CORA Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

Title	How do U.S. and Canadian consumers value credence attributes associated with beef labels after the North American BSE crisis of 2003?
Authors	Steiner, Bodo E.;Yang, Jun
Publication date	2010-07-01
Original Citation	Steiner, Bodo E. and Yang, Jun (2010) 'How do US and Canadian consumers value credence attributes associated with beef labels after the North American BSE crisis of 2003?'. International Journal of Consumer Studies, 34 (4):449-463. doi: 10.1111/j.1470-6431.2010.00889.x
Type of publication	Article (peer-reviewed)
Link to publisher's version	10.1111/j.1470-6431.2010.00889.x
Rights	© The Authors. Journal compilation © 2010 Blackwell Publishing Ltd. This is the pre-peer reviewed version of the following article: Steiner, B. E. and Yang, J. (2010), How do U.S. and Canadian consumers value credence attributes associated with beef labels after the North American BSE crisis of 2003? International Journal of Consumer Studies, 34(4): 449–463. which has been published in final form at http://dx.doi.org/10.1111/j.1470-6431.2010.00889.x
Download date	2026-11-06 08:13:52
Item downloaded from	https://hdl.handle.net/10468/420

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

This is the pre-peer reviewed version of the following article:

Steiner, B. E. and Yang, J. (2010), How do U.S. and Canadian consumers value credence attributes associated with beef labels after the North American BSE crisis of 2003? *International Journal of Consumer Studies*, 34(4): 449–463. © The Authors. Journal compilation © 2010 Blackwell Publishing Ltd

which has been published in final form at http://dx.doi.org/10.1111/j.1470-6431.2010.00889.x

CORA Cork Open Research Archive http://cora.ucc.ie

How do U.S. and Canadian consumers value credence attributes associated with beef labels after the North American BSE crisis of 2003?

Bodo E. Steiner and Jun Yang[1]

Forthcoming in: *International Journal of Consumers Studies*

November 2009

Abstract

A consumer survey conducted in 2006 (n = 419), and therefore after the first confirmed BSE cases in North America in 2003, employs attribute-based choice experiments for a cross-country comparison of consumers' valuation of credence attributes associated with beef steak labels; specifically a guarantee that beef was tested for BSE, a guarantee that the steaks were produced without genetically modified organisms (GMO), and a guarantee that beef steaks were produced without growth hormones and antibiotics. Considering consumers' socio-economic characteristics, the results suggest that consumers in Montana (U.S.) and Alberta (Canada) are significantly heterogeneous in their valuation of the above attributes, although consumers' relative valuation of these process attributes does not appear to have changed since the 2003 BSE crisis in each region. Alberta consumers place a significant valuation on beef tested for BSE, which is striking because Canada's current legal environment does not permit testing and labeling of such beef by private industry participants. Montana consumers' valuation was found highest for a guarantee that the steaks were produced without GMO. Effective supply-chain responses to consumers' valuation of credence attributes, for example in the form of labeling, should therefore take consumers' heterogeneity into account.

Keywords: beef labeling, choice experiments; multinomial logit; perceived risk; willingness-to-pay; Canada; U.S.

JEL classification: D12, L66, C35

[1]Department of Rural Economy, University of Alberta, 515 General Services Building, Edmonton, Alberta T6G 2H1, Canada; Associate Professor and Graduate Student (jy8@ualberta.ca), respectively. Correspondence: bsteiner@ualberta.ca. Funding provided by the Consumer and Market Demand Network of Canada is gratefully acknowledged.

1 Introduction

Food labels can play an important role to consumers, not only in instances where they are less informed about a product's quality attributes than sellers, but also when consumers have misperceptions about food risks. When consumers hold such risk perception biases that may be reflected in the under- or overestimation of the probability of risks to occur (Viscusi (1992), Fischhoff (1995), Johansson-Stenman (2008)), consumers' actual risk-taking behavior may not match their inherent food and risk preferences, so that an unintentionally higher consumption of risky foods can make consumers worse off.[2] Public information provision can play a role to counteract such market failures. Food labeling and an analysis of consumers' valuation of labeling attributes can be part of such public information provision, thereby contributing to public risk communication and outreach activities (Wilcox et al. (2004), McComas (2006)). Analyses of food labeling can also be part of industry risk communication strategies, thereby contributing to more effective supply-chain management strategies for firms and potentially reducing consumer misperceptions of risks overall (Steiner 2006).

Furthermore, there are a number of other reasons why it is important to improve our understanding of consumer choice and consumers' valuation of selected beef credence attributes as part of labeling. Consider the wave of food scares in Europe and North America over the past decade, it is likely that existing misperceptions of food-related risks (Setbon et al. 2005) were re-inforced by information available in the marketplace. This could be expected due to consumers' asymmetric valuation of negative and positive information. Since consumers give greater attention and weight to negative information

[2]See Magat et al. (1993) for a more extensive discussion of misperception of risks, in cases where consumers place excessive importance to low probabilities of risks. It has also been established that the severity of the consequences of a hazard are important to consumers in assessing food risks Slovic et al. (1968), impacting consumer risk perceptions (Slovic 1987)), and influencing choice probabilities Yeung et al. (2001).

in their decision-making process (Peeters et al. (1990), Aghion et al. (1991), Ahluwalia (2002)), there are incentives in the marketplace for a social over-provision of negative information to consumers. We have evidence from the U.S. on media biases in the area of food safety, additives and contaminants (Anderson 2000), as well as evidence from Europe that consumer misperceptions of food-related health risks have been exploited by mass-media publicity, so as to significantly and negatively affect consumers' decision-making on fresh-meat consumption (Verbeke 2003). But even in the absence of such misperceptions, the relative proximity of producers, wholesalers and retailers to the production process of food qualities implies that there are incentives for private firms to exploit information asymmetries about food and process quality characteristics to the detriment of the consumer (Beales et al. 1981).

Under such conditions of asymmetric and incomplete information, labeling can take on an important role of signaling inherent food qualities and risks embodied in a product or production process. Therefore, the nature of labeling as an extrinsic cue that informs buyers about intrinsic quality characteristics (Caswell 2000) can be an important contribution to the functioning of food markets. This contribution of labeling is particularly relevant in instances where consumers cannot determine the product's inherent quality even after consumption, as for example in the case of meat that is produced with genetically modified (GM) feed. In instances where those *credence attributes* (Nelson (1970), Darby et al. (1973)) are important, the government can have an important role to play through regulating liability (Shavell (1984), Steiner (2006)), through certification of labels, and by providing information through informational labeling (Caswell et al. 1996). Consequently, government intervention through labeling can also have an important influence on consumer (mis)perceptions of risks, knowledge and behavior (Viscusi et al. (1987), Viscusi (1992)).

There are a number of other reasons why we are interested in improving our under-

standing of consumers' valuation of selected credence attributes associated with beef labels. The provision of food labeling information is likely to increase consumers' perceived control (Knox 2000) and thus reduce perceived risks, since consumers' lack of perceived control has been identified as a factor that increases consumers' risk perceptions (McComas 2006) and consumers' demand for greater protection from risks (Slovic 1987). Further, we have evidence that North American consumers' demand for labeling information has been increasing in the case of GM foods (Brown et al. 2003). Research from Europe suggests that a better understanding of the seemingly irrational and changing consumer behavior with respect to food safety and risk information is also key to rebuilding consumer confidence and improving food risk communication strategies, particularly in the case of GM foods, where consumers perceive the control of GM technology at the level of society (Ritson et al. (2006), Verbeke et al. (2007)).

Furthermore, since audience segmentation is an aspect of effective risk communication (Silk et al. 2005), an analysis of consumers' valuation of credence attributes that accounts for specific socio-economic and demographic attributes of consumers may contribute to more effective risk communication efforts of public policymakers as well as of private supply-chain managers.

Since other studies (Finucane et al. (2000), Veeman et al. (2004), Bailey et al. (2005)) have explored similar credence attributes before the first BSE (*bovine spongiform encephalopathy*) cases were officially confirmed in North America (May of 2003 in Canada; June of 2005 in the U.S.), we also expect that a comparative analysis between a sample of U.S. and Canadian consumers that was conducted in 2006 is valuable in its own right.[3] In sum, we anticipate that further insights into consumers' valuation of selected credence attributes associated with beef labels could be valuable to policymakers and

[3]For more details about the history of BSE cases in North America and their trade implications on Alberta and Montana, see Lawrence et al. (2003), TheDaily (2004), David et al. (2005) and Su (2006).

industry participants alike.

The objective of our analysis is to explore consumers' valuation of three process quality characteristics associated with beef steak labels: beef that is (i) guaranteed produced without genetically modified organisms, (ii) guaranteed raised without growth hormones and antibiotics, and (iii) guaranteed tested for BSE.

2 Industry background

The implications of the May 2003 BSE case on aggregate red meat consumption in North America were significantly different from those in Europe. Canadian per capita beef consumption declined much less after May of 2003 (by about 10 percent; StatisticsCanada (2006)) than that of European consumers after March of 1996, when scientists had first established a possible link between BSE and variant Creutzfeld-Jakob Disease (Southey 1996). However, aggregate beef consumption in Canada and the U.S. has adjusted rather similarly. Following the 2003 Canadian BSE cow, annual beef per-capita consumption declined in 2004 in both the U.S. and Canada (StatisticsCanada 2006), yet it rebounded in both countries to levels exceeding the pre-BSE consumption levels in 2006 (Table 1).

[Table 1 about here]

Despite available information on similar aggregate beef consumption patterns for U.S. and Canadian consumers (Table 1), we have little information about how consumers' valuation of beef labeling attributes differs across the U.S. and Canada. Before attempting to contribute to this research gap by measuring consumers' willingness-to-pay (WTP) for beef labeling attributes, it is important to reflect on the key differences

(and similarities) between the U.S. and Canada in their regulatory schemes as they are related to the above three credence attributes.

In response to past food safety crises and differences in consumers' food safety concerns, governments and industry in the U.S. and Canada have responded with different quality assurance schemes and labeling regulations (Hobbs et al. (2002); Roberts et al. (2003)). With regard to labeling regulations for foods with genetically modified (GM) content, there are only minor differences between the U.S. and Canada. Both countries have not implemented mandatory labeling for foods with GM contents, and in both countries, food labels are only required to carry information about GM contents in cases where genetic modification significantly alters the properties of the food (Teisl et al. (2003), Roe et al. (2007)). Whereas U.S. consumers have been able to buy food products that are guaranteed to be not GM since 2002, based on a nationwide standard (United States Department of Agriculture (U.S.D.A.) certified organic; USDA (2008b)), this has not been the case in Canada until December 2007 when a nationwide standard for organic produce was implemented, which also contains a guarantee for the absence of GM (OTA 2008).

