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Public Policy, Invasive Species and Animal Disease Management

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Abstract

There has been a rapid increase in recent years in invasive species and animal management economic research. Expanded interest in the topic has been partially driven by the practical importance of public policy to deal effectively with invasive species, given its public good aspects. This paper shows that the basic criteria of public goods: non-rivalry and non-excludability, apply directly to animal disease border measures and eradication services, with some caveats. It is also argued that public policy should assess disease control and eradication on grounds of biology, national economic interests, and international cooperation. Specific regulations and programs must be evaluated on the basis of cost benefit principles.

Keywords: invasive species, animal disease management, BSE, FMD, sanitary barriers to trade

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Introduction

There has been a rapid increase in recent years in economic research devoted to analysis of the effects of invasive species on agriculture and natural resource environments. One genesis of this expanded interest in the topic has been growing awareness of the important conceptual and empirical issues to be resolved. Equally important has been the ever-increasing recognition of the practical importance of public policy for dealing effectively with invasive species. For the purposes of this paper, we consider invasive species to include exotic pests and diseases that can be introduced to a country from outside and that, once present, are expected to cause significant economic damage.

Animal disease management has played a central role in the expanding literature on the economics of exotic pests, diseases or invasive species. Animal agriculture comprises approximately half of U.S. agriculture's commodity cash receipts and animal disease outbreaks account for some of the highest profile cases of pest and disease management. This paper focuses on public policy as related to animal disease management, but the same core economic and policy issues arise for plant agriculture as well.

Government activities related to invasive species are pervasive and important. Such activities include restricting the movements of products and people across internal and external borders, destroying crops and livestock, requiring vaccination or pesticide treatments on a wide scale, regulating inputs (as in the use of mammalian nutrients for cattle) and research and development on how to control harmful species. These activities often have significant direct budget costs and even larger economic impacts in the markets affected. On the other side of the balance sheet, recent research has documented that in many cases there are large economic gains from effective exclusion or eradication of invasive species that derive from such benefits as reduced costs of production, higher food quality, lower human health threat, improved environmental quality and better access to markets.

Given the importance of invasive species, economic research that attempts to model and measure the benefits of exclusion or eradication is still relatively underdeveloped. Some aspects of the problem clearly demand much more investigation. Despite a rapid expansion of the literature related to invasive species, including work on risk analysis and the International Sanitary and Phytosanitary (SPS) agreement (WTO), much remains to be done.[1] Other types of agricultural

[1] The recent volume edited by Sumner includes a large collection of such studies. See also, Sumner and Lee and other studies collected in Orden and Roberts, editors; studies in Anderson, McRae and Wilson, editors; Roberts and other chapter in the National Research Council conference volume; James and Anderson; and Paarlberg and Lee, among others. See also the U.S. Department of

policies have received much more attention from economists and other analysts. For example, economists have focused much more analysis on explicit government transfer and subsidy programs included under the rubric of farm price and income supports than on pest policy. Even a cursory check of the academic or government literature in agricultural economics would show hundreds of studies of price and income supports and a relative handful of studies related to invasive species policy (Alston, Norton and Pardey; Alston and James; Sumner). The potential cost of the latter problems appears to be rising rapidly, at least in part due to the greater connectedness of the world economy.

This paper will review the public good aspects of control of animal diseases, focusing on efforts to eradicate and exclude, and discuss the general rationale for active public policy in this area. It will then illustrate these principles with a brief discussion of the foot and mouth disease (FMD) crisis that occurred in South American countries during 2000 and 2001, and with the finding of Bovine Spongiform Encephalopathy (BSE) in Canada and the United States in 2003. We conclude with a discussion of specific public policy considerations.

The Economics of Public Goods Applied to Management of Animal Diseases

Economists often note an active role for government in markets for goods or services that unaided market forces would fail to provide to a sufficient degree. When there is non-rivalry in consumption and it is impractical to exclude from benefits those who do not pay, it becomes difficult for private suppliers to profitably provide the good (or service). These market characteristics give rise to the classic "free rider" problem.

