Microsimulation of/for development

Martin Spielauer
martin.spielauer@dms-c.com

Organization

- What is microsimulation?
- 5 reasons why it (sometimes) make sense
- Typical application fields
- Limitations
- Does it make sense in a development context?
- Discussion

What is micro-simulation?

Computer-simulation of a society in which the population is represented by a large sample of its individual members and their behaviors.

- Static: tax-benefit accounting
- Dynamic: behaviors over time

When does it make sense? 1/5

When macro models fail to capture the existing population heterogeneity
(... and we care about it)

- No representative agent (or too many homogeneous groups)
- Research focus on distributions: e.g. winners & losers of reform

When does it make sense? 2/5

When it is easier and more intuitive than other approaches: sometimes behaviours are more stable or better understood on micro level.

- Some behaviors and behavioral differences very persistent
- Composition effects
- Non-linear tax and benefit rules formulated on micro level

When does it make sense? 3/5

When individual histories and consistent life-courses matter

Theoretical perspective: life-course paradigm

- Agency: decisions and events modeled in individual context
- Life-course interactions between life domains: work, family..
- Linked lives: Interactions between individuals

Practical perspective

- E.g. Pensions: Individual contribution histories matter

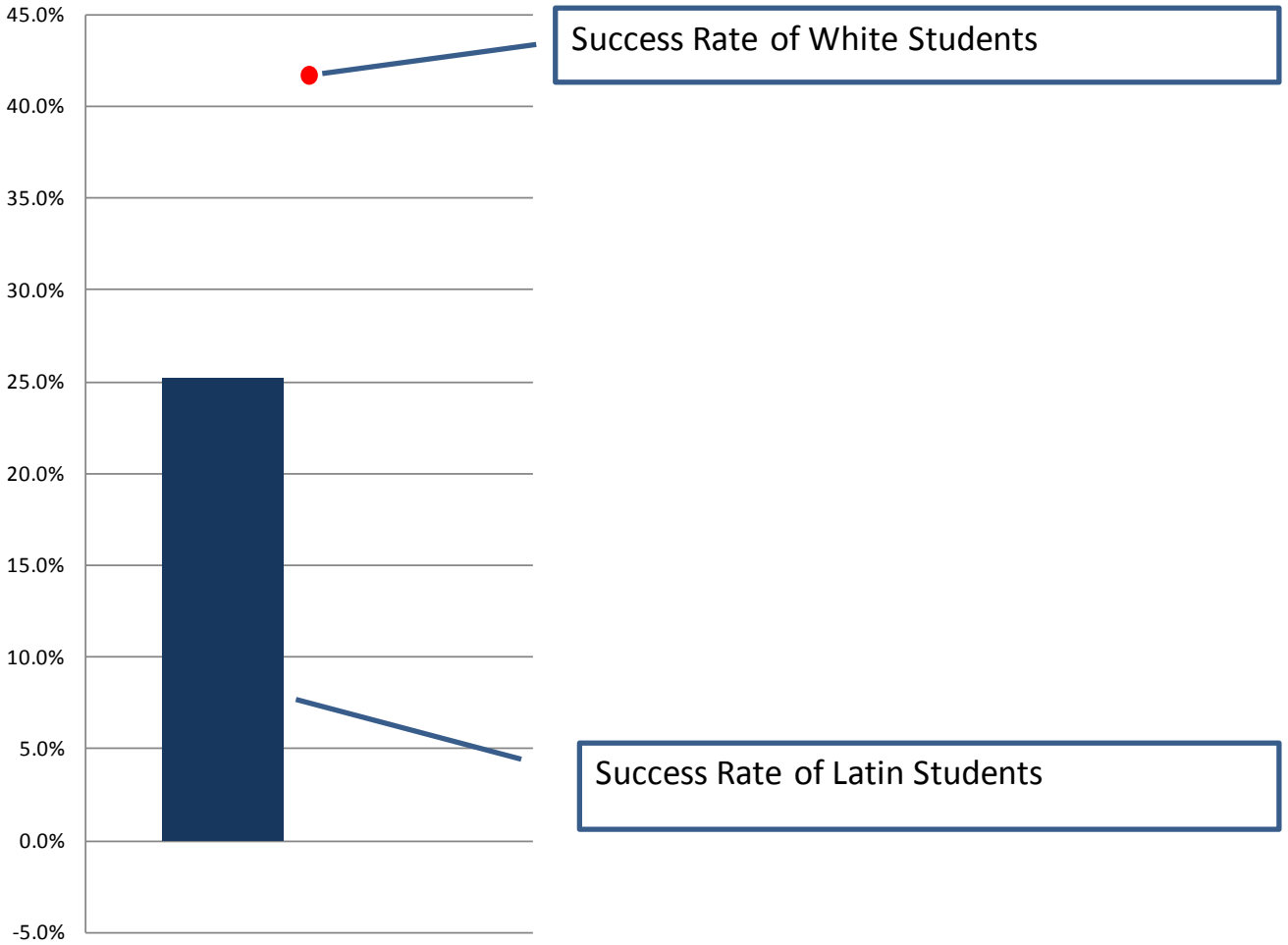
Example: microCC – US Colleges

Outcome (study success) often results from a series of choices. Microsimulation allows to identify the contribution of single decisions

- Initial condition: full/part-time, age, gender, ethnicity
- Repetitive decisions
  - Re-enroll
  - Full-/part/time and number of courses
  - pass exams
- Projection in context of demographic change

microCC – Decomposition– 1/4

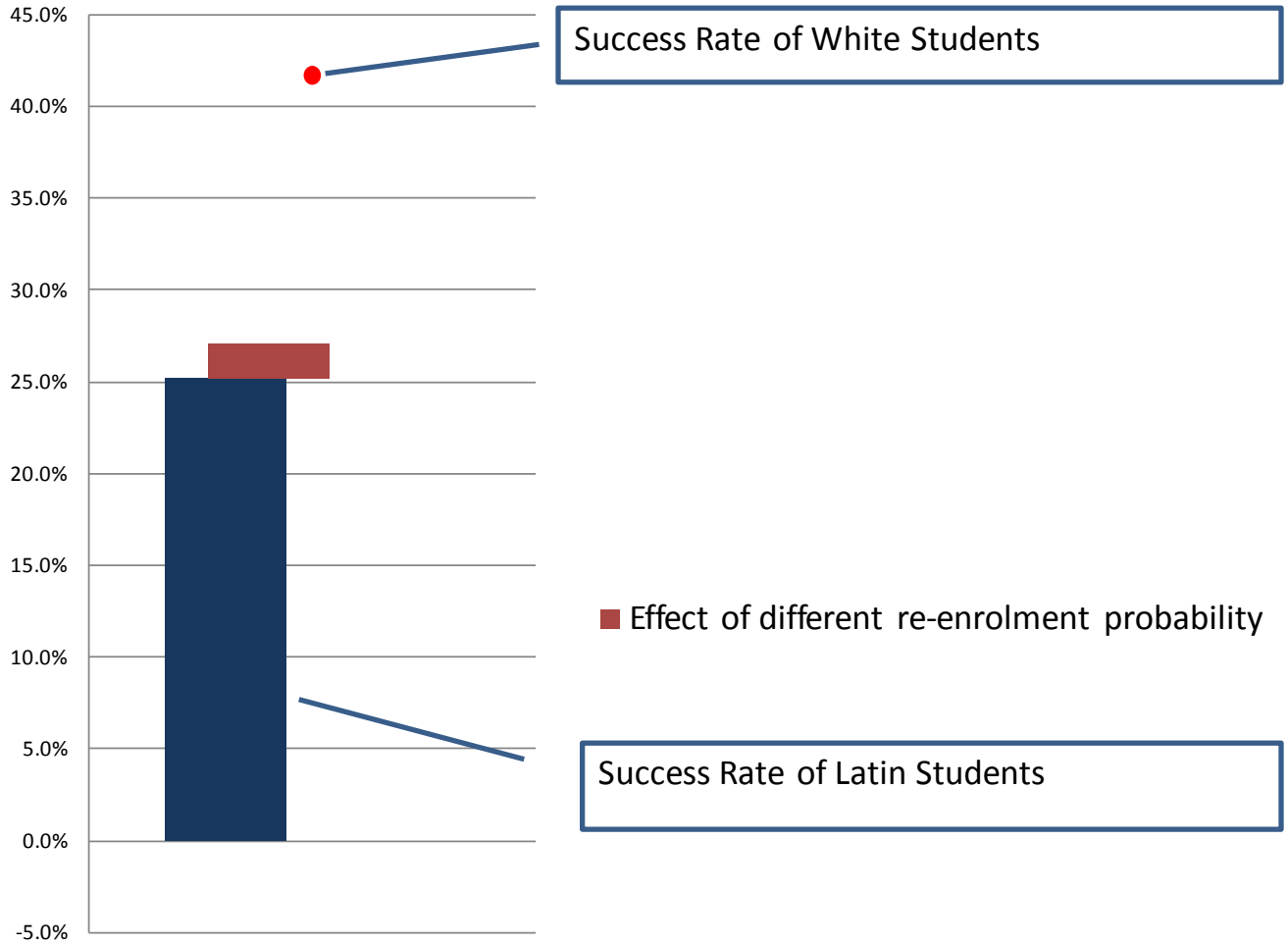
Compositional analysis: Latin students compared to White students, RI



