U.S. and Canadian Beef Export Price Flexibilities: A Comparison

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This paper provides a "what-if" analysis of a possible outbreak of BSE with specific focus on the ensuing decreases in quantities demanded of exported beef products by foreign consumers unconvinced that BSE does not directly cross the species barrier. We make use of an inverse import demand system by which we estimate changes in quantities demanded of 5%, 10%, 20% and 30% to estimate responses in price and the potential impact on the cattle industry in Canada and the U.S.

Keywords: BSE, ITSUR, Beef Export, Canada, U.S.

1. Introduction and Background

To date, Canada has had three confirmed cases and the United States has had two confirmed cases of bovine spongiform encephalopathy, or BSE[i]. The first Canadian case was confirmed on May 20, 2003; the second on January 2, 2005; and the third on January 11, 2005. In all three cases, no meat from the animals entered the human food system (Canadian Food Inspection Agency).The first U.S. case was apparently a Canadian import[ii], the second a twelve-year-old Texas-born cow[iii] [3]. Although the disease has spread to 21 countries worldwide[iv], for now it appears the respective agencies responsible for food safety in the U.S. and Canada (the FDA and the Canadian Food Inspection Agency) have the appropriate safeguards in place to protect cattle herds from widespread outbreaks of this disease. Although perhaps remote, the possibility for an outbreak nevertheless exists. This paper provides a "what-if" analysis of a possible outbreak of BSE with specific focus on the ensuing decreases in quantities demanded of exported beef products by consumers unconvinced that BSE does not directly cross the species barrier[v]. To achieve this, we make use of an inverse import demand or export supply system, which permits the substitution of a variety of quantities demanded to generate changes in price. Our substitutes consist of decreases in quantity demanded of 5%, 10%, 20% and 30%.

Globally, the U.S. is the largest beef producer with annual export revenues of approximately $3 billion. U.S. beef exports to Japan, the largest importer of U.S. beef, once exceeded $1 billion. However, with the first confirmed case of BSE in the United

States, Japan banned almost 100% of U.S. beef imports[vi]. Japan has now lifted that ban nearly 2 years after the first US case triggered the initial boycott. The other major U.S. beef importers include Canada, South Korea, and Mexico. Major Canadian beef importers include Japan, South Korea, Taiwan, Mexico, and China, totaling nearly 500 million Canadian dollars in export revenues[vii]. Whereas the U.S. experienced an almost 100% decrease in beef exports to Japan, Canadian exports to Japan suffered only an 18% decrease in light of the confirmed Canadian BSE cases[viii].

A varied body of research examines the *BSE crisis in the U.K and continental Europe*. A few authors have focused on the effects of BSE publicity in the form of media coverage on U.K. beef consumption: By analyzing farm-level demand for red meats, Fousekis and Revell [11] confirm that "meat scares," measured as the stock of publicity, have had a statistically significant impact on price formation at the farm level in the U.K. Burton and Young [4] determine that publicity surrounding BSE (measured via the construction of a media index) has had a significant effect on the allocation of consumer expenditure among meats in the U.K. Burton, Young and Cromb's [5] 1999 study confirms short-run shifts in meat expenditure shares due to BSE, but find that long-run effects were smaller than predicted by Burton and Young's [4] 1996 study—possibly due to the declining marginal impact of BSE media coverage. Lloyd, McCorriston, Morgan and Rayner [21] consider the impact of food scares (BSE) on U.K. beef prices at the retail, wholesale and producer levels over the 1990s. They find that negative publicity of food safety had the effect of an inward (or leftward) shift of the demand function at all three levels. Herrmann, Thompson and Kritschik-Bautz [12] attempt to measure the impact of advertising aimed at increasing the regional demand for Bavarian beef. They find regional promotion of Bavarian beef increased demand by 4.6%. However, this increase in demand was offset by a 6.9% decrease in consumption due to information and public awareness of BSE spanning the same time period.

Research into the *economic effects of BSE in the United Kingdom* has been conducted by Mainland and Ashworth [22], who develop a forecasting model composed of a regression model and ARIMA-type model, find that the BSE effect on revenues from finished cattle in the U.K. amounted to a loss of 8.6 percent and 11.8 percent over one year; Dnes [9], who applies a standard neoclassical analysis to alternative regulatory or institutional responses to the BSE crisis experienced by the U.K., concludes that non-intervention in the BSE crisis is the optimal solution; and Caskie, Davis and Moss [6, 7], who develop a regional input-output model to measure the economic impact of the BSE crisis on the U.K.

