

Agricultural trade liberalization in a world of uncertainty: discussion of the results of a world CGE model

Jean-Marc Boussard, Françoise Gerard, Marie-Gabrielle Piketty,
Ane-Kathrine Christensen, Tancrede Voituriez

► To cite this version:

Jean-Marc Boussard, Françoise Gerard, Marie-Gabrielle Piketty, Ane-Kathrine Christensen, Tancrede Voituriez. Agricultural trade liberalization in a world of uncertainty: discussion of the results of a world CGE model. 5. Annual Conference on Global Economic Analysis, National Tsing Hua University. TWN.; Purdue University. USA., Jun 2002, Taipei, Taiwan. hal-02762963

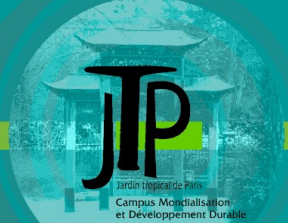
HAL Id: hal-02762963

<https://hal.inrae.fr/hal-02762963>

Submitted on 4 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Agricultural trade liberalization in a world of uncertainty: a CGE model

by

J.M. Boussard, F.Gerard, M.G. Piketty,

A.K. Christensen, T. Voituriez

CGE and agricultural trade liberalization

- **CGE good to take care of sectoral interactions**
- **Easy to make use of (thanks to GAMS/GTAP!)**
- **Yet dangerous !**
- **be careful not to confuse model and reality!**
- **Such confusions occurred when evaluating benefits from agricultural trade liberalisation**

The problem of agricultural trade liberalization

- **Agriculture disconnected from market since Roosevelt**
 - **Concern with food security issues**
 - **Ezekiel analysis of price instability**
- **Reinserted into WTO negotiations in Marrakech**
 - **"Farm problem" (Olson, Gardner) issues**
 - **Overproduction problems in developed countries**
 - **Large efficiency gains expected from comparative advantages**
- **CGE models played a role in evaluating change**
 - **Gains significant, but less than expected**
 - **Stability issues neglected**

Why is stability important in agriculture ?

- **Large efficiency gains may be expected from stabilized prices**
 - **Farmers (and bankers) are risk averse**
 - **Risk premium are inefficient**
- **Neglecting instability may underestimate benefits from liberalisation**
 - **Mutualising losses may have an insurance effect, and decrease climate induced price fluctuations (Bale and Lutz)**
- **Neglecting instability may overestimate benefits from liberalisation**
 - **If genuine market instability always keeps prices away of equilibrium**

Now, CGE's ignore instability !

- **They fail to take account of the facts at the origin of price intervention in agriculture, and thus, of the very problem they are addressing**
- **They thus may under- or over-estimate benefits from liberalisation, and misguide political bodies**

But how can we introduce risk and instability into a CGE model ?

Three key points in modelling risk and instability in CGE's

- **First order conditions in presence of risk**
- **The possible local instability of market equilibriums**
- **How is capital allocated to sectors ?**

First order conditions in presence of risk :

- **Neglecting risk leads to the standard first order condition:**

$$\hat{p}_j \frac{\partial q_j}{\partial x_i} = p_i$$

q_j : quantity of output j ;

p_i : equilibrium price of input i ;

\hat{p}_j : expected price of output j

x_i : quantity of input i

- **Introducing risk gives:**

\tilde{p}_j : Certainty equivalent of expected price \hat{p}_j

Under standard Markowitz utility function,

$$\tilde{p}_j = \hat{p}_j - A \hat{\sigma}_j^2 q_j$$

$$\tilde{p}_j \frac{\partial q_j}{\partial x_i} = p_i$$

- **This is easy to put in a CGE model !**

Modelling instability

- Sources of instability
- Exogenous: No problems...
- Endogenous:
 - Lags in delivery
[while standard CGE's assume consumption and production are simultaneous]
 - Imperfect expectations
[while standard CGE's assume expectations are not only *rational* but also *perfect*]
 - Poorly elastic demand
[how are demand elasticities in most models ?]
- The road to explosive cobwebs
[but risk as a return string]

How is capital allocated to sectors ?