Spielauer & Anderson 2012

microCC – Decomposition– 2/4

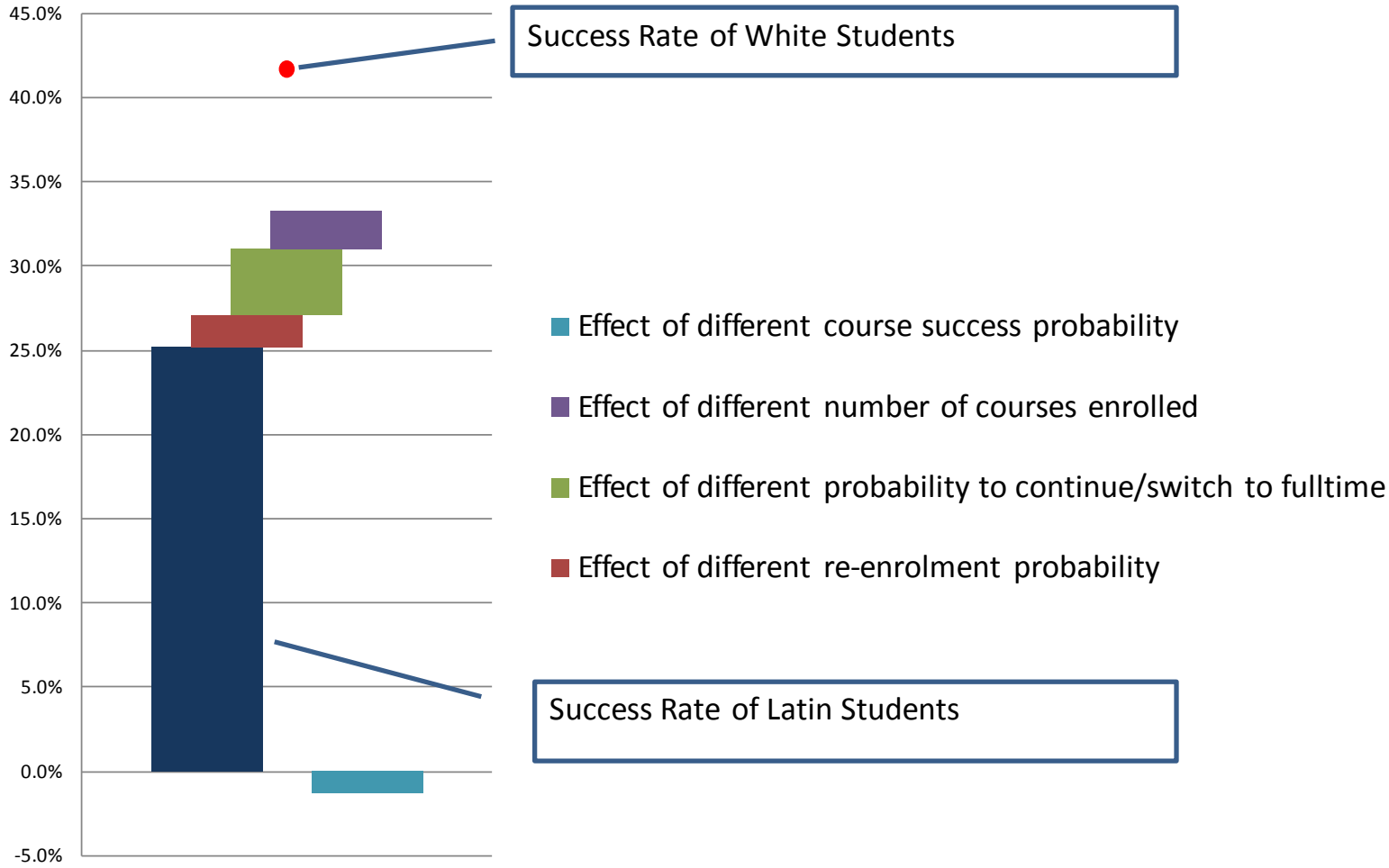
Compositional analysis: Latin students compared to White students, RI



