BSE and the Dynamics of Beef Consumption: Influences of Habit and Trust

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Abstract

This study relates habit persistence and trust to recurring food safety incidents in the context of a series of three BSE incidents in Canada. We examined the dynamics of monthly beef expenditure shares of a sample of Canadian households for monthly time periods during year 2002 through 2005 using micro level panel data which followed meat expenditures by Canadian households before and after the first three BSE cases which were discovered in 2003 and 2005. Our results suggest that households' reactions to the first three BSE events followed a similar general pattern: households reduced beef purchase expenditures following the discovery of BSE but these expenditures subsequently recovered, suggesting that concern diminished over time. Following the first BSE event, we identified an immediate negative impact on beef expenditures. However, in the case of the second and third BSE events, this negative impact was not evident until two months after these BSE announcements. In each of the three cases, the negative impact of BSE on beef purchase expenditures was limited to no more than four months. Assessment of how habit persistence affected beef expenditures indicates that this influence limited households reductions of beef purchases following the BSE events, but the effects of habit diminished subsequent to the initial event. Regarding the role of trust in shaping households' reactions to BSE, we found that households' respondents whose answers to standardized questions suggest that they are not "trusting" individuals were more sensitive to the food risks identified by the BSE events.

Key words: BSE, habit, and trust

1. INTRODUCTION

Canada's first detected case of Bovine Spongiform Encephalopathy (BSE) in a domestically raised bovine animal was announced on May 20, 2003[1]. There were rapid and severe consequences of this discovery. International borders to Canada's bovine exports were immediately closed following the BSE announcement (Roy and Klein, 2005). The Canadian beef industry suffered major financial costs due to the international border closures and consequent plunge in cattle prices. Over a year later, two more BSE events were confirmed, in Alberta. One of these was announced on January 2, 2005; the second on January 11, 2005. From 2003 until 2008, more than 10 cases of BSE were reported in Canada (Dessureault and Myles, 2008).

Consumers' responses to domestic BSE outbreaks have been explored in many nations where this animal disease has occurred. International evidence suggests that beef consumption fell dramatically after the discovery of BSE in most of these instances. For example, Japanese beef consumption fell by 70 percent in response to the first case of BSE in Japan, on September 11, 2001 (McCluskey et al., 2005). The decline in beef purchases by European populations after widespread and numerous incidents of BSE (and associated human deaths) had occurred in Western Europe has been documented, for example, in Great Britain (Burton and Young, 1996) and Italy (Mazzocchi and Lobb, 2005). Studies of beef consumption by U.S. consumers found negative, but short-lived, impacts of North American BSE incidents on beef demand (e.g., Kuchler and Tegene, 2006). Unlike the experience in other countries, statistics on aggregate Canadian beef disappearance suggest that Canadian beef consumption increased in both 2003 and 2005. According to Statistics Canada (2004), per capita beef consumption in Canada increased

from 13.5 kilograms (kg) in 2002 to 14.2 kg in 2003, a 5 percent gain. In 2005, a 3.6 percent increase in Canadian beef consumption was reported (Statistics Canada, 2006). Empirical studies on Canadian consumers' responses to domestic BSE incidents have mainly focused on the 2003 BSE incident. Peng et al. (2004) identified a significantly negative but small impact of Canada's first domestic BSE incident on fresh meat consumption in Alberta using a demand system approach. Maynard et al. (2008) examined BSE impacts on the retail sales of beef entrees in both Alberta and Ontario and concluded that while the 2003 BSE incident stopped some Ontario consumers from purchasing beef entrees in the short-term, there was no evidence that Alberta consumers responded to media reports on this BSE event. Moreover, Maynard et al.(2008) found that the BSE incident had no impacts on the quantity of beef entree consumption for either Alberta or Ontario consumers who continued their consumption of beef entrees after this BSE occurrence.

Recurring food safety incidents are not new phenomena. Other familiar examples include multiple outbreaks of Listeria, Salmonella, Avian Influenza, and other human and animal diseases. As well, habit persistence in food consumption has been recognized to exist. The role of trust in peoples' responses to food safety events is also of interest. It is plausible to postulate that recurring food safety events may lead to changes in purchasing patterns for certain food products, including changes in habits. There is empirical evidence that consumers adjust their meat consumption habits during food safety shocks and gradually return to past consumption patterns as their concerns diminish (Saghaian and Reed, 2007; Mazzocchi and Lobb, 2005). Previous literature, however, has paid little attention to recurrence of food safety events or related these to the role of consumption

habits in shaping individuals' responses to food risks. Furthermore, trust has been suggested by some recent literature as an important factor in analyzing consumer behavior under risk (see Lobb, 2005 for a review). The current study relates recurring food safety incidents to both habit persistence and trust in the context of the series of the first three incidents in Canada in which a domestic cow was found to have BSE.

2. LITERATURE REVIEW

In the context of varying national occurrence and as a major food risk concern for consumers, BSE events have attracted much attention worldwide. Previous studies mainly focused on consumer valuation of food risk reduction (e.g., Dickinson and Bailey, 2002), the impacts of BSE events on meat demand (e.g., Burton and Young, 1996), and consumers' responses to media reports on BSE (e.g., Piggott and Marsh, 2004). Negative impacts of BSE occurrence on beef demand and price have been confirmed by empirical studies in Japan (Peterson and Chen, 2005), Europe (Burton and Young, 1996) and the U.S. (Kuchler and Tegene, 2006). Burton and Young (1996) showed that the BSE outbreak in Great Britain reduced beef consumption in both the short-run and the long-run. Jin and Koo (2003) identified structural change in Japanese meat consumption resulting from BSE events in that nation. Although it is a common approach to estimate the effect of a food scare on consumer preferences by use of a single constant shifter on the intercept of an estimated demand function, in some circumstances of food safety events it appears more plausible to postulate that impacts on demand occur over time. There is growing interest in investigating the time period and extent during which consumers react to a BSE outbreak. Some studies account for gradual changes in preferences by incorporating a continuous shift variable, such as a media index into the

demand function (e.g., Piggott and Marsh, 2004). Others have used a time transition function to allow for gradual changes between particular time periods (e.g., Peterson and Chen, 2005). Using such methods, Mangen and Burrell (2001) concluded that consumers in the Netherlands exhibited a 21-month preference shift illustrated by reductions in beef purchases subsequent to a series of BSE-linked media stories in Europe in March 1996. Peterson and Chen (2005) similarly identified a transition period of two months of consumption changes in Japan. Kuchler and Tegene (2006) examined U.S. consumers' retail purchases of beef and beef products from 1998 through 2004 using ACNielsen Homescan data and concluded that most variance in purchases could be explained by trend and seasonality influences. These authors also concluded that the duration of BSE impacts on U.S. consumers was limited to no more than two weeks (Kuchler and Tegene, 2006).

Recent literature pays attention to the dynamics of consumer preferences in response to food safety concerns. Adda (2007) used the BSE scare in France as a natural experiment to study how previous consumption of risky goods affected consumer responses to this food risk. His study suggests that consumers with low and high levels of consumption of beef products were less affected than those with intermediate-level consumption (Adda, 2007). Mazzocchi and Lobb (2005) applied a stochastic approach to aggregate data on Italian household meat demand to measure time-varying impacts of two subsequent major BSE scares (1996 and 2000) in Europe. These authors found evidence that the influences of the second BSE outbreak on meat demand were much stronger than those generated by the first wave of BSE incidents (Mazzocchi and Lobb, 2005). Recovery in beef consumption from the first set of BSE events took only a few

months while the second BSE outbreak caused an upward shift in chicken demand for 14 months (Mazzocchi and Lobb, 2005). In general, however, recurrence associated with food safety incidents has received relatively little attention in the literature on the impacts of food safety events on demand. There has been very little focus on habits or on trust in this context.

