

# An agent-based model of residential mobility Assessing the impacts of urban regeneration policy in the EASEL district



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## ABSTRACT

Agent-based modelling (ABM) is a unique tool which can be used to analyse the behaviour and interactions between sets of individuals and amongst organisational entities, including businesses, government and policy-makers. Well out of its infancy, ABM provides the benefit of observing autonomous behaviour at the individual level in a simulation environment. It will be shown that ABM can be used to create a model of housing choice behaviour and residential mobility of the East and South East Leeds (EASEL) district in the UK. By so doing, proposed housing policy in the form of urban regeneration can be analysed before implementation, thus providing insights on the likely outcomes of these policy initiatives.

In this paper the case of the EASEL district is presented where, as of 2007, a series of regeneration schemes were outlined to bring physical and social improvements to this community. The demographic composition of the EASEL area is introduced. A general review and discussion of housing policy and the debate surrounding the usefulness of urban regeneration schemes provides the background to policy options and development priorities in this area. ABM is promoted as a fitting technique to be used to analyse the effects of a real housing policy on housing choice in this case study area. The methodological framework is presented, complete with a discussion on data, calibration and validation. Overall, the contribution of agent-based simulation for the evaluation of policy options is discussed.

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## 1. Introduction

Urban communities are not formed by chance; they are a complex combination of social worlds (Timms, 1971). Focusing on recovering and renewing lost vitality in the physical and social landscape of a community, regeneration policy is a combination of projects or schemes such as adult education programmes, the provision of additional green spaces, mixed tenure housing developments along with older policies such as retrofitting residential dwellings in need of repair. Such improvements can make a community more attractive to investors and with new businesses established, more jobs become available over time for those within the regenerated community (Trueman, Klemm, & Giroud, 2004). In this context, urban regeneration policy targets community development in a holistic way, equipping households with the tools necessary to improve their life chances.

This paper presents an agent-based model suitable for regeneration policy investigation. It applies this model to a case study from Leeds, England. The paper first introduces the East and South East

Leeds (EASEL) case study area and then discusses residential mobility behaviour (Sections 1 and 2). Section 3 presents a discussion on Spatial Modelling Techniques while a specific model of residential mobility is then described (Section 4). The model is executed in Section 5 and then used to explore the impacts of urban regeneration policy, specifically the creation of mixed-tenure housing communities (Section 6). Model results are presented followed by a discussion on the policy implications and further work (Section 7). The model is also referred to as the CHAIRS model; **Creating Housing Alternatives In Regenerated Societies**. This work builds on the earlier work of Jordan, Birkin, and Evans (2011) where a methodological framework is presented.

### 1.1. The EASEL case study area

Leeds is a metropolitan area located in the northern region of England. The city has become a major hub for finance and other professional services in the North. Its balanced economy combines affluence with deprivation, as well as a mixed age structure with a very substantial student community.

The EASEL case study area (Fig. 1) is a prime example of a disadvantaged community within this thriving city. It is home to

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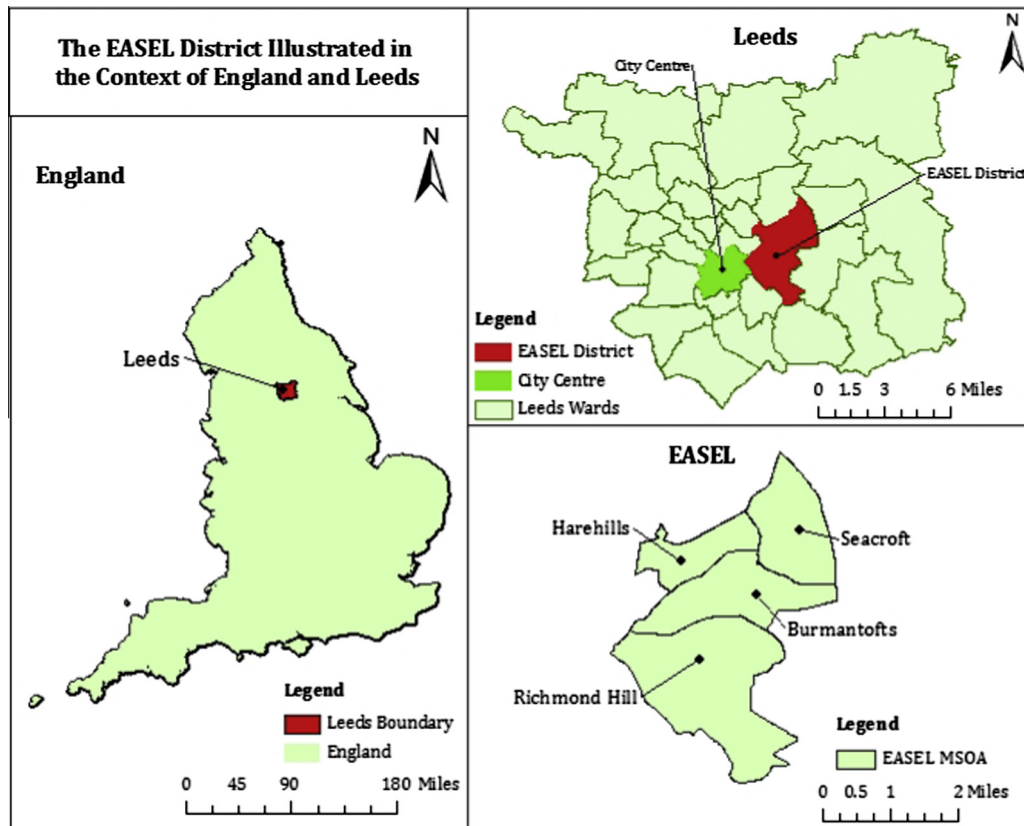


