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Trade Impact of Foot and Mouth Disease Information

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Trade Impacts of Foot and Mouth Disease Information

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Introduction

- Foot and Mouth Disease (FMD) is one of the most serious concerns in the livestock industry worldwide, particularly in developing countries.
- Despite a good deal of literature on FMD, empirical evidence specific to trade impacts is severely limited.
- Economic impacts of FMD stem from multiple sources, including trade sanctions imposed by the importing countries on livestock products from infected countries.
- With increased openness in trade in the current context of globalization, trade impacts of invasive disease outbreak are thought to be substantial but this has not been demonstrated in any comprehensive econometric analysis.
- In this study, we attempt to systematically quantify the magnitude of impacts of FMD outbreaks on exports of livestock and livestock products.

Primary Objectives

- Estimate export demand of meat and live animals across 145 countries.
- Examine effects of different types of reported livestock disease information (i.e., FMD outbreaks) and trade agreements on exports of meat and live animals.



Methodology

- Demand in country j is driven by perceived quality of the good with lower quality (i.e., FMD tainted products) leading to lower consumption (Piggott and Marsh, 2004). On the supply side country i exports are contingent on disease incidence and OIE/WTO guidelines. Both countries i and j are bound by bilateral or regional trade agreements.
- A spatial econometric model of aggregate export demand is specified as:

$$Q_{Mit} = \alpha_{Mi} + \rho_M W \hat{Q}_{Mit} + \beta_{1M} P_{it} + \beta_{2M} P_{2it} + \gamma_{1M} \ln GDP_{it} + \gamma_{2M} Ratio_{it} + \sum_{k=1}^3 \delta_{kM} FMD_{kit} + \varepsilon_{Mit}$$

$$Q_{Lit} = \alpha_{Li} + \rho_L W \hat{Q}_{Lit} + \beta_{1L} P_{it} + \beta_{2L} P_{2it} + \gamma_{1L} \ln GDP_{it} + \gamma_{2L} Ratio_{it} + \sum_{k=1}^3 \delta_{kL} FMD_{kit} + \varepsilon_{Lit}$$

Here, t indexes year $\{t = 1, 2, \dots, T\}$. M indexes meat and L indexes live animals on Q representing demand for the quantity of meat and number of live exports. GDP is the Gross Domestic Product for each country, $Ratio$ is the ratio of domestic production to domestic consumption, and FMD dummy variables represent different information reported by each country (discussed ahead).

- W is a block diagonal weighting matrix of dimension $NT \times NT$ with each block of size $N \times N$ identifying trade agreements between countries for each time period, t .
- To account for zero trade with panel data, we specify a Tobit panel estimator. To account for the spatially lagged endogenous variable, we extend this to estimate a spatial Tobit model, for both Q_M and Q_L .

➤ P denotes export prices. Missing prices are discussed below.

➤ To capture the effects of different degrees of reported disease outbreak information on exports, three disease dummies from OIE are incorporated in the model (the base case is no FMD; see Figure 1a below):

- No reported disease information (FMD_noinfo);
- Disease is known to be present but data is not available (non-reporting) (FMD_nodata); and
- Data on disease outbreak is available (FMD_out); and compared against no disease present (FMD_zero) as the base variable.

Data

➤ Annual observations from 1996 to 2009 for 145 countries are used.

Table 1. Source of data used in this analysis

Data	Source	Remarks
FMD outbreaks (4 levels of disease outbreak information) (Figure 1a)	World Organization for Animal Health (OIE)	6 species: Cattle, Buffalo, Goat, Sheep, Swine, and Camel
Quantity and value of livestock meat exports	Food and Ag. Organization (FAO)	20 different categories of meat products
Quantity (Head) and value of live animal exports	FAO	All 6 species
Prices for each category of export	Calculated	Value/Quantity
Data on bilateral and multilateral free trade agreements	WorldTradeLaw.net and Mercurio (2013)	Used to construct the weighting matrix, W .
Real GDP	The World Bank	Constant 2005 USD Units
Domestic production and domestic utilization of meat	FAO	Used to construct the use ratio

➤ Data on export prices could not be computed for some countries in some years due to zero trade flows. The missing prices on each export category are then predicted by estimating the following panel regressions:

$$\ln P_{Mit} = \beta_{M1} \ln regP_{Mit} + \beta_{M2} \ln worldP_{Mit} + \beta_{M3} \ln GDP_{it} + \beta_{M4} trend_t + \mu_{iM} + \varepsilon_{Mit}$$

$$\ln P_{Lit} = \beta_{L1} \ln regP_{Lit} + \beta_{L2} \ln worldP_{Lit} + \beta_{L3} \ln GDP_{it} + \beta_{L4} trend_t + \mu_{iL} + \varepsilon_{Lit}$$

where $RegP$ is the regional price (across continents) and $WorldP$ is the world price (Figure 1b). μ_i 's are time invariant country specific effects and ε is the standard error term. The models are estimated by fixed effects regression.

