Considering the addition of Spatial, Dynamic dimensions and/or Alternative Unit of Analyses in EUROMOD

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Understanding Complexity
Sources of Complexity

Core Purpose of Microsimulation Models
Understand and Manage Complexity

Population

Behaviour

Policy
Sources of Complexity – Dynamic Models

- Population
- Behaviour
- Policy
- Time
Sources of Complexity – Spatial Models

Population

Behaviour

Policy

Place
Dynamics
Issue

- Temporal Dimension important because
  - Policy Changes over time
  - Different market conditions
  - Underlying population changes – Ageing
  - Dynamics and Mobility
  - Policies that depend upon life-cycle attributes
  - Period of Analysis – Lifetime distribution quite different to current or annual
Issue

- Many EU wide cross-cutting problems
  - Ageing
  - Social Exclusion and Poverty
  - Public Finance Cost of Ageing
  - Implications for Mobility of Work of Social Insurance Pension Systems
  - Behavioural Change
- EU role in monitoring Eurozone public finances
  - Pensions and Social Insurance are very important components
Ageing and Reweighting

• Dynamic – Ageing (Longitudinal)
  • System of Equations (j) that simulate labour market and demographic characteristics, incorporating individual transitions $Y_{ijt} = (BX_{ijt} + u_{ij} + v_{ijt})$

• Dynamic – Ageing (Cross-sections)
  • System of Equations (j) that simulate labour market and demographic characteristics, for cross-sections $Y_{ijt} = (BX_{ijt} + e_{ijt})$

• Static – Ageing
  • Reweighting the Data to correspond to control totals
Dynamic Microsimulation

- Takes a system of equations – age individuals over time
- Sometimes constrain to external totals
Spectrum of Analyses

- Simulating entitlement of time-dependent benefits in a single year
- Nowcasting
- Simulation of single cohort over a full-lifecycle
- Simulating full cross-section over time
- Simulating Inter-generational and Intra-Generational impacts
- Simulating behavioural responses to these instruments
Spectrum of Analyses

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- **Nowcasting**
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Spectrum of Analyses

<table>
<thead>
<tr>
<th>Data</th>
<th>Cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulating entitlement of time-dependent benefits in a single year</td>
<td></td>
</tr>
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Simulating entitlement of time-dependent benefits in a single year

- Long-term historical dataset (typically administrative) allows for eligibility conditions to insurance benefits
- Li and O’Donoghue (2012) backcasted using retrospective labour market experience sufficient information to model current pensions
- Percentage of correctly simulated eligibility

<table>
<thead>
<tr>
<th>Pension Type</th>
<th>Correctly Simulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributory State Pension</td>
<td>96.08%</td>
</tr>
<tr>
<td>Occupational Pension</td>
<td>98.25%</td>
</tr>
<tr>
<td>Private Pension</td>
<td>97.36%</td>
</tr>
</tbody>
</table>

Example: Nowcasting

- Simulate historical distributional surveys to the present

Example: Simulation of single cohort over a full-lifecycle

- Annual versus Lifetime
  Redistribution for a single cohort

Example: Simulating full cross-section over time

- Simulation of pensioner poverty over time for existing and universal pension plan

Trend in Poverty Headcount rate

1995 2015 2035

Baseline Universal

Example: Simulating Inter-generational impacts

- Cumulative net gain from welfare state by generation over lifetime

Example: Decomposing Change in Inequality 2007-2012

- Decomposing inequality changes into effects 2007-2012
  - Market Income and Demographic changes have been pushing inequality upwards
  - Labour market structure and policy have been pushing in the other direction

Av. Change in Inequality due to components

<table>
<thead>
<tr>
<th>Change</th>
<th>Demographic</th>
<th>Market Income</th>
<th>Tax-Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arts, Social</td>
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<tr>
<td>Sciences and</td>
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<tr>
<td>Celtic Studies</td>
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</tbody>
</table>
Example: Decomposition of Impact of Crisis between the UK and Ireland

<table>
<thead>
<tr>
<th>Component</th>
<th>Pre-Crisis</th>
<th>Post Crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK Gini</td>
<td>0.317</td>
<td>0.305</td>
</tr>
<tr>
<td>IE-UK Gini</td>
<td>-0.042</td>
<td>-0.034</td>
</tr>
<tr>
<td>MC</td>
<td>0.019</td>
<td>0.018</td>
</tr>
<tr>
<td>Returns</td>
<td>0.016</td>
<td>0.031</td>
</tr>
<tr>
<td>TB</td>
<td>0.02</td>
<td>-0.052</td>
</tr>
</tbody>
</table>

