Economic Growth and Income Distribution: Linking Macroeconomic Models with Household Surveys at the Global Level

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Presented by:
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1. Motivation

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   2. Shifting household surveys in the future
   3. Accounting for general equilibrium effects
   4. Building a micro counterfactual (Microsimulations)

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4. Conclusions
1. Motivation

- Study ex ante the potential changes in global income distribution (of individuals).
  - IMF WEO (Apr 2011): “Tensions from the Two-Speed Recovery”

- Need of modeling tool that can generate “reasonable” predictions of how global inequality might change under different scenarios
  - *Predictions* should not be seen as *forecasts*, but as scenarios given certain conditions, or *ceteris paribus* scenarios
2. Methodological Approach

- Use household surveys for 121 countries (90% of world population).

1. Project forward changes in demographic and educational structure (from “inertia”).

2. Project changes in occupational structure and incomes:
   - Taking account of (1) and
   - Forecasting changes in incomes and returns in each sector from estimates of productivity growth and changes in demand from a “Global CGE”.
The GIDD method: 
A “Global CGE-Microsimulation System”

1. Population Projection by Age Groups (*Exogenous*)
2. Education Projection (*Semi-Exogenous*)
3. New Population Shares or Sampling Weights by Age and Education
4. CGE (*New Wages, Sectoral Reallocation*)
   - *Simulated Distribution*
Step 1: Demographic and Education Projections

Age
The changes in demographic structure are taken from WB or UN population projections

Education
Overall education attainments are assumed to be related with aging via a “pipeline” effect (Lutz and Goujon, 2001)

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<thead>
<tr>
<th></th>
<th>Skilled</th>
<th>Unskilled</th>
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<tbody>
<tr>
<td>Young</td>
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<tr>
<td>Old</td>
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Step 2: Reweighting individual observations in the surveys

- Organize sampling weights into a matrix of individuals by partition cells:

\[
W = [w_{mn}]
\]

Matrix of “n” individual sampling weights over “m” characteristics

\[
P_m = \sum_{n=1}^{N} w_{m,n} = Wi_n
\]

Population in Subgroup “m”

- The demographic and educational projections generate the target (or expected) population in each sub-group \( m \):

\[
\hat{P}_m = \sum_{n=1}^{N} a_{m,n} w_{m,n} = (A\cdot W)i_n
\]

\( \forall m = 1, \ldots, M \)

- System is under-identified (mxn-1 var, m constraints). Can be solved in various ways, including

\[
\bar{a}_m = \hat{P}_m \left( \sum_{n=1}^{N} w_{m,n} \right)^{-1}
\]

\( \forall m = 1, \ldots, M \)
Step 3: General Equilibrium Effects

• There are other changes in the economy, in addition to the age/education structure.

• These are simulated through a (computable) general equilibrium model, which incorporates the population changes from Steps 1 and 2.

  – The World Bank’s global LINKAGE model
    • Production function is nested CES with five factors:
      Unskilled and skilled labor, capital, land, natural resources.
    • Demand structure modeled through an ELES, with cross-price and income elasticities.
    • Sector-specific productivity growth trends “calibrated to be consistent with historical evidence”
Distributional effects of macro policies: top-down macro-micro approach

**Macro**: Global CGE model

Exogenous shock (age education, productivity) or policy change:
\[ \Delta X_s \rightarrow \Delta p, \Delta L, \Delta y \]

**"Linkage variables"**

\[ \Delta p, \Delta L, \Delta y \]

**Micro**: Samples of households and behavioral models

\[ (\Delta p, \Delta L, \Delta y) \rightarrow \{\Delta c_i, \Delta l_i, \Delta W_i\} \]
Step 4: Microsimulations

- **Microsimulation** → map aggregate results into household level specific results; two approaches:
  1. Fixed parametric distribution microsimulation (a la Adelman and Robinson, 1978)
  2. Endogenously generated distribution on the basis of a sample of households

- **GIDD uses 2; aggregate changes are matched by generating counterfactual distributions in the surveys by:**
  - Using probits to identify the most likely individuals to move sectors
  - Using sector-specific earnings equations to predict their earnings
  - Scaling resulting sector and skill gaps so that the changes in average gaps in the survey match the changes in average gaps in the CGE.
  - Making a final adjustment on overall levels of real aggregate per capita income
3. Applications

1. Global Income Inequality in 2030 (compared to 2000)
   - Predict a decline in global income inequality…
   - …driven mainly by inter-country convergence (however, some countries experience large inequality increases).
   - “Global middle class” grows from 7.6% to 16.1% of world population.

<table>
<thead>
<tr>
<th>Index</th>
<th>2000</th>
<th>2030</th>
<th>Dispersion Only</th>
<th>Convergence Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gini</td>
<td>0.672</td>
<td>0.626</td>
<td>0.673</td>
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<tr>
<td>Theil</td>
<td>0.905</td>
<td>0.749</td>
<td>0.904</td>
<td>0.749</td>
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<tr>
<td>Mean Log Deviation</td>
<td>0.884</td>
<td>0.764</td>
<td>0.893</td>
<td>0.759</td>
</tr>
</tbody>
</table>
3. Applications

1. Global Income Inequality in 2030 (compared to 2000)
   - Local inequality actually increases for 2/3 of the countries
3. Applications (ctd.)

2. The rising influence of China and India

![Percentage of Global Middle Class](chart)

- **China (2000):** 13%
- **India (2000):** 6%
- **Rest of the World (2000):** 87%
- **China (2030):** 38%
- **Rest of the World (2030):** 56%

Source: Authors' calculations
3. Applications (ctd.)

3. Distributional Impacts of Climate Change

- A “climate model” links carbon emissions to regional changes in temperatures.
- Use estimates in Cline (2007) to map these changes onto changes in agricultural productivity. Feed these into agricultural production functions in the CGE.

- Climate-change damage increases poverty in 2030 only moderately
- Larger losses among poor
3. Applications

Other applications:

- “Standard” multilateral trade simulations: the global poverty and income distribution effects of liberalizing agricultural trade;
- International migration scenarios;
- Mobility and middle class, forthcoming flagship of the Latin American Region;
- The poverty and distributional impacts of the 2008-9 global crisis: LAC regional study;
Conclusions

A list of really difficult things to do in economics:

- Measure global inequality
- Account for general equilibrium effects of policy changes
- Construct credible future scenarios

- This GIDD project has it all! Very easy to criticize, but:
  - If we want to address the questions addressed here, no clearly superior alternative to the GIDD is currently available;
  - GIDD, like any other economic model, is helpful to structure the discussion. We are ready to abandon any of its assumptions and working on testing the robustness of its results.