BSE IN NORTH AMERICA: CONSUMER PERCEPTIONS AND WILLINGNESS TO PAY FOR TESTED BEEF

By

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A thesis submitted in partial fulfillment
of the requirements of the degree of

Master of Arts in Agribusiness

WASHINGTON STATE UNIVERSITY
School of Economic Sciences

May 2005

To the Faculty of Washington State University:

The members of the Committee appointed to examine the thesis of MATTHEW LUKE MOORE find it satisfactory and recommend that it be accepted.

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ACKNOWLEDGEMENTS

Thanks to my committee chair Dr. Jill McCluskey and my committee members Dr. Tom Wahl and Dr. Ken Duft. Special thanks to Quan Li for her help with the empirical work. I admire their superior talents and efforts. I would like to acknowledge the International Marketing Program for Agricultural Commodities and Trade (IMPACT) CENTER at Washington State University for its financial support of the survey that was used in this thesis project. Their staff has been very kind and helpful in the tasks involved with the completion of this project. Thanks to Danielle Engelhardt for her help with the data processing and formatting. I would also like to acknowledge the School of Economic Sciences and the IMPACT center at Washington State University for providing me an assistantship. Thanks to Pikes Place Market and Whole Foods Market for the use of their facilities to conduct surveys.

I appreciate all the help and support of friends, family and professors who have helped me to successfully accomplish my thesis. I give special thanks to my family, Richard, Natalyn, Rick, Peyton, Madison, Amelia and Curran Moore. I want to express thanks to Dr. Everett Martin for all his help, knowledge and guidance, he is truly a great mentor. Lastly, I would like to show gratitude to Dan Snyder for all his practical training and skills in the art of meat fabrication.

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ABSTRACT

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The objective of this thesis is to better understand consumer preferences for beef after the discovery of Bovine Spongiform Encephalopathy (BSE), commonly known as "Mad Cow Disease," in the United States. This objective is accomplished with an empirical study and willingness to pay for BSE-tested beef. An social accounting matrix (SAM) Input-Output model using IMPLAN to analyze the effect of the demand shock from BSE on the Washington State economy when all beef exports are stopped.

The thesis estimates the premium U.S. consumers are willing to pay for beef labeled as BSE-tested as well as factors affecting their willingness to pay (WTP) for the beef. Data was collected in a consumer survey conducted in Seattle, Washington. A double-bounded dichotomous choice contingent valuation model was used to analyze

factors affecting WTP for BSE-tested beef and to estimate a mean WTP for BSE-tested beef.

From the survey, consumers consider themselves somewhat knowledgeable about BSE. Consumers know that variant Creutzfeldt - Jakob disease (vCJD) is contracted from eating BSE-infected beef. However, they had little knowledge about prion diseases. Consumers believe U.S. beef is still somewhat safe and think it is very important to test for BSE. Most consumers prefer beef originating from or produced in Washington and will choose BSE tested beef over regular non-tested beef, assuming equal quality and taste. Over half of the consumers did not change their consumption patterns of beef after the BSE news. Seafood and chicken are the main substitutes for conventional beef when consumption patterns did change. Half of the consumers have taken some precautions when buying beef. The U.S. Department of Agriculture is the source respondents' trust most for a reliable source of BSE information. Most agree on the implementation of a national identification system for beef. The estimated mean that consumers are willing to pay for BSE tested beef over regular non-tested beef is a 58.7% premium.

The discrete choice model is used to measure the impacts of food safety concerns, knowledge of BSE, risk, consumption frequency, demographics, price versus safety, and economic growth versus saving the environment.

Model estimation reveals three very important factors having a significant impact on this study were how people felt about the overall safety of U.S. beef, whether consumers preferred beef produced in Washington, and the precautions consumers take when buying beef.

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CHAPTER ONE

INTRODUCTION

On December 23, 2003 tests confirmed the first case of Bovine Spongiform Encephalopathy (BSE), commonly known as "Mad Cow Disease," in the United States. The first BSE case came from a Holstein cow in Mabton, Washington that was said to be injured while giving birth. The U.S. borders were immediately closed and all exports were seized for any and all ruminant products and byproducts. U.S. Department of Agriculture officials said more than 2,000 tons of meat and bone meal were being held owing to potential contamination with protein from the positive cow and would soon be disposed of in a landfill in accordance with all Federal, State and local regulations.

At the time of the discovery, the only thing consumers knew was that officials had identified a case of BSE in Washington. The closure of borders sent the public into a turmoil of uncertainty and nervousness. Over seventy foreign markets closed imports of U.S. beef. People were concerned for their families and assumed U.S. beef maybe unsafe for consumption. Many U.S. consumers stopped eating beef products and substituted other meat products for beef in their diets. When the cow was finally confirmed to have originated from Canada and all meat was traced and recalled, consumers resumed their beef consumption. To help prevent more BSE situations R-Calf has been fighting to keep the border closed until there are specific guidelines set in place for ruminants and

ruminant products coming across the border into the US. On March 2, 2005 the US District Court for the District of Montana granted a preliminary injunction to prevent the implementation of the minimal risk rule until the R-Calf lawsuit is considered on the merits by the court. (See Appendix 4 for BSE Minimal-Risk Regions and Importation of Live Animals.)

Another issue that consumers began to adopt as true was the perception of grass-fed beef being safer. However, the United States banned meat and bone meal (MBM) products in 1997, so all feedlot cattle should be as safe from BSE as grass-fed cattle. The problem still resides at the meat packing plant; where if one affected carcass is not caught, it can contaminate every meat product and jeopardize the health of hundreds of thousands of people.

There are several potential sources and pathways by which BSE could be introduced into the United States. These pathways include the development of a spontaneous BSE case, the import of an infected animal into the United States, scrapie in sheep, oral ingestion of tissue or material containing chronic wasting disease infectivity, horizontal or lateral transmission of chronic wasting disease, transmissible mink encephalopathy, transmissible spongiform encephalopathy (TSE) in pigs, TSEs in chickens and contamination from recycled products, including plate waste, gelatin, milk, blood, blood products and tallow. (Cohen et. al., 2003)

Even though there has only been one confirmed case of Mad Cow Disease in the United States, the BSE scare has cost U.S. beef producers more than 70 critical export

markets. The important question for the beef industry is how to win back their markets, and will the testing of beef for BSE help regain consumer confidence.

Research Objectives

The objective of this thesis is to better understand consumer preferences for beef after the discovery of BSE, commonly known as "Mad Cow Disease," in the United States. This study will help U.S. consumers, beef producers, meat packers, food industry firms, grocery store chains and other markets to evaluate the importance of food safety concerns and consumer preferences for BSE tested beef. In addition, willingness to pay for BSE tested beef products will be analyzed. Furthermore, consumer knowledge of BSE, food safety attitudes, environmental attitudes and who consumers trust for BSE information will be discussed along with other factors which affect these choices.

Thesis Format

This thesis is made up of an introduction, two independent but related articles, and a concluding chapter. The articles are 1) an empirical study dealing with consumption patterns and attitudes along with consumer willingness to pay for BSE tested beef and 2) estimation of a SAM input-output model using IMPLAN to analyze the effect of a demand shock on the Washington economy caused by the discovery of BSE.

Summary of Findings

The first article (Chapter 2) is based on an analysis of data obtained from a survey conducted in Seattle, Washington, with the purpose of eliciting whether consumer consumption patterns had changed since the discovery of BSE in the United States and their willingness to pay for BSE tested beef products. In the United States, with the closure of export markets and possible market loss to countries by competitors it is important to establish a safe meat supply and begin exporting to recapture foreign markets. The sooner the United States can convince export markets that U.S. beef is safe, the faster its producers can start exporting to countries like Japan and Korea, some of United State's largest export markets. These countries are asking the United States to provide documentation that its beef is BSE tested. Shortly after the BSE scare and controversy, many U.S. consumers began to feel that their beef should be BSE tested. However, there is now a sense that consumers want primarily Canadian cattle tested, since a majority of U.S. citizens believe the United States is BSE free. In any case, the United States will continue to test any suspected cattle, whether they are 30 months and older or not. On the other hand, the U.S. Department of Agriculture is unlikely to test every beef carcass for BSE, because it is not necessary from a scientific standpoint, economically feasible or efficient.

Using a dichotomous choice contingent valuation method, consumers were willing to pay a high premium for BSE tested beef. On average, consumers are willing to pay 58.7% more for BSE tested beef over regular beef, assuming equal quality and taste. Model estimation reveals three important factors having a significant impact on this study

were how people felt about the overall safety of U.S. beef, whether consumers preferred beef produced in Washington, and the precautions consumers were taking when buying beef.

The second article (Chapter 3) examines the negative demand shock from BSE on the Washington economy. While studying the effects of BSE on consumption patterns and willingness to pay, it is relevant to test what type of effect BSE would have on the meat packing industry if suddenly all beef exports were stopped, much like the BSE case in the United States. Using the IMPLAN data set and software a social accounting matrix (SAM) Input-Output model treating households as endogenous was used to estimate the total effect of a given negative change in sales to final demand for the meat packing industry. A scenario was constructed similar to the BSE incident in the United States. The impacts obtained from IMPLAN as a result of this shock simulates what might have happened to the Washington economy soon after the infected cow was found in December 2003. Since the time that the model was run, the origin of the infected cow was traced back to Canada. As a result, cattle prices have increased and exportation to some foreign markets has resumed.

According to IMPLAN data, the commodities produced by the meat packing industry in Washington serve domestic demand to a greater extent than foreign demand. Statewide, the meat packing industry is the 42nd largest exporting industry, with total exports equal to approximately $130 million. In the food processing sector, it is the second largest exporter. The meat packing industry's output is ranked 71st in the state valued at over a billion dollars ($1,080,216,000) and is 0.22% of the statewide output. It

is a large part of the food processing sector, contributing 10.51% of the total output. Within this sector, it is ranked third for output, following only frozen juices, fruits and vegetables and fresh or frozen fish. This industry provides 2,820 jobs in Washington State, making it the 130th largest employer statewide and the fifth largest employer among the food processing industries. This information was used to determine the impacts BSE would have on sales, employment and value added. It was then analyzed to observe the direct, indirect and induced effects on the economy.

References for Chapter One

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CHAPTER TWO

CONSUMER RESPONSE TO A BSE DISCOVERY IN WASHINGTON STATE

INTRODUCTION

On December 23, 2003, tests confirmed that a cow in the State of Washington was infected with Bovine Spongiform Encephalopathy (BSE), commonly known as "Mad Cow Disease." The first and only U.S. case of BSE came from a Holstein Cow in Mabton, Washington that was said to be injured while giving birth. On December 24, 2003, thirty nations including Japan banned imports of all U.S. beef.

History has shown that BSE can have worldwide effects. Catastrophic impacts on the beef industry can take place when a country is determined to have BSE within its borders; in an instant all exports can be halted. The halting of exports effects the economy and everyone involved with the food marketing sector, ranging from the cow/calf producer all the way to the retailer and consumer. A mitigating factor in terms of perceived U.S. food quality is that the infected cow was traced back to Canada. Even so, the BSE discovery in Washington affected consumer preferences, consumption patterns and the economy. This set a series of events in motion with cattle producers fighting to keep the U.S./Canadian border closed. This thesis analyzes the types of

consequences BSE had on the Washington economy and what areas were affected the most. A smaller timeline of BSE events is listed in Appendix 3.

