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Who Wins, Who Loses and By How Much? Predicting the Current, Future and Spatial Impact of Policy Change Using Microsimulation Models

Presentation to 'Research Institute for Socionetwork Strategies' International Workshop, Osaka

Professor Ann Harding

29 January 2009

Australian cash transfer system

- Almost all payments are income and asset tested (targeted to those in most need)
  - Age pensions, disability, parenting payment single (child < 8)
  - 'Allowances' have much harsher income tests & and may be activity tested - Newstart (unemployed), Youth Allowance

- Relatively high cash payments to families with children

- Benefits are **flat-rate**, paid from general revenue
  - Quite different to the social insurance (earnings-related) systems of Europe

- Numerous other minor payments (Rent assistance etc)
  - Plus 'health' concession cards (passport to concessional pharmaceuticals)

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Income tax side

- 'Progressive' tax schedule means that marginal tax rates increase as income increases
  - Top marginal rate of 45c in $ above $180,000 + 1.5% Medicare levy
- Also a multitude of tax concessions for specific groups
  - Senior Australians Tax Offset
  - Low Income Tax Offset
  - Mature Australians Tax Offset
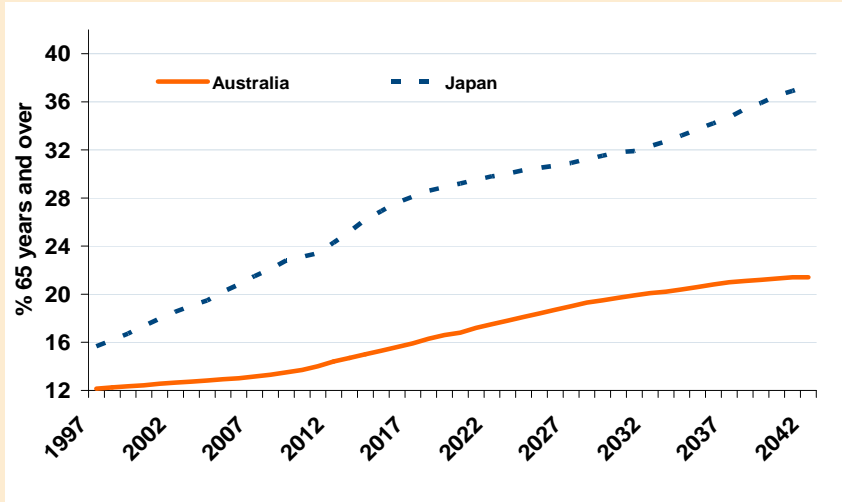 - Pensioner Rebate/Beneficiary Rebate

3

Challenges facing Australian welfare state

- Population ageing
- High effective marginal tax rates (work incentives)

- Currently major reviews underway
  - Harmer pension review (reports February 2009)
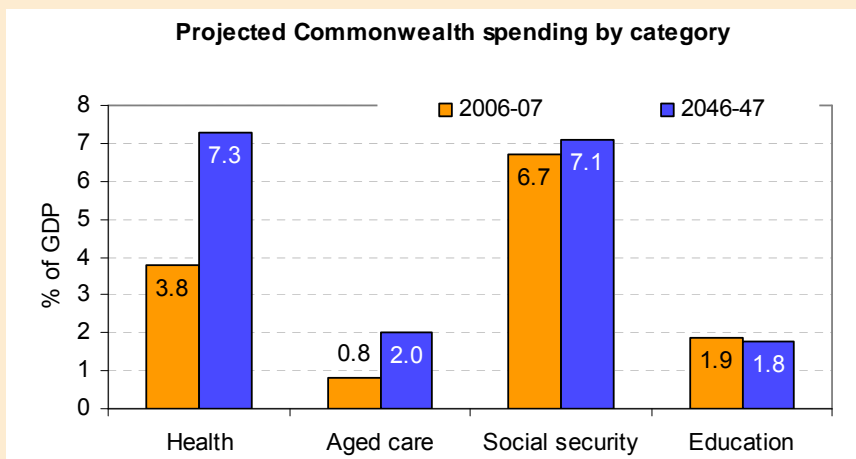 - Henry tax review (reports December 2009)

4

↑ in % of population aged 65 years +

Sources: Australian Bureau of Statistics + http://www.e-stat.go.jp/SG1/estat/eStatTopPortalE.do + Kaneko et al.(2008) based on medium-variant mortality (with medium-variant fertility)

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Resulting in much higher health and aged care costs in Australia

Projected Commonwealth spending by category

Source: Treasury *Intergenerational Report*, 2007 Budget Papers

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3

Projected gap between Commonwealth revenue and outlays in Australia

Per cent of GDP ... Per cent of GDP

Years: 2006-07, 2016-17, 2026-27, 2036-37, 2046-47
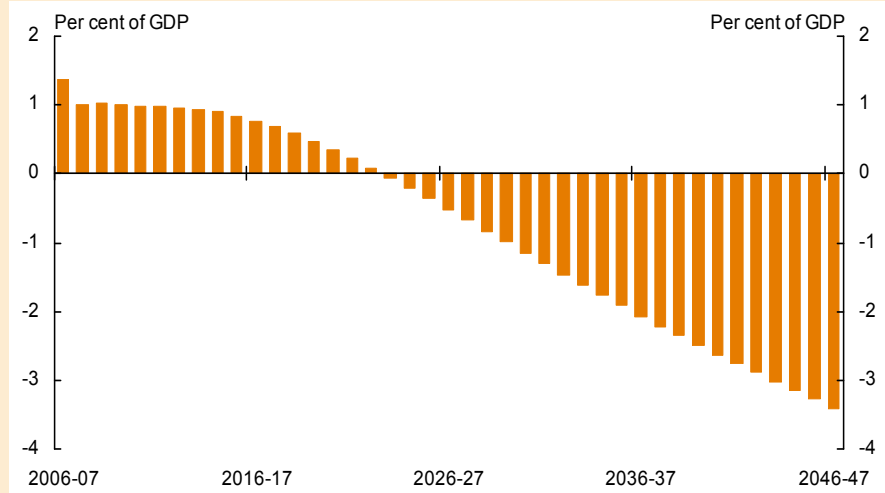
Source: Treasury Intergenerational Report 2007 (www.treasury.gov.au/igr)

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Using microsimulation models in policy process

What are microsimulation models?

