Microsimulation and policy analysis

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Microsimulation and policy analysis…

- Microsimulation and (micro)economics:
  - □ relationship between academic literature and microsimulation and its uses for policy-making
- Microsimulation and social policy-making at the EU level
  - □ EUROMOD: a model, a community, an approach
  - □ Comparison across countries provides a disciplined structure for analytical choices
  - □ Also relevant for other types of microsimulation model that address questions relevant for policy making in or for the EU
- New challenges for microsimulation

Microsimulation

- Microsimulation model is a set of rules operating on a representative sample of micro units
  - Many possible types of issue and micro-unit: traffic flows, water supply...
  - Here, focus on income and households (persons)

Tax-benefit models I

- Deal with household income, (re-)calculating income components, i.e. taxes and benefits
- Several types of model: "static", "dynamic", "behavioural"
  - But "static" models can incorporate elements of dynamic modelling and can be linked to behavioural models
- The main aim is to analyse the impact of policy changes (but also exogenous economic change or household characteristics) on the distribution of target variables, rather than
  - on the mean, as happens using regression techniques
  - on individual cases, as happens using OECD-style standard family type calculations

Microdata versus family type calculations

- Microsimulation models generally are based on sample surveys, which provide detailed information about individual and family characteristics, labor force status, housing status, earnings.
  - □ It is also common to analyze tax-benefit effects using a range of representative households (e.g. OECD Model family calculations)
  - □ Atkinson and Sutherland (1983) found that some 4% of actual families were covered by the hypothetical family model used by the Department of Health and Social Security
  - □ Cross country and over time representativeness
  - □ This concern is even more relevant for some of the theoretical simulation models used to investigate the effects of government policy in a complex intertemporal setting.

Added value to survey/register microdata

- Information which is otherwise not (publicly) available
  - e.g. tax deductions, benefit eligibility, net/gross values
- Indicators which only exist as output from a MSM
  - e.g. METRs, RRs, budget constraint charts, child contingent payments, net social benefits
- More up-to-date results (as data collection and release takes time)
  - Nowcasting (Leventi, Sutherland and Rastrigina, 2014) and forecasting (Brewer, Browne and Joyce, 2011)
- Results under alternative scenarios/assumptions
  - policy changes (reforms or illustrative changes)
  - changes in personal/household characteristics

Microsimulation and policy evaluation

- Microsimulation increasingly recognised as a key ingredient of a careful, evidence-based evaluation of the design of tax-benefit reforms
  - Importance of considering both ex-ante and ex-post approaches to study the effects of policy changes (Keane, 2010; Blundell, 2012)
  - Ex-ante: static and behavioural models
  - Ex-post: counterfactual scenarios to disentangle what would have happened without a given policy (Bargain and Callan, 2010)

Where does microsimulation come from?

- Guy Orcutt (1957) "A new type of socio-economic system", Review of Economics and Statistics, 39(2), 16-123.
  - *" Existing models of our socio-economic system have proved to be of rather **limited predictive usefulness**. This is particularly true with respect to predictions about the **effects of alternative governmental actions** and with respect to any predictions of a long-range character."*
  - *[…] " research efforts in the behavioral sciences have yielded and show promise of yielding very **substantial amounts of knowledge about elemental decision-making units**. However, existing models of socio-economic systems are neither built in terms of such units **nor are they well adapted to making use of knowledge about such units**."*

Where does microsimulation come from?

- *[...] **current models of our socio-economic system only predict aggregates and fail to predict distributions of individuals, households**, or firms [...].*
- *Aggregation of relationships about elemental decision-making units is fairly easy if the relationships to be aggregated are linear [...]. However, if nonlinear relationships are present, then stable relationships at the micro level are quite consistent with the absence of stable relationships at the aggregate level.*
- *This paper represents a first step in meeting the need for a **new type of model of a socio-economic system designed to capitalize on our growing knowledge about decision-making units.***

Microsimulation and Microeconomics:
a long marriage (Aaberge and Colombino, 2014)

- Orcutt proposed a microanalytic model for the whole economic system, including behavioural responses, as an alternative to the large macro-econometric models.

- However, Orcutt – a background in engineering and physics - had little confidence in microeconomic theory.

- As a consequence, the behavioural relationships illustrated for example in Orcutt et al. (1961) are reduced form specifications.

- Those specifications were considered reasonable approximation even in view of policy simulations (despite Marschak 1953).

Microsimulation and Microeconomics
Divorce

- During the 70s, 80s and 90s, large microsimulation models acquire popularity, also at the policy making level.
- The microsimulation community in this period focusses on the quality of data and the accounting reliability of the predictions.
- Behavioural responses are left outside.
- Arithmetic (static or non-behavioural) models are more palatable to policy makers.

