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**Assessing the economic costs of an outbreak of Foot and Mouth Disease on Brittany:**

**A dynamic computable general equilibrium analysis**

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# Assessing the economic costs of an outbreak of Foot and Mouth Disease on Brittany:

## A dynamic Computable General Equilibrium analysis

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### Introduction

- A very **local sanitary hazard** such as a FMD outbreak **can cause large economic disruptions** on the whole market (preventive trade restrictions, consumers scares etc).
- Indirect effects and market consequences poorly studied.
- Most economic analyses focus on epidemic dynamics and assess the direct costs of epidemic outbreaks.
- Because of the multiannual cattle breeding process, even **a very temporary FMD shock may result in lasting consequences** on agricultural productions and markets

### Research objectives

- Provide an assessment of the market and welfare impacts of a potential FMD outbreak in a European livestock-intensive region
- Compute its aggregate and dynamic economic costs and their distribution:
  - among economic stakeholders
  - through time

### Data and simulation scenario

#### Data

Social Accounting Matrix for the **French Brittany region**

- 50 sectors of which 23 agricultural activities
- 52 products of which 24 agricultural ones
- Multi-product activities taken into account

Brittany agriculture and livestock:

- 1<sup>st</sup> rank for milk, veal, pig and poultry production
- 2<sup>nd</sup> rank in terms of cattle production
- Farm and food processing industries represent 12% of regional total employment (6% at the national level)



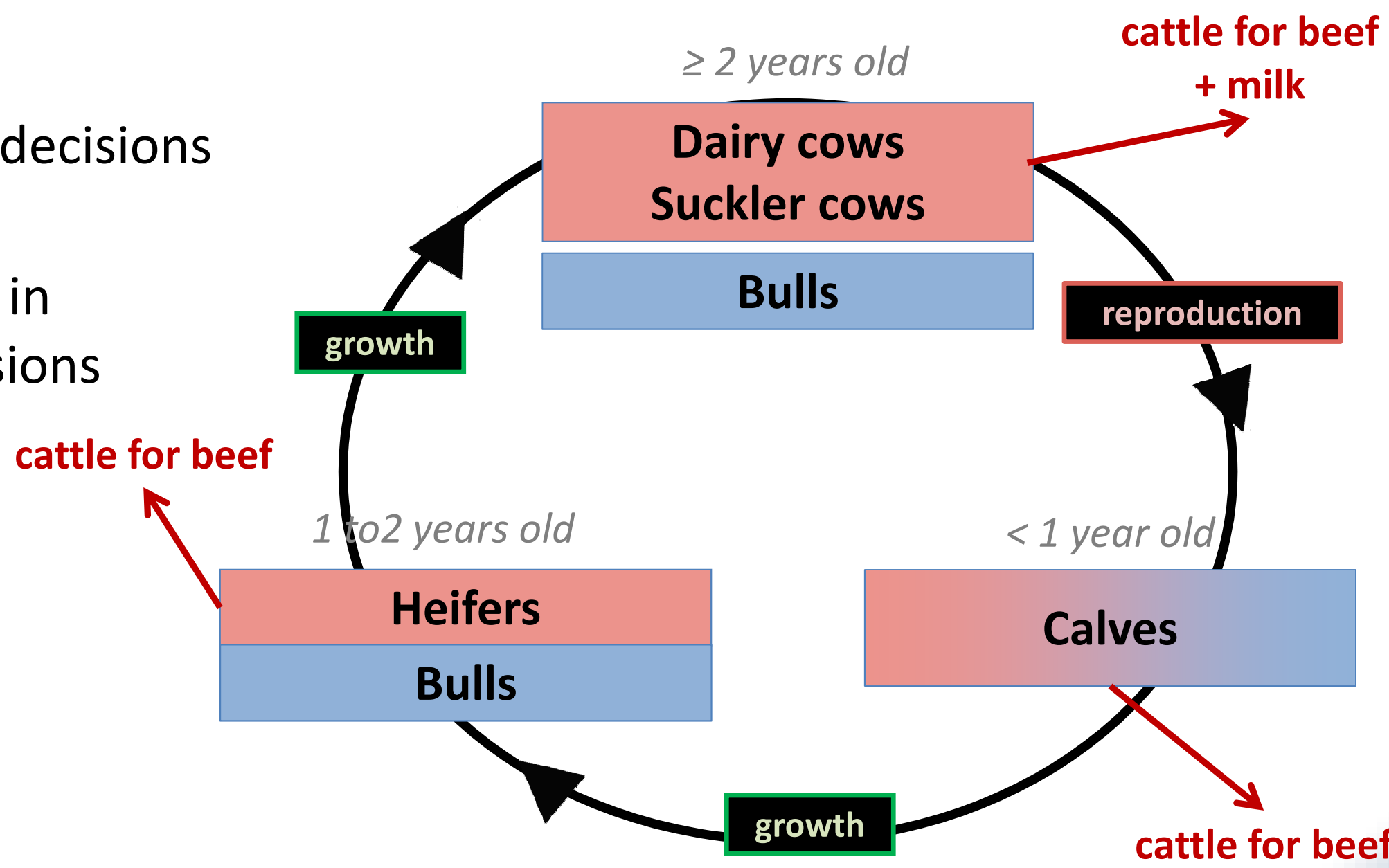
#### Simulation

- The FMD outbreak is simulated at the initial year of simulation
- How the simulated FMD outbreak alters our economy:
  - 10% culling of the total cattle herd (200,000 cattle) for sanitary reasons
  - Preventive sanitary bans on the movement of live animals
- From the second period, the region is considered as disease free (no more bans or culling)
- Results are computed over a **15-year period**

