Influence of generalized trust on Canadian consumers' reactions to the perceived food risk of three recurring BSE cases

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Abstract

Interest in the influence of trust on consumers' responses to food risk perceptions associated with Canadian instances of BSE motivates this study, in which Canadian households' expenditures on fresh meat are assessed in the context of the first three recurring risk events in which bovine spongiform encephalopathy (BSE) was found to have affected Canadian cows. Engel Curve analysis focusing on the dynamics of the monthly meat expenditure shares for a selected sample of 437 Canadian households for 2002 through 2005 is applied based on data on household expenditures for meat purchased by a national sample of Canadian households from the Nielsen Homescan® Canadian panel, supplemented by survey responses on BSE risk perceptions and measures of trust. Two sets of models are estimated: Engel curves in differences with instruments in levels and Engel curves in levels with instruments in differences. It is found that habit persistence limited households' reductions of beef purchases following the first BSE event and that that trust limited households' reduction in beef expenditure shares following the subsequent two BSE cases. Significant seasonal effects and a significant negative influence on beef expenditure shares are also found, consistent with the trend of declining consumption of beef in Canada since the late 1990s.

Key words: BSE, Generalized Method of Moments (GMM), trust

JEL codes: D12, C29

Introduction

There is growing interest in the study of trust and food risks, due to proliferating food safety incidents and increasing difficulties for consumers to assess the safety of their food products (Lobb 2005). Several analyses have investigated how trust affects consumers' perceptions and acceptance of food with risk attributes, as well as the sources of information on food safety that are trusted by consumers (e.g., Huffman,

2003; Siegrist 2000; Lobb et al. 2007). However, there is relatively little research that relates trust to consumers' reactions to recurring food safety incidents. This paper reports on economic analysis of the role of trust in mitigating consumers' reactions to food risks in the context of the first three of the recurring incidents in which a case of bovine spongiform encephalopathy (BSE) was detected in a Canadian raised bovine animal. The first of these incidents, announced on May 20, 2003[1] caused international borders to Canada's bovine exports to be closed immediately, with consequent declines in cattle prices which in turn led to major financial costs for the Canadian beef industry (Roy and Klein 2005). More than a year later two more BSE events were confirmed and announced, on January 2, 2005 and January 11, 2005, respectively. From 2003 until 2009, 16 cases in which a cow was affected by BSE were reported in Canada (CFIA 2009).

Although there have been several economic assessments of the influence of BSE on markets in Canada, most have focused on the first BSE incident. So far, to our knowledge, the only published work that has focused on the dynamics of consumer responses to recurring BSE cases in Canada was directed to the influence of habit in influencing Canadian consumers' responses to these events (Deng et al. 2011). The current study contributes to the literature by investigating the role of generalized trust on the responses of a sample of consumers' reactions to the first three of the recurring BSE events. This is pursued by analyzing how a measure of generalized trust is associated with the dynamics of a sample of Canadian households' meat expenditure shares over time.

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

Background and literature overview

Economic literature on market implications of food risks has mainly focused on how food risks affect the demand for associated food products. Examples of these studies include assessment of impacts of BSE events on meat demand (e.g., Burton and Young 1996) and studies of consumers' choices in the context of GM-derived food (e.g. Hu et al. 2004; Kalaitzandonakes et al. 2004) 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 sales fell by 70 percent in response to the first of numbers of cases of BSE in Japan (Zielenziger 2001). The decline in beef purchases by European populations after widespread and numerous incidents of BSE, together with associated human deaths in Western Europe, has also 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 (e.g., Kuchler and Tegene 2006).

Unlike experience in almost all 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. Meanwhile, consumer price indices show that retail beef prices fell by 14 percent from May through September 2003 and then rebounded in September 2003 (Boame et al., 2004). In 2005, a 3.6 percent increase in Canadian beef consumption was reported (Statistics Canada 2006)

when price indexes for beef declined slightly relative to 2004 (Agriculture and Agri-Food Canada 2007).