Spielauer & Anderson 2012

microCC – Decomposition– 3/4

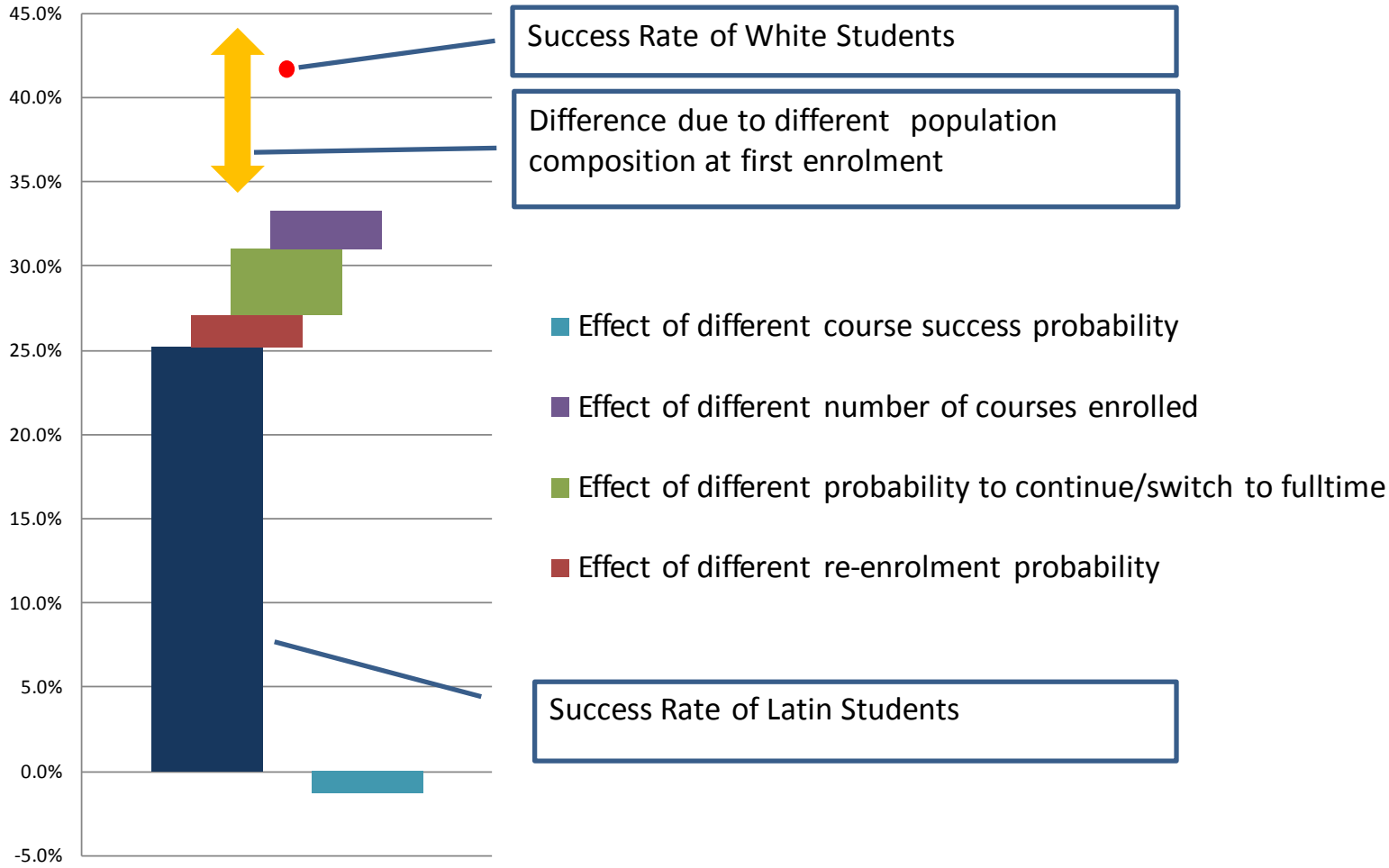
Compositional analysis: Latin students compared to White students, RI



