Special Report 03-4 January 2004

The Effects of the BSE Outbreak in the United States on the Beef and Cattle Industry

Hyun J. Jin
Anatoliy Skripnitchenko
Won W. Koo

Center for Agricultural Policy and Trade Studies
Department of Agribusiness and Applied Economics
North Dakota State University
Fargo, ND 58105-5636

NOTICE:

Information on other titles in this series may be obtained from: Department of Agribusiness and Applied Economics, North Dakota State University, P.O. Box 5636, Fargo, ND 58105. Telephone: 701-231-7441, Fax: 701-231-7400, or e-mail: cjensen@ndsuext.nodak.edu.

TABLE OF CONTENTS

HIGHLIGHTS

On December 23, 2003, Bovine Spongiform Encephalopathy (BSE), widely known as "mad cow disease," was found in the state of Washington. Major beef importing countries, including Japan, South Korea, and Mexico, banned imports of beef and beef products produced in the United States. A single case of BSE occurred on May 20, 2003, in Canada, prompting the United States to close its border to Canadian beef products. Prior to these BSE outbreaks in North America, the disease was detected in the United Kingdom and Japan.

U.S. consumer response to the BSE outbreak in Washington is unknown. However, the previous cases which occurred in the United Kingdom and Japan indicate that the BSE outbreaks reduced domestic consumption of beef produced in the countries and increased beef imports from BSE-free countries, suggesting that consumers in the United States may respond negatively to the BSE outbreak and reduce their consumption of beef.

Based on consumer response to BSE outbreaks in the United Kingdom and Japan, the BSE outbreak in Washington could reduce domestic consumption by 10% and exports by 75%, which could decrease the price of beef about 15%, from 370cents/lb in the third quarter of 2003 to 313.7cents/lb. However, prices of pork and chicken would increase about 3%, as consumers in this country switch from beef to pork and chicken consumption.

The decreased consumption and export of beef will affect prices of slaughter and feeder cattle accordingly. The price of slaughter cattle would decrease about 13.5%, and the price of feeder cattle would decrease about 16% in the United States.

If there are additional BSE outbreaks in the United States, the impacts will be much more significant. Domestic consumption of beef could decrease more than 20%, and U.S. exports would shutdown completely. In this case, the domestic price of beef could decrease 26%. Prices of slaughter and feeder cattle would decrease accordingly, about 20.9% and 24.5%, respectively, which could destroy the U.S. beef and cattle industry.

To isolate a future BSE outbreak in the region, it is important to improve traceability of the infected animals by introducing both country of origin and regional labeling and preserve it through the supply chain. If the labeling system is developed for the United States, and if U.S. processors could segregate cattle based on its origin by labeling, the impacts of BSE outbreaks on the U.S. beef/cattle industry could be less prominent. Labeling would allow U.S. and foreign consumers to distinguish beef coming from BSE-free regions in the United States.

The Effects of BSE Outbreaks in the United States on the Beef and Cattle Industry

Hyun J. Jin, Anatoliy Skripnitchenko, and Won W. Koo*

INTRODUCTION

On December 23, 2003, a case of Bovine Spongiform Encephalopathy (BSE), widely known as "mad cow disease," was found in the state of Washington. Major beef importing countries, including Japan, South Korea, and Mexico, temporarily banned imports of beef and beef products produced in the United States. U.S. consumer response to the BSE outbreak in Washington is unknown. However, previous cases which occurred in the United Kingdom and Japan indicate that the BSE outbreaks substantially reduced domestic consumption of beef produced in the countries and increased beef imports from BSE-free countries, suggesting that U.S. domestic consumption of beef may decline in response to the BSE outbreak.

A single case of BSE occurred in Canada on May 20, 2003, prompting the United States to close its border to Canadian beef products. The import ban resulting from the single BSE case, in combination with a decreased domestic cattle supply, caused record highs in the U.S. prices of beef and live cattle in the latter part of 2003.

The average retail prices of beef are much higher than the prices for the last fourteen years from 1989 to 2002 (Figure 1). The average beef prices during those years are 288.4, 293.2, and 298.9 cents per pound, respectively, for the first, second, and third quarter; whereas those in 2003 are 347.9, 363.9, and 370.0 cents per pound.

Two factors receive attention as main determinants for the increased beef prices: 1) decreased supply of cattle in the United States and 2) the U.S. government's ban on Canadian beef and cattle after the BSE outbreak in Canada last May.[1] According to ERS/USDA, poor weather conditions in late 2002 through early 2003 resulted in reduced feedlot gains and tight supplies of higher quality beef. In addition, the import ban on Canadian beef resulted in a reduced supply of beef in the United States. The Unites States imports about 10% of its domestic supply of beef from foreign countries, mainly Canada. Average U.S. import for the 1999-2001 period was 3.0 billion pounds annually (Table 1).

