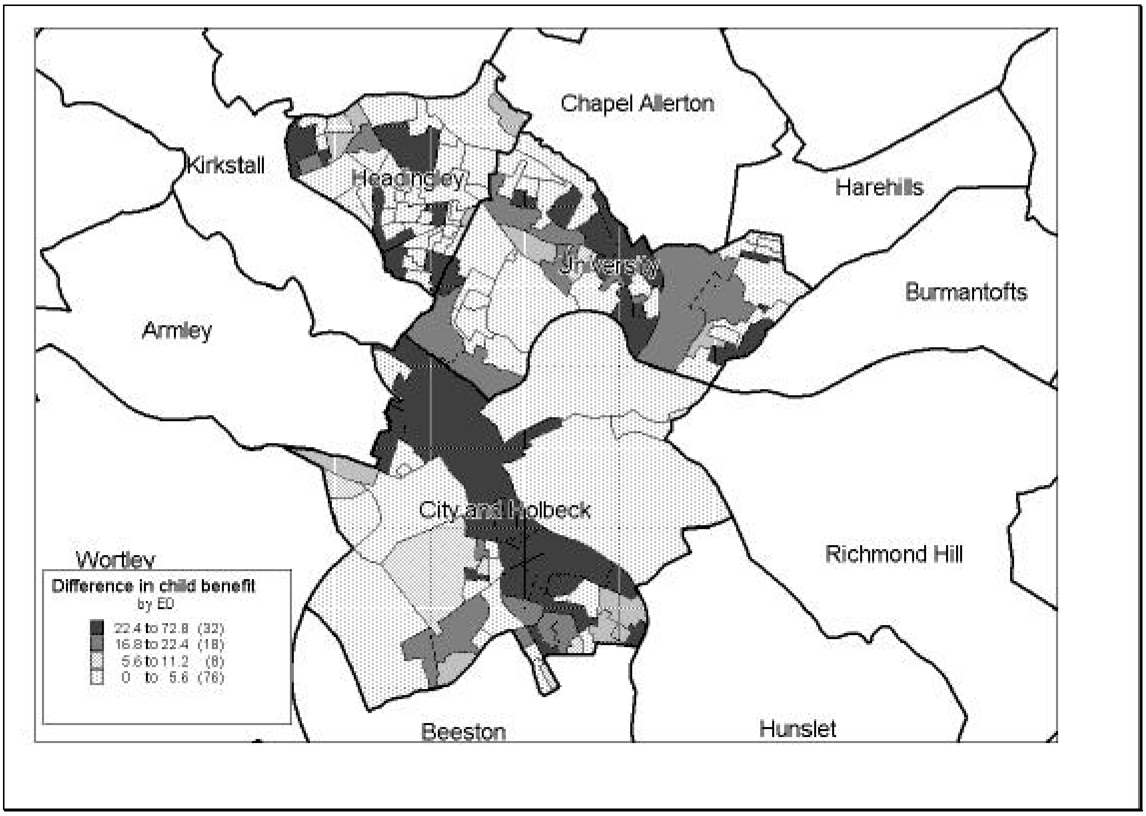


Figure 18 – Spatial distribution of the Child Benefit change under a hypothetical policy change.

In addition, social policy changes such as the above could be targeted at more specific socio-economic groups and then modelled with the use of spatial microsimulation models such as *SimLeeds*. Further, as it was the case with a possible change in the tax policy, an increase or decrease of child benefit would result to different multiplier effects in different localities.

3.3.4 Modelling the *New Deal*

The *New Deal* is a £5.2 billion *welfare-to-work* scheme and focuses mainly on young people but it also includes provisions for lone parents, the disabled and long-term unemployed adults (Peck, 1998). In particular, the New Deal is a major government initiative to help unemployed people find work or return to work and it is targeted at specific groups of benefit claimants (Welfare Benefits Handbook,vol.2, 1999).

The micro-spatial impacts of the New Deal in different regions and localities can be estimated in the context of spatial microsimulation models. Figure 19 depicts the estimated spatial distribution of one population sub-group, which will be affected by the New Deal initiative. This sub-group comprises all unemployed male Leeds residents who are aged 16-24, have no educational qualifications and belong to the socio-economic group *skilled manual workers*.

