

POLICY BRIEF: Indirect cost of ASF, Draft

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1. KEY MESSAGE

This study examined the indirect cost of a hypothetical outbreak of African Swine Fever (ASF) in both the Scottish and British pig herd. Indirect costs are defined as the economic loss incurred after disease freedom is declared.¹ With this definition, the estimates capture the market effects of a shock in the supply of pig meat. Specifically, the model considered the markets for beef, pork, sheep, chicken, feed wheat and milk. The results present the indirect cost of four outbreak-culling scenarios. In general, revenue in the market for pork will decline following an outbreak, while chicken, beef and lamb commodities will experience an increase in revenue, mostly due to commodity switching. However, in Scotland, consumers will face a higher retail price for all goods. In Britain, the estimates suggest a slight decline in the retail price for chicken.

2. MAJOR FINDINGS

1. For Scotland, the indirect cost following an outbreak of ASF is mainly driven by the revenue lost in the market for pork. However, total indirect costs are partly offset by increased revenue in other markets. This may be driven by a change in consumer demand for substitute products. Increased demand leads to increased retail prices; hence the consumer ends up paying more for all goods.
2. The magnitude of indirect costs are greater when considering retail prices (instead of producer prices), suggesting that the shock affects more than just the producers, but also other stakeholders along the supply chain.
3. For producers, a medium sized outbreak, defined as culling 20% of the national herd, generates a total revenue loss of £ 2.65 million. Because some markets experience an increase in revenue due to higher prices and increased demand, the revenue lost for the pork market exceeds the total revenue lost. In particular, the pork market loses £ 2.94 million. Using retail prices, which takes account of any value added along the supply chain, total indirect cost of a medium outbreak is £ 7.84 million.
4. For Britain, the cost estimates are larger. This is in part driven by a greater response in each of the variables, but also because the shock takes longer to dissipate.
5. For producers, a medium sized outbreak would cost pork producers £ 53.50 million. Using retail prices, total indirect cost of a medium outbreak is estimated to be £ 139.07 million.

3. OBJECTIVES

This study evaluated the indirect costs of an outbreak of African Swine Fever in both Scottish and British herds. This provides a better understanding of the wider economic effects of an animal disease outbreak as it captures the market linkages and dynamics following an outbreak.

¹ See Barratt et al., 2019
EPIC_202021_PB_005v1

4. POLICY IMPLICATIONS

This study does not consider the effect of different policies as it only provides the baseline scenario of an outbreak under current policy conditions. Thus, the results indicate the indirect costs related to the status quo. However, the model can be extended to consider multiple policy interventions if the epidemiological effects of these can be provided using a suitable model. As such, the results presented here can be used to compare the indirect cost of management strategies that will generate different culling outcomes.

5. IMPORTANT ASSUMPTIONS AND LIMITATIONS

A time series model estimated the impulse response functions (IRFs) - which describe the change in one variable over time in response to a shock in another variable. Because the data were expressed in natural logarithms, the estimated IRF coefficients may be interpreted as elasticities. Namely, in the case of ASF, the IRF elasticities estimate the percentage change in one variable in response to a 1% reduction in the quantity/supply of pig, due to culling (Barratt et al., 2019).

The type of time series model to estimate depends on the underlying characteristics of the data. Based on unit root- and cointegration tests, a vector error correction model (VECM), which estimates both long-run equilibrium relationships and short-run dynamics between the data series, was chosen. Because some of the time series exhibits structural breaks in the data generating process, models incorporating dummy variables to control for this were also considered (Joyeux, R., 2007). With a system including up to 12 different endogenous variables, the specification providing the best fit varied across the variables to be explained. The final model is the one that on average, provided the most accurate out of sample forecasts.

Once the IRF elasticities were obtained they were used to calculate how prices and quantities will respond to a shock in the supply of pig, that is, a decrease in the supply of pig due to increased culling. The IRF elasticities also capture the duration of the shock by identifying the number of months until the effect dissipated. Indirect costs were calculated for each market by taking the difference between the estimated post shock revenue and the pre-shock revenue.

The model does not consider the potential for wider economic effects, e.g. tourism and international trade. Thus, the indirect costs would probably be greater than those estimated here.