BSE is a degenerative neurological disease of the central nervous system (CNS), resulting in the development of spongy lesions in the brain. (Pictures of cows with Mad Cow Disease are presented in Appendix 8.) Scientists believe BSE is caused by misfolded or modified proteins called prions which build up in the CNS tissues, eventually killing nerve cells. Little is know of its source of origin, but BSE is classified as a transmissible spongiform encephalopathy (TSE), variants of which include scrapie in sheep, and chronic wasting disease in deer and elk. The most common TSE affecting humans is sporadic (or classic) Creutzfeldt - Jakob disease (CJD). (Fox et al., 2004)

BSE cannot be spread from animal to animal; it is believed to only spread through feed containing ruminant derived meat and bone meal (MBM) from BSE infected cattle. Scientists believe the use of ruminant derived MBM as a protein supplement in cattle feed spread the disease. As a result MBM was banned in the United States in 1997. The United States was the first country without BSE within its borders to implement a feed ban. (BSEinfo.org)

There are many reasons why consumers should be confident in the safety of U.S. beef. There have been many scientific studies showing that BSE is not found in beef muscle cuts or milk. In 1990 the United States became the first country without BSE within its borders to test cattle for the disease. (See appendixes 5, 6 and 7 for tables showing BSE tests and other surveillance information.) The BSE surveillance program mandates that all cattle with any signs of neurological disorder be tested for BSE and

banned from the human food chain. BSE affects older cattle, typically over 30 months of age. The vast majority of cattle going to market in the United States are less than 24 months of age and do not pose a risk of BSE. Many organic/natural food eaters have a sense that organically produced food is healthier, but according to the USDA, organically produced food is no safer or more nutritious than conventionally produced food. These types of products are defined by a marketing distinction, not a nutritional or safety difference. (BSEinfo.org)

Consuming safe beef products is important to the American public. Especially with many U.S. citizens consuming high protein diets, the issue of beef safety is an utmost concern. Food safety issues often determine whether or not the consumer will purchase beef products. Producers, feeders, packers, retailers, and consumers in many ways depend on one other for a safe and reliable product. This is why it is important to find out how consumers view the BSE issue, how their meat consumption patterns changed, and what they would like to see happen to ensure their food remains safe. In the remainder of this chapter, previous studies are reviewed, data is described, and different discrete choice models are specified and estimated.

Previous Studies

The BSE-outbreak and its effects on the livestock industry, beef demand, and consumer food safety perceptions have been studied in Europe, where a large number of countries have been affected. Loader and Hobbs (1996) analyzed the expected impact of the BSE-crisis on the beef industry. They argued that in addition to the direct financial

costs of the BSE-crisis for the industry, there are indirect or hidden costs, which are primarily transaction costs caused by asymmetric information. They also argued that there are some potential long-term benefits of the BSE-outbreak to the beef industry, including the industry becoming more consumer-oriented with a greater focus on food safety and opportunities for branding and market segmentation, creation of niche markets, and increased potential to capture price premiums. Certain firms such as organic producers and firms that emphasize quality assurance may gain direct benefits due to increased demand for their products.

Lloyd et al. (2001) studied the price adjustment in the U.K. beef market in response to the BSE outbreak, increased awareness, and likely effects of BSE. In the aftermath of the French BSE-outbreak, Latouche et al. (1998) conducted a survey in France in 1997, eliciting consumer consumption patterns and reasons for possible changes as well as consumer attitudes about quality labels and sanitary norms. Consumers were asked how much of a premium they would be willing to pay for beef that would not transmit the human variant of BSE. The meat products were medium-quality, low-priced minced steak with little risk of vCJD, and high-quality, higher-priced beef with no risk of vCJD. The mean willingness to pay (WTP) premiums for the two meat products (including zero bids) were 22 % of the original price and 13.7 % of the original price, respectively. Further, the authors found that employed and highly educated respondents as well as respondents who preferred labeled or organic products indicated higher WTP, while respondents who were involved in agricultural activities were less willing to pay a premium.

In Belgium, Verbeke et al. (2000) found that television coverage on meat safety had a negative effect on the demand for red meat after the Belgium BSE-outbreak. Younger people were the most susceptible to such negative media coverage. Other factors that affected demand for red meat negatively were the presence of children younger than 12 years old in the household and the respondent's age. Verbeke and Ward (2001) analyzed meat demand in Belgium after the BSE discoveries with an almost ideal demand system (AIDS) that included an index of TV coverage and advertising expenditures as explanatory variables. They found that advertising had only a minor impact on demand compared to the negative media coverage. In the Netherlands, Mangen and Burrell (2001) used a switching AIDS model to investigate preference shifts among Dutch consumers. They found that preference shifts due to the BSE crises reduced beef expenditures with offsetting gains in the shares of pork, prepared meat and fish.

McCluskey et al. (in press) analyzed factors that affect Japanese Consumers' willingness to pay (WTP) for BSE tested beef using data obtained from a consumer survey in Japan. They used a single bounded dichotomous choice contingent valuation model to recover the premium amount for WTP. They found consumers were willing to pay a premium on average of greater than 50% for BSE tested beef. They also noted that as the premium for BSE-tested beef increased; the respondent was less likely to be willing to pay the higher premium. In addition for a marginal increase in concerns with food safety the probability of accepting the premium is 0.22, the marginal effect of consuming less beef after the BSE is a 0.14 probability of accepting the premium, and

women had a 0.13 probability of accepting the premium. With this they found food safety attitudes, reduction in beef consumption following the BSE outbreak, and being female all have a statistically significant positive effect on the WTP for BSE tested beef. McCluskey et al.'s (in press) findings of willingness to pay to avoid BSE-tainted beef are higher than those of Latouche et al. (1998) in France. However, this is not surprising because in general, Japanese consumers are accustomed to paying high premiums for quality.

BSE can have major impacts on marketing and distribution channels. Pennings et al., (2002) analyzed how marketers need to understand why and how consumers react to a crisis. They showed that by decoupling the risk response behavior of consumers into separate components of risk perceptions and risk attitudes, a more robust conceptualization and prediction of consumer reactions is possible. With the frameworks provided, they believe answers can be obtained on how marketers can deal with these types of crisis. They showed that the relative influence of risk perception and risk attitude on consumers' reactions depends on the accuracy of knowing the probability of being exposed to the risk. Their results suggest that while clear, forthright, and consistent communication is effective in some countries; other countries require more extreme measures with respect to product supply.

Piggott and Marsh (2004) investigated whether food safety information impacts U.S. meat demand. They used a theoretical model of consumer response to publicized food safety information on meat demand developed with an empirical application to U.S. meat consumption. They found evidence for the existence of pre-

committed levels of consumption, seasonal factors, time trends, and contemporaneous own- and cross commodity food safety concerns. Also the average demand response to food safety concerns is small, especially in comparison to price effects, and to previous estimates of health related issues.

Loureiro and Umberger (2004) researched perceptions of food safety and meat attributes to the extent which these attitudes translate into willingness to pay (WTP) for labeled rib eye steaks. They found that the U.S. Department of Agriculture (USDA) food safety inspection labels, which indicate that the steak is tender or the ability to trace back the animal to the farm, are more important to the consumers than country of origin labeling. Other results indicated that when the socio-demographic characteristics are included, the country-of-origin label (COOL) attribute was not statistically significant in the selection of rib eye steaks, while the rest of the choice specific attributes remained statistically significant. They note that when COOL was simply presented as a generic labeling program and was not associated with a particular country (such as "Certified U.S. Beef"), consumers WTP for this attribute in rib eye steak was fairly low at $0.56 per pound. However, a label denoting that the steak has been USDA food safety inspected, carried a much larger premium of approximately $3.89 per pound; while a label denoting the product is traceable to the farm of origin carried a premium of $1.031 per pound, which is nearly twice the amount of the generic COOL premium.

The general theme across previous work is that the discovery of BSE has a significant effect on consumer willingness to pay for and consume beef. Media coverage

can increase the severity of the consumer response against beef. The current study complements this literature by adding the U.S. perspective.

Data

The data for this study originated from a consumer/questionnaire-based survey completed in Seattle, Washington. The survey was performed in two market locations, Whole Foods and Pikes Place. At the time these were the only locations willing to allow the Washington State University research team to conduct consumer surveys concerning this complicated and controversial subject matter. Respondents were selected at random and then asked by interviewers to fill out the survey on sight. An overall sample size of 605 respondents was obtained from the Seattle area. The survey was conducted on March 6 - 7, 2004 by a research team from the IMPACT Center at Washington State University. The survey was pre-tested with students at Washington State University and then carried out in Seattle. By collecting data from consumers where their decisions for purchasing beef are actually made, it is more likely that the survey elicited true consumer preferences. Each respondent who completed a questionnaire was given a $5.00 gift certificate to one of the markets as an incentive. Of the 605 surveys conducted, 603 of the surveys were fully completed. The approximate turn-down rate was 50%, for every one person that filled out a survey another refused.

The survey respondents were asked questions concerning various socioeconomic and demographic factors such as household income, gender, education level, number of children under 18 years old, number of household members groceries

are bought for and the age of the person performing the survey. Please refer to Appendix 2 for a survey example.

In a second level of questioning, respondents were asked about their food shopping habits and attitudes. These questions related to attitudes toward food safety and the importance of pricing in their buying decisions, attitudes toward economic growth and the importance of saving the environment as well as preferences for domestic and imported foods.

The third level of questioning related to the respondents' consumption levels of beef products since the news of BSE in Washington. Respondents were asked about their consumption frequency of beef, which was segregated into levels of: have they increased dramatically, increased slightly, remained the same, decreased slightly, or decreased dramatically since the BSE news.

Finally, consumers were asked questions on food safety, nutrition, and dieting to see if they had played an effect on their consumption and purchase patterns. Consumers were also asked questions that tested their knowledge of Mad Cow Disease, and who they trust most for beef and BSE information. Additionally a few questions were asked about other important topics such as COOL, genetically modified (GM) products and bio-security issues.

Survey Results

Of the 605 respondents 55.9% were female with an average age of 38.5 years. Data shows that 27.8% of the respondents have children under the age of 18 in the

household, and 71.6% do not. The mean for the number of people that groceries are bought for is 2.43. Respondents' education level consisted of 2.5% saying they have a compulsory education, 19.5% have a high school education, 14% have a two-year college education, 36.4% have a 4-year college education, and 26.3% have an advanced or professional degree above that of a 4-year college education. The average household income was $50,000 to $70,000. Summary statistics for the demographic variables are presented in Table 2.1.

In the second level of questioning, 61% of the respondents think they are somewhat knowledgeable about BSE. Thirty-four percent of the consumers feel U.S. beef is still somewhat safe. The most preferred origin of beef is the beef produced in Washington State, and then beef tested for BSE. Eight-one percent of respondents think it is very important to test for BSE. Most respondents, 60.2% have little knowledge about what the prion disease, but they do have some knowledge about the way humans can be infected with BSE. (See Appendix 1 for additional survey information.)