The *effects of BSE on other European* countries have been studied by Mazzocchi [23], who finds that the BSE crisis has had a negative impact on cattle prices in Italy. Alperovitch and Will [1] engage in a comparative assessment of the exposure level of the BSE agent in the U.K. and France and conclude that the French population has had a lower exposure to the BSE agent than the U.K. population. And Verbecke and Ward [28] analyze fresh meat consumption in Belgium over the years 1995 – 1998 and find a particularly negative impact on beef and veal expenditures in favor of beef substitutes, particularly pork.

BSE studies producing demand impact estimates using only the direct price flexibility method have been published by Jin and Koo [16], who find that Japanese meat demand is currently unstable and has undergone a structural change

synchronized with the BSE outbreak in Japan of mid-September 2001, and Sanjuán and Dawson [25], who focus on long-run effects of the BSE crisis on the producer-retail price transmission for beef and other protein sources in the U.K., find a structural break in the beef price relationship in February 1996 (the year in which vCJD[ix] was initially linked to the consumption of BSE-contaminated beef by the media).

Keefe and Jolly [18] extend the commodity price relationship body of knowledge with their direct impact estimate study using both direct and indirect price flexibilities. They employ the Seemingly Unrelated Regression (SUR) model to determine price flexibility of shrimp and changes in quantity supplied on world shrimp prices. Keefe and Langley [19] also use both direct and indirect methods of determining price flexibilities in their comparison between the U.K. and U.S. beef export markets. They find a significant increase in beef prices in response to a decrease in demand for imported beef products due to a decline in consumer confidence in the safety of beef products.

Since the responsiveness of buyers to changes in quantity supplied reflects the overall demand for a product, an evaluation of the changes in export supply from Canada and the United States in the international beef industry will be used to analyze the effects of beef import demand/export supply on world price. In this study, we construct an inverse demand system utilizing the Iterative Seemingly Unrelated Regression, or ITSUR, model of beef import demand/export supply to analyze price flexibilities resulting from a 5%, 10%, 20%, and 30% change in quantity demanded assuming as a catalyst a hypothetical widespread outbreak of BSE among domestic herds. Since demand for beef varies between different importers, the price flexibilities between the two exporting countries reflect responses to supply changes. In the long run, as consumer confidence declines due to BSE, and export supply lags behind demand, we expect world beef price to increase.

We have chosen to compare beef export price flexibilities from the United States with those of Canada because both countries have similar export markets and each has experienced only a very small, but very comparable, incidence of BSE. We further assume beef importers remain unconvinced that BSE does not directly cross the species barrier[x].

The remainder of this paper is organized in the following way: a brief discussion on inverse demand functions and price flexibility is followed by data and methodology sections, results and discussion section, and a conclusion.

2. Inverse Demand Functions and Price Flexibilities

According to Shang [26] price flexibility can be defined as the inverse of price elasticity of demand, or the responsiveness of buyers to changes in quantity supplied measured by the percentage change in price from a 1-percent change in quantity demanded. Negative price flexibilities confirm the existence of price flexibility, and positive values indicate price inflexibility [2]. Price flexibilities are widely utilized in agricultural pricing decisions providing producers with the ability to forecast the price they will receive as total supply increases or decreases [15]. With this information, producers will be able to adapt production schedules around estimated prices to maximize profits, but only a limited number of studies examine price

flexibility estimates from an inverse demand system (see for instance Moore [24], Alt [2], Houck [13, 14], Christensen and Manser [8], and Huang [15]) and even fewer provide flexibility estimates for agricultural cash crops such as beef. This important economic area has been overlooked in the international beef industry due to lack of experience about the requirements for modeling price flexibilities.

The issue of price flexibility remains an unresolved controversy. Eales [10] criticized Huang's proposition of using an inverse demand function to directly estimate price flexibilities by concluding that inversion of conditional estimates should not be used if unconditional sensitivity estimates are of main interest. As such, we attempt to estimate price flexibilities using both the direct and indirect methods (see Keefe and Jolly [18], Keefe and Langley, [19]) to determine the benefits of using price flexibilities for market trend evaluation based on short-run supply and the nature of the product.

