Trust, Perceptions, Intentions and Behaviour in Meat Consumption

by

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

Doctor of Philosophy

in

AGRICULTURAL AND RESOURCE ECONOMICS

RESOURCE ECONOMICS AND ENVIRONMENTAL SOCIOLOGY

University of Alberta

ABSTRACT

Consumers' concerns about animal diseases, production and processing methods could drive their choices of food products. Consumers' choices of food products will influence their nutritional status. Understanding preferences for food products could inform policy and assist in forecasting future demand for food products. In this study, the effects of generalized trust in people and trust in food agents regarding the safety of food on the demand for different forms of meat products, on preferences for pork production characteristics and on human health risk perceptions about bovine spongiform encephalopathy (BSE) and chronic wasting disease (CWD) are analysed. The following hypotheses are tested (i) consumers who have lower levels of trust (both general and agent specific trust about food safety) are more likely to purchase fresh meat products and less likely to purchase processed meat products as compared to those consumers who have higher levels of trust. Consumers who have lower levels of trust might be more concerned about the use of additives, flavors and the public information on cancer risks of processed food, for example as compared to those consumers who have higher levels of trust; (ii) consumers who have lower levels of trust (both general and agent specific trust about food safety) are willing to pay higher premiums for pork produced under more traditional forms of production as compared to those consumers who have higher levels of trust. Consumers who have lower levels of trust might prefer traditionally raised pork over conventional pork as compared to those consumers who have higher levels of trust due to concerns about the use of antibiotics, the feed given to animals and the use of hormones, for example; (iii) trust (both general and agent specific trust about food safety) is negatively related to human health risk perceptions about BSE and CWD. The three studies are linked in that the effects of trust on consumer behaviour are analysed in three different contexts and trust is measured using the same questions. The first hypothesis is tested using cluster analysis, demand system analysis, probit models, data from two Canada wide surveys (2008 and 2011) and meat purchase data for the period 2002 to 2009 for the same households. The second hypothesis is tested using cluster analysis, conditional and random parameter logit models and data from choice experiments and surveys in Canada in 2011 and in Edmonton in 2009 and 2011. The third hypothesis is tested using ordered probit regressions and data from surveys conducted in Canada in 2009 and 2010, in the U.S. in 2010 (two surveys) and in Japan in 2009. In summary, the results suggest that households with respondents who have lower levels of trust generally purchased more fresh meat products and fewer processed meat products as compared to households with respondents who have medium or higher levels of trust. Households in the low trust cluster generally substitute fresh and semi-processed meat products more than households in the medium and higher trust clusters. Households in the high trust cluster generally substitute semi-processed and fully processed meat products more than households in the low and medium trust clusters. A little surprising but respondents who have higher levels of trust are generally willing to pay higher premiums for traditionally raised pork as compared to those respondents who have lower levels of trust. Although the effects of trust on consumer's human health risk perceptions about BSE and CWD are not generally the same across countries or between the two diseases, trust does play a role in influencing risk perceptions in each country. In conclusion, trust is an important influence on consumer behaviour.

PREFACE

This thesis is an original work by Violet Muringai. The research projects, of which this thesis is a part, received research ethics approvals from the University of Albertan Research Ethics Board, Project names: Japanese Consumer Attitudes Towards Food Safety, Animal Testing and Traceability in the Meat Industry, No. Pro00008687, 2009; Canadian Consumer Attitudes Towards Food Safety, Animal Testing and Traceability in the Meat Industry, No. Pro00008762, 2009; Canadian Consumer Attitudes Towards Food Safety, Animal Testing and Traceability in the Cervid and Meat Industry, No. Pro00009300, 2010; American Consumer Attitudes Towards Food Safety, Animal Testing and Traceability in The Meat Industry, No. Pro00012398, 2010; American Consumer Attitudes Towards Food Safety, Animal Testing And Traceability in the Cervid Meat Industry, No. Pro00012415, 2010; Integrating Genomics, Meat Science, Consumer Science and Economics to Add Value to Alberta's Hog Sector, No. Pro00010525, 2009; Integrating Genomics and Pork Consumption, No. Pro00015981, 2011; Venison and Beef Risk Attitudes and Perceptions, No. Pro00024089, 2011. The other research project, of which this thesis is a part, received research ethics approval from the University of Alberta, Faculty of Agricultural, Life and Environmental Sciences Human Research Ethics Committee, Project Name 'TSEs and Society: The Economic Impact of the Outbreak of Prion Diseases on Meat Purchases', 2008.

DEDICATION

This thesis is dedicated to my husband Ronald, my daughter Ruvimbo, my aunt Claire Nyandoro, my late uncle Timon Nyandoro, my mom, dad, sisters (Juliet, Nancy, Last and Sharmaine) and brothers (Stancilous and Tavaziva). Thank you for the love and support you always give me. Thank you Ruvimbo for being such a wonderful daughter and for putting smiles on my face all the times. Thank you Nancy for encouraging me and for always being there for me when I need you.

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Professor Ellen Goddard, for her mentorship and financial support during my PhD studies. I am really grateful for the support and guidance she gave me over the years. I want to thank the University of Alberta (Provost Entrance Award and the Andrew Stewart Memorial Graduate Prize), the Faculty of Agricultural, Life and Environmental Sciences (Frank Aherne Graduate Scholarship in Swine Research and Support for the Advancement of Scholarship (SAS) grant) and the Department of Resource Economics and Environmental Sociology for the scholarships they gave me during my PhD studies. I also want to thank the Consumer and Market Demand Network, PrioNet Canada, Alberta Prion Research Institute, Genome Canada and Alberta Advanced Education and Technology for funding my studies. My sincere gratitude also goes to collaborators for the pork project i.e. Sturgeon Valley Pork, Alberta Pork, Canadian Pork Council, Western Swine Testing Association and Indentigen. I would like to thank the research team for the pork project i.e. Ellen Goddard, Jennifer Janz, Mindy Gerlat, Steve Moore, Graham Plastow, Heather Bruce, Sven Anders and Lifen Ma.

I also want to pass my sincere gratitude to Professors Wiktor Adamowicz and Sven Anders for serving on my supervisory committee. I would like to thank Professors Wim Verbeke and Henry An for serving as examiners for my thesis. I also want to thank professors who taught me during my coursework, Robin McClelland and other staff members in the Department of Resource Economics and Environmental Sociology for the help they gave me during my studies. I also want to thank my aunt, Claire Nyandoro, and my late uncle, Timon Nyandoro, for encouraging and supporting me to study for a PhD degree. I would like to thank my family, in-laws, my friends and colleagues who helped me in so many ways to make this dream come true. Thank you all!

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1. INTRODUCTION

1.0 Background

Trust, which is a form of social capital, is important for economic performance and innovation is hindered in situations where there is low trust (Knack and Keefer, 1997; Tonkiss, 2009). Trust can play an important role in reducing transaction costs between and within organizations (Kramer, 1999) thus promoting economic efficiency (Tonkiss, 2009). In economies where there are higher levels of trust, low costs are incurred in activities that depend on future actions of others (Knack and Keefer, 1997). Examples of transactions that are influenced by trust are future payments for goods or services and employment contracts (Knack and Keefer, 1997). Trust has also been shown to be important for economic deregulation since it leads to lower transaction costs and enhances the credibility of a change in policy by enabling coordination and cooperation across different groups in a society (Leibrecht and Pitlik, 2015). Moderate levels of trust are important for safety since trust enables safety cultures and ameliorates risk perceptions and distrust is important in monitoring another person to reduce mistakes and accidents, for example (e.g. Conchie and Donald, 2008).

Trust influences consumers' decisions when they purchase food products (Hobbs and Goddard, 2015). Trust might be important in the food system in cases where there are market failures due to information asymmetries (Janssen and Hamm, 2012). In neoclassical economics, rational consumers act with full information and they choose their most preferred bundle from a set of affordable alternatives (Varian, 2010). However, these assumptions are not true in situations where there are market failures due to imperfect information, information asymmetries, externalities, market power and public goods. With regards to food, information asymmetries might exist in terms of quality of products and credence attributes such as production systems or food safety interventions. In situations where there are information asymmetries consumers might choose products from trusted suppliers. In cases where consumers are not interested in knowing details of animal husbandry systems, their trust or distrust in the involved agents is important for accepting such systems (Frewer et al., 2005).

Trust is important in situations where there is risk and uncertainty, because it makes the process of considering complex information in the decision making process easier (Lewis and Weigert, 1985; Savadori et al., 2007), that is, it can operate as a social decision heuristic or behavioural rule of thumb (Kramer, 1999). Sodano (2002) states that trust is important in shaping the global food supply chain since it is important in building effective and stable networks especially with regards to biogenetic and information technologies. Distrust in general or in food agents and the government could be an important factor that determines consumers' response to food safety incidents. For example, animal disease incidents such as bovine spongiform encephalopathy (BSE) have been linked to a rise in consumer distrust in government institutions in Europe causing a decline in the demand for beef products (Powell and Leiss, 1997; Kjaernes et al., 2007).

In some studies, it was found that trust in agents involved in the food supply chain influences consumers' optimism and pessimism about the safety of food products (de Jonge, 2008; de Jonge et. al., 2008a; Aubeeluck 2010), perceptions about and acceptance of different food production technologies such as biotechnology (Ekici, 2004; Chen and Li, 2007; Moon and Balasubramania, 2004; James and Marks, 2008; Ding et al., 2012; Ding et al., 2015; Komirenko et al., 2010) and nanotechnology (Roosen et al., 2015; Siegrist et al., 2007, 2008). Lassoued and Hobbs (2015) found that consumers' trust in a given brand is positively related to their confidence in its quality and safety and this relationship is mediated by trust in the food system.

In marketing studies, the role of trust on brand loyalty or performance has also been assessed (e.g. Veloutsou, 2015; Chaudhuri and Holbrook, 2001). In some studies, the effects of trust on willingness to pay (WTP) for product and on-farm production attributes (e.g. Innes and Hobbs, 2011; Romanowska, 2009; Aubeeluck, 2010), cause related marketing (Hartmann et al., 2015) and consumer's response to animal diseases (e.g. Ding et al., 2013) have been assessed. In other studies, the effects of trust on people's risk perceptions (e.g. Tonsor et al., 2009), intentions to purchase meat products (e.g. Lobb et al., 2007) and actual purchase of meat products (Drescher et al., 2012; Wang et al., 2011) have been assessed.

From previous studies, distrust in agents such as food manufacturers, retailers, farmers might reduce their profits or producer surplus when consumers reduce or stop buying their products. In addition, distrust in these agents and the government might reduce consumer utility or surplus and overall net social welfare when consumers have to reduce or stop buying products they would want to buy. Consumers' distrust in general or their distrust in food agents might influence their food choices or their human health concerns with regards to food production practices or animal diseases.

In this research, an attempt is made to assess some aspects of the broad question 'What are the linkages between consumers' trust, perceptions, and stated and actual behaviour?' In the first essay, the linkage between trust and consumers' choice among fresh, semi-processed and fully processed meat products is tested using data from ACNielsen Homescan™ surveys conducted in 2008 and 2011 and ACNielsen Homescan™ historical meat purchase data (2002-2009) for the same Canadian households. In the second essay, the linkage between trust and perceptions and preferences for traditionally raised pork is analysed using three surveys and data from pork choice experiments in Edmonton (in 2009 and 2011) and Canada (2011). In the third essay, the effect of trust on consumers' human health risk perceptions about animal disease incidents (BSE and chronic wasting disease or CWD) is examined using online survey data for three countries, Canada (in 2009 and 2010), U.S. (two surveys in 2010) and Japan (in 2009).

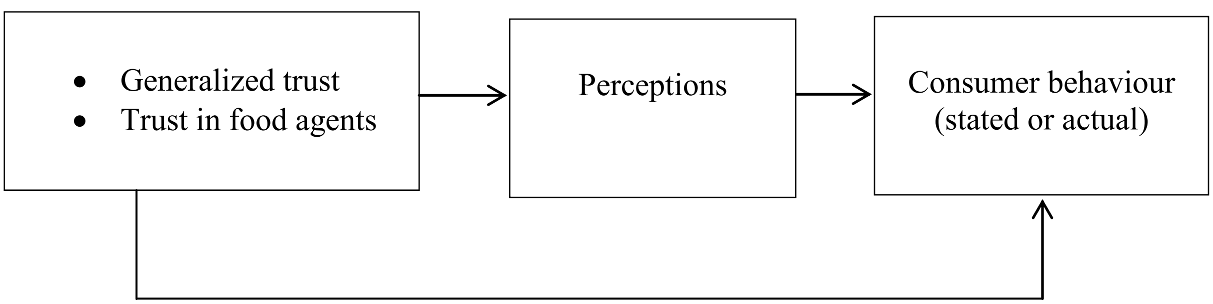
The effect of trust on consumer's choice is evaluated because psychological variables have been shown to be important in a consumer's decision making process and it is stated that in most cases heuristic rules drive human behaviour (McFadden, 2001). This research contributes to the economics literature and is important for public health authorities, policy makers, consumer advocacy groups, producers and other food agents because trust is linked to actual consumer purchases of different forms of meat products, perceptions and preferences for a production attribute and animal disease concerns. Consumer food choice and risk factors as defined by their physiological status influence their nutritional status (Sims, 1998).

1.1 Overview of the theoretical framework

The assessment of the effect of trust, which is a psychological variable, on consumer behaviour is mainly based on neoclassical theory of consumer demand and Lancaster's economic theory of value (Lancaster, 1966). Trust does not generate utility per se but it could influence tastes or preferences which might result in changes in marginal utility or demand for products and budget allocations. Other variables that influence demand for food products (besides prices and total expenditure) are differences in demographic characteristics (e.g. Pollak, 1978; Pollak and Wales, 1981; Drescher et al., 2012), habits (e.g. Pollak, 1978; Chen and Veeman, 1991; Ding et al., 2011), health information (Kinnucan et al., 1997; Kaabia et al., 2001; Chang and Just, 2007), risk perceptions and risk attitudes (Pennings et al., 2002; Schroeder et al., 2007; Yang and Goddard

(2011a, b) and potentially advertising (Dixit and Norman, 1978; Goddard and Tielu, 1988; Brester and Schroeder, 1995) among others.