These concepts clearly apply, at least to some degree, to protection from communicable diseases. Individuals have clear incentives to purchase typical private animal health services that improve the expected health of a single animal or herd. However, protecting one animal or ranch from a contagious disease also helps protect others, and often the cost of protection services is not substantially higher when an additional farm or ranch is added. The existence of public-good characteristics provides a rationale for a more active public policy action in an area; however, such characteristics do not preclude private market activity nor do they determine precisely the appropriate form of government action.[2] (Mitchell also

Agriculture Economic Research Service on line briefing room http://www.ers.usda.gov/Briefing/InvasiveSpecies/.)

[2] Coase in the case of lighthouses and Cheung in the case of bees and pollination services reminded economists that just because a situation seems at first blush to suggest public good or externality characteristics does not preclude market solutions. Thus it is useful to examine the characteristics of the potential market for invasive species control services.

provides a very useful treatment of some of these issues in the context of international trade.)

Individual farms respond to clear private profit incentives to reduce losses associated with disease occurrence even when those responses do not achieve eradication of a disease (or pest) from a country or region. (See Bicknell, Wilen and Howitt for an example.) When purely private incentives are less apparent, farmers respond to incentives created by collective action such as payment programs or the police power of the state. (Kuchler and Hamm, Ekboir).

Many regulations regarding animal disease management are related to concerns about environmental externalities and worker or consumer health and safety (Antle). Such regulations are not typically directed toward lowering the external costs of disease or toward altering the public good characteristics of disease control.

Government action for animal disease seems to depend on whether the disease is endemic or invasive (exotic), the degree of contagiousness, the human health threat and the expected economic importance or potential loss. If a disease is endemic, non-contagious and not a threat to human health, government action is usually minimal. When the disease is exotic and highly contagious (such as FMD) or involves risks to human health (BSE), governments tend to be more active in disease management. In most instances, high contagion and/or risks to human health also imply a large expected economic impact.

Consider two broad animal disease services: measures to keep a disease from entering a country or region (border barriers), and actions to eliminate a disease that has become established in a country or region (eradication). When a contagious disease is kept out at the border, initial benefits accrue to producers and consumers of the protected country or region. Keeping a disease out of a region lowers the marginal costs for some producers whose animals would otherwise become infected or who would have to bear higher costs of disease avoidance. Typically, the per-unit cost reductions from border barriers (the direct benefit of the border measure) do not depend on the amount of production in the region protected from the disease. In a competitive industry, the number of other producers that also experience lower marginal costs does not affect the per-unit cost declines for any individual producer. That is, the number of direct "users" of the service does not affect the benefit for any single user. Also, in a typical situation, the cost of border measures does not rise in proportion to the size of the industry protected. The number of farms or animals that benefit does not affect the measures required to exclude a disease from a region, except insofar as both are related to the length of the border to be protected or to the border traffic that must be controlled. Furthermore, with border protection for a region, it is not feasible to exclude individuals within the region from the benefits. All farms within the border are protected.

The public good nature of invasive animal disease border measures depends upon the definition of the geographical region or zone.[3] Natural barriers to the spread of a disease often provide some natural definition of an area over which the non-rivalry in consumption of disease protection services is defined and over which such services can be extended at low marginal cost. Such natural regions also define the group of producers over which it is infeasible to exclude neighbors from protection. Such natural borders or barriers are often not coincident with national or state administrative or political borders.

For example, consider a country with two natural regions North (N) and South (S). Suppose the country maintains effective border measures relative to outside countries and that both regions, N and S, are disease free. The border measures are set along the national boundaries. If there is an animal disease outbreak in region S, then controls at the border between the regions must be reinforced to keep region N free of the disease. This increases the cost of the exclusion system and the principle of non-rivalry is violated. The costs of the exclusion systems may rise not only because border controls between N and S have to be reinforced, but also because movements of animals may need to be monitored more carefully all over the country. If, as a consequence of the different health status between the two regions, the cost of production in S increases relative to the cost of production in N, incentives are created to move animals from S to N. Similar incentives are created if buyers are willing to pay a higher price for products from N, as a result of its remaining disease free. Non-rivalry in use of the national border services applies only when regions are carefully defined and depends on the nature of the industry, the habitat and the disease.

