



Modelling methods for trade policy research

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Research

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1. An introduction to various modelling approaches



What is trade policy analysis for?

- to provide a theoretically consistent, rigorous and quantitative way to evaluate different economic policies
- to confirm a policymaker judgement or alert him over unintended consequences
- The use of models can provide a common “language” for policy discourse or debate.
- estimations/simulations should COMPLEMENT policymaker’s own insights about the formation and conduct of policy making



What types of analysis? Ex-ante vs. Ex-post

- *Ex-Ante* analysis: simulates the (future) impact of alternative trade policies (simulations using PE/GE model)
 - What will be the effects of the Doha Round?
- *Ex-Post* analysis: quantifies the effects of past trade policies (econometric analysis; e.g. gravity models)
 - Does WTO accession increase trade?
 - Do RTAs increase intra-regional trade? How much trade diversion is going on?
- *What determines the choice between the two types of analysis?* *Ex-post* analysis requires that the policy has been in place for a sufficient period of time and that a counterfactual is available to benchmark its effects
- *One important difference:* no diagnostic tests in *ex-ante* analysis of the type used in econometrics, only sensitivity analysis or *ex-post* validation. *Ex-ante* analysis depends on the theoretical model more than *ex-post* analysis.



What type of analysis? Static vs. Dynamic

- *Comparative Static Analysis*: compares initial and final steady-state
 - more simple (theoretically, computationally)
- *Dynamic Analysis*: also looks at the evolution from the initial to the final equilibrium. It captures:
 - adjustment process
 - capital accumulation
 - technological changes



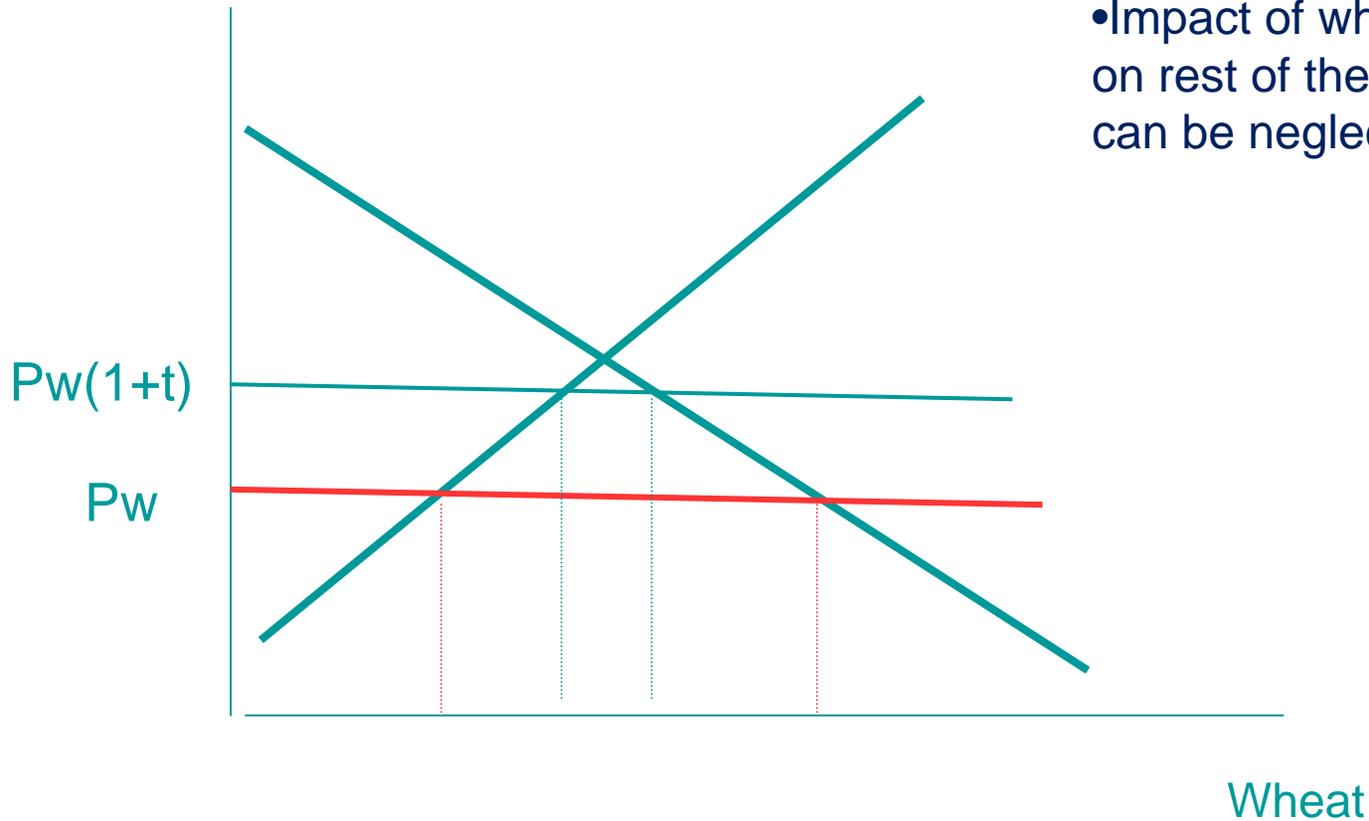
Ex-ante analysis: Partial vs. General equilibrium models