- **Based on microdata sets**
  - Records of individual people or households
  - 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
  - On whole population
  - On government budgets

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Static tax-transfer models

Static models widely used across developed world

- **Static tax-transfer models show *morning after* impact of a policy change**

- **EUROMOD for EU15 (and soon 25)**

- **TRIM model in US (http://trim3.urban.org/)**

- **SPSD/M for Canada**

- **LOTTE for Norway**

- **GLADHISPANIA for Spain**
  - See Gupta and Harding (2007) for summaries of 22 microsimulation models in use across the world

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STINMOD – Australian model

- **Static microsimulation model replicating rules of the Australian tax, social security, & family payments systems**

- **'Day after' impact, no behavioural change**

- **Developed by NATSEM, first release STINMOD 94, latest is STINMOD 08**

- **Shows impact of possible policy changes**
  - Fiscal (revenue and expenditure)
  - Distributional (winners and losers)
  - Effective marginal tax rates (EMTRs)

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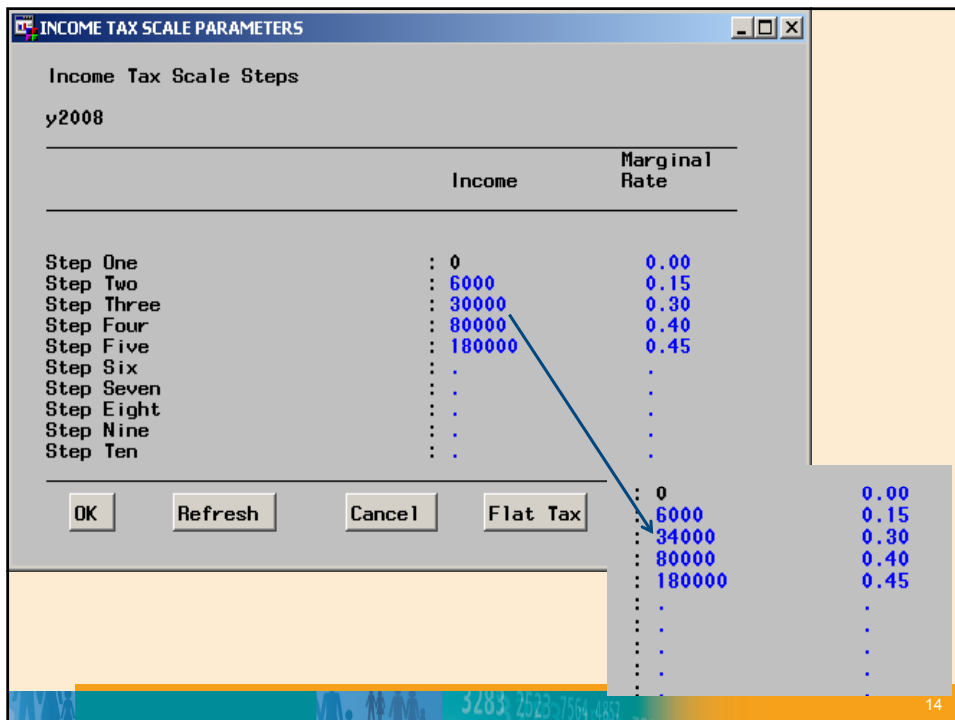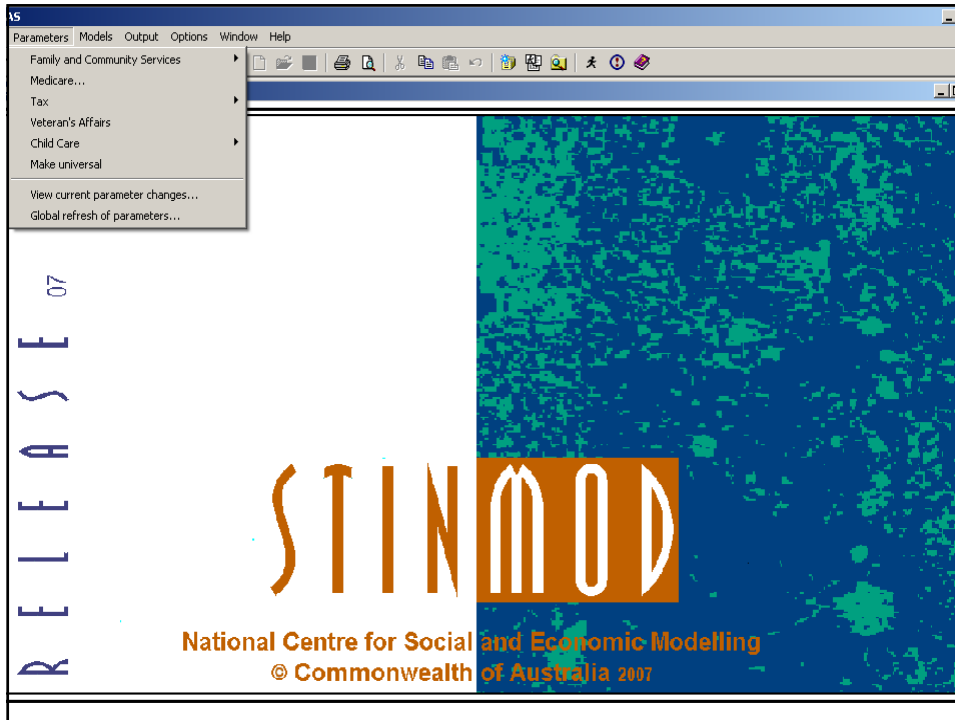
Simulation Outcome □ X

ESTIMATED SIMULATION OUTCOMES

Impact on 2008-09 of tax changes announced in 2007 election campai

y2008

	Number of Families	Proportion	$ Change in Average Weekly Income
Winners :	7,010,000	63.4	18.6
Losers :	0	0.0	0.0
No change :	4,048,800	36.6	0.0
Total :	11,058,700	100.0	11.8

Note: This and the following two slides also include the impact of other tax changes announced in the election campaign.

