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Core methodology III:

Poverty and distribution effects – the microsimulation methodology

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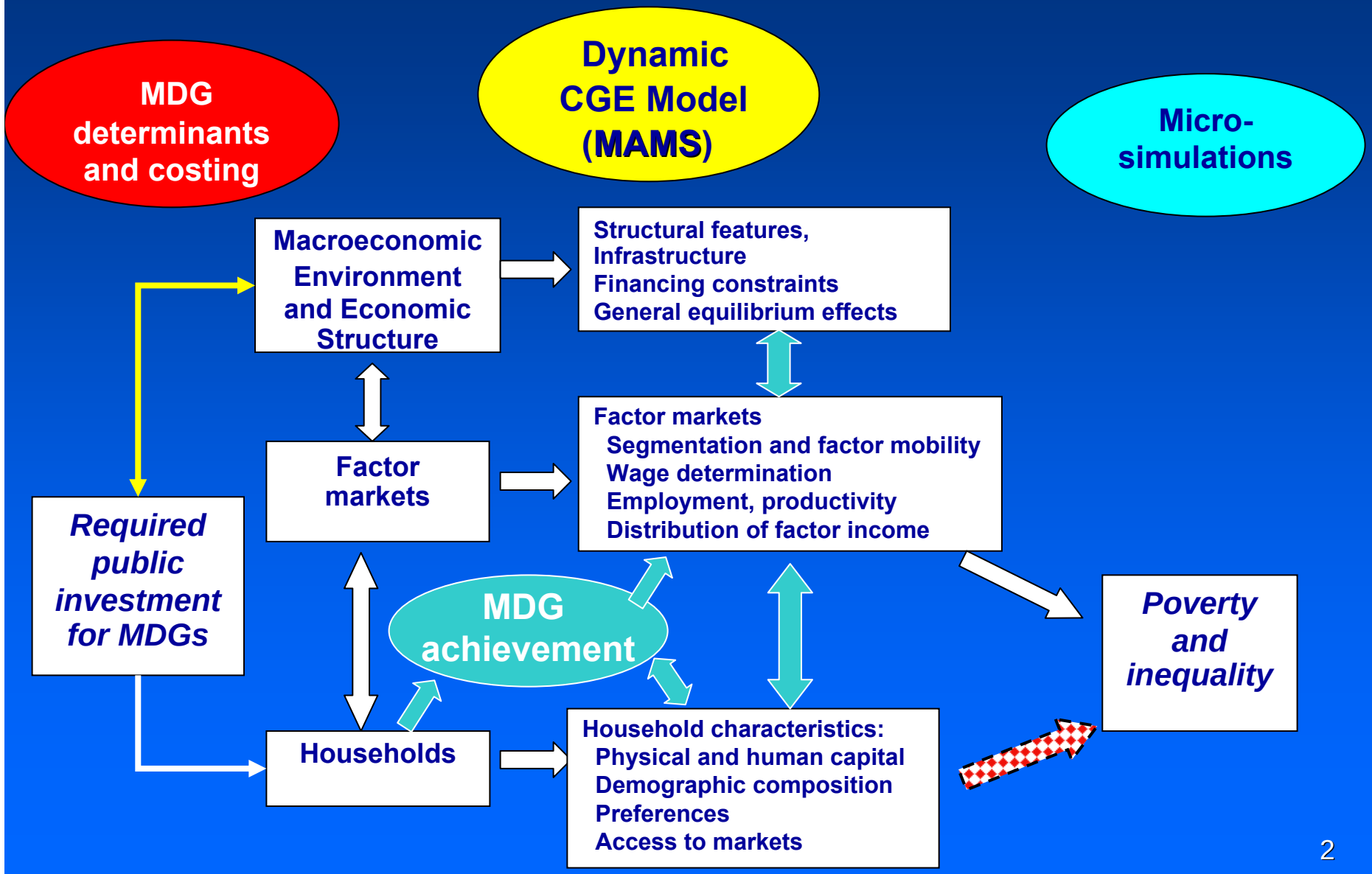
Macro-micro linkages



CGE framework: limited distributional detail

- A typical CGE model is composed of groups of representative households and representative workers
  - Only between-group income distribution
  - Omits within-group income distribution
    - can influence poverty outcomes notably
  - And, even if we have the detail on within-group income distribution: how do we know which workers are more likely to change position in the labour market?
    - E.g.: if, as a result of a policy simulation, the employment rate increases: Who is expected to lose her/his job?
- How can this methodological limitation be overcome?

Three alternative approaches

- 1. Use distribution function in CGE model:
  - A distribution curve is assumed for each group (e.g., Beta-Lorenz)
    - defines within-group distribution
    - enables simulation of changes in distribution curve and how these affect poverty
  - Limitation: we still do not know who does move in the distribution and where to.
    - that is, we assume a stable, unchanged within-group distribution.

Three alternative approaches

- 2. Top-down approach:
  - CGE simulation results are taken and applied to the full distribution as given by a micro data set (i.e., the household survey)
  - Assumption: there are no further feedback effects
  - Micro-modelling of the labour market adjustment:
    - ***2A Household income generation model***: system of equations that determine occupational choice, returns to labour and human capital, consumer prices and other household (individual) income components (Bourguignon et al.).
    - ***2B Occupational shifts proxied by a random selection procedure within a segmented labour-market structure*** (Paes de Barros et al.)