### Modelling framework

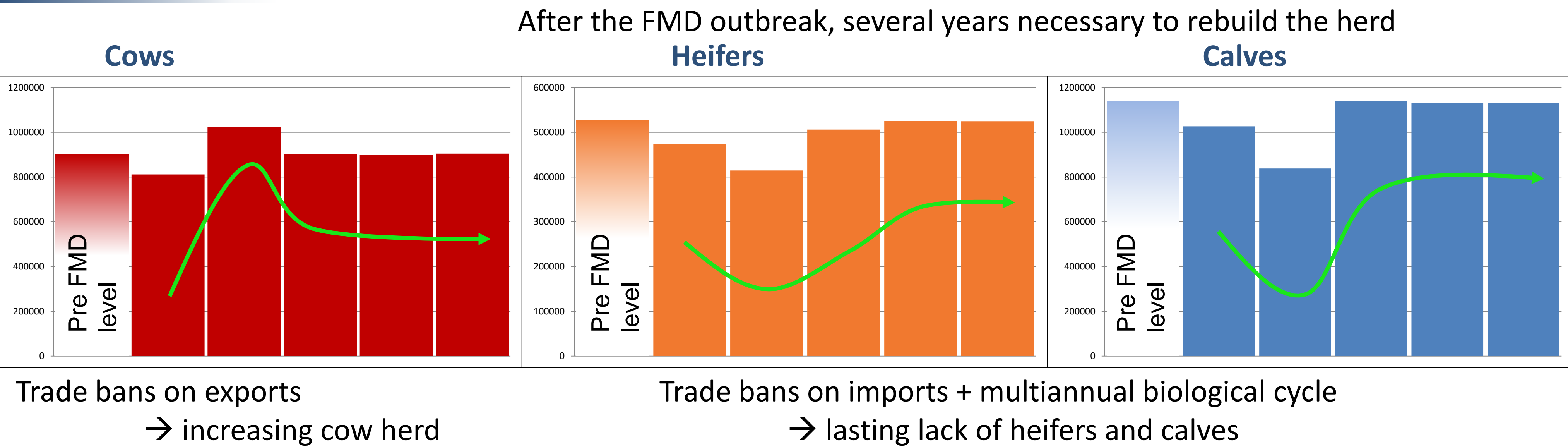
► **Dynamic CGE model** where farmers make their annual decisions of production under **intertemporal constraints**

- Dynamics of **capital** accumulation and investment decisions
- Dynamic **biological cycles** of the cattle herds  
The multiannual process of growth and reproduction in cattle herds are integrated in the yearly farmers decisions
- Household maximize intertemporal utility: trade-off consumption / savings
- Rational expectations
- Introduction of **rigidities on factor markets**
  - **Labor market:** existence of minimum wage levels and unused labor endowment
  - **Capital market:** farmers face credit constraints; investment capacity is limited (dependent on their annual capital returns)