In the third level of questioning, when consumers were asked how often they eat beef, 11.7% of the respondents indicated that they eat beef daily; 44.0% eat beef at least once a week; 22.3% eat beef at least once a month, but less than once a week; 10.2% eat beef less than once a month; and 11.6% never eat beef. When asked what beef products consumers normally buy, 43.2% buy ground beef; 22.8% buy roasts; 59% buy steaks and 12.9 % buy other products. Consumers were asked what factors they thought were important when purchasing beef, like cholesterol and fat, food borne illnesses, antibiotics in food, hormones in food, mad cow disease, organic and price. The

consumers were asked to mark each category as very important, somewhat important, or not important. The very important factors were those dealing with food safety issues like, food borne disease (76%), antibiotics in food (59%), hormones in food (60%), and Mad Cow Disease (73%). When it comes down to ranking important factors, food safety is a big concern. (See percentages in Table 2.5)

When consumers were asked if they were eating more red meat due to dietary reasons the study showed 15.4% of the individuals said yes; 83.1% said no; and 1.5% did not answer the question. Assuming equal quality and taste, 86.8% of consumers said they would buy beef products tested for BSE over other beef products if they had the opportunity. Ten percent said they would not buy beef products tested for BSE over other beef products if they had the opportunity and 3.1% did not answer the question.

According to this study over half of the respondents did not change their consumption patterns of beef after BSE was found in the United States. Respondents were asked how much their consumption of beef had changed since they heard that BSE was discovered in the United States. Nearly 5.8% increased their consumption dramatically; 2.3% increased their consumption slightly; 51.6% of consumption patterns remained the same; 18.5% decreased their consumption slightly; 16.0% decreased their consumption dramatically; and 5.8% did not answer the question.

Seafood and chicken are generally the main substitutes for conventional beef. When consumers were asked what they were substituting for conventional beef, the overall emphasis was placed on the following categories: 32.3% were substituting seafood; 15.2% were substituting pork; 35.4% were substituting chicken; 7.4% were

substituting lamb; 16.0% were substituting organic beef; 6.7% were substituting grass-fed beef; and 9.5% were substituting other foods.

In the fourth level of questioning, half of the respondents stated they have taken some precautions when buying beef. When asked whether they had taken any precautions when buying beef, their responses were the following: 49.9% said yes; 46.8% said no; and 3.3% did not answer the question. Many respondents wanted to know where their beef is originating. Most agree that there should be an implementation of a national identification system of beef. When asked how they feel about a national identification system being implemented, even if it raises the price of beef to consumers, 79.0% said yes; 18.3% said no; and 2.6% did not answer the question. This is an overwhelming statistic; people are very interested in knowing where their beef is coming from. Respondents were asked what information they felt is important to have on a beef label in a retail store. The responses were ranked in the following order of importance: sell-by (expiration) date, tested for BSE, grade, country of origin, and unit price. Again the top two responses deal with food safety.

The USDA is the source respondents' trust most for beef information. When asked who they trusted the most for beef information, the responses showed the following order: USDA, non-profit consumer groups, World Health Organization, university extension, and the National Cattlemen's Beef Association. When asked whether they think BSE is a food risk issue similar to GM food, 14.5% said it is very similar; 43.8% said it is somewhat similar; and 39.5% said it is not similar at all. When asked about their level of confidence in the bio-security system in the United States, 8.4% of are

respondents are very confident; 52.1% are somewhat confident; and 38.3% are not confident at all. When asked how often consumers buy organic products, 4.6% of the respondents said they never buy organic products; 14.7% seldom buy; 39.8% sometimes buy; and 40.3% regularly buy. Summary statistics for consumer information and perception variables are presented in Table 2.2.

Research Methodology

Given the nature of our survey data, the change in consumption of beef products since the BSE news is modeled using an ordered logit model. Further, this model is used to evaluate the factors that influence the probability of consuming beef since news of BSE. The qualitative choices of consuming beef products may be modeled as a linear function of the observable explanatory variables, x_i, and the unobservable variables, ε_i (Green, 2003)

$$y_i^* = x_i\beta + \varepsilon_i \tag{1}$$

The respondent's consumption behavior can be segregated into thresholds, α_j where $j = \{0, 1, 2, 3, 4\}$, comparable to censoring the data. Each respondent classified his/her consumption as increase dramatically, increase slightly, remain the same, decrease slightly, or decrease dramatically. Hence we observe:

$$
\begin{aligned}
&y_i = 0 \text{ (increase dramatically)} && \text{if } \; y_i^* \le \alpha_1 = 0 \\
&y_i = 1 \text{ (increase slightly)} && \text{if } \; \alpha_1 < y_i^* \le \alpha_2 \\
&y_i = 2 \text{ (remain the same)} && \text{if } \; \alpha_2 < y_i^* \le \alpha_3 \\
&y_i = 3 \text{ (decrease slightly)} && \text{if } \; \alpha_3 < y_i^* \le \alpha_4 \\
&y_i = 4 \text{ (decrease dramatically)} && \text{if } \; \alpha_4 > y_i^*
\end{aligned}
\tag{2}
$$

where the unknown α_j's are estimated along with the β's. The α_j's are restricted such that $\alpha_1 < \alpha_2 < \alpha_3 < \alpha_4$, which is required for positive probability estimates. Assuming that the ε_i's are independently and identically distributed the ordered-multinomial maximum likelihood estimator results. The probabilities are:

$$
\begin{aligned}
&\text{Prob } (y_i = 0|x_i) = F_{\varepsilon_i}(\alpha_1 - x_i\beta) \\
&\text{Prob } (y_i = 1|x_i) = F_{\varepsilon_i}(\alpha_2 - x_i\beta) - F_{\varepsilon_i}(\alpha_1 - x_i\beta) \\
&\text{Prob } (y_i = 2|x_i) = F_{\varepsilon_i}(\alpha_3 - x_i\beta) - F_{\varepsilon_i}(\alpha_2 - x_i\beta) \\
&\text{Prob } (y_i = 3|x_i) = F_{\varepsilon_i}(\alpha_4 - x_i\beta) - F_{\varepsilon_i}(\alpha_3 - x_i\beta) \\
&\text{Prob } (y_i = 4|x_i) = 1 - F_{\varepsilon_i}(\alpha_4 - x_i\beta) .
\end{aligned}
\tag{3}
$$

In the empirical implementation of the model, we define $F(.)$ to be the standard logistic distribution with mean zero and standard deviation $\sigma = \pi / \sqrt{3}$. The solution can be characterized by an optimal estimating function represented by the first-order conditions of the maximum of the log likelihood:

$$L = \sum_i \begin{Bmatrix} I_{D_i=1} \ln(F_{\varepsilon_i}(\alpha_1 - x_i\beta)) + I_{D_i=2} \ln[F_{\varepsilon_i}(\alpha_2 - x_i\beta) - F_{\varepsilon_i}(\alpha_1 - x_i\beta)] + \\ I_{D_i=3} \ln[F_{\varepsilon_i}(\alpha_3 - x_i\beta) - F_{\varepsilon_i}(\alpha_2 - x_i\beta)] + I_{D_i=4} \ln[F_{\varepsilon_i}(\alpha_4 - x_i\beta) - F_{\varepsilon_i}(\alpha_3 - x_i\beta)] + \\ I_{D_i=5} \ln[1 - F_{\varepsilon_i}(\alpha_4 - x_i\beta)] \end{Bmatrix} \quad (4)$$

where I_K is an indicator function for the event *K*, $D_i = j$ denotes that the j^{th} alternative occurred, and *i* denotes individual *i*. As is the case with binary models, the marginal effects of the exogenous variables on the probabilities are not equal to the coefficients, only the signs are unambiguous. Marginal effects are computed by taking the first derivative of the probabilities in (3) with respect to x_i.

Explanatory Variables

The following vector of explanatory variables will be considered for their effect on the probability of changing consumption patterns since the BSE news:

$$\chi_i = \begin{Bmatrix} GD, FSA, EA, SK, OS, BO, OaW, OaM, LTOaM, NEB, MCD, CMRMDR, \\ PT, USDA, NPCGT, NCBA, WSUE, WHO, POP, CULH, BG, EDUC, INC, AGE \end{Bmatrix} \quad (5)$$

The first variable, *GD*, denotes the gender of the respondent. *FSA* is the variable for food safety attitudes. EA is the variable for environmental attitudes. *SK* is the variable for self knowledge of BSE. *OS* is the variable for overall safety of U.S. Beef. *BO* is the variable for consumers that prefer beef produced in or originating from Washington. *OaW* is the variable for consumers that eat beef once a week. *OaM* is the

variable for consumers that eat beef once a month. *LTOaM* is the variable for consumers that eat beef less than once a month. *NEB* is the variable for consumers that never eat beef. *MCD* is the variable for Mad Cow Disease being an important factor when buying beef. *CMRMDR* is the variable for consuming more red meat due to dietary reasons. *PT* is the variable for precautions taken when buying beef. *USDA* is the variable for the USDA being trusted the most for beef information. *NPCGT* is the variable for non-profit consumer group trusted most for beef information. *NCBA* is the variable for National Cattlemen's Beef Association trusted most for beef information. *WSUE* is the variable for Washington State University Extension trusted most for beef information. *WHO* is the variable for World Health Organization trusted most for beef information. *POP* is the variable for consumers purchasing organic products. *CULH* is the variable for children under 18 living in household. *BG* is the variable for how many people the consumer buys groceries for including themselves. *EDUC* is the variable for the amount of education completed by the respondent. *INC* is the variable for income that the household received in 2002, and *AGE* is the variable for the age level of the respondent. The discrete or continuous nature of the explanatory variable is described in Tables 4 and 5. The grouping of discrete variable responses for estimation purposes can be found under the "coding" column in Tables 2.1 and 2.2 as well.

Analysis of the Consumption Model

This study revealed some interesting findings compared to other studies pertaining to consumer preferences and consumption patterns. Researchers can expect

social demographic variables such as: gender, presence of children under 18 living in household, education, income and age to have an important impact on the results of the data. However this was not the case in this study, those social demographic variables stated above had p-values grater than 0.1, therefore they were not significant. Gender had a p-value of 0.721, children under the age of 18 living in household had a p-value of 0.433, education completed had a p-value of 0.748, household income received for 2002 had a p-value of 0.779, and age had a p-value of 0.682. In addition to the social demographic variables not being significant, the variables dealing with food safety attitudes and environmental attitudes also had p-values grater than >0.1, with food safety attitudes having a p-value of 0.858 and environmental attitudes having a p-value of 0.33. Please see Table 2.3 for Parameter Estimates of the Consumption Model since the BSE news.

Three important factors that did have a significant impact, e.g. p-values less than 0.1, were how people felt about the overall safety of U.S. beef, whether consumers preferred beef produced in Washington, and the precautions consumers were taking when buying beef. Overall safety of U.S. beef had a p-value of 0.000, consumers preferring beef produced in Washington had a p-value of 0.004, and consumers taking precautions when buying beef had a p-value of 0.006. See Table 2.3 for Parameter Estimates of the Consumption Model since the BSE news or Table 2.4 for only the Significant Parameter Estimates.