Most empirical studies on Canadian consumers' responses to domestic BSE incidents focus on the 2003 case of BSE. Peng et al. (2004) found a small but significant negative effect of this event on Alberta consumption of beef products other than ground beef. Maynard et al. (2008) compared the effects of the 2003 BSE case on retail sales of beef entrees in Alberta and Ontario and found no evidence that Alberta consumers responded to this event by reducing consumption of these items, although the 2003 BSE incident did stop some Ontario consumers from purchasing beef entrees in the short-term. Ding et al (2011) concluded that habit persistence initially limited Canadian households' reductions of beef purchases following the first BSE event. However, households with higher beef expenditure shares reduced expenditure more than others following the second two BSE events, suggesting that habitual patterns of high levels of consumption tended to change with the recurrence of these food safety events. The current study considers the role of generalized trust in the context of the first three incidents in Canada in which a domestic cow was found to have BSE.

The concept of trust that has typically been applied in social science literature is generalized trust, for which the major foundation is mainly seen to be one's moral values (or moralistic trust) rather mainly depending on personal experiences (Yamigishi and Yamigishi 1994; Mansbridge 1999; Uslaner 2002). Generalized trust measures a person's belief that 'most people can be trusted' and tends to remain stable over time (Glaeser et al. 2000; Uslaner 2001). In contrast, strategic trust, which is based on particular situations, is seen as fragile (Uslaner 2002).

A substantial body of literature on trust distinguishes between interpersonal trust and trust in institutions (Newton 2007). Uslaner (2008) holds that institutional trust is also strategic trust, since people evaluate institutions based on their past experiences. The importance of institutional trust in societal risk management has been widely acknowledged in the risk literature (Poortinga and Pidgeon 2003). Trust in institutions has been found to be negatively related to perceived risks in several circumstances, such as the acceptance of gene technology and support of nuclear power (Siegrist 2000; Siegrist et al. 2000).

The analytic model and estimation approach

We develop and apply Engel function modeling to assess the dynamics of households' monthly beef expenditure shares before and after the initial three Canadian BSE cases as the means to assess how generalized trust affects Canadian households' expenditure behavior. Models of Engel functions identify the relationships between consumers' expenditure and income, with consideration of other appropriate economic and demographic factors. Engel functions based on the classic price independent logarithmic (PIGLOG) expenditure specification are consistent with utility theory (Muellbauer 1976), have been demonstrated to be appropriate for studies of food (Banks et al 1997; Blundell and Duncan 1998), and are applied in this study. Following Pollak and Wales (1981) a translating approach is adopted to incorporate non-price and non-income variables into the model; these include demographics, dummy variables associated with the specified BSE events, time trend, seasonal periods and a measure of generalized trust in strangers. To control for the impacts of price variations over time, households' beef expenditures and total meat expenditures are deflated by monthly regional price indices

(Statistics Canada 2002-2005). As in the approach followed by Ding et al. (2011), dynamics are included in the Engel function model by allowing current beef expenditure shares to depend on beef expenditure shares in the previous period, enabling habit formation also to be included in the model, but introducing potential problems of endogeneity. Consequently, estimation is based on the generalized method of moments (GMM) procedures developed by Arellano and Bond (1991) and Arellano and Bover (1995) which have been widely used to estimate dynamic panel data models.

The model tested takes the form:

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

where ω_{ht} denotes beef expenditure 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 the number of children in a household and dummy variables denoting the province of residence; BSE_{ij} are two sets of dummy variables indicating the specific month that followed the first BSE incident and the second pair of BSE events respectively; $trust_h$ is a dummy variable, taking the value of 1 if the respondent in household h selected " most people can be trusted"; μ_h captures unobservable individual characteristics; ε_{ht} is a random error term; and $\beta_0, \beta_1, \beta_2, \beta_3, \gamma_k, \delta_l, \alpha_{ij}, \eta_{ij}, \phi_{ij}$ are parameters to be estimated.

The GMM approach to estimation developed by Arellano and Bond (1991) involves two key steps: taking the first differences of the equations in levels and instrumenting the differenced endogenous variables with their own values lagged two periods and more. We initially transformed equation (1) by taking the first differences between equations in levels (each level represents a specific month), and then instrumented two differenced endogenous variables (the lagged beef share and the logarithm of the total meat expenditure) with their own values lagged two periods and more, retaining only the significant variables. These estimation results are presented in Table 3 (see equations in differences). For the purpose of comparison, we also apply the alternative approach to the problems of estimation of dynamic panel data models developed by Arellano and Bover (1995) and estimated equations in levels using the lagged differenced endogenous variables as instruments. These results are also reported in Table 3 (see equations in levels). The definitions of the significant variables, which are retained and used in the final estimations, are presented in Appendix 1.