Fig. 1. The EASEL district illustrated in the context of England and Leeds by Middle Layer Super Output Area (MLSOA/MSOA).

approximately 78,000 people living in 35,000 households (UK Census 2001). Note that Middle Layer Super Output Area (MSOA) is a type of census area geography of approximately 7200 individuals (Leeds City Council, 2007). The figure further divides the EASEL community into four census wards – each area of approximately 20,000 people. EASEL is home to a large number of social housing tenants. The district is an area noted to suffer from high levels of deprivation when socioeconomic variables are assessed as well as the negative effects of crime, violence and antisocial behaviour (Table 1).

Given these statistics (Table 1), if social inequalities are to be reduced the area requires change (Dorling, 2011). Leeds City Council intended to introduce a greater mix of housing tenures in council owned areas by providing houses for sale and for rent on the private market. It was felt that a greater mix of tenures leads to greater socioeconomic diversity (Leeds City Council, 2007). It is the impact of this mixed tenure housing project that will be analysed in this paper. Housing tenure refers to the ownership of the house; owner occupied, council rented, Housing Association (rented) or private rented.

## 2. Understanding residential mobility behaviour

Residential mobility is a process initiated by a decision to migrate and follows on with the selection of and relocation to a new home. In general, it is held that the decision to migrate is the result of a change in circumstance of households which prompts the need to search for a new residence (Dieleman, 2001; Rabe & Taylor, 2010; Rossi, 1955). In detail, however, households and individuals move for many reasons. Traditionally, reasons for moving have been strongly tied to changes in the life course or life cycle (Rossi, 1955). However, Clark and Onaka (1983) point out

Table 1

EASEL versus Leeds comparative statistics by employment, criminal activity, housing tenure, accommodation type and ethnicity group (UK Census 2001 and the West Yorkshire Police 2005 as referenced by the EASEL Area Action Plan (Leeds City Council, 2007)).

	EASEL		Leeds	
<i>Economic activity</i>				
All individuals (>=16)	53,228	100%	520,479	100%
Economically inactive	22,160	41.6%	177,773	34.2%
Economically active	31,068	58.4%	325,426	62.5%
Unemployed people	2854	5.4%	17,280	3.3%
<i>Crime</i>				
All reported crime	15,493	100%	98,320	100%
Domestic burglary	1219	7.9%	7793	7.9%
Vehicle crime	1879	12.1%	12,826	13%
Criminal damage	4280	27.6%	22,073	22.5%
<i>Tenure</i>				
All households	33,535	100%	301,623	100%
Owner occupied	12,693	37.9%	187,645	62.2%
Social housing: council	13,970	41.7%	63,075	20.9%
Housing Association	2683	8%	12,990	4.3%
Private rented	4189	12.5%	37,913	12.6%
<i>Households spaces and accommodation type</i>				
All households with residents	33,520	93.6%	301,614	96.5%
Vacant houses	2285	6.4%	10,861	3.5%
Detached	1280	3.6%	46,108	14.8%
Semi-detached	13,557	37.9%	121,394	38.8%
Terraced housing	12,953	36.2%	87,361	28%
Purpose built flats	7640	21.3%	44,179	14.1%
Flat/maisonette/shared house	343	1%	13,115	4.2%
Temporary structure	24	0.1%	398	0.1%
<i>Ethnicity group</i>				
White	44,924	84.4%	478,320	91.9%
Non-white	8304	15.6%	42,159	8.1%

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