Trust is defined by Lewis and Weigert (1985, p. 971) as ‘undertaking of a risky course of action on confident expectation that all persons involved in the action will act competently and dutifully’. Rousseau et al. (1998, p. 395) define trust as ‘… a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another’. Although other definitions are provided by different authors, most of these definitions emphasize the fact that one of the parties involved is vulnerable to the actions of the other. In this research we follow the widely used definition of trust by Rousseau et al. (1998). The focus is on determining the role of trust (generalized trust in people and trust in the government, farmers, retailers and manufacturers regarding the safety of food) on consumer perceptions and stated and actual behaviour (Figure 1.1).



Source: Illustration by author

Figure 1.1 Linkages between trust, perceptions and consumer intentions or behaviour

There is a possibility that there is a link between trust through perceptions of human health risk or quality of products to consumer behaviour. Trust is assumed to influence consumer behaviour directly and possibly indirectly through perceptions (risk or quality perceptions) about food products. In the first paper we test the direct link between trust and consumer behaviour in terms of demand for meat products. In the second paper we test the relationship between trust and quality perceptions and between trust and consumer intentions about traditionally raised pork. In the third paper, we assess the link between trust and consumers' human health risk perceptions about BSE and CWD.

In this research, we do not test the link between perceptions and actual consumer behaviour but this link has been tested in other studies using actual purchase data (e.g. Yang and Goddard, 2011a, b; Wang et al., 2011; Myae, 2015) or stated responses to food events (Pennings et al., 2002; Schroeder et al., 2007). The media has been shown to influence risk perceptions about food products. However, media coverage data for the variety of issues which affect food purchases is an increasingly complex set of variables to collect since there is a heavy influence of social media on food related issues. In addition, traditional media sources used in past studies (Yang and Goddard, 2011c; Myae, 2015) are not as readily available for semi processed and processed meat products as they were for the earlier fresh meat studies. Given these complexities media coverage was not included as an explanatory variable.

Following Eom (1994, p.761), in the case of food risks, it is assumed that there are two states of outcomes i.e. occurrence or non-occurrence of an adverse event which are associated with the following probabilities π and $1-\pi$ respectively. Assuming that the food risk affects product x, while z is a composite good, the state dependent utility function is specified as follows: $U_i(x,z)$ where i represent occurrence (1) or non-occurrence (2) of the adverse health event. According to Eom (1994), given that y is income and p is the relative price, the expected state dependent utility maximization problem is represented as follows:

$$\max_{X,Z} \; EU = \pi U_1(x,z) + (1-\pi)U_2(x,z) \text{ subject to } y = px + z \qquad (1.1)$$

Solving the above utility maximization problem, yields the following optimal demand

$$x^{*} = (p, y) \tag{1.2}$$

The state dependent indirect utility function is

$$EV(p, \pi, Y) = \pi V_1(y, p) + (1 - \pi) V_2(y, p) \tag{1.3}$$

Food safety incidents and the use of additives or flavours, for example, might influence the types (e.g. beef, pork or poultry) and forms (fresh, semi- processed and fully processed) of meat products purchased by households. In this study, it is assumed that the level of consumers' trust (generalized trust in people and institutional trust) might influence the consumer's perceptions and preferences for certain types or forms of meat products. Consumers who trust might purchase more products as compared to those who do not trust during or after food safety incidents. Let *t* represents trust, the utility maximization process is therefore changed to:

$$\max_{x,z} \; E(U) = \pi U_1(tx, z) + (1 - \pi) U_2(tx, z) \text{ subject to } y = px + z \tag{1.4}$$

Quantities of the meat demanded are specified as follows:

$$x^{*} = (p, y, t) \tag{1.5}$$

In the expected utility framework, it is assumed that the individual knows and understands the technical level of risk (π) (Viscusi, 1989). However, differences between judgements of risks by experts and the public might exist (Slovic et al., 1985). Viscusi (1989) developed the prospective reference theory using a Bayesian updating framework to incorporate risk perceptions in the expected utility framework. In the Bayesian updating framework, risk perceptions are updated by individuals when they get new information (Viscusi, 1989). In this research, risk perceptions are conceptualised following previous studies (Viscusi, 1991; Tonsor et al., 2009; Liu et al., 1998; Eom, 1994).

In the Bayesian updating framework, current risk perceptions are assumed to be a weighted average of prior perceived risk, direct or indirect experiences and information communicated to the person by different sources (Viscusi, 1991). Let π_a be prior perceived risk, π_b be risk perception based on direct or indirect personal experiences, π_c be the risk information communicated to the individual by different sources and α, θ and γ be weights which represents the fractions of informational content associated with prior risk perceptions, experiences and new risk information respectively. Current risk perceptions (π) are therefore represented as follows:

$$\pi = \alpha\pi_a + \theta\pi_b + \gamma\pi_c \tag{1.6}$$

In this study, risk perceptions about food safety incidents communicated to the individual by different sources (π_c) are assumed to be influenced by consumers' generalized trust in people and trust in agents responsible for ensuring the safety of food. There is no information about prior risk perceptions in this research, therefore only risk perceptions based on direct or indirect personal experiences and information from different sources are accounted for.

Trust could also influence consumers' preference for product attributes. According to Lancaster (1966), consumers derive utility from the attributes of goods not the goods themselves. In consumption, goods are inputs, product attributes are outputs and in preference orderings, goods are ranked indirectly through their collection of attributes. The consumer's utility maximization process in the simplified model (Lancaster, 1966, p. 136) is represented as follows:

$$\max_{z_i} U = U(\mathbf{z}) \text{ subject to } \mathbf{px} \leq y \tag{1.7}$$

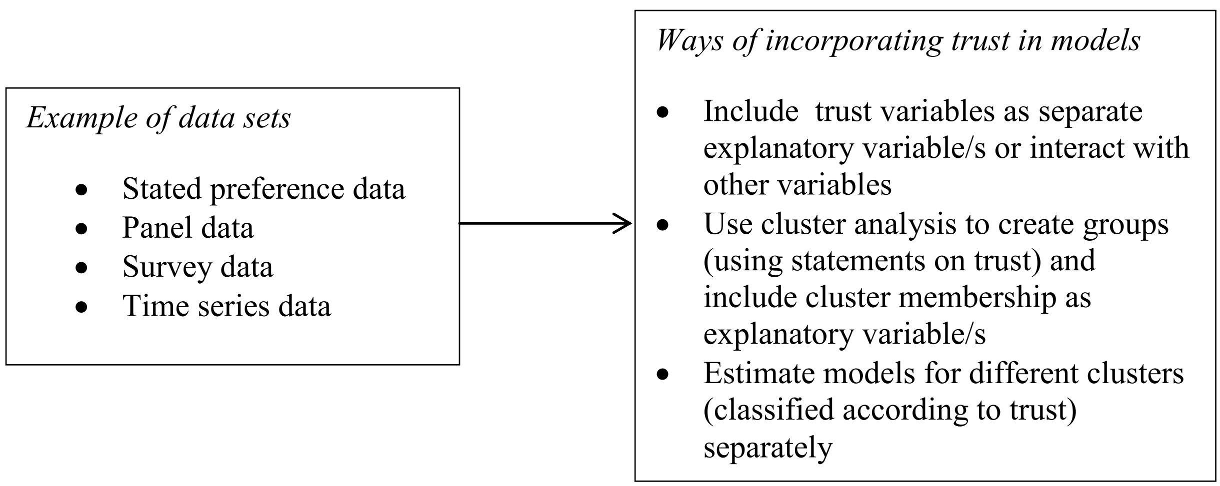
$$\mathbf{z} = B\mathbf{x}$$

$$\mathbf{z}, \mathbf{x} \geq 0$$

where **p** is prices of the products, *y* income, **z** represents a collection of attributes, **x** represent the collection of goods available to the consumer. Given that *t* represents trust, the utility function with the inclusion of the trust variable is therefore represented as follows:

$$U = U(t\mathbf{z}) \tag{1.8}$$

In the first paper we try to use equation 1.5 in the assessment of the effect of trust on demand for fresh, semi-processed and fully processed meat products. In the second paper we use the random utility framework which is consistent with Lancaster's theory of consumer demand to assess consumer's willingness to pay for traditionally raised pork. In the third paper we use equation 1.6 to try to assess the effect of trust on consumers' human health risk perceptions about BSE and CWD.



Source: Illustration by author

Figure 1.2 Different ways of incorporating trust in a model

Trust is incorporated in models in different ways (Figure 1.2) using data from surveys, stated preferences, or purchase data, for example. Trust variables can be included in models as separate explanatory variables or they can be interacted with other explanatory variables. The second way is to use cluster analysis on trust variables and include cluster membership dummies as explanatory variable/variables in regressions. The third way is to estimate different models for the different clusters separately and this allows all parameters in the model to vary across clusters.

In the first paper we estimate demand models for three clusters separately and we also include cluster membership as an explanatory variable in probit models of the factors influencing the probability of purchasing different forms of meat products. In the second paper a dummy variable for cluster membership is interacted with attributes in the conditional and random parameters logit models and it is also included as an explanatory variable in the regression model on factors influencing consumers' perceptions about traditionally raised pork. In the third paper, trust variables, as factors, are included directly in regressions together with other explanatory variables to determine the factors that influence human health risk perceptions about BSE and CWD. There might be endogeneity problems between trust and perceptions due to omitted variables that are correlated with both variables. Future studies can use other methods of estimation that account for endogeneity in disentangling the effects of trust on perceptions and intended or actual behaviour, for example, instrumental variables or generalized methods of moments.

1.2 Measurement of trust

Different types of trust have been analysed in the literature, for example, generalized trust in people, trust in agents or institutions (structural trust or system-oriented trust), trust in information from the different institutions and trust in brands among others. In this study we focus on generalized trust in people and trust in food agents regarding the safety of food. Generalized trust in people refers to trust among strangers (Earle, 2010). With respect to food, studies have analysed generalized trust in people and its effect on consumer preferences for product and production attributes (e.g. Ding et al., 2012; Aubeeluck, 2010; Romanowska, 2009) and human health concerns about BSE (e.g. Muringai and Goddard, 2011). Generalized trust in people is measured using attitudinal surveys, for example, the General Social Surveys in countries such as Canada and the U.S. (Earle et al., 2007; Glaeser et al., 2000). In the General Social Survey, generalized trust in people is measured using the following question 'Generally speaking, would you say that most people can be trusted?' In this case responses are as follows 1. people can be trusted 2. can't be too careful in dealing with people 3. don't know. In some studies generalized trust in people is measured by assessing people's trust in strangers (Glaeser et al., 2000; Ding et al., 2012). The General Social Survey question is criticized for being vague, abstract and difficult given that individual's might have different definitions for 'most people' and trustworthiness (Glaeser et al., 2000). According to Glaeser et al. (2000), although attitudinal questions are not a perfect measure of trust, they may be important in showing the degree of trustworthiness in a society.

Institutional trust is usually measured using questions that are aimed at assessing different dimensions of trust. In the literature, it has been shown that there are different dimensions or judgments that contribute to trust or distrust (Poortinga and Pidgeon, 2003). Renn and Levine (1991) state five components of trust i.e. perceived competence, objectivity, fairness, consistency and faith. Kasperson et al. (1992) identified four dimensions (commitment, competence, caring and predictability). In their analysis of Canadian data, de Jonge et al. (2008a) found that there are two main dimensions of trust (competence and commitment) regarding the safety of food.

In this analysis, questions from de Jonge (2008) that are aimed at assessing the competence, knowledge (with these two representing competence), honesty, openness, care and whether food agents pay attention to food safety (with these four often reflecting commitment) are used. Similar questions have been used to analyse the effect of trust in agents on consumer's confidence in food products (e.g. de Jong et al., 2008a, b; Aubeeluck, 2010), acceptance of technologies (e.g. Poortinga and Pidgeon, 2003; Siegrist et al., 2008; Frewer et al., 2003), preference for certain attributes (e.g. Ding et al., 2012) and demand for meat products (e.g. Drescher et al., 2012; Wang et al., 2011).

Trust and trustworthiness have also been measured using behavioural experiments (investment games or trust games) with monetary rewards (Glaeser et al., 2000; Johansson-Stenman et al., 2013). In the trust games, generally participants are paired such that there is a sender and a receiver. In this case a sender is given a certain amount of money and he or she will choose the amount of money he/she wants to invest. Trust is measured by the amount of money sent by the sender. High correlations between attitudinal and behavioural measures of trust have been found in previous studies (e.g. Johansson-Stenman et al., 2013).

1.3 Consumers' confidence in the safety of food in Canada

Consumers' choice of food products might be influenced by their confidence in the safety of food. Studies have been conducted in Canada to assess consumers' confidence in the safety of food. Some of the questions that are used to assess people's confidence in the food system are as follows 'How confident would you say you are right now in Canada's food safety system on a scale where 1 is not at all confident, 7 is completely confident and the midpoint 4 is moderately confident?' 'How safe do you think food produced in Canada is?' (Decima Research, 2010, p. 20). de Jonge et al. (2008a) used a number of statements that were aimed at assessing people's optimism or pessimism about the safety of food (general confidence in the safety of food) and their confidence in the different food groups. Consumer's confidence in the safety of the different food groups was assessed using the following statement 'How much confidence do you, generally, have in the safety of the following product groups' 1. no confidence … 5. complete confidence.

Most of the studies in Canada have generally found the majority of people to be confident in the safety of food from within the country (Decima Research, 2010; Léger Marketing, 2011; Environics Group, 2011; Ipsos Reid, 2004). A study by Decima Research (2010) showed that Canadians were confident in their food system (65% in 2010 and 60% in 2007 of the respondents were very confident in the Canadian food safety system). A recent study conducted by Environics Group (2011) showed that 93% of the producers, 89% of the general public and 99% of agricultural association executives were confident in the safety of food produced in Canada. However, confidence in the safety of imported food products is low (only 50% of the producers, 60% of agricultural association executives and 18% of the general public were confident in the safety of imported food products) (Environics Group, 2011). A study conducted by Ipsos Reid (2004) showed that Canadian consumers were confident in the safety of food produced in the country and were, overall, impressed by the quality of the food. The authors state that, although the consumers have little knowledge of the food safety standards in the supply chain, they trusted the food system (Ipsos and Reid, 2004, page vii). The study by Decima Research (2010) found that although most of the respondents were confident in the Canadian food system, only a few of them understood it. Hobbs et al. (2005) found that Canadians were generally confident in the food inspection system and the safety of food. de Jonge et al. (2008a) found that Canadian respondents were generally less confident about the safety of food and they worried more about issues relating to production and health as compared to Dutch respondents.

