



Tracking and Testing Of US and Canadian Cattle Herds for BSE: A Risk Management Dilemma

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The United States has historically imported a substantial number of cattle from Canada. Given the discovery of a BSE-infected animal in Canada and another in the United States with Canadian heritage raises the question as to whether the United States should track and test imported animals. One alternative for the near term is to identify, permanently mark, and track Canadian cattle in the United States. We will use economic analysis to quantify and compare risk management and economic consequences of such an alternative in an effort to help policy analysts and decision makers decide how best to assess and manage uncertain risks of BSE in the United States from imported cattle.

Background

Canada has tested thousands of cattle per year for Bovine Spongiform Encephalopathy (BSE)—3,377 animals in 2002—but has found only one cow with BSE. In the province of Alberta where the infected animal was found, “the brains of 2,769 targeted cattle were tested from October 1996 to March 31, 2004. One cow, condemned at slaughter (did not enter the human food chain), was confirmed positive for BSE in May 2003.... Brain tissue samples from the remaining 2768 cattle had no evidence of BSE” (Government of Alberta, 2004). The Canadian cattle tested included animals that exhibited neurological signs and/or emaciation as well as postmortem samples submitted to provincial diagnostic laboratories. If, based on European experience, targeted animals are about 60 times more likely to have BSE than nontargeted animals (Doherr et al., 2001), then the prevalence rate of BSE among nontargeted cattle would be about six per million cattle $((1/2,768) \cdot (1/60))$.

In December 2003, a second dairy cow from Alberta, imported into the United States to the state of Washington, was also diagnosed with BSE. The United States Department of Agriculture’s APHIS Veterinary Services (VS) issued an “Explanatory Note” in February 2004, following an investigation by the USDA and the Canadian Food Inspection Agency (CFIA). The note concluded that the previous risk analysis of Canadian cattle and beef products imported into the United States remained unchanged by the new case and that the risks remained low. They noted that both of the BSE cases of Canadian origin occurred in cattle born before the implementation of the feed ban on the use of animal neurological matter in livestock feed, which is alleged to be the main way the disease spreads (USDA, 2004).

The detection of two BSE cases from Alberta in less than eight months raises the question: What is the current prevalence of BSE in Canadian cattle? From a risk management perspective, the key question is what actions, if any, should be taken given the uncertainty about the true prevalence of BSE in Canadian cattle. This decision problem is made more challenging by high economic stakes and by scientific uncertainties regarding BSE sources, reservoirs, and dynamics. Additionally, false positives might be economically damaging—the USDA’s reports of unconfirmed BSE cases that turned out to be false had market impacts.

Scientific unknowns make predictive modeling highly uncertain, creating a dilemma for both health and economic risk management. Experience since 2003 has shown that the presence of confirmed BSE cases dramatically reduces US beef exports, even when the infected animals originated outside the United States. If the true prevalence of BSE in Canadian cattle shipped to the United States