Nature and descriptive analysis of the data

The major component of the data used in this study is a Nielsen Homescan® data set that follows expenditures on meat purchased by a national sample of Canadian households before and after the first BSE incident in Canada. This provides detailed information on expenditures for household purchases, by date, of a variety of food products for a period of time before and after the initial BSE incidents, in addition to demographic and socio-economic characteristics of each household. From this data set we use the data on a sample of panel household's expenditures, at retail grocery stores, for specified meat fresh meat products purchased for home consumption. Information on individual panel

household's province of residence, household income, age and education of household respondents and household composition is also available and used in the study. A second component of the data set used for the study was collected through a survey conducted by the Department of Rural Economy at the University of Alberta with the assistance of the Nielsen Company in early 2008. The survey was applied to those households that had been members of the Nielsen Homescan® consumer panel for a period before and after the first BSE case. This survey provides information on those respondents' risk perceptions regarding BSE and responses to questions on trust expressed by the household member responsible for the grocery purchases. These can be linked to responding household's expenditure records and related household characteristics.

We analyze monthly household expenditures on meat products from January 2002 until December 2005, a time period of 48 months that is selected because it encompasses the first three cases of BSE in Canada, enabling comparison of the role of trust on households' reactions to the initial and two subsequent BSE incidents. In order to focus on households that eat meat reasonably frequently, to avoid the econometric problems of missing values and to be able to focus on trust, we select from the complete panel of the Nielsen Homescan® all those households that stayed in the panel over the time period from January 2002 to December 2005, that purchased at least one meat product in each of those 48 consecutive months and had completed the 2008 trust survey. Applying these criteria gave a selected sample of 437 households for which there are a total of 20,976 observations.

(Insert Tables 1 and 2 about here)

Comparison of the descriptive statistics of household characteristics for the sample selected from the full Nielsen Homescan® panel and the Canadian population (Tables 1 and 2) indicates that the mean household size in the selected sample is 2.53 members, slightly larger than the 2006 average household size in Canada (2.5 members) (Statistics Canada 2006 Census a). The average age of household heads in the selected sample is 57.04 years; a counterpart statistic on the average age of household heads in the Canadian population is not available. The average household income for the selected sample is reported as Can $ 57,597, while the 2006 Census of Canada reports the average household income in Canada in 2005 as Can $ 69,548 (Statistics Canada 2006 Census b), which is appreciably higher than the mean household income for the selected sample. However, these figures are not fully comparable due to differences in the respective income measurement methods. The 2006 Census recorded the exact values of household incomes. However, the Nielsen Homescan® panel data set groups household income into the categories indicated in Table 1. Households that selected the highest income category ($70,000 and above) are assigned the value of Can $100,000 dollars, which is likely to somewhat underestimate average household income of the selected sample. Table 2, which compares the distribution of the levels of education of household heads between the selected sample and the Canadian population aged 20 years and over, shows that the percentage of household heads with high school education or less in the selected sample is almost identical to the selected Nielsen Homescan® panel sample. Overall, despite some differences, it seems that some major demographic characteristics of the selected sample are reasonably representative of the Canadian population.

Nonetheless, there may be differences in the unobservable characteristics or the behaviour of the sample and the Canadian population.

Despite growing interest in understanding the role of trust, measuring trust is challenging. The generalized trust 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 trust in the economic literature (e.g., Glaeser et al. 2000). In the 2008 survey of Nielsen Homescan® panel participants, this question was applied and respondents were asked to choose a response to this question from the statements: "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". Households were also asked to respond to a set of questions on the extent to which they trusted institutions, including government, manufacturers, farmers and retailers. However, since the information on trust was collected in 2008, five years after the first BSE incident which was discovered in 2003, we choose to use the data responses for the generalized trust question because literature on trust suggests that generalized trust, as measured by this question, tends to remain stable over time (e.g., Uslaner, 2001). Moreover, we expect the generalized trust measure to be exogenous to households' consumer expenditure decisions, whereas this may not be the case for institutional trust measures.