---

* Won W. Koo is Professor and Director, and Hyun J. Jin and Anatoliy Skripnitchenko are Research Assistant Professors, in the Center for Agricultural Policy and Trade Studies, North Dakota State University, Fargo.

[1] See, e.g., *Livestock, Dairy, and Poultry Outlook* published by Economic Research Service (ERS) of USDA.

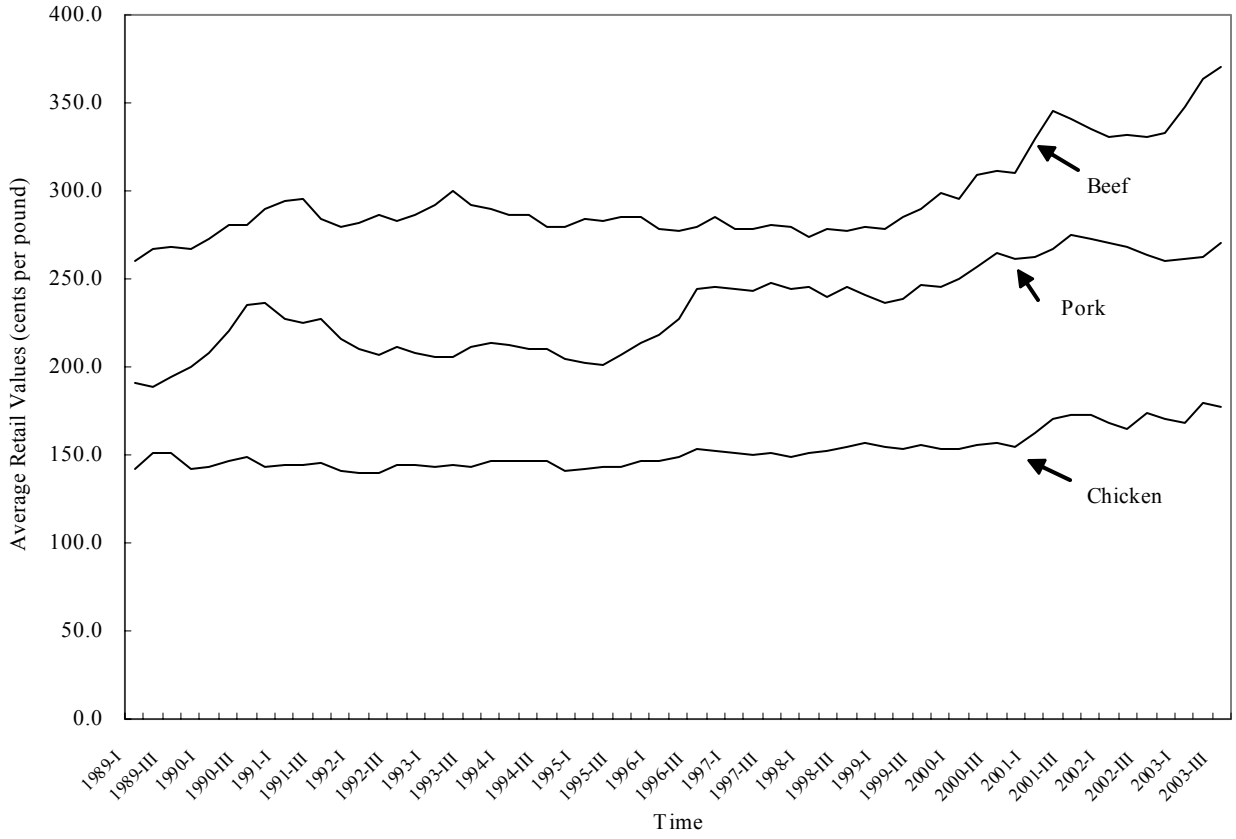

Figure 1. Average Meat Retail Values

Table 1. Beef Supply, Utilization, and Trade

	2001	2000	1999	Average
	----------million pounds----------			
Production	21,212	26,888	26,493	24,864
Beginning Stocks	525	411	393	443
Imports	3,161	3,031	2,873	3,022
Total Supply	29,898	30,330	29,759	29,996
Exports	2,271	2,468	2,412	2,384
Total Consumption	27,022	27,337	26,936	27,098

The United States also exported 2.4 billion pounds, or 8% of total domestic supply, annually for the 1999-2001 period. U.S. production of beef was 24.9 billion pounds annually for the same period.