Microsimulation and Microeconomics
Meanwhile…

- The lesson by Marshack 1953 and Hurvicz 1961– revived by Lucas 1976 – i.e. you need structural models to make policy simulation, gets eventually fully learnt.
- At the policy level, there is an increasing interest (fighting poverty, tax reforms, welfare reforms etc.) in issues that involve structural changes in the opportunity sets.
- Heckman, Hausman and many others (late 70s – early 80s) develop appropriate models to account for the complexities in the opportunity set.

Microsimulation and Microeconomics
Meanwhile…

- Applied microeconomists start using microsimulation techniques to compute responses to policies
- Discrete choice and random utility models offer a new and more flexible tool to model and simulate choices subject to complicated constraints.

Microsimulation and Microeconomics
Re-marriage

- The new millennium marks the re-encounter of microsimulation and microecono-(mics)(metrics)
  - □ Sutherland, Mitton and Weeks (Eds.) *Microsimulation Modelling for Policy Analysis: Challenges and Innovations*, Cambridge University, 2000.
  - □ Compare the program of the IMA conference in Camberra 2003 (most of the papers are arithmetic) to the IMA conference 2013 again in Camberra (most of the papers are behavioural, especially labour supply).
  - □ Lessons learnt and increasingly taken into account in the policy debate as well

Microsimulation and Microeconomics

- Structural models are necessary for ex-ante policy evaluation.
  - □ We need an economic model that allows separation of preferences (assumed to be invariant with respect to policy changes, i.e. structural parameters) and policy parameters.

…However:

- External validation is needed (Blundell, 2006)
- Out-of-sample prediction performance (Keane, 2010)
- Labour market equilibrium that can emerge as a consequence of a policy simulation (Colombino, 2013)
- Demand side constraints (Peichl and Siegloch, 2012)
- Longitudinal data to consider state dependence in the labour supply behaviour (Haan, 2010)

Microsimulation and Microeconomics

…Moreover:

- Structural parameters can also be estimated with experimental or quasi-experimental data (e.g. Todd & Wolpin 2006, Bargain & Doorley 2013): this might make them more robust and improve the internal validity of the identification conditions.

- Sometimes, policy-invariant parameters can be estimated with minimal parametric assumptions (e.g. the "sufficient statistics" idea of Chetty (2009): non-behavioural simulation can be complemented by point-estimates of elasticities or other local measures of behavioural responses).

Behavioral models and optimal policies

- Labour supply is central not only in the design and evaluation of specific tax-benefit reforms, but also in the identification of optimal tax-benefit systems.

- Labour supply model are now used to implement a computational approach to the optimal taxation problem (Blundell and Shepard, 2012; Aaberge and Colombino, 2013)
    - allowing the empirical identification of the optimal income tax rules
    - according to various social welfare criteria
    - and guaranteeing revenue neutrality.

Interpreting microsimulation results

- Non-behavioural models
    - day-after response
    - long-run effects if reforms imply marginal changes in the budget constraint
- Behavioural models
    - "month-after" response (Creedy and Duncan, 2005): labour supply effects but labour market mechanisms still late in the process of adjusting wage rates, labour demand, …
    - Very long-run perspective: perfectly elastic labour demand defined by the current wage rates
    - Comparative statics exercise: compare two equilibria induced by different policies, where agents make optimal choices which are mutually consistent or feasible, but then you must impose equilibrium constraints (e.g. Colombino 2013).

Microsimulation and social policy-making at the EU level

- Relevant objectives of EU's Open Method of Coordination (OMC) for social protection and social inclusion policy
  - □ policies should be evidence based,
  - □ policy-making should involve relevant stakeholders,
  - □ concern for social protection and social inclusion should be mainstreamed throughout all policy areas.
- President Junker to the European Parliament
  - □ "… *in the future, any support and reform programme [should go] not only through a fiscal sustainability assessment; but through a social impact assessment as well. The social effects of structural reforms need to be discussed in public (July 2014)*."
- Microsimulation: a highly relevant set of tools
  - □ Even if it is better suited to answering some questions than others

Microsimulation and social policy-making at the EU level

- Policy design: developing policies to meet the national targets set by the Europe 2020 strategy; msm can answer several different types of question:
  - □ Policies that are intended to move outcomes towards the employment target and/or the poverty and social inclusion target.
  - □ Policies that are intended to meet other targets with possible negative (or positive) effects on the social target outcomes.
  - □ Identifying situations where compensating social policies are needed to protect the vulnerable
- Policy monitoring: in the European Semester process
  - □ Dialogue between EC and MS
  - □ A policy framework which takes account of the social, economic and budgetary differences between Member States