- Partial Equilibrium models
 - In practice often focus on one sector at time
 - Neglect interactions between markets
 - Useful if second-order effects are likely to be small
 - Advantages:
 - Simple models
 - Transparent (as rely on few key parameters)
 - Adds realism to the specific sector



A partial equilibrium analysis

Price



- Impact of wheat market on rest of the economy can be neglected



Ex ante analysis: Partial vs. General equilibrium models

- A General Equilibrium model
- IMPORTANT: Imposes income/expenditure and resource constraints.
- Takes into account linkages between markets, both product and factor markets (including feedback to the original market)
- Note: it is possible to have a multiple markets PE model. The essential difference between GE and PE model is in the overall equilibrium condition $\text{Income} = \text{Expenditure}$.

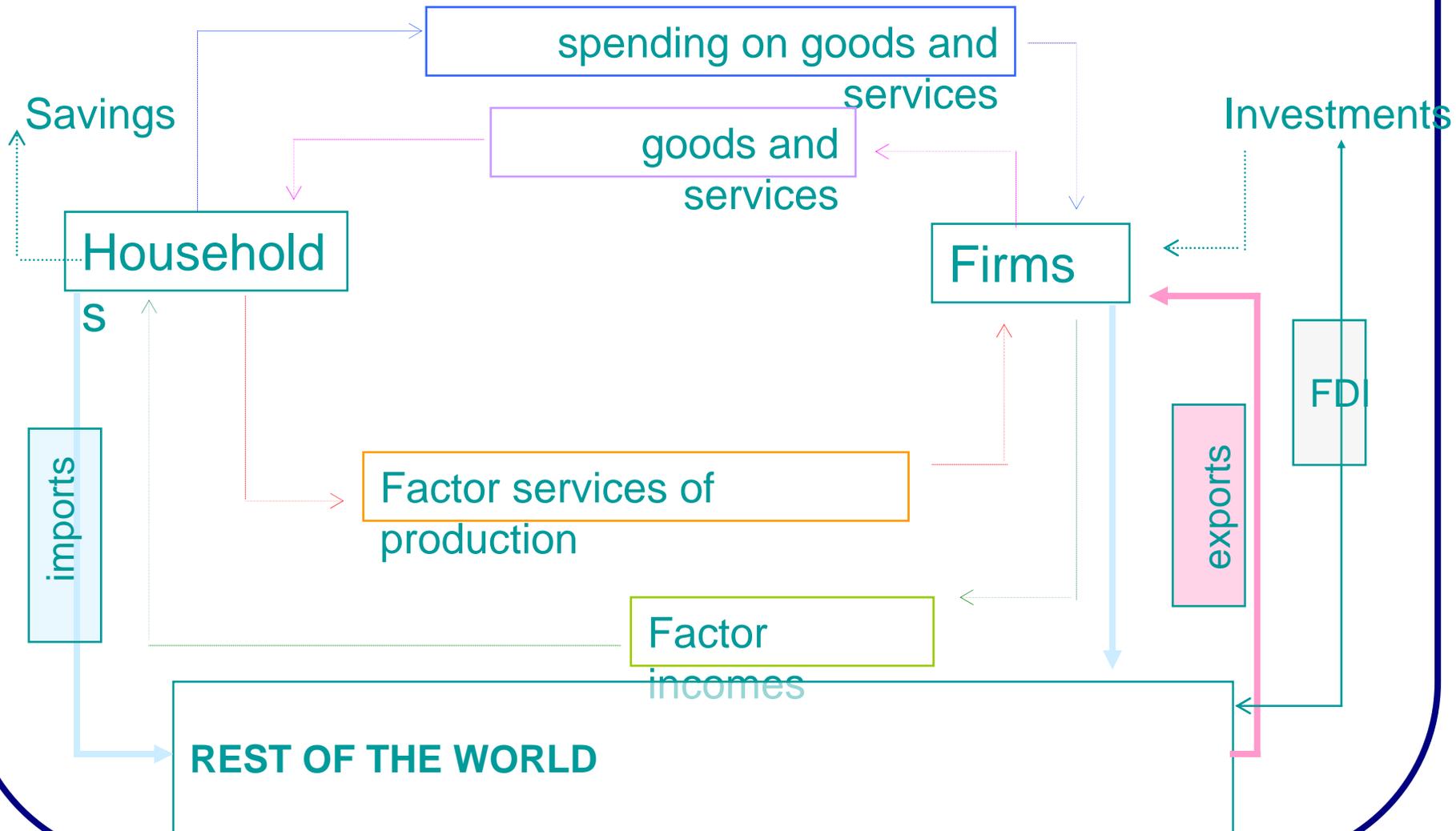


GE model structure

- 1. Underlying optimising behaviour of economic agents (households and firms) generate demand and supply curves
- 2. In each market: demand = domestic supply + foreign supply
- 3. Overall, total receipts = total payments



A general equilibrium view of an economy





GE or PE analysis?

- Nature of policy change
 - Does it cut across many markets or sectors?
Eg. Pervasive changes in tariffs may require RER depreciation to restore external balance
- Potential impact of change
 - Are there economy-wide impacts?
Eg. Extensive tariff reduction may affect factor rewards
- Constraints imposed by availability of data and resources



2. Computable General Equilibrium Models



CGEs...what are they?

- CGE is a GE model that uses the power of today's computers to calculate NUMERICALLY the effects of changes in exogenous and/or policy variables, in setting with many goods and factors and countries.