This study reviews BSE outbreaks and consumers' responses in Europe, Japan, and Canada and investigates potential impacts of the BSE outbreak that occurred in the state of Washington on the U.S. beef and cattle industry. The study focuses on the impacts of the BSE case on the domestic price of beef and also the prices of slaughter and feeder cattle.

The remainder of the paper is organized as follows. A brief review of BSE outbreak history is presented in the second section. The third section reviews previous studies on BSE outbreaks. The fourth section presents the possible scenarios, and the fifth section reports results from the simulations. A summary and conclusion follow in the last section.

BSE OUTBREAKS IN EUROPE, JAPAN, AND CANADA

BSE is a lethal, central nervous system disease, which specifically targets cattle. The disease is characterized by the appearance of vacuoles, or clear holes in neurons in the brains of affected cattle, that give the brain the appearance of a sponge or spongiform. BSE-affected animals may display changes in temperament, such as nervousness or aggression; abnormal posture; incoordination and difficulty in rising; decreased milk production; or loss of body condition despite continued appetite. There is no treatment, and infected cattle die. The incubation period ranges from 2 to 8 years. Following the onset of clinical signs, the animal's condition deteriorates until it dies or is destroyed. This usually takes from 2 weeks to 6 months. Most cases in the United Kingdom have occurred in dairy cows between 3 and 6 years of age.

The primary means of transmission of BSE to cattle is by eating feed contaminated with rendered material from BSE-infected cattle. There is also a possibility that in rare cases, mother to offspring transmission may occur, but this is unconfirmed. There is no evidence that BSE is transmitted directly from animal to animal.

BSE in cattle was initially recognized in the United Kingdom in 1986. The occurrence of BSE in cattle reached epidemic proportions in Europe by 1992, with more than 1,000 reported cases. Within the thirteen-year period, from 1987 to 2000, the total number of infected cattle increased to 180,000 in the United Kingdom, Ireland, Portugal, France, and Switzerland.[2] Consumers' alert to the danger was further augmented by the U.K. government's announcement, on March 20, 1996, that there is a possible link between consumption of BSE-infected meat and the development of Creutzfeldt-Jacob disease (vCJD). Approximately 135 people worldwide have been infected with vCJD. It is believed that they became infected by eating products from BSE-infected animals.

[2] Refer, e.g., *the Official BSE Homepage*, http://www.defra.gov.uk/animalh/bse/, U.K. Department for Environment, Food, & Rural Affairs, London, the United Kingdom.

The pronouncement of the finding generated considerable media attention and resulted in an immediate and significant decline in beef consumption in Europe. Consumers' concerns over the disease have grown around the world. Authorities in European countries have banned suspect animal feed and launched offensives against fears of BSE-infected meat. But it has been difficult to assuage consumer panic. Beef sales in Europe plummeted after the news. Some governments outside Europe have banned importing beef from European countries.

After the 1996 announcement by the U.K. government, beef consumption in Japan began to decline. The news released by the U.K. government may not have had a big impact on Japanese consumers because beef consumption in Japan comes mostly from domestic production and imports from BSE-free countries, such as the United States and Australia.[3] Without observing an outbreak in their own supply, consumers may not change their consumption patterns significantly (Caswell and Mojduszka, 1996). Moreover, Japan imported a negligible portion of beef from European countries. Therefore, Japanese consumers' responses to the U.K. government's announcement concerning vCJD may have been gradual rather than pronounced.

Amid signs of the spreading of BSE and vCJD across Europe, the Japanese government has tried to prevent the diseases from entering its borders. The government banned EU beef, food made from processed beef, and bull sperm that is used for breeding, and they restricted blood donations from people who have lived in Britain. However, on September 10, 2001, the Japanese government reported the first case of BSE within the country. The cow believed to carry the disease was a five-year-old Holstein and was located in Chiba Prefecture, which borders Tokyo on the east. The case was the first outside of Europe as well as the first in Asia. The Japanese beef industry reeled under the combined reaction in its domestic and export markets. South Korea and Singapore announced that they would stop imports of Japanese beef. China, Malaysia, and the Philippines joined the growing list of countries banning Japanese beef.

Strict European standards were adopted by the Japanese government and one million cattle were tested in an effort to fight the spread of the disease. At the same time, officials scrambled to reassure Japanese consumers and to persuade other countries to drop bans imposed on its meat after the announcement. Despite these measures, worries over food safety have taken a toll on the country's meat industry. Many wholesalers and retailers have suffered drops in sales ranging from 5-50% due to the concern over BSE. Consumption of beef in Japan has fallen sharply, and beef prices have dropped significantly.[4] During the period from 1998 through 2001, about 66%

---

[3] Australia has never reported any BSE outbreak in the country. For more information about the claim of BSE-free countries, see, for example, 1) BSE documents, *Geographical Risk of Bovine Spongiform Encephalopathy Rating*, Department of Agriculture Fisheries & Forestry-Australia. The original report was made by Food Safety Division of European Commission. Refer the web-site, http://europa.eu.int/comm/food/index_en.html, 2) *Ag Journal, Country Roads Network*, February 7, 2002: BSE in Japan Affect U.S. Producers, http://www.agjournalonline.com/, and 3) U.S. Department of Agriculture, Food Safety and Inspection Service, November 30, 2001, *News Release: BSE Analysis by Harvard Center for Risk Analysis*, Release N. 024101, Washington D.C.