Since the literature suggests that trust is negatively related to perceived risk (e.g., Sjöberg, 2001; Siegrist and Cvetkovich, 2000), we expect that households that do not

exhibit trust are more sensitive to the risks that might be associated with the first three cases of BSE. To test this hypothesis, we divided the sample into two segments: households that trust and households that do not trust, based on households' responses to the cited standardized trust question. Household respondents who answered the attitudinal trust question by choosing: "People can be trusted" were grouped together as "households who trust". Households who answered: "Can't be too careful in dealing with people" were labeled as "households who do not trust". Those households that chose "Don't know" were dropped from the sample for the various tests that follow. Figure 1 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 those that are not trusting.

(Insert Figure 1 about here)

In general, Figure 1 suggests that numbers of features of the trusting and non-trusting household groups are similar: there is a pattern of seasonality and an overall downward trend in expenditures on beef purchases. Following the first BSE incident in May 2003, both groups follow a similar general pattern of responses in that beef expenditure shares increased, reached a peak in September 2003 and then declined. 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. Thus we group the second and third BSE cases together and refer to these as the second BSE events. As seen in Figure 1, following the second pair of BSE events, the extent of the reaction patterns exhibited by the trusting and not trusting groups of households are quite

different. We observe that households that do not trust reduced their expenditures on beef dramatically in March 2005 following the second pair of cases of BSE, although their beef expenditures rebounded again in April 2005. The negative reactions of the trusting group were, however, relatively milder. Formal tests on the influences of trust on households' reactions to BSE are conducted and reported below.

Empirical model results and discussion

Table 3 (equations in differences) shows that lagged beef expenditure share has a significant positive effect on the current beef expenditure share, suggesting that beef consumption is habit forming. Beef expenditure share increases with the logarithm of total meat expenditure. There are significant seasonal effects on beef purchases: the coefficients for the monthly dummy variables of June and August are positive and significant, while dummy variables representing October, November, and December have negative impacts on beef expenditure share, indicating that beef expenditure increases during the summer and falls in winter. The time trend has a significant negative influence on beef expenditure shares over the time period considered in this study, reflecting the declining trend in consumption.

(Insert Table 3 about here)

The length of time for which the specified BSE events impact beef demand is an empirical issue. We identify these BSE impacts on households' beef purchases by searching the data over different time periods. Specifically, estimation is started including only a single BSE dummy variable indicating the month of the BSE occurrence

for each of the two BSE events. We then iteratively estimate the model by successively adding further BSE dummy variables for each of the first and second BSE events for as long as these are significant. From this process we find that BSE impacts vanished three months after the announcements for both the first and second BSE events. Consequently we include four BSE dummy variables for each of the two BSE events in the estimated model. The estimation results suggest that, overall, households reduced their beef consumption immediately following the first BSE announcement. However, this was relatively short-lived, as beef expenditure shares rebounded in the second month after the BSE announcement. With the second pair of BSE events, the negative impact of BSE on beef expenditure shares was not evident until two months after the BSE announcements and this impact only lasted for one month. Beef expenditure increased in the third month after the discovery of the second and third BSE cases.

We consider the effects of habit persistence in the data set of 437 households by interacting the lagged beef expenditure share with those BSE dummy variables which are significant (BSE11, BSE13, BSE14, BSE23, and BSE24). Only the interaction between the lagged beef share and BSE11 is significant and included in the final version of the estimated model. The positive and significant coefficient on the interaction between the lagged beef expenditure share and BSE11 suggests that habit persistence offset the negative impact of the first BSE case. Following the first BSE announcement, households with higher beef expenditure shares did not reduce their beef expenditure shares as much as did households with lower beef expenditure shares. Regarding the second pair of BSE cases, it appears that habit did not have significant impacts on the selected sample households' responses to these two recurrent cases of BSE.

To formally test the hypothesis that negative impacts of BSE incidents are offset by generalized trust, we interact the generalized trust variable with the two significant BSE dummy variables which have negative impacts on beef expenditure shares, i.e., BSE11 and BSE23. The coefficient on the interaction between trust and BSE23 is positive and significant, suggesting that trust led the households that are trusting from reducing their expenditures on beef purchases following the second and third BSE cases. Moreover, the magnitude of the negative impact of the this pair of BSE events on expenditure shares for beef purchases (0.066) almost equals the magnitude of the positive effect of trust (0.067) on these expenditure shares, suggesting that the households that are trusting barely reacted to the second pair of BSE events. In contrast, the coefficient on the interaction between trust and BSE11 is not significant; thus the results show no evidence that trust influenced households' responses to the first BSE event. A possible explanation for this pattern of results is that at the time of the first BSE announcement, risk concerns had more influence on the sampled consumers. However, the experience of the first BSE incident, as reflected in associated press reports, indicated the health risk of eating Canadian beef to be extremely low. Consequently, it seems that respondents that are trusting did not react to the second BSE events, while the less trusting respondents reduced their beef consumption after the discovery of the second and third BSE cases.

