Disaggregation of CGE results into household level results through micro-macro linkage: Analysing climate change mitigation policies from 2005 to 2030

Hielke Buddelmeyer, Nicolas Hérault, Guyonne Kalb and Mark van Zijll de Jong
Introduction

- Not endorsed by the Garnaut Review and does not form part of its Report, due to time constraints

Outline of the presentation:
- Project overview
- Focus on the approach
- Main characteristics of the microsimulation model (MITTS)
- Main limitations
- Overview of the results
Project overview

- **Objective:** disaggregation of CGE results into household level
- **3 scenarios for the period 2005-2030:**
  - Reference: business as usual scenario (assume negligible climate effects on economy until 2030)
  - 550 ppm scenario: reducing emissions for Australia to a level of 80 per cent below 2000 levels by 2050
  - 450 ppm scenario: involves a reduction to 90 per cent below 2000 levels by 2050
- **Both mitigation policies**
  - introduce an Emissions Trading Scheme on 1 July 2013
  - are assumed to be part of a coordinated global effort to stabilise carbon dioxide equivalent concentrations
Project overview

➢ Output to be produced:
  1. Real net income per adult equivalent
  2. Gini coefficient
  3. Budget shares of basic necessities
  4. Budget shares of energy expenditures
  5. Weekly hours of work

➢ Breakdown:
  – Income quintile (5)
  – State (8)
  – Household type (couples, singles, sole parents)
Project overview

Input to be used:
- Population projections by age, gender and State (from Treasury and ABS)

Input from CGE:
- Employment levels by industry and State
- Unemployment by State
- Interstate migrations
- Changes in labour and non-labour income by State
- Price changes by State and commodity (63)
- Changes in consumption levels by State and commodity
- Permit revenue generated by the ETS (to be redistributed on a per capita basis)
The approach (overview)

- Use changes in **population** composition and size and changes in employment to reweight a current sample (2003-2004 Survey of Income and Housing Cost), more on next slide
- Increase **wages** with real wage growth (by State)
- Use changes in **consumption** levels and consumer **prices** to compute household-specific price indices
- Update **non-labour** non-benefit **incomes** with changes in household real capital returns by State
- This sample can then be used in an usual microsimulation approach to:
  - reflect future populations
  - compute benefit payments and income taxes at the household level
  - derive household real net incomes and household budget shares
The approach (reweighting)

- Benchmarks used in the reweighting:
  - Step 1 (common to all scenarios):
    - Numbers of people by age, gender and state as provided by Treasury+ABS projections
    - 29 age groups * 2 genders * 8 regions = 66 constraints
  - Step 2 (scenario-specific):
    - CGE employment by industry (63→13) and state (8)
    - Unemployment by state (8)
    - Interstate migration (7)
    - Numbers of people by age and gender at the national level from step 1 (29)
    - Total number of constraints = 13*8 + 8 + 7 + 29 = 148
- New weights are obtained using a mathematical procedure minimising changes in original sample weights
The approach (household consumption)

- No consumption in MITTS
- Link MITTS sample to household expenditure survey
  - compute household budget shares for the 63 CGE commodities
- Use changes in consumption levels (by State) from CGE to update household budget shares
- 2 usages:
  1. Provide updated budget shares for basic necessities and a pre-defined energy bundle at the household level
  2. Combine updated budget shares with price changes from CGE to compute household specific price indices → used to deflate gross income
MITTS

- Melbourne Institute Tax and Transfer Simulator
  - Incorporates full complexity of direct income taxes & transfers
    - Replicates the rules of the actual tax and transfer system
  - Uses detailed individual level data: Survey of Income and Housing Cost (SIHC) collected by the Australian Bureau of Statistics (ABS)
    - Detailed information on income from a range of sources, labour supply, individual and household characteristics
  - Usually rules of the tax and transfer system are changed to simulate policy changes
    - Here we change the sample, the tax thresholds and incomes
MITTS

- Individual and aggregate changes can be computed
- Use weights to predict changes at the population level
- Government revenue and expenditure (relating to households) can be determined
- For this project, all behavioural changes are taken from the CGE modelling
- The behavioural component of MITTS is not used, but net incomes are calculated in MITTS, after applying wage changes and income changes derived from the CGE modelling
- Except for income tax thresholds, the tax and transfer system is unchanged
Some issues

- Average tax rates are assumed constant in CGE model:
  - due to real wage growth, tax thresholds need to increase in line with real wage growth
- No distinction between skill levels for employment and wage changes, and other limitations in the detail that is available
- One representative household per State
  - Changes in consumption in response to price changes are the same for all households in one State
  - However, starting point of consumption is different for each household
- Matching of categories in the two models, e.g. industries, commodities
- Assumptions about future income support levels
- Reweighting is, to some extent, a ‘black box’ for employment changes and interstate migrations
Analysis of real net income

- An example of the output the model generates.
- All incomes and wages are expressed in 2005 dollars.
- Household specific CPIs are used to calculate real incomes.
- Equivalised incomes are used.
Real net income

- Reference case
- 550ppm
- 450ppm
Disaggregation of CGE results into household level results through micro-macro linkage:
Analysing climate change mitigation policies from 2005 to 2030

Hielke Buddelmeyer, Nicolas Hérault, Guyonne Kalb and Mark van Zijll de Jong