Currently about 95 percent of all cattle in the United States are implanted with growth hormones due to increased production efficiency and decreased production costs (Campiche et al. (2004)). Growth promoting hormones are also in extensive use in Canadian beef production for more than 30 years (CAHI 2008). Voluntary labeling of beef from cattle administered growth hormones has long been practiced in Canada and the U.S., although U.S. consumers are both critical as well as unaware of the use of growth hormones in beef production (Lusk et al. 2002).

Labeling for BSE testing has become a policy and consumer issue, not at least since March 26, 2007, when the U.S. District Court for the District of Columbia ruled that the U.S. Department of Agriculture (USDA) does not have authority to regulate testing

for BSE. However, this ruling was repealed by the USDA (Hansen 2007). During fall of 2008, a federal appeals court confirmed the USDA ruling, such that the USDA can continue to forbid meat packers from BSE testing cattle (AlbertaBeef 2008). Since the Canadian Food Inspection Agency (CFIA) has effectively aligned its legal position with the U.S. position, beef labeled as BSE tested is neither available in the U.S. marketplace, nor in Canada.

3 Previous work related to credence attributes associated with beef labels

A number of studies have explored consumer attitudes toward beef labeling attributes, primarily applying conjoint analyses and experimental auction methods. Studies of consumer attitudes toward genetically modified foods and GM labels have found that specific consumer segments can be identified according to socio-economic, demographic and cognitive variables (e.g. Kuznesof et al. (1996), Baker et al. (2001), Finucane (2002), Veeman et al. (2004), Kiesel et al. (2005), Ritson et al. (2006), McCarthy et al. (2007), Costa-Font et al. (2008)). Negative GM labeling was found to be more valued by U.S. consumers than positive GM labeling (Roe et al. 2007). Results from Roe et al. (2007) also suggest that simple claims of No-GM content are viewed by consumers as most adequate in terms of the information provided to make an informed decision.

Lusk et al. (2002) conducted a contingent valuation mail survey in February of 2000, to assess U.S. consumers' valuation for two potential mandatory labeling programs, labeling of beef from cattle that was produced with growth hormones, and labeling of beef that was fed genetically modified corn. WTP for the former was found to exceed

WTP for the latter.

An experimental auction-based study of beef and pork sandwiches among Utah consumers by (Dickinson et al. 2002) suggests that simple farm/animal origin traceability assurance in the absence of additional quality assurances related to food safety is valued little by U.S. consumers.

Bailey et al. (2005) report on results from a survey conducted in three U.S. cities in two states (Utah and Idaho), where consumers were questioned near supermarket meat counters between December of 2004 and February 2005.[4] Results from their conjoint analysis suggest that a two-stage tracking process that is currently developed in the U.S. is less preferable to consumers than farm-to-fork traceability and/or guaranteed testing for BSE. In particular, the authors' results suggest that a higher percent of respondents is willing to pay a 5% price premium for a guaranteed BSE testing than for traceability.

Quagrainie et al. (1998) conducted a series of choice experiments in 1996 among Canadian consumers for origin labeling (beef and pork) and biopreservatives in packaging. While the study establishes a significant price premium for Canadian over U.S. beef, it finds that Canadian consumers view biopreservatives negatively in packaging.

More recently, Angulo et al. (2007) have examined the relationship between Spanish consumers' risk perception and their WTP for certified beef. The authors focus on voluntary beef labeling programs, particularly on traceability labeling, suggesting that traceability alone plays a very small role for consumer choices.

Our study is related to two other choice-experiment-based studies. Tonsor et al. (2005) conducted three choice experiments in 2002 in London, Frankfurt, and Paris, to ana-

[4]Similar to our survey, this survey did also not provide the participants with full information about OIE (The World Organization for Animal Health) standards as they relate to USDA BSE testing protocols.

lyze how consumers value beef steaks with attributes including "GM-free", farm-specific source verification, and domestic origin. This study finds that consumers are significantly heterogeneous across regions in their preferences for beef steak attributes. Lusk et al. (2004) conducted choice experiments in 2002 in the U.S., in order to test for hypothetical bias in consumers' valuation of beef steak attributes, including steaks that were "guaranteed natural". The marginal WTP for steak attributes was found to be equivalent in both the hypothetical and real settings, where consumers where given the option to actually purchase steaks.[5]

The present study is also related to another analysis of beef labeling strategies in Europe. Roosen et al. (2003) conducted mail-back surveys based on referendum design with follow-up in 2000 in France, Germany, and the UK, to analyze consumers' WTP for alternative beef labeling strategies. Their analysis focuses on brands, origin labels, and mandatory labeling of beef from cattle fed genetically modified feed. Consumers were asked to state their preferences for a brand that signals on behalf of an individual firm, for a product origin label, and for a mandatory GMO label. The study results suggest that European consumers have high concerns over GM foods, as more than 90% of surveyed consumers wanted a mandatory labeling program for beef produced from cattle fed genetically modified crops.

Our study differs from the above in several ways. It is, to the best of our knowledge, novel in terms of three aspects. First, it is the first comparative U.S.-Canadian study that analyzes consumers' valuation for beef labeling attributes, though confined to one region from each country only. Second, our study also seems to be the first study to explore North American consumers' willingness-to-pay for BSE testing using choice experiments. Third, it is to the best of our knowledge also the first choice-experiment based study in Canada focusing on beef labeling, in which the survey was conducted

[5]However, purchasing propensities were found to be higher in the hypothetical setting, compared to the non-hypothetical setting.

after the first 2003 Canadian BSE cases, during April of 2006 in both Montana and Alberta. It provides thus a useful comparison to the results from studies conducted prior to 2003.

4 Data and experimental design

4.1 Survey design steps

The survey development was initiated by focus group research using Alberta consumers, whereby four focus group discussions were facilitated with 8 to 10 consumers each, hosted at the University of Alberta. Two initial focus groups were conducted with a mixture of undergraduate and graduate students from the University of Alberta, in each case. Subsequently, a professional marketing firm was recruited to identify Alberta consumers based on random-digit-dialing, ensuring representativeness in terms of gender, age classes and geographic origin (urban vs. rural).

The focus group research was used to identify the key attributes and attribute levels for beef steaks, as well as to gain feedback on the web-format of the survey. For every attribute we tried to ensure that the wording as used in the final survey was not misunderstood. This was particularly important in the case of BSE testing and use of GMO in beef production. The focus groups confirmed that labeling for BSE testing was understood to refer to testing of every animal (and thus steak) that was sold under such a label. It was also confirmed that our statement that steaks were produced without GMO was not misunderstood to refer to a modification of the animal genes, but to the use of GMO feed in beef production. During the initial two focus groups we also discussed a larger set of credence attributes than the three finally chosen. These included farm-origin traceability and pesticide residues. However, given the

more significant discussion that was generated by the three credence attributes finally chosen in our analysis, as well as considering the regulatory and political controversy in early Spring 2006 about testing beef cows for BSE, we decided not to pursue consumers' willingness-to-pay for origin traceability and pesticide residues.[6]

4.2 Survey recruitment procedure

Following the above focus group discussions, a preliminary web-based survey was tested internally, by 8 individuals from the University of Alberta (members of the administrative, academic staff and graduate students). The web survey was then put live by an international marketing firm in the following manner. Consumers were first contacted via phone using a random digit dialing computer assisted telephone interviews (CATI) screener, and offered an incentive payment for participation ($5 Amazon gift voucher [in both Montana and Alberta]). Vegetarians and consumers under 18 were excluded from survey participation. Those consumers who did not complete the survey within two weeks received reminder emails and one reminder phone call. Following this procedure, the marketing firm first recruited 12 Alberta consumers via RDD and then stopped, so that final minor adjustments to the survey design could be performed.[7] After these steps, the international marketing firm used RDD to recruit a total of 214 consumers from Montana, and another 205 consumers from Alberta.

[6] *Creekstone Farms*, a U.S. meatpacker, sued the federal U.S. government in March of 2006, after the federal government had ruled that the company would not be allowed to test cows for BSE (Reuters 2006)

[7] For this initial survey, we placed comments boxes on each webpage, whereas the final survey concluded with one comments box.

4.3 Characteristics of sample population

Table (2) provides summary statistics about key socio-economic and demographic characteristics of the sample population for both Alberta and Montana consumers.

[Table (2) about here.]

Table (3) shows selected population characteristics from the U.S. and the Canadian census for 2006 and 2007.

[Table (3) about here.]

In both Alberta and Montana the survey was answered by more females than males. Respondents were, on average, older compared to the population in Alberta and Montana.[8] Consumers were also asked about their ethnic background, since previous studies on food-related hazards found significant ethnographic differences with regard to consumers' perceived risks (Flynn, Slovic, and Mertz (1994), Finucane, Slovic, Mertz, Flynn, and Satterfield (2000)). The summary statistics of our sample population for ethnic background suggest that there are significant differences between Alberta and Montana, particularly with regard to European heritage (30.5% in Alberta, 45.2% in Montana). A comparison of our sample of consumers to the 2006 Statistics Canada census population for Alberta, and to the Montana 2000 census suggests that consumers of European background are under-represented in our sample.[9] Comparing the proportion of Asian respondents in our sample (3.0% in Alberta, less than 1% in Montana)

[8]However, a concise comparison with census data is not conclusive, since we collected age information in ten-year intervals from respondents. Further, since we use age as a variable (as part of interaction terms) in our estimation, we can control for age-effects explicitly, as long as all age groups are represented in the raw data set (in our case of a possibly older sample population, we are interested in the lower end of the age distribution). As table (6) confirms (e.g. $Age < 20 \times Guar.\ BSE\ test$), the youngest age group is represented.