Microsimulation and social policy-making at the EU level

Relevance for microsimulation and policy making

- Ministries need access to microsimulation models
- "Stakeholders" too
  - □ European Commission, NGOs, trade unions, policy commentators, journalists, citizens….
  - □ Independent scrutiny of official analysis
- "Access" should be user-appropriate
  - □ Hands-on access to a flexible model
  - □ Commissioned analysis
  - □ Hands-on (e.g. web) access to a simplified, limited set of options
- For results to be useful and correctly interpreted there is a need for
  - □ Quality assurance and high quality inputs (micro-data, timeliness)
  - □ Model transparency + best practice meta-data, documentation etc.
  - □ Methodological literacy
  - □ The importance of technical details in driving the results

Relevance for microsimulation and policy making

- Results need to be comparable (or reconcilable) across
  - □ Countries
  - □ Time
  - □ Models
- Reasons for differences in results should be clear - important for the reputation of microsimulation

- Cross country comparability
  - □ A multi-country model such as EUROMOD
  - □ Mutual exchange and learning between national models

EUROMOD

- Multi-country tax-benefit MSM for the EU countries: unique in its covering 28 countries
- It was built because of difficulties in making national model calculations comparable
- National models exist in many of the countries covered: mutual exchange and learning
- A tool for comparative multi-country research and policy analysis: consistent results
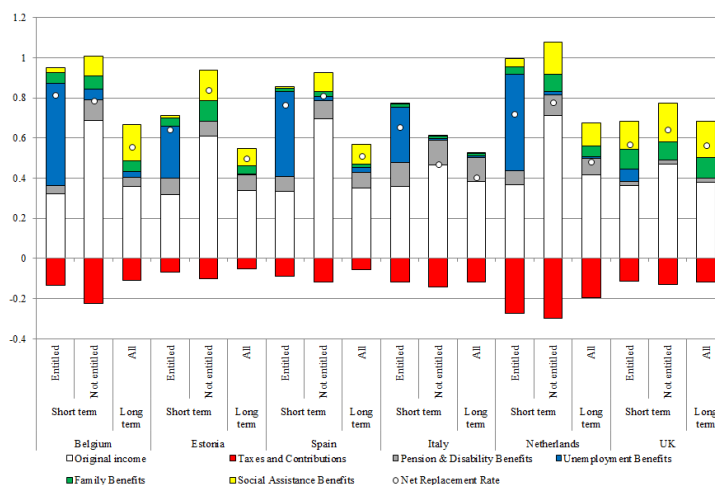
EUROMOD

- Typical features but <u>unique</u> for its multi-country dimension:
    - □ designed for comparative analysis of the effects of policies on household income
    - □ harmonised data and simulations
    - □ achieved through maximising user choice and model flexibility
    - □ tax-benefit modelling language: universal
    - □ library of policies

- Consistent results across countries allow:
    - □ Comparative analysis
    - □ EU-level outputs
    - □ Implications of common changes or changes with common objectives
    - □ Policy learning across countries (policy swapping)
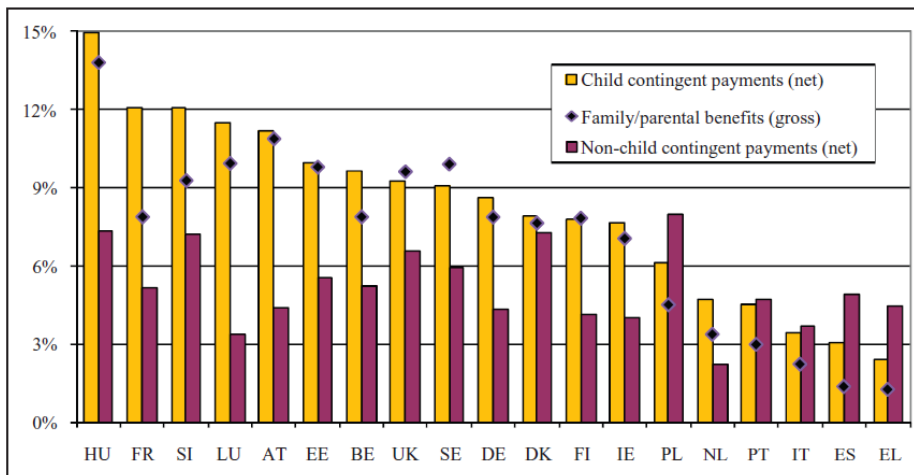
Stress testing the welfare system