Spielauer & Anderson 2012

microCC – Decomposition– 4/4

Compositional analysis: Latin students compared to White students, RI



Spielauer & Anderson 2012

When does it make sense? 4/5

When micro-data are required for answering policy questions for which information is not available in a single existing dataset

- Synthesis: Combination of information from various sources enhance quality and relevance of data
- Detailed projections into the future: planning
- Policy simulations: virtual world; consequences of actions

When does it make sense? 5/5

A logical next step complementing – and sometimes transforming – research by bridging the micro-macro gap

Example Demography:

- More detailed projections: Macro-projections ignore established knowledge on individual behaviors
- Adds synthesis to micro-analysis: consequences of changes in micro-behaviors on population level

Typical application fields

- Static tax-benefit models: standard tool available in many countries to identify winners and losers of tax reform and to calculate tax revenues
- Population projection models: detailed projections with fine-grained geography and socio-demographic characteristics
- Dynamic policy models: study of policies with a longitudinal component
  - Education: return to investments, student loans
  - Pension systems: sustainability and adequacy
  - Health: public health, treatment, finance
  - Care: health care, elderly care, care networks

Limitations

- Fundamental limitations
  - More detailed projections come at the price of higher randomness lowering the prediction power of results
  - More complex applications frequently require combining strengths of various approaches

- Price tag:
  - High data demands
  - Modeling expertise
  - Technical implementation

Developing world context

- Application in developing world currently very limited
- Some research and applications for “vulnerability profiling” by combining CGE models with microsimulation to study who is most affected by economic shocks (financial crisis) and changes (trade liberalization)
- Some models on spread of diseases: Malaria, HIV

- Can microsimulation inform policy making and program planning ? (or just an expensive toy for rich countries)