[4] See, for example, 1) *Japan Times* from September through October 2001, http://www.japantimes.co.jp, 2) *Hankyoreh News* in South Korea from September through December 2001, http://www.hani.co.kr, 3) *CNN news*, September 10, 2001: Japan Reports First Case of Mad Cow, http://www.cnn.com, 4) Jin and Koo (2003).

of beef sold in Japan was imported, and most imports came from the United States and Australia where BSE had not been found. According to the *International Agricultural Trade Report* (February 2002) by the Foreign Agricultural Service (FAS) of the USDA, nearly 60% of Japanese consumers have stopped eating beef since the first case of BSE. This may be partly due to a Japanese meat company blaming imported beef as the source of the infected meat, which might further shake consumer confidence.

The damage was compounded by the discovery of a second infected cow two months later. In November 2001, Japanese authorities found a second cow suspected of having BSE in Hokkaido. The second finding aggravated the situation and brought bigger shocks to the public. Third and fourth suspected cases were reported during the next month, and the recurrent cases of BSE continued to fuel consumer concern and ravaged Japan's beef industry.

Canada confirmed that a single cow tested positive for BSE in May 2003.[5] The cow came from a commercial farm in northern Alberta, Canada. Canadians eat only half the beef produced in the country, with much of the rest shipped to the United States, which banned imports of Canadian cattle and butchered meat after the case of BSE was found in Canada. Major slaughterhouses have geared down their operation, leaving cattle stock in feedlots. The single case of BSE and the U.S. ban have already caused a sharp decline in prices of cattle for slaughter.

The United States imported 1.7 million heads of live cattle from Canada in 2002, most for the purpose of slaughter. The United States is the primary destination for Canadian beef exports. Of the 1.2 million metric tons of beef exported by Canada in 2002, 83% was destined for U.S. markets. During 1999 to 2002, the United States imported more than 180 thousand tons of cattle feeders per year from Canada. Since both Canada and the United States established regulations prohibiting feeding of most mammalian proteins to ruminants in 1997, this feed should not have contained ruminant material.

Just after the BSE outbreak in Canada, the U.S. government banned imports of Canadian beef to minimize risks to the U.S. beef industry. The United States has placed Canada under its BSE restriction guidelines and does not accept any ruminants or ruminant products from Canada pending further investigation. On May 20, 2003, APHIS instituted emergency measures to minimize BSE risk to U.S. livestock, livestock producers, and other industries by suspending imports of ruminant animal products from Canada.[6]

---

[5] The BSE test was done as a part of Canada's active, targeted, on-going surveillance program, which is similar to the USDA's on-going targeted surveillance program that tested 19,990 cattle in 2002.

[6] For more specific information, visit the APHIS website at http://www.aphis.usda.gov.

A BRIEF REVIEW OF LITERATURE ON BSE AND CONSUMERS' RESPONSES

BSE has mainly occurred in European countries and, therefore, studies of the BSE outbreak and consumers' responses have focused on the cases in Europe. Studies have approached the BSE case from three different directions. The first group investigates consumers' responses using a contingent valuation method. The second group analyzes structural changes in consumers' preferences or producers' profits. The third group investigates economic consequences of the outbreaks.

A study among the first group is an examination by Latouche, Rainelli, and Vermersch (1998). They conducted a survey using a contingent valuation method to analyze consumer behavior in the area of Rennes after the BSE crisis. Their survey revealed that consumers are waiting for greater transparency and that they would accept paying for it.

In regard to the issue of consumers' preferences after the BSE outbreak, Mangen and Burrell (2001) investigated a structural change in Dutch consumers' preferences for meat and fish, following the U.K. government's announcement. They used a switching AIDS model and a sample period that covers January 1994 through May 1998. The hypothesis of constancy of the parameters of the AIDS model for meat and fish was rejected against a more general time-varying parameter model. The combined effects of the underlying trends and the irreversible components of the BSE effect were against beef, minced meat, and meat products, and in favor of pork, prepared meat, poultry and fish. Using a nonparametric approach, Jin and Koo (2003) showed that there is an ongoing structural change in Japanese consumers' preferences for meat; the consumers' tastes for meat have systematically moved away from beef to its substitutes. Peterson and Chen (2003) found that the Japanese meat system made a transition to a new state within five months of the BSE discovery.