The results from estimating equations in levels are also presented in Table 3. In general, these results are consistent with the findings from estimating equations in differences, indicating that habit persistence offset the negative impacts of BSE responses following the first BSE case and that trust had a similar influence following the subsequent pair of BSE cases. Moreover, the results from estimating equations in levels

show that demographic characteristics also influenced households' beef expenditure shares. The number of children in the household had a negative impact on households' beef expenditure shares and consumers in Quebec tended to consume more beef relative to consumers in other regions of Canada.

Conclusions

This study relates generalized trust to consumers' reactions to recurring food safety incidents in the context of the series of the first three BSE cases in Canada. We examined the dynamics of monthly beef expenditure shares of a sample of Canadian households over the time period from January 2002 till December 2005 using micro-level household data which followed meat expenditures by Canadian households before and after the first three BSE cases. We found that beef expenditure shares were affected by a number of factors, including habit, seasonality, trust, food risks perceptions and some demographic influences. The sampled households reduced their beef expenditure shares following the BSE announcements, but these recovered subsequently. For the first BSE event, in May 2003, we found evidence that while trust did not play a significant role, habit persistence offset the negative impact of BSE. However, for the subsequent pair of BSE events in January 2005, generalized trust, rather than habit, offset the negative impact of these BSE cases on household beef expenditures.

The finding that generalized trust offset the negative effect of the second and third Canadian BSE cases suggests that individual's world views (described by some as moral attitudes) are important in how consumers react to a situation in which there are modest recurring risk events. However, the determinants of both generalized and institutional trust are not fully understood and warrant further work, as does assessment of different

measures of trust. This study examined how generalized trust affects consumers' reactions to BSE for the first three Canadian BSE cases. Future work will include assessment of different trust measures in situations of recurrent risk and may also be able to apply data from much longer time periods in order to include the subsequent BSE cases, enabling assessment of dynamic relationships between trust, food risks, and consumer behavior in the long run. In this study, to focus on the impact of trust on a sample of Canadian households that tend to consume meat fairly regularly we selected, from the complete Nielsen Homescan® panel, those households that purchased at least one meat product (not necessarily beef) in each of 48 consecutive months from January 2002 to December 2005 and that also participated in the 2008 survey. We must acknowledge the possibility that the behavioral patterns exhibited by this study sample are different from that of the general population. The robustness of the findings from this study is subject to the tests of future research.

Table 1. Summary statistics of household characteristics of the selected sample from the Nielsen Homescan® panel and the Canadian population

	Definition Categories	Mean (Standard Deviation)	
		Selected Sample	Population
Household Size	1=Single member 2=Two members 3=Three members 4=Four members 5=Five-Nine Plus members	2.53 (1.07)	2.5
Household Head Age	26=18-34 40=35-44 50=45-54 60=55-64 70=65+	57.04 (11.24)	NA
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-$69,999 100,000=$70,000+	57,597.25 (28051.79)	69,548
Household Number		437	NA