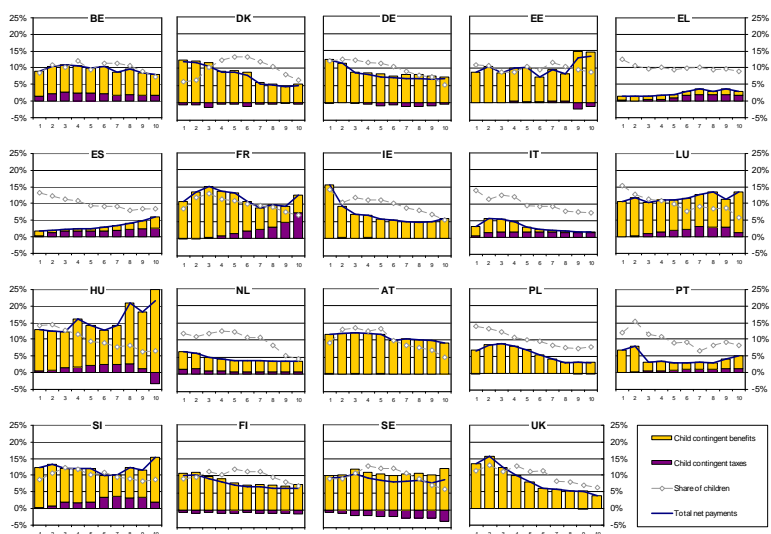- To what extent tax-benefit systems supported those who became unemployed at the onset of the Great Recession ?

Source: Fernandez et al. (2014) using EUROMOD
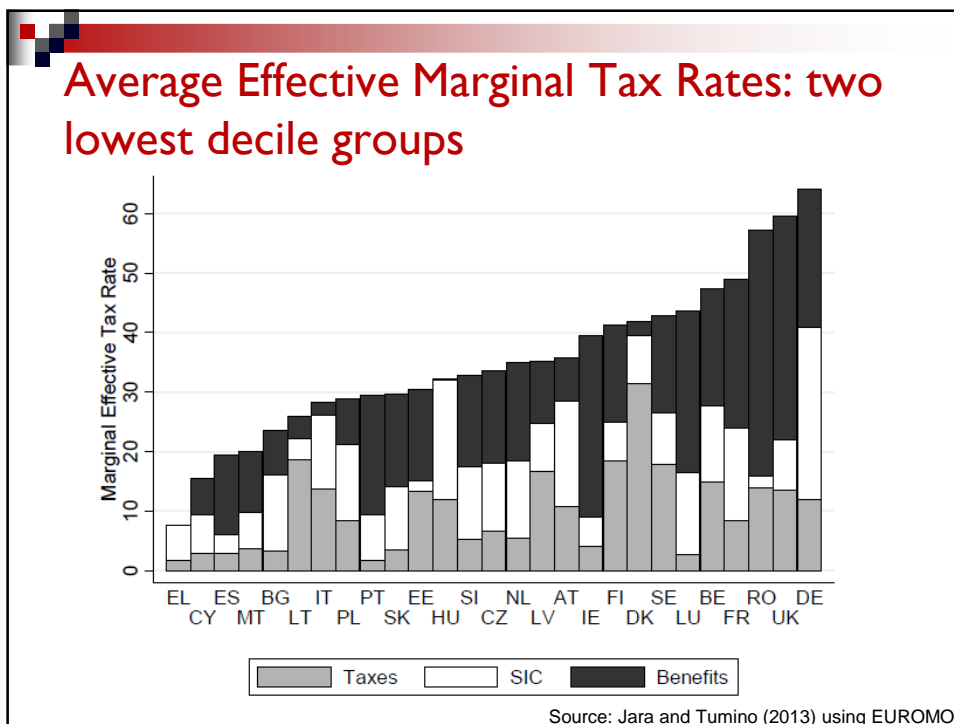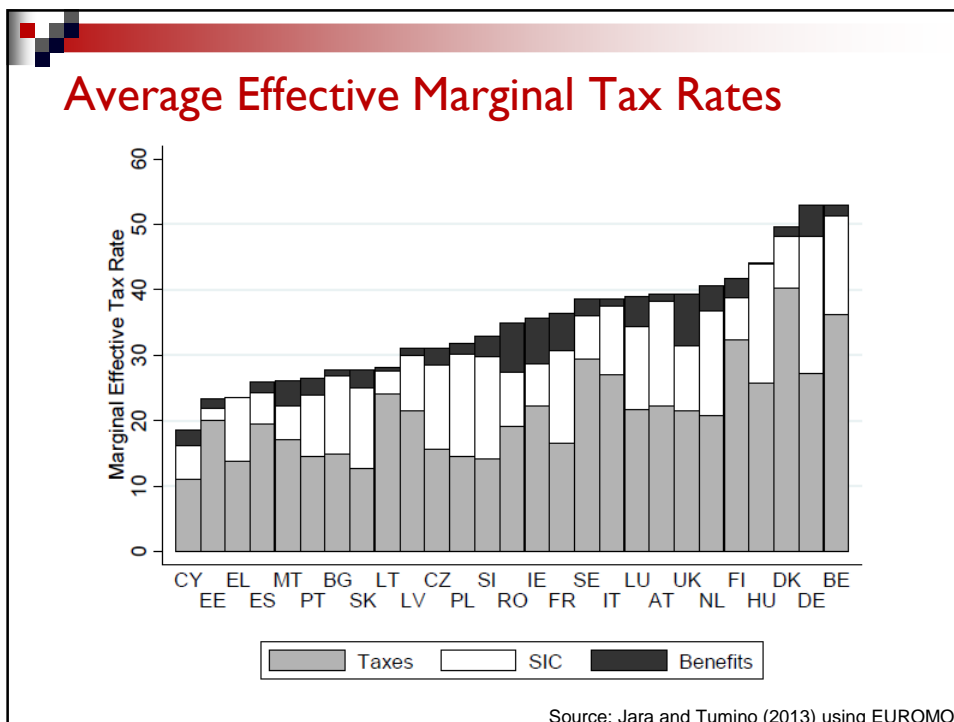
Child contingent support