[9]European heritage in the 2006 Alberta census population: 48,8%, Chow (2008). European ancestry in the 2000 Montana census: 65%, Brittingham et al. (2004) (German 27.0%, Irish 14.8%, English

with the Asian population in the census populations (South-Asian in Alberta: 3.2%, Southeast-Asian in Alberta: 0.9%, Chinese in Alberta: 3.7%; less than 1% in Montana), and comparing the population of respondents from Central/South America in our sample (2.1% in Alberta; less than 1% in the Montana census) with the population of Latin Americans in Alberta's Census (0.8%) and the Hispanic/Latino population in the Montana census (2.5%), our sample is judged reasonably representative in terms of ethnographic composition.

Further, comparing the level of education in our sample population (23% and 31.1% of Montana and Alberta consumers, respectively, have a University degree as their highest level of education) with the educational level of the general population, we also conclude that our sample population is a reasonable representation of the Alberta and Montana population (27.4% of the Montana population has a Bachelor's degree or higher; 22.0% of the Alberta population has a University certificate, diploma or degree at bachelor's level or above). Finally, since the sample population age appears to be higher in both regions compared to the census population, the higher proportion of married survey participants compared to married consumers that were captured by the census (about 18% higher in the case of Alberta, and about 17% higher in the case of Montana) may not be surprising.

12.6%, Norwegian 10.6%). However, the divergence between the composition of our sample data and that of the census data could also be the result of differences in questioning the consumers. Whereas our survey asked '*What is your ethnic Background?*', the U.S. census asked *What is this person's ancestry or ethnic origin?*. Furthermore, given the frequent blend of ethnic origin in a respondent's ethnic history, particular care should be taken when comparing census data to our sample population (the Statistics Canada 2006 census highlights that "*persons who reported multiple ethnic origins are counted more than once ..., as they are included in the multiple responses for each origin they reported*" (Chow 2008).

4.4 Survey structure

The survey consisted of three parts. First, consumers were asked several rating and ranking questions that related to beef steak attributes. In this first section of the survey, consumers were also asked to identify their regular beef steak purchase by selecting from four steak attributes and corresponding attribute levels from a table. The identification of consumers' regular beef steak purchase was deemed beneficial for the subsequent choice experiments, since we anticipate that by engaging consumers in a comparison between less familiar steak options with a beef steak option that is close to their individual preferences, trade-offs are generated which are close to actual trade-offs in the marketplace.

The four steak attributes and corresponding attribute levels were as following. First, consumers could choose from beef steaks with and without a guarantee that steaks were produced without genetically modified organisms (GMO). Second, respondents could choose from beef steaks with and without a guarantee for BSE testing. Third, consumers could choose steaks with and without a guarantee for absence of growth hormones and antibiotics.[10] Fourth, respondents could choose between four price levels for their beef steak purchase ($13.99/ kg, $15.99/kg, $22.99/kg, $28.99/kg). These prices were derived from actual retail prices observed during March of 2006 in Edmonton, Alberta, as well as from online prices displayed on the website of a major retailer that is present in both Alberta and Montana (Safeway Inc.).[11] We did not include specific

[10] Our focus group research suggested that combining growth hormones and antibiotics into one category was justified, as consumers' perceptions associated with both were rather similar, and consumers felt not confused by this joint category. Previous research has also used this joint category (Finucane et al. 2000).

[11] The following steak types were used to derive these prices: sirloin (Can$13.99/kg), leg steak (Can$15.99/kg), rib eye (Can$22.99/kg), and strip loin (Can$28.99/kg). Statistics Canada lists average *Canadian* retail prices Can$11.98/kg for round steak (September 2006), and Can$15.09/kg (September 2006) for sirloin steak (StatisticsCanada 2008a). Looking for other prices of comparable steaks in the U.S., there are prices for two comparable steaks from BLS/USDA available (USDA 2008a): Sirloin USDA Choice boneless U.S.$13.00/kg, September 2006, and Sirloin steak, graded and ungraded, not choice or prime U.S.$11.00/kg, September 2006).

steak types in this table associated with those four price levels, not only because we wanted to limit the number of attributes to four in the subsequent choice experiments, but also because we wanted to ensure that the same survey format could be used in both the U.S. and Canada so as to ensure comparability of results.[12]

Once consumers had selected their regular beef steak purchase, they proceeded to a repeated choice experiment.[13] This consisted of four tables (four separate web-pages), in each of which they could choose one of three options at varying attribute levels (choice A: their regular beef steak; choice B: a specified beef steak; choice C: neither). For such a given set of four treatments, the treatment order was randomized. The individual respondents were also randomly assigned to a given set of treatments.

Table (4) provides a description of variables used in the estimation. The variable *White (Red) meat eater* deserves further discussion. Based on a sliding scale of percentage distributions (e.g. 0% red/100% white, 10% red/90% white, 20% red/80% white, 30% red/70% white etc.), we asked consumers "*To what extent do you consider yourself to be a red meat eater (including beef, pork and lamb) or white meat eater (including chicken, turkey and fish)?* ". A *White Meat Eater* was defined as 40% red/60% white or more white; correspondingly, a *Red Meat Eater* was defined as 60% red/40% white, or more red. The variable *Even white/red meat eater* refers to cases where consumers selected 50% red/50% white from the sliding scale.[14]

[12]In the U.S. survey we also employed the same dollar figures in U.S.$ that were used in the Canadian survey in Can$. We did not convert the above Canadian Dollar prices into U.S. Dollars using purchasing power parity, (i) since the retail steak price brackets are largely comparable for similar qualities in the U.S. and Canada (taking also into consideration that there are grading differences in both countries that pose limits to comparability), and (ii) because we are mainly interested in the differences between the four price levels in the choice experiments and during the subsequent modeling (after conversion with purchasing power parity, the corresponding U.S.$ prices/kg would be as following: $11.66, $13.33, $19.16, $24.16, assuming a purchasing power parity for 1.20 U.S. dollars per Canadian dollar for 2006, OECD (2006)).

[13]The survey was programmed such that attributes and attribute levels that could be chosen by consumers from this status-quo trade-off were subsequently entered automatically into the repeated choice experiments for each consumer.

[14]Our sample data had the following consumption profile in this regard: white meat eaters (40%red/60%white or more white) Alberta: 30.55% , Montana: 25.48%, red meat eaters

5 Methodological approach

For an analysis of consumers' WTP for beef labeling attributes, we employed a series of attribute-based choice experiments, which are asking valuation (willingness-to-pay) questions in hypothetical settings (Adamowicz et al. (2001), Louviere et al. (2000)). The conceptual foundations of these choice experiments go back to hedonic price methods, which view the demand for goods as derived from the demand for attributes (Lancaster (1966), Griliches (1971)).

For an analysis of consumers' unordered responses in these choice experiments, we assume that consumers follow the standard assumptions of random utility theory. We further assume that an individual n's utility for alternative i can be written as:

$$U_{ni} = V_{ni} + \varepsilon_{ni} \tag{1}$$

where the utility of an alternative consists of a deterministic component V (the beef steak attributes and socio-economic and demographics of respondents), and a random error term ε (unobservables and measurement error). The probability that individual n chooses alternative i from a choice set of alternatives J, can then be expressed as:

$$P_{ni} = P(U_{ni} > U_{nj}, \forall\ i \neq j \in J) = P(\varepsilon_{nj} > \varepsilon_{ni} + V_{ni} - V_{nj}, \forall\ i \neq j \in J). \tag{2}$$

We further assume that the random error terms follow an extreme value Type I distribution, and that they are independently and identically distributed across alternatives. The choice probabilities in equation (2) can then be expressed as a multinomial logit

(60%red/40%white or more red) Alberta 44.15% , Montana 53.37%.

model (McFadden 1974),

$$P_{ni} = \frac{exp(\mu\beta^T X_{ni})}{\sum_{j=1}^{J} exp(\mu\beta^T X_{nj})}. \quad (3)$$

The deterministic part of the utility function is assumed to be linear in parameters,$V_{ni} = \mu\beta^T X_{ni}$, μ denotes a scale parameter of utilities normalized to $\mu = 1$, and β^T is a parameter vector associated with the vector of explanatory variables X_{ni}. Therefore, the steak attributes enter the consumer's utility function through X_{ni}. Interaction terms between socio-economic and demographic characteristics and the alternative-specific constants (as well as other attributes) were included to allow for preference heterogeneity (Louviere et al. 2000).[15]

We used an orthogonal main-effects only design (Louviere et al. 2000). To reduce the number of treatment combinations, we employed fractional factorial design and generated the experimental orthogonal design in SPSS. Alternative-specific constants (ASC's) were included in the models, in order to allow for unobserved sources of utility associated with the beef steak choices.

6 Results

6.1 Estimation results

We used the following estimation procedure. First, we pooled the data from both regions and estimated a joint model in which we reduced interaction terms until convergence was achieved. We used the variables as identified in this converged model to estimate separate models for each region, keeping the information on the log-likelihood values. Based on these three models, we then constructed likelihood ratio tests for the

[15] A mixed logit model (Train 2002) was estimated, but did not converge. We used Limdep 8.0 and NLogit 3.0.1 for estimation.

poolability of the Alberta and Montana data (Table 5). Poolability is rejected at the .01 level (LR chi square = 115.1181, $df = 40$, $p < .01$).

Table (6) displays the estimation results for Montana and Alberta with alternative-specific constants, consumers' socio-economic and demographic variables and reduced interaction terms.[16] As expected, the results suggest that price plays a significant role in consumers' steak choices in both Alberta and Montana, since the coefficient estimate for price is negative, suggesting that increasing steak prices decrease the utility of consumers. The interaction term for 'regular steak' (ALT1) and 'male' are significant in both regions, implying that the marginal utilities for unobservable attributes are different between male and female consumers.

The following discussion explores the extent to which consumers' valuation of the above credence attributes associated with beef labels can be explained by consumers' socio-economic and demographic characteristics. Likelihood-ratio tests were employed to check for the significance of interaction terms between design variables and socio-economic/ demographic variables.

In interpreting consumers' valuation for a 'BSE test guarantee', a 'GM free guarantee' and a 'hormone free guarantee', we focus on comparing our results to previous studies that have analyzed these three credence attributes in terms of consumers' perceived risks - both in terms of food risks as well as environmental risks.