Alternatively, assume a country is contained within a multi-country area that is a natural disease habitat region throughout which animals move and within which it is very costly to restrict the dissemination of the disease. For highly contagious diseases such as foot and mouth, even the best border control may not be enough to stop the spread of the disease. Although a country can impose costly border controls in an effort to keep the disease out, the country is unlikely to succeed and/or will face greatly higher cost if the disease enters another country within the region. Thus, each country would be advised to enter cooperative efforts with the other countries of the region to establish regional rather than country border controls. The potential payoff to regional (international) action is clear.

Next, note that there is no way to exclude non-payers from the consumption of disease control border measures. When a disease is kept out of an appropriately defined natural disease habitat region, the costs of control decrease for all local producers. However, there is no way that the disease could be allowed to infest the non-payers because that decision would itself damage those who paid for the

[3] Parts of the following discussion are drawn from Sumner (2003).

service. By definition, the disease would spread from any infected premise within the region to affect non-payers and payers alike.

The definition of the region is, once again, key. If we define disease control regions as those over which non-rivalry and non-excludability apply, then border measures are, by definition, public goods within those regions. As with non-rivalry, excludability for non-payers is technically possible between sub-regions for which there is some natural barrier. If the disease cannot easily spread across regions, then border services will keep a disease out, conditional on paying the fee.

Finally, it is useful to repeat that political boundaries are not necessarily the natural boundaries for the spread of a disease. For some cases, it is natural to control disease boundaries within a nation. The disease control operations are then not likely to coincide with other border control measures and specific financing arrangement may apply. For other diseases, joint collective action across national boundaries may be more natural. This applies, for example, to controlling certain livestock diseases across certain parts of the border between the United States and Canada.

Consider now the case of disease eradication. Eradication means eliminating a disease from a region once it has entered. Eradication of a disease once it has entered the nation or region is sometimes a "backup" to failed exclusion policies. Eradication is the extreme case of disease control and, when combined with disease exclusion, can result in a disease-free region. Eradication of diseases that spread readily in a habitat region also requires collective action because elimination of a disease from one part of the region is naturally short-lived if the disease will simply move back in quickly and easily.

The same two criteria of non-rivalry and non-excludability may be considered briefly in the context of eradication programs. Eradication of a disease from a region allows commodity producers to forego private costs of disease management, increase productivity per animal, reduce production losses and perhaps achieve higher consumer demand. The same disease and habitat characteristics that imply that border exclusion measures would lower costs for all producers in a natural disease control region also apply to eradication programs. Those farms potentially affected by the disease in that region (as well as consumers of the animal products) share the benefits of eradication services. Additional commodity production in the region increases the benefit of eradication services for expanding producers, but does not diminish the benefit of such services for existing producers. If some farmers in a natural habitat region (or consumers of affected products) refuse to pay for eradication services, there is no feasible way to exclude them from the eradication services.

Altering the example used above to demonstrate this case, assume that a single natural habitat region contains two administrative (not natural habitat) regions, East (E) and West (W), and that animals in both E and in W suffer from a contagious disease. Now suppose that farmers in E wish to eradicate the disease, but farmers in region W are unwilling to pay for eradication services. As both administrative regions are part of the same habitat region, both must participate in the eradication effort for it to be successful in either. Seeking eradication only for E would violate the principles of non-rivalry and non-excludability. With no effective natural barrier between E and W, the non-participating administrative region would be a source of continuing contamination and disease eradication from E would be impossible.

There is an important difference, however, between how the costs of eradication and of border exclusion programs relate to the number of farms and production quantity. Unlike the costs of border measures, the more animals affected, the more costly is eradication. If livestock act as a natural host for a disease, more animals must be eradicated. Of course, other factors also affect eradication costs, including the existence of multiple hosts, some of which may be wild species, the nature of disease control regulations that are required for control, and the features of the infested region, such as whether it includes urban as well as rural areas.