- **The third component: Non shiftable capital**
 - If capital is sector specific, savings must be allocated between sectors
 - Then, a classical Markowitz model makes the trick: In a separate module, households choose z to maximize:

with:

$$U = \sum_k \hat{\pi}_k z_k - A \hat{\sigma}_k^2 z_k^2$$

$\hat{\pi}_k$: Expected profitability of capital in sector k

$\hat{\sigma}_k$: Expected variance of profitability in k

z_k : share of savings invested in sector k

A : risk aversion coefficient of household

- **Clearly, risk matters again**

These ideas have been implemented in a large model in progress

- A GTAP model
- Two versions : Standard CGE
 Incertitude
- World aggregations : 3 regions / 10 sectors
 12 regions / 10 sectors
- 6 sectors related to agriculture

Model presentation

→ main characteristics shared by the 2 versions :

- economy wide model, world coverage
- recursive dynamic
- production function : CES of CI (aggregate intermediate consumption) and VA (aggregated added value)
- consumption : linear expenditure system
- international trade : armington, bilateral flow
- GTAP parameters, parametric difference between regions
- Endogenous volume and prices for goods and factors
- closure : Investment=Savings, endogenous trade balance

The 10 Sectors

- 1. **Paddy**
- 2. **Grains** : Wheat,others cereal grains
- 3. **Autres cultures** : Vegetables-fruits-nuts, oil seeds, sugar cane-sugar beet, plant-based fibers, others crops
- 4. **Productions animales** : Bovine cattle-sheep-goats-horses, other animal products, raw milk, wool, silk worm cocoons, fishing
- 5. **Sylviculture**: Forestry
- 6. **Industries agro-alimentaires** (9 secteurs GTAP)
- 7. **Industries du bois**
- 8. **Manufactures** (15 secteurs GTAP)
- 9. **Energie et ressources naturelles** (7 secteurs GTAP)
- 10. **Services** (4 secteurs GTAP)

Other features

five production factors :

- Land : used only by agricultural sectors, perfect mobility, flexible prices
- Natural resources : used only by forestry and energy-resources sectors, perfect mobility, flexible prices
- Highly qualified workers : mobility inside aggregated sectors, rigid wages
- Low qualified workers : mobility inside aggregated sectors, flexible wages
- Capital : sector specific, flexible prices

2 types of households : Middle-Rich / Middle-Poor

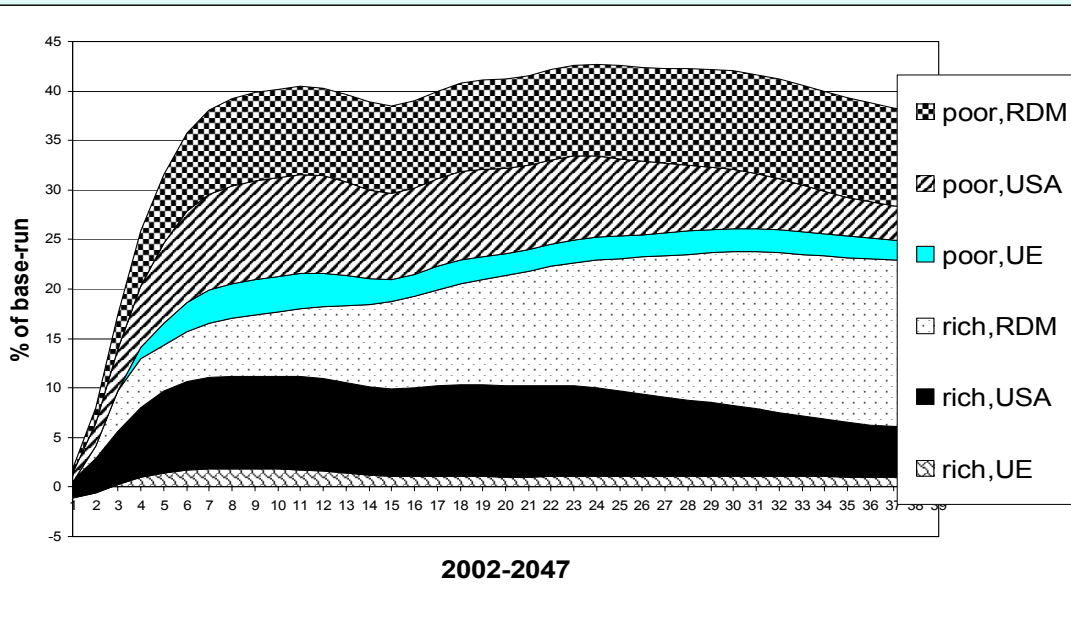
2 modules :