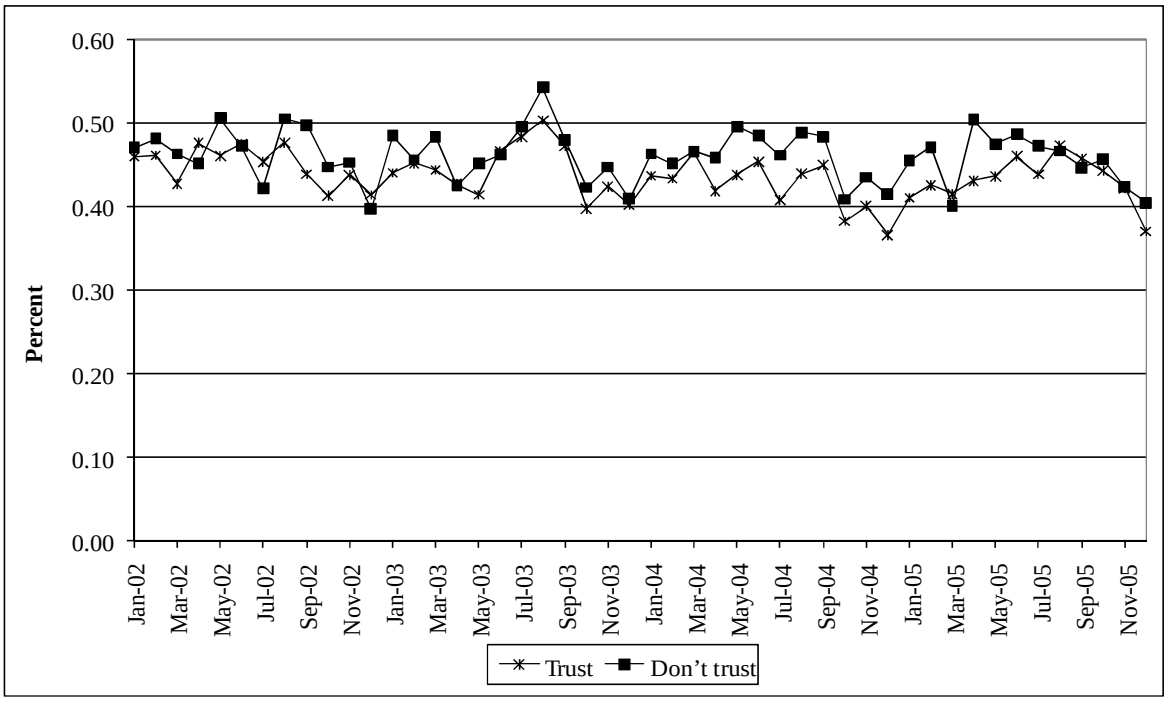
Source: Nielsen Homescan® Panel; Statistics Canada, 2006 Census (a) and (b).

Table 2. Household head education of the selected sample from the Nielsen Homescan® panel and the Canadian population 20 years and over

Household Head Education	Percent (%)	
	Selected Sample	Population (20+)
Not High School Graduate	18.6	15.7
High School Graduate	19.7	22.7
Some College or Tech.	15.7	13.3
College or Tech. Graduate	19.2	20.3
Some University	9.7	5.4
University Graduate	17.2	22.7

Source: Nielsen Homescan® Panel data; Statistics Canada, 2006 Census (c).

Figure 1. Average monthly expenditure shares for meat products from sampled Canadian households (2002-2005): Households that trust versus households that do not trust



Source: Based on data from Nielsen Homescan®, National All Channels, daily from January 1, 2002 to December 31, 2005

Table 3. Impacts of trust on households' responses to three BSE cases: Equations in differences versus equations in levels

	Equations in differences	Equations in levels
ω_{ht-1}	0.02407***	0.02284***
	(0.00770)	(0.00773)
$\ln x_{ht}$	0.01472**	0.02070***
	(0.00676)	(0.00646)
FEB	-0.00384	-0.00790
	(0.00891)	(0.00986)
MAR	-0.00129	-0.00078
	(0.00913)	(0.00915)
APR	-0.01074	-0.01050
	(0.00912)	(0.00913)
MAY	0.01170	0.01251
	(0.00900)	(0.00898)
JUN	0.01973*	0.02018**
	(0.01010)	(0.01013)
JUL	-0.01263	-0.01169
	(0.00952)	(0.00953)
AUG	0.02385**	0.02445**
	(0.00967)	(0.00968)
SEP	0.01436	0.01529
	(0.00938)	(0.00939)
OCT	-0.03217***	-0.03120***
	(0.00899)	(0.00900)
NOV	-0.01760*	-0.01659*
	(0.00906)	(0.00908)
DEC	-0.05127***	-0.05049***
	(0.00947)	(0.00952)
BSE11	-0.07537***	-0.08465***
	(0.02239)	(0.02387)
BSE12	-0.01088	-0.01005
	(0.01204)	(0.01204)
BSE13	0.04548***	0.04621***
	(0.01321)	(0.01320)
BSE14	0.04666***	0.04868***
	(0.01218)	(0.01219)
BSE21	-0.01295	-0.01260
	(0.01313)	(0.01315)
BSE22	0.00624	0.01117
	(0.01220)	(0.01277)