Where eradication costs are linked to variables such as the number of livestock, a per-unit assessment to fund part of the eradication costs would tie the funding of a program to one cost factor and to the benefits. To the extent that per-unit benefits are split between producers and consumers, a sales tax could again tie costs to those who benefit, though administration of a single good sales tax may be impractical.

The discussion above has been framed primarily in terms of an animal disease that raises the cost of production of animal products or services. However, many diseases have the additional impact of affecting the demand for animal products. Demand may decline because the disease affects the perceived quality or safety of the product, as with BSE, or because the presence of the disease triggers border measures from other jurisdictions and thus reduces the size of the market available, as with both BSE and FMD. This reduction in size of market differs from a direct effect on consumers' willingness to pay for several reasons. First, it does not necessarily imply that local consumers value the product less highly, e.g. with FMD, which has no significant human health effect. Second, if the disease results in an embargo in another region or country, total demand for the product will decline and local prices will decline, benefiting local consumers. Third, recuperation of consumer demand often requires more than satisfying local consumers; normally, recovering access to an expanded market requires satisfying a national or a foreign government that is attempting to exclude the disease. The effort to recover such a market may well require an additional call for government action to control an invasive species, e.g., to engage in eradication in the pest-infested region.

The public good characteristics we have been discussing have been defined over direct users of border measures to keep an animal disease out of a region and users of measures to eradicate an animal disease that has already entered. The beneficiaries of such measures are producers of the animals and consumers of the products or services that the animals provide. Thus, the scope of the "public" served is limited to a part of the total population. The more a disease is specific to a single species or agricultural industry, the more it is natural to consider applying the costs of providing border protection and eradication services to producers and consumers in that industry. These services are sometimes termed "industry collective goods" to distinguish them from public goods that apply to a broader spectrum of the population. In the case of industry collective goods, product or animal unit check-off programs or assessments are a natural funding mechanism. A disease that affects wildlife or pets as well as commercial livestock, or that has other widespread benefits, such as military security, are more natural candidates for general public funding.

We now illustrate these ideas with brief discussion of the FMD crisis in South America in 2000 and 2001, before examining the recent BSE cases in North America.

The South American FMD Crisis of 2000-2001

FMD is the most contagious disease among animals with cloven hoofs. The importance of this disease relates to its effects on costs of production and international trade, since it does not affect humans (Ekboir et al., Paarlberg and Lee). Because international beef markets have historically been segmented according to the presence or absence of FMD in the exporting country, the occurrence of the disease produces large economic losses on beef exporting countries. A simulation of the effects of an FMD outbreak in the California Central Valley resulted in an estimate of $13.5 billion in losses, considering direct costs of sacrificing animals, cleaning and disinfecting premises, plus indirect costs associated with trade interruptions (Ekboir, Jarvis and Bervejillo). This estimate assumed that the disease did not spread beyond the valley, did not include the costs of eradicating the disease were it to spread to wildlife, nor the costs of disruptions to tourism and wildlife, let alone the costs to meat processors and distributors or the environmental damages from control measures (burning or burying animals).

FMD has been present in the South American continent for decades. In 1990, there were 955 reported outbreaks south of Panama. Underreporting might be serious especially in remote areas of the continent where subsistence farming predominates. After decades of poor controls, Uruguay, Argentina, Brazil, and Paraguay started massive eradication campaigns at the end of the 1980s, thanks to (a) the availability of a new more effective vaccine , (b) a growing expectation that

eradication would allow greater access to foreign markets and, thus, to higher prices, and (c) development of a new organizational framework for sharing costs between government and private parties. Although there was some coordination among the veterinary services of these countries, each of the eradication campaigns was treated mainly as a domestic policy issue (Bervejillo and Jarvis, forthcoming).