Estimation of Willingness to Pay

A WTP function for BSE tested beef for individual *i* can be depicted as follows:

$$WTP_i = \alpha - \rho B_i + \lambda' z_i + \varepsilon_i \text{ for } i=1,\ldots.n \quad (6)$$

where B_i is the ultimate bid individual *i* faces, z_i is a column vector of observable characteristics of the individual, ε_i is a random variable accounting for random noise and possibly unobservable characteristics. Unknown parameters to be estimated are α, ρ, and λ. Linearity in *z* and ε is assumed for all individuals. Furthermore, the distribution of the error term is assumed to follow $\varepsilon \sim G(0, \sigma^2)$, where $G(0,\sigma^2)$ denotes a cumulative distribution function with mean zero and variance σ^2. The mean willingness to pay, *WTP*, is commonly estimated by restricting $\lambda_i = 0$ (Hanemann, et al., 1991). The empirical mean *WTP* can then be calculated as $-\tilde{\alpha}/\tilde{\rho}$.

This study found that consumers were willing to pay a 58.7% higher premium for BSE tested beef over non-tested beef. Only 10.1% of the consumers would not choose BSE tested beef over regular non-tested beef. This was not surprising at the time given the recent media exposure of BSE and how it impacted the North America/Canadian border closure. With the media discussing BSE in depth on the NEWS and in the papers, consumers were very much aware of the situation. Instantly all beef exports were stopped

and foreign markets denied beef imports from America and Canada. All the ships containing beef products destined for foreign markets had to return, and these countries looked elsewhere to obtain a safe supply of beef. People were scared about the safety of their families after BSE news and were definitely willing to pay more to maintain that safety. (See Table 2.6 for the WTP estimates.)

Discussion of Results and Implications

This study showed some very interesting findings to help us understand how the consumer feels about BSE and its impacts on the Washington economy. These results may help the U.S. beef industry understand how the public may react to this type of situation again in the future. What it does not give us is a true unbiased representation of Washington and its consumers. To better understand the public awareness of BSE and its effects, more surveys need to be conducted throughout the State of Washington. Not only in Seattle but in cities across Washington to give us a wider perspective of all of Washington's consumers. There is likely some population bias owing to the location of the data collection. First, the survey locations included two sites in front of natural food stores; this is not a good representation of the Washington economy as a whole. I believe it is acceptable to get a fair sample size from that designated area, but a majority of our Washington consumers are not shopping at those types of markets. We tried to conduct surveys in other parts of Washington including Spokane, Tri-cities, Moses Lake, Yakima, and Ellensburg, but no stores in those cities would cooperate because BSE is such a controversial topic, and they did not want us to scare their consumers or remind them of

BSE with our surveys. The store managers felt people were just starting to get over the BSE scare and they did not want consumers to stop buying beef. Consumers were purchasing more beef again, and the managers did not want to interrupt this pattern. Stores thought if surveys were conducted, they might change the consumers' minds about buying beef. Even with clarification of what the survey entailed, stores were not willing to allow surveys to be conducted at or around their stores. Now it would be interesting to see if stores would be more inclined to allow the surveys since no more BSE cases have occurred. Also it would be interesting to find out how much beef consumption has increased and how much they are willing to pay for BSE tested beef. I feel after a year you would see a significant difference in the results.

Another problem was that Pikes Place Market is not a place where much beef is bought or consumed; therefore it did not allow for an ideal representation of the beef consumer. Many respondents were vegetarians or organic/natural food consumers, for example Whole Foods Market consumers. The location is predominantly democratic in its political party affiliation, so it would be more useful to conduct surveys in a region that is considered to be more balanced politically. In order to capture a true representation of beef consumer preferences, the surveys needed to be performed in several locations across the state. Only then will you efficiently get a good random sample with little bias. Another option is to conduct surveys at locations across the state with thousands of pedestrians, perhaps a mall, and ask them to fill out a survey.

Conclusions

In this study, we found that consumers placed a lot of emphasis on knowing that their beef supply was safe and they have a great concern for the overall safety of U.S. beef. The study shows that consumers take comfort in wanting to know their beef was produced in Washington, and since the BSE news they try to take more precautions when buying beef and want to know its source of origin. More information should be gathered on how people feel about Country of Origin Labeling (COOL), which will have a direct impact on whether U.S. consumers feel that American beef needs to be BSE tested. As long as CNS tissues are used in pet food, there is always a potential for more BSE related instances to occur. Unintentional feeding of banned material is still a possibility in foreign countries. Many countries around the world do not have strict feed bans in place and could still be feeding infected materials to their livestock. Bovine Spongiform Encephalopathy is a world renowned problem, and will continue to be an issue until the necessary steps are taken to stop the feeding of banned substances and materials.

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Table 2.1. Summary Statistics for Demographic Variables

Variable	Description (Coding)	Distribution of Survey Responses	
Age	0 if > 35 years 1 if < 35 years		Mean = 38.5 or 1965.5 Std. dev. = 13.4
Gender	0 if male 1 if female unsure	43.6% 55.9% 0.5%	
Education	1 if Compulsory Education 2 if High School 3 if 2-year college 4 if 4-year college or university 5 if advanced/professional degree 6 if refuse	2.5% 19.5% 14% 36.4% 26.3% 1.3%	
Children	0 if children under 18 in household 1 otherwise other	27.8% 71.6% 0.7%	
Income	1 if <30,000 USD 2 if 30,000-50,000 USD 3 if 50,000-70,000 USD 4 if 70,000-100,000 USD 5 if >100,000 USD 6 if refused	26.0% 19.7% 15.5% 14.5% 19.8% 4.5%	Coding for estimation: 0 if <50,000USD 1 if > 50,000 USD annual income
Family Size	Number of people shopped for		Mean = 2.4253 Std. dev. = 1.5320

Table 2.2. Summary Statistics for Consumer Information and Perception Variables

Variable	Description & Coding	Distribution of Responses
Opinion	Opinion about overall safety of US beef 0 very safe, or somewhat safe 1 if somewhat unsafe, very unsafe, or don't know	Very Safe 19.5% Somewhat Safe 34.2% Somewhat unsafe 23.1% Very Unsafe 13.6% Don't Know 8.8%
Safety vs. Price	Importance of food safety vs. food price Scale from 1 to 10 where 1 food safety all important 10 food price all important	Mean = 7.8463 Std. dev. = 2.3049
Risk	Risk associated with GM corn-fed beef 0 if high risk 1 if low risk, no risk, or do not know	High risk 14.5% Low risk 43.8% No risk 39.5%
Environment	Importance of economic growth vs. saving environment Scale form 1 to 10 where 1 economic growth at all costs is all important 10 saving the environment at all costs is all important	Mean = 7.4562 Std. dev. = 2.1439
Knowledge	Knowledge about mad cow disease 1 if very knowledgeable 2 if somewhat knowledgeable 3 if not informed	Very knowledgeable = 32.1% Somewhat knowledgeable = 61.0% Not informed= 6.9%

Table 2.3 Parameter Estimates for Consumption Model Since BSE News

Predictor	**Coef**	**SE Coef**	**Z**	**P**
Constant (1)	-3.8089	0.8174	-4.66	0
Constant (2)	-2.4406	0.8049	-3.03	0.002
Constant (3)	1.4595	0.7918	1.84	0.065
Constant (4)	1.9586	0.8026	2.44	0.015
Gender	-0.0818	0.2287	-0.36	0.721
Food Safety Attitudes	0.00905	0.05043	0.18	0.858
Environmental Attitudes	-0.05664	0.05817	-0.97	0.33
Self Knowledge of BSE	-0.3327	0.2411	-1.38	0.168
Overall Safety of U.S. Beef	-0.978	0.2545	-3.84	0
Prefer Beef Produced in Washington	0.2622	0.09132	2.87	0.004
Eat Beef Once a Week	0.8775	0.3871	2.27	0.023
Eat Beef Once a Month	1.5598	0.4417	3.53	0
Eat Beef Less Than Once a Month	2.1808	0.5305	4.11	0
Never Eat Beef	1.0752	0.5953	1.81	0.071
Mad Cow Disease is an Important Factor When Buying Beef	0.7295	0.2827	2.58	0.01
Consuming More Red Meat for Diet Reasons	-0.4439	0.3264	-1.36	0.174
Precautions Taken When Buying Beef	0.6918	0.25	2.77	0.006
USDA Trusted Most for Beef Information	-0.1059	0.2801	-0.38	0.705
Non-Profit Consumer Group Trusted Most for Beef Information	0.141	0.2678	0.53	0.598
National Cattlemen's Beef Association Trusted Most for Beef Information	-0.0173	0.5272	-0.03	0.974
Washington State University Extension Trusted Most for Beef Information	-0.1119	0.3196	-0.35	0.726
World Health Organization Trusted Most for Beef Information	0.2204	0.2937	0.75	0.453
Purchase Organic Products	-0.2066	0.2562	-0.81	0.42
Children Under 18 Living in Household	-0.243	0.3096	-0.78	0.433
Buy Groceries For How Many People	0.0731	0.1095	0.67	0.505
Education Completed	0.0804	0.2498	0.32	0.748
Income for 2002 That Household Received	0.0667	0.2378	0.28	0.779
Age	0.003579	0.008738	0.41	0.682

Table 2.4 Significant Parameter Estimates for Consumption Model Since BSE News

Predictor	**Coef**	**SE Coef**	**Z**	**P**
Constant (1)	-3.8089	0.8174	-4.66	0
Constant (2)	-2.4406	0.8049	-3.03	0.002
Constant (3)	1.4595	0.7918	1.84	0.065
Constant (4)	1.9586	0.8026	2.44	0.015
Overall Safety of U.S. Beef	-0.978	0.2545	-3.84	0
Prefer Beef Produced in Washington	0.2622	0.09132	2.87	0.004
Eat Beef Once a Week	0.8775	0.3871	2.27	0.023
Eat Beef Once a Month	1.5598	0.4417	3.53	0
Eat Beef Less Than Once a Month	2.1808	0.5305	4.11	0
Never Eat Beef	1.0752	0.5953	1.81	0.071
Mad Cow Disease is an Important Factor When Buying Beef	0.7295	0.2827	2.58	0.01
Precautions Taken When Buying Beef	0.6918	0.25	2.77	0.006

Table 2.5 Factors that are Important When Purchasing Beef and the Percentage of Times Marked.

		Very Important	Somewhat Important	Not Important
1	Cholesterol and Fat	40.8%	34.7%	15.2%
2	Food Borne Disease	75.7%	12.4%	2.6%
3	Antibiotics in Food	58.8%	26.0%	5.5%
4	Hormones in Food	60.3%	23.8%	6.1%
5	Mad Cow Disease	73.4%	12.6%	4.1%
6	Organic	43.8%	32.2%	15.4%
7	Price	28.9%	48.6%	11.7%

Table 2.6 Consumers WTP for BSE Tested Beef

	Mean WTP	95% Confidence Interval
All respondents (571 observations)	*58.7%*	[45.5%, 72.0%]

APPENDIX 1

KEY FINDINGS OF THE BEEF CONSUMPTION SURVEY

APPENDIX 1

Key findings of the Beef Consumption Survey

Sample size: 605 people (55.9% of the respondents were female, average age of 38.5)

Area: Seattle area

Method: face-to-face interview

Date: March 6-7, 2004

(Individuals)

Numbers of comments correspond to survey question numbers.