Table 3 continued

	Equations in differences	Equations in levels
BSE23	-0.06643***	-0.05344**
	(0.01712)	(0.01656)
BSE24	0.02917**	0.02953**
	(0.01166)	(0.01169)
T	-0.00045**	-0.00054***
	(0.00018)	(0.00019)
$\omega_{ht-1} * BSE11$	0.11624***	0.13291***
	(0.03625)	(0.04211)
TRUST*BSE11	-0.02094	-0.01608
	(0.02360)	(0.02243)
TRUST*BSE23	0.06704***	0.03916*
	(0.02484)	(0.02314)
NKID		-0.03970**
		(0.01600)
QC		0.09184***
		(0.01212)
CONSTANT		0.35379***
		(0.02690)

*,**,*** signify 10%, 5% and 1% levels of significance respectively.

Appendix 1 Definitions of the estimation model 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 indicating the month when the 1st BSE incident occurred (1=May 2003; 0=otherwise).
BSE12	A dummy variable indicating one month after the 1st BSE occurrence (1=June 2003; 0=otherwise).
BSE13	A dummy variable indicating two months after the 1st BSE occurrence (1=July 2003; 0=otherwise).
BSE14	A dummy variable indicating three months after the 1st BSE occurrence (1=August 2003; 0=otherwise).
BSE21	A dummy variable indicating the month when the 2nd BSE incident occurred (1=January 2005; 0=otherwise).
BSE22	A dummy variable indicating one month after the 2nd BSE occurrence (1=February 2005; 0=otherwise).
BSE23	A dummy variable indicating two months after the 2nd BSE occurrence (1=March 2005; 0=otherwise).
BSE24	A dummy variable indicating three months after the 2nd BSE occurrence (1=April 2005; 0=otherwise).
T	Time trend
$TRUST_h$	A dummy variable indicating trust (1=most people can be trusted; 0=can't be too careful in dealing with people)
NKID	Number of children in a household
QC	Regional dummy variable (1=Quebec; 0=otherwise).

References

Agriculture and Agri-Food Canada 2007**.**Beef demand in Canada. http://www4.agr.gc.ca/AAFCAAC/display-afficher.do?id=1184247072557&lang=eng (accessed April 20, 2009).

Arellano, M. and S. Bond. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies* 58(2): 277-297.

Arellano, M. and O. Bover. 1995. Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics* 68(1): 29-51.

Banks, J., R. Blundell and A. Lewbel. 1997. Quadratic Engel curves and consumer demand. *The Review of Economics and Statistics* 79 (4): 527–39.

Blundell, R. and A. Duncan. 1998. Semiparametric estimation and consumer demand. *Journal of Applied Econometrics* 13 (5): 435–61.

Burton, M., and T. Young. 1996. The impact of BSE on the demand for beef and other meats in Great Britain. *Applied Economics* 28(6): 687-693.

CFIA (Canadian Food Inspection Agency). 2009. BSE enhanced surveillance program.http://www.inspection.gc.ca/english/anima/heasan/disemala/bseesb/surv/surve.shtml

Deng, Y., M. Veeman and W. Adamowicz. 2011. Habit, BSE, and the dynamics of beef consumption. *Canadian Journal of Agricultural Economics.* In press. (Journal number not yet assigned).

Glaeser, E. L., D.I. Laibson, J.A. Scheinkman, and C.L. Soutter. 2000. Measuring trust. *Quarterly Journal of Economic*, 115(3): 811-846.

Houghton, J.R., G. Rowe, L.J. Frewer, E. van Kleef, G. Chryssochoidis, O. Kehagia, S. Korzen-Bohr, J. Lassen, U. Pfenning, and A. Strada. 2008. The quality of food risk management in Europe: perspectives and priorities. *Food Policy* 33(1): 13-26.

Hu, W., A. Hunnemeyer, M. Veeman, W. Adamowicz, and L. Srivastava. 2004. Trading off health, environmental and genetic modification attributes in food. *European Review of Agricultural Economics* 31(3): 389-408.

Huffman, W. E. 2003. Consumers' acceptance of (and resistance to) genetically modified foods in high-income countries: Effects of labels and information in an uncertain environment. *American Journal of Agricultural Economics* 85(5): 1112-1118.