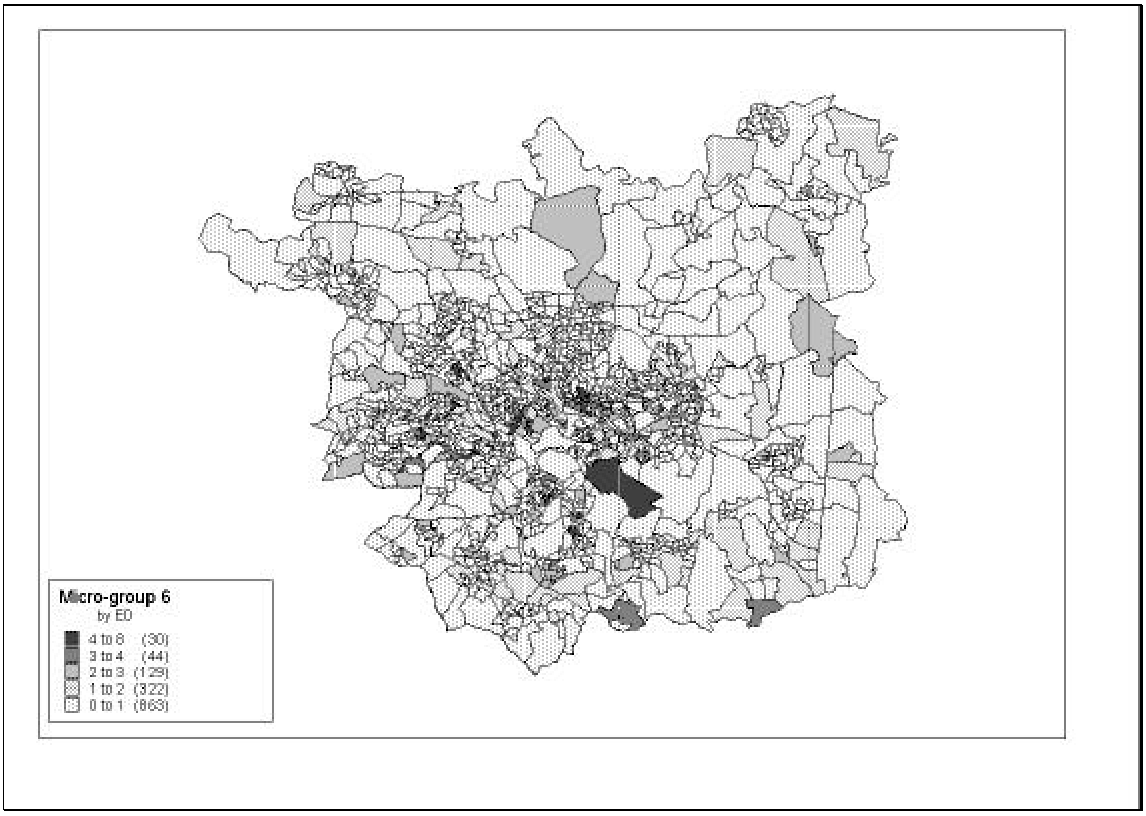


Figure 19 – Spatial distribution of unemployed male Leeds residents, aged 16-24, with no educational qualifications, belonging to the socio-economic group *skilled manual workers*.