As for the third group, Ashworth and Mainland (1995) reviewed economic consequences of the BSE outbreak for the British meat industry. Adda (2002) investigated the effects of past consumption of risky goods on current consumption patterns, using the "mad cow" crisis as a natural experiment. He found that new health information interacts with prior exposure to risks. Consumers with intermediate levels of past consumption decreased their demand for beef and sought higher quality products, while low- and high-stock consumers did not alter their behavior after the crisis. Verbeke and Ward (2001) investigated fresh meat consumption in Belgium during the period from 1995 through 1998 using an AIDS model. In specifying the demand system, they incorporated a media index mainly pertaining to BSE; their results showed that television publicity has a negative impact on beef expenditure, in favor of pork. Burton and Young (1996) investigated the impact of BSE on the demand for beef and other meats in the United Kingdom. Indices of media coverage of BSE are incorporated in a dynamic AIDS model of meat demand. The publicity which BSE has received is found to have had significant effects on the allocation of consumer expenditure among the meats. A short-run impact has been identified which accounts in large part for the discernible drop in the market share of beef in the early 1990s. There also appears to be a significant long-run impact of BSE, which by the end of 2003 has reduced the beef market share by 4.5%.

SCENARIOS FOR POSSIBLE OUTCOMES RELATED TO THE U.S. CASE OF BSE

Since U.S. consumer response to the BSE outbreak is unknown, several scenarios regarding decreases in domestic consumption and exports are developed on the basis of the U.K. and Japanese experiences when cases of BSE occurred in their countries. Scenarios include 5%, 10%, 15%, and 20% decreases in domestic consumption. A single, isolated case may reduce domestic consumption by 5-10%. However, additional occurrences of BSE may cause much more severe reductions in the domestic consumption of beef.

Export scenarios include 50%, 75%, and 100% decreases in U.S. exports, depending upon importers' responses to the BSE outbreaks. The major importing countries, Japan, South Korea, and Mexico, have banned imports of U.S. beef and cattle. If the BSE is a single, isolated case, the import ban could be only temporary. However, if additional BSE outbreaks were to occur, import bans would be more widespread and could last for a much longer period. Previous studies indicate that Japan and the United Kingdom experienced a structural change in consumers' preferences for meat after a BSE outbreak in the countries. This implies that the effects of a BSE or vCJD outbreak will create long-term effects as well as short-term upheaval. The EU ban on U.K. beef ended in 1998, but the country's cattle industry has never recovered. This may be because once the beef industry has been damaged, recovering to the previous state takes considerable time and costs. If BSE becomes widespread in the United States, consumers' willingness to buy U.S. beef will dramatically decline and its impacts on the U.S. beef industry could be significant.

SIMULATION AND ECONOMIC IMPLICATIONS

The simulation is focused on the possible effects of the BSE outbreak on the domestic price of beef and the prices of slaughter and feeder cattle in the United States. The data of per capita consumption of beef, pork, and chicken were obtained from the *Livestock, Dairy, and Poultry Outlook*, ERS/USDA. The unit of consumption data is pound and the disappearance is boneless equivalent. The beef price is the average retail choice price, and the pork and chicken prices are the average retail prices. Price data prior to January 2001 are monthly observation from *Food Marketing and Price Spreads: Farm-to-Retail Price Spreads for Individual Food Items* released by ERS/USDA. Price data after January 2001 are monthly observations from A*verage Monthly Retail Prices for Beef, Pork, Poultry, Lamb, and Veal Based on Supermarket Scanner Data* released by ERS/USDA.[7] The monthly observations were converted to quarterly frequency by calculating the average of three months. The unit of price is cents per pound. The data for beef production and meat trade were retrieved from the *Livestock, Dairy, and Poultry Outlook*, ERS/USDA. The unit of the data is million pounds.

The data for cattle prices were obtained from the *Livestock, Dairy, and Poultry Outlook*, ERS/USDA. The data for commercial cattle slaughter, annual calf crop, and beef replacement heifers were obtained from cattle industry data managed by Cattle-Fax, and the unit is one

[7] The values in *food marketing and price spreads: farm-to-retail price spreads for individual food items* were also based on the supermarket scanner data. Therefore, the two different sets of price data are consistent with respect to source.

thousand head. Consumer price index and prime interest rate were retrieved from the federal reserve bank at St. Louis. Price of corn #2 yellow were obtained from the livestock marketing information center, ERS/USDA, and the unit is dollar per bushel. Fed cattle marketings from feedlots greater than 32 thousand head as a percentage of total fed cattle were used as a proxy for technology in cattle finishing, and data were obtained from ERS/USDA.

