

INTRODUCTION & BACKGROUND

In Fall 2012 problems with E. coli contamination at an Alberta-based processing plant (XL Foods) resulted in the largest beef recall in Canadian history. Other outbreaks of E. coli food poisoning have been associated with a variety of food products, from spinach, to sprouts, to raw milk. The E. coli O157:H7 bacterium occurs naturally within the intestines of cattle and other mammals, while the animals themselves are not exposed to the danger of carrying the bacteria (they are asymptomatic carriers).

E. coli contamination of food can occur in two major ways: (I) through contamination of water irrigation supplies or ground water systems with manure run-off and (II) Through the cross-contamination from cattle hides to meat products as a result of shedding within a slaughter plant.

A number of potential interventions in both the post-harvest and pre-harvest stage can address the E. coli pathogen. These include use of vaccines and microbial probiotics; electron-beam processing; irradiation; ethylene gas processing and steam pasteurization.



A cattle vaccine for E. coli exists (Econiche) and has been shown to be effective in reducing the risk of E. coli contamination. The vaccine has been approved for use in Canada, nevertheless, Canadian cattle producers have been hesitant to adopt this technology. There is a cost to a cattle producer of vaccinating cattle but while the vaccine lowers the risk of E. coli contamination in the food chain, it does not deliver enhanced productivity gains for the cattle operation.

The benefits of the vaccine flow elsewhere within the supply chain, to processors/packers, retailers and consumers. There is no structure in place to reward producers for the added cost of adoption.

Using the E. coli vaccine as a case study, this project examines the factors affecting the adoption of technologies with positive spillover (externality) effects related to food safety. Positive spillovers occur when the benefits from a technology innovation extend beyond the firm (farm) adopting the technology. If there are insufficient incentives for the firm to adopt the new technology adoption levels are sub-optimal, resulting in foregone benefits for society.

STUDY OBJECTIVES

There are four main objectives to the research:

- 1) Examine the underlying economics of incentives to adopt socially beneficial technologies.
- 2) Explore the barriers to adoption of the E. coli vaccine
- 3) Examine whether incentives for adoption could be strengthened through closer supply chain coordination
- 4) Discuss implications for policies to enhance adoption of socially beneficial technologies

THEORETICAL CONSIDERATIONS

Several theoretical frameworks shed light on the low adoption rates of the E. coli vaccine and other technologies whose benefits spillover into different sectors or different stages of the supply chain. The theoretical frameworks include: Transaction Cost Economic (TCE); the theory of the Anti-Commons and finally market failure.

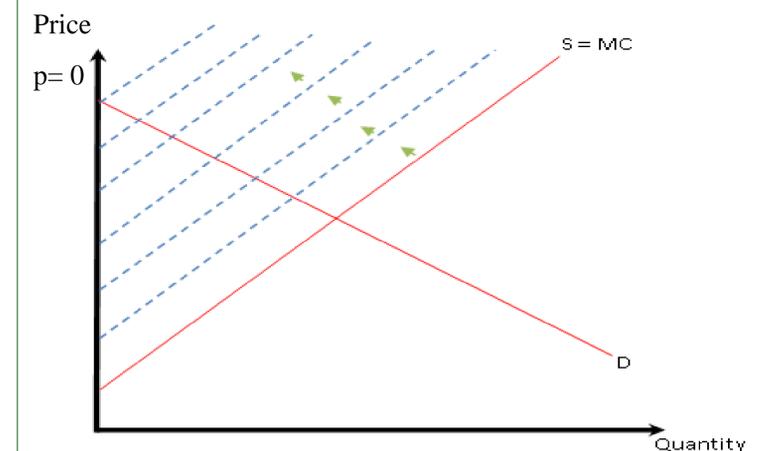
Transaction Cost Economics

Transaction costs arise between firms and affect supply chain structure that emerge. Transaction costs include the costs of information search, negotiation, monitoring and enforcement. An adopter of the technology faces increased costs in terms of the purchase, administration and relevant infrastructure changes that the vaccine might require. Supply chain governance structures that allow a value to be placed on the reduced risk from vaccinated cattle are necessary before a premium for these cattle will emerge. Closer forms of coordination such as through branded beef alliances or contracting may reduce the transaction costs of verifying vaccination programs.

Market Failure

- Marginal Social Benefit (MSB) is greater than Private Social Benefits (PSB) given that the adoption of such technology in the current supply chain structure translates to benefits to public health rather than benefits to producers.
- Cattle producers who adopt the technology cannot exclude others within the supply chain from benefiting from their adoption of the vaccine causing the free-rider problem due to the positive externalities/spillovers.
- In the absence of mechanism to verify vaccination status, information asymmetry may also be a source of market failure
- All the above have led to problems of under investment

THEORETICAL CONSIDERATIONS CONTINUED



Graph showing the Anti-Commons in the beef industry

Tragedy of the Anti-Commons

The theory of the anti-commons is premised on the notion that the right to exclude is greater than the right to use thus leading to the under utilization of a resource (E. coli vaccine) (Heller, 1998). E. coli outbreaks in the beef industry can damage the reputation of the entire sector. The benefits of adoption therefore depend on whether a few, many, or all producers adopt. There is a threshold level of adoption below which an Anti-Commons problem exists.

Figure 2 shows that if the right of cattle producers who do not wish to adopt the vaccine technology is greater than those who wish to adopt, the marginal cost (MC) of a potential adopter increases relative to that of a non-adopter to the point where the various additional costs to adoption price the cattle producer off the market (P=0). This leads to the under utilization of the resource (the vaccine).

This research is in progress.

REFERENCES

Heller, M. (1997) The Tragedy of the Anti-commons: Property in the Transition from Marx to Markets. The William Davidson Institute: University of Michigan Business School Working Paper No. 40.

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