TECHNOLOGICAL PROGRESS IN THE BRAZILIAN AGRICULTURE, POVERTY AND INCOME DISTRIBUTION EFFECTS.

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Objective

- Present a methodology which allows the extension of traditional aggregated welfare analysis to a detailed analysis of impacts on poverty and income distribution.
- Present a case study on technological change in the Brazilian agriculture as an illustration.

Partial equilibrium methods

- Usual assumptions for technological change (TC) evaluation:
  - One market at a time.
  - Prices in other markets fixed.
  - Do not take into account vertical effects: linkages between primary production and upstream and downstream markets.
  - Do not take into account horizontal effects: competition in the factor markets, products substitution.

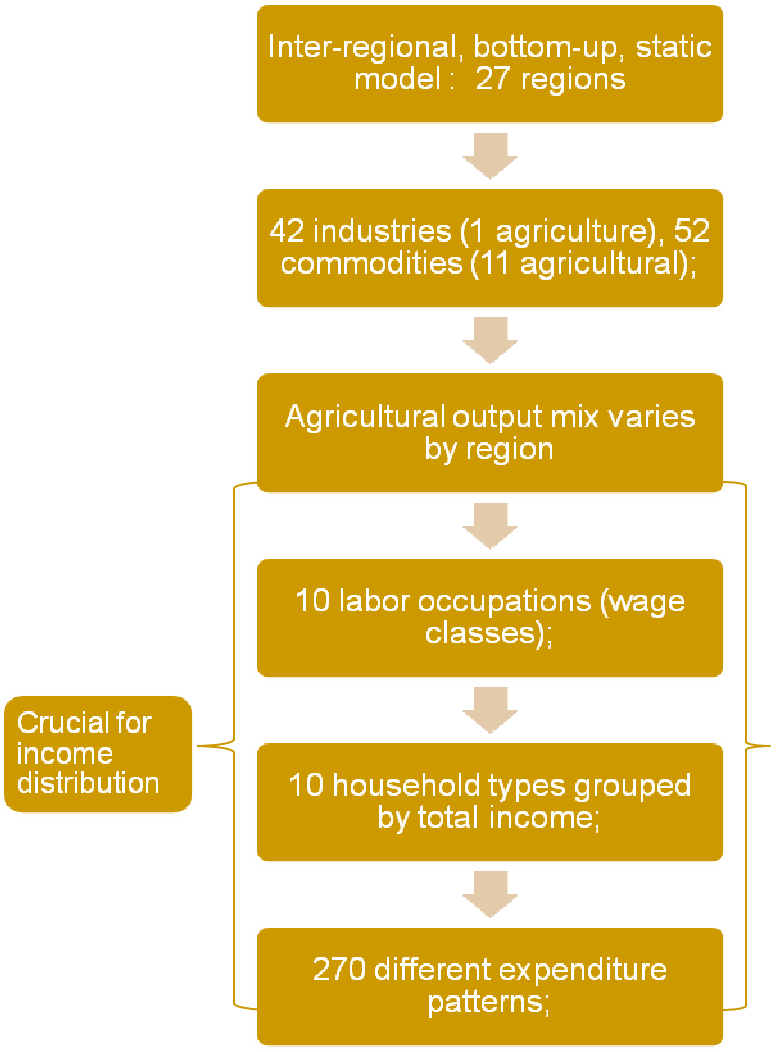
Effects of TC in agriculture: complex.

- Reduction in food prices: gains are transmitted in the commercialization chain.
- What about the factor markets? For a given production, the TC reduces demand for factors of production, including labor.
- There is a potentially negative social effect: which factors go unemployed? What happens to their prices?
- These effects are complex.

The General Equilibrium approach

- Overcome the previous limitations in reproducing the circular flow of funds in the economy.
- Explicitly models factor and product markets.
- Takes into account:
  - the inter-sector relations in the markets.
  - the consistency of aggregated flows in the economy (macro equilibrium).
- This paper uses a Computable General Equilibrium approach:
  - TERM-BR: a CGE model of Brazil
  - A micro-simulation model tailored for poverty and income distribution analysis.