- CGEs provide a precise numerical answer to the question "what is the impact of(a numerically specified trade policy)?"



Typical simulation procedure

- 4 steps:
 1. Choose a theoretical model
 2. Provide the model with the data (economy variables and elasticities)
 3. Calibrate the model
 4. Change the values of the policy variable of interest (tariff) and recalculate economic variables



Operationalizing a CGE model

... 1. choose the theoretical model

- Introduce assumptions on
- market structure (im/perfect competition)
- production function
- representative household max behaviour
- government behaviour
- substitutability between domestic and foreign products (Armington assumption)
- Investment and dynamics
- Model closure (unemployment?)
- Social Welfare = Welfare of the representative household



Operationalizing a CGE model

2) provide the model with the data

- Social Accounting Matrix
 - SAM provide CGE with baseline data (national income aggregates, trade flows, tariffs and subsidies) Social accounting matrix
 - SAM builds on the circular flow
 - Uses info on I-O tables, national accounts, government fiscal account, trade data
 - Need to be collected, standardized (same base year and currency) and combined



Operationalizing a CGE model

2) provide the model with the data

- Select values for key parameters: Elasticities
 - substitution between factor of productions
 - household price elasticities of demand
 - household income elasticity
 - substitution between domestic and foreign products (Armington elasticities)

- Note: PE and GE approach are complementary. In many cases (e.g. in GTAP), CGE models borrows parameter estimates from PE econometric studies



Operationalizing a CGE model

3) Calibrate the model

- Calibration
- Calculate a subset of parameters that together with the SAM and inputted values for the elasticities can replicate the data of the reference year (baseline)