In the case of Montana, we have evidence that male consumers have, compared to female consumers, a higher marginal utility for a 'BSE test guarantee'. This finding could be due to differences in risk perceptions, hence food risks which these male consumers associate with BSE may be perceived greater compared to food risks that female respondents from Montana associate with BSE. We have no evidence for a difference in

[16] In the case of Alberta (Montana), and across all choice sets, consumers opted out 7.75% (12.65%), chose steak choice one 63.44% (63.14%), and chose beef steak two 28.8% (24.21%) of the time.

marginal utilities between male and female consumers from Alberta with regard to the 'BSE test guarantee'. Indeed, we have also no other evidence that marginal utilities differ between male and female respondents with regard to the two other credence attributes. These findings could be compared to a U.S. study by Finucane et al. (2000), in which risks of food-related hazards were analyzed, including (i) the risk of getting mad-cow disease, (ii) the risks associated with genetically engineered crops, and (iii) the risks associated with growth hormones and antibiotics in meat. The mean ratings of perceived risks associated with (i)-(ii) were all higher for females compared to males, and for both males and females, (iii) received the highest mean rating whereas (i) received the lowest.

Further, in Finucane et al. (2000), Asian males were found to have lower perceived risks than white males for growth hormones and antibiotics in meat, whereas Asian males were found to allocate significantly higher (slightly higher) risk ratings than white males to the risk of getting mad-cow disease (to risks associated with genetically-engineered crops). Thus, we had anticipated three findings; first, that the marginal utility for a 'BSE test guarantee' in our survey would be higher for females than males; and second, recalling that the Asian population in our Alberta sample was larger than that in our Montana sample (Alberta: 3.0%, Montana $< 1\%$), we anticipated that if a positive interaction term between male and 'BSE test guarantee' would be found, it would be more likely to find a significant interaction term for Alberta male consumers than for Montana male consumers; third, since the confirmation of the first BSE cases in Canada and the U.S. in 2003, we had anticipated that irrespective of gender, a 'BSE test guarantee' would be valued higher compared to a 'hormone free guarantee' and a 'GM free guarantee'. We conclude that the high valuation of male respondents from Montana for a 'BSE test guarantee' may be a reflection that these consumers perceive risks associated with BSE to be higher compared to risks associated with growth hormones and antibiotics.

The interaction term for 'education level below college' and 'hormone free guarantee' is significant and positive in both regions. This suggests that both Alberta and Montana consumers with an educational level below college have on average a higher marginal utility for a 'hormone free guarantee' compared to respondents with an educational level that is higher or equal to college level. However, only Montana consumers (and not Alberta consumers) with an educational level below college have higher marginal utility also for a 'BSE test guarantee'. One possible explanation for the higher valuation of a 'BSE test guarantee' and a 'hormone free guarantee' by consumers with lower levels of education could be that the marginal utility of additional information for these process qualities is lower for consumers with higher levels of education. However, a recent European study on consumers' attitudes toward biotechnology would suggest that we could expect a positive and significant interaction term for 'education level below college' and 'GM free guarantee'. The study by Lusk et al. (2004) found that consumers with higher levels of subjective knowledge about potential benefits of biotechnology (benefits of GM food production) were less influenced by new information about this technology. Therefore, assuming for our study that more educated consumers have higher levels of subjective knowledge about GM foods, the low valuation of these consumers for a 'GM free guarantee' could have been expected, if this labeling information was perceived as having little influence on consumer choice, as in the study by Lusk et al. (2004). However, not only are there significant differences in public attitudes toward biotechnology between North America and Europe (Finucane (2002), Priest et al. (2003), Gaskell et al. (2004), Traill et al. (2004) , Lusk et al. (2004), Roe et al. (2007)), but a significant interaction term for an education level below college' and a 'GM free guarantee' requires us to look beyond consumers' influence by new information as a direct explanatory factor. If new information has little influence on consumers, this impact with little behavioral change is likely a reflection of consumers' level of perceived control, and thus consumers' risk perception (Slovic

1987).

Therefore, to what extent could the above results regarding the interaction terms for 'education level below college' be explained by consumers' risk perceptions, and specifically by consumers' perceived personal control? If consumers have limited perceived control, they are more likely to engage in self-protection activities (Slovic 1987), so that labeling can be important to enhance consumers' perceived personal control (Knox 2000). Thus, we would expect that more highly educated consumers in our sample, who are likely to have a higher level of perceived control over risks associated with BSE and growth hormones compared to consumers with lower education, associate lower levels of perceived risks with BSE and growth hormones. Consequently, beef labels associated with these two credence qualities are likely to be valued lower by consumers with higher levels of education, compared to consumers with less formal education, as suggested by our estimates.

Nevertheless, our results are still striking in that the interaction terms 'BSE test guarantee'/ 'education below college' as well as a 'hormone free guarantee'/ 'education below college' were found to be statistically significant, yet not the interaction term 'GM free guarantee'/ 'education below college'. The insignificance of the interaction term for GMO may be explained by consumers' differential view with regard to perceived control as it relates to environmental risk (Rowland 2002).[17] A study of 30 food and non-food products in Germany suggests that consumers consider most foods in terms of personal risk, except for GM foods, where consumers judge both personal and environmental risks to be important (Schütz and Wiedemann 1998). This finding is supported by a Canadian-wide survey conducted in January of 2003, in which respondents considered agricultural biotechnology as more of an environmental risk issue

[17]Environmental risks can be understood here to encompass both ecological and ethical concerns of consumers, both of which have been found to be important in affecting consumer attitudes toward GM foods (Knox 2000).

than an issue of food safety (Veeman and Adamowicz 2004). Consequently, we could expect that consumers' perceived personal control over risks associated with a beef steak that is produced with GMO is also influenced by perceptions for environmental risk, a factor which is likely absent in the case of beef steaks that consumers associate with BSE and growth hormones/antibiotics.

Further, consumers' perceptions of environmental risks may also help to explain why lower levels of education in our survey are associated with a higher valuation of a 'BSE test guarantee' and 'hormone free guarantee', yet not with a 'GM free guarantee'. A previous U.S. study based on surveys conducted in 1992, 1994 and 1998 finds that more educated consumers are more supportive of agricultural biotechnology (Hoban 1998). Considering this evidence together with the above findings from Schütz et al. (1998) and Veeman et al. (2004) on environmental risks, we could expect that the more educated consumers, as those in Hoban (1998), perceive environmental risks to be less significant compared to consumers with lower levels of education. Thus, assuming for our study that consumers judge environmental risk to be mostly relevant in the context of beef that is guaranteed produced without genetically modified organisms (and not with regard to growth hormones, antibiotics or BSE), and that consumers with less formal education judge these environmental risks to be more significant compared to consumers with higher education, we could expect that the 'GM free guarantee' in our survey is not valued highly by consumers with higher levels of education. Further, since we have evidence that U.S. and Canadian consumers' attitudes towards agricultural biotechnology are rather similar (Hoban 1998), it could be argued that it is not too surprising that the interaction term 'GM free guarantee'/'education below college' is neither significant in Canada nor in the U.S..

Considering the immigration status of our respondents, the marginal utility of Alberta consumers who lived for fewer than five years in Canada decreases as steak prices

increase, and their marginal utility increases for steaks that carry a 'GM free guarantee', compared to consumers who lived in Canada for more than five years. Since very few Montana consumers are recent immigrants (Table 2), and since many recent Alberta immigrants in our sample are non-white (who are thus likely to have perceived risk that are higher compared to white, longer-term immigrants; Flynn et al. (1994)), it is not surprising that these effects are confined to Alberta consumers in our sample.

Further, both interaction terms for 'white meat eater' and 'price', as well as 'white meat eater' and 'GM free guarantee' are significant and positive in the case of Alberta.[18] This suggests that increasing steak prices increase the utility of white meat eaters, and that the marginal utility for a 'GM free guarantee' is higher for white meat eaters compared to red meat eaters. This result is somewhat anticipated. First, since we expect that consumers who eat lower quantities of red meat ('white meat eaters') are more likely to purchase red meat of higher quality (price), with could include a number of process quality traits.[19] However, it is not clear why 'White meat eaters' value a 'GM free guarantee' more highly compared to the other two process quality traits under consideration. The fact that the interaction term for 'white meat eater' and 'GM free guarantee' is significant for Alberta only, which has a larger share of Asian population compared to Montana, may be associated with Asian consumers being more likely to consume white meats, and with the greater perceived risks that Asian consumers may associate with GMO. Clearly, we have not sufficient ethnographic evidence from Canada to validate or reject such claims.[20]

[18]Since the interaction term 'white meat eater' and 'GM free guarantee' is not significant in the case of Montana, the results suggests that Montana consumers' marginal utility for price and for a 'GM free guarantee' is not affected by whether consumers are red or white meat eaters.

[19]Evidence from the U.S. suggests that consumers with lower income eat more red meat (Davis et al. 2005). The analysis of Guenther et al. (2005) also suggests that "*Individuals with higher than average beef consumption include those living in the Midwest, those in households with no young children (age 5 years and younger), Mexican Americans and non-Hispanic blacks, and those with lesser household incomes.*" (p.1268). Our assumption is thus that consumers with lower household incomes are more likely to purchase beef of lower quality.

[20]Nevertheless, our results with regard to the 'white meat eater' and 'GM free guarantee' interaction term could be compared with findings from a European study. Kuznesof et al. (1996) find that genetic

The interaction term for regular smoker and price is significant (and negative) in the case of Montana consumers only, suggesting that the marginal utility of regular smokers from Montana decreases as steak prices increase. Similarly, the significant and negative interaction term for regular smokers from Montana and 'BSE test guarantee' suggests that, compared to consumers that do not smoke regularly, the former have a lower marginal utility for such a 'BSE test guarantee'. Since we have no evidence of a similar effect in the case of Alberta, our results suggest that marginal utilities of Alberta consumers for steak price and for BSE testing are not significantly different between regular smokers and those consumers that do not smoke regularly. We collected information about smoking behavior from respondents based on the hypothesis that smoking behavior can be associated with high-risk behavior.[21] Consequently, we expected that regular smokers, who are likely less risk averse with regard to food risks, would value a 'BSE test guarantee' less compared to respondents who are not regular smokers. Therefore, the finding of a significant and negative interaction term for regular smokers from Montana and a 'BSE test guarantee' supports our initial hypothesis. Further, the fact that a 'BSE test guarantee', and neither a 'hormone free guarantee' nor a 'GM free guarantee' delivered a significant interaction term with regular smokers may be due to these consumers' perception that risks associated with the above three beef labeling attributes are perceived to be highest in the case of a 'BSE test guarantee'.

modification is less acceptable to UK consumers for red meats compared to poultry and fish. In the context of our study, this could have led us to expect that the valuation of a 'GM free guarantee' would be higher for red meat compared to white meat eaters.