6. FIGURES AND TABLES

Scotland

Figure 1 reports the indirect cost related to the culling of 5% of the Scottish pig herd, disaggregated by the different markets. The model with producer prices reflects how an outbreak is affecting the producers, whereas the use of retail prices incorporates wider market effects, including any value added occurring between the farmgate and the final retailer. In general, the reduction in revenue in the market for pork is slightly offset by increased revenue in other markets acting as substitute goods. The use of retail prices indicates greater costs to the economy than when we only considered producers. Because consumers can change their consumption bundle by substituting with other alternatives such as fish, vegetarian options

and imported meat products we cannot say anything specific about the total cost burden for consumers. However, all retail prices increase in response to a culling shock in pig, thus the price of purchasing Scottish meat does increase for the consumer. Table 1 reports total indirect cost and the indirect cost for the pork market, for four different outbreak scenarios; small, medium, large and very large. In the last scenario 60% of the national herd is culled, this corresponds to an outbreak in North East Scotland where 60% of the nation’s sows and fattening pigs are located.²

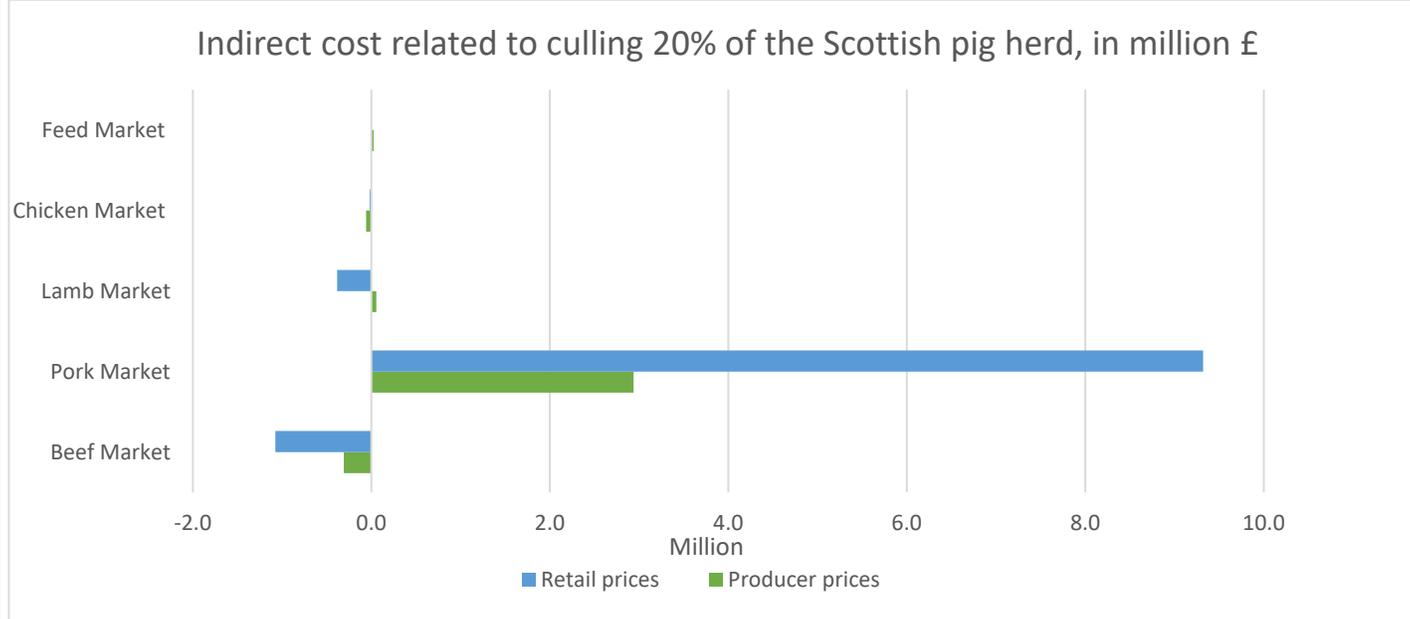


Figure 1: Negative values indicate increase in revenue.

Table1. Indirect cost in Scotland

Proportion of national herd culled	Total indirect cost, producer prices (in million £)	Indirect cost in the market for pork, producer prices (in million £)	Total indirect cost, Retail prices (in million £)	Indirect cost in the market for pork, retail prices (in million £)
5%	0.66	0.74	1.96	2.33
20%	2.65	2.94	7.84	9.32
35%	4.64	5.14	13.73	16.32
60%	7.94	8.81	23.57	28.02

Great Britain

Figure 1 illustrates the indirect cost related to culling 20% of the British pig herd. The figure reports numbers from our retail price model, and includes the upper and lower bound estimates, as defined by the 95% confidence interval. These bounds are included because they are wider than in the Scottish estimates,

² See <https://www.gmscotland.co.uk/pigs>

and thus there is more uncertainty associated with the point estimates. The beef and lamb market appears to be most affected by this, and more so with producer prices. However, the estimate of revenue loss for the pork market remains relatively consistent, even with producer prices. Table 2 reports the total indirect cost and indirect cost in the pork market for four different outbreak scenarios.