Portfolio Outcome □ X

ESTIMATED ANNUAL PORTFOLIO OUTCOMES

Impact on 2008-09 of tax changes announced in 2007 election campai

y2008

Portfolio	Base Outcome $m	Simulation Outcome $m	Difference $m
Outlays			
FaCS	69115.591	69115.591	0.00
DVA	5777.709	5777.709	0.00
Revenue			
TAX OFFICE	106093.743	99308.174	-6785.57
		Net Outcome	6785.57

```
Outcome by Family Type and Income                                    _ □ ✕
  Estimated Change in Family Disposable Income - $ pw

  Impact on 2008-09 of tax changes announced in 2007 election campai
  Outcome: ALL              Population: All Recipients
  y2008

                   |            Family Type
  Weekly           |
  Taxable  | Married   Married +  Sole      Single     |
  Income   | no childr. children   Parent    Adult      |    ALL

  < 150    |    0.20      0.58      0.00      0.00      |    0.05
  150-299  |    0.26      0.33      0.08      0.71      |    0.56
  300-449  |    0.45      2.09      1.62      5.62      |    3.32
  450-599  |    1.47      7.03      6.39      8.68      |    5.59
  600-749  |   10.78     15.96     16.99     19.06     |   17.23
  750-899  |   17.43     19.09     19.57     20.30     |   19.60
  900-1049 |   20.27     19.58     19.33     18.63     |   19.17
  1050-1199|   21.33     18.82     15.86     12.77     |   16.69
  1200-1349|   23.78     20.35     13.47     11.54     |   17.84
  1350-1499|   26.20     21.61     13.69     11.54     |   19.45
   1500+   |   26.45     24.85     15.42     11.54     |   23.65

  TOTAL    |   13.15     21.07      7.32      7.96     |   11.80
```
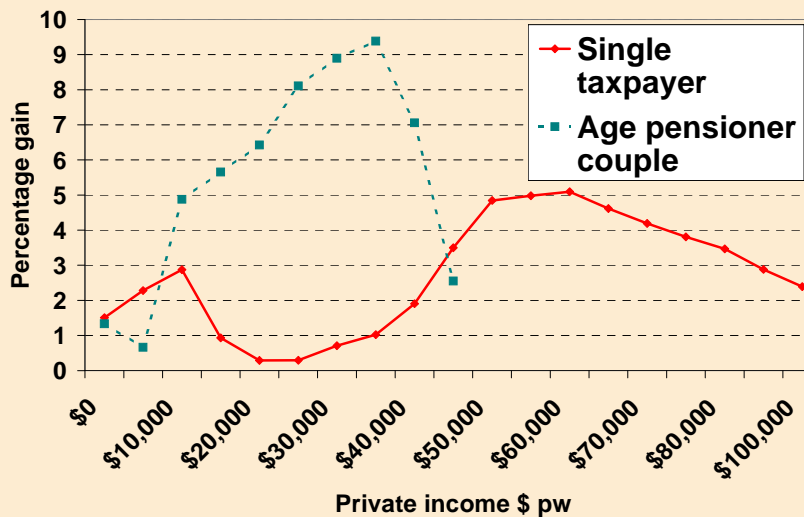
The Great Australian tax reform debate, 1998-2000

- Introduction of 10% goods & services tax (like VAT)

- Removal of existing inefficient indirect taxes (wholesale sales tax)

- Major cuts in income tax

- Large increases in social security to compensate poor

- Question: how to ensure tax reform package is fair?

- Answer: assess its distributional impact using microsimulation models -> use NATSEM

- Compensation to poor increased after NATSEM analysis

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% gain in disposable income in July 2000 tax reform package

Legend:
- **Single taxpayer** (red line)
- **Age pensioner couple** (teal dashed line)

Y-axis: **Percentage gain** (0 to 10)
X-axis: **Private income $ pw** ($0, $10,000, $20,000, $30,000, $40,000, $50,000, $60,000, $70,000, $80,000, $100,000)
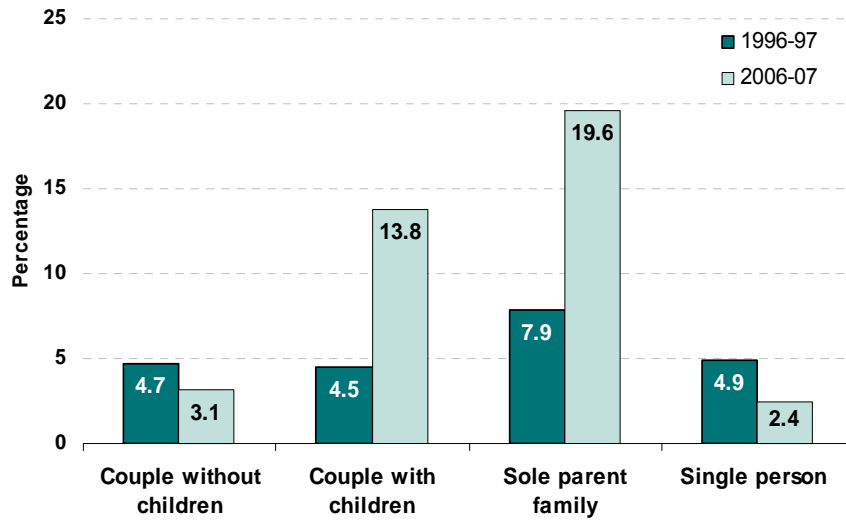
Source: Harding et al, 2000