Effects on the Price of Beef

The purpose of this simulation is to examine the effect of a decreased amount of consumption on domestic retail prices of meat, due to the BSE outbreak in the United States. We assumed that U.S. consumers will exercise more caution when purchasing beef at grocery stores as a result of the outbreak of BSE. We used two different base prices: values at the third quarter of 2003 and 2002 average. Ranges of negative shocks to domestic beef demand and offshore demand for U.S. beef were set up based on consumers' responses and beef exports of European countries and Japan after they experienced the BSE outbreak: 5% to 20% decreases in domestic demand and 50% to 100% decreases in offshore demand.

According to the report[8] *Livestock and Poultry – World Markets and Trade,* released by the FAS/USDA, beef consumption in the EU countries fell by about 7% and remained stagnant in 1997. Consumption in France and Italy was down 5% over this period and was lower in Germany and the United Kingdom, down 7% and 8%, respectively. Substitution with other meats was evident almost immediately following the crisis, as U.K. and French consumers began purchasing more lamb. EU consumers turned to poultry and, to a lesser extent, pork. Some U.K. consumers switched from domestic beef to U.S. beef. According to the report, EU beef exports dropped significantly in 1996 but rebounded in 1997, partly due to export subsidies.

The report also indicates that while food safety is a factor in the minds of EU consumers, price is also important in deciding whether or not to purchase beef. In other words, if the price of beef is attractive enough to consumers, they may buy it despite any lingering concerns over BSE. Reduced price of beef is a natural consequence due to decreased demand. Based on the responses by EU consumers, a lowered price will stimulate lament demand for beef. Therefore, although beef consumption decreases due to a structural change in consumers' preference from beef to its substitutes, it could be somewhat offset by increased consumption because of lowered price. Realized reduction in beef consumption and exports would be somewhere in the range, depending on the number of the outbreak occurrences, price reduction, and U.S. government subsidy to beef exports.

In the simulation, we used the flexibilities obtained from the study by Eales and Unnevehr (1991) and assumed that U.S. domestic cattle supply is given in the short-run. The effects of beef export reduction were analyzed assuming that export reduction will impact the U.S. domestic meat market in the same way as it affects the total disappearance of beef.[9]

---

[8] The report analyzes the continuing effect of BSE on beef market, trade, and policy, and it was released in March 1998.

[9] The percentage of total beef export on the total disappearance of beef is 10.5 and 9.8%, respectively, at 2002 and the third quarter of 2003.

The results of the simulation are presented in Table 2. The first column shows the scenarios of reduction of domestic beef consumption due to the BSE outbreak, and the second column presents the scenarios of reduction of offshore U.S. beef demand. The next six columns detail the changes in meat prices pertaining to each scenario. We chose two sets of base prices: values at the third quarter of 2003 and 2002 annual average. The results show that larger demand reductions result in bigger changes of meat prices. Beef prices decrease, but pork and chicken prices increase, indicating that consumers will switch some portion of meat consumption from beef to its substitutes. For example, if domestic consumption of beef decreases by 10% and U.S. exports of beef decrease by 75% due to the isolated case of BSE, the price of beef would decrease about 15%, from 370 cents/lb. to 313 cents/lb., while prices of pork and chicken would increase about 3%. Alternatively, if domestic consumption of beef decreased by 20% and exports by 100%, the price of beef would decrease about 26%, while the prices of pork and chicken would increase about 5%. The switch in consumers' purchasing pattern is a natural consequence, as indicated by most empirical studies. The effects of the reduction of domestic beef consumption are larger than those of offshore demand reduction. This result was expected since beef exports are, on average, 10% of total beef disappearance.

Table 2. The Effects of Decreased Beef Demand on Meat Prices, Due to a BSE Outbreak

Scenarios		Base Price: 2003 Third Quarter			Base Price: 2002 Average		
Demand Decrease	Exports Decrease	Beef	Pork	Chicken	Beef	Pork	Chicken
		Base Prices (cents/lb.)			*Base Prices (cents/lb.)*		
		370.0	269.9	177.7	331.5	265.7	169.7
5%	50%	337.8	274.2	180.6	301.0	270.2	172.6
	75%	329.6	275.3	181.4	292.8	271.4	173.4
	100%	321.4	276.4	182.1	284.5	272.6	174.2
10%	50%	321.9	276.3	182.1	287.0	272.3	174.0
	75%	313.7	277.4	182.8	278.7	273.5	174.8
	100%	305.5	278.5	183.6	270.5	274.7	175.6
15%	50%	306.0	278.4	183.5	272.9	274.3	175.4
	75%	297.8	279.5	184.3	264.7	275.5	176.2
	100%	289.6	280.6	185.0	256.4	276.7	177.0
20%	50%	290.1	280.5	185.0	258.9	276.4	176.7
	75%	281.9	281.6	185.7	250.6	277.6	177.5
	100%	273.8	282.7	186.5	242.4	278.8	178.3

Note: The unit is *cents* per pound.