3. Methodology

The model presented in this study examines the international import demand/export supply for beef from the United States and Canada. In this study, the focus is on four important aspects of the international beef market that are used as determinants of beef price: export beef quantity demanded, real per capita income, the price of beef substitutes, and the real exchange rate. The following inverse import demand model may be normalized with respect to quantity and unbiased parameter estimates generated.

$$\text{LN } P_{\text{Beef U.S.}} = \beta_1 + \beta_2 \text{ LN } Q_{\text{Beef U.S.}} + \beta_3 \text{ LN } INC_{\text{U.S.}} + \beta_4 \text{ LN } P_{subs} + \beta_5 \text{ LN ER} + \mu \quad (1)$$

$$\text{LN } P_{\text{Beef CA}} = \beta_6 + \beta_7 \text{ LN } Q_{\text{Beef CA}} + \beta_8 \text{ LN } INC_{CA} + \beta_9 \text{ LN } P_{subs} + \beta_{10} \text{ LN ER} + \mu \quad (2)$$

where $P_{BeefU.S.}$ and P_{BeefCA} are the deflated prices of beef exports in 1000 U.S. dollars per metric ton from the United States and Canada. $Q_{\text{Beef U.S.}}$ details the quantity demanded of beef exports from the U.S., while $Q_{\text{Beef CA}}$ represents the quantity demanded of beef exports from Canada, both in metric tons. Both the $Q_{\text{Beef U.S.}}$ and the $Q_{\text{Beef CA}}$ variables are expected to display negative signs. The variable INC (real per capita income of major U.S. and Canadian beef importers) is used in the analysis to account for income consumption effects for beef from an import demand perspective. Increases in income (other factors constant) should positively affect the quantity consumed of beef since the expected sign of income is historically positive. P_{subs} is used to specify the effects of the price of beef substitutes on the price of beef exports by taking a weighted price average of chicken and pork for the United States and Canada separately[xi]. Chicken and pork are typically assumed to be substitutes for beef in western countries. For instance, Karagiannis, Katranidis and Velentzas [17] construct an almost ideal demand system for meat in Greece and find that chicken, pork and lamb are substitutes for beef. Further, Caskie, Moss and Davis [6] show a sustained increase in consumption of poultry, lamb and pork in the United Kingdom during the height of the BSE crisis. Since lamb consumption in North America is minimal compared to lamb consumption in most European countries, we have chosen not to include lamb as a substitute for beef. Because beef consumption has historically increased with increases in the prices of chicken and pork, the expected sign is positive.

Finally, the ER variable describes an index of real foreign exchange rates. This exchange rate index was constructed using real exchange rates between beef importing countries of the United States and Canada and the two countries, respectively. The index includes all currencies which have significant impact on the beef importing/exporting market of the U.S. and Canada and contains all the countries that contribute to those countries' total international beef trade. This variable is expected to exhibit a negative sign. As importer currency values increase abroad, producers in an exporting country receive less revenue for their beef and will be less inclined to sell on the international market.

It is expected that $\beta_2 < 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 < 0$, $\beta_7 < 0$, $\beta_8 > 0$, $\beta_9 > 0$, and $\beta_{10} < 0$, and assumed to be independently and identically distributed with mean zero and variance of σ^2. It is further assumed that the equations are unbiased, efficient, consistent, and free of multicollinearity. Evidence suggests that the double log linear functional from, as employed here to account for price flexibilities and data transformations, is superior to a linear version [20]. The set of demand functions will be estimated using the Iterative Seemingly Unrelated Regression (ITSUR) model to determine if the disturbances in each equation are correlated. Correlated disturbance terms would indicate a relationship between the U.S. and Canadian beef markets. ISTUR is further employed to determine if the error terms in the set of equations are also correlated allowing an improvement of efficiency in the estimation of the model (See Pindyck and Rubinfeld [25]). We expect the error term for the U.S. inverse beef import demand equation used in the ITSUR model to be correlated with the disturbances in the Canadian inverse beef import demand equation. To determine if the equations are correlated and if there is an increase in efficiency over ordinary least squares in regressing both demand equations together, we utilize the generalized least squares estimator. By calculating a SIGMA value using the covariance and variance estimates developed from both equations, we measure the percentage by which efficiency of the model increases. The following equation represents the SIGMA value as it is calculated from the estimated ITSUR covariance and variance matrix.

$$\rho_{\varepsilon\mu} = \frac{\sigma_{\varepsilon\mu}}{(\sigma_{\varepsilon})(\sigma_{\mu})} \tag{3}$$

A large SIGMA value indicates that the equations are correlated and that efficiency improvement has been achieved.