The TERM-BR model: main aspects

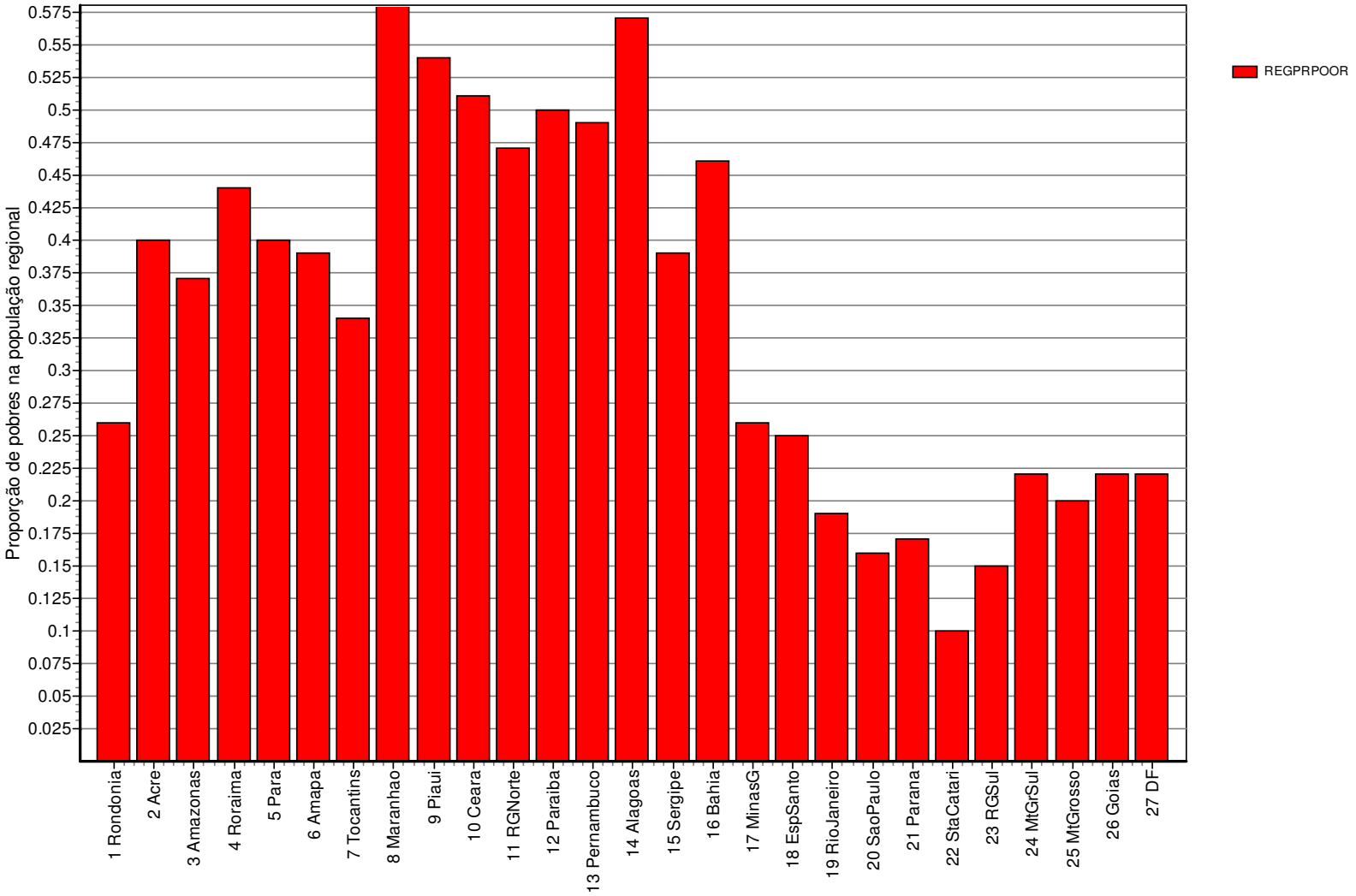


Calibrated with Brazilian 2004 data: IO tables, household surveys, expenditure surveys, other sources