3. **Most of the respondents think they are somewhat knowledgeable about BSE.** Pertained to how knowledgeable the consumer was with BSE, the results showed 32.1% were **very knowledgeable**, 61.0% were **somewhat knowledgeable** and 6.9% were **not informed**.

4. **The safety of US beef is still somewhat safe.** Pertained to how consumers perceive the overall safety of U.S. Beef. The study showed 19.5% (118) thought they were **very safe**; 34.2% (207) thought **somewhat safe**; 23.1% (140) thought **somewhat unsafe**; 13.6% (82) thought **very unsafe**, 8.8% (53) **did not know**, and 0.8% (5) **did not answer** the question.

5. **The most preferred beef products produced in Washington State, and then beef tested for BSE**. Asked the consumer to rank their preferred beef products from 1

being most preferred to 5 being the least preferred. The data showed the following means: beef **produced in Washington State** =2.09; **beef produced in U.S.** =2.25; **beef tested for BSE** =2.16; **beef produced in Canada** =3.73; and **beef produced in Australia** =3.89.

The following is the order in which they were ranked:

(1) produced in Washington State =2.09

(2) beef tested for BSE =2.16

(3) beef produced in U.S. =2.25

(4) beef produced in Canada =3.73

(5) beef produced in Australia =3.89

6. Pertained to how often the consumers eat beef. The study showed 11.7% of the respondents **eat beef daily**; 44.0% eat beef **at least once a week**; 22.3% eat beef **at least once a month, but less than once a week**; 10.2% eat beef **less than once a month**; 11.6% **never eat beef**.

7. Pertained to what beef products consumers normally buy. 43.2% buy **ground beef**; 22.8% **buy roasts**; 59% **buy steaks** and 12.9 % **buy other products**.

8. Asked the consumer what factors they thought were important when purchasing beef. The following percentages are how often the surveyors checked the following categories:

		Very Important	Somewhat Important	Not Important
1	**Cholesterol and Fat**	**40.8%**	**34.7%**	**15.2%**
2	**Food Borne Disease**	**75.7%**	**12.4%**	**2.6%**
3	**Antibiotics in Food**	**58.8%**	**26.0%**	**5.5%**
4	**Hormones in Food**	**60.3%**	**23.8%**	**6.1%**
5	**Mad Cow Disease**	**73.4%**	**12.6%**	**4.1%**
6	**Organic**	**43.8%**	**32.2%**	**15.4%**
7	**Price**	**28.9%**	**48.6%**	**11.7%**

9. **Respondents think it is very important testing for BSE.** Pertained to how important it is to test for BSE. The study showed that out of the 605 surveys, 81% (490) of the people thought it was **very important** to test for BSE; 15.4% (93) thought it was **somewhat important**; 2.6% (16) thought it was **somewhat unimportant**; 0.3% (2) thought it was **not important at all**; and 0.7% (4) of the people **did not answer** the question.

10. Pertained to consumers eating more red meat due to dietary reasons. The study showed 15.4% (93) of the individuals said **yes**; 83.1% (503) said **no**, and 1.5% (9) **did not answer** the question.

11. **Most respondents have little knowledge about prion disease.** Tested the consumer's knowledge of which species the prion disease had been diagnosed in. Out of

the total number of surveys conducted, these are the species they marked, The following percentages are how often the surveyors checked the following categories: 17.9% thought **sheep**; 4.3% thought **dog**; 2.4% thought **cat**; 3.8% thought **fish**; 5.0% thought **horse**; 29% thought **cattle**, and 60.2% did not know.

12. **Have some knowledge about the way humans can be infected with BSE.** Tested the consumer's knowledge of how humans can be infected with mad cow disease. The overall emphases on the categories marked were as follows: 9.3% said **touching the meat**; 49.3% said **eating beef steak**; 26.5 % said **obtaining blood transfusions from people with Creutzfeldt-Jakob disease**; 7.6% said **drinking milk**; and 77.9 % said **eating beef brain**.

13. **Most respondents will choose BSE tested beef over the regular beef, assuming equal price and taste.** Asked the consumer if they had the opportunity to buy beef products tested for BSE over other beef products assuming equal price and taste, would they buy them. The study showed 86.8% (525) said **yes**, 10.1% (61) said **no**, and 3.1% (19) **did not answer** the question.

15. **Over half of the respondents did not change the consumption pattern of beef after BSE news.** Asked the consumer how their consumption of beef has changed since they heard that BSE was discovered in the U.S. The response was that 5.8% (35) **increased** their consumption **dramatically**; 2.3% (14**) increased** their consumption

slightly; 51.6% (312) their consumption **remained the same**; 18.5% (112) **decreased** their consumption **slightly**, 16.0% (97) **decreased** their consumption **dramatically**, and 5.8% (35) **did not answer** the question.

16. **Seafood and chicken are main substitutes for conventional beef.** Asked the consumer what they were substituting conventional beef for, and found that the overall emphases on the categories marked were as follows: 32.3% said **seafood**; 15.2% said **pork**; 35.4% said **chicken**; 7.4% said **lamb**; 16.0% **organic beef**; 6.7% said **grass-fed beef**; and 9.5% said **other**.

17. **Half of the respondents have taken some precaution when buying beef.** Asked the consumer if they had taken any precaution when buying beef. Their response showed the following: 49.9% (302) said **yes**; 46.8% (283) said **no**; and 3.3% (20) **did not answer** the question.

18. **Most agree on the implementation of national identification system of beef.** Asked the consumer about how they feel about a national identification system being implemented, even if it raises the price of beef to consumers. The survey showed 79.0% (478) said **yes**; 18.3% (111) said **no**; and 2.6% (16) **did not answer** the question.

19. Asked the consumer if beef was labeled in the store what they felt would be important on the label. The study showed the following: the most important label is sell by date, then tested for BSE, grade, country of origin, unit price.

20. **USDA is the source the respondents trust most for beef information.** Asked the consumer who they trusted the most for beef information. The study showed the following order: USDA, non-profit consumer group, world health organization, university extension, national cattlemen's beef association.

21. Asked the consumer if they think BSE is a food risk issue similar to GM food. 14.5% think very similar; 43.8% said somewhat similar; 39.5% said not similar at all.

22. 8.4% are very confident about the biosecurity system in the US; 52.1% are somewhat confident; 38.3% are not confident at all.

23. 4.6% never buy organic products; 14.7% seldom buy; 39.8% sometime buy; 40.3% regularly buy.

24. 27.8% have children under 18 in household; 71.6% do not have.

25. Asked how many people buy groceries for. The mean is 2.43.

26. Education level: 2.5% have compulsory education; 19.5% have high school education; 14% have 2- year college; 36.4% have 4-year college; 26.3% have advanced degree.

27. The average household annual income is $50,000-70,000.

Household annual income:

26% , less than $30,000

19.7%, $30,000-50,000

15.5%, $50,000-70,000

14.5%, $70,000-100,000

19.8%, greater than $100,000

APPENDIX 2

EXAMPLE OF SURVEY CONDUCTED

APPENDIX 2

Example of Survey Conducted in Seattle

M / F	Site:	Date:

This research has been approved by the Institutional Review Board at Washington State University. If you have any questions about this research project, you can contact the WSU IRB at (509) 335-9661. [1]

Q1. When you are purchasing food, how much importance is placed on food safety versus lower food prices on a scale from 1 to 10, where **1 means that food price is all important and 10 means food safety is all important? (Circle One)**

1 2 3 4 5 6 7 8 9 10

Q2. Where would you place yourself on a scale from 1 to 10, **if economic growth at all costs is a 1 and saving the environment at all costs is a 10. (Circle One)**

1 2 3 4 5 6 7 8 9 10

Q3. How knowledgeable are you about "Mad Cow Disease" or bovine spongiform encephalopathy (BSE)?

1. Very knowledgeable---source of information?_____ (eg. Newspaper, TV, internet, radio, etc.)
2. Somewhat knowledgeable---source of information?_____
3. Not informed

Q4. How do you feel overall about the safety of US beef?

1. Very safe
2. Somewhat safe
3. Somewhat unsafe
4. Very unsafe
5. Don't know

Q5. Please rank your preferred beef products (**1 is the most preferred product and 5 is the least preferred**)

____beef produced in Washington State
____beef produced in US
____beef tested for BSE
____beef produced in Canada
____beef produced in Australia

Q6. How often do you eat beef?

1. Daily
2. At least once a week
3. At least once a month, but less than once a week
4. Less than once a month
5. Never

Q7. What beef products do you normally buy?

1. Ground beef
2. Roasts

[1] Survey1(+)

3. Steaks
4. Other_____

Q8. When you buy beef, how important are the following factors to you? (Please check)

		Very Important	Somewhat Important	Not Important
1.	Cholesterol and fat	_____	_____	_____
2.	Food borne disease	_____	_____	_____
3.	Antibiotics in food	_____	_____	_____
4.	Hormones in food	_____	_____	_____
5.	Mad cow disease	_____	_____	_____
6.	Organic	_____	_____	_____
7.	Price	_____	_____	_____

Q9. How important is testing for BSE (mad cow disease)?

1. Very important
2. Somewhat important
3. Somewhat unimportant
4. Not important at all

Q10. Are you eating more red meat due to dietary reasons?

1. Yes
2. No

Q11. In which species has prion disease been diagnosed? **(Check all that apply)**

Sheep_____ Dog_____ Cat_____ Fish_____ Horse_____ Cattle_____ I don't know____

Q12. By which of the following ways, may humans get mad cow disease? **(Check all that apply)**

Touching the contagious meat_____
Eating beef steak_____
Blood transfusions from people who have variant Creutzfeldt-Jakob disease_____
Drinking milk_____
Eating beef brain_____

Read the following: Scientists confirm that BSE has not been found in beef muscle and it is only found in nerve tissue, specifically the brain and spinal cord. So experts say eating muscle cuts such as beef steak and roasts is safe. However, they advise against eating brain, tripe, or other parts that may contain part of the spinal column.

Q13. If you had the opportunity to buy a beef product that was tested for BSE, would you buy it rather than other beef products, assuming equal price and equal taste?

1. Yes **(if yes go to Q14a)**
2. No **(if no go to Q14b)**

Q14(a). Would you be willing to purchase this product if it cost 5% more than other beef products? **(go to Q15)**

1. Yes 2. No

Q14(b). Would you be willing to purchase this product if it cost 5% less than other beef products?

1. Yes 2. No

Q15. How has your consumption of beef changed since you heard the BSE news in the US?

1. Increase dramatically **(skip to Q17)**
2. Increase slightly **(skip to Q17)**
3. Remain the same **(skip to Q17)**
4. Decrease slightly
5. Decrease dramatically

Q16. If you are not consuming conventional beef, what are you substituting? **(Check all that apply)**

1. Seafood
2. Pork
3. Chicken
4. Lamb
5. Organic beef
6. Grass-fed beef
7. Other _____

Q17. As a consumer, have you taken any precautions when buying beef?

1. Yes What are they? _____
2. No

Q18. Do you feel that a national identification system for beef should be implemented even if it raises the price of beef to consumers?