Habit formation has been examined in studies of consumer behaviour (e.g., Browning and Collado, 2007). The tendency for habit persistence to be exhibited in consumption of at least some goods and services suggests non-separability in preferences across time periods. Heaton (1993) studied the interaction between time-nonseparable preferences and time aggregation based on aggregate consumption data on durables, nondurables and services. He concluded that it was important to account for time nonseparabilities in preferences for short periods of time, while for longer periods of time, preferences were more consistent with time-separable preferences (Heaton, 1993). Heaton (1993) also suggested that habit effects tend to dominate substitution effects in data aggregated over longer periods of time and that the explanation of this is that it takes time to develop a habit so that it is more likely to find evidence for habit formation as the length of time period increases.

Perhaps due to data availability, most empirical studies on consumption which allow for time non-separable preferences are based on aggregate data. However, it has been argued that aggregation can distort preferences due to a number of factors unrelated to preferences (Dynan, 2000). Microeconomic-level household data are less affected by time averaging than aggregate data (Dynan, 2000). There is growing interest in testing time nonseparabilities in preferences using microeconomic level data (e.g., Meghir and

Weber, 1996; Naik and Moore, 1996). Studies which examined habit formation in the context of food consumption have had mixed findings. Guariglia and Rossi (2002), and Naik and Moore (1996) found evidence of habit formation in households' food expenditure, while studies by Dynan (2000) do not support the presence of habits in food consumption. Although empirical literature on habit formation has generally rejected models without habit formation, it has been argued that it is important to distinguish between state dependence and heterogeneity to avoid overstatement of habit effects (Naik and Moore, 1996; Keane, 1997). However, to distinguish between state dependence and heterogeneity, panel data with several periods of observations for each micro unit are required. Using Spanish panel data on family expenditure, Browning and Collado (2007) concluded that both state dependence and heterogeneity should be considered in the analysis of demand behavior to avoid seriously biased estimates. The current study adds to the literature by examining habit persistence in the context of a series of food safety incidents using microeconomic-level household panel data.

Turning to the literature on trust-related studies, so far there is no general agreement on how to interpret trust as a concept. Some conceive trust as a personality trait (e.g., Rotter, 1967, 1980). Rotter (1967, p651), for example, defines interpersonal trust as "an expectancy held by an individual or a group that the word, promise, verbal or written statement of another individual or group can be relied upon". This definition views trust as a generalized expectancy which an individual develops through various personal experiences, which remains stable across situations and over a person's lifetime (Couch and Jones, 1997). Research which defines trust along this line focuses on individual differences as well as the stability of an individual's trust level over time (Lewis and

Weigert, 1985). However, others argue that trust is situation specific and the impact of situational differences on trust is greater than that of personality differences (e.g., Driscoll, 1978).

Lewis and Weigert (1985, p969) argue that "the primary function of trust is sociological". According to Lewis and Weigert (1985), trust as a social experience has cognitive, emotional and behavioral dimensions. Modern society has a complicated structure and anonymity is widespread (Lewis and Weigert, 1985). As a result, it is argued that social order is largely based on trust in the system ("system trust" rather than personal trust (Lewis and Weigert, 1985). Relationships between concepts identified as generalized trust and institutional/political trust have been examined in the political science literature, where evidence that these two types of trust are related is noted (e.g., Hall, 1999). However, in terms of explaining this correlation, there is a lack of agreement on whether generalized trust predicts institutional trust or vice versa. (Rothstein and Stolle, 2002).

The importance of trust in institutions in societal risk management has been widely acknowledged in the literature on risk perceptions (Poortinga and Pidgeon, 2003). Trust in institutions is found to be negatively related to perceived risks in several circumstances, such as the acceptance of gene technology (Siegrist, 2000) and the support of nuclear power (e.g., Siegrist et al., 2000). Studies on food risks have mainly focused on how trust in various organizations involved in the food system affect consumers' responses to food risks. For example, Dierks and Hanf (2006) found trust in information sources to be an important factor to consumers' purchasing decisions when facing a hypothesized salmonella incident. Current understanding on how generalized trust might

affect consumer reactions to food safety incidents is very limited. One focus of this study addresses this lack of information by investigating the role of generalized trust in shaping Canadian households' reactions to the first three domestic cases of BSE in Canada.

3. DATA

The study uses data available from the ACNielsen Homescan panel, which is a national sample of Canadian households. The panel data set follows the purchases of meat by these households before and after the first BSE incident in Canada. The data series cover the period from January 1, 2002 to December 31, 2007, during which 10 cases of BSE were confirmed in Canada. The data set contains detailed information on household purchase expenditures on a variety of food products categorized by their universal product codes (UPCs) (for processed packaged food items which include meat) and for others without UPCs (for fresh meat purchases). The purchase information includes detailed descriptions of the different meat products purchased by the household for home consumption, the household's expenditures to purchase the different specified meat products, and the dates on which these household purchases were made. The data set also reports information on household characteristics, including the region of residence, household income, the age and education level of the household head and the composition of the household. Moreover, further information is available from a survey, conducted in early 2008, that was applied to those households that had been members of the consumer panel for a period before and after the first BSE case. This survey provides information on respondents' risk perceptions regarding BSE and responses to questions on trust expressed by the household member responsible for the grocery purchases.

We investigate household expenditures on different meat purchases for the time period from January 2002 to December 2005, based on individual household's total monthly expenditures on fresh meat purchased at retail grocery stores (meat without UPCs). This time period is selected because it encompasses the first three cases of BSE in Canada and is sufficiently long to assess the impacts of habit persistence. Thus the choice of this period allows examination of how Canadian consumers responded to the initial BSE event and enables comparison of reactions to the series of two further BSE incidents. The size of the panel has varied, from a low of 8849 households in 2003 to a high of 9635 households in 2004. To avoid the problem of missing values and reduce the volume of data to a more manageable size, we selected from the complete data base those households that had stayed in the panel over the time period from 2002 to 2005 for which there were purchase records for each of the 48 consecutive months from January 2002 to December 2005. This reduces the number of households to 644. Matching the households in the Homescan data set with those in the survey data set, we selected only those households that had also participated in the 2008 survey. As a result, our final sample consists of 437 households (for which there are a total of 20,976 observations).

Tables 1a and 1b give descriptive statistics of households' characteristics for the selected sample and for the full Homescan panel respectively. T-statistics suggest there are some relatively small but significant differences between the selected sample and the full Homescan panel. The mean of the household size in the selected sample (2.53) is slightly larger than the average household size in the full panel (2.51). According to the Canadian Census of Population, in 2006 the average household size in Canada was 2.5 persons. The difference between the sample mean (2.53 persons) and the population

mean (2.5 persons) is relatively small. The average age of the household head in the selected sample is 57.04, while for the full Homescan panel this is 51.12. The selected sample has a slightly lower level of education than is the case for the full panel (Table1b). Table1b shows that the percentage of people with some college education or less is higher in the selected sample than in the full Homescan panel. Counterpart statistics on the average age and education level of household heads in the Canadian population are not available. There is no significant difference in the average household income between the selected sample and the full panel. However, the 2006 Canadian census indicates an average household income of $C69,548 in 2005, which is appreciably higher than for the selected sample mean ($C50,989.70). However, the methods to measure household income for the sample are imprecise and downward biassed. The 2006 Census recorded exact values of reported household income, while the Homescan panel data recorded income in categories. Households that selected $70,000 and above are assigned the value of 75,000 dollars, which is likely to underestimate average household income of the selected sample. Despite their differences, basing the analyses on the selected sample avoids missing values in the dataset and enables trust to be assessed, while making full use of the data from those households for which there are purchase records in every month during the time period considered.