Modelling of the labour market

- The two methods (2A and 2B) define total per capita household income as follows:

$$ypc_{hi} = \frac{1}{n_h}\left[\sum_{i=1}^{n_h} yp_{hi} + yq_h\right]$$

where:

- n_h = size of household *h*,
- yp_{hi} = labour income of member *i* of household *h* ,
- yq_h = sum of all non-labour incomes of the household

Modelling of the labour market

- Focuses on the effects of changes in employment and labour income. Non-labour incomes are assumed to be constant.
- Bourguignon et al:
  - Labour income $Yp = f(O;\ S, E, X)$
  - Probability of being employed $O = f(S, E, X)$
  - Probability of participating $P = f(X, Z)$

    O = type of occupation (sector)

    S = level of education (education)

    E = age (labour-market experience)

    X = individual characteristics, socio-demographic

    Z = household characteristics

Modelling of the labour market

- Micro-simulations:
  - CGE results for "representative" labour categories
  - Probabilities (parameters) from labour supply and remuneration functions are used to simulate:
    - who has larger probability to move in the labour market (from one sector to another, between categories),
    - and, as a consequence, the new level of remuneration

Modelling of the labour market

- Paes de Barros, Ganuza and Vos
  - Segmented labour market approach, without actual modelling (non-parametric approach, assuming random processes)

- The labour market structure λ is a function of the following parameters:

  $\lambda = \lambda\ (P, U, S, O, W_1, W_2, M)$

  - P - participation rates for labour type j
  - U - unemployment rate for labour type j
  - S - employment structure by production sector
  - O - employment structure by occupational category
  - W_1 – remuneration structure by sector
  - W_2 – overall average remuneration
  - M - composition of employment by skill level

  – Labour type j is defined by sex and skills
  – Segments k are defined based on economic sector and occupational category

Classification of population at working age

		Men		Women	
		Skilled	Unskilled	Skilled	Unskilled
Active	Employed				
	Un-employed				
Inactive					

Classification of employed population (= 16 labour categories)

		Men		Women	
		Skilled	Unskilled	Skilled	Unskilled
Tradables sector	Wage				
	Non-wage				
Non-tradables sector	Wage				
	Non-wage				

Paes de Barros method

- Changes in the parameters of the labour market result in a new labour market structure λ^*
- "*Before or after approach*": a counterfactual labour market structure is defined according to micro data from a previous or posterior year
- "*Top-down* approach", the counterfactual labour market structure is derived from a macro model, i.e., a CGE model

Paes de Barros method

- A random number is assigned to each person at working age
- Population at working age is ordered according to:
  - activity condition (active versus inactive),
  - economic sector,
  - occupational category and
  - education level, and...
  - … within "segments", according to random numbers
- Income (YPI) is assigned to all those individuals who, according to λ*, become employed, or change their occupational position and/or level of education
- Income of all those individuals that become unemployed or inactive are set equal to zero

Example: effect of a change in the unemployment rate of skilled men workers (N=100)

		Simulation 1		Simulation 2		
	N	Un-employment rate falls to 6 %	Simu-lated	Un-employment rate increases to 12 %	Simu-lated	
Employed	90	Unchanged	90	↓↓↓↓↓ The last 2 employed become unemployed	88	Employed
		↑↑↑↑↑↑ The first 4 unemployed become employed	4		2	
Un-employed	10		6	Unchanged	10	Un-employed

Paes de Barros method

- To simulate changes in W_1 all YPIs within each of the 16 labour categories are multiplied by an adjustment factor, maintaining the overall average level fixed

- To simulate changes in W_2 all YPIs are multiplied by an adjustment factor such that the overall average level fixed is consistent with the counterfactual scenario

- Based on the simulated YPIs the new total per capita household incomes (YPC) as well as different inequality and poverty indicators are computed

Paes de Barros method

Key assumptions:

- There is lack of a full model of the labour market
  - there are only "segment"; however, individuals can move from one "segment" to another under some restrictions (sex, skilled level, and so on)
- A randomized process is applied to simulate the effects of changes in the labour-market structure
  - on average, the effect of the random changes correctly reflects the impact of the actual changes in the labour market
- Because of the introduction of a process of random assignation, the micro-simulations are repeated a large number of times in Monte Carlo fashion → this allows constructing 95 per cent confidence intervals for the indices of inequality and poverty

Paes de Barros method

- In brief:
  - From CGE model, changes in the labour market structure are applied (individually or sequentially) to micro data, affecting the overall income distribution:

$$\lambda^* = \lambda^*(P^*, U^*, S^*, O^*, W^*_1, W^*_2, M^*)$$

  - Who does move? Random process is assumed to general new income distribution
  - Micro-simulations are repeated many times in Monte Carlo fashion to compute confidence intervals for inequality and poverty indicators that are statistically significant

Paes de Barros method

Advantages:

- Enables to analyse the impact of a wide range of labour-market parameters, individually or sequentially
- It does not demand econometric estimation

Possible disadvantages:

- Behaviour is not modelled
- Results in sequential application may depend on base year
- Results in sequential application may depend on the order in which the sequence of labour-market parameter changes is applied

Paes de Barros method

- Static micro-simulations: as explained earlier
- Dynamic micro-simulations:
  - a number of additional, restrictive assumptions are required as observed survey data may only be available for the base year and perhaps a few years beyond that, but not for the entire projected forward period.

Paes de Barros method

- Dynamic micro-simulations:
  - beyond the base year and for lack of additional modelling of demographic shifts and labour participation, it is assumed that no changes in the population structure (such as migration or population ageing) take place during the simulation period.
  - hence, only one household survey is used, to which labour market structures for *t* periods are imposed
  - obvious limitation of the methodology, but justifiable to the extent that the CGE model does not consider such demographic changes either.