Kalaitzandonakes, N., L.A. Marks, and S.S. Vickner. 2004. Media coverage of biotech foods and influence on consumer choice. *American Journal of Agricultural Economics* 86(5): 1238-1246.

Lobb, A. E., 2005. Consumer Trust, Risk and Food Safety: A Review. *Food Economics* 2(1): 3-12.

Lobb, A. E., M. Mazzocchi, and W.B. Traill. 2007. Modelling risk perception and trust in food safety information within the theory of planned behaviour. *Food Quality and Preference* 18(2): 384-395.

Muellbauer, J. 1976. Community preferences and the representative consumer. *Econometrica* 44 (5): 979–99.

Piggott, N. E. and T.L., Marsh. 2004. Does Food Safety Information Impact U.S. Meat Demand? *American Journal of Agricultural Economics* 86(1): 154-174.

Pollak, R. A. and T. J. Wales. 1981. Demographic variables in demand analysis. *Econometrica* 49 (6):1533–51.

Siegrist, M. 2000. The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk Analysis* 20(2): 195-204.

Siegrist, M., and G. Cvetkovich. 2000. Perception of hazards: The role of social trust and knowledge. *Risk Analysis* 20(5): 713-720.

Sjöberg, L. 2001. Limits of knowledge and the limited importance of trust. *Risk Analysis* 21(1): 189-198.

Statistics Canada. 2004. The Daily, Food consumption 2003. http://www.statcan.ca/Daily/English/040526/d040526e.htm (accessed April 5, 2009).

Statistics Canada. 2006. The Daily, Food consumption 2005. http://www.statcan.gc.ca/dailyquotidien/060601/dq060601c-eng.htm (accessed February 8, 2009).

Statistics Canada. 2002-2005. CANSIM table 3260020. http://dc.chass.utoronto.ca/cgi-bin/cansimdim/c2_arrays.pl (accessed April 20, 2009).

Statistics Canada. 2006 Census (a). Average Household Size for Canada, Provinces and Territories, 2006, 2001 and 1996 Censuses. http://www12.statcan.ca/english/census06/data/trends/table_2.cfm?T=PR&LINE_ID=407&TOPIC_ID=400 (accessed April 30, 2009).

———. 2006 Census (b). Statistics Canada catalogue no. 97-563-XCB2006045. http://www12.statcan.ca/english/census06/data/topics/RetrieveProductTable.cfm?ALEVEL=3&APATH=3&CATNO=&DETAIL=0&DIM=&DS=99&FL=0&FREE=0&GAL=0&GC=99&GID=837928&GK=NA&GRP=1&IPS=&METH=0&ORDER=1&PID=94592&PTYPE=88971&RL=0&S=1&SUB=0&ShowAll=No&StartRow=1&Temporal=2006&Theme=81&VID=0&VNAMEE=&VNAMEF= (accessed April 30, 2009).

———. 2006 Census (c). Highest Certificate, Diploma or Degree (14), Age Groups (10A) and Sex (3) for the Population 15 Years and Over of Canada, Provinces, Territories, Census Metropolitan Areas and Census Agglomerations. http://www12.statcan.gc.ca/english/census06/data/topics/RetrieveProductTable.cfm?ALEVEL=3&APATH=3&CATNO=97-560 XCB2006007&DETAIL=0&DIM=&DS=99&FL=0&FREE=0&GAL=&GC=99&GK=NA&GRP=0&IPS=97-560-XCB2006007&METH=0&ORDER=&PID=93609&PTYPE=88971&RL=0&S=1&ShowAll=&StartRow=&SUB=&Temporal=2006&Theme=75&VID=&VNAMEE=&VNAMEF=(accessed April 30, 2009).

Uslaner, E. M. 2001. Trust as a moral value. Prepared for the conference, "Social Capital: Interdisciplinary Perspectives", University of Exeter, United Kingdom. http://huss.exeter.ac.uk/politics/research/socialcapital/papers/uslaner.pdf. Accessed 14 September 2009.

Uslaner, E. M. 2002. The moral foundation of trust. New York: Cambridge University Press.

Uslaner, E. M. 2008. Trust as a moral value. In *The handbook of social capital*, edited by D. Castiglione, J.W. van Deth, and G. Wolleb, pp. 101-121. Oxford University Press, New York.