[Insert Table 1a and Table 1b Here]

In this study, we apply budget share analysis both for reasons of data availability and since this enables assessment of the dynamics of beef demand patterns following the food safety shocks associated with the first three Canadian BSE incidents. Expenditures on meat products were grouped into four categories: beef, pork, poultry and “other”. In

Figure1 monthly price indices[2], available from Statistics Canada, for the different meat groups are graphed. These show that beef prices fell after the 2003 announcement of the first BSE event, which had led to an immediate closure of export markets for bovine animals and meat. A trough in beef prices occurred in September 2003. The Homescan dataset contains no information on meat prices. To take into account the impacts of price variation over time, meat expenditures were deflated by monthly regional price indices. These price indices are aggregated monthly regional consumer price indices for meat products in broad categories (i.e., beef, pork, etc), published by Statistics Canada, CANSIM database. These regions reported are the Maritimes, Quebec, Ontario, Manitoba/Saskatchewan, Alberta and British Columbia. Monthly shares of individual household's expenditures on each of the identified four meat categories were constructed for each household. Monthly expenditure shares for each the four meat categories averaged over the selected households are shown in Figure 2.

[Insert Figures 1 and 2 here]

Figure 2 shows the pattern of seasonality in household's beef and poultry purchases. Poultry consumption peaks during the Christmas season, while beef consumption peaks during the summer months. A slightly downward trend in the share of the expenditure on beef is seen in Figure 2 over the period examined. However, Figure 2 also suggests an increase in beef expenditure shares following the first BSE incident in May 2003, reaching a peak in September 2003. This might be due to a combined effect of both declining beef price and seasonality (the 2003 BSE event was discovered just prior to the peak season of beef consumption). A formal test of the influence of the BSE incident on beef demand, controlling for trend and seasonality, is discussed in the next section. Both

the second and third BSE cases occurred in the month of January 2005, making it impossible to separate the impacts of these two cases using monthly data. For the purposes of this study, we group the second two cases together and refer to these as the second BSE events. Figures 1 and 2 do not reveal patterns that might suggest how the second BSE events may have affected prices and purchases of meat products.

One attractive feature of panel data is that it allows researchers to investigate heterogeneity in micro units. Figure 3 indicates the distributions of changes in the values of monthly beef expenditure shares from April to May in 2002 and 2003, recognizing that these two months are of interest because the first BSE case occurred in May 2003. This graph shows two interesting features. One is that in comparison to the year before the first BSE case, the distribution of changes in monthly beef expenditure shares after the BSE announcement shifted slightly towards the left, which suggests some negative impacts on beef consumption associated with the first BSE announcement. Another feature reflected in Figure 3 is that most households were relatively consistent in their beef consumption, since for the majority of the selected households, the month to month changes in beef expenditure shares were less than 20% of their meat expenditure. Figure 4 depicts the distributions of changes in the values of beef expenditure shares from December 2002 to January 2003, and of changes from December 2004 to January 2005. From Figure 4 comparison can be made of the distributions for the year preceding the second BSE events with the year in which the second BSE events occurred. Relative to the first BSE event, this reveals a generally similar pattern of behavioral changes for the second BSE events, which occurred in January 2005.

[Insert Figures 3 and 4 here]

A possible explanation for the feature that most of the sampled households tended to be relatively consistent in the pattern of their beef consumption expenditures in the period following the three food safety events is that beef consumption is habit forming. If this is the case, habit persistence may affect a household's ability or incentives to adjust to the BSE events. We postulate that habit persistence resulted in some households not changing their patterns of consumption. To examine whether habit affected households' reactions to the BSE events, we grouped the households into two categories based on their average monthly beef expenditure shares in 2002, a choice which avoids BSE and seasonality impacts on beef consumption. Group 1 consists of households for which average beef expenditure shares were less than 50% of meat expenditures, while group 2 consists of households whose average beef shares were at least 50% of their meat expenditures. The pattern of the adjustments in beef consumption expenditures following the BSE incidents, shown in Table 2, suggests that households with higher beef expenditure shares were more reluctant to change their purchases of beef.

[Insert Table 2 here]

4. MODEL SPECIFICATION AND ESTIMATION METHOD

This section reports formal tests of the impacts of the first two BSE events in Canada on household's meat expenditures. The model specification incorporates dynamics into Engel curve estimation following the procedures developed by Browning and Collado (2007). The extended model takes the form:

$$\omega_{ht} = \beta_0 + \beta_1 \ln x_{ht} + \beta_2 \omega_{ht-1} + \beta_3 t + \sum_{k=2}^{12} \gamma_k D_{kt} + \sum_l \delta_l z_{lht} + \sum_{i=1}^{2}\sum_{j=1}^{4} \alpha_{ij} BSE_{ij} + \mu_h + \varepsilon_{ht} \quad (1)$$

where ω_{ht} denotes beef share for household h at time t, $\ln x_{ht}$ is the logarithm of total meat expenditure for household h at time t, ω_{ht-1} is the lagged beef expenditure share, t denotes the time trend, D_{kt} are 11 monthly seasonal dummy variables with January as the base, z_{lht} are demographic variables including education, number of children in a household and a regional dummy variable, BSE_{ij} are two sets of dummy variables indicating the specific month that followed the first BSE incident and second pair of BSE events respectively, μ_h is an unobservable individual characteristics, ε_{ht} is a random error term, and $\beta_0, \beta_1, \beta_2, \beta_3, \gamma_k, \delta_l, \alpha_{ij}$ are coefficients to be estimated.

Models tested on panel data have been used in the literature to examine many dynamic relationships (e.g., Arellano and Bond, 1991; Browning and Collada, 2007; Keane, 1997). One common feature of these models is the presence of a lagged dependent variable on the right hand side. The inclusion of a lagged dependent variable complicates estimation of such models. The approach that takes the first difference of the equations and then estimates the differenced equations has been widely used in empirical analysis on dynamic panel data (Browning and Collada, 2007). The idea of using lagged values of dependent variable as instruments for the differenced equations was first suggested by Anderson and Hsiao (1981). Based on this concept, Arellano and Bond (1991) developed a generalized method of moments (GMM) procedure which improves estimation efficiency by making use of all available moment conditions. Arellano and Bover (1995) unify the literature and develop a general framework for efficient IV estimators. Although using instruments in levels for equations expressed in first differences is a typical approach to estimate dynamic panel data models, Arellano and

Bover (1995) suggest that there are potential gains to estimate equations in levels using instruments in first differences. We adopted the GMM approach developed by Arellano and Bond (1991) and Arellano and Bover (1995). Two sets of models were estimated: Engel curves in differences with instruments in levels and Engel curves in levels with instruments in differences. The results are presented and discussed in the following section.

5. RESULTS AND DISCUSSION

5.1. The magnitudes and duration of the impacts of BSE incidents

5.1.1. Testing Engel curves in differences

Under the assumption that the errors are not serially correlated, lagged values of endogenous variables are valid instruments for the equations in first differences associated with later periods (Arellano and Bond, 1991). Demographic variables are time-invariant and dropped out in taking the first differences of the equations. We instrumented the two endogenous variables in equation (1) (lagged beef share and the logarithm of total expenditure), with their own values, lagged two periods and more, respectively. Other explanatory variables in equation (1) are assumed to be exogenous. The estimation results of this model version are presented in Table 3 (see equations in differences). The coding of variables is described in Appendix 1.