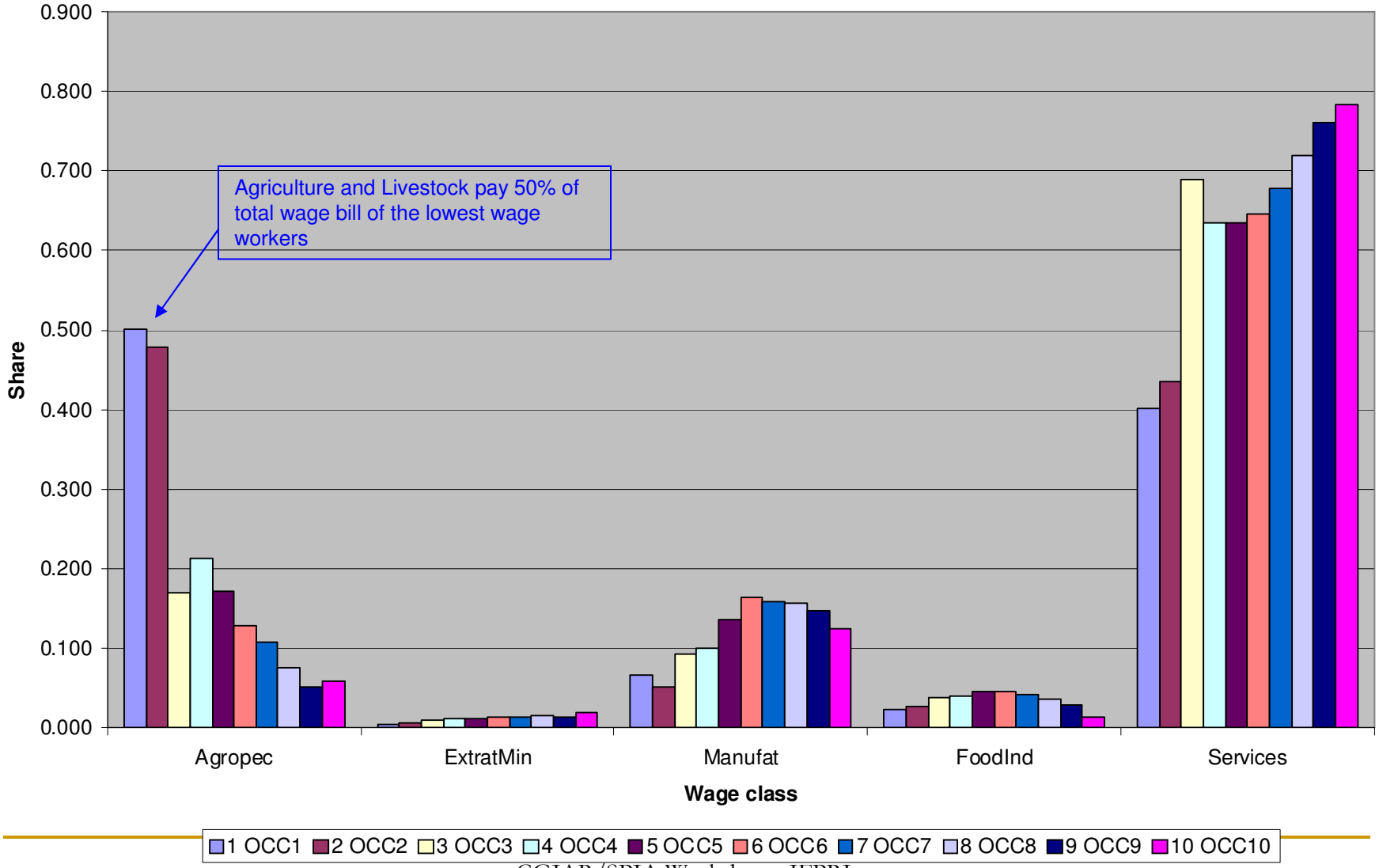
- Micro-simulation module:
- 283,363 adults;
- 121,849 households;
- 41 activities;
- 41 commodities;
- 27 regions.
- 270 different expenditure patterns;