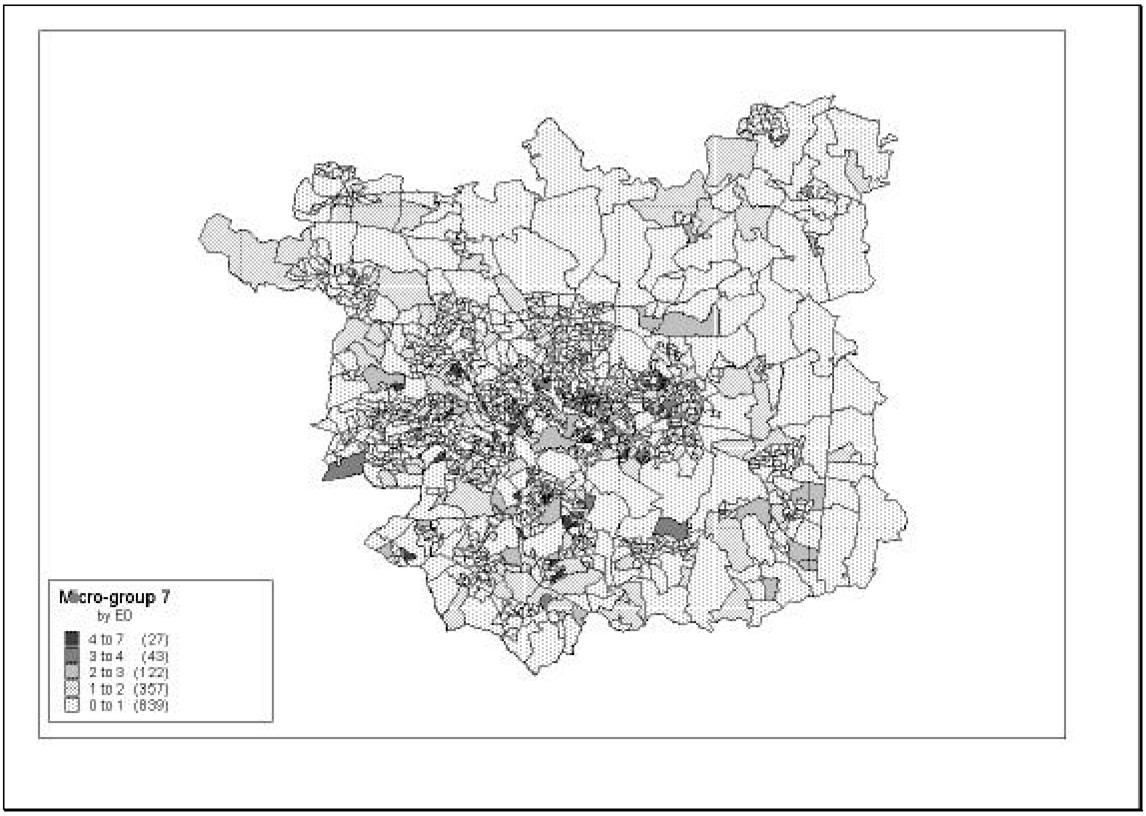


Figure 20 - Spatial distribution of unemployed male Leeds residents, aged 16-24, with no educational qualifications, belonging to the socio-economic group *partly skilled.*

Likewise, figure 20 depicts the estimated geographical distribution of all unemployed male Leeds residents who are aged 16-24, have no educational qualifications and belong to the socio-economic group *partly skilled*, whereas figures 21 and 22 depict the same socio-economic groups but for females.

