Microsimulation Modelling, NATSEM and Evidence-Based Policy Making

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What are microsimulation models?

- Based on microdata sets
  - Records of individual people or households
    - Mirrors heterogeneity in population
  - Usually large – thousands of records
    - Sample surveys (Australian Bureau of Statistics), or
    - Administrative data

- Allow detailed assessment of impact of change
  - On individuals
  - On groups of individuals (eg sole parents)
  - On whole population
  - On government budgets
Static models of taxes and transfers
Income tax and social security

- STINMOD model is now maintained by NATSEM for Australian government departments (Family and Community Services, Education Science and Training, Treasury, Employment and Workplace Relations)
- 12 years old
- STINMOD simulates all the major income tax and cash transfer programs (age pension, family payments etc)
- Used regularly in research – distributional impact of welfare state, impact of minimum wage rises, EMTRs
- Constructed on top of Income Surveys and Expenditure Surveys (2 versions)
### Income Tax Scale Steps

**Year 2003-04 average parameters**

<table>
<thead>
<tr>
<th>Income</th>
<th>Marginal Rate</th>
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<tbody>
<tr>
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<td>50000</td>
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Step One  
Step Two  
Step Three 
Step Four 
Step Five 
Step Six  
Step Seven 
Step Eight 
Step Nine  
Step Ten  

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<thead>
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<td>52000</td>
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<td>62500</td>
<td>0.47</td>
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<td>Weekly Taxable Income</td>
<td>Married no childr.</td>
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<td>&lt; 150</td>
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<td>300-449</td>
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<td>1200-1349</td>
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<td>1350-1499</td>
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<tr>
<td>1500+</td>
<td>14.02</td>
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<tr>
<td>TOTAL</td>
<td>5.99</td>
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</table>
% gain in disposable income in July 2000 tax reform package

Source: Harding et al, 2000, p. 26 &29
Bottom 60% net gainers from welfare state in 2001-02

![Graph showing average household income per week for different quintiles.](image)

*Note: Final income means private income plus cash transfers and the value of government-subsidised health, education, welfare and housing services consumed, minus income tax, GST and excises. From Harding et al, 2004 (on NATSEM website).*
CHILDMOD – An alternative child support scheme

- A recent STINMOD extension
- Child Support Scheme requires separated parents to each contribute to the costs of raising their children
- Many concerns about Scheme
- Ministerial Task Force reported two weeks ago
- NATSEM built the Taskforce two models:  
  - ‘hypothetical’ (illustrative families) and  
  - ‘distributional’ (summed gains and losses to govt and parents)
Proposed Scheme: Payments of Non-Resident Parent

Private Income of Non-Resident Parent ($ per year)

Child Support Paid by Non-Resident Parent for One 13-17 Year Old CS Child

- Current Child Support Paid
- Proposed Child Support Paid

Resident parent has zero private income and 100% of care; non-resident parent's income increased. Source: Ministerial Task Force, 2005, p. 227
Proposed Scheme: EMTRs of Non-Resident Parent

Effective Marginal Tax Rate of Non-Resident Parent for One 13-17 Year Old CS Child*

* Effective marginal tax rate averaged over the relevant income range. Resident parent has zero private income and 100% of the care; non-resident parent's income increased. Source: Ministerial Task Force, 2005, p. 237
Health models
Who uses NSW public hospitals: the rich or the poor?

- Have added measure of socio-economic status to NSW hosp administrative data
- Imputed income quintile of patients, by age, gender and the Census Collection District that they live in
- Spatial unit is the CCD
- Policy questions:
  - Are poor more likely to use hospitals than the rich?
  - Are there differences between public and private hospital usage?
% of NSW population using public hospitals, 1996-97

Per cent of NSW population using public hospitals

Bottom 20%  Quintile2  Quintile3  Quintile4  Top 20%

0-19 yo  20-39 yo  40-59 yo  60-69 yo  70+ yo  All ages
MediSim: The Australian Pharmaceutical Benefits Scheme

- PBS aims to provide affordable access to prescription medicines
- MediSim constructed on top of National Health Survey microdata and simulates changes in
  - the drugs listed under the PBS
  - drug prices
  - the rules (settings) of the PBS – copayments and safety net thresholds
  - costs to government and consumers
  - the distributional impacts
- Cost Federal govt $4.2 bn in 2001-02
% of PBS outlays received by each income quintile of Aust’ns

- Bottom one-fifth (lowest quintile): 41%
- Next one-fifth: 29%
- Middle one-fifth: 15%
- Top one-fifth: 8%
- Next one-fifth: 7%

Ranked by equivalent disposable income of their family using new OECD scalae.