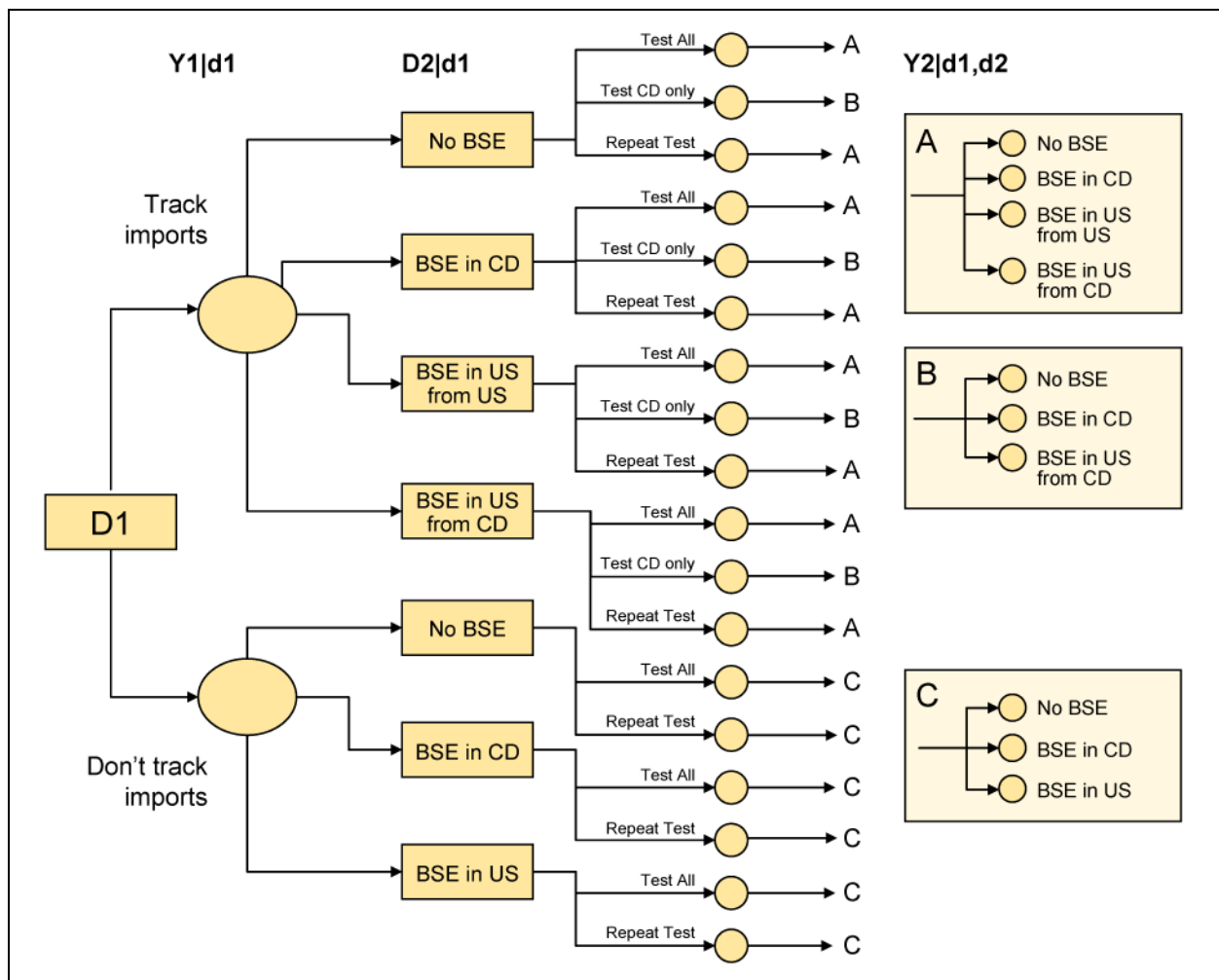


Figure 1. Decision tree for BSE testing policy.

were known to be as high as six per million head, then continued prevention of cattle imports from Canada might be expected. On the other hand, if the prevalence of BSE in Canadian cattle were known to be much smaller or zero, then the advantages of trade could be gained by allowing unrestricted imports. Given the high economic stakes and uncertainties, it has been difficult to decide or objectively evaluate what policies would best promote US and international interests. Options range from the status quo (preserving current import restrictions and testing programs) to tightening or loosening import policies. Another alternative involves gathering more information

before deciding. This might be done by tracking and testing Canadian cattle as they enter and live in the United States and then using this information in support of decisions on import restrictions. Discovery of which of these (or other) options is most desirable requires comparing their associated chances of gains and losses.

Formulating the Risk Management Decision Problem

Figure 1 outlines the decision alternatives to be compared in a sequential manner. An initial (Stage 1) decision whether to track Canadian cattle in the US (“Track CD imports”) or not to track them (“Do

not track CD imports”) is followed by arrival of additional information from ongoing sampling and BSE testing programs in the US and Canada. If the Stage 1 decision was “Track CD imports,” then in the next year, any of the following informative events may be observed:

- no new BSE cases are detected;
- BSE case(s) of Canadian origin are detected in the United States;
- BSE case(s) of US origin are detected in the United States; or
- BSE case(s) of Canadian origin are detected in Canada.

If the Stage 1 decision is “Don’t track CD imports,” then the four possible observations for the next period are

aggregated to only the following three:

- no new BSE cases are detected;
- new BSE case(s) are detected in Canada; or
- new BSE case(s) are detected in the United States.

A Stage 1 decision to track imports increases the chances that the origin of a new case can be determined.

After the Stage 1 decision, and given updated information about any new BSE cases, a subsequent (Stage 2) decision will be made about whether to sell and process healthy-appearing cattle without first requiring them to be tested for BSE (“No required test”), versus requiring all US cattle to be tested for BSE before being sold or processed (“Test all”), versus requiring only all Canadian cattle in the United States to be tested for BSE before being sold or processed (“Require testing for CD cattle only”). The latter option is available only if the Stage 1 decision was to track Canadian cattle imports. Stage 2 decisions will be made conditional on the information available then. For example, if a new BSE case of unknown origin is detected in the United States, then the best Stage 2 decision might be to test all US cattle at slaughter to reduce export and domestic losses; if the origin of the case is known to be Canadian and the Stage 1 decision was to track Canadian imports, then the best Stage 2 decision might be to require testing for Canadian cattle only.