1.4 Food safety incidents in Canada

In situations where there is risk (e.g. food safety events), consumer's trust might influence their choice of food products. Food industries have been affected by a number of food safety incidents over the past decade. In Canada, food borne illnesses are approximated to be around 11 million cases each year (Canadian Food Inspection Agency, 2012a). Schroeder et al. (2007, p. 1) stated that 'beef food safety events have contributed to considerable market volatility, produced varied consumer reactions, created policy debates, sparked heated trade disputes, and generally contributed to beef industry frustrations'.

Food safety is important for public health and international trade (Satcher, 2000) and incidents in which food safety has been compromised may have resulted in increased consumers' health and safety concerns (Fontanesi, 2009). Food safety incidents could lead to reduced consumers' confidence in food products (de Jonge et al., 2008a) thus resulting in negative economic implications for the related industries through reduced consumption of the involved products. People's response to food recalls or to media coverage of food safety incidents can affect the overall nutritional quality of their diet if the identified food contributes unique nutrients to the diet. An example is where consumers reduced their consumption of beef in many European countries (e.g. Switzerland and France) due to BSE concerns (Chatard-Pannetier et al., 2004). Chatard-Pannetier et al. (2004) stated that the reduction in the consumption of beef by elderly people was worrying since these elderly people already consumed lower amounts of protein. In the United Kingdom, there are concerns that the reductions in meat consumption due to BSE could have led to increased iron deficiencies especially in young women and children as well as reduced intake of other micronutrients (Scientific Advisory Committee on Nutrition (SACN), 2010). In addition to public health concerns, previous studies have shown that food safety incidents can also affect sales, reputation of businesses, consumer perceptions and behaviour (Kalogeras, 2010).

Food safety incidents can be separated into perceived food safety incidents e.g. BSE when all specified risk materials are being removed from the food chain and CWD (since to date there is no established link between consumption of meat from cervid animals with CWD and human health), and real food safety incidents such as *Escherichia coli (E. coli)*, *Salmonella and Listeria*. The *listeria* outbreak in Canada, which occurred in the summer of 2008 led to 23 deaths (Canadian Food Inspection Agency, 2012b). Meat from XL Foods Inc. contaminated with *E. coli* O157 in Alberta, Canada between September and October 2012 was linked to the illness of 17 people as of November 1, 2012 (Public Health Agency of Canada, 2012). The numbers of food recall alerts due to microbial agents in Canada between 2011 and July 2015 are summarized in Table 1.1.

Table 1.1 Number of food recall warnings 2011-2015 (July, 21) in Canada

	Potential risk to the public		
	Class I High risk	Class II Moderate risk	Class III Low and no risk
Clostridium Botulinum	32	0	1
Listeria	123	9	0
Salmonella	27	117	2
Staphylococcus	0	14	0
E. coli O26:H1	0	1	0
E. coli O157:H7	3	0	0
E. coli O157	112	2	0

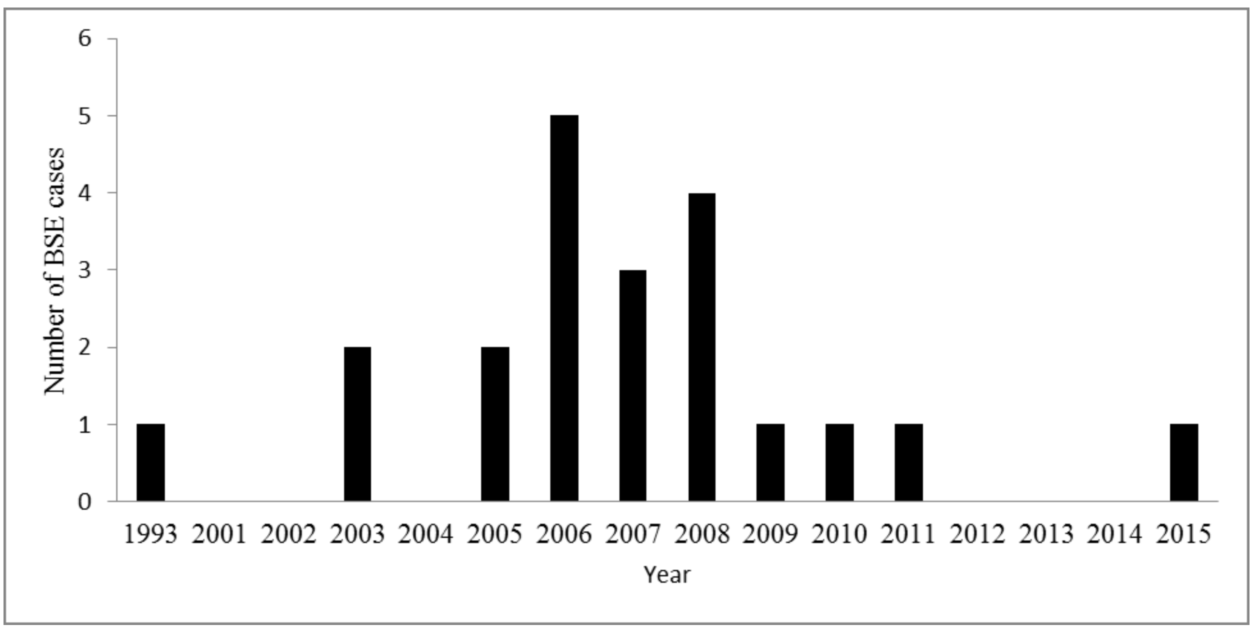
Note: high risk-could cause serious health problems or death, moderate risk-could lead to short term or non-life threatening health problems, low or no risk-not likely cause any health problems

Source: Calculations by author using data from Canadian Food Inspection Agency (2015)

Recall of a product can lead to losses in revenue for producers, thus leading to losses in profits. Food incidents that have high risks to human health can lead to deaths or serious health problems for the public. Recurrence of such food recalls might lead consumers to choose different forms of products, look for food safety attributes, change location of purchase or read labels. It is therefore hypothesized that after the occurrence or in the presence of real and perceived food safety incidents, consumers' distrust in food agencies can negatively influence their consumption of the different forms of food products.

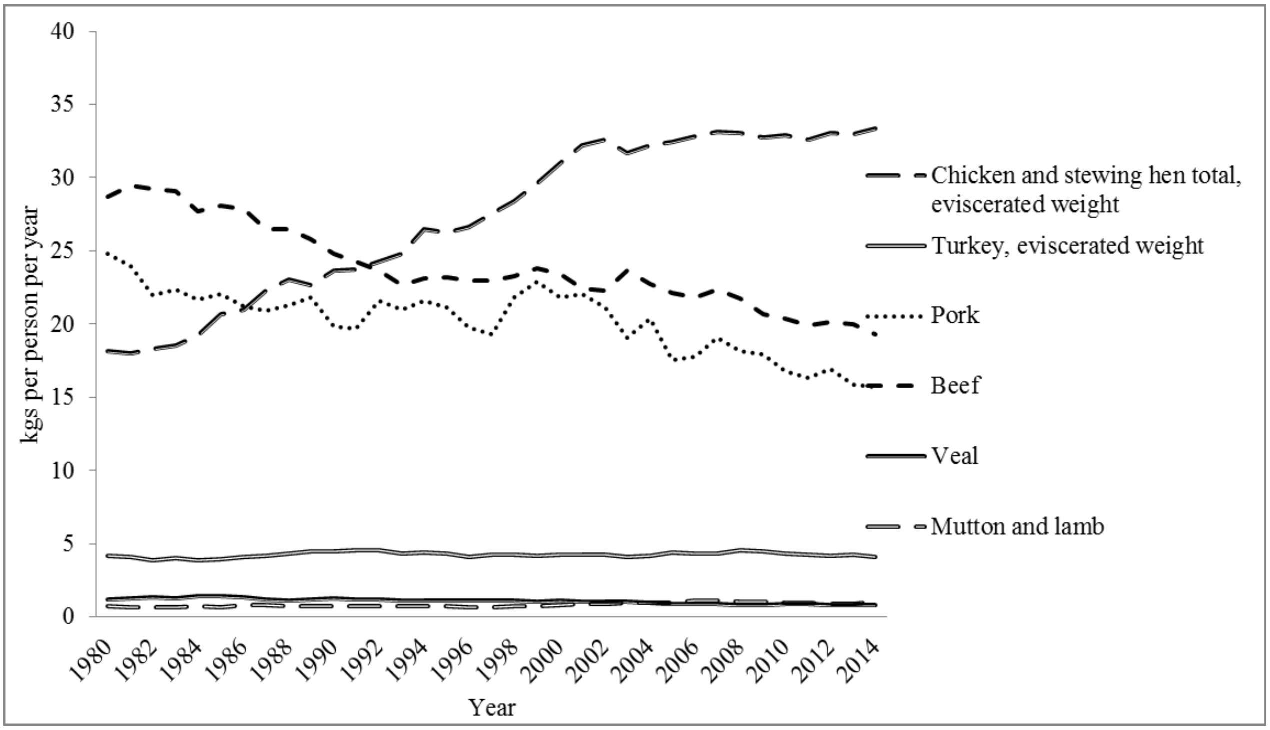
1.5 Animal disease incidents in Canada

According to the Canadian Food Inspection Agency (2016a) there have been 20 cases of BSE (Fig 1.3) in Canadian born cattle since the 1990's (that is 19 cases in Canada and 1 in the U.S). Although the bans have been mostly removed, BSE led to the closure of borders for Canadian beef and live cattle by the U.S. and other countries and this negatively affected processors, feedlots and cow-calf producers in 2003 (Statistics Canada, 2006).



Note: The animal found with BSE in 1993 was imported from the UK to Canada
Source: Illustration by author using data from Canadian Food Inspection Agency (2016a)
Figure 1.3 BSE cases in Canada

The decline in beef prices led to high financial costs for the Canadian beef industry (LeRoy and Klein, 2005) and Canadian producers lost \$5.3 billion (Statistics Canada, 2006). Between May 2003 and December 2004, the Canadian government spent \$2.5 billion in BSE related payments to beef producers (Statistics Canada, 2006).



Source: Own illustration using data from Statistics Canada. Table 002-0011 - Food available in Canada, annual (kilograms per person, per year unless otherwise noted) (accessed February 03 2016)
Figure 1.4 Per capita disappearance of meat in Canada (kgs per person per year)

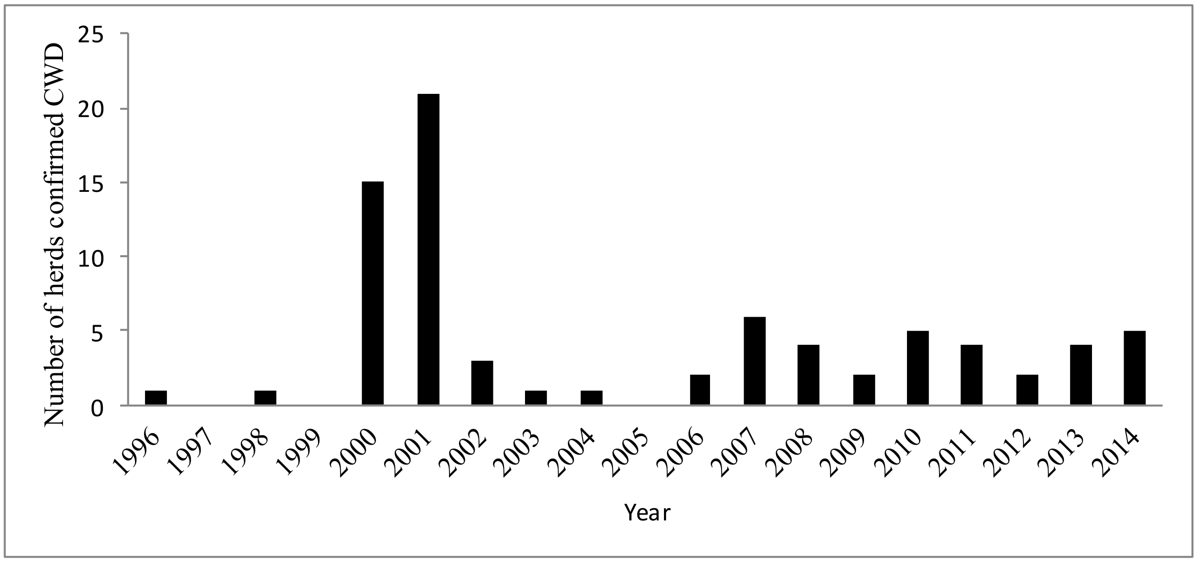
Per capita consumption of beef in Canada increased somewhat after the first BSE case (in May 2003) possibly due to lower prices and consumers' desire to support beef farmers (Statistics Canada, 2004). According to Statistics Canada (2004), domestic consumption of beef increased by 5.0% between 2002 and 2003 (increased from 13.5 kgs in 2002 to 14.2 kgs in 2003). However, Figure 1.4 show that there is a longer term downward trend in the disappearance (meat available for consumption from production, imports and minus exports) of red meats such as beef and pork while the consumption of poultry meat is increasing over the longer time frame.

Yang and Goddard (2011c) analysed the effect of consumers' and cow-calf producers' risk perceptions and media information about BSE on Canadian beef demand and the supply of slaughter cows respectively. Consumers who were more concerned about BSE (had high risk perceptions about BSE) decreased the demand for beef as compared to those consumers who were less concerned about the disease. Cow-calf producers' who had high risk perceptions about the disease increased the supply of slaughter cows as compared to those who perceived the disease as having low risk. Myae (2015) found that media coverage of BSE decreases the consumption of beef and increases the consumption of venison, bison, chicken and turkey.

CWD in Canada and the U.S. has affected hunting, wildlife industries, local and international markets for wild and farmed cervids and may affect perceptions of venison safety. CWD has affected animals in Canada, the U.S. and North Korea (Adamowicz et al., 2010; Kahn et al., 2004). In Canada, the first case of CWD was found in an elk herd at a farm in Saskatchewan in 1996 and most of the CWD cases have been found in that province while some cases have been found in Alberta (Canada Food Inspection Agency, 2009; Abrams et al., 2011). There have been 77 domestic cervid herds in Canada (Figure 1.5) that have been confirmed to be affected by CWD and subsequently depopulated (Canadian Food Inspection Agency, 2016b).