Source: Figari, Paulus and Sutherland (2011) using EUROMOD

Child contingent support

Source: Figari, Paulus and Sutherland (2011) using EUROMOD

Average Effective Marginal Tax Rates

Source: Jara and Tumino (2013) using EUROMOD

Average Effective Marginal Tax Rates: two lowest decile groups

Source: Jara and Tumino (2013) using EUROMOD

New challenges for microsimulation

- Tax-benefit modelling is now in widespread use to provide evidence in the policy-making process, inspired by and benefitting from academic research
- Within academia, accepted and recognized part of the toolbox in applied public economics
- Four main challenges to promote:
  - □ the method and its regular use for evidence based policy-making and policy monitoring
  - □ the adoption of more sophisticated and specialised methods
  - □ better practice in use of models

New challenges for microsimulation

- Four main challenges:
  - □ **Formal framework** for disentangling the effects of policies and increasing the clarity and transparency of microsimulation uses
  - □ **Behavioural microsimulation** to be extended in terms of policy scope (housing, mobility, savings, …) and compared with ex-post studies
  - □ **Feedback effects between micro and macro level** to go beyond the partial equilibrium framework and to extend the policy scope (environmental models)
  - □ **Cross-country comparisons** of policy effects and policy swap to increase the level of policy learning (Southern Africa, Latin America, Balkans….)

Outlook for the future

□ Data to be improved and reconciled with other information

- Increasing use of register data and related trade-off between high-precision and widespread access
- Technological developments to overcome these trade-offs and access data remotely (e.g. WIDER African models, Mefisto for Flanders, Soresi in Austria)
- Statistical linkage of data from different sources to extend the policy scope and consider the complexity of the tax-benefit system (e.g. indirect taxes, Decoster 2014)
- Modelling of take-up and compliance behaviour
- Statistical significance and reliability of results

Outlook for the future

□ Approach

- **From black box to glass box:** ".... microsimulation modelling still has not achieved the kind of scientific status it deserves. One reason is that many potential users are concerned about the '**black box**' nature of microsimulation models. An important step, therefore, is for microsimulation modelling to become a '**glass box**' activity, including for example public availability of the model and open source code" (Wolfson, 2009)
- **Collaborative approach**: "In the end, cooperation within the microsimulation community and particularly between academic researchers and policy makers will contribute to the integration of microsimulation for policy analysis into the mainstream of economic policy-making" (Atkinson, 2009).

Inputs and credits

- Figari F., A. Paulus and H. Sutherland, Microsimulation and Policy Analysis, in Handbook of Income Distribution Volume 2, edited by A. B. Atkinson and F. Bourguignon, Elsevier, 2014.

- Aaberge R. and U. Colombino, Labour Supply Models, in C. O'Donoghue (Ed.), Handbook of Microsimulation, Emerald, 2014.

- EUROMOD at www.iser.ac.uk\euromod

- Papers cited in the slides