Effects on Slaughter and Feeder Cattle Prices

The simulation examines the effect of the decreased amount of domestic beef consumption on the domestic cattle market, due to the BSE outbreak. The scenarios, consisting of reductions in domestic consumption and offshore demand, and all basic assumptions are the same as in the first scenario. Elasticities and flexibilities in the markets for slaughter cattle and feeder cattle were obtained from the study by Marsh (2003). He estimated a model for U.S. domestic

slaughter and feeder cattle to determine the effects of declining U.S. retail beef demand on farm-level beef prices and production.

The results of the simulation are displayed in Table 3. The results show that decreased demand for beef reduces prices of slaughter and feeder cattle. Supply of slaughter cattle increases slightly and supply of feeder cattle is constant. Constant supply of feeder cattle is expected since response of feeder cattle supply to own-price changes includes a two-year lag in Marsh's model. Therefore, in the short-run analysis, supply of feeder cattle is constant. An increased supply of slaughter cattle is rather puzzling, but the model indicates that supply of slaughter cattle is more sensitive to input prices than to output prices. Thus, albeit slaughter cattle (output) and feeder cattle (a main input) prices decrease together, the supply of slaughter cattle is affected more by price reduction of feeder cattle. That is, the negative impact of price reduction of slaughter cattle is more than offset by the positive impact of price reduction of feeder cattle.

If domestic consumption of beef decreases by 10% and U.S. exports by 75% due to the BSE outbreak, the prices of slaughter and feeder cattle would decrease by 13.5% and 16%, respectively. If domestic consumption decreases by 20% with a decrease in U.S. exports by 100%, domestic prices of slaughter and feeder cattle would decrease by 20.9% and 24.5%, respectively, which would destroy the U.S. cattle industry. In addition, its impacts on related industries, such as fast food restaurants (e.g., MacDonald's, Burger King, etc.) and the feed grain industry, could be significant.

Table 3. The Effects of Decreased Beef Demand on Farm-level Prices and Supply, Due to a BSE Outbreak

Scenarios		Price of Slaughter Cattle	Quantity of Slaughter Cattle	Price of Feeder Cattle	Quantity of Feeder Cattle	Producer Surplus
Demand Decrease	Exports Decrease			*Base Prices*		
		67.14	35.8	80.07	32.7	22,974
5%	50%	61.63	36.6	72.25	32.7	21,562
	75%	59.99	36.9	69.96	32.7	21,137
	100%	58.34	37.1	67.66	32.7	20,706
10%	50%	59.64	36.9	69.46	32.7	21,045
	75%	58.05	37.2	67.26	32.7	20,630
	100%	56.46	37.4	65.05	32.7	20,210
15%	50%	57.79	37.2	66.89	32.7	20,561
	75%	56.26	37.5	64.77	32.7	20,156
	100%	54.71	37.7	62.65	32.7	19,745
20%	50%	56.08	37.5	64.52	32.7	20,108
	75%	54.59	37.8	62.47	32.7	19,711
	100%	53.09	38.0	60.43	32.7	19,310

Note: Base quantities and prices are 2002 Average. The units of cattle quantities are million head, those of prices are dollar per cwt, and that of surplus is million dollar. To calculate producer surplus, it is assumed that average weight of a slaughter steer is 1,200 lbs.

CONCLUSIONS

On December 23, 2003, a single case of BSE was found in the state of Washington. Major beef importing countries, including Japan, South Korea, and Mexico, have banned imports of beef and beef products produced in the United States. U.S. consumer response to the BSE outbreak is unknown. However, consumer responses to BSE in the United Kingdom and Japan indicate that the BSE outbreaks resulted in major reductions in the consumption of beef. Based on these past cases, we expect that there would be about a 5-20% reduction in beef consumption in the United States, due to the BSE outbreak in Washington.

If domestic consumption of beef is reduced by 10% and U.S. beef exports by 75%, the domestic price of beef would decrease by about 15%, while the prices of pork and chicken would increase about 3% as consumers in this country switch from beef to pork and chicken consumption.

The decreased domestic consumption of beef also would affect the prices of slaughter and feeder cattle in the United States. With the same percentage decreases in domestic demand and foreign import demand for U.S. beef, the prices of slaughter and feeder cattle would decrease by 13.5% and 16%, respectively.