Operationalizing a CGE model

4) run the simulation

A simulation is a comparison:

Economy before
trade policy change

Economy after
trade policy change



Policy change

Difference between the two is attributed to policy change



Tracing differences in results

- Deterministic – outcome is completely determined by choice of input and model (no “residual”)



- Differences in simulation results = differences in choice of input and model
- “Story” must explain why the choice of input and model is appropriate/optimal for the policy question of interest



CGE ...desirable features

- If policy models are to be used in policy debate, they need:
 - policy relevance
 - transparency
 - timeliness
 - validation and evaluation
 - diversity of approaches.
- To simulate the impact of multilateral negotiations typically economists draw on existing datasets. This implies using existing models



3. A popular software for CGE analysis: GTAP



GTAP: main features

- Multi-region model (Policy Relevance)
 - GATT/WTO multilateral liberalization
 - Regional Trading Blocks
 - Environmental Policy

- Global database 2001 (Timeless?)
 - Bilateral trade flow data
 - Bilateral duty collection data
 - 57 commodities in 87 regions

- Standard modelling framework (Transparency?)
- Global network of researchers (Evaluation and Validation, Diversity of Approaches to some extent)



GTAP ... Standard Structure

- Perfect competition and CRS (resources fully employed)
- Armington assumption: goods are differentiated by country of origin
- Static
- Explicit treatment of international trade and transport margins (global transport sector)
- No direct link between public expenditure and taxes
- Global Banking sector

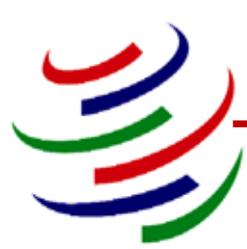


GTAP...limitations

- Some sectors in some countries could be characterized by imperfect competition and economies of scale
- Armington assumption does not allow for the relocation of firms+ amplify TOT effects
- Absence of variety effect
- The use of a global banking sector is due to the lack of bilateral investment and ownership data
 - No specific treatment of domestic vs. foreign investment
 - Only a small proportion of domestic savings will return to a region as investment
- Not appropriate to look at issues related to the composition of public expenditures
- Labor market issues cannot be dealt with properly. However, some of the assumptions can be relaxed/modified (***Diversity of Approaches***)



4. Evidence on the effects of the Doha Round



The 3 most discussed CGE models

- Carnegie
- Mirage (CEPII)
- Linkage (World Bank)

- They all use GTAP data base
 - NB Carnegie model do not run pre-simulations
- They differ in model assumptions and simulated scenarios



Differences in assumptions

- Linkage model (World Bank)
 - Dynamic model (simulated for the period from 2005 to 2015)
 - Constant returns to scale
 - Full employment
- Mirage (Cepii)
 - dynamic model with fixed technology (simulated for the period 2007 2020)
 - increasing returns in manufacturing and services, constant returns in agriculture
- Carnegie
 - Static model
 - Constant returns to scale
 - Unemployment in developing countries (unskilled workers in manufacturing)



Differences in simulated scenarios

- Linkage (World Bank, Anderson et al. 2006)
 1. Only merchandise trade liberalization
 2. LDCs do not liberalize
 3. Cuts applied on bound rates, different cut rates across bands in Ag; 50 percent cut in NAMA by developed countries, 33 per cent by developing countries

- Mirage (CEPII, Decreux and Fontagné, 2006)
 1. Include service trade liberalization
 2. G90 countries do not liberalize (neither tariffs not domestic subsidies)
 3. Cuts applied on bound rates, swiss formula in NAMA, 36 per cent cut in Ag
 4. Different quality of products between North and South

- Carnegie
 - 1-2 like linkage
 - 3. Cuts applied on *applied* rates, in NAMA same percentages as Linkage, in Ag uniform cuts. NB As a result Ag is relatively less liberalized than NAMA even compared to other studies