4. Data

The Iterative Seemingly Unrelated Regression (ITSUR) model is applied to annual data from 1970 to 2003 of U.S. and Canadian beef export prices and quantities, real per capita income from major U.S. and Canadian beef importers, an index of real foreign exchange rate between major beef importing countries and the U.S. and Canada, and a weighted price average of U.S. and Canadian beef substitutes. U.S. and Canadian beef export prices and quantities as well as U.S. and Canadian prices of beef substitutes are from the Food and Agriculture Organization of the United Nations (FAO) statistical databases (FAOSTAT) found online at www.fao.org. Beef importer per capita income data were taken from the United Nation's online Common Database (CDB),[xii] and foreign exchange rate data were taken from the

International Financial Yearbook,[xiii] published online by the International Monetary Fund.

5. Results and Discussion

Tables 1 and 2 present the descriptive statistics of the variables employed in the U.S. and the Canada models. Each table provides the mean, standard deviation, minimum, and maximum values of the variables. The estimated Iterative Seemingly Unrelated Regression (ITSUR) model substantiates the theory that the disturbance and error terms in both equations are correlated thus establishing a relationship between the Canadian and U.S. beef export markets. Using the covariance and variance statistics in Equation (3), a SIGMA value of 0.32 was calculated indicating that the estimation of both equations simultaneously increased efficiency of the model by 32%. From this observation, it can be stated that both equations should be used concurrently to produce a model that accurately represents demand and price fluctuations, which could result from a BSE crisis in both Canada and the United States.

Equations (1) and (2) are estimated using a double log inverse export demand function with the ITSUR model. A cursory examination of the correlation matrix indicates that multicollinearity does not appear to be a problem. Table 3 reports the results of the ITSUR analysis of the determinants of the inverse demand equations of beef exports from Canada and the United States to major international importers.

Results of the ITSUR model in Table 3 contain eight statistically significant structural coefficients at the $\alpha = 0.05$ level that exhibit the expected signs. Positive relationships are established between the price of beef and real per capita income and the price of beef substitutes while a negative relationship exists between price and quantity and exchange rates for both equations and show that income, substitute price, exchange rate, and quantity demanded all significantly influence the U.S. and Canadian beef export markets. In the U.S. equation, the model explains 83% of the variation in beef export price over the 33-year period. The model explains 92% of the variation in Canadian beef export price over the same length of time. The model also demonstrates no signs of heteroscedasticity or autocorrelation as summarized in the regression diagnostics (Table 4). The model and resulting diagnostics contribute apparent support to the explanation of beef export price variations and evaluating supply changes from Canada and the United States in the international beef industry.

Table 1: *Descriptive Statistics—U.S. Variables Used in Model Development*

	Mean	Standard Deviation	Minimum	Maximum
$Quantity_{Beef}$	45,033.88	44,422.86	1,016.00	143,628.00
$Price_{Beef}$	2.00	0.51	1.05	3.21
$Price_{Substitutes}$	1.96	0.39	0.95	2.68
Real Per Capita Income	6,766.21	5,046.26	591.82	14,665.47
Exchange Rate	6.08	1.58	3.79	8.05

Note: Quantity is measured in metric tons, and prices and income are measured in US dollars

Table 2: *Descriptive Statistics—Canadian Variables Used in Model Development*

	Mean	Standard Deviation	Minimum	Maximum
$Quantity_{Beef}$	45,033.88	44,422.86	1,016.00	143,628.00
$Price_{Beef}$	2.00	0.51	1.05	3.21
$Price_{Substitutes}$	1.96	0.39	0.95	2.68
Real Per Capita Income	6,766.21	5,046.26	591.82	14,665.47
Exchange Rate	6.08	1.58	3.79	8.05

Note: Quantity is measured in metric tons, and prices and income are measured in U.S. dollars.