Employment change in the model: jobs allocation

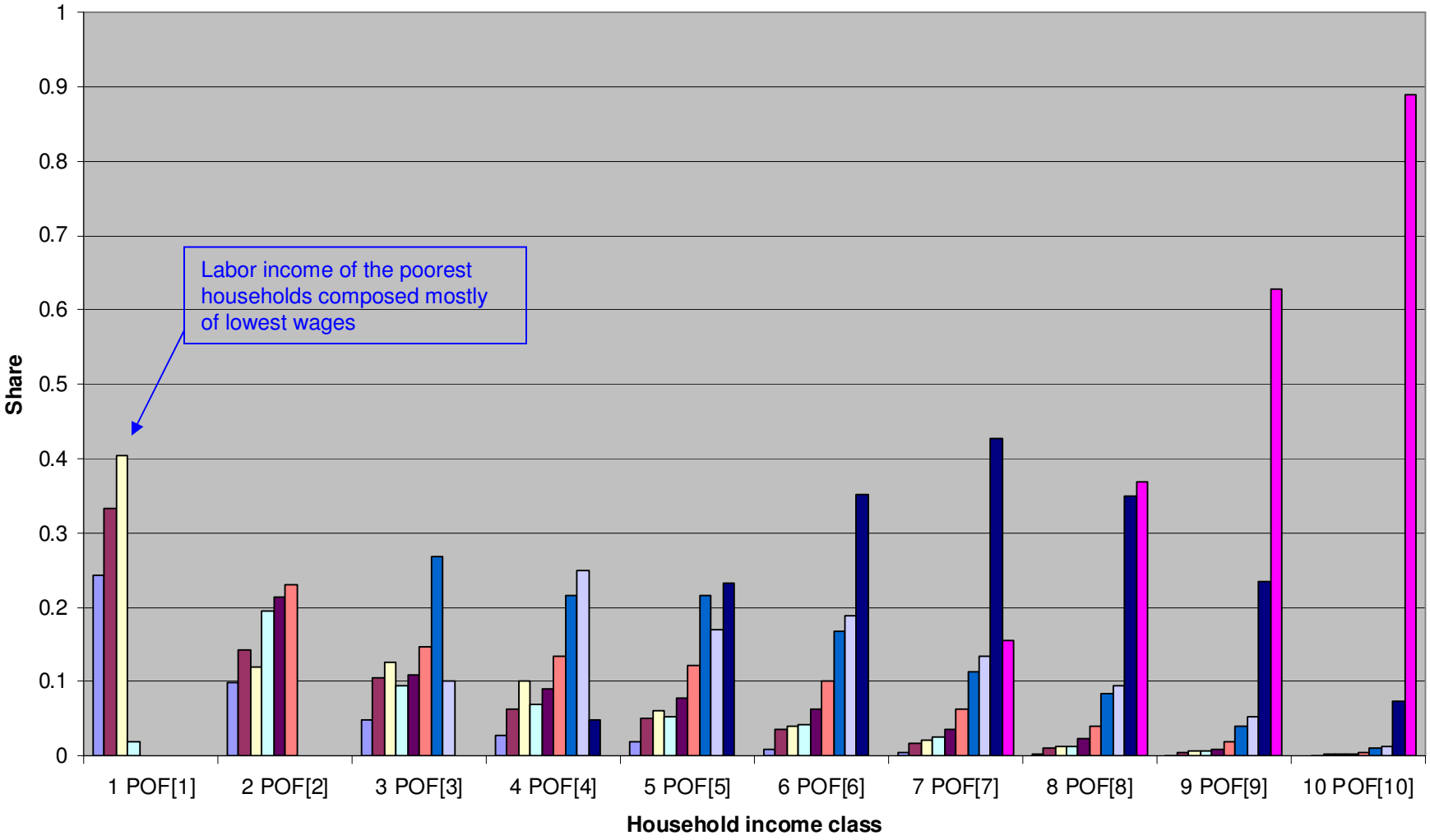
Why it is so important? Share of poor persons as a share of regional population