- The cross-country differentials in disposable income have narrowed during the crisis compared to 2007,
- Due to a larger drop in inequality in the UK than in Ireland,
- Despite a widening gap in redistributive impact of TB system
- Due to a large increase in market income inequality in Ireland

Sologon, Van Kerm, O'Donoghue et al., (forthcoming)
How to Implement in EUROMOD

• It was one time...
  • The LIAM framework was built using the same algorithms and philosophy as EUROMOD –
  • Both have diverged LIAM2 and later EUROMOD
• Use dynamic microsimulation model to produce future panels
• Use EUROMOD to simulate policy
• Synergies in cross-country development

How to Implement in EUROMOD

- However
  - Family not Household Unit of Analysis
  - Lack of comparative long-term panel data since ECHP
  - Relatively expensive
Spatial
Issue

• Sub-national unit such as Region of particular interest to EU. Cohesion, Regional Development and Rural Development Policy

• Statistical method to generate spatially referenced data, combining small area Census Information and Household Micro Data

• Scope
  • National – NATSEM (Australia) SMILE (Ireland)
  • City – SimLeeds (Leeds); UrbanSim (Berkeley)

• Spatial Unit
  • Address
  • District
  • County/Region etc.
Issue

• Techniques
  • Statistical Matching in World Bank Poverty Mapping Literature linking Micro Income/Exp Survey Data to Census Micro Data
  • Reweighting to County control totals (Australia)
  • Simulated Annealing (Leeds)
  • Quota Sampling (Ireland)

• Issues with
  • Small Cell Sizes and Weights
  • “top 1%”
Example Analysis - Improving Income Quality – Imputed Rent (Scope: Nation; Unit: District)

Kilgarriff, Paul, Martin Charlton, Ronan Foley, Cathal ODonoghue
The Impact of Housing Consumption Value on the Spatial Distribution of Welfare, *Journal of Housing Economics*. 
Example Analysis - Improving Income Quality – Commuting Cost (Scope: Nation; Unit: District)

Example Analysis — Flood Impact (Scope: County; Unit: District)

- Direct and Indirect household impacts of Storm Desmond
- County Galway

How to Implement in EUROMOD

- EUROMOD is already a Spatial Microsimulation Model
  - Scope European Union
  - Spatial Unit – Country (Region)
- To disaggregate Spatial Unit Further
  - Source Small Area Census constraint Data or micro data
  - Select Reweighting, Re-sampling or Statistical Matching as appropriate to “spatialize” EU-SILC.
  - E.g. NATSEM, SMILE
Unit of Analysis
Issue

- Farm Unit of Analysis
- Agriculture and Food
  - EU Responsibility for policy
- Significant financial resources
- Large distributional dimension
- Policy driven industry
- Currently modelling mainly focuses on gross incomes
  - However general and farm specific MT benefits and taxation has major incentive implications
Example Analysis: Distributional Analysis of CAP Reform - Winners and Losers Analysis from post 2014 CAP analysis

Example Analysis: Impact of Tax-Benefit System on Policy Incentives

- Policies that aim to incentivise
  - Food security
  - Environmental Improvement
  - Land Use Change
- Severely impacted by means tested benefits
Example Analysis: Farm Household Viability

- Incorporating Tax and Benefits alter the level of viability (Farm income relative to working off farm etc)
How to Implement in EUROMOD

- DG-Agri collects comparable micro data (since the Treaty of Rome) on farm incomes and characteristics – FADN
- Contains data to simulate capital, investment deductions and other business taxes
- Need to statistically match to FADN data to Household Data (SILC) to do distributional and tax analysis, particularly in the case of joint taxation
Caution

- Move to increase complexity of models
- Complexity → More costly, time consuming, harder to interpret
- All Models are wrong – some are useful (Box)
- KISS → Simpler may be better
- Just because we can do it doesn’t mean we should
- Challenge is to have enough complexity to produce a Model that is Useful
Forthcoming

• Practical Microsimulation Modelling (Oxford University Press)