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Trends in effective marginal tax rates (EMTRs)

- With ageing population and labour shortages, EMTRs are a major policy issue

- Australia wants to reduce work disincentives – issue being considered in current Treasury Tax Review

- EMTRs measure the proportion of an additional dollar of earnings that is lost to both income tax and the reduction of income-tested government benefits (e.g. Newstart, Aged Pension, Family Tax Benefit (FTB)

- Australian system highly means-tested:
  - In 2006-07, 7.1 % of working-age Australians (910,000 people) faced EMTRs of 50c in the dollar or more.
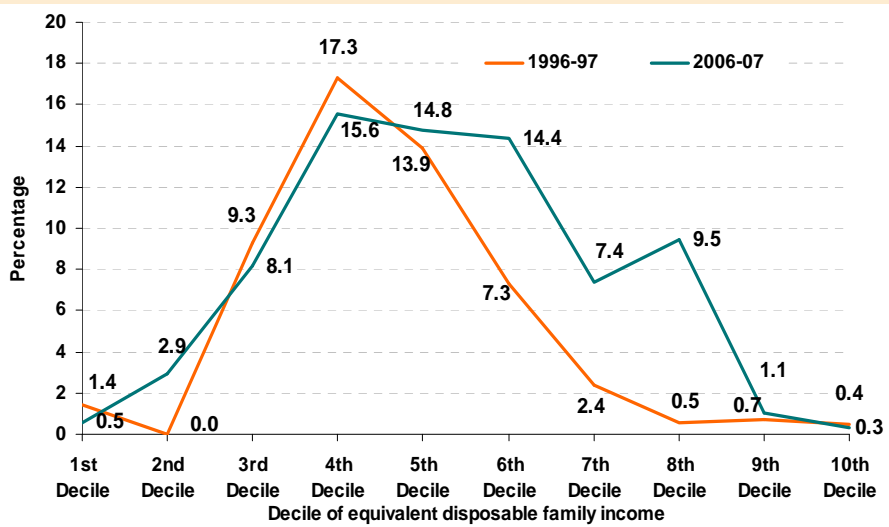 - Up from 4.8% in 1996-97

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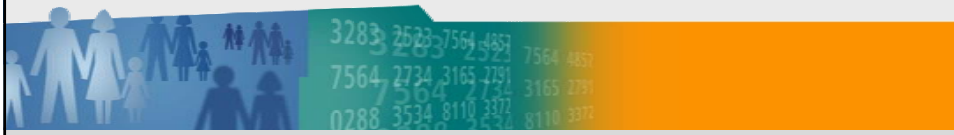## Proportion of each family type with high EMTRs

Note: 'High' EMTRs defined here as > 50 %.   Source: Harding et al, 2006

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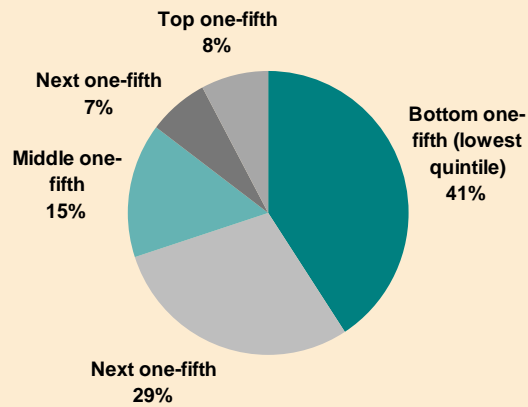## Distribution of high EMTRs by decile, 1996-97 and 2006-07

Source: Harding et al, 2006

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Health microsimulation models

MediSim: The Australian Pharmaceutical Benefits Scheme

- PBS aims to provide affordable access to prescription medicines

- Concessional patients – pay up to $5.00 per script in 2008 (government pays rest)

- General patients – pay up to $31.30 per script in 08

- Cost Federal govt $5.7 bn in 2006-07

- Second Intergenerational Report predicts spending on pharmaceutical benefits to grow faster than other areas
  - 0.7% GDP in 2006-07 to 2.5% GDP in 2046-47

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% of total PBS outlays received by each income quintile

Top one-fifth
8%

Next one-fifth
7%

Middle one-fifth
15%

Bottom one-fifth (lowest quintile)
41%

Next one-fifth
29%

Ranked by equivalent disposable income of their family using new OECD scales

Source: Harding et al, 2004

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Other health models

- HealthMod – cost and use of doctors (Medicare)

- HospMod – cost and use of public and private hospitals

- Diabetes model – long-term costs and benefits of diabetes prevention and management strategies

- DYNOPTA – optimising ageing and compressing morbidity – dynamic model of 45+ yr olds

- Dementia modelling

- NHMRC Economics and Financing of Health project
  - With Monash Uni
  - Linking MONASH macro model to NATSEM's micro models

