



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

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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

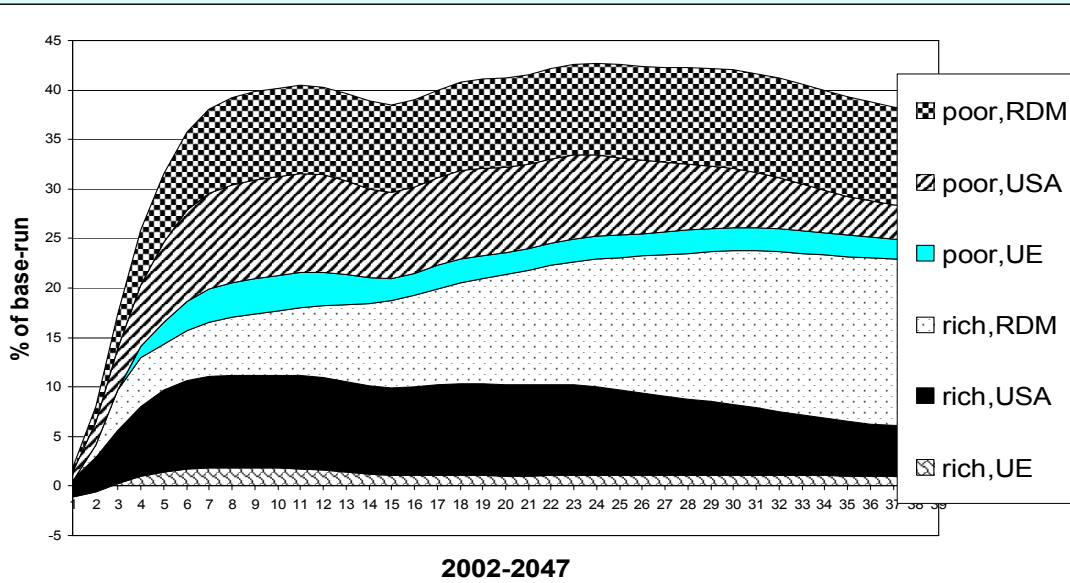
2 modules :

Real : physical flows of products

consumption and production decision

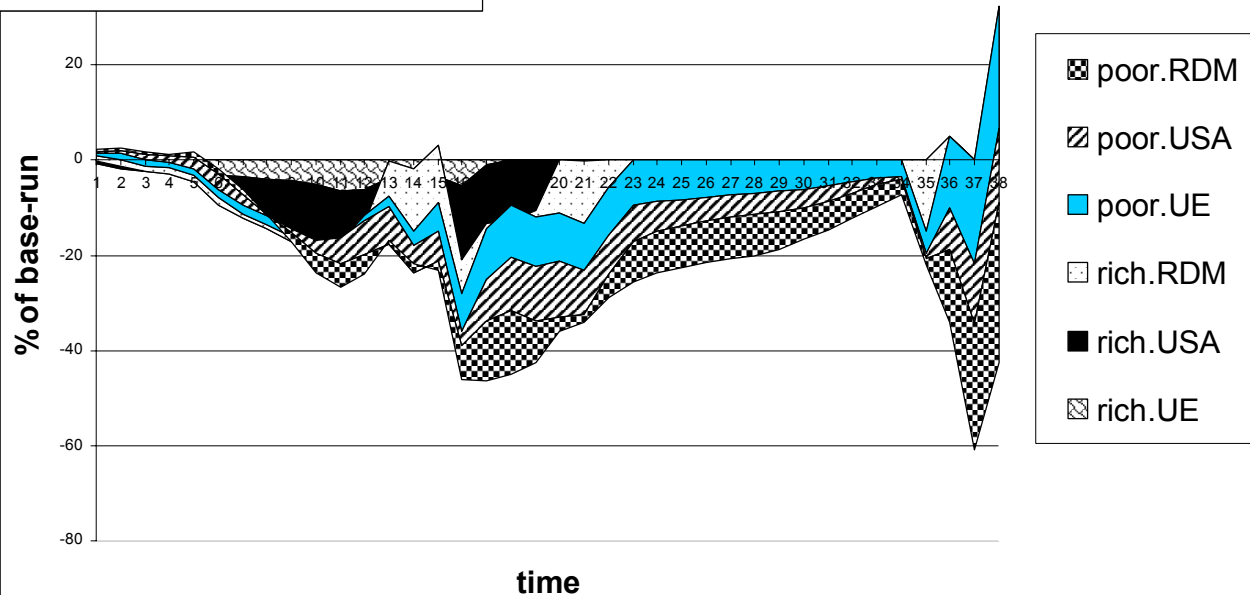
Financial : investment decision

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:

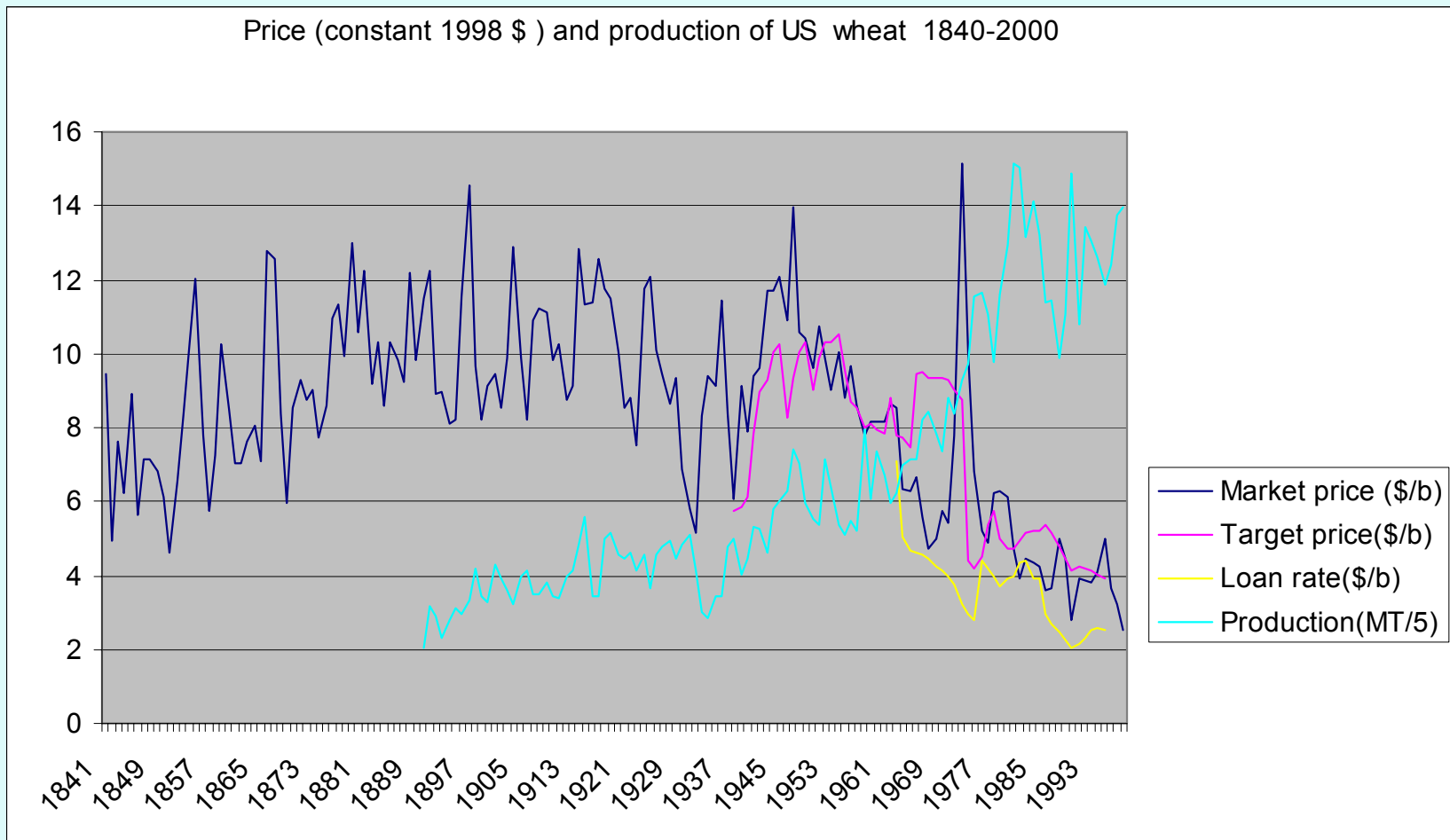
Calibrating, performing sensitivity analysis and validating on real data the reference scenario....

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