1. Yes
2. No

Q19. If beef is labeled, which of the following is important on the label? **(Check all that apply)**

1. Country of origin _____
2. Grade _____
3. Age _____
4. Tested for BSE _____
5. Unit price _____
6. Weight _____
7. Nutritional information _____
8. Lean or extra lean _____
9. Sell by date _____

Q20. Which of the following do you trust most for beef information?

1. USDA
2. Non-profit consumer group
3. National Cattlemen's Beef Association
4. Washington State University Extension
5. World Health Organization

Q21. Do you think that BSE is a food risk issue similar to GM (genetically modified) food (eg. GM-corn-fed beef)?

1. Very similar 2. Somewhat similar 3. Not similar at all

Q22. Are you confident about the biosecurity system in the US?

1. Very confident 2. Somewhat confident 3. Not confident at all

Q23. Do you buy organic products when they are available?

1. never 2. seldom 3. sometimes 4. regularly

Q24. Do you have any children under the age of 18 that live in your household?

1. Yes
2. No

Q25. How many people do you usually buy groceries for, including yourself? _____

Q26. What is the highest level of education that you have completed?

1. Compulsory education
2. High school
3. 2-year college
4. 4-year college or university
5. Advanced or professional degree

Q27. How much income did your household receive in 2002?

1. Less than $30,000
2. $30,000-$50,000
3. $50,000-$70,000
4. $70,000-$100,000
5. Greater than$100,000

Q28. Which year were you born? _____

APPENDIX 3

THE 2004 MAD-COW DISEASE TIMELINE:

APPENDIX 3

THE 2004 MAD-COW DISEASE TIMELINE

Here are highlights of a Canadian Press timeline of BSE-related events in 2004.

Dec. 23, 2003: USDA announces the first confirmed U.S. case of mad cow.

Jan. 6, 2004: DNA tests confirm the Washington state cow came from an Alberta herd.

April 19, 2004: U.S. changes import rules and begins accepting more beef products from Canada, including all bone-in cuts and processed beef from animals under 30-months of age.

May 2004: USDA reaches court settlement with R-CALF to halt imports of Canadian processed beef products until the larger issue of dropping the ban on live Canadian cattle is settled.

May 26, 2004: R-CALF, the Consumer Federation of America, Public Citizen and the U.S. Consumers Union press the U.S. government to hold public hearings on Canadian imports.

July 23, 2004: A risk assessment study commissioned by the U.S. Department of

Agriculture supports reopening the border to live Canadian cattle.

Aug. 3, 2004: Canadian meat-packers nearly tripled their profits since the mad cow crisis hit Canada, says a report by Alberta's auditor general.

Aug. 12, 2004: Angry after struggling to survive the mad cow crisis for 15 months, a small group of Canadian producers launches a multimillion-dollar claim against the U.S. government in a bid to force the reopening of the border to live cattle.

Sept. 16, 2004: NMA asks the United States District Court in Billings, Montana to grant it intervenor status in the lawsuit R-CALF v. USDA.

Nov. 29, 2004: A report from Bank of Montreal economics department says Canadian cattle producers have lost about $5 billion since the crisis began.

Nov. 30, 2004: During a visit to Canada, Bush says his administration is working "as quickly as we can" to resolve the mad cow trade dispute so the free flow of cattle across the border can resume.

Dec. 10, 2004: Ottawa proposes banning high-risk material from animal feed, pet food and fertilizers, in an effort to prevent mad cow disease.

Dec. 29, 2004: The U.S. announces plans to reopen the border on March 7 to nearly all Canadian exports of beef and live cattle.

Jan. 2, 2005: CFIA confirms a third case of BSE in a dairy cow in Alberta. The cow was downer and did not enter the food supply.

March 2, 2005: the U.S. District Court for the District of Montana granted a preliminary injunction to prevent the implementation of the minimal risk rule until the R-CALF lawsuit is considered on the merits by the court.

Source:

http://www.nmaonline.org/files/PDF/lt1.3.05.pdf

APPENDIX 4

BSE MINIMAL-RISK REGIONS AND IMPORTATION OF LIVE ANIMALS AND COMMODITIES FROM CANADA DELAY OF EFFECTIVE DATE

APPENDIX 4

BSE MINIMAL-RISK REGIONS AND IMPORTATION OF LIVE ANIMALS

USDA
United States Department of Agriculture
Animal and Plant Health Inspection Service
Veterinary Services
National Animal Health Policy and Programs
4700 River Road
Unit 33
Riverdale, MD 20737
APHIS *Safeguarding American Agriculture*
APHIS is an agency of USDA's Marketing and Regulatory Programs
An Equal Opportunity Provider and Employer
Federal Relay Service
(Voice/TTY/ASCII/Spanish)
1-800-877-8339

March 4, 2005

Subject: BSE Minimal-Risk Regions and Importation of Live Animals and Commodities from Canada Delay of Effective Date

To: Importers, Brokers and Other Interested Parties
(301)734-8093
FAX (301) 734-8818

On January 4, 2005, the USDA, Animal and Plant Health Inspection Service (APHIS) published a final rule which amended the regulations to provide for the importation of certain ruminants, ruminant products and byproducts from regions that pose a minimal risk of introducing bovine spongiform encephalopathy (BSE) into the United States, and designated Canada as the first minimal-risk region (70 FR 460-553, Docket No. 03-080-3). The effective date of the final rule was to be March 7, 2005.

However, on March 2, 2005 the U.S. District Court for the District of Montana granted a preliminary injunction to prevent the implementation of the minimal risk rule until the R-CALF lawsuit is considered on the merits by the court.

Therefore, until further notice, the current import requirements for ruminant and ruminant commodities from Canada will remain unchanged. Only those commodities that were listed in the August 15, 2003 notice (republished May 6, 2004) will be eligible for importation from Canada, under the risk-mitigation measures specified in that notice.

Jere L. Dick
Associate Deputy Administrator
National Animal Health Policy and Programs
Source: http://www.aphis.usda.gov/lpa/issues/bse/bserisk.pdf

APPENDIX 5

2004 TOTAL FOR ALL BSE TESTS

APPENDIX 5

2004 Total for All BSE Tests

Bovine Spongiform Encephalopathy (BSE)

Month	**Number of Tests**
*January	1,680
*February	1,524
*March	2,292
*April	1,857
*May	1,639
June 1–July 4 Week 1–Week 5	12,398
July 5–August 1 Week 6–Week 9	15,828
August 2–September 5 Week 10– Week 14	24,383
September 6–October 3 Week 15–Week 18	21,107
October 4–October 31 Week 19–Week 22	25,476

November 1–December 5 Week 23– Week 27	36,961
December 6–January 2, 2005Week 28–Week 31	31,323
Total For 2004	**176,468**

*These tests are prior to the enhanced BSE Surveillance program. Please keep in mind that all the tests prior to June 1 are immunohistochemistry (IHC) tests.

Source:

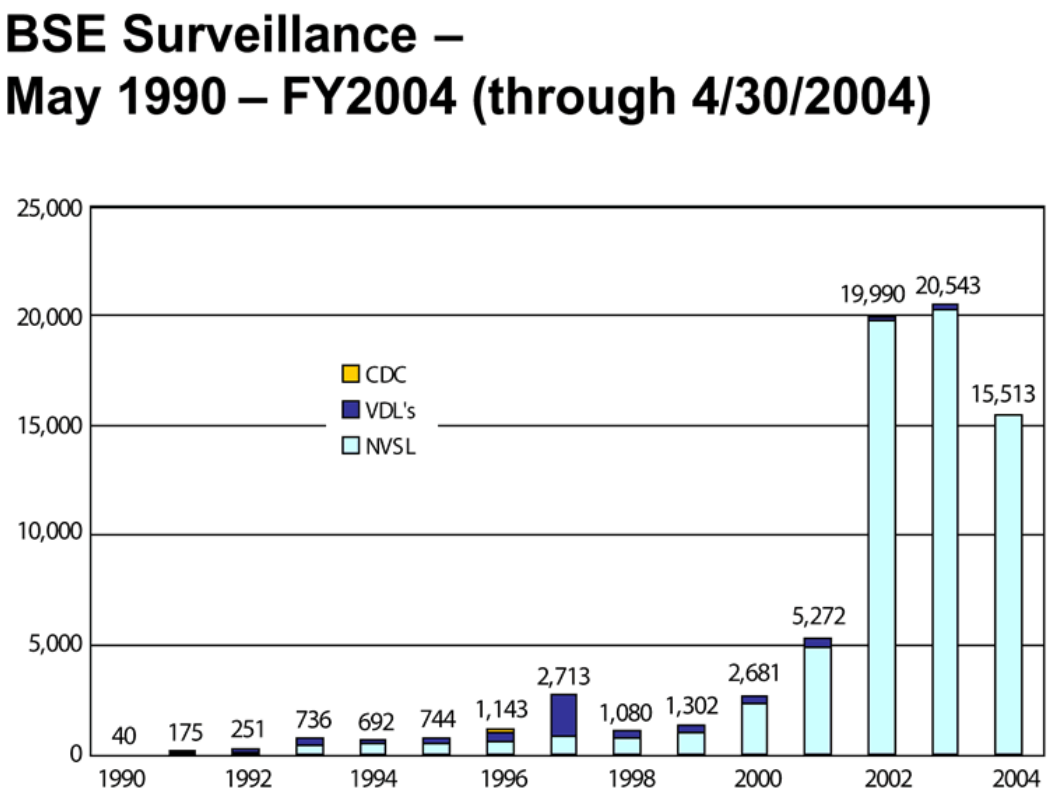
http://www.aphis.usda.gov/lpa/issues/bse/bse_2004_tests.html

APPENDIX 6

BSE SURVEILLANCE

APPENDIX 6

BSE Surveillance —
May 1990 – FY 2004 (through 4/30/2004)



Source:

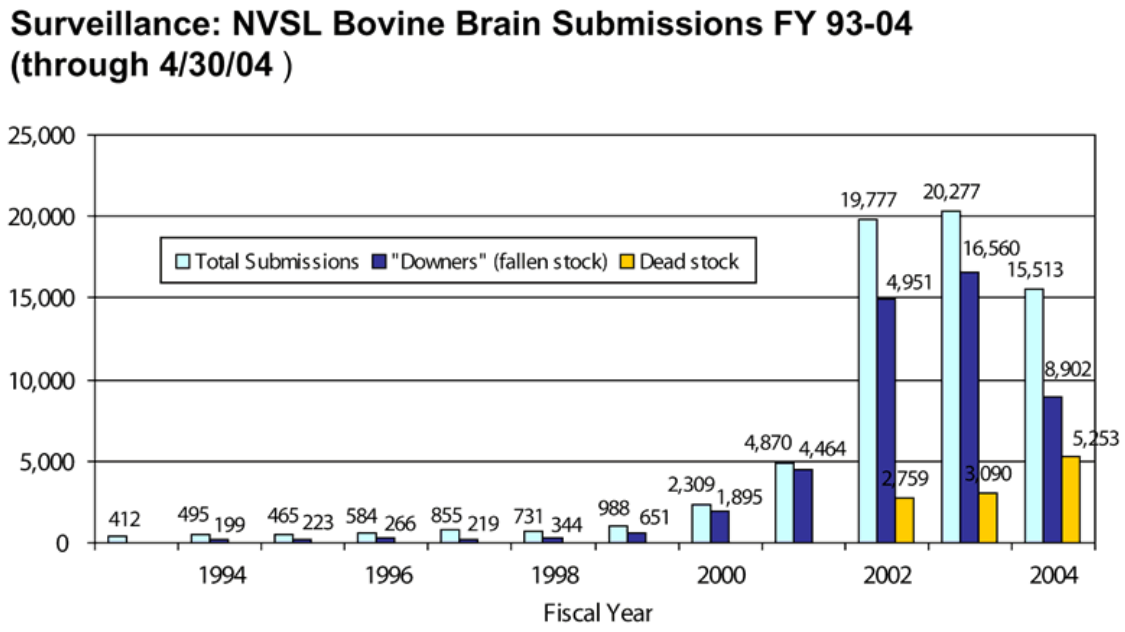
http://www.aphis.usda.gov/lpa/issues/bse/surveillance/figure2f.html