In each country, eradication began with efforts to vaccinate all cattle against FMD. As vaccination continued, whenever isolated FMD outbreaks occurred, all exposed animals were slaughtered. Eventually, vaccination continued and no further outbreaks were reported. The hope, in this situation, was that the disease had been eradicated and that vaccination could then be halted. Uruguay was the first country to achieve disease-free status, with vaccination, and also the first to then suspend vaccination, in 1994[4]. Subsequently, Argentina, the southern region of Brazil, and Paraguay also achieved disease-free status, with vaccination, and between April 1999 and April 2000, each stopped vaccination. At that time, the entire sub-region was considered free of disease, without vaccination. However, the virus was active in parts of Bolivia (nearly 50 reported outbreaks in 1999-2000) and northern Brazil (84 reported outbreaks in 1999-2000). The sanitary controls at the borders (international borders as well as borders between regions of a country) were not effective (Correa Melo, Saraiva and Astudillo). There are no natural barriers separating these five South American countries. Moreover, as in some regions the terrain is difficult, it is costly to police animal movements. Consequently, even the border checkpoints were not always effective in controlling the movement of cattle. These problems soon became apparent.

In July 2000, an FMD outbreak was announced in the northern province of Formosa, Argentina. Argentina had suspended vaccination more than a year before, and the price of cattle in its markets was higher than those in Paraguay. Paraguayan cattle were likely being moved into Argentina thanks to loose border controls, the absence of enforcement on cattle identification regulations, and the persistence of a black market. Once FMD was identified, Argentina applied stamping out to animals on all the affected premises and initiated serological vigilance in the surrounding areas. Nonetheless, the outbreak was never fully controlled and the virus began spreading throughout the region. During the second half of 2000, FMD outbreaks were recorded in the Brazilian state of Rio Grande do Sul, in Paraguay, and in the northern region of Uruguay. In February 2001, Argentina decided to begin vaccinating its entire herd again. Nonetheless, the number of officially recorded outbreaks in Argentina increased dramatically after February 2001. By April, the disease had also crossed the Argentine-Uruguayan border. It reached the south of Brazil a few weeks later. Although all countries had planned to control FMD by stamping out outbreaks as they occurred, the disease

[4] Chile has been FMD free for decades. This country is isolated by the natural frontier of the Andes range.

spread too fast to be controlled. Stamping out was discarded as a plan after the first week. All countries reinitiated vaccination of their entire herd.

The impact of the FMD crisis on beef exports from Argentina and Uruguay was dramatic. Following eradication, Uruguay had gained access to NAFTA and East Asian markets and its exports to these markets increased sharply. After the disease hit the region, Uruguay's beef exports fell by 33% and Argentina's fell in value by 80% (2002). Exports recovered somewhat in 2003 because Canada and the U.S. concluded, after completing risk assessments on both South American countries, that FMD had been controlled through vaccination and that de-boned beef was unlikely to carry FMD.

Exhibit 1: Contagious Diseases Management and International Cooperation

The South American crisis provides several lessons:

- Successful eradication campaigns of highly contagious animal diseases call for a combined private and public effort. Complete eradication requires universal compliance, which can only be secured if private agents perceive benefits (including the absence of sanction) from cooperation.

- Contagious diseases must be treated from a regional perspective. Rather than use administrative borders, the region must be framed by the natural habitat and the likely paths of disease transmission. The lack of a regional plan to control FMD partly explains the dimension of the South American crisis. Had the countries initiated a regional, rather than a national surveillance and control system, the consequences of an outbreak could have been less devastating.

- In the process of eradication, stringent border measures must be maintained for sub-regions. If there is only weak separation between contiguous regions and if the prices received by farmers in the disease-free region are higher than those on the other side, movement of animals will likely follow unless border measures are stringent.

- It benefits a country that has eradicated a disease to contribute to the eradication costs of its neighbors. The cost of a new outbreak likely exceeds the cost of international cooperation to eradicate the disease from the natural habitat. This result is especially likely to be true for exporters. Note that Uruguay exports about 55% of its beef production, Argentina 15% or less, and Paraguay a very small percentage. Thus, by this measure, Uruguay should be relatively more willing to contribute to the costs of regional eradication than either of its neighbors.

The BSE Cases in North America

Finding a case of BSE in Canada in May 2003, and a case in the United States (of Canadian origin) in December 2003, has raised the profile of animal disease issues in North America. The public policy responses to these events are also instructive. As is well known, BSE causes the eventual death of infected animals, but does not seem to be contagious from one infected live animal to another uninfected live animal. BSE is evidently transmitted by animals eating brain cells and nerve tissues that are contained in the bone meal produced by rendering dead animals that were infected.