Table 3. *ITSUR Analysis and Estimated Price Flexibilities of Beef Exports from the United States and Canada*

United States

	Parameter Estimates	t-Values	Indirect Flexibilities	Confidence Interval
$Quantity_{Beef}$	-1.23	5.58*	-0.90	{-1.30, -0.71}
$Price_{Substitutes}$	0.39	2.30*	0.88	{0.53, 1.09}
Real Per Capita Income	0.30	2.97*	0.59	{0.20, 0.91}
Exchange Rate	-0.22	2.55*	-0.47	{-0.67, -0.17}

Canada

	Parameter Estimates	t-Values	Indirect Flexibilities	Confidence Interval
$Quantity_{Beef}$	-0.27	3.61*	-0.42	{-0.43, -0.12}
$Price_{Substitutes}$	0.13	2.73*	0.67	{0.04, 0.73}
Real Per Capita Income	0.48	5.49*	0.25	{0.09, 0.51}
Exchange Rate	-0.35	2.04*	-0.39	{-0.52, -0.29}

* Statistically significant at $\alpha \leq .05$(calculated with $\alpha<=.05$)

The Brusch-Pagan test established an F-statistic of 1.95 and 2.41 for the United States and Canadian beef export equations, respectively, which when compared to a critical value of 3.94 confirms that the null hypothesis of homoscedasticity cannot be rejected. The Durbin Watson statistics allude to no serial correlation, and Ramsey's RESET tests confirm the absence of specification errors (See Table 4). A test for Cointegration was performed to check for any spurious correlation between regressors. An F-statistic of 1.57 for the U.S. beef equation and 2.10 for the Canadian beef equation are both smaller than the critical value of 5.86. Therefore, we fail to reject the null hypothesis of no spurious correlation.

The reciprocal of the direct price flexibility forms the lower limit of the direct price elasticity (See Houck [13]). As shown in Table 3, the indirectly calculated price flexibilities only deviate slightly from the direct calculations extracted from the regression computation. According to Houck, the estimation of confidence intervals of the indirect price flexibilities are calculated to determine the extent of deviation. The $Q_{\text{Beef U.S.}}$ variable produced a 95% confidence interval of -1.30 to -0.71 (obtained from the regression results), which includes the direct price flexibility of –1.23 and indirect flexibility of -0.90. The $Q_{\text{Beef CA}}$ variable produced an interval of -0.43 to –0.12, which includes the direct price flexibility of –0.27 and indirect flexibility of -0.42. Both the directly calculated price flexibilities and the indirectly calculated price flexibilities fall within the limits of the intervals. The results indicate that the direct price flexibility estimates are not significantly different from the indirectly calculated flexibilities for evaluating the effects of beef supply on world price. These 95% confidence intervals suggest that it is very likely that these intervals will contain the directly calculated flexibility, and the intervals obtained in this study can be expected to contain the true flexibility 95% of the time. Since direct price flexibility estimates were consistent with indirect estimates, only the direct estimates are presented below.

Since demand for beef varies between the different importers, the price flexibilities between the two exporting countries reflect the response to supply changes. The price flexibility for the quantity demanded of U.S. beef exports is –1.23 and -0.27 for Canada. Thus, a 1% decrease in beef supply from the U.S. will increase price by approximately 1.23%, whereas a 1% decrease in beef supply from Canada will increase price by 0.27% implying a disparity in demand between the major importing countries and a relatively sizable response in price by the U.S. beef importers. In the international beef market, cross price flexibilities for the price of substitutes were 0.39 for the U.S. and 0.13 for Canada indicating that beef exports from either country have a lower response to substitute price variations than the quantity demanded for beef. These results could be an indication that the price of beef is highly responsive to changes in export supply as would be experienced during a BSE outbreak in the U.S. Price is less responsive to changes in substitute prices.