In the Arellano-Bond approach, the validity of the instruments is conditional on the assumption of a lack of serial correlation in errors (Arellano and Bond, 1991). Lags are used as instruments for endogenous variables in our estimation based on the assumption that the errors are not serially correlated. Therefore, testing for autocorrelation between

the errors is necessary to justify the validity of these instrumental variables. Durbin-Watson statistics suggest no evidence of autocorrelated errors in equations in levels.

Table 3 (equations in differences) shows that lagged beef expenditure share has a positive effect on current beef share which suggests evidence of habit persistence. Beef expenditure share increases with the logarithm of total meat expenditure. There are significant seasonal effects on beef purchases. Beef expenditure increases during the summer as the coefficients for the monthly dummy variables of June and August are positive and significant. Beef expenditure share drops in winter, in particular over the Christmas season. The time trend has significant negative influence on beef expenditure share, indicating that the beef expenditure share declines over the time period considered in this study, which is consistent with the trend of declining consumption of beef in Canada since late 1990s (Statistics Canada, 2007).

The impact of BSE on beef expenditure is the focus of this model. We locate the BSE impacts on expenditure shares by searching over the time period and iteratively estimating the model. We started estimation by including only one BSE dummy variable (which represents the month of the BSE occurrence) for each of the two BSE events. We then iteratively estimated the model by successively adding a further BSE dummy variable for the two BSE incidents considered (i.e., we extended the time period by one more month every time we re-estimated the model). The impacts on beef expenditure share vanished three months after the BSE announcements. This pattern was found for both the first and second BSE events. Consequently, four BSE event dummy variables are kept for each of the first two BSE events, indicating the specific month following the BSE announcements. Following the announcement of the first BSE case, made on May

20, 2003, there was an immediate negative impact on beef expenditure shares. The results suggest that the BSE dummy representing May 2003 (BSE11) has a significant and negative effect on beef expenditure shares. One month later, the BSE impact is still negative but no longer significant. In the following two months, beef purchases expenditures increased. One possible explanation for this temporary upward trend is a price effect: a large drop in beef prices in Canada was observed following the BSE announcement and the closure of beef export market access. It appears that at the time of the announcement of the first BSE case, risk concerns may have been dominant for many consumers, leading to an immediate reduction in beef expenditures after evidence of the initial Canadian BSE case. However, it seems that concern about risk impacts diminished gradually and consumers resumed their previous consumption patterns as time passed.

The data set contains no information on prices so we controlled the effects of price on beef expenditures by deflating expenditures by the price indices. Although aggregated price indices reveal the trend of price changes, they contain much less information than would the real prices corresponding to those purchases. So the increase in beef purchase expenditures in the second and third month after the initial BSE announcement may be due to price effects which were not captured by the price indices used in deflation. Alternatively, it may be possible that consumers increased their beef expenditures two months after the BSE discovery because they wanted to compensate for the reduced purchases in the previous period.

Following the second BSE events, a negative impact on beef expenditures was not evident until two months after the announcements of these second and third BSE cases and this reaction lasted only for a very short period of time. Expenditures on beef

purchases increased in April 2005, the third month after the discovery of the second and third BSE cases (Table 3 (equations in differences)). The second two BSE events revealed a similar pattern to the 2003 incident: consumers initially decreased beef purchases, but then resumed their earlier consumption patterns, even reaching a higher level of expenditure. These findings are generally consistent with the literature on consumers' responses to a single food safety incident, which suggests that consumers initially reduce purchases and then gradually return to their past consumption patterns (Saghaian and Reed, 2007; Mazzocchi and Lobb, 2005). However, the specific patterns of consumer responses that we observed relative to the first and the second Canadian BSE cases are different. The negative impact on sampled household expenditures was slower to take effect following the second BSE events, suggesting that consumers did not respond to the news of the second BSE events as quickly as they had responded to the first BSE case. Even so, the magnitudes of the negative impacts on beef expenditure shares are similar. A possible reason for the slower response in reduction of beef expenditure shares following the second BSE events might be that the second events were seen as less a shock, compared to the first instance of a domestic case of BSE. Relating to this, there were fewer media reports following the second and third BSE incidents in Canada than followed the initial cases (Boyd, 2008). The price impacts that followed the second BSE case were also less severe (see Figure1).

5.1.2. Testing Engel curves in levels

An alternative approach to estimate dynamic Engel curves proposed by Arellano and Bover (1995) is to estimate equations in levels using lagged first differences of the endogenous variables as instruments. This estimation method allowed us to examine the

effects of household demographics on expenditures and to compare the findings with the results from estimating equations in first differences. Lagged first differences of beef expenditure shares and logged total meat expenditures were used as instruments for the beef expenditure share and the log of total meat expenditure respectively to estimate the equations in levels. These results are also presented in Table 3 (equations in levels).

The findings from two estimation methods are consistent. The results from estimating equations in levels (Table 3) suggest that beef expenditure is habit forming and positively related to the log of total meat expenditure. Beef expenditure shares increased during the summer months and decreased in winter. We also observe a declining trend in the beef expenditure share over the entire period (i.e., from January 2002 to December 2005). Relative to the two BSE events, the same cycle is identified: the sampled households reduced their relative expenditures on beef after the both BSE events but this decline was subsequently reversed. However, the first BSE case was followed by an immediate negative reaction in beef expenditure shares by the sampled households, while the reduction in beef expenditure shares following the second BSE events did not occur until two months after the BSE announcements. Testing the estimating model (equation 1) in levels, it is also possible to assess the impacts of household demographics. The demographics of households evidently play a role in determining beef expenditure shares. It seems that beef consumption is affected by the composition of a household. Households with more children have lower beef shares. Households located in Quebec have higher beef expenditure shares than households in other regions. However, we found no evidence of interaction effects between BSE responses and household demographics.

[Insert Table 3 here]

5.2. Habit persistence and household responses to BSE

In this section the dynamic relationship between consumption habits and BSE shocks is examined. We tested two hypotheses in this regard. The first hypothesis is that households with higher beef expenditure shares reacted less to the BSE events. There is evidence in Table 3 that beef consumption is habit forming, in that higher past beef expenditure shares lead to higher current beef expenditure shares. Consequently we expect that a household's response to a food risk event depends not only on views of risk per se, but also on the household's desire, expressed through its habit, to adjust to that risk event. We also hypothesize that habit persistence in beef consumption, expressed through expenditures on beef purchases, tends to offset some of the negative impacts of the BSE events. The second hypothesis relates to the recurrence of the first three Canadian BSE events and is based on the expectation that effects of habit persistence diminish following more than one risky event. The rationale for this hypothesis is that consumers may gradually alter their beef consumption habits over time following successive BSE cases. That is, habit is expected to have less impact on adjustments in purchasing patterns following successive BSE cases. To test these hypotheses, we interacted the lagged dependent variable with those BSE dummy variables which are significant in equation (1) (i.e., BSE11, BSE13, BSE14, BSE23 and BSE24), and introduced these interaction terms into equation (1). The modified model is:

$$\omega_{ht} = \beta_0 + \beta_1 \ln x_{ht} + \beta_2 \omega_{ht-1} + \beta_3 t + \sum_{k=2}^{12} \gamma_k D_{kt} + \sum_l \delta_l z_{lht} + \sum_{i=1}^{2}\sum_{j=1}^{4} \alpha_{ij} BSE_{ij} + \sum_{i=1}^{2}\sum_{j=1}^{4} \eta_{ij} BSE_{ij}\omega_{ht-1} + \mu_h + \varepsilon_{ht} \quad (2)$$