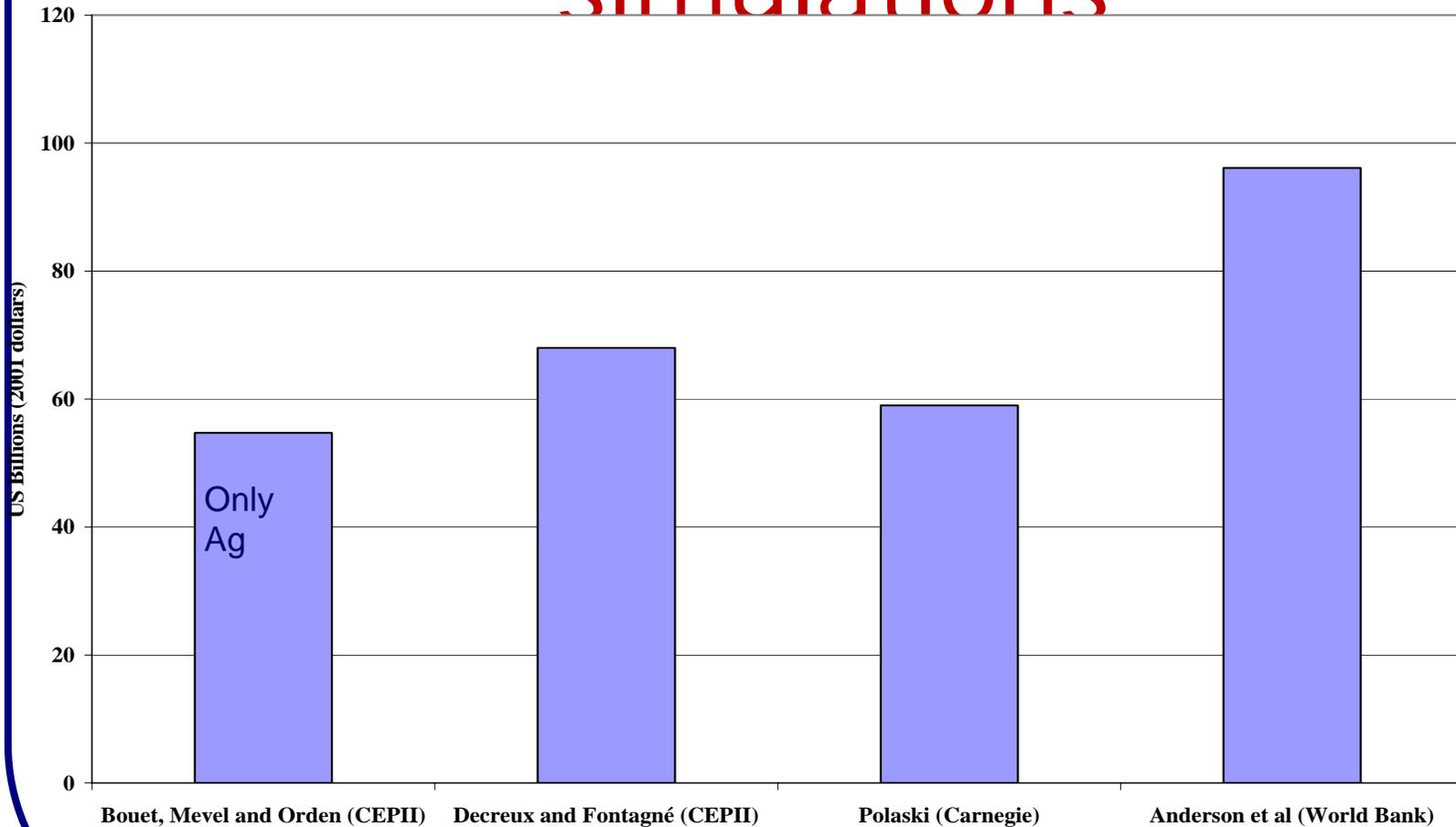


What have we learned from the Doha Round CGE simulations?

