The Use of Agent-Based Modelling in Modelling Migration

Lois Liao (PhD Candidate, CPM)
Table of Content

- Background
- Theoretical Framework
- Methodology
- Results
- Challenges
Background

- To understand migration and policy implications
- To incorporate big data and economic theories
- To adopt a multi-disciplinary approach
Theoretical Framework

- Tiebout Model
- Behavioural Elements

Decision-making Process → Rational Decision

Push
Pull

Behavioural Biases
Herding
Endowment Effect
Sense of Community

Education
Transportation
Security and safety
Employment
Green environment
Housing affordability
In general, an agent-based model includes (Heppenstall et al., 2011):

1) A number of agents, who operate within the same or different pre-set behavioural rules;

2) The behavioural rules derived from literature studies and relevant theories, where the rules can be rational, heuristic or randomised;

3) The learning and adaptation of agents towards the environment

4) An interactive relation between agents

5) A non-agent environment which include the initial settings and/or the background process

The rating of a given borough $k$ for an agent $i$ is:

$$R_i^k = \alpha_i U_i^k + \beta_i I_i^k$$

Methodology – General ABM

- Expected utility based on independent assessment
- Social information
Methodology – Data Collection

• **Agent characteristics:** Income, education qualification, ethnicity, religious belief

• **Environment/Neighbourhood characteristics:** Transportation accessibility, environment score, crime rate, housing affordability, job density, education quality
Results

2013

Legend

<table>
<thead>
<tr>
<th>Equal ranges</th>
<th>Low (&gt;=)</th>
<th>(&lt;) High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1.0</td>
<td>26.0</td>
</tr>
<tr>
<td>3</td>
<td>26.0</td>
<td>51.0</td>
</tr>
<tr>
<td>4</td>
<td>51.0</td>
<td>101.0</td>
</tr>
<tr>
<td>5</td>
<td>101.0</td>
<td>201.0</td>
</tr>
</tbody>
</table>
Results

2015

Legend
Equal ranges  Low (>)  (<) High
1 0.0 1.0
2 1.0 26.0
3 26.0 51.0
4 51.0 101.0
5 101.0 201.0
Challenges

1. **Data.** Incorporation of empirical data in the modelling process can be premature

2. **Validation.** Inconsistency between the intended model and the programmed model

3. **Assumptions.** Heavily dependent on assumptions and potential issues of over-fitting