Table 4 presents the results from estimating equation 2 in differences and the results from estimating the equation in levels. Only the interaction term between a BSE dummy variable indicating May 2003 (i.e., BSE11) and lagged beef share is significant. Those terms which are not significant are excluded from the model. In general, the model estimates are not sensitive to the inclusion of the interaction terms between lagged beef share and the BSE dummy variables. The same cycle of behavior is identified for both the first and second BSE events: households reduced their beef expenditure shares following the BSE announcements but these recovered subsequently. The patterns of reaction and the impacts of habit persistence, however, are different for the first and two subsequent BSE events. Following the first BSE incident, household's beef expenditure shares shifted downward immediately. A second feature is the joint effect of BSE and habit persistence. The positive coefficient on the interaction between the lagged beef expenditure share and BSE11 suggests that habit persistence offset the negative BSE effect and that households with higher beef expenditures reduced this relatively less following the first case of BSE than was the case for households with lower beef expenditures. None of the interactions between the lagged beef share and a BSE dummy variable that related to the second BSE events is significant, suggesting that habit persistence did not affect households' reactions to the second BSE events. The finding that habit persistence reduced the negative impact associated with the first BSE case but had no influence on households' reactions to the second BSE events might indicate diminished impacts of habit persistence offsetting the risk following successive risk events.

We observe that the magnitudes of the negative effects on beef expenditure shares associated with the first and second BSE events are very similar in the model which does not consider the interaction between habit and BSE (Table 3). The coefficients for the two BSE dummy variables (BSE11 and BSE23) are very close and their value is about -0.03 (Table 3). The inclusion of the interaction term, however, altered the magnitudes of the estimated negative impacts associated with the first BSE case. In the new model (Table 4), the negative effect of BSE is much greater in the first BSE case than in the second BSE case. The coefficient for BSE11 is almost -0.08 while the coefficient for BSE23 is about -0.03 (Table 4). The reduced negative impact in the case of the second BSE events suggests that the second BSE case was less a risk shock than was the first BSE case. This might be due to consumers' experience of adjusting to the first BSE case or because there was less media attention: the second and third Canadian BSE incidents attracted much less media attention than did the initial domestic BSE case in Canada (Boyd, 2008). Negative impact on beef demand of media coverage relating to some outbreaks of BSE have been reported in some empirical studies where there have been numbers of BSE events (e.g., Burton and Young, 1996; Piggott and Marsh, 2004). The tendency for less media attention in the second and subsequent Canadian BSE cases may reflect lower concerns among the Canadian public, which in turn may be associated with the rapid, science-based and transparent handling of the risks that were made apparent by the first Canadian BSE case. These are possible factors that might contribute to the lower negative impacts on beef expenditures in the case of the second BSE events. As reported in Table 4, the findings from estimation equations in differences and equations in levels are consistent.

[Insert Table 4 here]

5.3. Trust and household responses to BSE

The second focus of this study is related to trust. Due to the complexity of the food chain, consumers have little knowledge of food production and increasingly rely on institutions to guarantee the safety of their food products (Lang and Hallman, 2005). Consequently trust may be an important factor in analyzing consumers' behavior towards food risks. This study examines the influence of generalized trust on consumer reactions to BSE. We focus on the influence of generalized trust for which there have been few if any studies which relate to consumer reactions to recurring food safety incidents. Information on trust expressed by the household member is from a survey conducted in 2008. This survey was conducted five years after the first BSE incident and three years after the second BSE events. Since generalized trust is assumed to remain relatively stable over an individual's lifetime and across situations (Couch and Jones, 1997), it may be reasonable to relate the generalized trust information collected in 2008 with respondents' previous household meat purchase data.

Measuring trust remains a challenging task. The attitudinal question 'Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?' has been widely used to measure generalized trust in the economic literature (e.g., Glaeser et al., 2000). In the 2008 survey, the household panel participants were asked to choose a response to the cited attitudinal question from the statements that: 'People can be trusted', or 'Can't be too careful in dealing with people', or 'Don't know'. In total, 201 responding households answered that 'People can be

trusted; 210 households answered ‘Can’t be too careful in dealing with people’; and 26 households chose ‘Don’t know’.

Previous literature suggests that trust is negatively related to perceived risk (e.g., Siegrist, 2000). Therefore, we expect that the households who do not exhibit trust were more sensitive to the BSE cases. To test this hypothesis, we divided the sample into two segments: households who trust and households who do not trust, based on households’ responses to the cited standardized trust question. Household respondents who answered that ‘People can be trusted’ were grouped together as ‘households who trust’. Households who answered that ‘Can’t be too careful in dealing with people’ were labeled as ‘households who do not trust’. We dropped those households who chose ‘Don’t know’ from the sample for the tests that follow.

Figure 5 shows the dynamics of the average monthly beef expenditure shares over the time period from January 2002 to December 2005 for both the trusting households and the households who are not trusting. In general, many features of the two groups are similar: there is a pattern of seasonality and an overall downward trend in beef consumption. Both groups followed a similar pattern of responses to the first BSE incident (in May 2003) in that beef expenditure shares increased, reached a peak in September 2003 and then declined. However, following the second pair of BSE events, the reaction patterns exhibited by the “trusting group” and the “not trusting” group were quite different. We observe that households who do not trust reduced their beef consumption dramatically in March 2005 following the second BSE cases although their beef expenditure rebounded in April 2005. The reactions of the trusting group, however, were relatively milder.

[Insert Figure 5 here]

We then compared the behavior of the two trust groups (trusting and not trusting) relative to beef purchases using equation (2). We estimated equations in differences and equations in levels (see results in Table 5). The dynamics of beef consumption of the two trust-based groups are different. As suggested by Figure 5, both groups exhibited the same pattern of reactions in beef expenditure shares to the first BSE case, but their responses differed following the second BSE incidents. Households who trusted did not react to the second BSE case while households who were in the "do not trust" group reduced their beef expenditures in the second month following the second BSE incidents and then increased beef purchases in the third month. The coefficients in the models for both groups are relatively stable with the use of different estimation methods. Further, comparison of the results from estimating equations in differences indicates that the magnitude of the negative impact on beef expenditure shares following the first BSE case shown by the group of respondents who do not trust is twice the impact on the group that does exhibit trust. The coefficient for BSE11 in the trusting group is -0.06 while the coefficient for BSE11 in the "not trusting" group is -0.11. These findings support the hypothesis that those individuals who do not trust are more sensitive to the risks associated with BSE incidents.

We also notice substantial differences between the two trust groups in the habit and seasonality effects in Table 5. It seems that households who trust have strong habits relative to households who do not trust: the coefficient for lagged beef share is positive and significant for the trusting group. For households who do not trust, there is no evidence of habit persistence in their beef consumption. However, the results from the

"not trusting" group suggest a significant interaction effect between habit and the first BSE incident. Based on our current findings, the relationship between trust and habits in a risky event is unclear and will be a focus of further work. The results from the two trust groups have quite different seasonality effects, which might be due to the reduced sample size.