- **Common results:**
- Multilateral liberalization is beneficial at the global level
- There are potential gains for developing countries
- Developing countries own liberalization is an important source of their gains
- Removing subsidies may damage net food importer countries



Welfare benefits from alternative Doha Round simulations

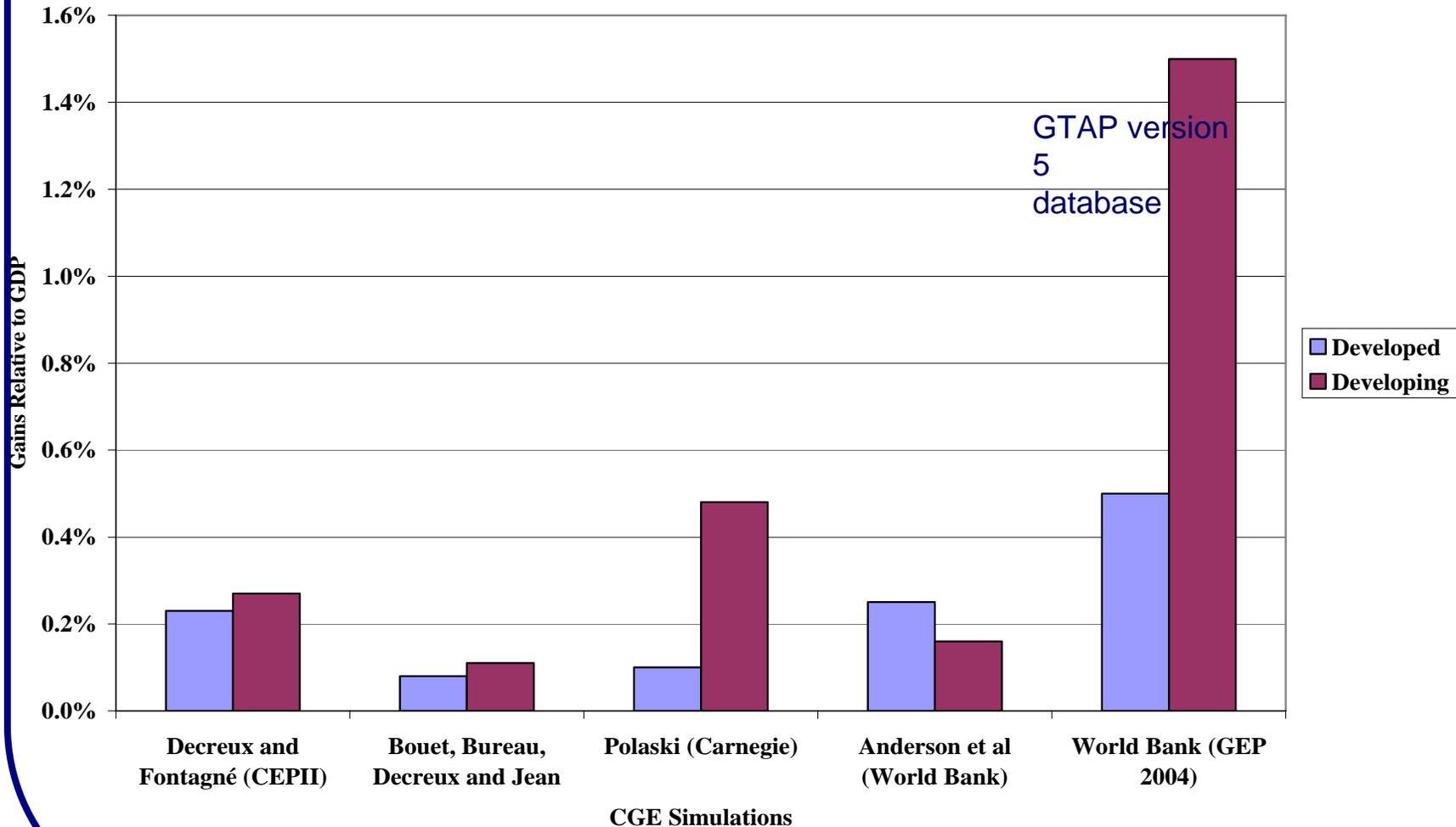


IRS yield larger gains



Gains for developed and developing countries

Recently estimated gains are small!