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Estimated Reduction in Diabetes from a Secondary Prevention Program (Males)
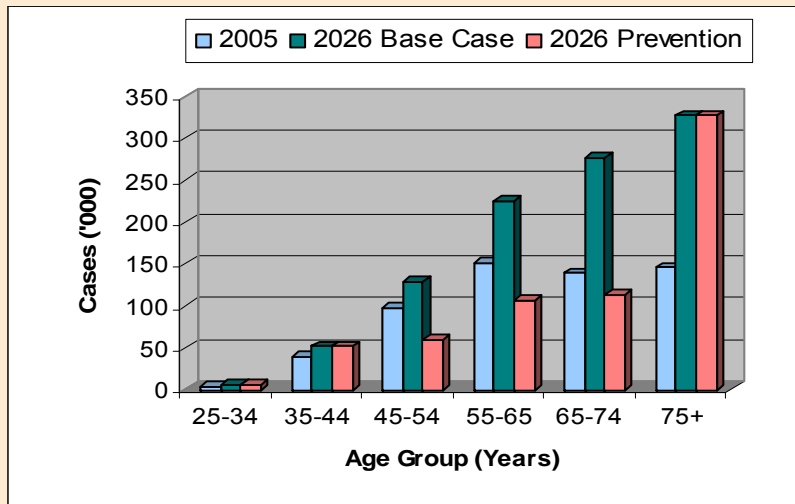
Example of the reduction in the number of Australians with Type 2 diabetes in 2026 if a secondary prevention strategy is run (e.g. an intensive lifestyle intervention that promotes improved exercise and diet etc). This is output from the Diabetes Model.

Dynamic models: simulating the future

History

- Treasury Intergenerational Report highlighted policy changes coming

- Model required to look at equity issues
  - Modelling underlying the IGR is at an aggregated level
  - New modelling capacity required to assess:
    – the distributional impact of future changes
    – the inter-generational redistributive impacts
    – the likely capacity to pay of different groups

- Dynamic microsimulation provides both aggregate and distributional outcomes

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The Australian Population and Policy Simulation Model (APPSIM)

- 5 year project, started in late 2005

- Funded by the ARC and 12 Commonwealth Govt agencies

- Similar to SESIM (Sweden), DESTINIE (France), MOSART (Norway), DYNACAN (Canada), PENSIM (UK)

Australian Government — Productivity Commission

Australian Bureau of Statistics

Centrelink — giving you options

Australian Government — Department of Families, Housing, Community Services and Indigenous Affairs

Australian Government — Department of the Prime Minister and Cabinet

Australian Government — The Treasury

Australian Government — Department of Innovation, Industry, Science and Research

Australian Government — Department of Immigration and Citizenship

Australian Government — Department of Health and Ageing

Australian Government — Department of Finance and Deregulation

Australian Government — Department of Education, Employment and Workplace Relations

Australian Government — Department of Broadband, Communications and the Digital Economy

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APPSIM

- APPSIM aims to provide snapshot output of the characteristics of the population and government programs as at 30 June each year.

- Base data is 2001 Census one per cent sample file (188,000 people), stored in Microsoft Access database

- Parameters stored in Excel spreadsheets and language is C#

- Full population model, with individuals being aged to about 2050; discrete yearly time unit

- HILDA panel data being used to estimate transition probabilities – 5 years of data, 7000 households, sample size problems

- Alignment required to match ABS population projections and Treasury Intergenerational Report labour force projections
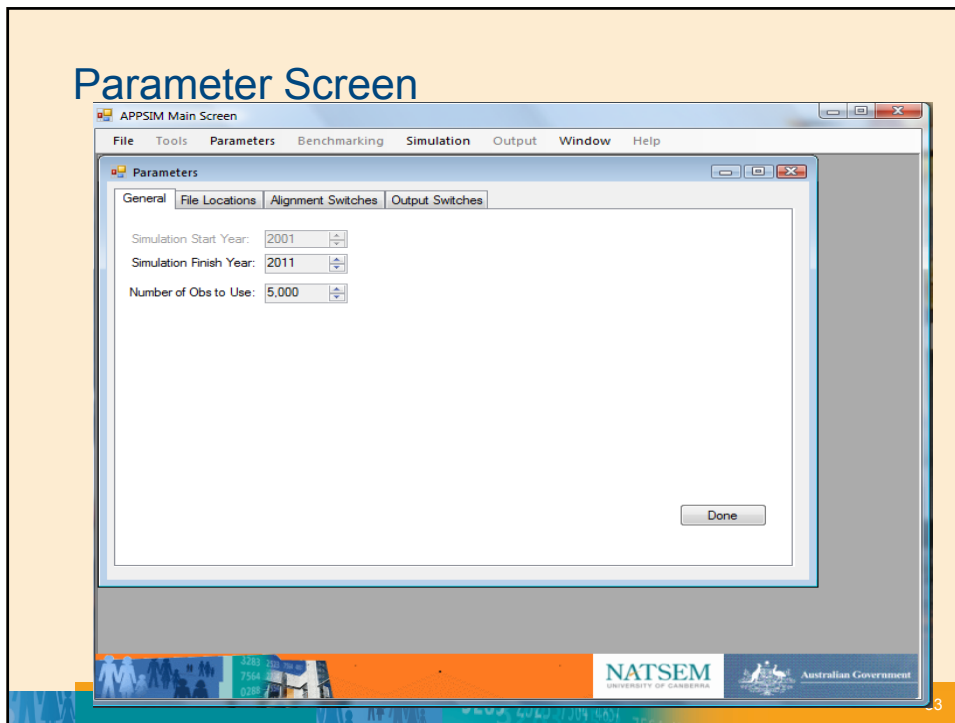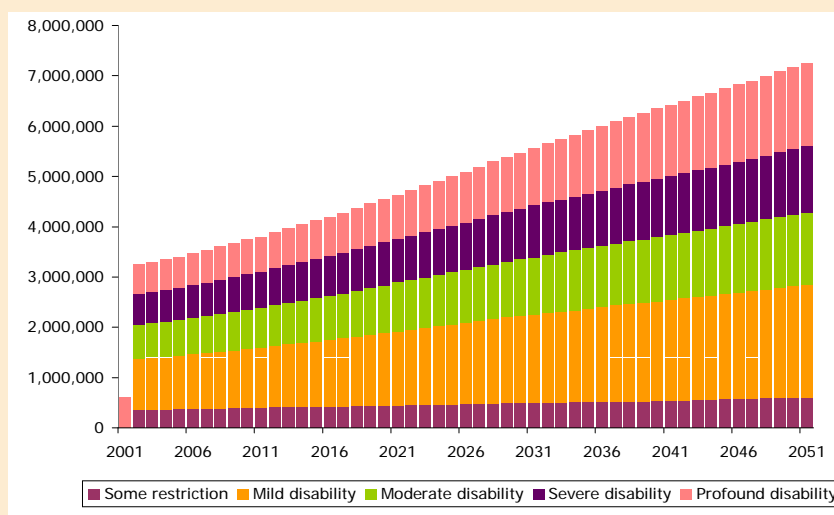
Processes to be modelled within APPSIM

