Assessing Development Strategies to Achieve the MDGs in the Arab Region

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Plenary Session IX:

The Micro-Simulation Methodology

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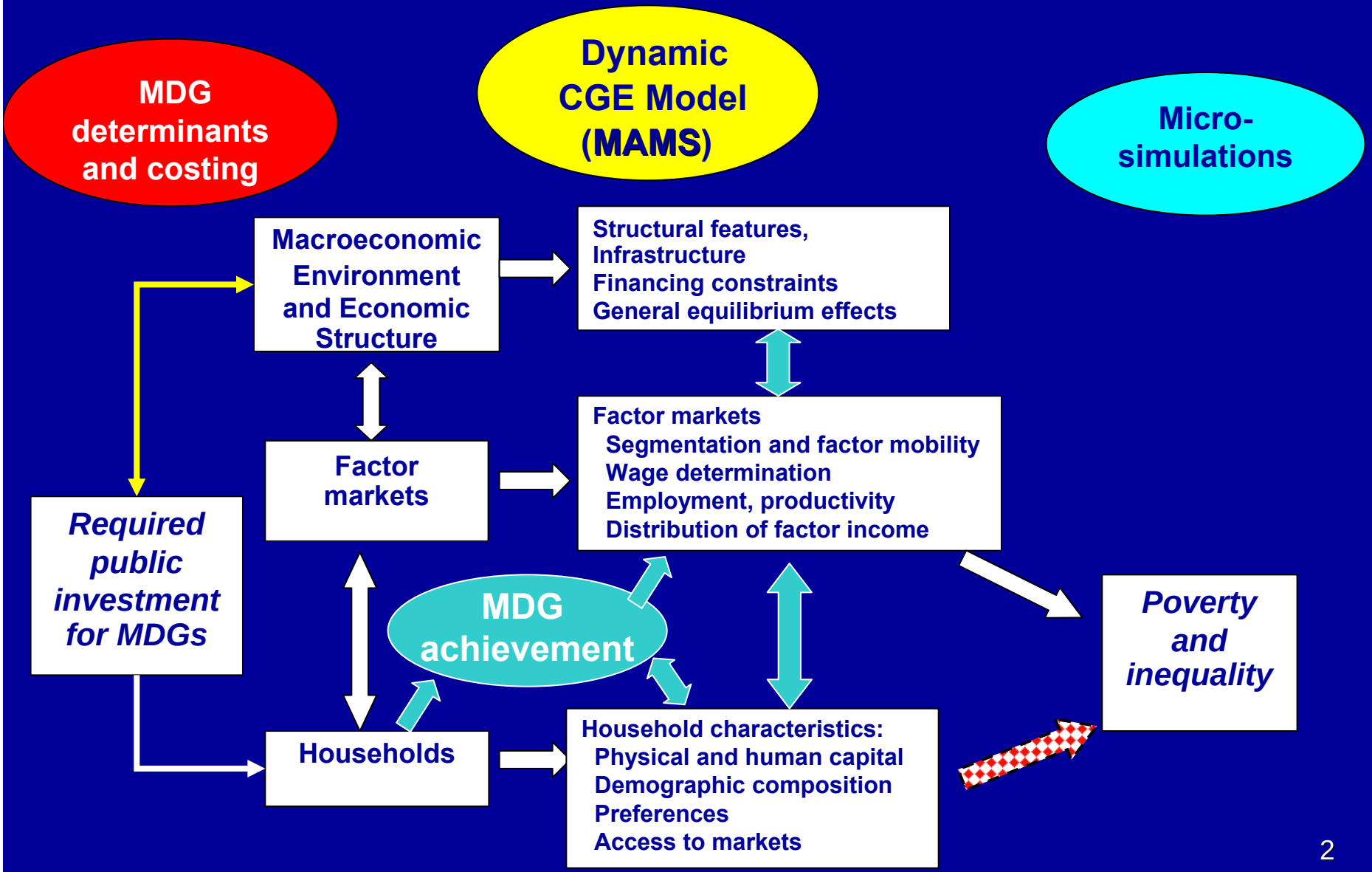
Macro-micro linkages



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 shifts in distribution curve and how these affect poverty
  - Limitation: we still do not know who will move in the distribution and where to.
    - that is, we assume a stable, unchanged within-group distribution (fixed shape of distribution curve)

Three alternative approaches

2. Two types of top-down approaches:

- Top-down
  - 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
- Modelling labour market adjustment:
  - ***2.A: 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.).
  - ***2.B: 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:

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

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 (yq_h) 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 (Bourguignon)

- 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 of workers
    - And given that: how new levels of remuneration are distributed

Modelling of the labour market

- Paes de Barros, Ganuza and Vos (2002)
  - Segmented labour market approach
  - No actual modelling (non-parametric approach)
  - Assumes random labour market adjustment processes

Modelling of the labour market (Paes de Barros et al.)

- 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 in working age

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

Classification of employed population (EXAMPLE = 16 labour categories)

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

Paes de Barros method

Basic approach:

- Changes in the parameters of the labour market result in a new labour market structure λ^*

Alternative applications:

- "*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

How does it work?

- 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

- Same procedure as for shifts between employed and unemployed (U) for shifts by labour category (O) and sector (S)

- 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 wage/labour income level fixed

- To simulate changes in W_2 all YPIs are multiplied by an adjustment factor such that the overall average labour income level is adjusted in accordance with the average wage increase derived from the counterfactual scenario

Paes de Barros method

Final steps

- Based on the simulated YPIs the new total per capita household incomes (YPC) are computed obtaining a new, counterfactual income distribution

- New inequality indicators (for YPI and YPC), using alternative measures (Gini, Theil, entropy), and poverty indicators (for alternative poverty lines) are computed

Paes de Barros method

Key assumptions:

- We do not need a full model of the labour market
  - there are only "segments", but individuals can move from one "segment" to another under certain restrictions (sex, skilled level, and so on)

- A randomized process is applied to simulate the effects of changes in the labour-market structure
  - It assumes that, 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 summary:
  - 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 moves? Determined through a random process which generates a 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
- Shows separate and combined effects of each type of labour market shift (e.g. Unemployment change, wage change, etc.) on poverty and inequality outcomes
- It does not demand econometric estimation

Possible disadvantages:

- Behaviour is not modelled
- Results in sequential application may depend on the order in which the sequence of labour-market parameter changes is applied ("path dependence")

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 certainly not for the forward simulation period.
  - CGE outcomes (deviations from base year for any given simulation year) are imposed on base year household survey data

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.

References:

- Bourguignon, François, Anne-Sophie Robilliard, and Sherman Robinson (2002). "Representative versus real households in the macro-economic modeling of inequality", Washington, D.C.: World Bank and IFPRI (Mimeo).
- Bourguignon, François, Francisco Ferreira and Nora Lustig, (2005) *The Microeconomics of Income Distribution Dynamics in East Asia and Latin America*, Oxford, New York: Oxford University Press (for World Bank).
- Ganuza, Enrique, Ricardo Paes de Barros, and Rob Vos (2002). "Labour Market Adjustment, Poverty and Inequality during Liberalisation", in: *Economic Liberalisation, Distribution and Poverty: Latin America in the 1990s*, Rob Vos, Lance Taylor and Ricardo Paes de Barros, eds. Cheltenham (UK) and Northampton (US): Edward Elgar Publishers, pp. 54-88.