The role of preferences and pre-simulations

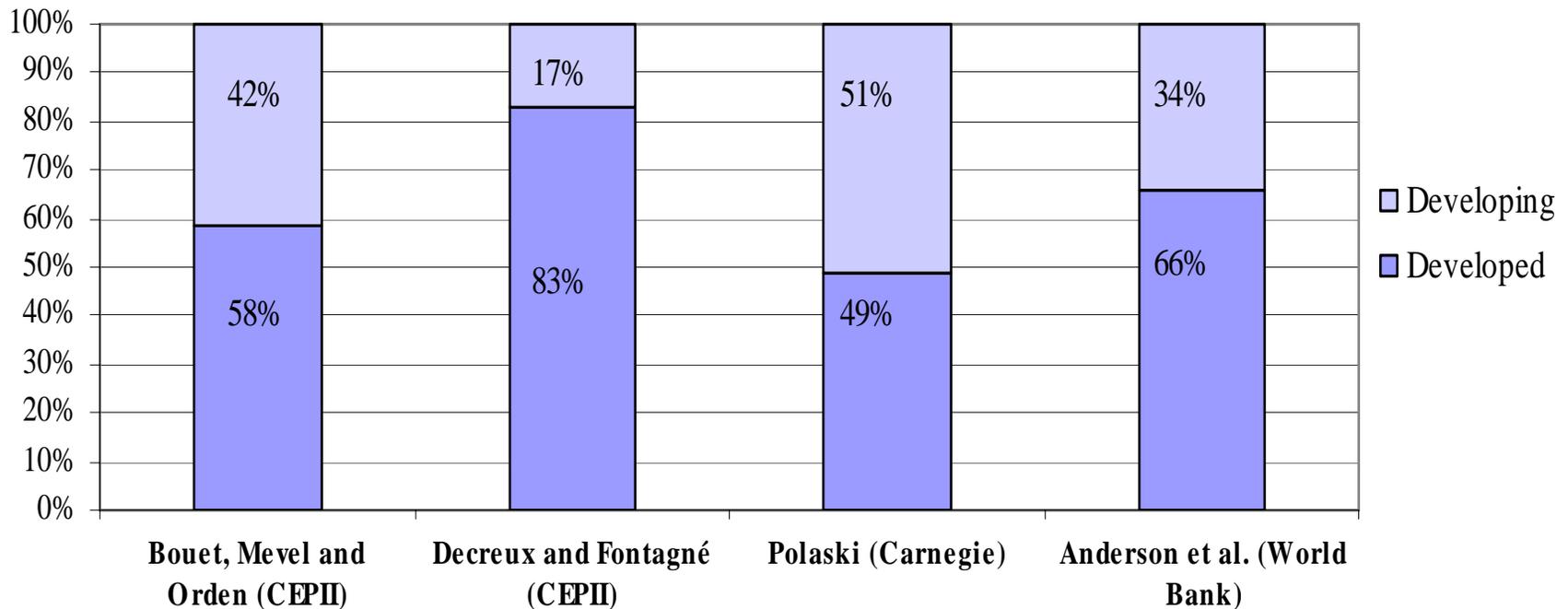


and what have we NOT learned from the Doha Round CGE simulations?

- **Results differ among studies on how gains are redistributed**
- 1. What share of the benefits go to developing countries?
- 2. What share comes from agriculture liberalization? From NAMA?