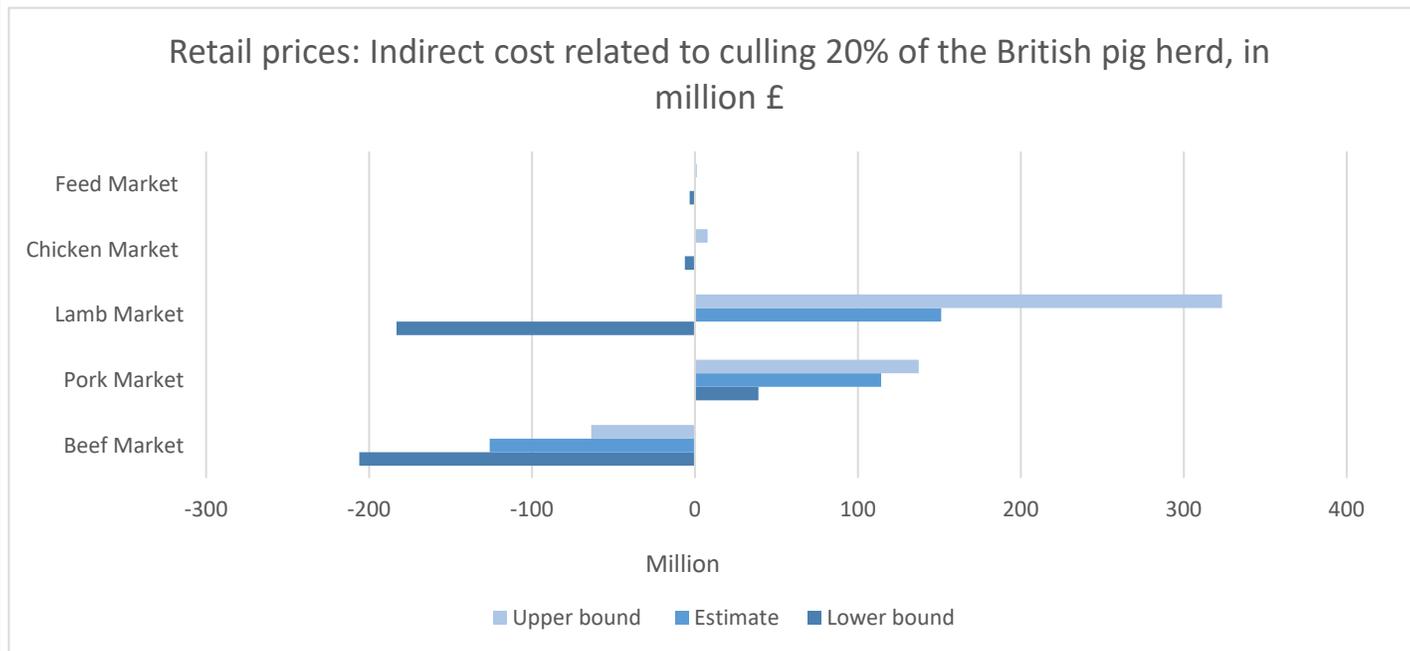


Figure 2: Negative values indicate increase in revenue.

In general, the effect on cost estimated on British data are greater than those estimated on Scottish data. This is in part driven by a greater response in each of the variables, but also because the shock takes longer to dissipate in Great Britain. Almost all prices are estimated to increase following an outbreak. The exceptions are the retail and producer prices for chicken. Thus, consumers will face increased prices for most commodities, and uninfected pig producers may benefit from the decrease in supply.

Table 2. Indirect cost in Great Britain

Proportion of national herd culled	Indirect cost in the market for pork, producer prices (in million £)	Total indirect cost, Retail prices (in million £)	Indirect cost in the market for pork, retail prices (in million £)
5%	13.34	33.60	27.3
20%	53.50	139.07	114.3
35%	93.86	251.51	208.5
60%	161.54	454.43	381.88

7. LINKS TO EXISTING PUBLICATIONS OR REPORTS

Barratt, A. S., Rich, K. M., Eze, J. I., Porphyre, T., Gunn, G. J., & Stott, A. W. (2019). Framework for Estimating Indirect Costs in Animal Health Using Time Series Analysis. *Frontiers in veterinary science*, 6, 190.

Joyeux, R. (2007), "How to deal with structural breaks in practical cointegration analysis", in B. Bhaskara Rao (ed.), *Cointegration for the Applied Economists*, (2nd. ed.), Palgrave Macmillan, New York, 195-221.