Labor demand structure in Brazil, 2004



Household income composition. Brazil, 2004



Scenario to be simulated

- Based on Bonelli and Fonseca (1998) and Gasques et al (2004) studies for the nineties.
- Agriculture TFP rate of growth: 2% above manufacturing.
- Five years period, starting in 2004: a 10% TFP productivity shock in agriculture and livestock sectors.
- Non-biased TC: crucial for income distribution analysis.

Model closure

- Capital stock fixed at sector level.
- Lowest 5 occupational types: mobile between regions and sectors. Unemployment.
- Highest 5: total supply fixed at national level, mobile between sectors and regions.
- Land stock fixed by state.

Hicksian Equivalent Variation

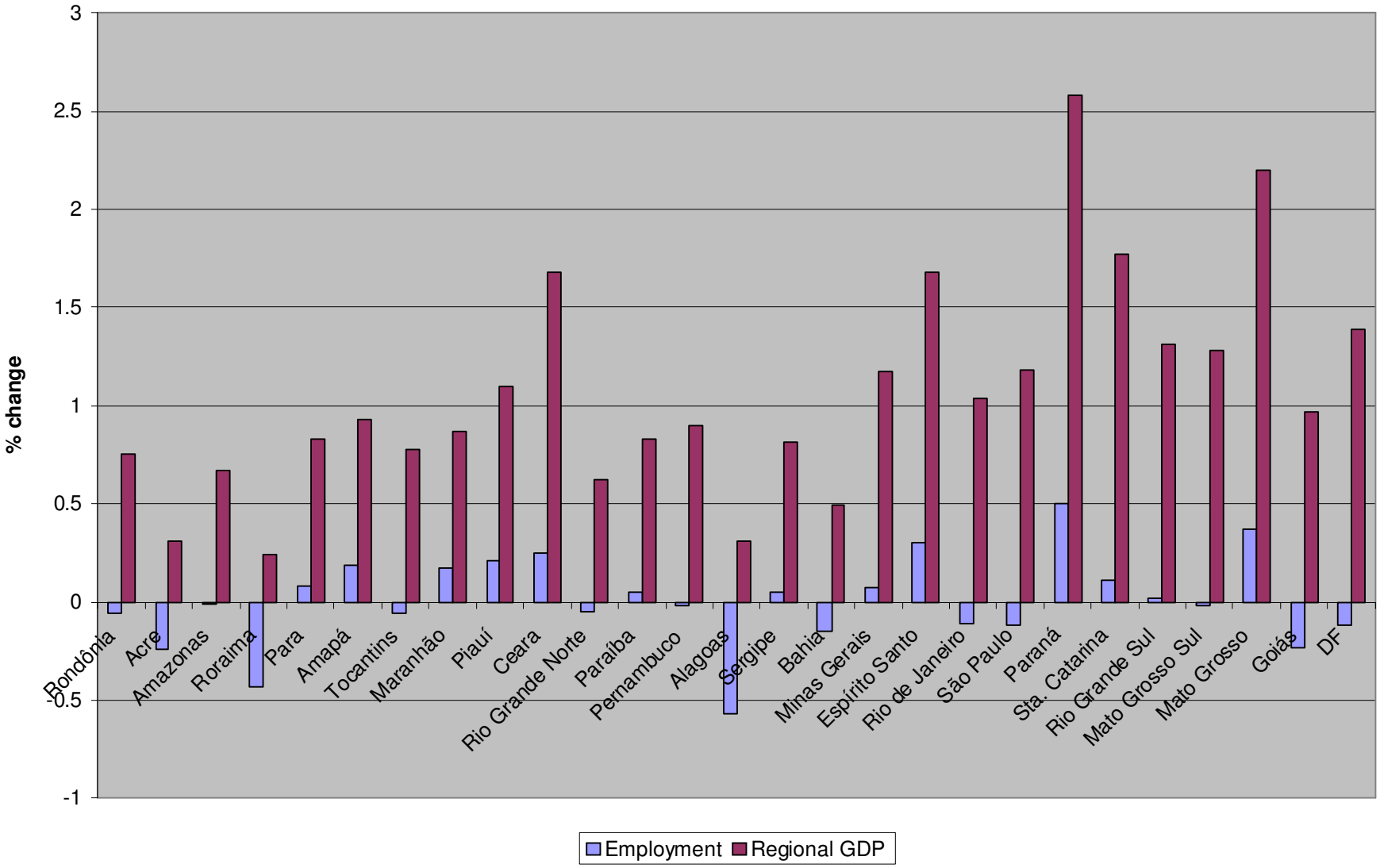
- R$12,996.00 millions gain in 2004 values (5 years). This corresponds to 0.67% of the Brazilian GDP in 2004, or a gain of about 0.11% of GDP per year (R$2.6 billions per year).
- This is the kind of result we could get without the micro-simulation module.