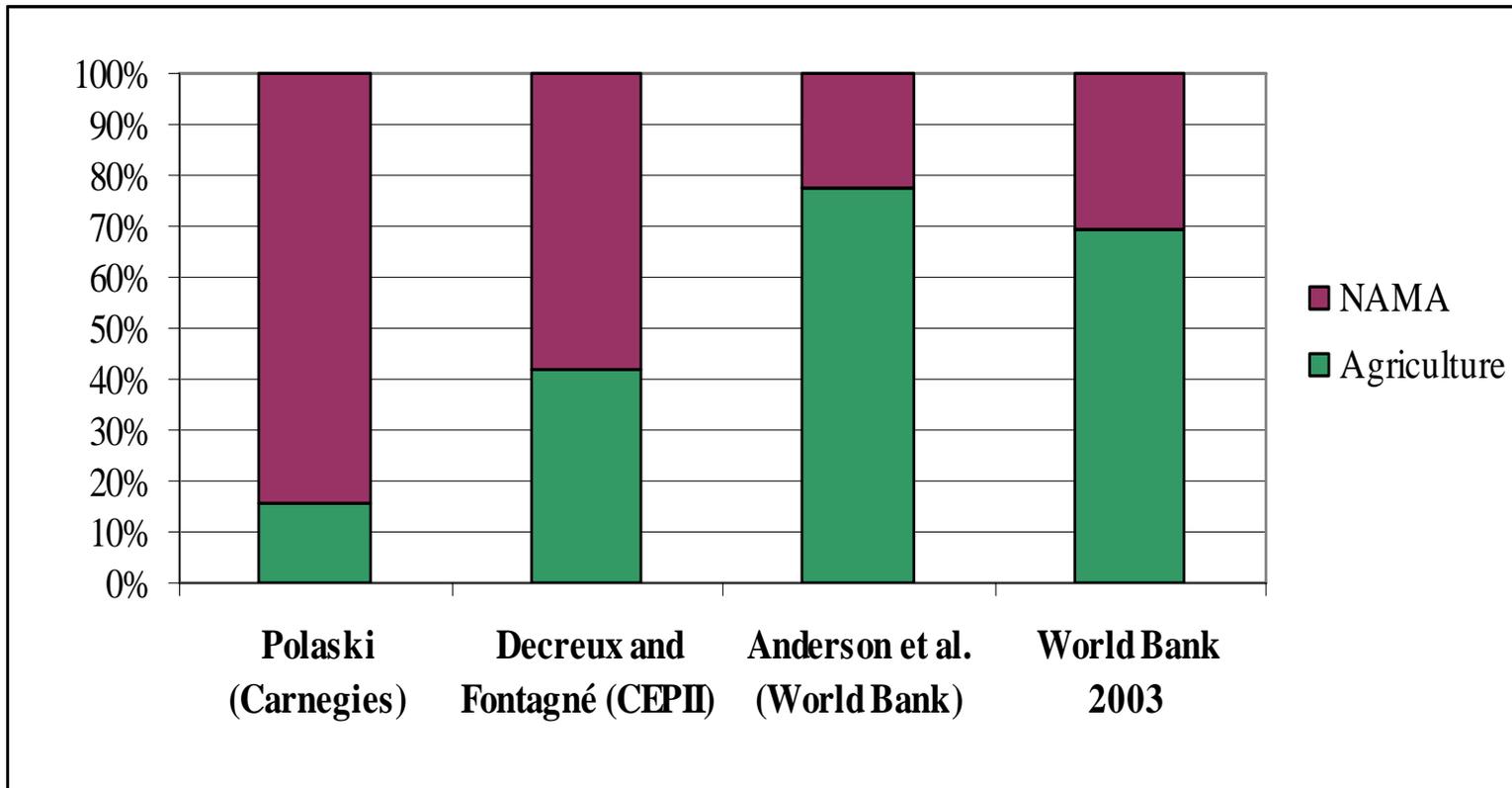
Distribution of gains across regions



Unemployment in manu increases the gains for developing countries



The impact of agriculture vs. manufacturing liberalization



- Unemployment in manuf increases the gains from NAMA
- The importance of aggregation



A big limit: SSA

- In general, CGE results on SSA are not very reliable because:
 - (i) the quality of data for SSA in CGE models is very poor,
 - (ii) the level of aggregation of data is too high both at the regional and sectoral level. For example, data do not allow to distinguish between food importer and food exporter, thus missing interlinkages between these countries.



What is the concern?

- Growing scepticism over the usefulness of CGEs



How can modelling better assist policy making?

- A. Improving confidence in simulation results
 - Sensitivity analyses (incl. Monte Carlo simulation)
 - Ex-post verifications
 - Use also focused models
- B. Better reflecting negotiation in simulation scenarios
- C. Improving modelling of:
 - Better treatment of services
 - Adjustment costs
 - Functioning of factor (labour) markets
 - Tariff revenue implications of trade liberalization
 - Potential for diversification



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- D. Improving data
 - trade transaction costs
 - to obtain more disaggregated sectors
 - need better disaggregation of regions/countries

- E. Improving communication of results to policymakers
 - Put more emphasis on trade flows (even though it is mercantilist)
 - Need to show more results of changes in income distribution and poverty
 - Transparency



References

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