APPENDIX 7

SURVEILLANCE: NVSL BOVINE BRAIN SUBMISSIONS FY 93–04

APPENDIX 7

Surveillance: NVSL Bovine Brain Submissions
FY 93–04 (through 4/30/04)



Source:

http://www.aphis.usda.gov/lpa/issues/bse/surveillance/figure3f.html

APPENDIX 8

PICTURES OF CATTLE WITH BSE

APPENDIX 8

Pictures of Cattle with BSE

#2

Photos 2 & 3
Cattle affected by BSE experience progressive degeneration of the nervous system. Changes in temperament (e.g., nervousness or aggression), abnormal posture, incoordination and difficulty in rising, decreased milk production, and/or loss of weight despite continued appetite are followed by death.

Source: www.aphis.usda.gov

APHIS photos by Dr. Art Davis

#3

CHAPTER 3

A SAM INPUT-OUTPUT MODEL TO ANALYZE THE NEGATIVE DEMAND SHOCK OF BSE ON THE WASHINGTON ECONOMY WHEN ALL BEEF EXPORTS ARE STOPPED

INTRODUCTION

The meat packing industry is an important part of the food-processing sector in Washington. Meat processing plants are defined to include businesses engaged in the slaughtering of cattle, hogs, sheep, lambs, and calves for meat to be sold or to be used by the business for canning, curing, freezing, and in making sausage, lard and other products. In the State of Washington, the processing of cattle comprises a large portion of this industry, as will be demonstrated later. A loss in the demand for the products of this industry would create a devastating effect on the overall welfare of the state; however, it is difficult to understand the significance of such a change without understanding initially how the industry fits into the overall state economy and into the food processing sector.

The closing of U.S. beef export markets due to a recent incident of BSE in Washington will not only directly affect Washington's beef industry, but it will also affect the overall state and national economies. (Holland, 2004) The analysis indicated that the effects on beef producers, processors, and consumers, as well as the overall economy, depend critically on how domestic consumers respond to the incident. Holland simulated two different scenarios with a Computable General Equilibrium (CGE) model of the national and Washington economies. In the first scenario, assuming a 90% decline in foreign exports and constant domestic consumption, he found the economic effect of BSE on the U.S. economy to have about an 8% loss in employment in the U.S. meatpacking (beef) industry. An employment loss in the cattle industries ranged from 23% to 32%. There was about a 6% decrease in U.S. beef producer prices, and there was an income loss (labor and capital) equaled almost 3 billion dollars to the U.S. beef and cattle producers. In the second scenario, with a 90% decline in foreign exports, and constant domestic consumption, he found the economic effect of BSE on the Washington economy to have about an 11% loss in employment in the Washington meatpacking (beef) industry. An employment loss in the cattle industries ranged from 15% to 23%. There was about a 5% decrease in Washington beef producer price, and there was an income loss (labor and capital) of about 41 million dollars to Washington beef and cattle producers. (Holland, 2004)

IMPLAN

In this next section, I used an input-output model to conduct an alternative assessment of the BSE scenario. The simulation was modeled with IMPLAN software,

which is an economic impact assessment modeling system. It allows the user to easily build economic models to estimate the impacts of economic changes in their states, counties, or communities. (Olson and Lindall, 2003)

The IMPLAN database was created by MIG, Inc. The input-output accounting describes commodity flows from producers to intermediate and final consumers. The total industry purchases of commodities, services, employment compensation, value added, and imports are equal to the value of the commodities produced. Purchases for final use (final demand) drive the model. Industries produce goods and services for final demand and purchase goods and services from other producers. These other producers, in turn, purchase goods and services. This buying of goods and services (indirect purchases) continues until leakages from the region (imports and value added) stop the cycle. These indirect and induced effects (the effects of household spending) can be mathematically derived. The derivation is called the Leontief inverse. The resulting sets of multipliers describe the change of output for each and every regional industry caused by a one dollar change in final demand for any given industry.

The IMPLAN computer program was developed as a cost-effective means to develop regional input-output models. IMPLAN accounts closely follow the accounting conventions used in the "Input-Output Study of the U.S. Economy" by the Bureau of Economic Analysis (1980) and the rectangular format recommended by the United Nations. The IMPLAN system was designed to serve three functions: 1) data retrieval, 2) data reduction and model development, and 3) impact analysis. Comprehensive and

detailed data coverage of the entire United States by county, and the ability to incorporate user-supplied data at each stage of the model building process, provides a high degree of flexibility both in terms of geographic coverage and model formulation. The IMPLAN database, created by MIG, Inc., consists of two major parts: 1) a national-level technology matrix and 2) estimates of sector activity for final demand, final payments, industry output and employment for each county in the United States along with state and national totals. New databases are developed annually by MIG, Inc. (Olson and Lindall, 2003)

IMPLAN reports that the meat packing commodity is produced by a variety of different industries, including: meat packing plants ($994,680,000), sausages and other prepared meats, poultry processing, canned specialties, canned fruits and vegetables, frozen specialties, prepared feeds, breads, cake and related products, cookies and crackers, animal and marine fats and oils, food preparations-N.E.C. and leather tanning and finishing. The total commodity production according to IMPLAN is $1,080,220,000.

The meat packing industry's output is ranked 71st in the state at $1,080,216,000 and is 0.219% of the statewide output. It is a large part of the food processing sector, contributing 10.51% of the total output. Within this sector, it is ranked third for output, following only frozen juices, fruits and vegetables and fresh or frozen fish. The production of this industry provides 2,820 jobs in Washington State. This makes it the 130th largest employer statewide and the fifth largest employer among the food processing industries. The earnings per job are approximately $31,000. This is in the middle for both the state economy, where it ranks 307th out of 525 industries, and for

the food processing industry, where it ranks 29th out of 45 industries. Most of the earnings for the meat packing industry go to workers in the form of wages. Sole proprietors make up a small percentage of the firms in the meat packing industry making only $683,000 in total annual income. Other property income, comprised mostly of corporations, received substantially more than proprietors, making $12,863,000 in income in 2000. The significant contribution the meat packing industry makes to the state economy through sales and employment is supported by the purchase of a large amount of inputs, many of which come from Washington.

The meat packing industry buys a total of $972,517,000 in inputs. The biggest input suppliers to it are the meat products used to make the commodity. These are approximately 84% of the total inputs, and include range fed cattle; ranch fed cattle; cattle feedlots and hogs; as well as other miscellaneous animals. Of the most significant inputs, 64.5% of the range-fed cattle are from Washington, as are 87.9% of the ranch-fed cattle, and 90.1% of the inputs from cattle feedlots. To complete the production of the commodity, the industry also has significant expenses for paperboard containers and boxes, miscellaneous plastic products, motor freight, wholesale trade, banking and advertising. The products produced by Washington's meat packing industry serve a variety of consumers, 82.98% of which are in Washington State.

The commodities produced by the meat packing industry in Washington serve domestic demand to a greater extent than foreign demand. Statewide, it is the 42nd largest exporting industry, with total exports equal to $130,197,000. In the food processing sector, it is the second largest exporter. The data available on IMPLAN reports no

domestic exports; however, this contradicts other sources and is likely incorrect. A recent example of Washington-processed meat being exported was during the discovery of BSE in a Washington-grown cow. The meat from that animal was recalled from a number of western states, including those as far away as Nevada. Despite this discrepancy, the current zero value from IMPLAN will be used for the remainder of this analysis.

Intermediate, industry-to-industry demand is 13.4% of the total demand for this commodity. Of the institutional demand for the commodity, household demand is the largest institution and consumes 85.2% of the institutional demand. Household demand ranges from $35,108,000 for the lowest income level to $206,611,000 for the $50,000-75,000 income level. It is interesting to note however, that the wealthiest households, those that make more than $150,000, consume only $68,134,000 of the meat packing commodity. The state and local governments consume the remainder of the institutional demand along with inventory changes and domestic exports.

The meat packing industry and the main commodity it produces is clearly an important part of the food processing sector in the Washington economy, and therefore is also important to the overall health of the statewide economy. Any shock to the final demand of this industry will create a shock to the entire Washington economy based on the substantial number of employees it has and the input purchases it makes within the state.

A social accounting matrix (SAM) input-output model treating households as endogenous was used to estimate the total impact of a given negative change in sales to

final demand for the meat packing industry. A scenario was constructed similar to the BSE incident that occurred in the United States. The impacts obtained from IMPLAN simulations as a result of this shock are similar to what probably occurred in the Washington economy since that December day, when the infected cow was found. This scenario was simulated in the spring of 2004. Since then a lot of things have occurred so this information is purely to show what may have happened that spring. Shortly after the BSE-infected cow was detected in Mabton, Washington, all exports of beef and beef by-products were halted. IMPLAN provides an explanation of how the negative demand shock would hurt the Washington economy when all exports of beef to foreign countries were stopped. One can see after analyzing the data found in IMPLAN that there were very serious and profound effects, and that sales and jobs in secondary industries can be very dependent on exogenous demand from the meat packing industry.

The basic structure of a SAM is derived from the National Income and Product Accounts. Major categories that appear for both rows and columns of the SAM are production, consumption, accumulation, and trade accounts. These main accounts are broken down into several sub-accounts. In a SAM, rows represent receipts, and columns represent expenditures. (Holland and Wyeth, 1993)

According to the IMPLAN commodity trade report, meat packing plants in Washington obtained $130,196,620 from foreign export trade. This value is the amount of money received from exporting meat to foreign countries such as Japan or Korea. In order to test the BSE scenario, it was taken into account that not all meat and animal products would be affected by the BSE scare, only beef. Of the $130,196,620 the

Washington meat packing industry obtained from foreign trade, an implemented negative exogenous demand shock of ($100,000,000) was placed on the economy for the halting of beef exports. The remaining amount of $30,196,620 we did not change because the industry also includes exports of other types of meats and by-products including pork, chickens, sheep, goats, and horses. The $100,000,000 figure was chosen as a well-rounded estimation for the negative demand shock; it is not a precise representation of the actual amount of beef exports.