CWD has potential negative impacts on the industry for farmed cervids e.g. could affect sales of venison, breeding stock and elk velvet (Arnot et al., 2009). According to Kahn (2004), CWD led to the ban of exports (for example by Korea) of live elk, elk semen and antler velvet which resulted in lower prices for live animals and velvet. According to Heberlein and Stedman

(2009), purchases of hunting licenses decreased in Wisconsin, U.S. when three wild white tailed deer were found to be infected with CWD.



Source: Illustration by author using data from Canada Food Inspection Agency (2016b)
Figure 1.5 Number of domestic cervid herds confirmed with CWD in Canada

It is important to note that although measures have been taken to avoid the consumption of infected animals by humans, there is no scientific evidence that suggests that CWD is a risk to human health (Canadian Food Inspection Agency, 2016c; Belay et al., 2004; Abrams et al., 2011). However, consumers might perceive otherwise and their concerns about the human health risk of CWD might affect venison purchases.

Studies have been conducted on the economic impacts of CWD (e.g. Arnot et al., 2009; Seidl and Koontz, 2004; Petigara et al., 2011; Bishop, 2004) and on hunter perceptions about the risk of CWD and the management of the disease (e.g. Needham and Vaske, 2008; Needham et al., 2004; Zimmer et al., 2011). Myae (2015) found that media coverage of CWD decreases the consumption of venison, bison, pork and chicken while it increases the consumption beef. Although researchers have analysed the socio-economic impacts of animal diseases, very few studies have analysed the effect of trust on people's perceptions about the safety of meat in the presence of animal disease incidents such as BSE and CWD which is one of the aims of this research. In this analysis, results from Canada will be compared with results from Japan (for BSE) and the U.S. (for BSE and CWD) in order to assess similarities and differences across countries and across diseases.

1.6 Livestock production issues

Trust might influence consumer's WTP in situations where they do not have sufficient information about the product. Consumers' demand for high quality products, improved welfare of animals, environment stewardship and sustainability has led to changes in meat production systems (Verbeke et al., 2010). Some consumers might link production practices to food safety. Muringai and Goddard (2011) found that Canadian respondents were mostly concerned about animal diseases, conditions in which animals are raised, antibiotics in meat in the 2006 survey and genetically modified animals, antibiotics in meat and animal diseases in the 2011 survey. Lusk et al. (2006) found that consumers were willing to pay premiums for pork produced without antibiotics. Some consumers are against the intensive production of livestock which has led some supermarkets to buy from farmers that have different animal standards in order to improve the welfare of these animals (Tudge, 2010).

Previous studies have assessed people's trust in private and third party institutions and the government in providing credible quality signals on attributes derived from production (on – farm production methods) and WTP for those attributes (Innes and Hobbs, 2011; Nocella et al., 2010). Romanowska (2009) assessed the effect of generalized trust in people on certification of credence attributes for eggs such as normal eggs, free run/free range and vitamin enhanced eggs.

In summary results showed that generalized trust in people significantly influenced preference for the attributes and their certification. In the current study the literature will be extended by examining the role of consumers' generalized trust in people and trust in food agents regarding the safety of food on perceptions and preferences for traditionally raised pork.

1.7 Problem statement

Consumers are increasingly concerned about food safety and food quality and these issues have influenced strategies and policy initiatives by industries and the government respectively (Hobbs et al., 2005). Consumers are interested in the impacts of agricultural production on, for example, their health, animal welfare and the environment. Information asymmetry is present in food markets in the case of credence characteristics such as food safety and production attributes. In the presence of information asymmetry, consumers do not have full information on the characteristics of the products that they purchase in terms of the production systems, the quality and safety of the product. From an economic point of view, information asymmetry is one of the reasons for market failure. Trust might weaken the impact of information asymmetry since it might reduce consumers' uncertainties when making choices among products. It is assumed that in cases where consumers do not have full information about the product they want to purchase, they might choose to purchase the product if they trust agents that are involved in the supply of the product (in this case retailers, food manufacturers, farmers and the government). Trust in food suppliers and the media shape the response of consumers to food safety events (Savadori et al., 2007). According to Savadori et al. (2007), distrust in the system (in this context the food system) might result in political activism, development of alternative markets and consumers decision to avoid the product.

Consumers' trust or distrust in general, trust or distrust in food agents and trust or distrust in information provided by different governmental and non-governmental agencies could therefore influence the overall utility they gain from consuming the products. This can have implications for the success of new food products and the market share of existing products. If lack of trust drives behaviour then maybe particular behaviours are the result of trying to purchase products with fewer actions by the people you don't trust. However, it is therefore important to empirically assess whether there are indeed linkages among consumer trust, perceptions and stated and actual behaviour in terms of consumption of food products. Knowledge of the linkages between trust and food purchasing is important because food consumption has a direct impact on public health. Certain groups of consumers might reduce their consumption of certain meat products contain that certain nutrients which could negatively affect their health. Since consumers are assumed to purchase and are more willing to pay for the products they trust as compared to those they do not trust, trusted producers can benefit in terms of increased producer surplus and profits.

1.8 Study objectives

The overall objective of this study is to examine the linkages between trust, perceptions, intentions and actual behaviour. The specific objectives are as follows:

1. To determine the linkages between trust and the demand for different forms of meat products (fresh, semi-processed and fully processed products). In this study, ACNielsen Homescan™ data (2002-2009) and data from two ACNielsen Homescan™ surveys in 2008 and 2011 are used.

2. To examine the linkages between trust, perceptions and preferences for traditionally raised pork and other product attributes (i.e. country of origin, on farm food safety accreditation and marbling). In this study, data from choice experiments and surveys in Edmonton (2009 and 2011) and in Canada (2011) are used.
3. To determine the effect of trust on consumers' human health risk perceptions about BSE and CWD. In this study, data from Canada (in 2009 and 2010), U.S. (two surveys in 2010) and Japan (in 2009) are used.

1.9 The contribution of this dissertation

In this research, theoretical models about the effects of trust on consumer perceptions and behaviour are included. The research also contributes to literature empirically since different data and analytical tools are used to assess the effects of trust on demand for different products differentiated by meat type and degree of processing, perceptions and preferences for production attributes and risk perceptions about BSE and CWD.

In the first essay, a consumer demand system model is estimated using both revealed preference and survey data to quantify the effects of trust on purchases of fresh, semi-processed and fully processed products. Drescher et al. (2012) analysed the effect of trust in the food industry on demand for fresh and processed meat products in Canada using real purchase data from July 2007 to July 2008, using Engel functions, and survey data on trust variables from a 2008 survey (this data is part of the data used in the current analysis). The current analysis extends the research by Drescher et al. (2012) by using a bigger panel of data in terms of the number of years under study and two surveys and by calculating price and expenditure elasticities from twelve demand systems, for the different meat products for different groups of respondents classified according to their generalized trust in people and trust in the food industry. Results generated from this study are important for public policy purposes because they will show whether monitoring people's trust could help policy makers in predicting the type of products purchased by different consumers in cases of food safety events. Understanding the factors that affect consumption and substitution decisions is important for public health because consumption of, for example, processed food products can have negative effects on human health. Knowledge of the characteristics of consumers that are more likely to prefer certain food products can assist in the communications of risks and benefits of consuming certain meat products.

Results from previous studies have shown that consumers prefer certain production practices. However, Allender and Richards (2010) found that mandatory cage-free production of eggs in California would lead to a $106 million loss in consumers' welfare due to increased production costs. Clear labelling of products would be more efficient in improving animal welfare and non-cage systems (Allender and Richards, 2010). There is limited literature on the effect of generalized trust in people and trust in food agents on preferences for production attributes. Roosen et al. (2015) analysed the effect of trust in the food industry on consumers' preferences for nanotechnology in Canada and Germany. Ding et al. (2012; 2015) analysed the effect of generalized trust in people and trust in the food industry on preference for a genetically modified product. In this analysis, the effect of trust on consumers' perceptions and preferences for traditionally raised pork is analysed. Comparisons are made across three data sets. Results from the current analysis might help in understanding consumers' perceptions and preferences for animal production methods and it might help in developing marketing strategies for pork products for the different market segments.

In previous studies, the effects of trust on risk perceptions have been analysed. Tonsor et al. (2009) analysed the effect of trust on beef risk perceptions in three countries (Canada, U.S. and Japan). In other studies the effect of trust in agents on hunter perceptions about CWD has been analysed (Needham and Vaske, 2008). However, there is still limited literature on the linkages between trust and consumer perceptions about the safety of meat after or in the presence of animal disease incidents such as BSE and CWD which is done in this study. The analysis of the effect of trust on consumers' human health concerns about animal diseases (BSE and CWD) is important for public health and food marketing because in cases where consumers are concerned about the disease, they might choose not to consume the meat products. Trusting consumers might be less concerned about animal disease incidents while non-trusting consumers might be more concerned about the diseases. Therefore, monitoring people's trust in general or trust in food agents regarding the safety of food might give information on consumers' response to future animal disease incidents which is important for public policy in the area of diet and health. This study is also important because results will be compared between BSE and CWD to assess whether different risk management strategies should be used for different animal disease incidents. Results will be compared across countries (Canada, the U.S. and Japan for BSE and Canada and the U.S. for CWD) to assess whether there are differences in the effect of trust on animal disease risk perceptions across countries. A multiple product comparison might help identify if there is a direct link between an animal disease and risk perception about any particular product. Undertaking the comparison may help show whether the links between the presence of an animal disease and risk perceptions across the sampled populations is related to familiarity or frequency of consumption of the product. The comparison of animal disease effects on meat risk perceptions across countries is important because of the increasing importance of international trade, international trade restrictions arising from animal diseases and potential differences in national demands for regulation in response to animal diseases.

In summary, results from this research could be used by other researchers who are interested in understanding the factors that drive consumer behaviour. In addition, this research could be used by public health authorities, policy makers, consumer advocacy groups, producers and other food agents because the effect of trust on consumer perceptions, attitudes, intentions and actual behaviour are analysed.

1.10 Organisation of the dissertation

The second chapter of the thesis addresses the effect of trust on consumers' demand for fresh, semi-processed and fully processed meat products. The third chapter addresses the effect of trust on consumers' perceptions and preference for traditionally raised pork. The fourth chapter addresses the effect of trust on consumers' human health risk perceptions about BSE and CWD. The fifth chapter contains a summary of the thesis, policy insights, and limitations of the three studies and areas of further research.

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2. TRUST AND CONSUMERS' DEMAND FOR DIFFERENT FORMS OF MEAT PRODUCTS

2.0 Introduction

Meat products are sold in different forms in Canada i.e. generic products, branded fresh, frozen and processed products. The degree of processing of a product is a form of product differentiation. However, there are other forms of product differentiation which include pricing, advertising, distribution channels, branding, quality or other attributes. The World Health Organisation (2015, pg. 2) define processed meat as '… meat that has been transformed through salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation'. Meat processing is important in providing products that have a longer shelf life, the use of additives enhances flavour and appearance and it allows for the inclusion of animal tissues that are not normally sold in fresh meat markets in the food chain, thus reducing waste (Heinz and Hautzinger, 2007). Convenient products also save time and energy in food preparation.

The consumption of meat products has been identified as having positive and negative health implications depending on the level of consumption and the form (fresh or processed) of product consumed. Meat products have high concentrations of proteins, vitamins and mineral salts and are a source of iron and fats (Wyness et al., 2011). Red meat is an important source of protein, iron, zinc and vitamin B12 (McAfee e al., 2010). Although there are variations in the results from epidemiological studies, the consumption of processed meat has been linked to increased risks of colorectal cancer (zur Hausen, 2012; McAfee et al., 2010). The World Health Organisation (2015) reported that the consumption of a 50 gram portion of processed meat leads to an 18% increase in the probability of the risk of colorectal cancer and the risk goes up with increases in the quantities of the meat consumed. Limited evidence on the link between consumption of red meat and colorectal, pancreatic and prostate cancer was also found (World Health Organisation, 2015).

There have been food recalls in Canada due to *Listeria, Salmonella, E. coli, Clostridium botulinum* and the presence of allergens among others (Canadian Food Inspection Agency, 2015). The occurrence of food safety incidents e.g. *Listeria* in processed deli meats, *E. coli* in ground beef, or animal diseases such as bovine spongiform encephalopathy (BSE) and public information about the human health risks of processed meat products might influence consumers' choice between fresh and processed meat products.

Consumers' generalized trust in people and trust in food agents might influence the demand for fresh or processed meat products. However, there is limited information on how trust affects consumers' choice of different forms of meat products using actual purchase data. In this study, the objective is to assess the effect of trust (generalized trust in people and trust in the food industry regarding the safety of food) on consumers' substitution among fresh, semi-processed and fully processed meat products. It is hypothesized that consumers who have lower levels of trust (both general and agent specific trust about food safety) are more likely to purchase fresh meat products and less likely to purchase processed meat products as compared to those consumers who have higher levels of trust. In this study, fresh meat is defined as raw meat without any ingredients added e.g. steaks and ground meat. Semi-processed meat refers to raw meat that is partially processed e.g. bacon, sausages, smoked, seasoned or stuffed products while fully processed meat includes ready to eat or ready to heat products or highly processed products such as schnitzel, burgers and meatloaf.

This analysis is based on two types of ACNielsen Homescan™ data sets for the same Canadian households (i.e. data from surveys conducted in 2008 and 2011 and meat purchase data for the period 2002-2009). The study contributes to literature by combining actual purchase data and survey data and using a demand system analysis to assess the effect of trust on consumers' demand for different forms of meat products differentiated by degree of processing. The estimated elasticities will show the responsiveness of the demand for the different forms of products to prices and expenditure by groups of households classified according to their levels of generalized trust in people and trust in food agents regarding the safety of food. Understanding choices of meat products by trusting, non-trusting and neutral consumers can help the government and food suppliers in predicting demand for different forms of meat products in the future. Understanding the factors that affect consumption decisions is important for public health because consumption of products such as processed food products might have negative effects on human health. Results will also show the demographic factors that influence the demand for different forms of meat products which is important for developing marketing strategies for the products.

2.1 Theoretical framework

The widely used definition of trust by Rousseau et al. (1998, p. 395) which states that trust is '… a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another' is followed in this research. In the case of food issues, consumers might feel vulnerable to the actions of agents that are involved in ensuring food safety, for example, the government, farmers, retailers and food manufacturers. Generalized trust in people and trust in food agents regarding the safety of food could affect consumer's demand for fresh, semi-processed and fully processed meat products. Given the public information on the cancer risks of processed meat products (World Health Organisation, 2015), consumers with low levels of trust might prefer fresh products over processed products as compared to those consumers who have higher levels of trust. In addition, the use of additives and flavors and food safety incidents such as *Listeria* in deli meats might also lead consumers who have low levels of trust in the food system or in people in general to choose fresh over processed meat products.