BSE was newly recognized in the United Kingdom (UK) in 1986 and there have been roughly 180,000 cases reported to date in the UK. The rate at which new cases appeared fell dramatically in the UK once feeding practices were changed to preclude feeding animal tissues (bone meal from rendered carcasses). However, new cases continue to be found in the UK and Europe (Bervejillo and Jarvis). Cases outside of Europe have been found, notably in Japan. The cases in North America are among the most recent new outbreaks. (Mathews, Bernstein, and Buzby, APHIS(a), CFIS) . The most important feature of BSE is the connection to variant Creutzfeldt-Jakob disease (vCJD), which affects human and leads to an early death. Humans eating the affected tissue of infected animals may contract vCJD. There have been approximately 145 cases of vCJD in the UK and a handful in other places, most traceable back to the UK (University of California, IGA, Phillips).

In response to the finding of BSE in Canada, nations worldwide embargoed imports of Canadian beef and live cattle, as they had done to beef from other countries that had previously suffered outbreaks. Since the Canadian cattle industry relies on exports for about half of its demand, the impact on beef prices in Canada was dramatic (Poulin and Boame). Lower prices encouraged significant increases in Canadian beef consumption during the period when export meat markets were closed. By September 2003, the U.S. agreed to accept Canadian boneless beef from animals less than 30 months old. By December 2003, Canadian beef exports had almost recovered, though shipments to Japan, a major market, were still restricted and live cattle exports to the U.S. were still banned (APHIS(b)).[5]

The discovery of BSE in the United States had a similar effect on the demand for US beef. Current evidence shows only a slight or no negative response by U.S. consumers, but the immediate bans on imports of U.S. meat products by many countries sharply reduced foreign demand for U.S. beef. The United States exports about nine percent of its beef production and most of this market closed. The exception is Canada, which takes about 1 percent of U.S. beef production. Canada

[5] With more cattle slaughtered in Canada rather than exported live, Canadian beef production was higher than otherwise and so exports as a share of production had not recovered.

kept the market open for U.S. boneless beef from animals of less than 30 months, live cattle destined for immediate slaughter, and dairy products, semen, embryos and protein-free tallow. (CFIS). US cattle prices fell by about 20 percent in response to the announcement of the BSE finding and remained down by about that magnitude for the first 50 days after the initial report. This result suggests a short-run demand elasticity of about 0.3 (a 7% cut in demand caused a 20 percent price decline during a period when supply was almost completely inelastic.)

Prior to the BSE discovery, the United States had adopted several measures to a) reduce the likelihood that the disease would appear, b) reduce the probability that it would spread widely within the cattle herd if it did appear, and c) ensure that the disease would not enter the human food chain. The US had imposed a ban on most beef products from the UK and Europe (and then Canada) and had heightened the surveillance of the cattle herd and, particularly, of slaughtered animals. The United States also had prohibited feeding meat and bone meals derived from mammals to ruminants. The international trade restrictions following BSE findings have been issues at the WTO, but many import restrictions have remained (Roberts and Unnevehr).

The response of the U.S government following the discovery of BSE in the U.S. was swift and vigorous (USDA, FSIS and Cattle fax). New measures included a) the recall of meat that may have included that of the infected animal, b) efforts to trace the infected animal, a mature dairy cow, and c) once traced to a herd in Canada, efforts to locate other animals from the same herd. Longer-term measures included instituting additional BSE testing, banning the use of beef from animals unable to walk into the slaughter facility from use as human food, prohibiting the use of additional types of cattle tissues from being used for food, and requiring altered slaughter procedures to reduce the risk of beef contamination with brain and other nerve tissue. In addition, vigorous negotiations were initiated with Japan, Korea and other beef importers to demonstrate the safety of US beef and encourage them to renew U.S. beef imports.

