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:
• 1st rank for milk, veal, pig and poultry production
• 2nd 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

<table>
<thead>
<tr>
<th>Cows</th>
<th>Heifers</th>
<th>Calves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-FMD Food</td>
<td>Trade bans on exports ⇒ increasing cow herd</td>
<td>Trade bans on imports + multiannual biological cycle ⇒ lasting lack of heifers and calves</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effects on the rigidities on factor markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy cow activity</td>
</tr>
</tbody>
</table>

Welfare consequences

<table>
<thead>
<tr>
<th>Perfect factor markets</th>
<th>Constraints on investment and wages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of land</td>
<td>-2.9</td>
</tr>
<tr>
<td>physical capital</td>
<td>6.4</td>
</tr>
<tr>
<td>cattle herd</td>
<td>1.6</td>
</tr>
<tr>
<td>foreign debt</td>
<td>273.8</td>
</tr>
</tbody>
</table>
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 rebuid 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 lasting and significantly affected by a brief health hazard

Linked publications

• A.Rault (2012). On the effectiveness of mutual funds to cope with lasting market risks: the case of FMD in Brittany. EAAE 126th seminar, Capri