In this research we use the expected utility framework (Varian, 2010; Eom, 1994) to assess differences in demand for fresh, semi processed and fully processed meat products across consumer groups classified according to their levels of generalized trust in people and trust in food agents regarding food safety. In the case of food risks, it is hypothesized that there are two states of outcomes i.e. occurrence or non-occurrence of the adverse health event which are associated with the following probabilities π and $1-\pi$. Given that the food risk affects product x, while z is a composite good, the state dependent utility function is specified as follows: $U_i(x,z)$ where i represent occurrence (1) or non-occurrence (2) of the adverse health event. Following Eom (1994, p. 761), given y is income and p is the relative price, the expected state dependent utility maximization problem is represented as follows:

$$\max_{x,z} EU = \pi U_1(x,z) + (1-\pi)U_2(x,z) \text{ subject to } y = px + z \tag{1.1}$$

Maximizing expected utility subject to a budget constraint results in the following optimal demand function:

$$x^* = (p, y) \tag{1.2}$$

The state dependent indirect utility function is

$$EV(p,\pi,Y) = \pi V_c(y,p) + (1-\pi)V_{nc}(y,p) \tag{1.3}$$

In this study, it is assumed that more trusting consumers might demand more processed meat products and less fresh products as compared to less trusting consumers. This implies that high trusting consumers might derive higher utility from consuming processed meat products and lower utility for fresh products as compared to low trusting consumers. This effect is represented by $U_i(tx,z)$ with t representing trust. The utility maximization process above is therefore changed to:

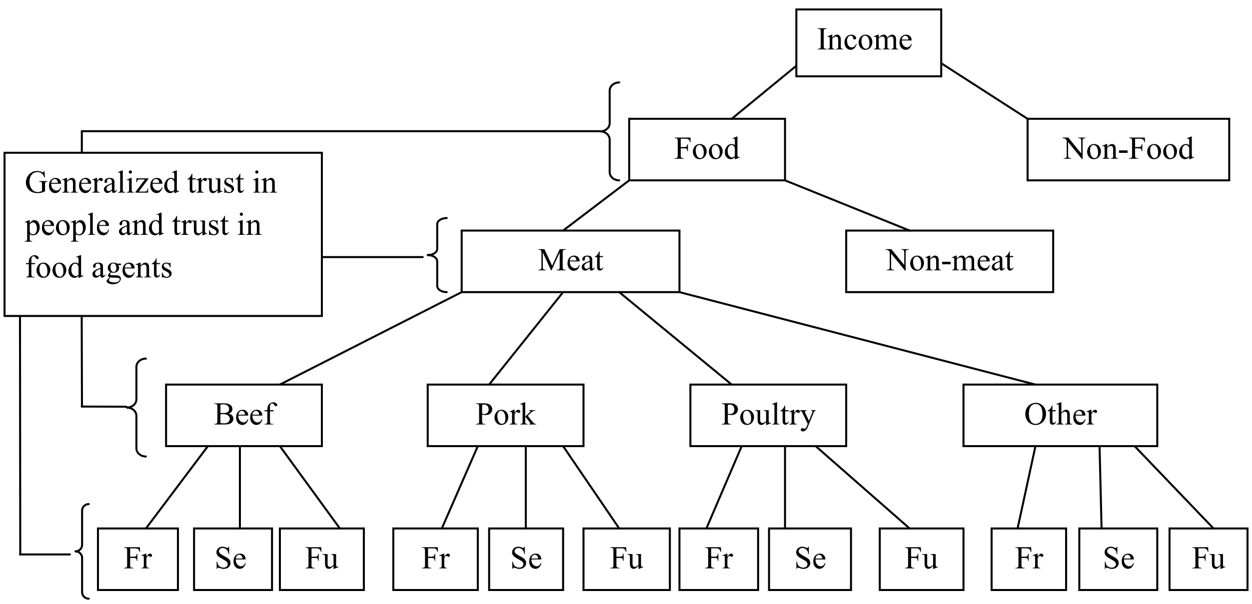
$$\max_{x,z}\ E(U) = \pi U_1(tx,z) + (1-\pi)U_2(tx,z) \text{ subject to } y = px + z \tag{1.4}$$

Quantities of the meat demanded are specified as follows: $x^* = (p, y, t)$ (1.5)

In the framework above, individuals are assumed to know and understand the technical level of risk (π) (Viscusi, 1989). However, differences have been observed between technical and subjective risk judgements (Slovic et al., 1985). Trust might also influence subjective risk judgements about meat products (Tonsor et al., 2009) but this effect is not analysed in the current study. In this study, we are trying to assess the effect of trust on consumers' demand for different forms of food products classified according to degree of processing (equation 1.5).

According to Deaton and Muellbauer (1980), consumer decisions are complex i.e. they choose to allocate their current and future incomes across different products, they deal with uncertainty and there might be interactions among these problems. The assumption of weak separability simplifies the consumer's problem in that expenditures for a given group are assumed to be determined by total expenditure within the current period and not factors such as assets, wage rates and interest rates (Deaton and Muellbauer, 1980). Preferences for products can be explained independently from preferences for commodities in another group i.e. marginal rates of substitution among commodities in a given group are independent of any goods in another group (Deaton and Muellbauer, 1980). In this case a rational consumer maximizes utility subject to a budget constraint or minimizes expenditure subject to utility at each stage of the decision process.

In this study, it is assumed that there is weak separability in terms of allocation of expenditures among meat and non-meat products which allows for the separation of the demand for meat products from the demand for other products. The assumption of weak separability implies that demand for meat products can be analysed using total expenditure on meat and prices of meat products.



Note: Fr-fresh, Se-semi-processed and Fu-fully processed

Source: Illustration by author

Figure 2.1 Possible utility tree

Two stage budgeting is assumed whereby in the first stage, total expenditure is allocated to groups of meat products (beef, pork, poultry and other meats) and in the second stage the consumer allocates expenditure to the different forms of meat products (fresh, semi-processed and fully processed products). It is also assumed that generalized trust in people and trust in the food industry influence purchases of food products, type of meat products purchased and choices between fresh, semi-processed and fully processed products (Figure 2.1).

2.2 Literature review

2.2.1 Consumers' demand for meat products

In previous studies, the demand for meat products has been analysed using disappearance data (e.g. Marsh et al., 2004; Piggott and Marsh, 2004), expenditure surveys (e.g. Capp et al., 1985; Burton and Young, 1996; Lambert et al., 2006; Salvanes and Devoretz, 1997), Homescan data (Myae 2015, Drescher et al., 2012; Harris and Shiptsova, 2007; Yang and Goddard, 2011a, b; Zhang, 2010; Ding et al., 2013) and retail level scanner data (e.g. Goddard et al., 2010; Ahmad and Anders, 2012) (see Table A1 in appendix A). The demand for meat products can be analysed using single equations or systems of demand equations. Although single equation demand analysis satisfies the homogeneity assumption, adding up and symmetry are not satisfied (Deaton and Meullbauer, 1980).

One group of the complete demand systems includes the linear expenditure system (LES) and quadratic expenditure system (QES) and in these models regularity conditions (i.e. concavity and monotonicity) are imposed (Deaton and Muellbauer, 1980). Another group of demand systems that have been used in the analysis of demand for food products include flexible functional forms in which there are no a priori restrictions on possible elasticities (Deaton and Muellbauer, 1980; Barnett and Seck, 2008). Examples of flexible functional forms are the Almost Ideal Demand System (AIDS), Quadratic Almost Ideal Demand System (Q-AIDS), Linear Approximated Almost Ideal Demand System (LA-AIDS) and translog models. In some consumer studies, demand models are modified to account for zero expenditure since some households might not purchase a given product using a two-step procedure e.g. Heien and Wessels (1990) demand model (e.g. Myae, 2015; Zhang, 2010).

Although there are many studies that have analysed the demand for meat, the demand for meat products differentiated by the degree of product processing have been analysed in only a few studies. Zhang (2010) analysed the factors that influence demand for fresh, semi-processed and fully processed beef, pork, poultry and other meats in Alberta and Ontario using the Working-Lesser demand models. Although there were variations in results, purchases of the different forms of meat products were significantly influenced by demographic factors, prices, total expenditure, advertising expenditures and number of grocery chains visited. Zhang (2010) also assessed consumer's choice of national versus private brand for fully processed products.

Goddard et al. (2010) also analysed the demand for fresh, semi-processed and fully processed meats using retail level scanner data for Canada and a Translog demand model. In summary, results showed that there were strong substitutions among fresh, semi-processed and fully processed products especially for beef.

Capps et al. (1985) analysed the demand for convenience and non-convenience foods using an AIDS model and data from consumption surveys for the U.S. Food products were classified into non-convenience, basic convenience, complex convenience and manufactured convenience products. Non-convenience products included fresh products that are not processed, that are home frozen, canned or preserved and food products used as ingredients. Basic convenience foods included foods that are processed but mostly for preservation, that had a few ingredients and foods which require time and energy but do not have culinary skills built in while complex convenience foods included foods with a number of ingredients, that save time and energy and had culinary skills built in. Manufactured convenience foods included foods that do not need preparation at home. In summary, prices influenced budget shares more than total expenditure. Compared to male headed households, female headed households spent more money on non-convenience foods and less money on complex and manufactured convenience foods. Households with household heads that had college education spent less money on non-convenience and complex convenience foods and more money on basic and manufactured convenience foods as compared to households that had household heads with no college education. Households with older household heads (at least 35 years of age) spend less money on convenience foods and more money on non-convenience foods as compared to households with younger household heads. Household size was positively related to amount of money spent on basic and complex convenience foods and negatively related to amount of money spent on non-convenience foods.

Salvanes and DeVoretz (1997) analysed the demand for fresh and processed meat and fish in Canada using data from expenditure surveys and an AIDS model. Results suggests that the demand for meat and fish should not be estimated separately at the aggregate level but could be estimated separately if products are disaggregated into fresh and processed products.

Harris and Shiptsova (2007) analysed the demand for ready foods using ordinary least squares regressions on ACNielsen Homescan panel data for the U.S. In summary, results showed that expenditure on ready meals was significantly influenced by income (positively), price (positively), age of household head (negatively), education (negatively), presence of children in the household (positively), poverty (negatively) and living in metro area (positively). Ahmad and Anders (2012) found that consumers preferred 'natural' and health attributes in chicken and sea food as compared to highly processed products.

In summary, there is limited information on consumers' demand for different forms of meat products. Consumers' demand for fresh and processed meat products might be influenced by differences in demographic variables, prices, total expenditure and advertising expenditure among others.

2.2.2 The effect of trust on demand for meat products

Although a significant number of studies have assessed the demand for meat products, there is limited information on the effect of consumers' trust on their actual retail purchases of meat products in general or their purchases of different forms of meat products. Drescher et al. (2012) assessed the effect of trust in the food industry on meat purchase behaviour with special focus on the extent of meat processing (fresh or processed) using scanner and survey data from Canada. Three clusters were created (high trust, medium trust and low trust) using a segmentation analysis. Engel functions were used to assess the effect of trust, demographic variables and total meat expenditure on expenditures on fresh and processed meat. Two trust variables (dummies) were included in the Engel functions i.e. high trust and low trust with medium trust as a reference. Low trust consumers had low purchases of meat especially processed meat. However, there was no significant relationship between trust and expenditures for fresh or processed meats in the Engel functions.

Ding et al. (2013) examined the effect of generalized trust in people on consumers' expenditures for fresh meat products in response to the first three BSE cases in Canada using Engel curve analysis and Nielsen Homescan® panel. From the results, generalized trust in people, risk perceptions and demographic factors influenced shares of beef expenditure.

Wang et al. (2011) assessed the factors that influence the number of units purchased by Canadian households in response to BSE. Generalized trust in people and trust in different institutions or organisations (consumer organisations, media, scientists, retailers, farmers, food manufacturers) was also included in the analysis. Results showed that trust is an important determinant of consumers' responses to BSE in terms of quantities of meat purchased.

Lobb et al. (2007) analysed the effect of trust in information on consumers' likelihood to purchase chicken. Results showed that trust in the media negatively affected the likelihood of consuming chicken.

In summary, there are limited studies on the effect of consumers' trust on their actual purchases of meat products differentiated by degree of product processing. The current study extends the analysis of the demand for fresh, semi-processed and fully processed products by Zhang (2010) and Goddard et al. (2010) by assessing the effect of trust on consumers' preferences for these products. As compared to the study by Zhang (2010), two data sets from Nielsen Homescan™ surveys conducted in 2008 and 2011 and a bigger panel of the household purchase database are included in the analysis. The study also extends the analysis by Drescher et al. (2012) by using a demand system analysis to assess the effect of changes in trust on the consumption of fresh and processed products. There are two surveys in the current study and a bigger panel with purchases of meat products as compared to the data used by Drescher et al. (2012).

2.3 Empirical methods

For this study the aim is to analyse preferences for fresh, semi-processed and fully processed meat products by groups of consumers classified according to their level of generalized trust in people and trust in food agents regarding the safety of food. Some households did not purchase some forms of meat products. Zero consumption means that the dependent variable is censored which leads to biased results such that a two steps estimation process which leads to consistent and asymptotically efficient results is used in this study (Heien and Wessels, 1990). The first step involves the estimation of a probit model that assesses the probability of the decision of whether or not to buy a specific form of meat product.

Following Heien and Wessels (1990, p. 369-370), the probit regression for whether or not the household consumes the type of meat is specified as follows:

$$Y_{ih} = f(p_{1h},.....p_{nh},m_h,d_{1h},.....,d_{sh}) \qquad 2.3$$

where Y_{ih} is 1 if the h^{th} household consumes the i^{th} form of meat and 0 otherwise, m_h is total expenditure for household h, p_{ih} is the price of i^{th} type of meat for household h and d_{sh} represents demographic or socio-economic variables for household h (gender of respondent (1. female and 0. male), age of respondent, education level attained by respondent, household size, language spoken by respondent (1. French and 0. otherwise), living in a urban (1) or rural area (0), presence of children less than 18 years of age and household income).