*Source: Harding et al, 2004*
HEALTHMOD

- Will simulate hospital, medical, and pharmaceutical sectors
- Constructed on top of National Health Survey
- National level model
- Pharmaceuticals done, MBS well underway, hospitals just starting
- ARC and NHMRC 3 to 5 year grants
Dynamic models
What is DYNAMOD?

- **Simulates** the events that happen to ordinary Australians over their lifetime
- Starts in 1986 with 150,000 people (1% of the Australian population – the Census sample)
- Models individuals (the *micro* level)
- Uses regression equations to model human behaviour over time (*dynamic*)
- DYNAMOD to be replaced by APPSIM (Australian Population and Policy Simulation Model) – won 5 year grant last week with 13 govt depts as research partners
DYNAMOD3’s Simulation Cycle

Australia 1986

Simulation Clock

New Quarter?

Y

Macro-economics

Deaths

Emigration

Disability & Recovery

Immigration

Couple Dissolution

Pregnancy and Births

Couple Formation

Annual Earnings And Savings

Labour Force

Education

New Year?

Y

Australia 2050
Can changing the compulsory 9% Superannuation Guarantee rate help the boomers finance their future retirement?
Spatial models
Spatial Microdata and Microsimulation

- Combine the information-rich ABS survey data with the geographically disaggregated Census data

- Using ‘spatial microsimulation’ to create detailed unit record data for small areas (synthetic spatial microdata)

- Results available for different areas, e.g.

  Statistical Local Areas, Postal Areas, Census Collection Districts
Spatial microsimulation: Combining HES and Census Data

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<th>Source unit record data (HES)</th>
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<table>
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<th>Synthetic unit record data for small areas</th>
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SYNAGI – SYNthetic Australian Geo-demographic Information

- Estimates of income, wealth, poverty, spending, housing stress etc at a small area level (SLA)
- Built on top of the Household Expenditure Survey (rewighted to the Census)

- Research partners: Queensland Department of Premier and Cabinet, NSW Premier’s Department, ACT Chief Minister’s Department, Victorian Department of Sustainability and Environment & ABS
Centrelink’s CuSP Model
(Customer Service Projection Model)

- A tool to assist Centrelink strategic decision-making by:

- producing projections of Centrelink customers and channel use
- over the next 5 years
- for small areas
- and under alternative scenarios about the future

- Needed an evidence based methodology to help:
  - match services available to customers’ needs and preferences
  - deliver the service via the most suitable channel and
  - in most efficient way.
Customers relative to total population – June 2002

Brisbane Study Area 1, Customers as a proportion of total adult population, 2002
Labels are number of customers, 2002
Distribution of projected growth rates in channel use by Age Pensioners: postal areas, 2002 - 2012

Source: CuSP Model
CAREMOD: future aged care needs and costs

- Simulating current and future characteristics of older Australians
- At a detailed regional level (SLA)
- Imputing functional status and thus likely need for different types of care
- And forecasting future incomes and assets of old
- Built on top of the 1998 Survey of Disability, Ageing and Carers
- Research partners: NSW Dept of Ageing, Disability and Home Care and Australian Government Dept of Health and Ageing
% needing high level institutional care

PERCENTAGE OF POPULATION AGED 55 YEARS AND OVER
WITH CARE MODALITY 5

Quintiles (Percent)
- 2.1 - 7.9
- 7.9 - 9.0
- 9.0 - 10.0
- 10.0 - 11.2
- 11.2 - 38.6
- Spatial model (SLA)
- Models receipt of Commonwealth Rent Assistance
  - Means-tested assistance to low income private renters
- Can change rules of CRA and predict spatial impact
- Now being extended to add:
  - public renters as well
  - plus projections for 20 years
% in unaffordable housing
Evidence based policy making

- Growing demand for decision support tools
  - Reduce risk to policy makers making billion dollar decisions
  - Assess distributional implications of policy change before implemented
  - Improve predictive capacity & strategic planning

- NATSEMs has now constructed dozens of microsimulation models, based on ABS or admin microdata

- Exciting new developments are
  - Spatial microsimulation models
  - Health and housing models
  - Next generation of dynamic models

- For free copies of all publications as released, email hotline@natsem.canberra.edu.au
Selected references

**STINMOD applications**


**CHILDMOD**

**NSW Hospitals Model**


**MediSim**


Selected references

**DYNAMOD**

**SYNAGI & Spatial Microsimulation**


**CuSP Model**

**CAREMOD**
Brown, S, Lymer, M,Yap, M,Singh and A, Harding “Where are Aged Care Services Needed in NSW – Small Area Projections of Care Needs and Capacity for Self Provision of Older Australians” Aged Care Association of Victoria State Conferences, May 2005 *

**HOUSEMOD**
Melhuish, T and King, A, 2004, *Baseline small area projections of the demand for housing assistance*, AHURI Positioning Paper, Australian Housing and Urban Research Institute, Melbourne, September