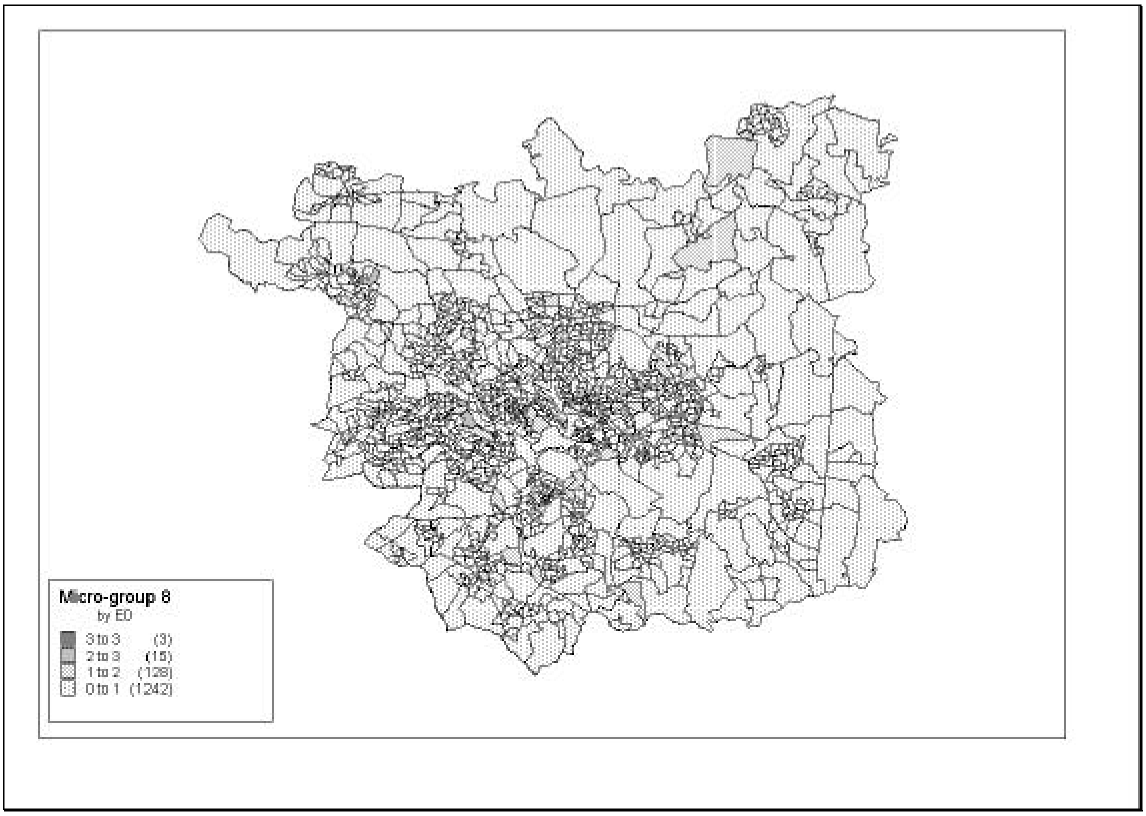


Figure 21 - Spatial distribution of unemployed female Leeds residents, aged 16-24, with no educational qualifications, belonging to the socio-economic group *skilled manual workers*.