Calculated real per capita income flexibilities for the United States and Canada's beef importers are 0.30 and 0.48 respectively, indicating that beef is a normal good with a greater price response from importers of Canadian beef than from importers of U.S. beef. A 1% increase in the importing countries' income will increase the quantity of beef consumed thereby increasing the export price by 0.30% in the U.S. and by 0.48% in Canada. Countries that import from Canada, such as Taiwan and China , have a greater tendency of decrease the amount of imported beef with

Table 4. *Regression **D**iagnostics for ITSUR Model*

Test	F-statistic U.S. Beef Exports	F-statistic Canada Beef Exports
Number of Observations	33	33
Serial Correlation:		
Durbin-Watson	1.97	2.13
Heteroscedasticity:		
Brusch-Pagan	1.57	2.41
Specification:		
Ramsey RESET	0.72	0.27
Root MSE	0.35	0.24
R^2	0.83	0.92
Adjusted R^2	0.81	0.91
F-Test	5.86*	7.75*
Spurious Correlation:		
Test of Cointegration	1.57	2.10

*Statistically significant at $\alpha \leq .05$
(Calculated with $\alpha \leq .05$)

increase in price than do the major U.S. importers. In the United States and Canadian beef export markets, exchange rate flexibilities are -0.22 and -0.35, revealing an almost identical price response to changes in the exchange rate. A 1% decrease in the exchange rate will increase the U.S. price of beef exports by 0.22% and the Canadian price by 0.35%. Divergences in exchange rates over time demonstrate that U.S. and Canadian producers are less concerned with international exchange rate fluctuations than they are with major supply changes.

Response of Price to Quantity Fluctuations

In order to assess the relative price response to fluctuations in export supply from diseases, such as BSE, the ITSUR model of beef import demand from the U.S. and

Canada is used to describe hypothetical decreases in import quantity demanded based on possible repercussions emerging from a food safety crisis. As stated above, there is a sizable difference in the demand between the U.S. and Canadian importing countries and a substantial response in price by the U.S. beef importers. Using the estimated direct method of price flexibility estimation in conjunction with hypothetical decreases in beef export supply, export prices in the U.S. and Canada were calculated to determine the effects of a reduction in import demand/export supply on price. Should major reductions in supply or demand occur as they did during the first confirmed U.S. BSE case in 2003, the calculated price flexibilities will provide producers an understanding and indication of the resulting price increase that will accompany an import demand decrease. Given the U.S. beef price flexibility of –1.23, a 5% decrease in import quantity demanded results in a 7.4% increase in price. Furthermore, a 10% decrease results in a 15.2% increase in price, a 20% decrease results in a 26.4% increase in price, and a 30% decrease in import quantity demanded results in a 37.6% increase in price. Given the Canadian direct price flexibility of -0.27, a 5% decrease in import quantity demanded results in a 2.3% increase in price, a 10% decrease results in a 6.7% increase in price, a 20% decrease results in a 14.4% increase in price, and a 30% decrease in import quantity demanded results in a 20.5% increase in price.

The largest increase in price was calculated between the 10% and 20% decrease in import quantity demanded; therefore, a decrease in quantity demanded of beef exports from either the U.S. or Canada between these two percentages would cause a large jump in price on the international market with the greater response occurring in the U.S. market. Should world quantity demanded (or export supply) by beef consumers decrease significantly due to food-borne diseases such as BSE and due to the associated decreased in international consumer confidence, our results indicate that the price of beef will increase substantially. Our analysis reveals that the U.S. is at a far greater disadvantage than Canada when confronted with a decrease in demand by their major importers since the U.S.'s international beef price is predicted to be highly responsive to any decreases in quantity demanded.

6. Conclusion

Since the BSE debacle in the U.K. in the 1990s, producers have feared the near or total loss of their beef herds and the collapse of domestic and international demand resulting from decreases in consumer confidence (consider, for instance, the import ban placed on U.K. beef by the European Union in 1996, which resulted in the near ruination of the U.K. beef industry). After the discovery of a case of BSE in the U.S. in 2003, consumers seemed undeterred in their beef consumption, but importers of U.S. beef immediately lost confidence in the safety of the U.S. beef supply, causing a $500 million decrease in export revenues. Unlike the U.S., Canada experienced only a small reduction in import demand as evidenced by the modest calculated price flexibility and the minor response of price to changes in quantity. Since the second confirmed case in the U.S., waning confidence of beef importers continues; both U.S. and Canadian producers are under great pressure to eliminate the threat of BSE from the beef industry.