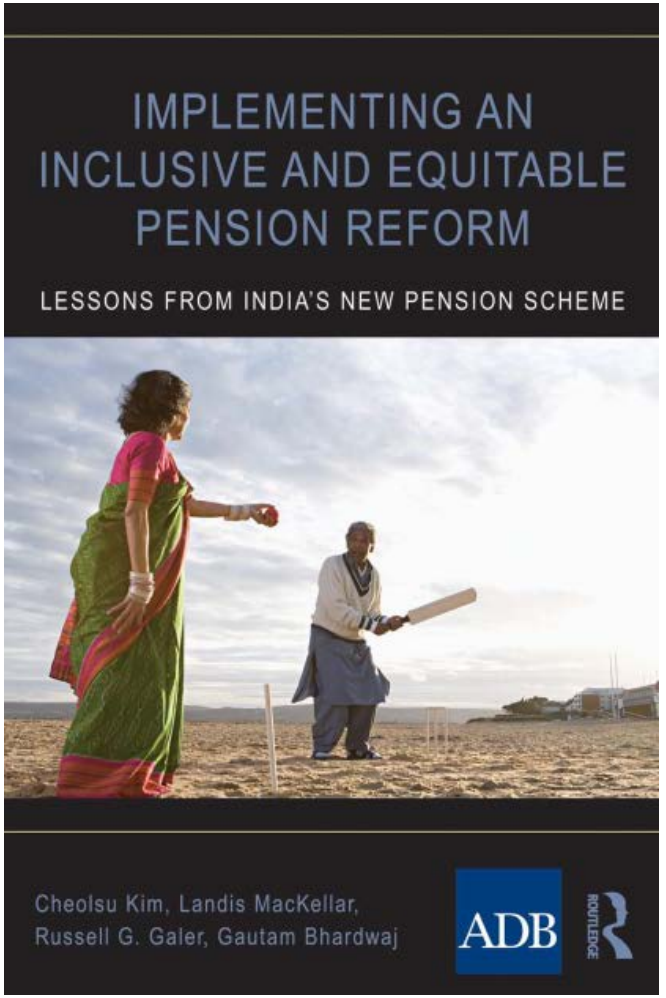
Population heterogeneity

Many development policies and programs specifically address vulnerable population groups

- Developing countries often display high levels of inequality
- No single `representative agent`
- Many development goals (e.g. Millennia Goals) target distributions and high-risk groups

Example: microNPS

Re-production of a macro model with a realistic representation of population can add new insights!



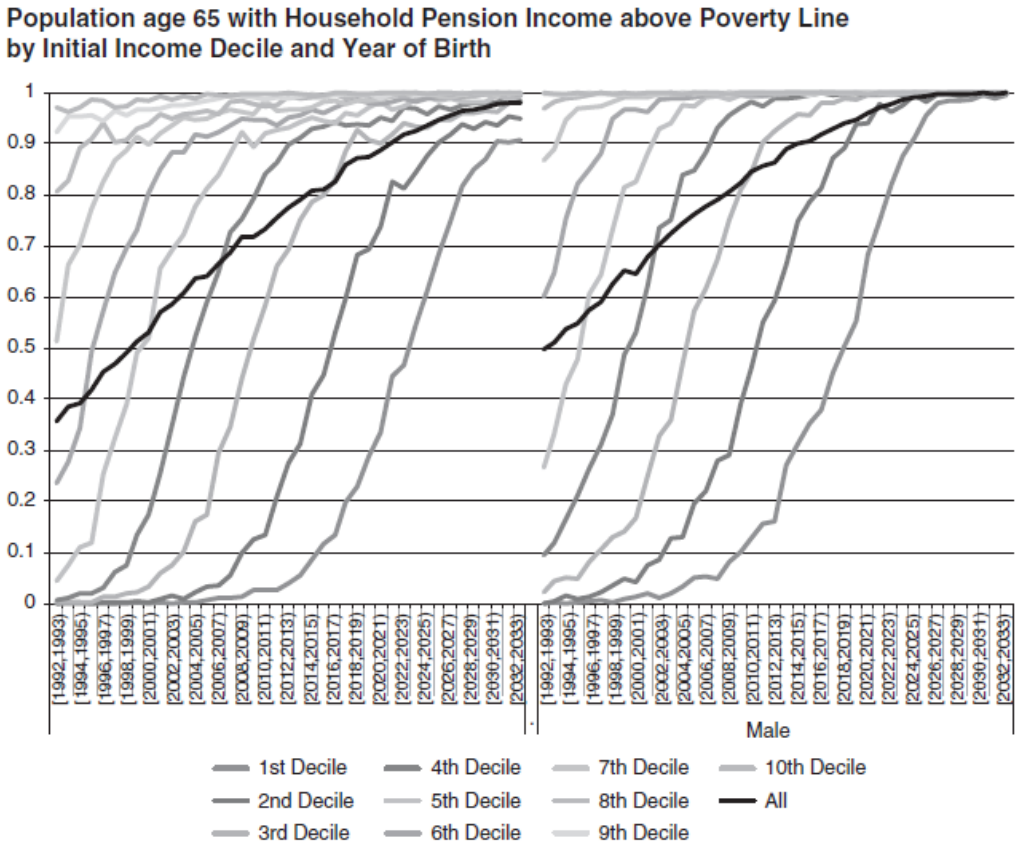
microNPS – Pension System, India

Model based on highly stylized synthetic data complementing macro analysis with distributional analysis