Estimated Economic Consequences of Detecting Additional BSE Cases

Given this decision problem, one may estimate the economic costs associated with each terminal node (i.e., “leaf” node) at the tips of Figure 1. Three types of costs will be consid-

ered: tracking costs, testing costs, and market costs. Tracking costs are estimated to be \$30.7 million and represent the cost of permanently marking each live animal coming into the United States, including labor and materials. Testing costs represent the costs of the BSE tests, including kits, labor, shipping, holding, laboratory facilities, and expenses. Testing all cattle in the United States is estimated to total \$1.09 billion. Testing Canadian cattle only would cost \$47.3 million, and testing only those animals that fail an initial screening test would cost \$2.4 million.

Market costs represent market losses (or gains) associated with each second-stage outcome as a function of all that occurred up to that point. These costs are dependent on the source of the BSE animal and the type of tracking and testing programs in place when the discovery occurs. These impacts range from a loss of \$12.2 billion when there is a case of BSE in the United States from a US animal to a gain of \$1.3 billion when there is a case of BSE in Canada and tracking of Canadian cattle in the United States. The full set of possible outcomes can be found in Cox et al. (2004).

BSE Decision Consequences

The economic consequences of tracking Canadian cattle imports depend on the chances as to whether and where BSE is detected. The probabilities of the different economic consequences, given the choices of Stage 1 and Stage 2 decisions, are estimates of the probabilities of finding one or more BSE-positive cattle among each batch of 1,000 tested. The probabilities of the different outcomes were estimated from data collected following the discovery of the first BSE animal in

Canada. The full set of probabilities can be found in Cox et al. (2004).

Consequences of Decisions in the Base Case

Under the baseline assumptions, the expected net cost to track imports is \$10.3 million per year, while the expected cost to do not track imports is \$90.0 million per year. Thus, the expected net economic value of the information provided by tracking is \$79.7 million per year, reflecting a much higher probability of large market losses when imports are not tracked. Such large results occur because without tracking, BSE cases of Canadian origin in the United States cannot be distinguished from (and therefore have the same economic impact as) BSE cases of US origin. The least-cost rule then is to track Canadian cattle imports, then continue limited sampling in Stage 2 no matter what occurs. In other words, the benefit from tracking in this case does not come from avoiding the cost of 100% testing of US cattle, because this is costly. Rather, it comes from the assumed reduced loss of US beef sales if the country of origin of a BSE case detected in the United States is Canada and this can be ascertained and announced.

A sensitivity analysis, where we varied the probabilities and costs, indicates that the dominance of this decision is robust to many variations in the input data, suggesting that the model’s recommendation to begin tracking may be well justified despite remaining uncertainties. The economic value of tracking information comes primarily from limited export losses and from avoiding the need to test all US cattle to win back customers. Although the best second-stage decisions vary across sensitivity analysis cases, most results agree that

tracking is the optimal current decision, even while differing in their precise (Stage 2 planning) reasons.

Impacts of Possible Win-Back of Export Markets

The above analysis pessimistically assumes that the losses of US cattle and beef export markets following the discovery of a Canadian-origin BSE case in December 2003 are persistent and irreversible. If policies in the United States result in recovery of some of the lost export markets, then the economic impacts from tracking and testing could dwarf those calculated for the base case. For example, under an assumption that aggressive testing would allow the United States to regain its lost exports (as long as no confirmed BSE case of US origin is discovered), the optimal strategy becomes to immediately start tracking all Canadian cattle and, if a confirmed BSE case of Canadian origin is found, to test all Canadian-origin cattle in the United States prior to export. In this case, the expected net economic value of the information provided by tracking increases to \$771.6 million per year.

Concluding Comments

This analysis suggests that the economic value of information provided by tracking of imports and implementation of testing programs in the United States greatly exceeds its costs for cattle that may be imported in the future. For “legacy” Canadian cattle that have already entered the United States, moving quickly to locate and

start tracking them before any additional BSE cases are detected appears to be well justified for almost any plausible set of input assumptions, provided that the cost per head is kept within bounds (up to \$35/head, based on the sensitivity analyses for the base case). If the costs per head are too great to justify locating all legacy animals, then location and tracking efforts should focus on the oldest animals—those with the greatest risk of becoming new BSE cases.

The analysis provided here focuses on potential economic consequences and risk management options for possibly mitigating losses if another BSE case is discovered in the United States. The possibility that some BSE cases might pose (currently unquantified) health risks of variant Creutzfeldt Jakob Disease (vCJD) to humans reinforces the conclusions by increasing the importance of being able to identify the origin of any new BSE cases quickly.

That tracking and testing may be imperfect has sometimes been advanced as a qualitative argument for restricting or rejecting them. The quantitative comparisons in the sensitivity analyses suggest that this reasoning is usually not justified: Measures that help to identify the origins and prevalence of BSE cases have high information value for improving future risk management decisions and creating additional risk management options, even if they are less than perfect.

For Further Information

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