Green shading denotes initial module construction completed or well underway
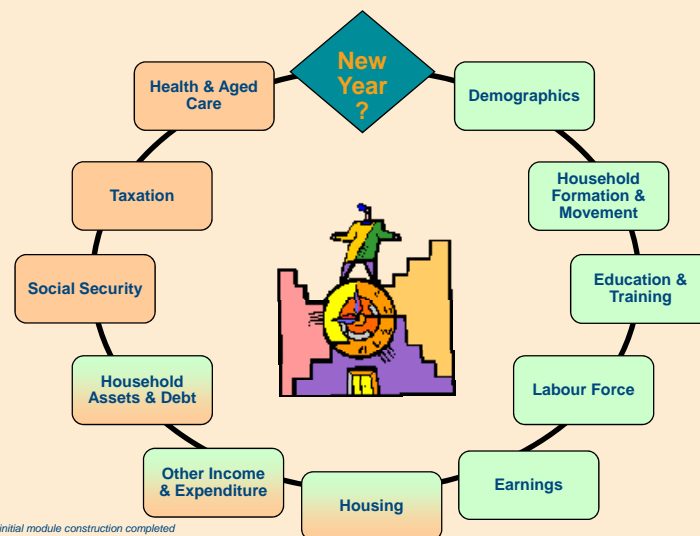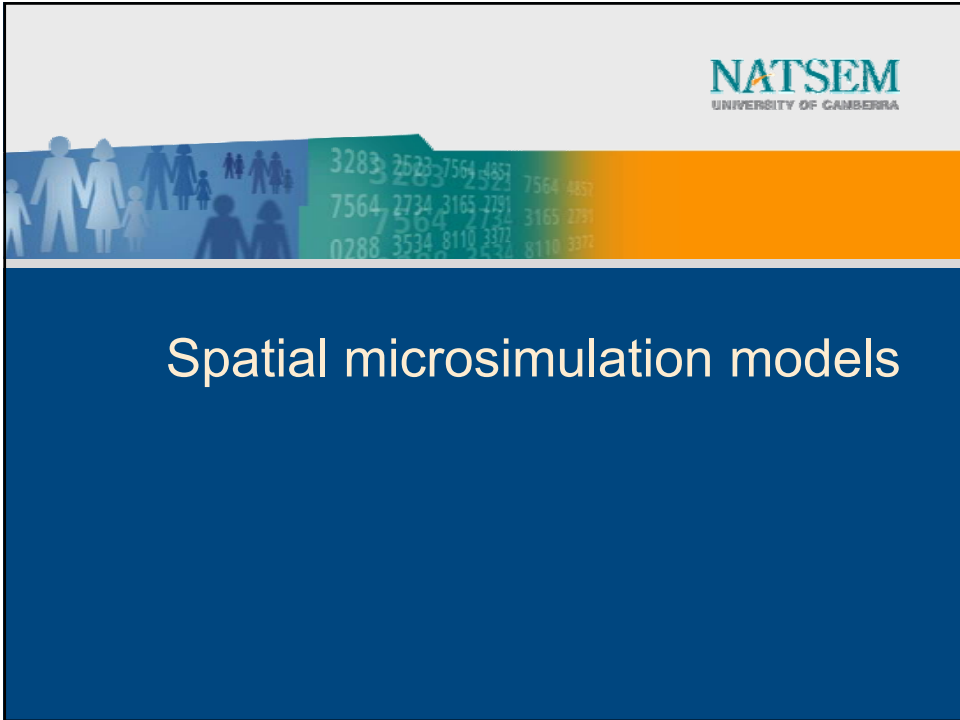
Parameter Screen

APPSIM Sample Output – Disability Status

NOT FOR QUOTATION, Experimental projection output only, APPSIM still under development, December 2008
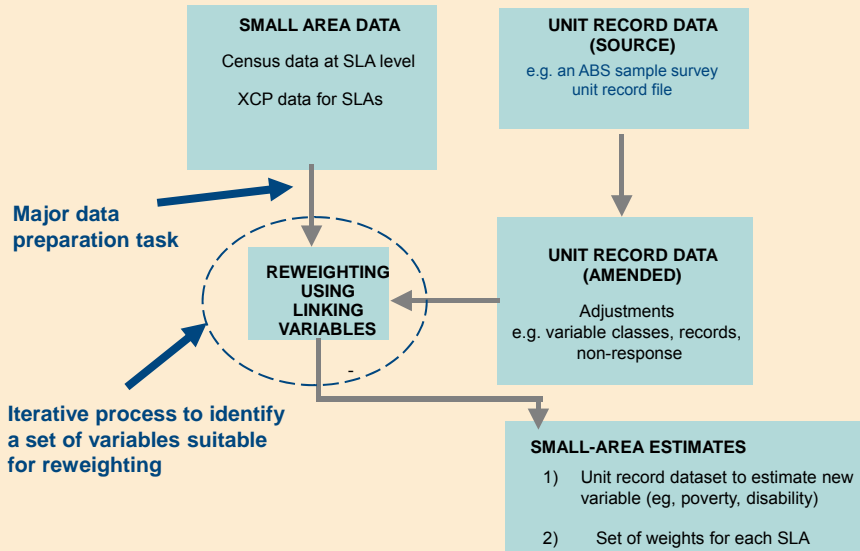
Spatial microsimulation models