[21] We have support from Zuckerman et al. (2000) and Eensoo et al. (2007) for this hypothesis. The recent study by Eenso et al. (2007) from Europe suggests that smoking is an independent predictor of all sample groups [boys and girls aged $15.3 \pm .5$ years] with high traffic risks, since the study finds that all high traffic risk groups were approximately three to five times more likely to be smokers compared to low-risk groups. Although the case of beginning smokers is a "*... strong repudiation of the model of informed rational choice* (Slovic et al. 2007, p.1349), we have overwhelming evidence that due to nicotine addiction, only a fraction of beginning smokers actually quit (Chassin et al. (1990); Slovic et al. (2007)). Therefore, we expect that the results from Eenso et al. (2007) continue to hold for adult smokers in our sample.

6.2 Willingness-to-pay measures

Since we were also interested in welfare measures, we computed the marginal willingness-to-pay (WTP) for attributes based on the above two regional models (Table 6), such that,

$$MWTP_j = \frac{1}{MUM} * MU_j, \tag{4}$$

where the negative marginal utility of price is the marginal utility of money (MUM), and MU_j denotes the marginal utility of jth attribute. The marginal utility of price was allowed to vary across individuals, since interaction terms between price and socio-economic and demographic variables were included in the model. Although an average consumer could be used to calculate the marginal WTP, due to the likely non-linear nature of the marginal WTP function, we calculated the individual marginal WTP's and then derived the average marginal WTP for specific attributes.

As a second welfare measure, we follow Freeman (1993) to obtain compensating variation (CV) measures for the above credence attributes,

$$CV = \frac{1}{MUM} * (Log(\sum_i e^{v_i^1}) - Log(\sum_i e^{v_i^0})). \tag{5}$$

Table (7) displays both of the above welfare measures in terms of the WTP premiums for the above credence attributes, in terms of marginal WTP (MWTP) as well as CV, in U.S. Dollars.

[Table (7) about here]

The key difference between consumers from Alberta and Montana is that Alberta

consumers' willingness-to-pay premium is highest for beef that is guaranteed tested for BSE (mean MWTP Alberta: 3.82 $/kg; mean CV: 7.08 $/kg), whereas it is highest for beef that is guaranteed raised without growth hormones and antibiotics in the case of Montana consumers (mean MWTP for Montana: 3.5 $/kg; mean CV: 6.11 $/kg). Alberta consumers value a 'BSE test guarantee' 28% higher compared to consumers from Montana. Compared to the WTP premium for a 'BSE test guarantee', the mean MWTP premium is 1.08 $/kg lower for a 'hormone free guarantee', and 1.91 $/kg lower for a 'GM free guarantee' in the case of Alberta consumers. Compared to the WTP premium for a 'hormone free guarantee', the mean MWTP premium is 0.77 $/kg lower for a 'BSE test guarantee', and 1.05 $/kg lower for a 'GM free guarantee' in the case of Montana consumers.

We had anticipated that Alberta (and not Montana) consumers' willingness-to-pay premium would be highest for beef that is guaranteed tested for BSE. This could be expected, since the first officially confirmed North American BSE case in 2003 originated from Alberta, and is thus likely to have affected consumers' risk perceptions associated with BSE more significantly compared to those of Montana consumers.

Our Montana results could also be compared to a U.S. consumer study conducted in 2000, which explored consumers' valuation of two potential mandatory beef labeling programs Lusk et al. (2002). Similar to our findings, the study suggests that consumers' WTP is higher for a mandatory labeling program for beef administered growth hormones than for mandatory labeling of beef from cattle fed GM corn. Considering the high valuation that Montana consumers place on a 'hormone free guarantee', it is also remarkable that a significant market existed in 2006 and continues to exist in Montana for growth-hormone-free beef products.[22]

[22]Examples include 'Montana Legend Natural Angus Beef', http://www.montanalegend.com/ourstory.cfm; 'Montana Ranch Brand': http://www.montanaranchbrand.com/; 'Montana Black': http://www.montanablack.org/PressRelease.htm; 'Lifeline': http://www.lifelinefarm.com/beef.php; other grass-fed beef producers:

7 Discussion and conclusions

Considering that the first North American BSE case originated from Alberta, Canada, in May of 2003, it is not too surprising that Alberta consumers value beef labeled as guaranteed tested for BSE more highly than U.S. consumers from Montana. A consumer survey was conducted in April of 2006 in Alberta and Montana, to explore the extent to which consumers value three credence attributes associated with beef steak labels differently. These attributes were a BSE test guarantee, a guarantee that beef was produced without genetically modified organisms (GMO), and a guarantee that beef was raised without growth hormones and antibiotics. Our estimation results from an attribute-based repeated choice-experiment suggest that consumers in Alberta and Montana are not only heterogeneous with regard to their socio-economic and demographic attributes in their valuation of the above credence attributes, but also that Alberta consumers' willingness-to-pay (WTP) premium is highest for a BSE test guarantee, whereas it is highest for a guaranteed absence of growth hormones and antibiotics in beef production in the case of Montana consumers.

The latter findings are consistent with the results of U.S. and Canadian studies that were conducted prior to May 2003, which suggests that the relative valuation of perceived risks associated with the above three credence attributes may not have changed significantly since then, in both regions. A Canadian study conducted in January of 2003 reports that consumers perceived BSE as a more risky food issue compared to growth hormones, and growth hormones more risky than genetic modification (Veeman et al. 2004). The U.S. study by Finucane et al. (2000) suggests that risks associated with growth hormones and antibiotics in meat were perceived higher than risks associated with genetically engineered crops, and the risk of getting mad-cow disease.

http://www.eatwild.com/products/montana.html. Alberta beef producers/feedlots that currently supply growth hormone free beef: $http://www.agric.gov.ab.ca/app68/dinealberta?cat1=Beef$.

Keeping the limited geographical coverage of our survey sample in mind, we hope that the results contribute to a better understanding of the informational and regulatory needs of consumers, policy makers and industry. The heterogeneity of consumers' valuation that was identified may help industry participants and governments alike in rebuilding consumer trust and in improving food risk communication strategies as part of more effective supply-chain management strategies.

More specifically, since audience segmentation has been identified as a particularly useful means for health communication strategies (Rogers 1996), our results suggest that there is scope for a public differential risk communication approach, so that the effectiveness and efficiency of risk communication could be improved. Risk communication could here be understood not merely as conveying technical risk information to consumers, but also as a means for generating trust (Johnson et al. 1994) through informed decision-making on perceived and objective risks (Anderson (2000), Knox (2000), Johansson-Stenman (2008)). Considering beef labeling, trust could be generated by the government when regulating liability, certifying labels, and implementing informational labeling in a competent and accountable manner, which takes into account specific consumer demands for labeling.

Given the significant valuation of a BSE test guarantee by consumers from Alberta (and to a lesser extent by consumers from Montana), from a normative point of view, our results provide some support that market forces should be allowed to satisfy consumer demands. Thus, an argument could be made that private firms in Canada and the U.S. should, in principle, be allowed to supply credence attributes such as BSE testing, while the regulator could accompany this step by focusing on appropriate monitoring and certification of labels that go along with such claims. Industry participants could then identify whether the marginal costs of implementing such a BSE testing scheme exceed the marginal benefits from capturing greater consumer surplus through labeling

BSE testing. If this regulatory change would come forward, private firms could also use BSE testing to further differentiate their products and brands in the marketplace, and to limit their product liability, thereby potentially reducing harmful externalities.

Considering our results for beef that is guaranteed produced without GMO in the context of Caswell's (2000) support for mandatory programs in countries where a large proportion of the population cares about GMO status, our findings provide some support for the implementation of mandatory labeling. Recognizing that Alberta consumers allocate a lower WTP premium to beef guaranteed produced without GMO (both compared to Montana consumers, as well as compared to the WTP premium associated with the other credence attributes), our results suggest that there is some, but weaker, support for mandatory labeling GMO in Canada, compared to regulatory scope with regard to BSE testing. This support for mandatory labeling in Canada is in line with an earlier Canada-wide survey conducted in January of 2003, which provided evidence that consumers have a strong desire for public engagement in biotechnology policy, and that they have a strong preference for mandatory labeling (Veeman et al. 2004).

However, our analysis faces a number of issues, beyond the potential hypothetical biases of choice experiments (Louviere et al. 2000). A comparison of census data from Montana and Alberta with U.S. and Canadian census counterparts (Table 3) shows that the ethnographic profile in Montana is significantly different from that of the U.S. as a whole, whereas the ethnographic and socio-demographic differences between Alberta and Canada as a whole seem relatively small. This suggests that it could be more justified to generalize our results for Alberta to Canada as a whole, compared to generalizing our Montana results beyond its state borders.

Further, our analysis did neither inquire about respondents' knowledge with regard to regulatory differences as it relates to the three credence attributes under consideration,

nor about their scientific and labeling knowledge related to the credence attributes of this study. For the former a more complex analysis would be desirable of how consumers' risk perceptions are related to trust in regulatory activities (e.g. perceived stringency of enforcing labeling regulations) of the U.S. and Canadian governments. For the latter a more detailed analysis of consumers' misperceptions of risks would be desirable, to show how these differ according to socio-economic and demographic or other cognitive characteristics of consumers. Such analyses of risk perception biases are also likely to be of value, since we have evidence for limits to the effectiveness of public information provision when consumers suffer from optimistic biases (Weinstein et al. 1995). However, such an analytical extension is likely challenging, since analyses of risk perception biases and consumer knowledge need to take into account that consumers' level of knowledge is only one dimension of how consumers conceptualize food-related hazards (evidence from Slovic (1987) and Fife-Schaw et al. (1996) suggests that consumers conceptualize food-related hazards in terms of three key dimensions, the level of dread, the level of knowledge and whether the hazard occurred naturally/ is man-made).