IMPLAN would have configured the $100,000,000 shock in producer prices; however, exports leaving port are valued in purchaser prices. To fix this, I added in marketing and transportation margins. I did this in order to recover the original value of the commodity, and I had IMPLAN supply values for marketing and transportation and included them into the impact analysis. Doing this provides a better understanding of how the money is distributed and allows the effects that occurred to be readily recognized. To calculate these margins, I took the margins set for state and local government and divided it into one, obtaining 1.19, which I then set as the level of the shock in IMPLAN before running the scenario. The estimated margin value obtained from IMPLAN for wholesale trade is -$14,994,000 and for motor freight and transportation is -$4,928,574. These can be seen in the first output table below. Based on the demand shock I configured, I was interested in the change the impact would create in a direct, indirect, induced and total manner on the output, employment and value added for the meat packing industry.

Results

After running the impact, the first detrimental effect I saw was the loss of sales from Washington, with the direct total sales lost in Washington reaching ($119,000,002). This figure is the sum of the immediate change to meat packing plants, domestic trade and foreign trade. The indirect total sales lost in Washington were ($92,302,291), which is the sum of the impacts to the upstream suppliers of inputs. The total induced sales lost in Washington were ($25,685,133). This is the sum of the decrease in spending due to lost wages. The overall total sales lost in Washington were ($236,987,426). The estimated negative direct change in sales for meat packing plants was ($94,643,592), which was the largest industry affected, comprising 79.5% of the total sales. The indirect loss in sales for meat packing plants I found to be ($2,033,648) which was 2.2% of total indirect sales. Meat packing plants did not make the top 10 for induced effects but as a total it made up ($96,855,976), which was 40.9% of total output affected. The following Table 3.1 shows the top ten direct, indirect, induced and total effects for output and the percent affect each sector had on the total output after the shock. The percent of total equals the sector value divided by the overall total of the effects: direct, indirect, induced and total; multiplied by 100. Please refer to Table 3.1.

Employment was also examined to determine the estimated change in number of jobs if there was a sudden ($100,000,000) drop in beef exports. The direct employment lost in Washington reached (432). The indirect employment lost in Washington was (925). The induced employment lost in Washington was (303). The overall total employment lost in Washington totaled (1,659). Meat packing plants had a

direct value of (247) jobs, which was 57.1% of the total jobs directly affected. Meat packing plants were not found in the top ten for indirect and induced but as a total they made up (253) jobs, which acquired 15.2% of total employment affected. The following Table 3.2 shows the top ten direct, indirect, induced and total effects on employment and the percent affect each sector had on employment due to the shock.

The change to the value added categories was the last effect I wanted to research based on a sudden ($100,000,000) drop in beef exports. The direct total value-added lost in Washington reached negative ($22,684,448). The indirect total value-added lost in Washington reached ($33,353,520). The induced total value-added lost in Washington was ($15,831,061). The overall total value-added lost in Washington was ($71,869,028). Meat packing plants had a direct total value added loss of ($9,436,114), which was 41.4% of the total value added. Meat packing plants were not among the top ten affected industries in the indirect and induced tables, but as total value added they made up ($9,656,692), which was 13.4% of the total value added affect. The following Table 3.3 shows the top ten direct, indirect, induced and total effects on total value added and the percent affect each sector had on the total value added due to the shock.

Table 3.1 Output Impact (Sales)

Direct	Output Impact Sector	Value $	% of Total
58	Meat Packing Plants	-94,643,592	79.5
447	Wholesale Trade	-14,994,000	12.6
59	Sausages and Other Prepared Meats	-4,928,574	4.1
435	Motor Freight Transport and Warehousing	-3,174,587	2.7
5	Cattle Feedlots	-353,570	0.3
3	Ranch Fed Cattle	-267,974	0.2
433	Railroads and Related Services	-231,577	0.2
436	Water Transportation	-115,224	0.1
437	Air Transportation	-112,091	0.1
4	Range Fed Cattle	-69,627	0.1

Indirect	Sector	Value $	% of Total
5	Cattle Feedlots	-29,545,714	32.0
3	Ranch Fed Cattle	-18,787,814	20.4
447	Wholesale Trade	-7,440,046	8.1
4	Range Fed Cattle	-6,491,979	7.0
435	Motor Freight Transport and Warehousing	-3,026,000	3.3
462	Real Estate	-2,488,392	2.7
58	Meat Packing Plants	-2,033,648	2.2
456	Banking	-1,741,002	1.9
56	Maintenance and Repair Other Facilities	-1,366,386	1.5
210	Petroleum Refining	-1,217,789	1.3

Induced	Sector	Value $	% of Total
461	Owner-occupied Dwellings	-2,358,463	9.2
490	Doctors and Dentists	-1,492,090	5.8
447	Wholesale Trade	-1,452,049	5.7
454	Eating & Drinking	-1,289,804	5.0
462	Real Estate	-1,275,982	5.0
492	Hospitals	-1,228,182	4.8
456	Banking	-973,268	3.8
455	Miscellaneous Retail	-840,021	3.3
459	Insurance Carriers	-743,421	2.9
451	Automotive Dealers & Service Stations	-716,336	2.8

Total	Sector	Value $	% of Total
58	Meat Packing Plants	-96,855,976	40.9
5	Cattle Feedlots	-29,955,524	12.6
447	Wholesale Trade	-23,886,096	10.1
3	Ranch Fed Cattle	-19,091,668	8.1
4	Range Fed Cattle	-6,573,946	2.8
435	Motor Freight Transport and Warehousing	-6,492,572	2.7
59	Sausages and Other Prepared Meats	-5,119,400	2.2
462	Real Estate	-3,764,374	1.6
456	Banking	-2,714,270	1.1
461	Owner-occupied Dwellings	-2,358,463	1.0

Table 3.2 Employment Impact

Direct	Employment Impact Sector	Value Jobs	% of Total
58	Meat Packing Plants	-247.1	57.1
447	Wholesale Trade	-124.7	28.8
435	Motor Freight Transport and Warehousing	-28.1	6.5
59	Sausages and Other Prepared Meats	-21.9	5.1
3	Ranch Fed Cattle	-4.2	1.0
5	Cattle Feedlots	-1.4	0.3
4	Range Fed Cattle	-1.2	0.3
433	Railroads and Related Services	-1.1	0.3
437	Air Transportation	-1.0	0.2
440	Transportation Services	-0.6	0.1

Indirect	Sector	Value Jobs	% of Total
3	Ranch Fed Cattle	-295.9	32.0
5	Cattle Feedlots	-116.1	12.6
4	Range Fed Cattle	-115.8	12.5
447	Wholesale Trade	-61.9	6.7
13	Hay and Pasture	-46.3	5.0
26	Agricultural- Forestry- Fishery Services	-39.1	4.2
435	Motor Freight Transport and Warehousing	-26.7	2.9
6	Sheep- Lambs and Goats	-21.4	2.3
474	Personnel Supply Services	-21.1	2.3
56	Maintenance and Repair Other Facilities	-18.3	2.0

Induced	Sector	Value Jobs	% of Total
454	Eating & Drinking	-31.4	10.4
455	Miscellaneous Retail	-20.9	6.9
490	Doctors and Dentists	-18.1	6.0
492	Hospitals	-14.9	4.9
447	Wholesale Trade	-12.1	4.0
450	Food Stores	-11.8	3.9
449	General Merchandise Stores	-9.3	3.1
451	Automotive Dealers & Service Stations	-8.8	2.9
488	Amusement and Recreation Services- N.E.C.	-7.8	2.6
462	Real Estate	-7.4	2.4

Total	Sector	Value Jobs	% of Total
3	Ranch Fed Cattle	-300.7	18.1
58	Meat Packing Plants	-252.9	15.2
447	Wholesale Trade	-198.6	12.0
5	Cattle Feedlots	-117.7	7.1
4	Range Fed Cattle	-117.3	7.1
435	Motor Freight Transport and Warehousing	-57.4	3.5
13	Hay and Pasture	-46.4	2.8
26	Agricultural- Forestry- Fishery Services	-39.9	2.4
454	Eating & Drinking	-33.9	2.0
474	Personnel Supply Services	-25.1	1.5

Table 3.3 Total Value Added Impact

Direct	Total Value Added Impact Sector	Value $	% of Total
447	Wholesale Trade	-10,367,567	45.7
58	Meat Packing Plants	-9,436,114	41.6
435	Motor Freight Transport and Warehousing	-1,414,915	6.2
59	Sausages and Other Prepared Meats	-1,007,927	4.4
433	Railroads and Related Services	-125,760	0.6
5	Cattle Feedlots	-80,784	0.4
3	Ranch Fed Cattle	-69,914	0.3
437	Air Transportation	-68,431	0.3
436	Water Transportation	-43,052	0.2
440	Transportation Services	-33,857	0.1

Indirect	Sector	Value $	% of Total
5	Cattle Feedlots	-6,750,633	20.2
447	Wholesale Trade	-5,144,403	15.4
3	Ranch Fed Cattle	-4,901,739	14.7
462	Real Estate	-1,770,071	5.3
4	Range Fed Cattle	-1,600,782	4.8
435	Motor Freight Transport and Warehousing	-1,348,690	4.0
456	Banking	-1,152,920	3.5
56	Maintenance and Repair Other Facilities	-967,156	2.9
475	Computer and Data Processing Services	-749,624	2.2
26	Agricultural- Forestry- Fishery Services	-608,765	1.8

Induced	Sector	Value $	% of Total
461	Owner-occupied Dwellings	-1,786,489	11.3
447	Wholesale Trade	-1,004,016	6.3
490	Doctors and Dentists	-964,403	6.1
462	Real Estate	-907,646	5.7
492	Hospitals	-831,259	5.3
454	Eating & Drinking	-727,231	4.6
455	Miscellaneous Retail	-655,223	4.1
456	Banking	-644,514	4.1
451	Automotive Dealers & Service Stations	-537,988	3.4
450	Food Stores	-516,092	3.3

Total	Sector	Value $	% of Total
447	Wholesale Trade	-16,515,986	23.0
58	Meat Packing Plants	-9,656,692	13.4
5	Cattle Feedlots	-6,844,267	9.5
3	Ranch Fed Cattle	-4,981,015	6.9
435	Motor Freight Transport and Warehousing	-2,893,743	4.0
462	Real Estate	-2,677,717	3.7
456	Banking	-1,797,434	2.5
461	Owner-occupied Dwellings	-1,786,489	2.5
4	Range Fed Cattle	-1,620,994	2.3
56	Maintenance and Repair Other Facilities	-1,195,530	1.7

CONCLUSION

The meat processing industry is an important part of the Washington economy. Not only is it important in terms of the total economy, but it is also one of the top players in the food processing sector. A major part of the industry is exports to foreign countries, which recently, because of the BSE-scare in beef animals, has been largely restricted. This analysis examined the industry as part of the Washington economy and the effect a substantial decrease in exports would have on it. It is clear that such a decrease would severely limit the operations of the industry, resulting in a substantial loss of jobs as well as a decrease in the purchases of inputs from downstream suppliers. These effects would be felt primarily within Washington State, where they would ripple throughout the cattle industry, causing a great deal of economic loss in rural areas statewide. Using this type of model one can see by the devastating shock it had on Washington, what kind of effects BSE can have nationally.

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