Fig 1a. FMD Outbreak Data (1996-2009)

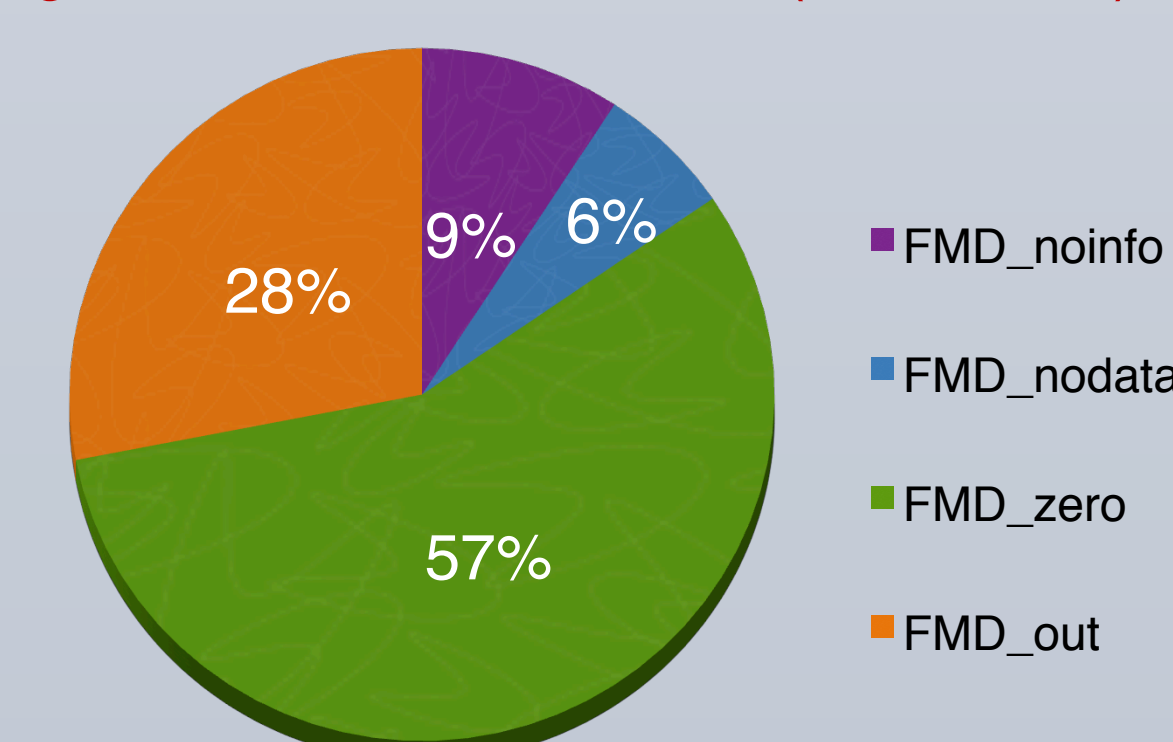
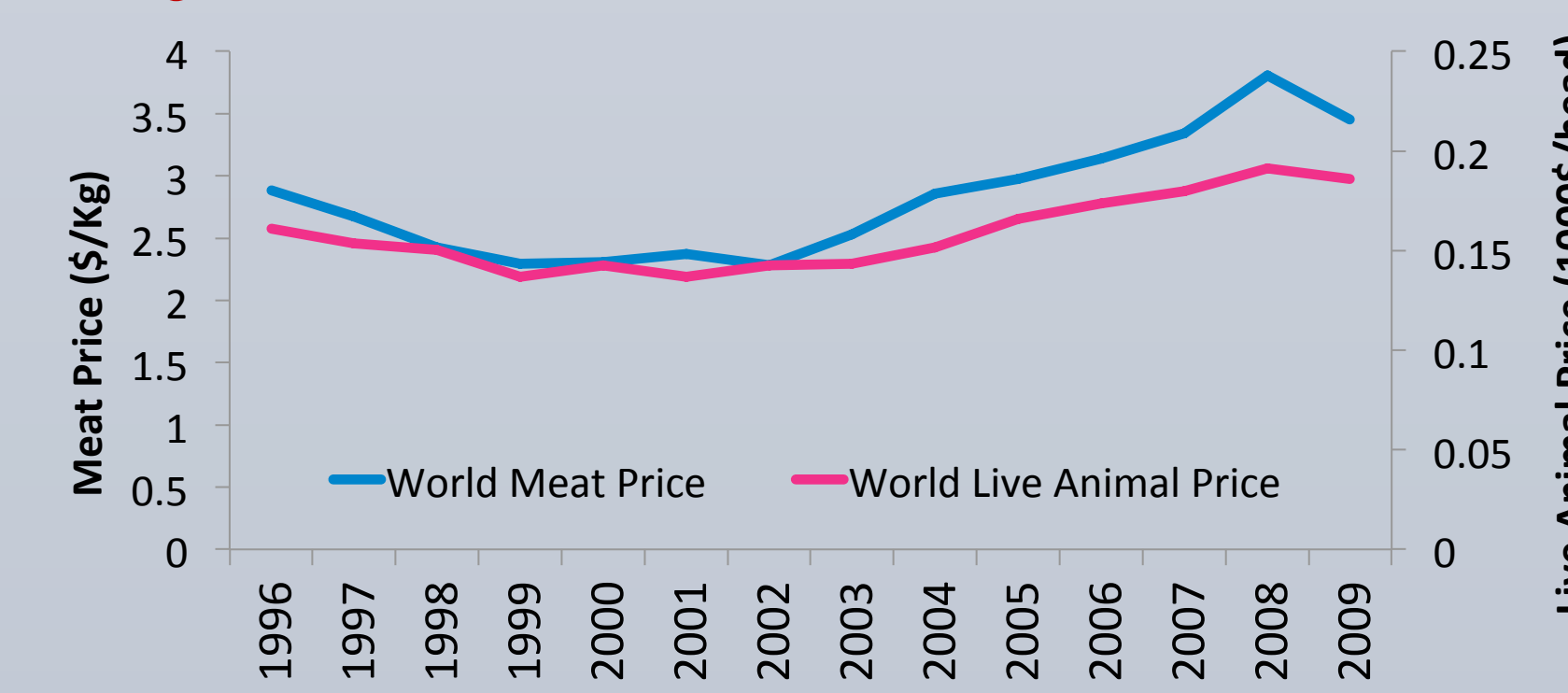