Considering the above caveats, to what extent could our analysis of the above credence attributes still be usefully employed to reflect on consumer trust issues? It has been suggested that trust can be understood as the willingness-to-accept vulnerability under conditions of risks, as a function of credible information (Barber (1983), Rousseau et al. (1998), Hong et al. (2007)). Consumers' willingness-to-accept food-related risks in decision-problems related to steak choices is therefore likely a function of how economic agents facilitate these decision-problems, for example through labeling information. Consumers' perceived stringency of the regulator's labeling, certification and monitoring activities is likely to affect consumer trust directly (in the form of trust in competence; Barber (1983)), and indirectly through industry-driven labeling and quality assurance activities. For example, European evidence suggests that public trust in

regulatory authority can have a significant impact on the evolution of industry-driven labeling schemes (Steiner 2006). Our estimation results are thus likely a reflection of consumers' perceptions with regard to both potentially trust-generating sources, government and industry. Any attempt to disentangle the relative contribution of these sources on consumer trust in a comparison of consumers' valuation of individual credence attributes is likely further aggravated by the fact that the controllability of risks (including the biological control; Ritson et al. 2006) likely varies across credence attributes. Slovic (1987) and Fife-Schaw et al. (1996) suggest that consumers' preferences towards regulation are a function of how controllable the food risks are, considering that health effects which are uncertain and delayed are perceived as more severe to human health compared to a harmful and immediate effect (e.g. Slovic, Fischhoff, and Lichtenstein (1980)).

In future comparative studies, it would therefore be desirable to explore the sources of these trust differences, accounting for the entity on whose behalf the label signals, the mechanism of accreditation, as well as unraveling the different facets of consumer trust in federal vs. state-level government while accounting for controllability of food risks. Since trust is an important facet of risk communication (Johnson et al. (1994), Knox (2000)), the benefits of expanding an analysis in this direction could be significant. Furthermore, future analyses of consumers' valuation of credence attributes would benefit from addressing perceived risks and perceived benefits separately, since we have evidence that risks and benefits are confounded in the minds of consumers (Alhakami et al. 1994), yet perceived benefits were found to be particularly important with regard to GMO (Finucane 2002).

Future work is also likely to benefit from a segmentation of consumers that goes beyond socio-economic and demographic variables. A more complete approach toward audience segmentation could take account of consumers' cultural differences (Finucane 2002) and

consumers' differences in subjective norms toward credence attributes (Silk et al. 2005), leading the way toward more effective labeling, risk communication and supply-chain management strategies.

References

Adamowicz, V. and P. Boxall (2001). *Future directions of stated choice methods for environment valuation*. Paper prepared for: Choice experiments - A new approach to environmental evaluation, London, UK.

Aghion, P., N. Bloom, R. Blundell, R. Griffith, and P. Howitt (1991). Asymmetrical effects of positive and negative events: The mobilization-minimization hypothesis. *Psychological Bulletin 110*, 67–85.

Ahluwalia, R. (2002). How prevalent is the negativity effect in consumer environments? *Journal of Consumer Research 29*, 270–279.

AlbertaBeef (2008). *Court rules in favour of USDA*. http://www.albertabeef.org/news/archived-news/?issue=77, accessed October 22, 2008.

Alhakami, A. and P. Slovic (1994). A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis 14*(6), 1085–1096.

Anderson, W. (2000). The future relationship between the media, the food industry and the consumer. *British Medical Bulletin 56*(1), 254–268.

Angulo, A. and J. Gil (2007). Risk perception and consumer willingness to pay for certified beef in spain. *Food Quality and Preference 18*, 1106–1117.

Bailey, D., J. Robb, and L. Checketts (2005). Perspectives on traceability and bse testing in the u.s. beef industry. *Choices 20*(4), 293–297.

Baker, G. and T. Burnham (2001). Consumer response to genetically modified foods: Market segment analysis and implications for producers and policy makers. *Journal of Agricultural and Resource Economics 2*, 387–403.

Barber, B. (1983). *The logic and limits of trust*. New Jersey: Rutgers University Press.

BCStats (2007). *2006 Census Profile Alberta*. British Columbia Statistics, *http : //www.bcstats.gov.bc.ca/data/cen*06/*profiles/detail*[*underscore*]*b/* 48000000.*pdf*, accessed September 26, 2008.

Beales, H., R. Craswell, and S. Salop (1981). The efficient regulation of consumer information. *Journal of Law and Economics 24*(3), 491–539.

Brittingham, A. and G. PatriciadelaCruz (2004). *Ancestry 2000: Census 2000 brief*. U.S. Census Bureau, *http : //www.census.gov/prod/*2004*pubs/c*2*kbr* − 35.*pdf*, accessed September 22, 2008.

Brown, J. and Y. Ping (2003). Consumer perception of risk associated with eating genetically engineered soybeans is less in the presence of a perceived consumer benefit. *Journal of the American Dietetic Association 103*(2), 208–214.

CAHI (2008). *Hormones: A Safe, Effective Production Tool for the Canadian Beef Industry*. Canadian Animal Health Institute, *http : //www.cahi* − *icsa.ca/pdf/Beef* − *Hormones* − *Factsheet.pdf*, accessed September 15, 2008.

Campiche, J., R. Holcomb, and C. Ward (2004). *Impacts of Consumer Characteristics and Perceptions on Willingness to Pay for Natural Beef in the Southern Plains*. Stillwater: Food and Agricultural Products Research and Technology Center, Oklahoma State University, Research Report P-1006.

Caswell, J. (2000). Analyzing quality and quality assurance (including labeling) for gmos. *AgBioForum 3*(4), 225–230.

Caswell, J. and E. Mojduszka (1996). Using informational labeling to influence the market for quality in food products. *American Journal of Agricultural Economics, Proceedings 78*(5), 1248–1253.

Chassin, L., C. Presson, S. Sherman, and D. Edwards (1990). The natural history of cigarette smoking: predicting young-adult smoking outcomes from adolescent smoking patterns. *Health Psychology 9*(6), 701–716.

Chow, R. (2008). *2006 Census of Canada: Ethnic Origin and Visible Minorities Release*. Alberta Finance and Enterprise, *http : //www.finance.gov.ab.ca/aboutalberta/census/*2008[*underscore*]0411 [*underscore*]*ethnic*[*underscore*]*origin*[*underscore*]*visible* [*underscore*]*minorities.pdf*, accessed September 29, 2008.

Costa-Font, M., J. Gil, and B. Traill (2008). Consumer acceptance, valuation of and attitudes towards genetically modified food: Review and implications for food policy. *Food Policy 33*, 99–111.

Darby, M. R. and E. Karni (1973). Free competition and the optimal amount of fraud. *The Journal of law and economics 16*, 67–88.

Davis, C. and B.-H. Lin (2005). *Factors affecting U.S. Beef Consumption*. Washington D.C.: Electronic outlook report from ERS, LDP-M-135-02, October 2005.

Dickinson, D. and D. V. Bailey (2002). Meat traceability: are us consumers willing to pay for it? *Journal of Agricultural and Resource Economics 2*, 348–364.

Eensoo, D., M. Harro, H. Pullmann, J. Allik, and J. Harro (2007). Association of traffic behavior with personality and platelet monoamine oxidase activity in schoolchildren. *Journal of Adolescent Health 40*, 311–317.

Fife-Schaw, C. and G. Rowe (1996). Public perceptions of everyday food hazards: a psychometric study. *Risk Analysis 16*, 487–500.

Finucane, M. (2002). Mad cows, mad corn and mad communities: the role of sociocultural factors in the perceived risk of genetically-modified food. *Proceedings of the Nutrition Society 61*, 31–37.

Finucane, M., P. Slovic, C. Mertz, J. Flynn, and T. Satterfield (2000). Gender, race, and perceived risk: The 'white male' effect. *Health, Risk and Society 2*, 159–172.

Fischhoff, B. (1995). Risk perception and communication unplugged: Twenty years of process. *Risk analysis 15*(2), 137–145.

Flynn, J., P. Slovic, and C. Mertz (1994). Gender, race and perception of environmental health risks. *Risk Analysis 14*, 1101–08.

Freeman, M. A. (1993). *The Measurement of Environmental and Resource Values: Theory and Methods*. Washington, D.C.: Resources for the Future.

Gaskell, G., N. Allum, W. Wagner, N. Kronberger, H. Torgersen, J. Hampel, and J. Bardes (2004). Gm foods and the misperception of risk perception. *Riks Analysis 24*(1), 185–194.

Griliches, Z. (1971). *Price Indexes and Quality Change*. Cambridge, Mass.: Harvard University Press.

Guenther, P., H. Jensen, S. Batres-Marquez, and C. Chun-Fu (2005). Sociodemographic, knowledge, and attitudinal factors related to meat consumption in the united states. *Journal of the American Dietetic Association 105*(8), 1266–1274.

Hansen, M. (2007). *Open letter to Honorable Michael Johanns, Secretary of Agriculture, U.S. Department of Agriculture*. Consumers Union, http://www.consumersunion.org/pub/core food safety/004564.html, accessed March 13, 2008.

Hoban, T. (1998). Trends in consumer attitudes about agricultural biotechnology. *AgBio Forum 1*, 3–7.

Hobbs, J., A. Fearne, and J. Spriggs (2002). Incentive structures for food safety and quality assurance: an international comparison. *Food Control 13*, 77–81.

Hong, K. and I. Bohnet (2007). Status and distrust: The relevance of inequality and betrayal aversion. *Journal of Economic Psychology*, 197–213.

Johansson-Stenman, O. (2008). Mad cows, terrorism and junk food: Should public policy reflect perceived or objective risks? *Journal of Health Economics 27*, 234–248.

Johnson, B. and P. Slovic (1994). "improving" risk communication and risk management: Legislated solutions or legislated disasters? *Risk Analysis 14*(6), 905–906.

Kiesel, K., D. Buschena, and V. Smith (2005). Do voluntary biotechnology labels matter to the consumer? evidence from the fluid milk market. *American Journal of Agricultural Economics 87*, 378–92.

Knox, B. (2000). Consumer perception and understanding of risk from food. *British Medical Bulletin 56*(1), 97–109.

Kuznesof, S. and C. Ritson (1996). Consumer acceptability of genetically modified foods with special reference to farmed salmon. *British Food Journal 4,5*, 39–47.

Lancaster, K. (1966). A new approach to consumer theory. *Journal of Political Economy 74*(2), 132–157.

Lawrence, J. and D. Otto (2003). *Economic importance of Montana's cattle industry*. http://www.beef.org/NEWSECONOMICIMPORTANCEOFMONTAN AS-CATTLE INDUSTRY2711.aspx, accessed March 23, 2007.