Model results

Table 1. Model results. Wages and employment, by occupational class. Percent variations.

Wage class	Nominal wage	Real wage	Employment
OCC1 (lowest wage)	-1.33	-1.25	-0.63
OCC2	-1.01	-1.01	-0.51
OCC3	0.32	0.27	0.14
OCC4	0.06	0.00	0.00
OCC5	0.31	0.24	0.12
OCC6	1.33	1.26	0
OCC7	1.47	1.40	0
OCC8	1.53	1.46	0
OCC9	1.63	1.55	0
OCC10 (highest wage)	1.04	0.96	0

Model results. Employment and Regional GDP. % variation.

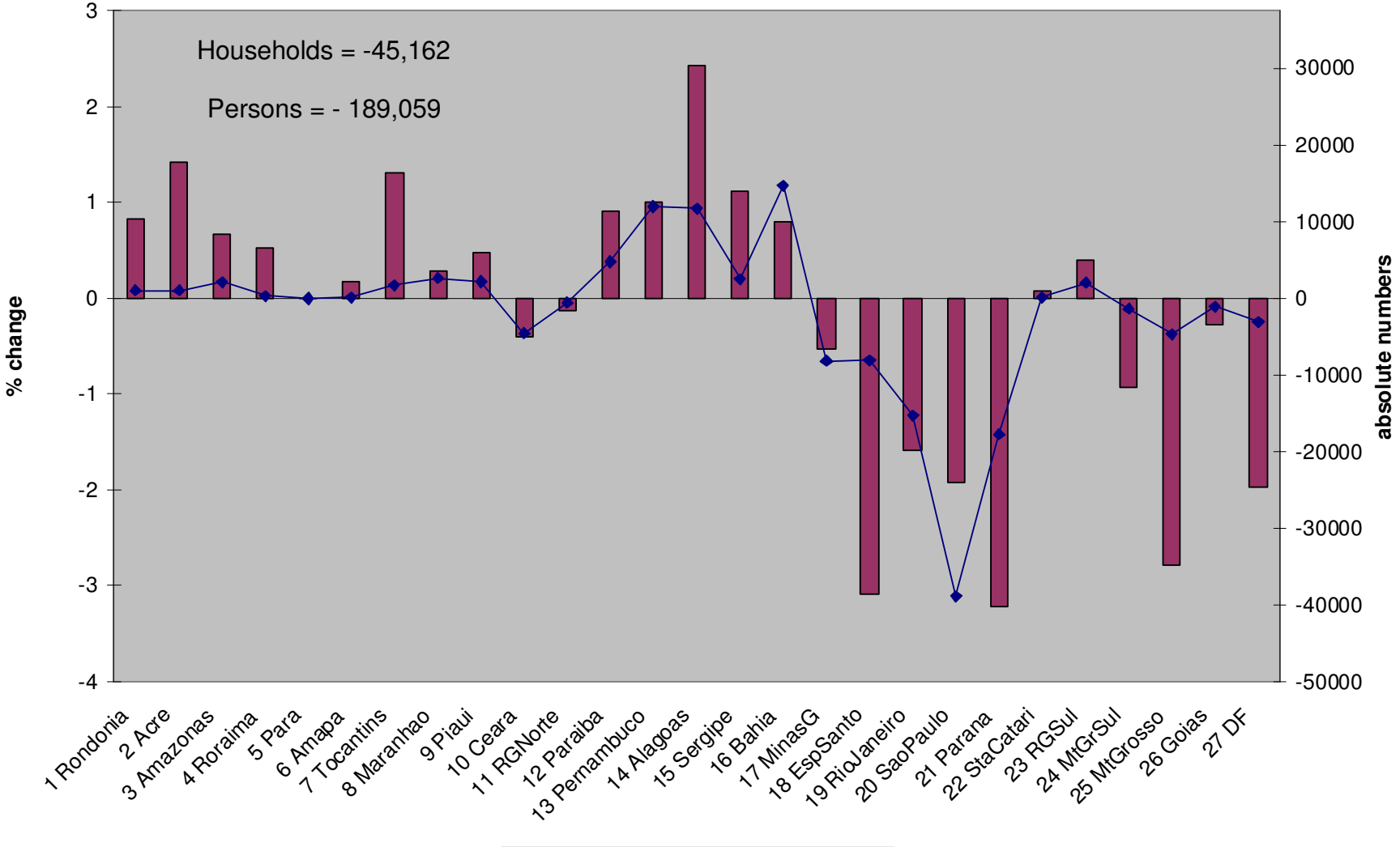


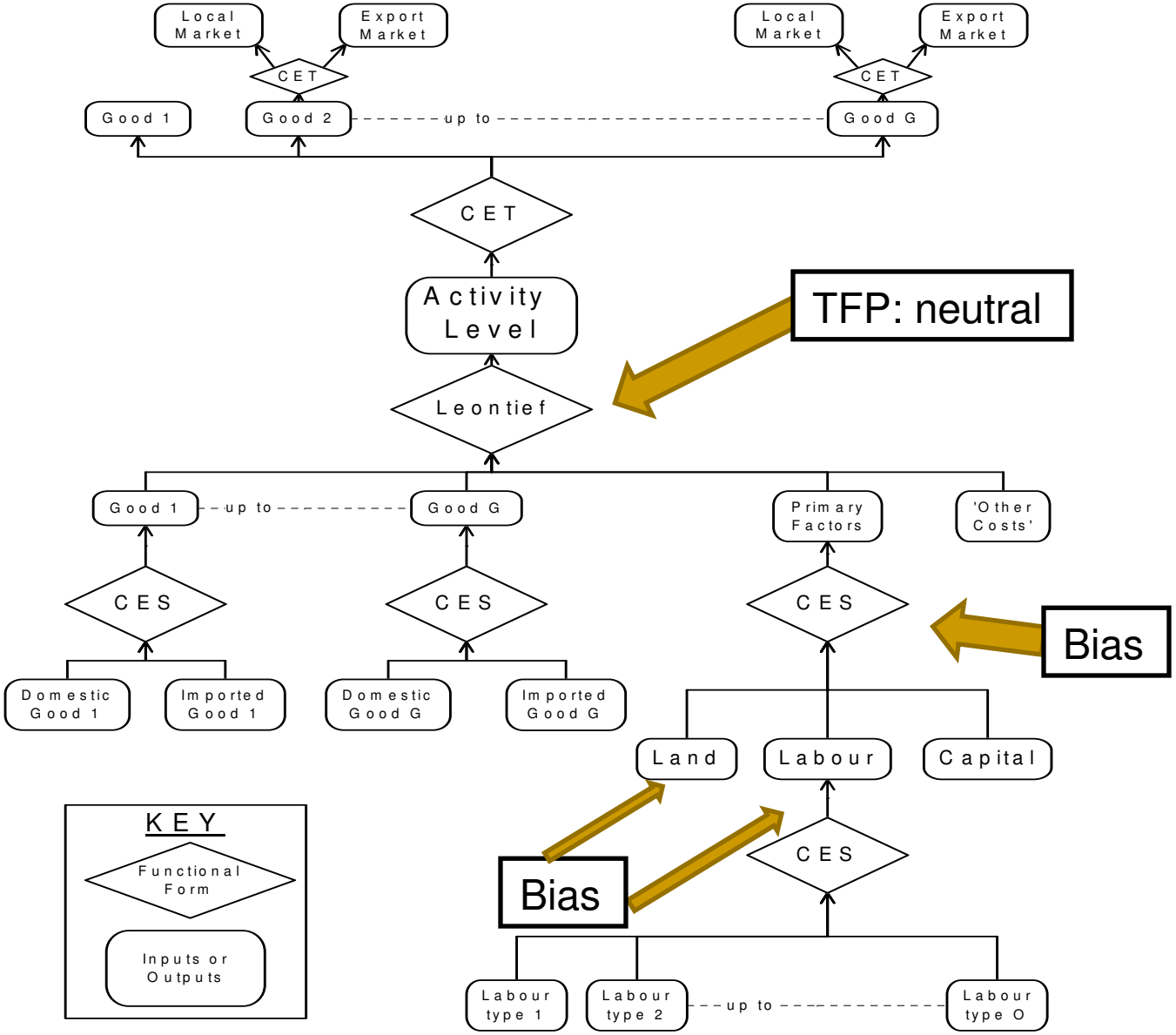
Tracking back labor to households: Poverty and income distribution results

Table 1. Poverty and income distribution results. Percent variation.