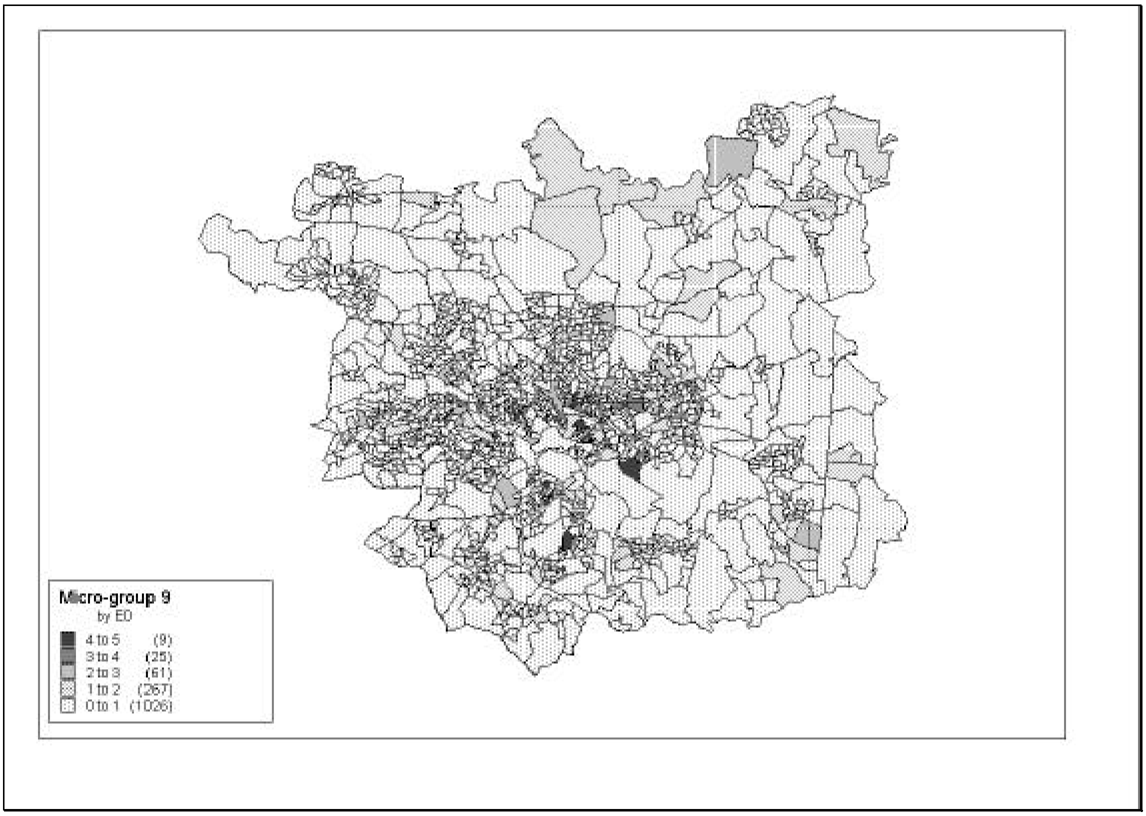


Figure 22 - Spatial distribution of unemployed female Leeds residents, aged 16-24, with no educational qualifications, belonging to the socio-economic group *partly skilled*.

Clearly, this kind of analysis can provide useful intelligence to the policy makers that will allow for a possible re-design of policies such as the New Deal and for more efficient information campaigns. Further, it can be reasonably expected that the participants of policy schemes such as the *New Deal* would soon stop claiming benefits such as the Job Seekers Allowance and that they would have higher disposable incomes. This development would lead to local multiplier effects. The geographical distribution of these multiplier effects would depend on the spatial distribution of the policy target groups.

4. Concluding comments

In this paper we have presented a micro-analytic spatial modelling approach to local social policy analysis and to the prediction of the impact on different localities of possible changes in major national policies.

First, we reviewed the existing social policy impact assessment work and we argued that, although there has been considerable progress in the development and application of methods to evaluate different social policies, there is a need for the spatial evaluation of the impact these policies at the local scale. We then argued the case for a spatial microsimulation approach to national social policy analysis and evaluation.

Further, we outlined the merits and limitation of microsimulation modelling techniques and we demonstrated how these techniques can be employed for the analysis of social policy schemes. In particular, we have presented *SimLeeds*, which is a spatial microsimulation model developed for the Leeds urban system. We have shown how the *SimLeeds* model outputs can provide insights into the design and analysis of national social policies and initiatives. More specifically, we gave an example of how spatial microsimulation models such as *SimLeeds* can be used to assess the spatial impact of a change in the taxation policy and the child benefit policy. We also used *SimLeeds* outputs to explore the spatial distribution of the New Deal scheme target groups. It has also been argued that spatially oriented social policy-making could be seen as an alternative to the traditional *area-based* policies.

Moreover, we have pointed out that the initial spatial impacts of changes in national social policies would have local multiplier effects. Therefore, there is a challenge to estimate these effects and we believe that this can be carried out in a spatial microsimulation framework (see Ballas and Clarke, 1999). Further, urban dynamics and event modelling can be introduced to models such as *SimLeeds* in order to explore the possible changes in the behaviour of households and individuals under different social policy scenarios. In order to do so though, we would need to obtain information on the conditional probabilities of each household or individual changing state. In particular, we could estimate, using various data sources, the probability of an individual to change states conditional upon his/her attributes and circumstances. For instance, we could estimate the probability of each individual migrating, changing retail location, sending their children to another school etc. if he/she becomes employed/promoted/unemployed etc. in the context of a major social policy initiative, given his/her existing household attributes. We could then perform Monte Carlo sampling from these probabilities to update the population of micro-units under different *what-if* social policy scenarios.

Our aim is to further develop *SimLeeds,* so that it will include more household variables and to incorporate all the urban sub-systems that make up the local socio-economic structure (i.e. education, health provision etc.). We will also include dynamic modelling procedures in order to render *SimLeeds* capable of performing sophisticated *what-if* local multiplier analysis of different social policy initiatives. In addition, we will add mapping capabilities to *SimLeeds* and therefore display its outputs without the need of transferring the data to Geographical Information Systems (GIS) software packages.

Finally, given that *SimLeeds* is being developed in JAVA, which is a platform independent programming language, it can be put on the World Wide Web and linked to Virtual Decision-Making Environments (VDMEs). The latter are Internet World Wide Web based systems that allow the general public to explore 'real world' problems and become more involved in the public participation processes of the planning system (Carver *et al*, 1999; Evans *et al*, 1999). We believe that models such as *SimLeeds* can be used not only to inform us what are the consequences and the local multiplier effects of major policy changes but also to inform the general public about these and to enhance, in this way, the public participation in policy making procedures.

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