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)**

Constructing small-area estimates

SMALL AREA DATA

Census data at SLA level

XCP data for SLAs

UNIT RECORD DATA (SOURCE)

e.g. an ABS sample survey unit record file

Major data preparation task

REWEIGHTING USING LINKING VARIABLES

UNIT RECORD DATA (AMENDED)

Adjustments
e.g. variable classes, records, non-response

Iterative process to identify a set of variables suitable for reweighting

SMALL-AREA ESTIMATES

1) Unit record dataset to estimate new variable (eg, poverty, disability)

2) Set of weights for each SLA

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Reweighting

turning the national person weights in an ABS unit record file into ...

... person weights of small-areas

Unit record	Household ID	Age	Disability Level	Other variables	Person weight
1	1	65	profound	.	1029
2	2	70	severe	.	157
3	2	75	none	.	157
4	2	65	mild	.	157
5	3	60	none	.	1003
6	3	65	none	.	1003
7	4	70	none	.	70
8	4	85	moderate	.	70
9	6	80	mild	.	703
10	6	65	severe	.	703
.	.	.	.	.	.
.	.	.	.	.	.
53220	15374	.	.	.	.
					19,374,000

Num of individuals in Aust

NSW SLA1	NSW SLA2	NSW SLA3	Other SLAs
0	0	0	
0	0	0	
0	0	0	
0	0	0	
2.45	13.54	16.38	
2.45	13.54	16.38	
0	0	0	
0	0	0	
3.27	0	0	
3.27	0	0	
.	.	.	.
.	.	.	.
12465	**25853**	**27940**	.

Num of individuals in small areas

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Application 1: Analysis of Specific Population Sub-Groups

- Allows – for small areas:

  - identification and analysis of specific socio-demographic groups and characteristics
  - analysis at various population levels: e.g. persons, income units, households

- Examples – children in low income families; children in jobless families; unskilled youth, those in housing stress

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Percentage of households in unaffordable housing

- 0.88% - 6.05%
- 6.06% - 9.48%
- 9.49% - 14.00%
- 14.01% - 29.27%
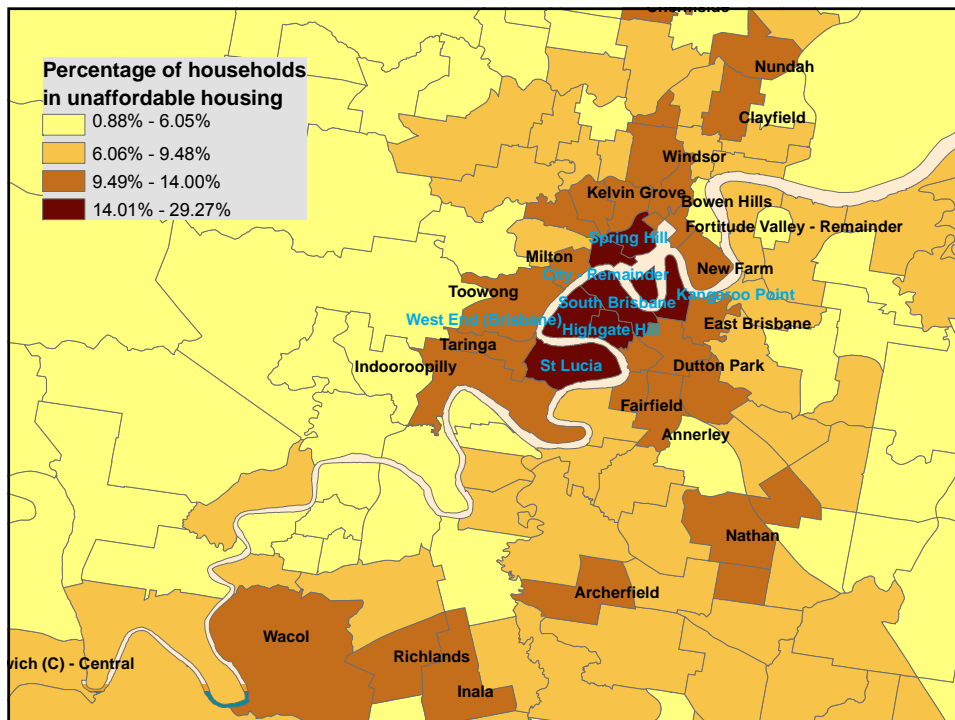
Application 2: Predict spatial impact of a policy change

- **Spatial microdata now linked with NATSEM's existing microsimulation models to model the immediate distributional/revenue impact of a policy change**

  - link synthetic spatial output to STINMOD and model changes to the tax and transfer system for small geographic areas
  - Currently modelling changes in Commonwealth Rent Assistance, income tax, social security and family payments
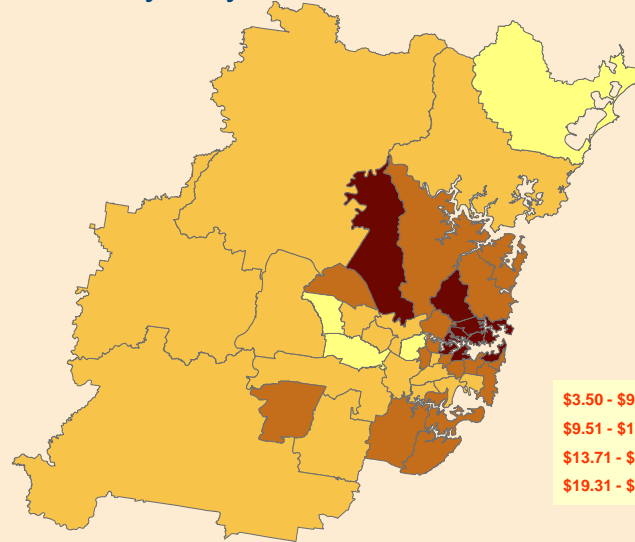   - spatialMSM and HOUSEMOD models

Where did the $5bn of 2005-06 tax cuts go?

