

Conclusions

This report presents a modeling framework designed to estimate the economic impacts of livestock disease outbreaks. The combined framework is designed to examine the impacts of highly contagious livestock diseases and alternative control and surveillance options. The framework has three key features: (1) the initial disease-spread component can be based on an epidemiological model that incorporates disease-spread parameters; (2) supply shocks, along with demand and trade shocks, can be introduced into a model of the U.S. agricultural sector; and (3) time is disaggregated into a quarterly model of the U.S. agricultural sector in which economic shock dynamics can be observed over 20 quarters. Only 16 quarters were examined in this simulation study because the short duration of impacts resulted in no differences from the baseline in the latter quarters.

A hypothetical FMD outbreak is used to illustrate the utility of the modeling framework. In our example, the initial outbreaks arise from using garbage as feed in four small farrow-to-finish operations in the Midwest. Three alternative control strategies and three levels of disease-outbreak intensity are examined. The strategies considered are destruction of direct-contact herds, destruction of direct-contact and indirect-contact herds, and slaughter of all animals within a 1-km ring. The disease-spread model is solved 50 times for each scenario to give mean, low, and high outcomes. Exports of beef, pork, lamb meat, cattle, hogs, lambs, and sheep are assumed to be halted during the outbreaks, with restrictions continuing for one quarter beyond the slaughter of the last confirmed case associated with the outbreak.

For our hypothetical FMD scenario, the epidemiological model estimates destruction of relatively small numbers of susceptible animals, a maximum of 77,582 out of a susceptible population of 9.8 million animals in the database used. Despite the small numbers of animals slaughtered, the economic model results show large losses to capital and management for beef, beef cattle, hogs, and pork. These losses are a direct result of the increased domestic supplies that occur with the loss of trade under our trade assumptions, which lead to lower prices. However, dairy sector returns to capital and management increase because few dairy cattle are destroyed, exports are not restricted, and feed costs are lower. Other sectors experience small losses or, in some cases, small gains.

Because loss of U.S. exports is linked to length of an outbreak, control strategies that reduce the duration of the outbreak predominate. The most extreme, ring destruction, always reduces the length of an outbreak to less than one quarter. The mean- and low-outbreak cases for direct-contact slaughter and direct-and-indirect-contact slaughter also reduce the outbreak to one quarter. But these control strategies exhibit some iterations in which FMD outbreaks last beyond two quarters, triggering export losses into the fourth quarter after the hypothetical outbreak. Under direct-contact and a combination of direct- and indirect-contact slaughter, the total U.S. loss of net returns to capital and management in agriculture and agribusiness ranges from \$2,773 million to \$4,062 million in our scenario, while U.S. consumers benefit from lower prices during the quarters in which U.S. exports are assumed to be embargoed.

A number of variations could alter the results presented here. One factor that may affect the outcome of control strategies is the type of outbreak. Animal losses and length of outbreak are sensitive to assumptions about the type of outbreak. While in our examples the outbreaks occur in small hog operations in the U.S. Midwest, control strategies that predominate could be different for outbreaks that (1) occur in larger operations with more off-farm movement, (2) differ spatially, or (3) originate with a different species. In particular, the effectiveness of ring destruction in lowering the duration might not hold, and costs could be larger than reported in this analysis. Other control strategies could also yield results that differ from those observed in this study, including vaccination strategies, regionalization, quarantine-zone policy alternatives, and marketing potential for uninfected livestock slaughter. For example, if a quarantine policy restricted poultry movements within quarantine zones during an FMD outbreak, or if meat from uninfected livestock could be marketed through normal channels, results could be different.

A poultry version of the framework has been developed to examine the impacts of trade regionalization in the event of a hypothetical outbreak of Highly Pathogenic Avian Influenza (Paarlberg, Seitzinger, and Lee, 2007). Another way the model presented here could be used is to examine policy-switching strategies. For example, the model could give an indication of the impacts of switching to a vaccination policy after a period of time when disposal resources become overwhelmed, as they did during the 2001 FMD outbreak in the Netherlands (de Klerk, 2002; Plumiers et al., 2002).