The inverse Mills ratio computed from the probit model is included as an instrumental variable in the second step of the estimation process. The inverse Mills ratio accounts for the latent censoring variables in the demand system. The inverse Mills ratio (R_{ih}) for the i^{th} meat product for the h^{th} household is computed as follows:

$$R_{ih} = \phi(\mathbf{p}_h,\mathbf{d}_h,m_h)/\Phi(\mathbf{p}_h,\mathbf{d}_h,m_h) \qquad 2.4$$

where $\mathbf{p}_h$ is a vector of prices for the h^{th} household, $\mathbf{d}_h$ is a vector of demographic variables for the h^{th} household, ϕ is the density function and Φ is the cumulative-probability function. ϕ is the density function and Φ is the cumulative-probability function. For households that do not consume the form of meat, the inverse Mills ratio is computed as follows:

$$R_{ih} = \phi(\mathbf{p}_h, \mathbf{d}_h, m_h)/(1-\Phi(\mathbf{p}_h, \mathbf{d}_h, m_h)) \qquad 2.5$$

In the second step, a two stage demand system is estimated. In the first stage, the logarithm of total expenditure is expressed as a function of demographic variables, prices (p), expenditure shares (w) for different forms of meat products, the lag of the log of total expenditure, trend (T) and demographic variables as follows:

$$\log(m_{hit}) = x_0 + x_1 \log(m_{hit-1}) + x_2\left(\sum_{i=1}^{12} w_{hit*} \log(p_{hit})\right) + x_3 T + x_h \sum d_h + \varepsilon_t \qquad (2.6)$$

The Working (1943) and Leser (1963) model is used in the second stage of the demand system since more flexible models e.g. AIDS model could not be used because some prices of products are highly correlated. We are interested in assessing the substitutions across fresh, semi-processed and fully processed products in the same meat group. Only prices for the same meat group are included in the equations for the second stage of the demand system. For example, in the equation for fresh beef, the price of fresh beef, semi-processed beef and fully processed beef are included. Lagged quantities of products are included in order to capture the effects of habits and to resolve autocorrelation.

The original Working-Leser model relates budget shares to the logarithm of expenditure (Deaton and Muellbauer, 1980) as follows:

$$w_i = \alpha_i + \beta_i \log(m) \qquad (2.7)$$

For adding up to be satisfied $\sum \alpha_i = 1$ and $\sum \beta_i = 0$

In this analysis, the Working-Leser demand model is specified as follows:

$$w_{hit} = \alpha_i + \beta_i \log(m_{ht}) + \sum_{i=1}^{3} \theta_{ij} \log(p_{hjt}) + \gamma_i q_{hit-1} + \lambda_h \sum d_h + \psi_i R_{it} + \pi_i T + \varepsilon_{it} \qquad (2.8)$$

where $q_{i\,t-1}$ is the previous quantity for meat *i* and R_i is the inverse Mills ratio from the probit equation for meat *i*. Other variables are defined as before.

Marshallian expenditure elasticity (η_i) = $(\beta_i / w_i) + 1$ (2.9)

Marshallian price elasticitity (η_{ij}) = $-\delta_{ij} + (\theta_{ij} / w_i)$ (2.10)

where δ =1 if $i = j$ and 0 otherwise

Following Chalfant et al. (1991), the elasticity of substitution (σ_{ij}) is calculated using the Slutsky equation in its elasticity form ($\eta_{ij}^* = w_j \sigma_{ij} = \eta_{ij} + w_j \eta_i$) which shows the relationship between compensated price elasticity (η_{ij}^*), elasticity of substitution and Marshallian price and expenditure elasticities.

$$\sigma_{ii} = (\theta_{ii} / w_i^2) - 1 / w_i + \beta_i / w_i + 1 \qquad (2.11)$$

$$\sigma_{ij} = (\theta_{ij} / w_i w_j) + \beta_i / w_i + 1 \qquad (2.12)$$

Demand models for the different forms of meat products are estimated as a system for the three clusters separately. Seemingly unrelated regression analysis in Time Series Processor GiveWin2 is used since there might be high correlations across residuals for the expenditure and share equations. Full information maximum likelihood and least squares estimations were also used but the models did not perform well. Since there are 12 meat categories, 11 equations are estimated because of the adding up restriction (fully processed other meats is left out in the estimation). Symmetry is also imposed in the system by setting $\delta_{ij} = \delta_{ji}$. Own price and expenditure elasticities for fully processed other meats are calculated using the adding up condition and Engel aggregation condition $\sum_j e_{ij} + e_i = 0$ respectively.

Probit models are also estimated to determine the effect of trust on the probability of purchasing different forms of meat products with medium trust and high trust included as explanatory variables together with total expenditure, prices and demographic variables in Nlogit 4.0. For random weighted products, meat products are classified using information from ACNielsen Homescan^{TM} data on type of meat, meat processed form and meat processed type following Zhang, 2010 (see Tables A2, A3 and A4 in ppendix A). For most products with universal product codes (UPC), product classifications are based on product descriptions in the data and in some cases where information about the meat or processing information about the product was not available, the products were searched online.

Respondents who participated in the surveys in 2008 and 2011 are grouped into three segments (low trust, medium trust and high trust) using data for 2008 since the purchase data is for the period 2002-2009. Households could be grouped into segments using hierarchical, k-means or two step cluster analysis. In this analysis, k-means cluster analysis in SPSS 21 is used to group respondents since the number of clusters (three) needed for this analysis is known in advance (Mooi and Sarstedt, 2011).

Respondents are grouped into three segments depending on their responses to questions on generalized trust in people and trust in food agents regarding the safety of food. Generalized trust in people is measured using the following General Social Survey question ‘Generally speaking, would you say that most people can be trusted? 1. people can trusted 2. can’t be too careful in dealing with people 3. don’t know’ (Glaeser et al., 2000). A dummy variable is created for generalized trust in people with 1 representing the response 'people can be trusted' and 0 representing otherwise.

Trust in retailers, food manufacturers, the government and farmers regarding the safety of food is measured using statements adopted from de Jonge (2008). Using food manufacturers as an example, the statements are as follows (i) Manufacturers have the competence to control the safety of food (ii) Manufacturers have sufficient knowledge to guarantee the safety of food products (iii) Manufacturers are honest about the safety of food (iv) Manufacturers are sufficiently open about the safety of food (v) Manufacturers take good care of the safety of our food (vi) Manufacturers give special attention to the safety of food. Responses are as follows 1. strongly disagree 2. disagree 3. neither agree, nor disagree 4. agree. 5. strongly agree. These questions have been used in previous studies (e.g. de Jonge, 2008; de Jonge et al., 2008a; Wang et al., 2011; Ding et al., 2012).

2.4 Data

Data used in this analysis are from an ACNielsen Homescan™ panel on household purchases of meat products (2002-2009) and two ACNielsen Homescan™ surveys conducted in 2008 and 2011. Households with information on purchases available in the meat purchase data from 2002-2009 and who also participated in the two surveys (1827 households) are included in the analysis.

Due to cost, a subset of households was selected for survey completion in 2008 and the selection criterion for the households was that they had meat purchases for the period 2002 to 2006. The reason was that the researchers wanted to make sure that they had some people consuming meat before BSE events which could allow for the assessment of whether BSE affected meat consumption. Also due to cost, all households who participated in the 2008 survey could not be interviewed in 2011. There were 4090 and 3136 households in the surveys in 2008 and 2011 respectively. Of those households who participated in the 2008 and 2011 surveys, there were 2198 households that were present in both surveys. There were 1827 households that participated in both surveys and recorded meat purchases in each year for the period 2002 to 2009 which are the households that are included in the current analysis. This might bias results since only households that recorded meat purchases in every year and participated in both surveys were included in the analysis.

There are 371 households who participated in both surveys that were left out of the analysis because they did not record meat purchases for some or all years. One hundred and twenty four households did not record meat purchases in 2002 maybe because they were not yet in the panel (Table 2.1). The numbers of households who were present in both surveys and purchased meat in each year are summarised in Table 2.1. The number of household that did not record meat purchases in a given number of years is also recorded in the same table. Information on trust and meat expenditures for those households that recorded data on meat purchases but were excluded from the analysis because they did not record meat purchases for all years is reported in appendix A (Tables A9 and A10).

Table 2.1 Overview of households in the data sets

Number of households that participated in both surveys and had purchase data in a given year								
Year	2002	2003	2004	2005	2006	2007	2008	2009
#of households	2023	2154	2155	2125	2120	2123	2153	2082
Number of households present in both surveys that have missing data for a given number of years								
# of years	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years
# of households	248	58	24	17	10	6	4	4

Source: Data collected in ACNielsen Homescan™ surveys and ACNielsen Homescan™ purchase data

The data on meat purchases contains information on expenditure, units purchased, type of meat, brand, type of meat cut, meat processed form and meat processed type. The 2008 and 2011 surveys contain information on generalized trust in people and trust in farmers, retailers, manufactures and the government regarding the safety of food. The ACNielsen Homescan™ data and surveys all contain information on demographic characteristics of the household. Individual/household specific variables are summarized in Table 2.2. The original ACNielsen Homescan™ panel was selected to be representative of the Canadian population. There are more females in the surveys as compared to the national census because the surveys were targeted at people who mostly purchase groceries for the household. The data used in the current study is only a subsample of the original surveys.

Table 2.2 Summaries for individual specific variables in the Nielsen Homescan™ surveys

	2008 survey	2011 survey
% female	-	65.9
Average age of respondent	57.0	59.0
	(8.50)	(7.38)
Household size	2.05	1.98
	(1.05)	(0.99)
% having children < 18 years age	11.8	8.30
Average years of education	13.4	-
	(2.14)	
% living in urban an area	57.4	-
French speaking (%)	24.6	24.6
Average household income (CAN$10,000)	6.31	5.70
	(3.40)	(2.80)
Maritimes (%)	13.8	13.8
Quebec (%)	26.4	26.3
Ontario (%)	24.8	24.9
Manitoba/ Saskatchewan (%)	9.9	9.9
Alberta (%)	12.4	12.1
British Columbia	12.6	12.9
Sample size	1827	1827

Standard deviations are in parentheses and - implies that data is not available in the survey

Source: Data collected in ACNielsen Homescan™ surveys

2.4.1 Generalized trust in people and trust in the food industry

About 48% and 47% of respondents in 2008 and 2011 stated that most people can be trusted (Table 2.3). In the General Social Survey, 46.5% of the respondents stated that most people can be trusted (Statistics Canada, 2008). About 6% and 5% of respondents in the 2008 and 2011 surveys answered 'don't know' on the question of generalized trust in people.

Table 2.3 Generalized trust in people and trust in food agents

	2008 survey	2011survey
Generalized trust in people[1]		
people can be trusted	47.8%	47.1%
can't be too careful when dealing with people	46.1%	48.0%
don't know	6.02%	4.87%
Trust in food agents regarding the safety of food (1. strongly disagree… 5. strongly agree)		
	Average (standard deviation)	
The government		
has the competence to control the safety of food	3.33 (1.03))	3.53 (1.00)
has sufficient knowledge to guarantee the safety of food products	3.40 (0.99)	3.59 (0.97)
is honest about the safety of food	2.92 (0.94)	3.12 (0.99)
is sufficiently open about the safety of food	2.92 (0.94)	3.05 (0.99)
takes good care of the safety of our food	2.98 (0.93)	3.16 (0.97)
gives special attention to the safety of food	3.06 (0.94)	3.19 (0.99)
Farmers		
have the competence to control the safety of food	3.40 (0.88)	3.51 (0.87)
have sufficient knowledge to guarantee the safety of food products	3.36 (0.88)	3.50 (0.84)
are honest about the safety of food	3.29 (0.80)	3.40 (0.80)
are sufficiently open about the safety of food	3.26 (0.81)	3.33 (0.80)
take good care of the safety of our food	3.31 (0.78)	3.44 (0.78)
give special attention to the safety of food	3.25 (0.78)	3.41 (0.80)
Retailers		
have the competence to control the safety of food	3.11 (0.94)	3.23 (0.96)
have sufficient knowledge to guarantee the safety of food products	3.08 (0.93)	3.25 (0.94)
are honest about the safety of food	2.96 (0.81)	3.05 (0.85)
are sufficiently open about the safety of food	2.98 (0.84)	3.01 (0.88)
take good care of the safety of our food	3.09 (0.82)	3.18 (0.87)
give special attention to the safety of food	3.08 (0.81)	3.16 (0.86)
Food manufacturers		
have the competence to control the safety of food	3.40 (0.92)	3.56 (0.93)
have sufficient knowledge to guarantee the safety of food products	3.51 (0.85)	3.64 (0.88)
are honest about the safety of food	2.83 (0.84)	3.01 (0.91)
are sufficiently open about the safety of food	2.84 (0.86)	2.94 (0.94)
take good care of the safety of our food	3.03 (0.83)	3.22 (0.88)
give special attention to the safety of food	3.05 (0.84)	3.24 (0.88)
Sample size	1827	1827

Source: Data collected in ACNielsen Homescan™ surveys

[1] For the empirical analysis, the question on generalized trust in people is a dummy variable 1. people can be trusted 0. otherwise. More categories for the generalized trust in people question could be used in the future.