[Insert Table 5 here]

6. CONCLUSIONS

We examined the dynamics of monthly beef expenditure shares of a sample of Canadian households for monthly time periods during the years 2002 through 2005 using micro- level panel data which followed meat expenditures by Canadian households before and after the first three BSE cases which were found in 2003 and 2005. Our results suggest that the dynamics of beef expenditure shares were influenced by numbers of factors, including food risk, habit, trust, seasonality, time trend, and household characteristics. The first case of BSE was followed by immediate negative impacts in households' beef purchase expenditures. However, after the second and third BSE events, negative impacts were not observed until two months after these incidents. For both the first and subsequent two incidents, the duration of impacts was no more than four months. Reactions followed the same general pattern in each case: households reduced their beef purchase expenditures following the announcement of the BSE occurrence; then, evidently as concern diminished, their expenditures on beef consumption recovered. From our assessment of how habit affected beef expenditures, we found evidence that habit persistence limited households reductions of beef purchases following the BSE events but the effects of habit diminished subsequently to the initial event. Regarding the

role of trust in shaping households' reactions to BSE, we found that households who do not trust were more sensitive to the food risks identified by the BSE events.

Current understanding of how consumption patterns evolve over time in the presence of a series of food scares is very limited. This study provides some knowledge of how expenditure, consumption habits and trust interacted with BSE shocks to influence the dynamics of beef consumption following the first three cases in BSE occurred in a domestic cow in Canada. Future studies may be able to apply data from a longer time period to assess reactions to subsequent BSE cases. People typically rely on the press, radio, television and internet media for information when a food safety event occurs. Consumers' perceptions of risk tend to be amplified when there are high profile media reports on food scares (Frewer et al., 2002). However, trust in information sources may affect public reactions to a risky event (Frewer et al., 1996). How recurring food safety incidents, trust and media coverage act to shape consumption habits over time is not well understood. Further study investigating interactions between habit and trust may help in understanding these influences.

Endnotes

[1] One earlier case where BSE was detected, in December 1993, involved a cow imported from Britain; this caused little concern and received little publicity.

[2] The price indices are monthly Consumer Price Indices (CPI) for fresh or frozen meat products in Canada. These price data are published by Statistics Canada, CANSIM database. The CPI compares, in percentage terms, prices in any given time period to prices in the official base period, which is 2002=100.

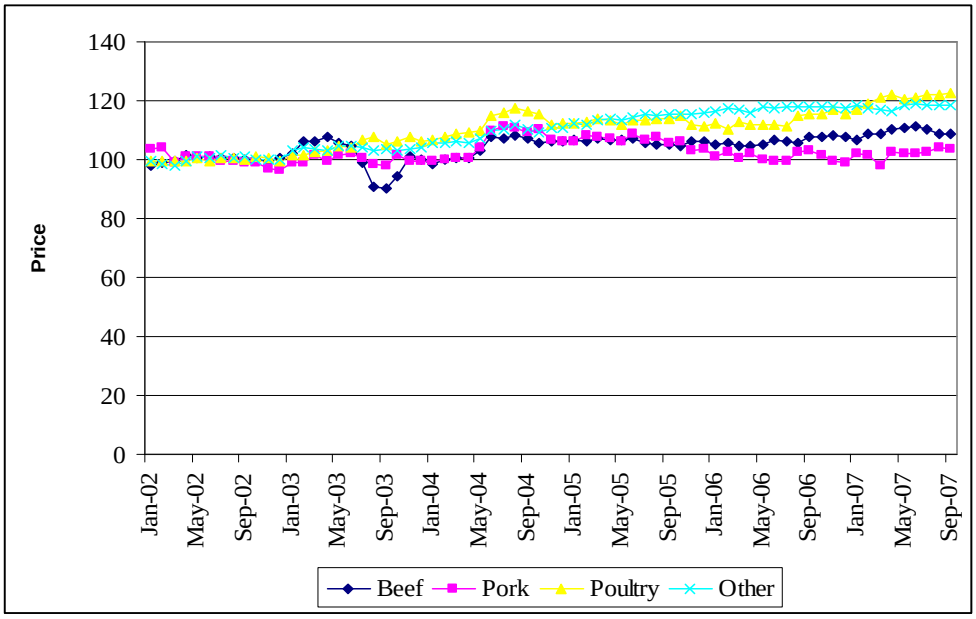
Table1a. Summary Statistics of Household Characteristics: Selected Sample versus the Whole Panel

	Definition	Mean (StdDev)	
		Selected Sample	Whole Panel
Household Size	1=Single member 2=Two members 3=Three members 4=Four members 5=Five-Nine Plus members	2.53 (1.12)	2.51 (1.22)
Household Head Age	26=18-34 40=35-44 50=45-54 60=55-64 70=65+	57.04 (11.24)	51.12 (13.07)
Income	15,000=<$20,000 25,000=$20,000-$29,999 35,000=$30,000-$39,999 45,000=$40,000-$49,999 65,000=$50,000-$69,999 75,000=$70,000+	50989.70 (20738.98)	51116.85 (21258.44)
Household Number	—	437	14176

Table 1b. Household Head Education: Selected Sample versus the Whole Panel

Household Head Education	Percent	
	Selected Sample	Whole Panel
Not High School Grad	18.6	15.1
High School Grad	19.7	18.4
Some College or Tech	15.7	13.8
College or Tech Grad	19.2	21.6
Some University	9.7	9.7
University Grad	17.2	21.5

Figure 1. Monthly Consumer Price Indices for Meat Products in Canada



Source: Statistics Canada, CANSIM database.

Figure 2. Average Monthly Expenditure Shares (January 2002-December 2005)