2004-05		2005-06	
Tax threshold	Tax rate	Tax threshold	Tax rate
$6,000	0.17	$6,000	0.15
$21,600	0.3	$21,600	0.3
$58,000	0.42	$63,000	0.42
$70,000	0.47	$95,000	0.47

Estimated average tax cut per household per week, Sydney SLAs, 2005-06

$3.50 - $9.50 pw (lightest)
$9.51 - $13.70
$13.71 - $19.30
$19.31 - $34.10 pw (darkest)

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Application 3: Develop needs-based planning indicators

- CAREMOD
  - 'Regionalised' Survey of Disability, Ageing and Carers
  - 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
- Projecting current and future need for services at small area level
  - Given population ageing
- Research partners: NSW, Vic, Qld and ACT

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Change in population with disability, living alone and on pension amongst those aged 65 years and over, NSW 2001-2021(Number)

Source: Lymer et al, 2008
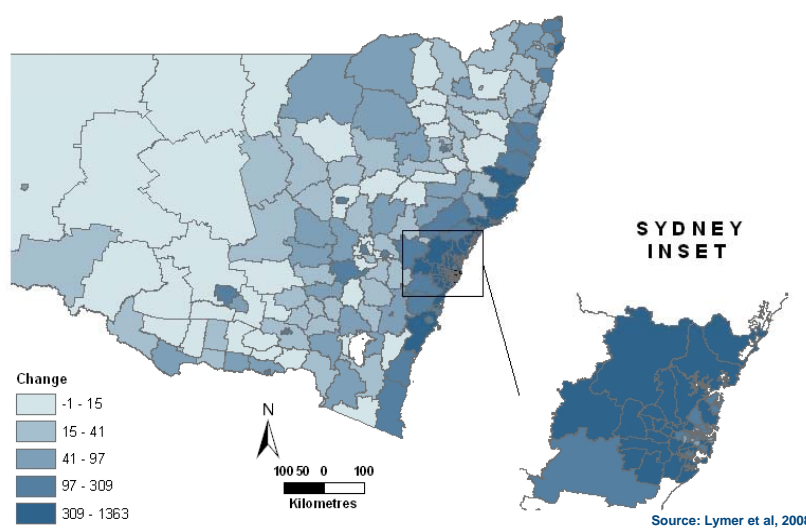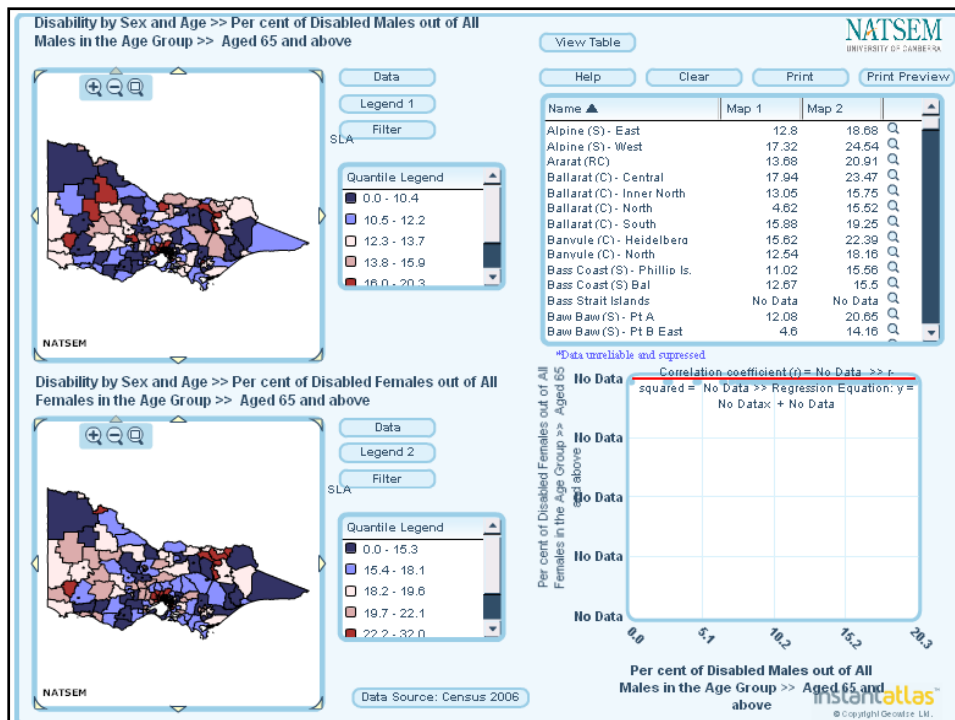
Evidence based policy making

- Growing demand for quantitative decision support tools

- Not good enough today to do 'back of the envelope' estimates of impact of policy change

- Log on to **www.natsem.canberra.edu.au** and join our free email update list
    - 2nd General conference of International Microsimulation Association, Ottawa, June 2009 http://www.statcan.gc.ca/conferences/ima-aim2009/index-eng.htm
    - International Microsimulation Association (free to join) - http://www.microsimulation.org/

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+ see the papers describing the construction of APPSIM at the Working Paper section of the NATSEM website – www.natsem.canberra.edu.au

STINMOD and its use in public policy

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