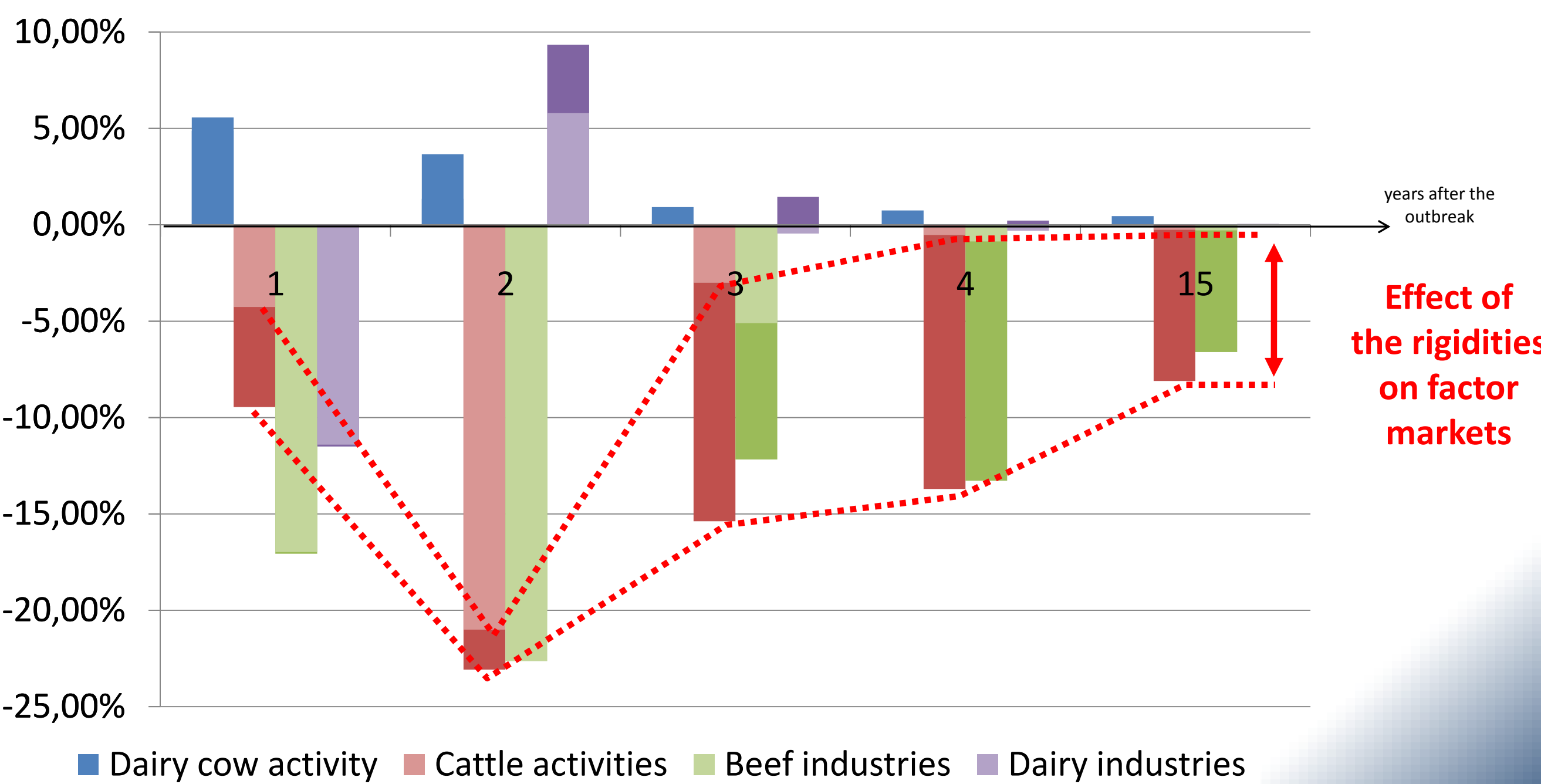
### Simulation results

#### Impacts on the herd structure



#### Impacts on the value added

- Apart from the dairy sector, severe and lasting economic losses
- The whole food chain suffers losses from a brief FMD outbreak and relative sanitary measures
- Time needed to rebuild the herd → increasing losses in time on both agriculture and food industries
- Realistic constrained markets of labor and capital  
→ increased losses on the long run



### Welfare consequences

(in M€)	Perfect factor markets	Constraints on investment and wages
Value of land	-2.9	-85.4
physical capital	6.4	-367.5
cattle herd	1.6	-70.3
foreign debt	273.8	226.3
Discounted welfare	-168.9	-1276.9

- At the regional level the economic shock resulting from a FMD outbreak results in **significant losses on the long run**.
- Rigidities on labor and capital market induce **huge losses on factor markets**:
  - Difficulties to rebuild the herds
  - Decreasing value of land
  - Losses of physical capital due to investment constraints and expenditures on wages
- In the end of simulation, the overall welfare loss is more than 7 times higher when labor constraints are taken into account.
- From an initial shock representing a 150M€ loss, the **global economic consequences can be 8 times greater**.

### Conclusions

- Catastrophic nature of economic shock due to a FMD outbreak, particularly in presence of rigidities on factor markets
- Lasting market effects for the whole livestock sector
- **Non parallel effects in the agricultural sector and in the food industries**
- Importance of the biological cycles of the herd in the economic dynamics
- **The whole regional welfare is lastingly and significantly affected by a brief health hazard**

### Linked publications

- Arnaud Rault, S.Krebs (2011). Livestock epidemics and catastrophic risk management: state of the art and prospects on economic dynamics. *Working paper WP11-05 INRA SMART-LERECO*
- A.Gohin, J.Cordier, S.Krebs, A.Rault (2012). Dynamic impacts of a catastrophic production event: the foot-and-mouth disease case. *Risk Analysis [in press]*
- A.Gohin, A.Rault (2012). Assessing the economic costs of an outbreak of foot-and-mouth disease on Brittany: a dynamic computable general equilibrium analysis. *EAAE 123<sup>rd</sup> seminar, Dublin*.
- A.Rault (2012). On the effectiveness of mutual funds to cope with lasting market risks: the case of FMD in Brittany. *EAAE 126<sup>th</sup> seminar, Capri*