- microNPS complements economic macro-analysis on the design and implementation of India's New Pension System (NPS)
- Shows for which part of the population the proposed system generates sufficient retirement income
- Allows introducing individual level conditions to join the pension plan and make contributions
- Models effect of transaction costs on individual returns

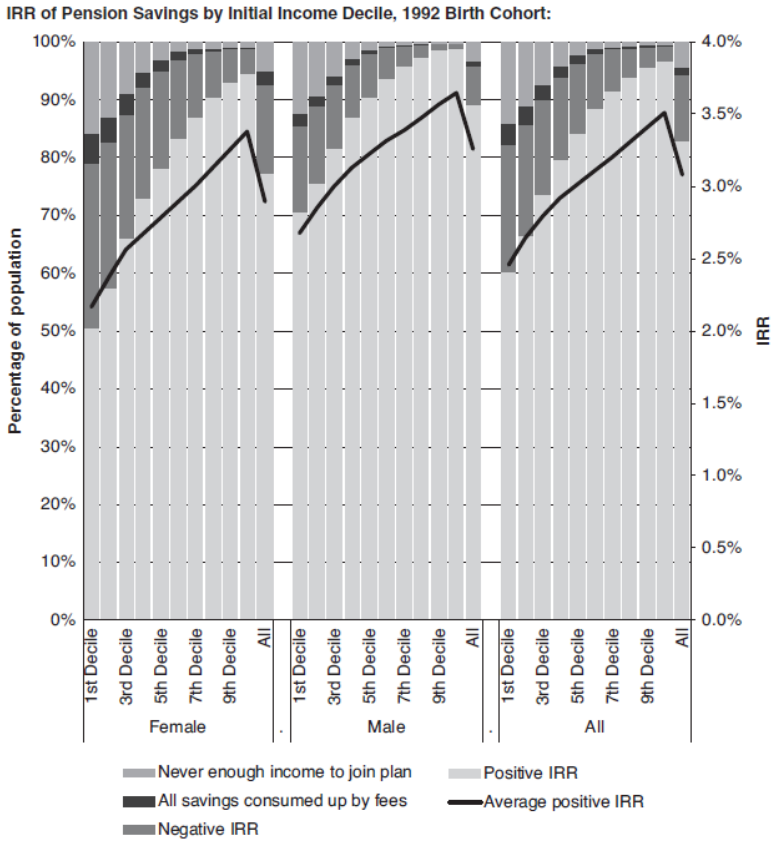
microNPS – Poverty prevention

Shows how policy goals are met within different population groups



microNPS – Internal Rates of Return

Transaction fees can lead to a broad distribution of returns favoring the well off



Life-course perspective

Many policies have a longitudinal component and cause behavioral changes with effects unfolding over time and generations

- Some policies can have dramatic effects on life: survival
- Many policies have downstream effects. E.g. Education affects timing and number of births and child survival
- Behavioral effects: some policies explicitly encourage behavioral change: e.g. Conditional cash transfers.
- Cost-benefit analysis should include downstream effects beyond individual accounting

Data perspective

Microsimulation can enhance policy relevance of existing data and inform data collection

- Combination of information from various sources enhances policy relevance of existing data
- New surveys often part of development projects: identify necessary information for better projections and policy planning enhance relevance of data collection

Transforming research

A vehicle to better understand development?

- Modeling (and translation of theory into computer code) as an activity leads to a better understanding of the subject studied
- Better understanding of consequences of changes in micro-behaviors on population level: drivers of development
- Improving projection technologies
- Testing theories? E.g. modernization

Example: Mauritania

Example: Mauritania

- Data: synthetic data combining census with surveys
- Demographic projection:
  - Start from reproduction of DemProj macro model
  - Geographical context: contextual variables and migration
  - Model of education
- First application: child mortality
- Medium- Long-term: Modeling platform
  - Policies to reduce poverty
  - Typical vulnerabilities: Draughts (and migration)

Development context: Benefits

- Supports planning by more detailed projections
- Supports fundamental policy decisions by better understanding of options
- Supports policy and program design
  - Distributional consequences
  - Ex-ante evaluation and cost-benefit analysis in more detailed context including down-stream effects
- Supports monitoring of programs