Louviere, J., D. Hensher, and J. Swait (2000). *Stated choice methods: Analysis and applications*. Cambridge, UK: Cambridge University Press.

Lusk, J. and J. Fox (2002). Consumer demand for mandatory labeling of beef from cattle administered growth hormones or fed genetically modified corn. *Journal of Agricultural and Applied Economics 1*, 27–38.

Lusk, J., L. House, C. Valli, S. Jaeger, M. Moore, B. Morrow, and B. Traill (2004). Effect of information about benefits of biotechnology on consumer acceptance of genetically modified food: evidence from experimental auctions in the united states, england, and france. *European Review of Agricultural Economics 31*, 179–204.

Magat, W. and W. K. Viscusi (1993). *Informational Approaches to Regulation*. Cambridge, Mass.: MIT Press.

McCarthya, M., M. Brennan, A. Kelly, C. Ritson, M. de Boer, and N. Thompson (2007). Who is at risk and what do they know? segmenting a population on their food safety knowledge. *Food Quality and Preference 18*, 205–217.

McComas, K. (2006). Defining moments in risk communication research: 1996-2005. *Journal of Health Communication 11*(1), 75–91.

McFadden, D. (1974). Frontiers in econometrics. In P. Zarembka (Ed.), *Conditional logit analysis of qualitative choice behavior*, pp. 105–142. New York: Academic Press.

Nelson, P. (1970). Information and consumer behavior. *Journal of Political Economy 78*, 311–329.

OECD (2006). *Purchasing Power Parities Data.* http://www.oecd.org/document/47/0.html, accessed March 23, 2006.

OTA (2008). *Organic Trade Association Canada: Canada's Organic Products Regulations (OPR) and Organic Standards.* http://www.ota.com/standards/canadian.html, accessed July 12, 2008.

Peeters, G. and J. Czapinski (1990). Positive-negative asymmetry in evaluations: The distinction between affective and informational negative effects. *European Review of Social Psychology 1*, 33–60.

Priest, S., H. Bonfadelli, and M. Rusanen (2003). The "trust gap" hypothesis: Predicting support for biotechnology across national cultures as a function of trust in actors. *Risk Analysis 23*(4), 751–766.

Quagrainie, K., J. Unterschultz, and M. Veeman (1998). Effects of product origin and selected demographics on consumer choice of red meats? *Canadian Journal of Agricultural Economics 46*, 201–219.

Reuters (2006). *Meatpacker sues U.S. for right to do mad cow tests.* USA Today, $http://www.usatoday.com/money/industries/food/2006-03-23-mad-$

$cow - suit_x.htm$, accessed April 12, 2006.

Ritson, C. and S. Kuznesof (2006). Food consumption, risk perception and alternative production technologies. In J. Eilenberg and H. Hokkanen (Eds.), *An Ecological and Societal Approach to Biological Control*, pp. 47–64. Springer, NY: Edward Elgar.

Roberts, D. and L. Unnevehr (2003). Resolving trade disputes arising from trends in food safety regulation: The role of the multilateral governance framework. In J. Buzby (Ed.), *International Trade and Food Safety: Economic Theory and Case Studies*, pp. 57–89. Washington, DC: Economic Research Service, Ag.Econ. Report No.828.

Roe, B. and M. Teisl (2007). Genetically modified food labeling: The impacts of message and messenger on consumer perceptions of labels and products. *Food Policy 32*(1), 49–66.

Rogers, E. M. (1996). Up-to-date report. *Journal of Health Communication 1*(1), 15–23.

Roosen, J., J. Lusk, and J. Fox (2003). Consumer demand for and attitudes toward alternative beef labeling strategies in france, germany, and the uk. *Agribusiness - An international Journal 19*(1), 77–90.

Rousseau, D., S. Sitkin, R. Burt, and C. Camerer (1998). Not so different after all: A cross-discipline view of trust. *Academy of Management Review 23*, 393–404.

Rowland, I. (2002). Genetically modified foods, science, consumers and the media. *Proceedings of the Nutrition Society 61*, 25–29.

Schütz, H. and P. Wiedemann (1998). Judgments of personal and environmental nsks of consumer products - do they differ? *Risk analysis 18*, 119–129.

Setbon, M., J. Raude, C. Fischler, and A. Flahault (2005). Risk perception of the "mad cow disease" in france: determinants and consequences. *Risk Analysis 25*,

813–26.

Shavell, S. (1984). A model of the optimal use of liability and safety regulation. *Rand Journal of Economics 15*(2), 271–280.

Silk, K., J. Weiner, and R. Parrott (2005). Gene cuisine or frankenfood? the theory of reasoned action as an audience segmentation strategy for messages about genetically modified foods. *Journal of Health Communication 8*, 751–67.

Slovic, P. (1987). Perception of risk. *Science 236*, 280–85.

Slovic, P., M. Finucane, E. Peters, and D. MacGregor (2007). The affect heuristic. *European Journal of Operational Research 177*, 1333–352.

Slovic, P., B. Fischhoff, and S. Lichtenstein (1980). Facts and fears: understanding perceived risks. In R. Schwing and W. Albers (Eds.), *Societal Risk Assessment: How Safe Is Safe Enough?*, pp. 181–216. New York: Plenum Press.

Slovic, P. and S. Lichtenstein (1968). Relative importance of probabilities and payoff in risk taking. *Journal of Experimental Psychology Monograph 3*, 1–18.

Southey, C. (1996). Beef consumption well below pre bse levels. *Financial Times 05.06.1996*, 10.

StatisticsCanada, . (2007). *Food Statistics 2006*. Statistics Canada, Agriculture Division, Catalogue no. 21-020-XIE, ISSN 1705-2920.

StatisticsCanada (2006). *Food Consumption Highlights 2006*. http://www.statcan.ca/english/ads/23F0001XCB/highlight.htm, accessed March 23, 2007.

StatisticsCanada (2008a). *Average retail prices*. http://www40.statcan.ca/l01/cst01/econ155a.htm, accessed September 22, 2007.

StatisticsCanada (2008b). *Canada's Ethnocultural Mosaic in 2006*. 2006 Census

of Canada, *http : //www*42.*statcan.ca/smr*08/*pdf/smr*08[*underscore*]110 − *eng.pdf*, accessed September 26, 2008.

StatisticsCanada (2008c). *Visible minority groups, percentage distribution (2006), for Canada, provinces and territories*. 2006 Census of Canada, *http : //www*12.*statcan.ca/english/census*06/*data/highlights/ethnic/*, accessed September 29, 2008.

Steiner, B. (2006). Governance reform of german food safety regulation: Cosmetic or real? In C. Ansell and D. Vogel (Eds.), *What's The Beef: The Contested Governance of European Food Safety*, pp. 181–210. Cambridge, Mass.: MIT Press.

Su, C. (2006). *Agriculture and Food Value Chain Facts 2006*. AAFRD, *http : //www*1.*agric.gov.ab.ca/*$*department/deptdocs.nsf/all/com*7126, accessed March 23, 2007.

Teisl, M. and J. Caswell (2003). *Information Policy and Genetically Modified Food: Weighing the Benefits and Costs*. Working Paper No.2003-1, Department of Resource Economics, University of Massachusetts, Amherst, MA.

TheDaily, S. (2004). *Livestock estimates*. Statistics Canada, http://www.statcan.ca/Daily/English/040819/d040819b.htm, accessed March 23, 2007.

Tonsor, G., T. Schroeder, J. Fox, and A. Biere (2005). European preferences for beef steak attributes. *Journal of Agricultural and Resource Economics 30*(2), 367–380.

Traill, B., S. Jaeger, W. Yee, C. Valli, L. House, J. Lusk, and M. J. M. Moore, M. (2004). Categories of gm risk-benefit perceptions and their antecedents. *AgBioForum 7*, 176–86.

Train, K. (2002). *Discrete Choice Methods with simulation*. Cambridge: Cambridge University Press.

USCensus (2008a). *2007 American Community Survey 1-Year Estimates*. U.S. Census Bureau, *http* : *//factfinder.census.gov/servlet/STTable*, accessed September 27, 2008.

USCensus (2008b). *Montana in focus*. U.S. Census Bureau, *http* : *//www.census.gov/Press* − *Release/www/releases/archives/voting/*011432.*html*, accessed September 22, 2008.

USDA (2008a). *Average retail prices*. United States Department of Agriculture, http://www.ers.usda.gov/Data/meatpricespreads/, accessed October 20, 2008.

USDA (2008b). *National Organic Program*. http://www.ams.usda.gov, accessed March 17, 2008.

Veeman, M. and V. Adamowicz (2004). *Genetically Modified Foods: Consumers' Attitudes and Labeling Issues*. Edmonton, Alberta: Project report 0401, University of Alberta, Department of Rural Economy.

Verbeke, W. (2003). Consumer perception of food safety: role and influencing factors. In A. Velthuis, L. Unnevehr, H. Hogeveen, and R. Huirne (Eds.), *New approaches to food safety economics*, pp. 29–34. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Verbeke, W., L. Frewer, J. Scholderer, and H. DeBrabander (2007). Why consumers behave as they do with respect to food safety and risk information. *Analytica Chimica Acta 586*, 2–7.

Viscusi, K. (1992). Risk perceptions in regulation, tort liability, and the market. *The Cato Review of Business and Government 14*(4).

Viscusi, K., W. Magat, and J. Huber (1987). An investigation of the rationality of consumer valuations of multiple health risks. *Rand journal of economics 18*(4), 465–479.

Weinstein, N. and W. Klein (1995). Resistance of personal risk perceptions to debiasing interventions. *Health Psychology 14*, 132–140.

Wilcock, A., M. Pun, J. Khanona, and M. Aung (2004). Consumer attitudes, knowledge and behaviour: a review of food safety issues. *Trends in Food Science and Technology 15*, 56–66.

Yeung, R. and J. Morris (2001). Food safety risk: consumer perception and purchase behavior. *British Food Journal 103*(3), 170–186.

Zuckerman, M. and D. M. Kuhlman (2000). Personality and risk-taking: common biosocial factors. *Journal of Personality 68*, 999–1029.

