Simulation Model of the Irish Local Economy: Short and Medium Term Projections of Household Income

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Teagasc Rural Economy and Development Programme
Rapid Growth to 2007
- Big Fall post 2007
  - GNP pc fell to 2000 levels in 2011

**GDP pc & GNP pc** Both in Constant Prices (€ per capita)

- Expenditure Increase 2007-2009 up 15%
- Fall in Tax Revenues 2007-2010 down 33%

**Public Finance**

Source: CSO National Accounts

The Irish Agriculture and Food Development Authority

Source: CSO National Accounts
- Lost most of the employment gain of Celtic Tiger
- Disproportionately Young or Male
- Employment rate of women under 35 higher than men in 2011
- Big falls in share of construction (50% fall in share)

A decline of approximately 13% from the peak.

The spatial change?
Budget Constraint for a married couple with children 2007-2013 (Adjusted for CPI)

• Significant earnings growth heterogeneity

The Irish Agriculture and Food Development Authority
Price and Wage Inflation (2007-2013)

- Significant earnings growth heterogeneity

Equivalised Disposable Income (SILC)

Equivalised Disposable Income (parametric equivalence scale, 0.5)
Nowcasting using Dynamic Ageing
Challenges

- Fast moving economic situation
  - Significant policy changes → need quick analysis
  - However data often produced at a lag of two years
  - However other data sources (LFS, Admin Data) more quickly available
- Reweighting tools in this fast moving environment may not give us enough control to adapt to the component changes
- Solution apply a “dynamic” microsimulation model
Methodology

- Options
  - Static Ageing (Reweighting)
  - Dynamic Ageing
- Such large multi-dimension changes
  - Over-reliance on small numbers → Static Ageing Difficult
- Therefore develop system of equations
  - Bourguignon, Fournier, Gurgand (2001)
  - Bourguignon, Ferreira, and Leite (2002)
  - O’Donoghue (2002)
Methodology

- **Historical Simulation** – micro data contains changes in all components simultaneously
  - Estimate a system of equations representing labour market states and income sources
  - Use Micro-simulation model to simulate each stage in turn on each micro population for historical years

- **Forward Simulation**
  - Simulate income distribution from last data year using system of equations (dynamic microsimulation model) using official statistics based calibration totals
  - See O'Donoghue and Li (2012)

- Simulate Disposable Income using Tax-Benefit Model
Calibration-Alignment

- We calibrate all the labour market variables to the Irish LFS (QHNS)
- Process
  - Use a system of equations
  - With Calibration
- \( P(I) = f(XB + e) \)
  - \( e \) such that \( I^* = 1 \) if \( I = 1 \) in data and v.v.
- Select on rank of \( XB + e \)
- Similar for Multinomial Logit
- Calibrated to external control total
  - In the case of calibration rates equal to the raw data, the model will simulate the same values as the raw
- Advantages
  - Allows for non-random relationship
  - Can incorporate a more diverse system, factoring sector specific impacts
• In order to project we use alignment or calibration
• Firstly comparing history with alignment → similar trend by higher inequality due to different employment rates between micro data and external data
• Project using the same calibration totals
Spatial Impact
Spatial Analysis Challenges

- No spatial income data
  - Census has no incomes
- Income Data has no spatial component
  - Solution → Develop a Spatial Microsimulation Model of the Irish Local Economy
- Baseline Population
  - Utilise Quota Sampling [Farrell et al., 2012]
  - Sampling Households from EU-SILC
  - Calibrated to 3400 districts from 2006 Small Area Census
  - Improve spatial heterogeneity via Aligned Simulation [Morrissey et al., 2012]
External Validation – initial quota sample

- Match variables
  - Excellent Match
- Compare
  - SMILE Household Poverty Rate by County
  - ESRI Survey on Household Quality
- Correlation 0.79
- However there is much greater spread in the NSHQ than in the SMILE output.
Validation Average Disposable Incomes – post calibration
Validation Poverty (post Calibration)

85% Correlation
### Between and Within District Variability

<table>
<thead>
<tr>
<th>Income Type</th>
<th>District</th>
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<tbody>
<tr>
<td>Market Income</td>
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<tr>
<td>$I_2$</td>
<td>0.46</td>
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<td>Between %</td>
<td>5.3</td>
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<tr>
<td>Within %</td>
<td>94.7</td>
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<tr>
<td>Gross Income</td>
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<tr>
<td>$I_2$</td>
<td>0.31</td>
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<tr>
<td>Between %</td>
<td>5.3</td>
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<tr>
<td>Within %</td>
<td>94.8</td>
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<tr>
<td>Disposable Income</td>
<td></td>
</tr>
<tr>
<td>$I_2$</td>
<td>0.21</td>
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<tr>
<td>Between %</td>
<td>5.6</td>
</tr>
<tr>
<td>Within %</td>
<td>94.5</td>
</tr>
</tbody>
</table>
Spatial Projection Challenges

- No 2011 Census until last month
  - Require timely spatial information
  - Solution → project spatial labour market
  - Here → treat demographic change as exogenous – see Lennon et al (forthcoming)

- However
  - Regional (8) trends in Employment and Unemployment – QHNS – lag two quarters
  - Unemployment claimant data at Social Welfare Office Level ()
  - National Accounts – Estimates of Household Primary and Disposable Income at the County Level
  - Earnings, Hours and Employment Costs Survey – Update Earnings from 2005 to 2011 based on Index numbers for Earnings by Occupation and Industry

• Highest growth rate of unemployment (red) highest in commuting zones around cities
Spatial Projection Challenges

- Employment
  
  \[ E_{2006} = f(B_{2006}X_{2006} + s_{2006}) \]

- Where
  
  \[ X_{2006} \text{- Demographic Distribution at District level} \]
  
  \[ s_{2006} \text{- Spatial fixed effect} \]

- Challenge
  
  Combine to generate spatial change in
  
  \[ E_{2011} = f(B_{2011}X_{2006} + s_{2011}) \]

  
  \[ \text{Employment, [Also Occupation, Industry, Unemployment]} \]
Methodology

- Produce spatial fixed effect $s_{2006}$
  - Apply national Age-Sex Employment Rates to District in 2006
  - Compare Difference with 2006 District Census to identify spatial fixed effect
- Model changes due to Age-Sex Employment Differentials from QHNS
  - $B_{2006}X_{2006} \rightarrow B_{2011}X_{2006}$
- However likely changes in spatial fixed effect over and above national age-sex changes due to spatial heterogeneity in labour market structure
  - $s_{2006} \rightarrow s_{2011}$
- Utilise
  - Regional QHNS to produce differential employment data at NUTS3 region
  - Social Welfare Office Data to spatially differentiate change within region adjusted for age-sex differential
  - Assume remaining intra Social Welfare Office Differential changes are due only to age-sex differential
• Model resulting impacts in terms of market income and disposable income using a microsimulation model
• We see a general reduction in living standards (red), but differential effects
• Higher poverty in Deep Rural areas relative to Commuting Zones
• The pattern of higher poverty spread to wider areas, reflecting the changed employment and income changes
Thank You