Foot-and-Mouth Disease Impacts on U.S. Pork Exports: A Comparative Study of the Spatial Econometric Model versus the Gravity Model

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Introduction

Foot-and-Mouth Disease (FMD) is a highly contagious disease that affects cloven-hoofed animals such as cattle, goats, and pigs. FMD causes a high fever, blisters inside the mouth and on the feet, which may rupture and cause lameness. A serious FMD outbreak can create tremendous negative impacts on animal health, domestic meat production, and agricultural economic activity.

Empirical Results

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>No Fixed Effects</th>
<th>With Fixed Effects</th>
<th>SEM</th>
<th>PPML</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGDP</td>
<td>0.095 ***</td>
<td>0.048 ***</td>
<td>0.099 ***</td>
<td>0.123 ***</td>
</tr>
<tr>
<td>Distance</td>
<td>-0.110 ***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>0.055</td>
<td>0.013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colonial         45</td>
<td>0.164 ***</td>
<td>0.119 ***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contiguity</td>
<td>0.455 ***</td>
<td>0.014</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA</td>
<td>0.126 *</td>
<td>0.073 **</td>
<td>0.059 ***</td>
<td>0.074 ***</td>
</tr>
<tr>
<td>FMDSL</td>
<td>0.121 ***</td>
<td>0.047 **</td>
<td>0.013</td>
<td>0.014</td>
</tr>
<tr>
<td>MDNL</td>
<td>-0.050</td>
<td>-0.004</td>
<td>0.020</td>
<td>0.024</td>
</tr>
<tr>
<td>Observation</td>
<td>941</td>
<td>941</td>
<td>941</td>
<td>941</td>
</tr>
<tr>
<td>AIC</td>
<td>4,129,792</td>
<td>4,487,479</td>
<td>5,375,944</td>
<td>5,054,300</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-2,633,009</td>
<td>-2,194,992</td>
<td>-8,593,089</td>
<td>-8,238,910</td>
</tr>
</tbody>
</table>

Note: * = 0.10, ** = 0.05, and *** = 0.01.

Research Method

Gravity model

Endogeneity (Santos-Silva and Tenreyro, 2006) and endogenous multilateral resistance terms (Baijer and Bergstrand, 2007) should be aware when using gravity model.

Poisson Pseudo-Maximum-Likelihood (PPML) with fixed effects is used in this study.

Spatial Econometric Model

Two different spatial dependence models: Spatial Error Model (SEM); Spatial Lag Model.

SEM, where space matters only in the error process, is applied to investigate U.S. pork exports.

Fixed effects in a spatial autoregressive structure are introducing additional exogenous information, which augments the sample data information.

Empirical Model

<table>
<thead>
<tr>
<th>Participation Question</th>
<th>Outcome Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probit</td>
<td>PPML</td>
</tr>
<tr>
<td>Export in Binary</td>
<td>Export in Continuous</td>
</tr>
<tr>
<td>Export in Continuous</td>
<td>Export in Continuous</td>
</tr>
</tbody>
</table>

Cragg’s Model for Participation and Outcome Questions

Footnotes

1 United Nations Commodity Trade Statistics Database.
2 Foreign Agricultural Service/ U.S. Department of Agriculture
3 Centre d'Etudes Prospectives et d'Informations Internationales
4 World Trade Organization

Footnotes

25th CAE

The Impact of Foot-and-Mouth Disease on U.S. Pork Exports: A Comparative Study of the Spatial Econometric Model versus the Gravity Model

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Research Questions

Do U.S. pork exports gain more market share while other importers develop FMD?

FMD-affected countries can adopt a slaughter or vaccination policy to deal with FMD. Do different policies adopted by FMD-affected importers lead to different impacts on U.S. pork exporters?

A gravity model and spatial econometric model are used and compared. Do the estimators of these two models in this study have consistent results?

Data

Data include U.S. pork exports to the 181 importing countries during 1996 to 2007.

Annual value of U.S. pork exports are derived from the UN-CTSD.

Real GDP is derived from the FAS/USDA in U.S. dollars.

FMID records are from the OIE website.

The indicators of distance, contiguity, colonial relations, and common language are CEPII.

RTA can be found in WTO website.

Conclusion

Do U.S. pork exports gain more market share while other importers develop FMD?

The results of Cragg’s model show that only importers with a vaccination policy are more likely to enhance pork imports from the U.S.

The empirical results for SEM and PPML estimators are similar and consistent when fixed effects and zero-valued trade are excluded in the U.S. example.