Fig 1b. Trend of World Prices of Meat and Live Animals



Results

Table 2. Estimated coefficients (robust standard errors) of export demand equations

Variable	Meat Export Quantity	Live Animal Export Quantity
$W \cdot Q$	0.010*** (0.002)	0.016*** (0.003)
P_meat	515 (1168)	-5527 (7205)
P_live	6138 (6961)	-713 (31270)
$\ln GDP$	32763*** (6467)	114619*** (24760)
$Ratio$	113059*** (14874)	366089*** (66030)
FMD_noinfo	-794 (13036)	-74678 (62758)
FMD_nodata	-27772* (14956)	-54661 (66441)
FMD_out	-33733*** (9635)	-36445 (44003)
Constant	-829745*** (156533)	-3042665*** (600262)

*** Indicates statistically significant at the 1% level.

- The spatial correlation coefficient is significant and positive for both equations, indicating the positive impact of trade agreements on meat and live animal exports.
- Prices are insignificant. Significantly positive coefficients of GDP and $Ratio$ indicate countries with higher values of these variables have higher exports.
- Nonreporting, infected countries (FMD_nodata) export less meat. FMD outbreaks (FMD_out) are significant and negative, coinciding with lower meat exports.
- FMD outbreaks do not have a significant impact on live animal trade.

HOW LARGE IS THE TRADE EFFECT?

- Compared to disease-free countries, FMD-infected countries exhibit about 34,000 tons of reduction in export of meat (about 1/3 the average export quantities).
- In 2009, the loss in trade revenue for an average country is estimated to be more than 116 million USD at the world price of 3.45 \$/Kg of exportable meat. For Africa, this loss cumulates to about 3 billion US dollars in 2009.

Conclusion and Policy Implications

- Trade impacts of FMD outbreaks are statistically and economically significant. On average, countries that suffer FMD outbreaks realize a loss of more than a third of their meat export revenue.
- Investing on preventive and control measures for FMD is likely to benefit countries that have potential for meat exports.
- International cooperation and collaboration, especially supporting the developing countries, can help eradicate FMD globally.