If additional cases of BSE were to occur in the United States, consumer response would be much more negative, resulting in a more than 20% reduction in domestic consumption of beef. If this happens, the domestic price of beef would decrease by more than 25%, and the prices of slaughter and feeder cattle would decrease accordingly, which could destroy the U.S. beef and cattle industry.

To isolate a future BSE outbreak in the region, it is important to improve traceability of the infected animals by introducing both country of origin and regional labeling and preserve it through the supply chain. If the labeling system is developed for the United States, and if U.S. processors could segregate cattle based on its origin by labeling, the impacts of BSE outbreaks on the U.S. beef/cattle industry could be less prominent. Labeling would allow U.S. and foreign consumers to distinguish beef coming from BSE-free regions in the United States.

References

Adda, J. "Behavior Towards Health Risks: An Empirical Study Using the 'Mad Cow' Crisis as an Experiment." Working Paper, Department of Economics, University College London, 2002.

Ag Journal. *BSE in Japan Affect U.S. Producers*, http://www.agjournalonline.com/. Country Roads Network, February 2002.

Ashworth, S. W. and D. D. Mainland. "The Economic Impact of BSE on the UK Beef Industry." *Outlook on Agriculture* 24-3 (1995): 151-54.

Burton, M. P. and T. Young. "The Impact of BSE on the Demand for Beef and Other Meats in Great Britain." *Applied Economics* 28 (1996): 687-93.

Caswell, J. A. and E. M. Mojduszka. "Using Informational Labeling to Influence the Market for Quality in Food Products." *American Journal of Agricultural Economics* 78 (1996): 1248-53.

Department of Agriculture Fisheries & Forestry-Australia. *Geographical Risk of Bovine Spongiform Encephalopathy Rating*. Australia, 2003.

Economic Research Service. *Food Marketing and Price Spreads: Farm-to-Retail Price Spreads for Individual Food Items*. U.S. Department of Agriculture, Washington D.C.

Economic Research Service. *Livestock, Dairy, and Poultry Outlo*ok. U.S. Department of Agriculture, Washington D.C., 1995~2003.

Economic Research Service. *Monthly Retail Prices for Beef, Pork, Poultry, Lamb, and Veal Based on Supermarket Scanner Data*. U.S. Department of Agriculture, Washington D.C.

Eales, J. S. and L. J. Unnevehr. "The Inverse Almost Ideal Demand System." In *Proceedings of the NCR-134 Conference: Applied Commodity Price Analysis, Forecasting, and Market Risk Management*, ed. M. L. Hayenga, 420-17. Chicago, Department of Economics, Iowa State University, 1991.

Food Safety and Inspection Service. *News Release: BSE Analysis by Harvard Center for Risk Analysis*, *Release N. 024101*. U.S. Department of Agriculture, Washington D.C., November 2001.

Foreign Agricultural Service. *Livestock and Poultry - World Markets and Trade*. U.S. Department of Agriculture, Washington D.C., 1998.

Jin, H. J. and W. W. Koo. "The Effect of the BSE Outbreak in Japan on Consumers' Preferences." *European Review of Agricultural Economics* 30-2 (2003): 173-92.

Latouche, K., P. Rainelli, and D. Vermersch. "Food Safety Issues and the BSE Scare: Some Lessons from the French Case." *Food Policy* 23-5 (1998): 347-56.

Mangen, M. J. and Burrell, A. M. "Decomposing Preference Shifts for Meat and Fish in the Netherlands." *Journal of Agricultural Economics* 52-2 (2001): 16-28.

March, J. M. "Impacts of Declining U.S. Retail Beef Demand on Farm-Level Beef Prices and Production." *American Journal of Agricultural Economics* 85-4 (2003): 902-13.

Pennings, M. E., B. Wansink, and M. T. G. Meulenberg. "A Note on Modeling Consumer Reactions to A Crisis: the Case of the Mad-Cow Disease." *International Journal of Research in Marketing* 19-1 (2002): 91-100.

Peterson, H. H. and Y. Chen. "The Impact of BSE on Japanese Retail Beef Market." Selected Paper at the Southern Agricultural Economics Association Annual Meeting, 2003.

Piggott, N. E. and T. L. Marsh. "Does Food Safety Information Impact U.S. Meat Demand?" Working Paper, North Carolina State University, 2002.

U.K. Department for Environment, Food, & Rural Affairs. *Official BSE Homepage*, http://www.defra.gov.uk/animalh/bse/. London, the United Kingdom.

Verbeke, W. and R. W. Ward. "A Fresh Meat Almost Ideal Demand System Incorporating Negative TV Press and Advertising Impact." *Agricultural Economics* 23 (2001): 359-74.