For economists, one point lacking in the public information provided by the government regarding these early responses was an explicit discussion of their costs and benefits. Of course, when immediate threats exist, normal requirements for cost benefit analysis prior to the implementation of new regulations are suspended. Nonetheless there was little public analysis of whether these responses were cost effective. Although the discussion in this paper can be only preliminary and is sure to be controversial, several considerations are important.

The simplest issue to deal with is costs. Each of the new measures imposed costs on farmers and meat processing firms. An assessment of those costs is required. We believe that the total cost of the new regulations is very high and the number of

lives saved will be very low. Accordingly, the cost per life saved will also be very high.

There are three demand-side issues that must be considered along with the costs. First, and most important, how much did the new rules and regulations improve human health and safety? With BSE, this really involves asking how many cases of BSE may be prevented or, more importantly, how many cases of vCJD will be avoided. Data on the expected values of lives saved can then be used to compare the benefits achieved per dollar of costs and these ratios may be compared to alternative policies and other regulations. It is well known that the cost per life saved via the implementation of past government regulations in the United States ranges from about $100,000 to hundreds of billions of dollars (Viscusi, Vernon and Harrington, p. 676). In general, it appears that a sensible expected price (cost) for saving a live through a regulatory change is in the lower part of that rate, probably not more than $500,000-$1,000,000. Given that, in the UK, there was roughly one case of vCJD per 1,000 cases of BSE, the probability is very low that a significant number of deaths in the United States would result from a quite limited outbreak of BSE. If the expected benefits (lives saved) are indeed low, then the implicit cost per life saved from the newly imposed BSE regulations must be very high. For example, if the new regulations caused an increase in the price of US beef produced by just one cent per pound (live weight), the cost of the measures would be more than $300 million per year.[6] Current evidence taken from the UK experience suggests that the expected number of BSE related deaths are very small, if not nil, implying that these regulations must impose a very high cost per expected life saved (relative to other health and safety regulations in the United States).

The second demand consideration is the degree to which regulatory measures help create or maintain consumer confidence that beef is safe, even if the regulations have a relatively small real effect on human health or safety. Some measures may be useful as public relations or promotion of demand. If so, mandatory collective action may be justified, as opposed to a solely voluntary industry response. When information is costly, mandatory measures may help an industry gain consumer acceptance. If that is a role of regulations, such regulation might naturally be introduced or maintained through a marketing order framework developed by the industry and funded with assessments. Consumers would bear some of the incidence of the costs of such regulations. Of course, it remains important to ask how much such regulations actually contribute to demand. In the case of the recent U.S. BSE discovery, demand was maintained after the outbreak and consumer confidence has remained high. That may be because of the regulatory response or it may be that consumers made risk assessments based on available information and

[6] About 36 million head are slaughtered with an average weight of more than one thousand pounds. So, using the figure on one cent per pound is just over $10 per head and close to $400 million per year in total.

Exhibit 2: The Regulatory Economics of Animal Diseases

The finding of BSE in the United States raised a host of important considerations and demanded response from the government. It also raises issues for regulatory economics.

- In an era of opening agricultural markets, it is important to stress the need for a strong support system to allow for imports when human health is assured within the limits of risk assessments and where the rationale for trade restrictions is based on sound documentation. This system should provide appropriate balance between openness and protection.

- Trade embargoes that result from following current WTO rules may lead to a situation where the costs incurred by the country trying to accommodate the consequences of the embargo are well beyond the social optimum. Satisfying foreign government demands may not add anything of substance to the safety of the local population.

- When, in response to a trade embargoes and/or the existence of a temporary invigorated public concern, regulations impose a virtually unbounded value of human life saved, society expends resources unwisely, thereby reducing its ability to respond appropriately to other animal diseases that are less visible and less trade distorting.

decided that vCJD risks remained very small even after the discovery and with no new regulations or government actions.