In this paper, estimation of U.S. and Canadian beef export markets for the years 1970 through 2003 is achieved by applying the ITSUR model to beef import demand equations using price as the dependent variable. The paper introduces hypothetical decreases in the import demand for beef using directly and indirectly estimated price flexibilities to evaluate the impact of a disease outbreak on beef price in both the United States and Canada. The results of our "what-if" analysis suggest a near immediate reaction to a threat to beef safety in the United States with a less-intense reaction in Canada. Importers are likely to immediately lose confidence in the safety of beef and therefore decrease demand significantly. Our analysis also indicates no significant difference between directly and indirectly calculated price flexibilities for this beef model. All of the directly calculated price flexibilities fell within the lower limits of the intervals, suggesting that one method is not more advantageous than the other for evaluating the effects of import quantity demanded on price.

Based on the differences in demand for beef from Canada and the U.S. and the calculated hypothetical decreases in quantity demanded, the price of beef will see a substantial increase of anywhere between 7.4% to 37.61% in the United States but only between 2.3% and 20.5% in Canada. The largest increase in price from either country was calculated between the 10% and 20% decrease in quantity demanded. Overall, the results indicate that if import demand/export supply should plummet due to diseases such as BSE and the associated decrease in international consumer confidence, the price of beef is predicted to increase substantially. This outcome suggests that if in the long-run, beef producers can maintain or even increase supply, they will benefit greatly from higher prices. It is the short-run effects (such as the loss of cattle herds and associated revenues) that will cause the greatest damage to those producers not prepared to cope with an outbreak.

Although the threat of an extensive BSE outbreak in the U.S. seems remote at this time, the U.S. Department of Agriculture plays an integral and necessary part in the process of ensuring the safety of U.S. beef. Armed with the results of this research, which shows significant losses in beef industry revenues given our hypothetical food safety scare and the associated decrease in international consumer confidence, beef producers should join the ranks of those appealing to relevant governmental agencies to continue to enforce safe beef rearing methods and food handling practices.

Isolating the effects of the individual BSE occurrences in each country could be achieved through the use of a dummy variable. However, 2004 (and even more recent) data in the form in which it was acquired for this study are not available at this time. Furthermore, the fact that the occurrences of BSE in both the U.S. and Canada have been relatively recent (one each in 2003, one U.S. case in 2004 and the remainder of Canadian cases in 2005) indicates the need to allow a few years to pass before the isolated effects can be captured and measured. We are aware that this presently represents a limitation of our study that can be remedied as additional data become available.

We plan to continue our data collection over the next several years to enable us to isolate the effects of the individual occurrences of BSE in each country.

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Endnotes

[i] Widely known as mad-cow disease, it is believed that links exist between BSE and the human variant Creutzfeld-Jacob Disease, or CJD.

[ii] This case was confirmed on December 25, 2003; the animal originated in Alberta, Canada.

[iii] This particular animal was sold through a livestock sale in November of 2004 and transported to a packing plant. The animal was dead upon arrival and therefore refused by the packing plant. At a pet food plant, where the dead animal was then shipped, the carcass was sampled for BSE and destroyed (USDA, 2005).

[iv] Anderson, Paul and Jonathan Riley, Farmers Weekly, vol 139 (14), p. 7 (10/3/2003).

[v] The results of research searching for a link between BSE and vCJD remain inconclusive.

[vi] The U.S. is calling for Japan to resume beef imports in return for endorsement of Japanese membership in the U.N. Security Council <http://news.yahoo.com, 3/18/2005>. According to a Japanese government spokesman, this most recent BSE case in the U.S. will not affect deliberations on ending a 19-month ban on American beef imports "Japan: U.S. mad cow case won't affect ban" <http://news.yahoo.com, 6/30/2005>

[vii] "11th Straight Year of Record Sales for Canadian Beef Exports," The Canada Beef Export Federation Newsletter, p. 1, March 2003.

[viii] Ibid.

[ix] The human version of BSE is a new variant of Creutzfeld-Jakob Disease, or vCJD.

[x] It has been suggested, but not proven, that BSE has crossed the species barrier and represents a threat to regular consumers of beef products. To date, all but ten of the 153 known vCJD deaths occurred in Britain (Bergman, Brian, "Doubting our prime cuts," Maclean's, 1/26/2004, Vol. 117, Issue 4, p. 26 – 27).

[xi] The price of beef substitutes for each country was calculated by adding the price of chicken times the quantity of chicken to the price of pork times the quantity of pork and dividing this total by the quantity of chicken added to the quantity of pork.

[xii] http://unstats.un.org/unsd/databases.htm

[xiii] http://www.imf.org/external/pubs/cat/longres.cfm?sk=397.0.