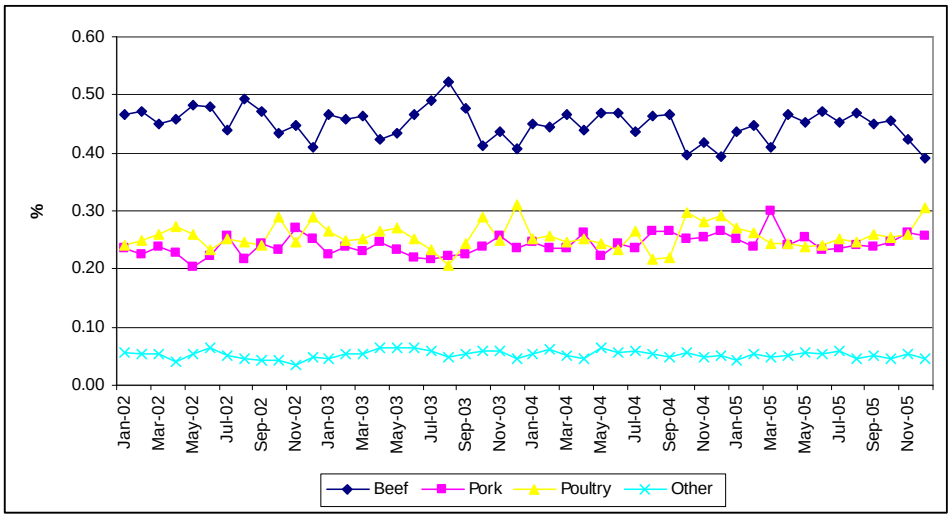
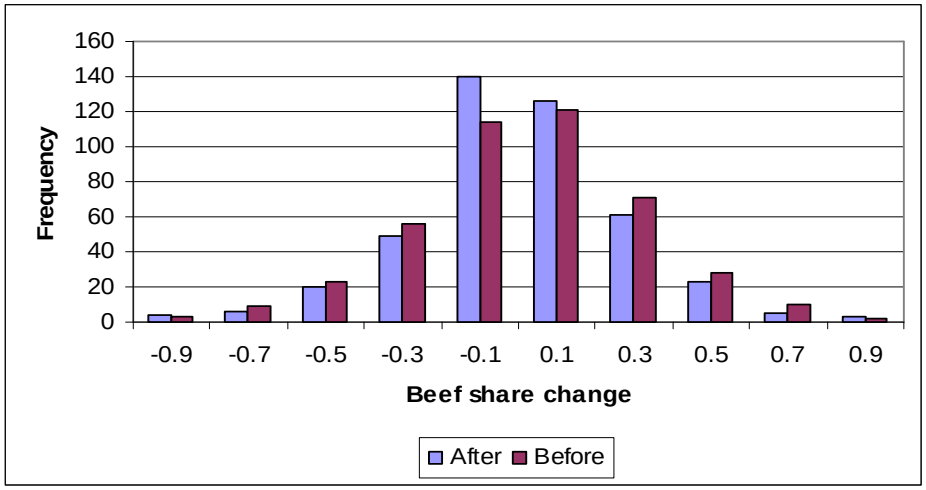
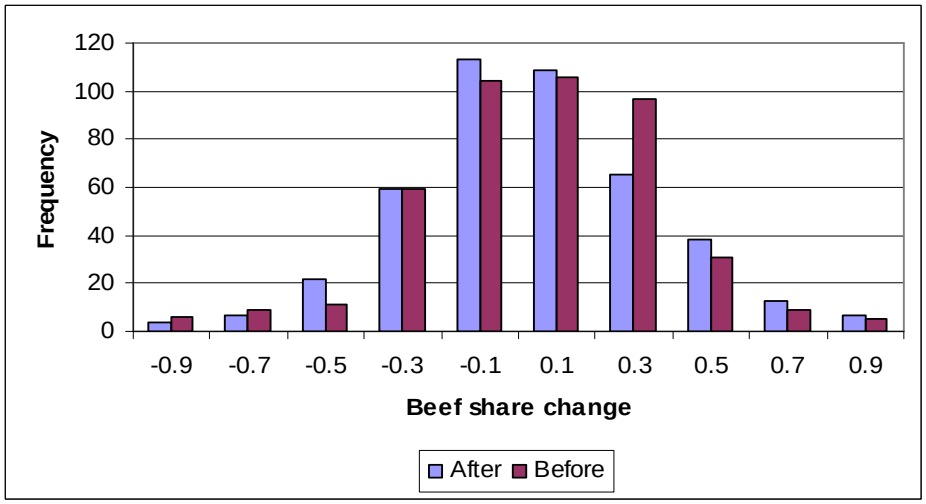


Figure 3. Adjustments of Beef Expenditure Shares following the 1st BSE Incident



Note: Beef share change before the 1st BSE incident=beef share in May 2002-beef share in April 2002.
Beef share change after the 1st BSE incident=beef share in May 2003-beef share in April 2003.

Figure 4. Adjustments of Beef Expenditure Shares following the 2nd BSE Incidents



Note: Beef share change before the 2nd BSE events=beef share in January 2003-beef share in December 2002.
Beef share change after the 2nd BSE events=beef share in January 2005-beef share in December 2004.

Table 2. Changes in Beef Expenditure Shares after the 1st and 2nd BSE Events (Means and Standard Deviations)

Beef expenditure share	Number of households (% of sampled households)	Changes from April to May 2003	Changes from December 2004 to January 2005
[0, 0.50)	257(58.8%)	0.0134 (0.2720)	0.0523 (0.3189)
[0.50, 1]	180 (41.2%)	0.0079 (0.2953)	0.0252 (0.3266)

Table 3. Beef Consumption Engel Curve Parameter Estimates: Equations in Differences versus Equations in Levels

	Equations in differences	Equations in levels
ω_{ht-1}	0.02940***	0.02791***
	(0.00742)	(0.00743)
$\ln x_{ht}$	0.01428**	0.02016***
	(0.00674)	(0.00642)
FEB	-0.00148	-0.00449
	(0.00863)	(0.00955)
MAR	0.00180	0.00233
	(0.00896)	(0.00898)
APR	-0.01281	-0.01221
	(0.00891)	(0.00892)
MAY	0.01213	0.01303
	(0.00879)	(0.00878)
JUN	0.01995**	0.02067**
	(0.00982)	(0.00984)
JUL	-0.01061	-0.00953
	(0.00932)	(0.00932)
AUG	0.02353**	0.02415***
	(0.00927)	(0.00928)
SEP	0.01478	0.01568*
	(0.00906)	(0.00907)
OCT	-0.02971***	-0.02895***
	(0.00870)	(0.00871)
NOV	-0.01630*	-0.01553*
	(0.00877)	(0.00880)
DEC	-0.04823***	-0.04758***
	(0.00916)	(0.00922)
BSE11	-0.03154***	-0.03160***
	(0.01107)	(0.01109)
BSE12	-0.01028	-0.00980
	(0.01199)	(0.01200)
BSE13	0.04391***	0.04386***
	(0.01282)	(0.01281)
BSE14	0.04652***	0.04794***
	(0.01182)	(0.01182)
BSE21	-0.00879	-0.00810
	(0.01279)	(0.01283)
BSE22	0.00148	0.00567
	(0.01169)	(0.01224)
BSE23	-0.03427***	-0.03483***
	(0.01188)	(0.01194)
BSE24	0.029009**	0.02918**
	(0.01135)	(0.01139)
T	-0.00049***	-0.00055***
	(0.00018)	(0.00018)
NKID	–	-0.02968*
		(0.01542)
EDU	–	0.01788
		(0.01108)
QC	–	0.09004***
		(0.01176)
CONSTANT	–	0.34362***
		(0.02685)

Note: See Appendix 1 for the definitions of the variables.
*,**,*** signify, 10%, 5% and 1% levels of significance respectively

Table 4. The Impacts of Habit Persistence on Households' Responses to Three BSE Events: Equations in Differences versus Equations in Levels

	Equations in differences	Equations in levels
ω_{ht-1}	0.02584***	0.02425***
	(0.00749)	(0.00753)
$\ln x_{ht}$	0.01352**	0.01985***
	(0.00674)	(0.00641)
FEB	-0.00140	-0.00435
	(0.00862)	(0.00953)
MAR	0.00191	0.00250
	(0.00896)	(0.00898)
APR	-0.01271	-0.01206
	(0.00890)	(0.00891)
MAY	0.01225	0.01320
	(0.00879)	(0.00878)
JUN	0.02006**	0.02087*
	(0.00982)	(0.00984)
JUL	-0.01047	-0.00930
	(0.00932)	(0.00933)
AUG	0.02356**	0.02426***
	(0.00927)	(0.00928)
SEP	0.01499*	0.01597*
	(0.00906)	(0.00907)
OCT	-0.02952***	-0.02872***
	(0.00870)	(0.00871)
NOV	-0.01629*	-0.01547*
	(0.00877)	(0.00880)
DEC	-0.04816***	-0.04747***
	(0.00914)	(0.00920)
BSE11	-0.08433***	-0.08663***
	(0.01872)	(0.02077)
BSE12	-0.01033	-0.00988
	(0.01200)	(0.01201)
BSE13	0.04395***	0.04386***
	(0.01282)	(0.01281)
BSE14	0.04672***	0.04813***
	(0.01183)	(0.01183)
BSE21	-0.00893	-0.00814
	(0.01279)	(0.01283)
BSE22	0.00144	0.00564
	(0.01170)	(0.01224)
BSE23	-0.03427***	-0.03482***
	(0.01188)	(0.01194)
BSE24	0.02891**	-0.2908**
	(0.01135)	(0.01139)
T	-0.00049***	-0.00055***
	(0.00018)	(0.00019)
$\omega_{ht-1} * BSE11$	0.11979***	0.12520***
	(0.03560)	(0.04141)
NKID	–	-0.02982*
		(0.01546)
EDU	–	0.01917*
		(0.01111)
QC	–	0.09039***
		(0.01179)
CONSTANT	–	0.34573***
		(0.02686)