A final demand side issue concerns satisfying foreign governments rather than consumers. For the United States beef industry, Korea and Japan are two major markets. These countries are also well known for their agricultural protection and for their use of technical trade barriers. Satisfying the governments of Korea and Japan is expected to be a long and difficult process that may require even more stringent regulations in the United States. Given the nature of the beef trade, most of the regulations that have been imposed in response to the demands of the foreign governments would likely be applied to all production, not just that which is destined for export to those markets. The costs of those regulations, imposed indirectly by the foreign governments, would therefore be born not only by the consumers in Japan and Korea -- and by U.S. producers, but by US consumers as well. Thus, requirements to meet regulatory demand for about 4 percent of the market for U.S. beef would be imposed on the other 96 percent of the market. Furthermore, U.S. consumers would also face higher prices from opening the export market. Opening a foreign market is not necessarily of benefit to the U.S. economy

when doing so requires costs that are born by domestic consumers as well.[7] Careful benefit and cost calculation are required before such regulations would be adopted. (See Buzby (editor) for further discussion of these issues.).

Policy Conclusions

Border measures and eradication services for many animal diseases have public goods characteristics that call for collective action. However, even if it is known that the exclusion and/or eradication of an animal disease has public good characteristics, such general knowledge is insufficient to indicate how policies appropriate to that disease should be designed and implemented. Further, such general knowledge does not indicate whether any particular program is cost effective.

Consider a simple border inspection program that is known to exclude an exotic disease and thereby lower costs of production in a region that produces a large share of the supply of some farm commodity. Under these conditions, the inspection program increases returns to land and management on farms in that region, and reduces the consumer price. In that way, both consumers and producers gain from the program. If the sum of producer and consumer gains is larger than the cost of operating the program, there is a net welfare gain from the efforts to exclude the disease.

Often, however, disease exclusion programs are more complex. Consider, alternatively, a program that successfully excludes a disease by banning imports from a competitive region that is infested with the disease. In this case, producers (or other resource owners) in the protected region gain for two reasons: they experience lower costs by avoiding the disease and they experience less competition from the embargoed region. In this case, the consumer price may be higher and, if so, producers have gained, but consumers have lost. If imports from the embargoed region would be large without the disease exclusion program and the cost savings are modest, the overall societal welfare from successful disease exclusion almost surely falls. The reason is clear. A successful disease exclusion program that restricts international trade, reduces gains from trade, and the loss may be large relative to the savings from excluding the disease. A program that is biologically successful and compatible with international SPS rules may still harm the economy when consumer and producer interests are both important (James and Anderson, Sumner).

[7] It could be feasible to charge the added regulatory costs to those export markets that demand the added regulation, say, Japan and Korea. If a specific fee was applied to 4 percent of the slaughter, one cent per pound added cost would imply a fee of 25 cents per pound.

Now consider an invasive disease that has newly infested an area. Choosing whether to eradicate the disease again implies balancing costs and benefits of producers, consumers, taxpayers and, perhaps, other interests such as environmental quality or wildlife values. The simplest cost to consider is the direct budget cost of agencies undertaking eradication. These costs may be borne by general taxpayers or by industry consumers and producers if a levy program is introduced. Often, eradication is achieved by limiting production of host crops or livestock in a region. This imposes costs in terms of lost profits that are borne by producers or by taxpayers if compensation is offered. Of course, higher prices offset some producer losses and are a pure gain to producers who do not have eradication costs, but who gain from the higher consumer prices. Assessing these impacts requires careful modeling and data from a variety of sources. Data requirements include biological and agronomic information about the diseases, the habitats, and the potential methods of eradication (See Sumner (editor) for analysis applied to real agricultural cases).

The basic criteria of public goods: non-rivalry and non-excludability, apply directly to animal disease border measures and eradication services, with three provisos. First, regions over which the criteria apply are defined not by political boundaries, but rather by characteristics of natural disease habitat and spread. This definition may lead to international cooperation in some cases. Second, costs of eradication are likely to rise with increased animal production. Third, for some highly contagious diseases, the public good characteristics may not apply to the general population as long as no natural barrier exists within the national territory. Fuller recognition of the nature of some of the public good characteristics of exotic diseases services may allow better response to the concern over funding, even within governmental agencies. The design of better public policy may also lead to enhanced industry participation in operating and funding programs. Public policy should in this case assess disease control and eradication on grounds of biology, national economic interests, and international cooperation. Even these specific regulations and programs must be evaluated on the basis of basic cost benefit principles.

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