Table (1): Annual beef per capita consumption in the U.S. and Canada (kg)

	1980	1981	1985	1986	1990	1991	1996	2001	2002	2003	2004	2005	2006
U.S. beef, not adjusted[a]	34.7		35.9		30.7		30.2	30.0	30.7	29.5	30.0		
Can beef, not adjusted[b]		39.86		38.2		33.28	31.45	30.75	30.46	31.77	30.66	31.08	31.74
Can beef, adjusted[c]		17.59		16.67		13.95	13.31	13.01	12.89	13.44	12.97	13.15	13.43

Source: StatisticsCanada (2007), Davis and Lin (2005)

[a] refers to "retail weight equivalent", where "*retail products are sold with less bone and closer trim* (Davis *et al.* 2005, p.5)

[b] "*Does not adjust for losses, such as waste and/or spoilage, in stores, households, private institutions or restaurants or losses during preparation.*" (Statistics Canada 2006, p.24)

[c] refers to boneless weight; "*The data have been adjusted for retail, household, cooking and plate loss.*" (Statistics Canada 2006, p.32)

Table (2): Summary statistics of choice experiment participants

VARIABLE	ALBERTA	MONTANA
female (%)	62	58
age (mean, years)	45	49
Asian (%)	3.0	< 1
British Isles (%)	16.5	21
Central/South American (%)	2.1	< 1
European (%)	30.5	45.2
University degree (highest level of education) (%)	31.1	23
married (%)	68.74	69.71
lived for more than 10 years in Can./U.S., respectively (%)	53.22	99.04
smokers (%)	13.84	12.02

Table (5): Testing for poolability

	Full model at convergence (Log-Likelihood)	Restricted model (Log-Likelihood)	LR	p-value
Canada	-509.737	-537.571	55.669	0.189
U.S.	-580.219	-589.337	18.236	0.999
Pooled	-1147.515	-1170.838	46.645	0.331

Table (3): Selected U.S. and Canadian Census Data (in percent, 2006/07)

	MONTANA	U.S.	ALBERTA	CANADA
Women	50.0	50.7	50	51
Median age (years)	39.2	36.4	36	39.5
White alone, not Hispanic or Latino	88.7	66.4		
Black alone	0.4	12.8		
Black			1.4	2.5
Hispanic or Latino	2.5	14.8		
South Asian			3.2	4.0
Chinese			3.7	3.9
Filipino			1.6	1.3
Latin American			0.8	1.0
Southeast-Asian			0.9	0.8
Foreign born	1.9	12.5		
Percentage visible minority			13.9	16.2
Bachelor's degree or higher (age 25+)	27.4	27.0		
University certificate, diploma or degree at bachelor's level or above			22.0	22.9
Now married (except separated)	52.8	50.2		
Legally married (and not separated)			50.7	47.9

Source: BCStats (2007), StatisticsCanada (2008b), StatisticsCanada (2008c), USCensus (2008b), USCensus (2008a). Data compiled from Statistics Canada, Census of Population and Housing, U.S. Census Bureau Total Population Estimates (2007), State Population Estimates by Characteristics (2006), American Community Survey (2006). According to the Canadian Census *South Asian* includes 'East Indian,' 'Pakistani,' 'Sri Lankan,' etc., and *Southeast-Asian* includes 'Vietnamese,' 'Cambodian,' 'Malaysian,' 'Laotian,' etc. (StatisticsCanada 2008c).

Table (4): description and names of variables used

ALT1	alternative specific constant for steak choice 1
ALT2	alternative specific constant for steak choice 2
Price	in Canadian Dollars/kg: \$13.99, \$15.99, \$22.99, \$28.99
Guar. BSE test	steak "guaranteed tested for BSE": 0 = no, 1 = yes
GMO guarantee	steak "produced without genetically modified organisms": 0 = no, 1 = yes
Guar. free of growth hormones	steak "guaranteed raised without growth hormones and antibiotics: 0 = no, 1 = yes
gender	0 = male, 1 = female
20≤age<49	between 20 and 49 years of age (0 = under 20, 1 = 20-49 years, 2 = 50 and above)
Edu less college	college education or less (0 = below college, 1 = above college [incl. college])
< 5 years in Can(U.S.)	live for less than five years in Canada (0 = less than 5 ys, 1 = more than 5 ys)
White Meat eater	(0 = no, 1 = yes)
Red Meat eater	(0 = no, 1 = yes)
Even white/red meat eater	(0 = no, 1 = yes)

Table (6): estimation results

VARIABLES			**PARAMETER ESTIMATES (standard errors)**
	Alberta	Montana	pooled
ALT1	5.146*** (0.371)	4.342*** (0.303)	4.537*** (0.225)
ALT2	4.043*** (0.379)	3.432*** (0.334)	3.555*** (0.239)
Price	-0.146*** (0.033)	-0.141*** (0.041)	-0.129 *** (0.021)
Guar. BSE test	0.419 (0.221)	-0.169 (0.561)	0.273 (0.152)
Guar. free of GMO	0.053 (0.335)	0.651 (0.469)	0.305 (0.201)
Guar. free of growth hormones	0.434 (0.316)	0.297 (0.428)	0.229 (0.182)
ALT1 × Male	0.79* (0.364)	0.658** (0.292)	0.573*** (0.219)
ALT2 × Male	0.173 (0.375)	0.549 (0.325)	0.224 (0.234)
White Meat eater × Price	0.033*** (0.011)	0.010 (0.011)	0.016* (0.007)
Even white/red meat eater × Price	0.002 (0.009)	-0.014 (0.009)	-0.008 (0.006)
Male × Price	-0.008 (0.018)	-0.022 (0.016)	-0.010 (0.011)

Age $<$ 20 $\times$ Price	0.031 (0.053)	0.032 (0.048)	0.027 (0.034)
20$\leq$age$<$49 $\times$ Price	0.001 (0.027)	0.011 (0.025)	0.009 (0.018)
Edu less college $\times$ Price	0.0003 (0.009)	-0.009 (0.007)	-0.003 (0.005)
Regular smoker $\times$ Price	0.013 (0.011)	-0.029*** (0.009)	-0.011 (0.006)
$<$ 5 years in Can(U.S.) $\times$ Price	-0.027* (0.012)	-0.007 (0.029)	-0.015*** (0.005)
White meat eater $\times$ Guar. BSE test	0.122 (0.114)	0.204 (0.131)	0.165* (0.079)
Even white/red meat eater $\times$ Guar. BSE test	-0.116 (0.095)	0.085 (0.099)	0.007 (0.064)
Male $\times$ Guar. BSE test	-0.092 (0.079)	0.288*** (0.073)	0.1 (0.051)
Age $<$ 20 $\times$ Guar. BSE test	-0.171 (0.396)	-0.123 (0.718)	-0.208 (0.274)
20$\leq$age$<$49 $\times$ Guar. BSE test	0.219 (0.209)	0.141 (0.369)	0.199 (0.147)
Education below college $\times$ Guar. BSE test	-0.089 (0.085)	0.349*** (0.083)	0.160*** (0.057)
Regular smoker $\times$ Guar. BSE test	-0.178 (0.102)	-0.377*** (0.115)	-0.268*** (0.072)
$<$ 5 years in Can(U.S.) $\times$ Guar. BSE test	0.165 (0.157)	0.486 (0.418)	0.001 (0.049)
White meat eater $\times$ Guar. free of GMO	0.229* (0.113)	0.002 (0.146)	0.169** (0.082)
Even white/red meat eater $\times$ Guar. free of GMO	-0.078 (0.098)	0.074 (0.109)	-0.005 (0.068)
Male $\times$ Guar. free of GMO	0.087 (0.085)	-0.019 (0.080)	0.062 (0.056)
Age $<$ 20 $\times$ Guar. free of GMO	-0.527 (0.603)	0.118 (0.636)	-0.234 (0.376)

20≤age<49 × Guar. free of GMO	0.259 (0.308)	-0.093 (0.331)	0.123 (0.196)
Education below college × Guar. free of GMO	-0.056 (0.087)	-0.167 (0.093)	-0.089 (0.061)
Regular smoker × Guar. free of GMO	0.132 (0.107)	0.154 (0.125)	0.178** (0.079)
< 5 years in Can(U.S.) × Guar. free of GMO	-0.088 (0.172)	-0.256 (0.323)	0.049 (0.054)
White meat eater × Guar. free of growth hormones	0.014 (0.111)	0.231 (0.138)	0.123 (0.081)
Even white/red meat eater × Guar. free of growth hormones	0.056 (0.094)	-0.066 (0.106)	-0.012 (0.066)
Male × Guar. free of hormone	-0.007 (0.083)	-0.145 (0.076)	-0.114* (0.054)
Age<20 × Guar. free of hormones	-0.767 (0.579)	-0.626 (0.579)	-0.525 (0.337)
20≤age<49 × Guar. free of growth hormones	0.415 (0.297)	0.302 (0.306)	0.255 (0.178)
Education below college × Guar. free of growth hormones	0.203** (0.083)	0.207** (0.089)	0.184*** (0.059)
Regular smoker × Guar. free of hormone	-0.032 (0.102)	0.075 (0.120)	0.002 (0.074)
< 5 years in Can(U.S.) × Guar. free of growth hormones	0.375** (0.157)	0.023 (0.298)	0.087 (0.052)
LogLikelihood at convergence	-537.571	-589.337	-1170.834
Log-likelihood ratio test for poolability of regions			LR = 115.1181; Chi-sq (40) = 55.758
Number of observations			419

*,** ,*** represent 95%,97,5% and 99% significance levels, respectively

Table (7): Welfare measures (WTP premia, in U.S. Dollars/kg)

Region	*Statistics*	*MWTP BSE*	*MWTP GMO*	*MWTP Hormones*	*CV BSE*	*CV GMO*	*CV Hormones*
Alberta	Mean (SD)	3.82 (2.72)	1.91 (2.26)	2.74 (1.90)	7.08 (5.21)	3.63 (4.36)	5.09 (3.61)
Montana	Mean (SD)	2.72 (3.75)	2.45 (1.83)	3.5 (2.51)	4.94 (6.79)	4.37 (3.43)	6.11 (4.55)

Note: SD refers to standard deviation; MWTP (CV) BSE, GMO and Hormones refers to marginal willingness-to-pay (compensating variation) for 'BSE test guarantee', 'GM free guarantee' and 'hormone free guarantee', respectively. All figures are expressed in U.S. dollars, based on 2006 purchasing power parity of 1.20 Canadian dollar (OECD 2006).