Figure 5. Average Monthly Beef Expenditure Shares: Households Who Trust versus Households Who Do Not Trust

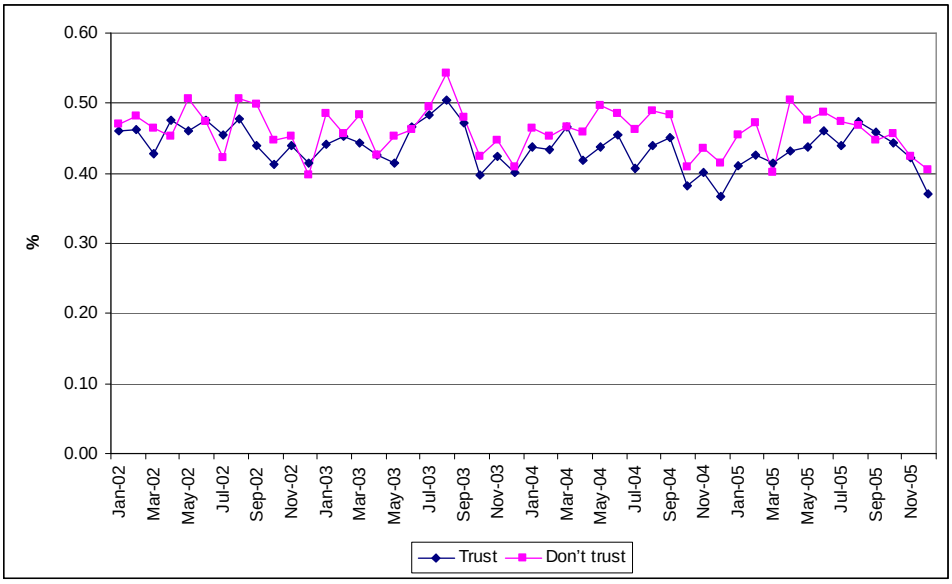


Table 5: BSE Impacts on Beef Consumption Engel Curve: Households Who Trust versus Households Who Do Not Trust

	Equations in differences		Equations in levels	
	Trust	Don't trust	Trust	Don't trust
ω_{ht-1}	0.03031***	-0.00828	0.02227**	-0.00848
	(0.01030)	(0.01009)	(0.01039)	(0.01021)
$\ln x_{ht}$	0.01610**	0.01038	0.01799***	0.01406**
	(0.00711)	(0.00661)	(0.00674)	(0.00637)
FEB	0.00692	-0.01764	0.00527	-0.02414*
	(0.01244)	(0.01169)	(0.01376)	(0.01296)
MAR	0.00811	-0.00684	0.00881	-0.00687
	(0.01322)	(0.01200)	(0.01323)	(0.01201)
APR	0.00811	-0.02098*	0.00847	-0.02177*
	(0.01277)	(0.01173)	(0.01279)	(0.01175)
MAY	0.01785	0.00904	0.01868	0.00917
	(0.01250)	(0.01211)	(0.01248)	(0.01213)
JUN	0.03396**	0.00953	0.03438**	0.00902
	(0.01510)	(0.01272)	(0.01517)	(0.01276)
JUL	0.00442	-0.02850**	0.00494	-0.02848**
	(0.01367)	(0.01202)	(0.01382)	(0.01204)
AUG	0.03844***	0.01075	0.03902***	0.00944
	(0.01377)	(0.01260)	(0.01379)	(0.01267)
SEP	0.02951**	0.00209	0.03048**	0.00174
	(0.01458)	(0.01108)	(0.01465)	(0.01112)
OCT	-0.01211	-0.04109***	-0.01114	-0.04200***
	(0.01227)	(0.01108)	(0.01228)	(0.01194)
NOV	-0.00041	-0.03027**	0.00012	-0.03055**
	(0.01256)	(0.01242)	(0.01263)	(0.01249)
DEC	-0.03315**	-0.06317***	-0.03274**	-0.06398***
	(0.01368)	(0.01198)	(0.01380)	(0.01209)
BSE11	-0.05787**	-0.11249***	-0.11607***	-0.11931***
	(0.02713)	(0.02408)	(0.03013)	(0.02635)
BSE12	0.00241	-0.02103	0.00228	-0.02185
	(0.01565)	(0.01682)	(0.01567)	(0.01689)
BSE13	0.04093**	0.04039**	0.04200**	0.03939**
	(0.01891)	(0.01674)	(0.01910)	(0.01676)
BSE14	0.04055**	0.05873***	0.04139**	0.06063***
	(0.01692)	(0.01567)	(0.01695)	(0.01574)
BSE21	-0.01396	-0.01532	-0.01438	-0.01473
	(0.01730)	(0.01742)	(0.01775)	(0.01738)
BSE22	0.00115	0.01840	0.00301	0.02398
	(0.01789)	(0.01503)	(0.01847)	(0.01566)
BSE23	-0.00016	-0.06568***	-0.00038	-0.06723***
	(0.01771)	(0.01523)	(0.01787)	(0.01527)
BSE24	0.00491	0.04490***	0.00566	0.04534***
	(0.01662)	(0.01442)	(0.01666)	(0.01446)
T	-0.00054**	-0.00027	-0.00057**	-0.00026***
	(0.00025)	(0.00025)	(0.00027)	(0.00026)
$\omega_{ht-1} * BSE11$	0.01959	0.19035***	0.15448***	0.20206***
	(0.05083)	(0.04546)	(0.05912)	(0.05179)
NKID	–	–	-0.01755	-0.00884
			(0.01631)	(0.01794)
EDU	–	–	0.00628	0.03666**
			(0.01510)	(0.01515)
QC	–	–	0.07701***	0.09308***
			(0.01705)	(0.01670)
CONSTANT	–	–	0.33275***	0.36730***
			(0.03054)	(0.02984)

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Appendix 1: Definition of the variables

Variables	Definition
ω_{ht-1}	Monthly beef expenditure share for household h at time t-1
$\ln x_{ht}$	The logarithm of total meat expenditure for household h at time t
FEB-DEC	Monthly seasonal dummy variables
BSE11	A dummy variable indicates the month when the 1st BSE incident occurred (1=May 2003; 0=otherwise).
BSE12	A dummy variable indicates one month after the 1st BSE occurrence (1=June 2003; 0=otherwise).
BSE13	A dummy variable indicates two months after the 1st BSE occurrence (1=July 2003; 0=otherwise).
BSE14	A dummy variable indicates three months after the 1st BSE occurrence (1=August 2003; 0=otherwise).
BSE21	A dummy variable indicates the month when the 2nd BSE incident occurred (1=January 2005; 0=otherwise).
BSE22	A dummy variable indicates one month after the 2nd BSE occurrence (1=February 2005; 0=otherwise).
BSE23	A dummy variable indicates two months after the 2nd BSE occurrence (1=March 2005; 0=otherwise).
BSE24	A dummy variable indicates three months after the 2nd BSE occurrence (1=April 2005; 0=otherwise).
T	Time trend
NKID	Number of children in a household
EDU	The education level of the household head (1=high school and below; 0=otherwise).
QC	Regional dummy variable (1=Quebec; 0=otherwise).