Household Income class	Average real income	GINI Index	Proportion of poor households (headcount ratio)	Average poverty gap (FGT1)
1 POF[1]	2.00		-0.70	-0.31
2 POF[2]	0.10		-0.39	2.49
3 POF[3]	0.27		-1.40	10.04
4 POF[4]	0.56		9.91	42.25
5 POF[5]	0.71		27.97	97.08
6 POF[6]	0.90		196.58	896.91
7 POF[7]	0.96		502.78	67559.20
8 POF[8]	1.00		0	0
9 POF[9]	0.95		0	0
10 POF[10]	0.78		0	0
Original values (base year)	-	0.55	0.28	0.12
Percentage change		0.35	-0.29	1.35

Change in poor households, by regions.




Local Market
Export Market
CET
Good 1
Good 2
up to
Good G
CET
Activity Level
Leontief
TFP: neutral
Good 1
up to
Good G
Primary Factors
'Other Costs'
CES
CES
CES
Bias
Domestic Good 1
Imported Good 1
Domestic Good G
Imported Good G
Land
Labour
Capital
KEY
Functional Form
Inputs or Outputs
Bias
CES
Labour type 1
Labour type 2
up to
Labour type O

Final remarks

- CGE models can presently deal with poverty and income distribution analysis with great level of detail.
- The crucial point for the analysis is the precise identification of which type of technological change is at work.
- What if we had biased (labor saving) tech change?
- What if the TC rate is not uniform across regions?

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