Table 2.4 Final cluster centers for k-means cluster analysis

	2008 survey			2011 survey		
	Low trust	Medium trust	High trust	Low trust	Medium trust	High trust
Generalized trust in people	0	0	1	0	0	1
Food manufacturers						
have the competence to control the safety of food	3	3	4	3	4	4
have sufficient knowledge to guarantee the safety of food products	3	4	4	3	4	4
are honest about the safety of food	2	3	4	2	3	4
are sufficiently open about the safety of food	2	3	4	2	3	4
take good care of the safety of our food	2	3	4	2	3	4
give special attention to the safety of food	2	3	4	2	3	4
Retailers						
have the competence to control the safety of food	2	3	4	2	3	4
have sufficient knowledge to guarantee the safety of food products	2	3	4	2	3	4
are honest about the safety of food	2	3	4	2	3	4
are sufficiently open about the safety of food	2	3	4	2	3	4
take good care of the safety of our food	2	3	4	2	3	4
give special attention to the safety of food	2	3	4	2	3	4
The government						
has the competence to control the safety of food	2	3	4	2	3	4
has sufficient knowledge to guarantee the safety of food products	2	3	4	3	4	4
is honest about the safety of food	2	3	4	2	3	4
is sufficiently open about the safety of food	2	3	4	2	3	4
takes good care of the safety of our food	2	3	4	2	3	4
gives special attention to the safety of food	2	3	4	2	3	4
Farmers						
have the competence to control the safety of food	3	3	4	3	3	4
have sufficient knowledge to guarantee the safety of food products	3	3	4	3	3	4
are honest about the safety of food	3	3	4	3	3	4
are sufficiently open about the safety of food	3	3	4	3	3	4
take good care of the safety of our food	3	3	4	3	3	4
give special attention to the safety of food	3	3	4	3	3	4
Distance between clusters						
Low		3.62	7.59		3.77	7.92
Medium			4.04			4.20
Size of cluster (%)	351 (19.2)	945 (51.7)	531 (29.1)	307 (16.8)	884 (48.4)	636 (34.8)

Source: Data collected in ACNielsen Homescan™ surveys

Table 2.5 Analysis of variance results from k-means cluster analysis

	2008						2011					
	Cluster		Error				Cluster		Error			
	Mean square	Degrees of freedom	Mean square	Degrees of freedom	F	Sig.	Mean square	Degrees of freedom	Mean Square	Degrees of freedom	F	Sig.
General trust	6.8	2.0	0.2	1824.0	28.1	0.0	6.5	2.0	0.2	1824.0	26.8	0.0
Manufacturers												
competent	217.1	2.0	0.6	1824.0	352.3	0.0	248.1	2.0	0.6	1824.0	419.1	0.0
knowledge	172.9	2.0	0.5	1824.0	320.3	0.0	215.6	2.0	0.5	1824.0	395.9	0.0
honest	319.1	2.0	0.4	1824.0	876.7	0.0	358.6	2.0	0.4	1824.0	829.5	0.0
open	335.5	2.0	0.4	1824.0	920.6	0.0	381.2	2.0	0.5	1824.0	834.8	0.0
care	325.4	2.0	0.3	1824.0	989.4	0.0	359.8	2.0	0.4	1824.0	967.7	0.0
attention	303.8	2.0	0.4	1824.0	823.6	0.0	357.6	2.0	0.4	1824.0	917.5	0.0
Retailers												
competent	245.6	2.0	0.6	1824.0	398.3	0.0	286.6	2.0	0.6	1824.0	474.4	0.0
knowledge	260.6	2.0	0.6	1824.0	450.2	0.0	271.3	2.0	0.6	1824.0	461.0	0.0
honest	279.8	2.0	0.4	1824.0	787.4	0.0	297.3	2.0	0.4	1824.0	747.0	0.0
open	298.6	2.0	0.4	1824.0	806.8	0.0	308.9	2.0	0.4	1824.0	712.9	0.0
care	292.9	2.0	0.4	1824.0	835.1	0.0	317.9	2.0	0.4	1824.0	795.1	0.0
attention	255.9	2.0	0.4	1824.0	695.9	0.0	309.0	2.0	0.4	1824.0	762.8	0.0
Government												
competent	311.2	2.0	0.7	1824.0	433.0	0.0	318.9	2.0	0.7	1824.0	483.5	0.0
knowledge	253.1	2.0	0.7	1824.0	364.5	0.0	281.4	2.0	0.6	1824.0	439.4	0.0
honest	370.7	2.0	0.5	1824.0	784.2	0.0	430.9	2.0	0.5	1824.0	861.8	0.0
open	375.7	2.0	0.5	1824.0	791.8	0.0	427.6	2.0	0.5	1824.0	849.1	0.0
care	375.1	2.0	0.5	1824.0	816.1	0.0	438.9	2.0	0.5	1824.0	953.6	0.0
attention	342.3	2.0	0.5	1824.0	685.3	0.0	432.0	2.0	0.5	1824.0	854.6	0.0
Farmers												
competent	118.7	2.0	0.6	1824.0	183.7	0.0	103.8	2.0	0.6	1824.0	163.0	0.0
knowledge	129.1	2.0	0.6	1824.0	206.7	0.0	108.9	2.0	0.6	1824.0	187.0	0.0
honest	154.8	2.0	0.5	1824.0	328.7	0.0	138.0	2.0	0.5	1824.0	286.1	0.0
open	167.0	2.0	0.5	1824.0	358.0	0.0	147.1	2.0	0.5	1824.0	310.7	0.0
care	154.0	2.0	0.4	1824.0	356.3	0.0	149.5	2.0	0.4	1824.0	336.9	0.0
attention	154.3	2.0	0.4	1824.0	350.1	0.0	155.6	2.0	0.5	1824.0	330.3	0.0

Source: Data collected in ACNielsen Homescan™ surveys

Respondents generally trust food agents regarding the safety of food since average responses are above average (given a scale 1. strongly disagree … 5. strongly agree). Most respondents trust farmers compared to other food agents. Food manufacturers and the government are rated highly in terms of being competent and knowledgeable about the safety of food while farmers are rated highly for being open, caring, honesty and paying attention regarding the food safety.

Table 2.6 Trust clusters by demographic variables

	2008 survey			2011 survey		
	Low trust	Medium trust	High trust	Low trust	Medium trust	High trust
Average age of respondent	57.2	57.1	56.8	59.3	59.4	58.2
	(8.58)	(8.52)	(8.43)	(7.13)	(7.33)	(7.37)
Household size	1.99	2.08	2.04	1.96	1.92	2.07
	(1.03)	(1.07)	(1.02)	(1.06)	(0.92)	(1.05)
% with children < 18 years age	10.0	13.1	10.7	6.5	7.6	10.1
Average years of education	13.3	13.4	13.4	-	-	-
	(2.07)	(2.11)	(2.24)			
% living in an urban area	54.1	58.0	58.4	-	-	-
French speaking (%)	14.0	24.1	32.4	17.3	22.5	31.0
Average household income	5.88	6.20	6.80	5.54	5.56	5.98
(CAN$10,000)	(3.32)	(3.40)	(3.39)	(2.79)	(2.73)	(2.89)
Maritimes (%)	15.1	14.7	11.3	14.3	15.6	11.2
Quebec (%)	15.7	26.0	35.5	19.8	24.3	32.2
Ontario (%)	29.6	24.0	23.1	26.7	25.7	22.9
Manitoba/ Saskatchewan (%)	7.4	11.6	8.52	8.80	10.2	10.1
Alberta (%)	15.1	12.0	11.3	13.7	11.2	12.6
British Columbia	17.1	11.7	11.3	16.6	13.0	11.0
Sample size	351	945	531	307	884	636

Standard deviations are in parentheses

Source: Data collected in ACNielsen Homescan™ surveys

Results on k-means cluster analysis[2] are summarized in Tables 2.4 and 2.5. In 2008, 19%,

[2] If we cluster households using only the questions on trust in food agents regarding the safety of food (i.e. excluding generalized trust in people), 99.8% of the households stay in the original clusters, 2 households move from the medium to high trust cluster and 2 households move from the high to medium trust cluster. The sizes of clusters do not change.

52% and 29% of the respondents are in the low, medium and high trust clusters respectively. In 2011, approximately 17%, 48% and 35% of the respondents belonged to the low, medium and high trust clusters respectively. Majority of respondents are in the medium trust cluster. Demographic characteristics of respondents in each trust cluster are summarized in Table 2.6.

About 60% of the respondents did not shift clusters between the 2008 and 2011 surveys (Table 2.7). About 9% remained in the low trust cluster, 31.5% stayed in the middle trust cluster and 19% stayed in the high trust cluster. About 14% of the respondents moved from the medium trust cluster to the high cluster between the two surveys. About 9% of the respondents moved from the high trust cluster to the medium cluster.

Table 2.7 Changes in trust clusters between 2008 and 2011

Changes in cluster membership	Number of respondents
Stayed in low trust cluster	171 (9.40%)
Stayed in medium trust cluster	575 (31.5%)
Stayed in high trust cluster	350 (19.2%)
Moved from low trust to medium trust cluster	146 (8.00%)
Moved from low to high trust cluster	34 (1.90%)
Moved from medium to low trust cluster	118 (6.50%)
Moved from medium trust to high trust cluster	252 (13.8%)
Moved from high trust to low trust cluster	18 (1.00%)
Moved from high trust to medium trust cluster	163 (8.90%)
Sample size	1827

Source: Data collected in ACNielsen Homescan™ surveys

2.4.2 Household expenditures for different types of meat products

Average expenditures for the different forms of meat products by households are summarized in Table 2.8. Most households purchased beef and poultry products as compared to pork and other meats. Average expenditures are higher for fresh meat compared to processed meat.

Table 2.8 Average household expenditures for different forms of meat products ($)

		All sample	Low trust	Medium trust	High trust
		Average (standard deviation)			
Beef	All	142.2	130.8	143.1	148.2
		(154.3)	(155.8)	(154.7)	(152.1)
	Fresh	126.6	116.9	126.9	132.6
		(144.5)	(147.4)	(144.1)	(143.1)
	Semi-processed	4.30	3.79	4.49	4.29
		(11.8)	(10.2)	(12.4)	(11.6)
	Fully processed	11.3	10.2	11.8	11.3
		(23.3)	(21.5)	(25.1)	(21.1)
Pork	All	82.1	79.2	83.1	82.2
		(85.8)	(82.4)	(90.2)	(79.8)
	Fresh	63.1	60.4	63.5	64.2
		(71.9)	(67.1)	(75.7)	(68.0)
	Semi-processed	13.9	13.7	14.3	13.4
		(25.6)	(27.1)	(25.9)	(24.1)
	Fully processed	5.07	5.08	5.24	4.69
		(12.7)	(12.3)	(13.5)	(11.3)
Poultry	All	110.2	112.0	111.5	106.9
		(108.2)	(116.3)	(110.5)	(98.1)
	Fresh	84.2	88.6	84.3	81.0
		(90.1)	(102.1)	(90.9)	(79.7)
	Semi-processed	4.27	4.16	4.42	4.08
		(12.2)	(12.0)	(12.9)	(11.0)
	Fully processed	21.8	19.3	22.8	21.9
		(46.9)	(43.9)	(49.9)	(43.1)
Other meats	All	30.0	29.5	29.6	31.1
		(43.6)	(44.7)	(43.9)	(42.5)
	Fresh	11.1	11.8	10.5	11.6
		(27.3)	(27.7)	(26.9)	(27.8)
	Semi-processed	8.61	7.02	8.90	9.14
		(16.3)	(13.7)	(16.6)	(17.2)
	Fully processed	10.4	10.8	10.1	10.4
		(22.5)	(24.2)	(22.5)	(21.2)

Standard deviations are in parentheses

Source: Own computations using data from ACNielsen Homescan™ purchase data

2.4.3 Prices for meat products

The ACNielsen Homescan^{TM} data contain information on expenditures, weights and number of items purchased for products with UPCs. For random weighted products, there is information on expenditure and number of items purchased but there is no information on the weights of the products.

In cases where quantities are available (products with UPCs), the price of the product is calculated by dividing expenditure by quantity of the product. For random weighted products, prices of the products cannot be calculated in the same way as above since the quantity of the product is not known. Therefore, yearly average prices for random weighted meat products are obtained from the ACNielsen Market Track^{TM} scanner data. These prices are national averages such that prices in this analysis only vary across years.

The available ACNielsen Market Track^{TM} data does not completely cover the period 2002 to 2009 because most prices go up to either 2006 or 2007. For some products, prices are also available for the 2009 period. For the products that have missing prices for 2009, ordinary least squares (OLS) regression in StataSE 11 is used to determine the relationship between the price of the specific product and either price for a beef, pork, chicken, turkey or lamb product that have a price for 2009. Monthly dummy variables are also included in the regressions. Results from OLS regressions are used to compute the missing prices for 2009. Linear interpolation in Microsoft Excel is used to calculate some prices for 2007 and all prices for 2008. Average nominal prices for the different forms of meat products are summarized in Table 2.9. Nominal prices are converted to real prices using the Consumer Price Indices from Statistics Canada (2015) with 2002 as the base year. Correlations between nominal prices of different forms of meat products are presented in Table 2.10.

Table 2.9 Average nominal prices of different forms of meat products

		2002	2003	2004	2005	2006	2007	2008	2009
		Average (standard deviation)							
Beef	All	9.98	10.1	10.2	10.0	9.92	10.1	10.4	10.7
		(5.61)	(5.80)	(5.90)	(5.48)	(5.42)	(5.80)	(5.76)	(6.02)
	Fresh	9.68	9.92	10.1	10.1	9.97	10.2	10.8	11.6
		(5.68)	(5.88)	(6.01)	(5.64)	(5.49)	(5.97)	(5.97)	(6.37)
	Semi-processed	11.2	11.3	11.2	11.3	11.2	11.1	10.7	10.6
		(2.11)	(1.93)	(1.68)	(1.84)	(1.90)	(1.70)	(1.95)	(2.42)
	Fully processed	11.8	12.5	11.9	8.90	8.90	8.76	8.49	8.22
		(5.39)	(5.51)	(5.66)	(5.05)	(5.43)	(4.98)	(4.87)	(4.41)
Pork	All	8.51	8.71	8.97	8.94	8.53	8.66	8.44	8.40
		(2.34)	(3.05)	(3.26)	(2.82)	(4.23)	(4.77)	(5.36)	(6.13)
	Fresh	8.37	8.70	8.93	8.89	8.51	8.66	8.42	8.37
		(2.27)	(3.16)	(3.45)	(2.86)	(4.55)	(5.18)	(5.92)	(7.02)
	Semi-processed	9.01	8.58	9.01	8.93	8.03	8.09	8.08	8.03
		(2.41)	(2.53)	(2.56)	(2.66)	(2.50)	(2.61)	(2.96)	(3.32)
	Fully processed	9.12	9.17	9.26	9.63	10.2	10.4	9.21	9.15
		(2.68)	(2.68)	(2.63)	(2.68)	(3.39)	(4.15)	(4.24)	(4.44)
Poultry	All	8.01	8.07	8.17	7.50	7.44	7.63	8.48	8.96
		(3.46)	(2.52)	(3.68)	(3.29)	(3.23)	(3.21)	(3.70)	(3.79)
	Fresh	7.28	7.28	7.38	7.24	7.11	7.39	7.68	8.16
		(3.17)	(3.20)	(3.31)	(3.05)	(2.95)	(2.96)	(3.06)	(3.07)
	Semi-processed	9.98	10.4	9.21	9.80	11.1	9.87	10.5	9.92
		(2.91)	(3.33)	(3.51)	(3.15)	(3.91)	(4.12)	(3.90)	(5.53)
	Fully processed	9.71	9.81	10.3	11.7	11.0	10.8	10.0	9.85
		(3.57)	(3.55)	(3.84)	(5.30)	(3.99)	(4.78)	(4.35)	(4.19)
Other meats	All	10.79	11.0	11.1	9.21	9.40	9.04	12.0	12.7
		(5.56)	(5.72)	(5.90)	(3.68)	(3.83)	(4.15)	(8.09)	(8.18)
	Fresh	12.7	12.6	12.4	10.5	10.7	11.0	13.1	13.4
		(7.51)	(7.52)	(7.35)	(6.00)	(6.18)	(6.14)	(8.02)	(7.86)
	Semi-processed	9.57	9.64	9.31	8.55	8.73	7.86	9.97	11.4
		(2.81)	(2.74)	(2.73)	(1.25)	(1.24)	(1.51)	(9.43)	(11.8)
	Fully processed	11.1	11.3	11.7	9.42	9.90	10.8	12.8	12.7
		(6.20)	(6.19)	(6.43)	(2.28)	(3.91)	(3.29)	(6.38)	(6.06)