Real : physical flows of products

consumption and production decision

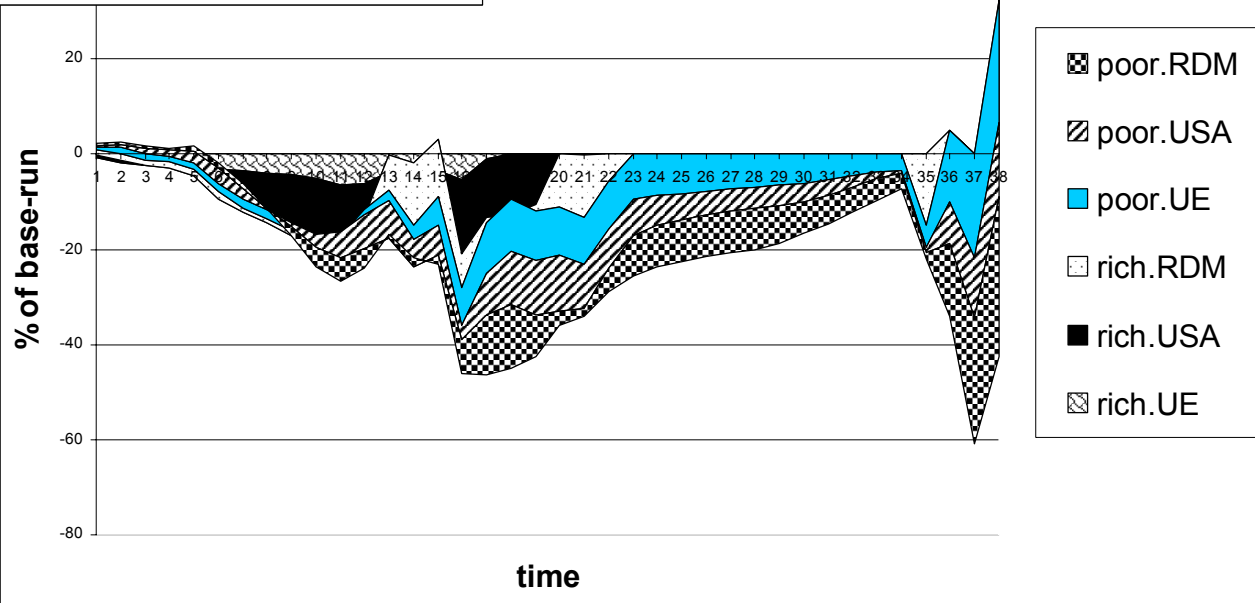
Financial : investment decision

Preliminary results



Gains associated with trade liberalization in the standard version

Losses associated with trade liberalization in the version considering risk and uncertainty



Research agenda and conclusion

→ In progress:

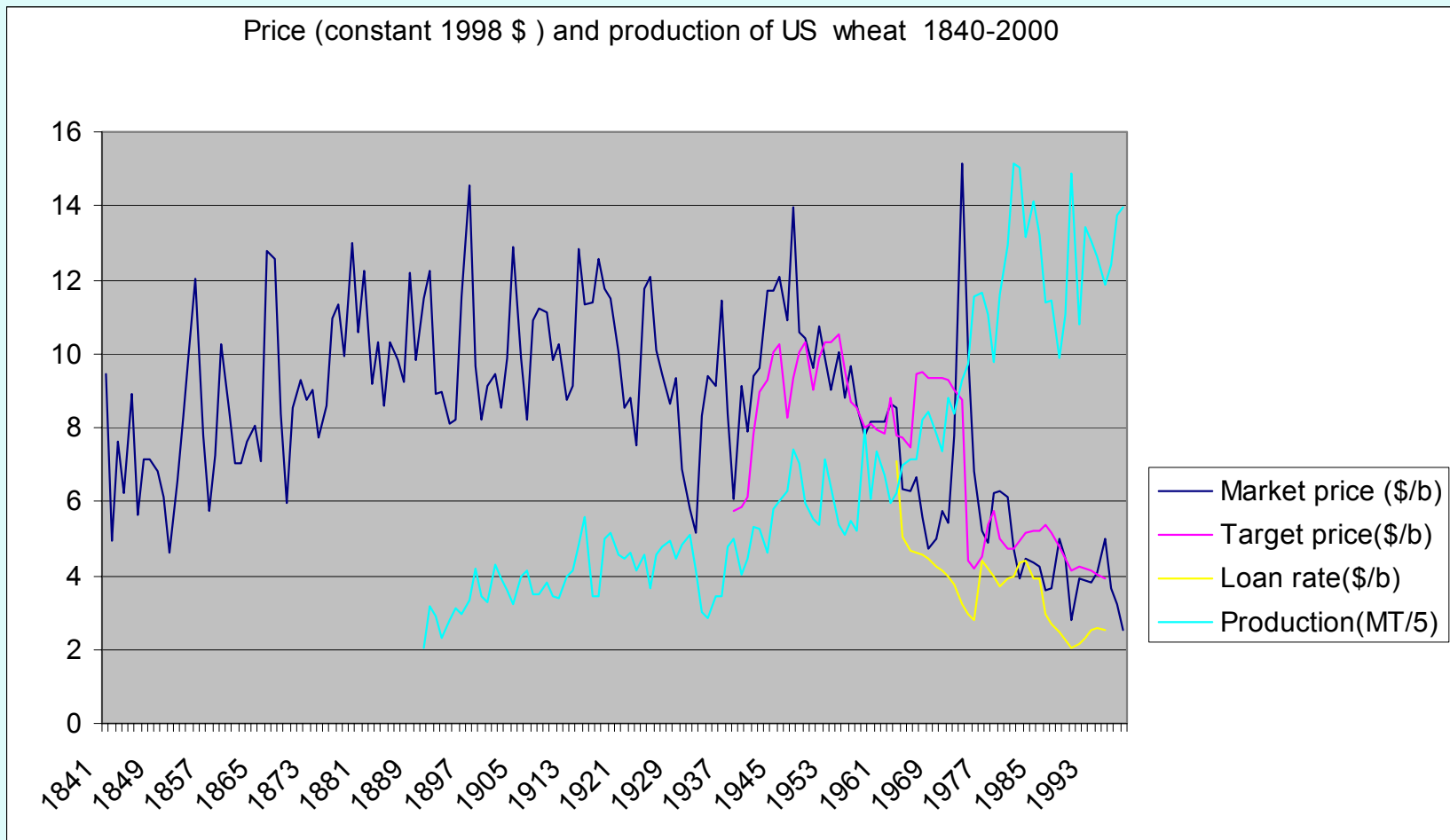
Calibrating, performing sensitivity analysis and validating on real data the reference scenario...

Improving capital module : endogenous exchange and interest rates

→ But we can be sure of :

- Liberalization gains may be considerably reduced by uncertainty
- Necessity to define market friendly intervention, which may prevent crisis

An example :



The agricultural exception

Tomatoes retail price index in large American cities, as compared to new car retail price index
Source: Economagic.com