Standard deviations are in parentheses

Source: Data from ACNielsen Market Track™ data

Table 2.10 Correlations between nominal prices for different forms of meat products

		Beef			Pork			Poultry			Other meats		
		Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed
Beef	Fresh	1.00											
	Semi-processed	-0.94	1.00										
	Fully processed	-0.60	0.59	1.00									
Pork	Fresh	-0.48	0.65	0.31	1.00								
	Semi-processed	-0.58	0.66	0.71	0.53	1.00							
	Fully processed	-0.27	0.25	-0.45	0.17	-0.42	1.00						
Poultry	Fresh	0.97	-0.92	-0.43	-0.46	-0.44	-0.41	1.00					
	Semi-processed	-0.05	-0.09	-0.28	-0.52	-0.59	0.27	-0.20	1.00				
	Fully processed	-0.30	0.42	-0.45	0.55	0.04	0.68	-0.45	0.01	1.00			
Other meats	Fresh	0.55	-0.62	0.26	-0.50	-0.03	-0.83	0.68	-0.15	-0.92	1.00		
	Semi-processed	0.73	-0.69	-0.01	-0.53	-0.16	-0.78	0.79	-0.02	-0.70	0.87	1.00	
	Fully processed	0.71	-0.80	-0.02	-0.46	-0.30	-0.60	0.80	-0.15	-0.78	0.91	0.77	1.00

Source: Data from ACNielsen Market Track™ data

2.5 Empirical Results

Results from the probit models where dummy variables for medium trust and high trust (low trust is the base) are included as explanatory variables together with prices, total expenditure and demographic variables are reported first. Results from the demand system estimations (including own price and cross price elasticities and elasticities of substitution) are reported in the second section. Except for the gender variable which is only available in the 2011 survey, demographic variables used in the analysis are from the 2008 survey. The variable on whether there are children aged less than 18 years of age in the household was not included in the demand system estimations because it was causing quasi-complete separation in the probit models for the high trust group.

2.5.1 Effect of trust on the probability of purchasing different forms of meat products

Results from probit model regressions of the effect of trust on the probability of purchasing different forms of meat products are summarized in Table 2.11. R^2 values are higher for fresh beef, fresh pork, fresh poultry, fully processed poultry and fully processed other meats as compared to the other forms of meat products. The percentage of correct predictions varies across the different models with highest values for the regressions on the factors influencing the probability of purchasing fresh beef (92%) and fresh poultry (92%). Marginal effects of explanatory variables on the conditional probability of purchasing different types of meat products are summarized in Table 2.12. Households with respondents who have high levels of trust are less likely to purchase fresh beef and more likely to purchase fully processed beef and fully processed poultry as compared to households that have respondents who have low levels of trust.

Table 2.11 Probit model results on the effect of trust on probability of purchasing different forms of meat products

	Beef			Pork			Poultry			Other meats		
	Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed
Constant	2.67*	-0.52	1.29	-1.01***	-0.64***	2.38***	-0.63	0.93***	-4.29***	-5.45***	-0.61***	-12.3***
	(1.44)	(0.91)	(0.87)	(0.30)	(0.22)	(0.22)	(0.51)	(0.34)	(0.33)	(0.19)	(0.18)	(0.12)
Female	0.09**	-0.03	0.02	0.17***	0.01	-0.04*	0.26***	0.10***	0.056**	-0.03	-0.02	-0.02
	(0.04)	(0.02)	(0.02)	(0.03)	(0.02)	(0.023)	(0.04)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
Age	0.005**	-0.002	-0.01***	0.01***	0.01***	-0.01***	0.01***	-0.01***	-0.02***	0.01***	-0.004***	-0.004**
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Education	0.01	0.01	-0.004	-0.03***	-0.02***	-0.02**	0.02***	-0.01	-0.011*	0.04***	-0.02***	-0.003
	(0.01)	(0.01)	(0.01)	(0.01)	(0.006)	(0.006)	(0.009)	(0.01)	(0.006)	(0.01)	(0.005)	(0.006)
Household size	-0.19***	-0.04**	0.01	0.047*	0.05***	0.08***	-0.08***	-0.01	0.07***	0.034**	0.06***	0.12***
	(0.03)	(0.02)	(0.02)	(0.025)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.016)	(0.02)	(0.02)
Child	0.06	0.002	0.14***	-0.09	0.03	-0.02	0.19**	0.06	0.002	-0.02	-0.02	-0.06
	(0.09)	(0.05)	(0.05)	(0.08)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
French	0.36***	0.30***	0.12***	0.38***	0.06**	0.005	0.19***	0.39***	0.17***	0.24***	0.50***	-0.065**
	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Urban	0.19***	-0.08***	0.10***	-0.14***	-0.16***	-0.03	0.04	0.01	-0.07**	0.04*	-0.08***	-0.01
	(0.04)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.022)	(0.02)	(0.02)
Income	-0.01	-0.01***	0.002	-0.01*	-0.0003	-0.0003	-0.01	0.02***	0.002	0.01***	-0.006	0.006
(/CAN$10,000)	(0.01)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.01)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Total expenditure	0.006***	0.001***	0.001***	0.004***	0.002***	0.001***	0.005***	0.001***	0.001***	0.001***	0.001***	0.0007***
	(0.0003)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.00005)	(0.0004)	(0.00005)	(0.0001	(0.00005)	(0.0001)	(0.0004)
Price of fresh beef	-0.34***	-0.14	0.19**									
	(0.13)	(0.09)	(0.08)	-	-	-	-	-	-	-	-	-
Price of semi-processed	0.07	0.15***	-0.19***									
beef	(0.05)	(0.03)	(0.03)	-	-	-	-	-	-	-	-	-
Price of fully processed	-0.003	-0.06***	-0.14***									
beef	(0.03)	(0.02)	(0.02)	-	-	-	-	-	-	-	-	-
				0.16	0.32***	-0.08						
Price of fresh pork	-	-	-	(0.11)	(0.07)	(0.08)	-	-	-	-	-	-
Price of semi-processed				-0.24***	-0.36***	-0.02						
pork	-	-	-	(0.06)	(0.04)	(0.04)	-	-	-	-	-	-
Price of fully processed				0.15***	0.04	-0.22***						
pork	-	-	-	(0.04)	(0.03)	(0.03)	-	-	-	-	-	-
Price of fresh poultry							-0.22***	-0.14***	1.80***			
	-	-	-	-	-	-	(0.07)	(0.05)	(0.05)	-	-	-
Price of semi-processed							0.07**	0.07***	-0.01			
poultry	-	-	-	-	-	-	(0.03)	(0.02)	(0.02)	-	-	-
Price of fully processed							0.11***	0.05***	-0.75***			
poultry	-	-	-	-	-	-	(0.02)	(0.02)	(0.02)	-	-	-
Price of fresh other meats										-0.62***	0.29***	-0.82***
	-	-	-	-	-	-	-	-	-	(0.03)	(0.03)	(0.03)
Price of semi-processed										0.45***	-0.11***	0.96***
other meats	-	-	-	-	-	-	-	-	-	(0.03	(0.03)	(0.03)
Price of fully processed										0.61***	-0.18***	1.20***
other meats	-	-	-	-	-	-	-	-	-	(0.03)	(0.03)	(0.03)

Medium trust	0.02	0.04	0.09***	0.06	0.03	0.03	-0.10**	0.03	0.09***	-0.04	0.09***	-0.003
	(0.05)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
High trust	-0.09*	0.05	0.09***	0.05	0.04	0.0001	-0.03	-0.01	0.08**	-0.04	0.04	0.05
	(0.05)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)
McFadden Pseudo R^2	0.24	0.08	0.10	0.21	0.09	0.06	0.23	0.06	0.23	0.08	0.08	0.28
% of correct predictions	92.1	72.4	65.6	88.2	66.4	68.5	91.8	76.0	73.6	67.0	64.0	74.5
# of households	1827	1827	1827	1827	1827	1827	1827	1827	1827	1827	1827	1827
# of observations	14616	14616	14616	14616	14616	14616	14616	14616	14616	14616	14616	14616

Standard errors are in parentheses. ***, **and * indicates significance at 1%, 5%, and 10% levels respectively

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track^{TM} data

Table 2.12 Marginal effects of the effect of explanatory variables on purchases of different forms of meat products

	Beef			Pork			Poultry			Other meats		
	Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed	Fresh	Semi-processed	Fully processed
Female	0.01**	-0.01	0.01	0.03***	0.002	-0.014*	0.03***	0.03***	0.02**	-0.01	-0.01	-0.005
	(0.005)	(0.01)	(0.01)	(0.01)	(0.01)	(0.008)	(0.005)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.0006**	-0.0006	-0.003***	0.002***	0.002***	-0.002***	0.001***	-0.002***	-0.01***	0.005***	-0.001***	-0.001*
	(0.0003)	(0.0005)	(0.0005)	(0.0003)	(0.0005)	(0.0005)	(0.0003)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0004)
Education	0.001	0.002	-0.002	-0.005***	-0.01***	-0.006***	0.003***	-0.002	-0.0032*	0.01***	-0.01***	-0.001
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Household size	-0.02***	-0.01**	0.004	0.008*	0.02***	0.03***	-0.01***	-0.002	0.02***	0.01*	0.02***	0.03***
	(0.003)	(0.005)	(0.006)	(0.0041)	(0.006)	(0.005)	(0.003)	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)
Child	0.01	0.001	0.05***	-0.01	0.01	-0.01	0.02**	0.02	0.001	-0.01	-0.01	-0.01
	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
French	0.04***	0.10***	0.04***	0.06***	0.02**	0.002	0.022***	0.12***	0.05***	0.08***	0.19***	-0.02*
	(0.004)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.0048)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Urban	0.02***	-0.025***	0.04***	-0.02***	-0.06***	-0.01	0.004	0.002	-0.02***	0.014*	-0.03***	-0.001
	(0.004)	(0.01)	(0.01)	(0.005)	(0.01)	(0.01)	(0.004)	(0.01)	(0.007)	(0.008)	(0.01)	(0.01)
Income	-0.001	-0.005***	0.001	-0.0016*	-0.0001	-0.0001	-0.001	0.005***	0.001	0.005***	-0.002	0.0017
(/CAN $10,000)	(0.001)	(0.001)	(0.001)	(0.0008)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.0011)
Total expenditure	0.001***	0.0004***	0.0004***	0.001***	0.001***	0.0003***	0.001***	0.0003***	0.0003***	0.0003***	0.0004***	0.0002***
	(0.00003)	(0.00002)	(0.00002)	(0.00003)	(0.00002)	(0.00002)	(0.00003)	(0.00001)	(0.00001)	(0.00002)	(0.00002)	(0.00001)
Price of fresh beef	-0.04***	-0.04	0.07***							-0.22***	0.11***	-0.22***
	(0.016)	(0.02)	(0.03)	-	-	-	-	-	-	(0.01)	(0.01)	(0.01)
Price of semi-processed beef	0.01	0.05***	-0.07***							0.16***	-0.04***	0.26***
	(0.01)	(0.01)	(0.001)	-	-	-	-	-	-	(0.01)	(0.01)	(0.01)
Price of fully processed beef	-0.0004	-0.02***	-0.05***							0.21***	-0.06***	0.33***
	(0.003)	(0.006)	(0.01)	-	-	-	-	-	-	(0.01)	(0.01)	(0.01)
				0.03	0.11***	-0.03						
Price of fresh pork	-	-	-	(0.02)	(0.03)	(0.03)	-	-	-	-	-	-
Price of semi-				-0.04***	-0.13***	-0.01						
processed pork	-	-	-	(0.01)	(0.02)	(0.02)	-	-	-	-	-	-

Price of fully processed pork	-	-	-	0.02*** (0.007)	0.02 (0.01)	-0.08*** (0.01)	-	-	-	-	-	-
Price of fresh poultry	-	-	-	-	-	-	-0.03*** (0.01)	-0.12*** (0.01)	0.55*** (0.01)	-	-	-
Price of semi-processed poultry	-	-	-	-	-	-	0.008** (0.004)	0.02*** (0.005)	-0.003 (0.01)	-	-	-
Price of fully processed poultry	-	-	-	-	-	-	0.01*** (0.003)	0.01*** (0.005)	-0.23*** (0.004)	-	-	-
Price of fresh other meats	-	-	-	-	-	-				-0.22*** (0.01)	0.11*** (0.01)	-0.22*** (0.01)
Price of semi-processed other meats	-	-	-	-	-	-				0.16*** (0.01)	-0.04*** (0.01)	0.26*** (0.01)
Price of fully processed other meats				-	-	-				0.21*** (0.01)	-0.06*** (0.01)	0.33*** (0.01)
Medium trust	0.002 (0.005)	0.01 (0.01)	0.03*** (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	-0.012** (0.006)	0.01 (0.01)	0.027** (0.01)	-0.01 (0.01)	0.03*** (0.01)	-0.001 (0.01)
High trust	-0.01* (0.006)	0.017 (0.011)	0.03*** (0.01)	0.01 (0.01)	0.01 (0.01)	0.0004 (0.01)	-0.004 (0.01)	-0.004 (0.01)	0.024** (0.01)	-0.01 (0.01)	0.01 (0.01)	0.01 (0.01)

Standard errors are in parentheses. ***, **and * indicates significance at 1%, 5%, and 10% levels respectively

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track™ data

High trust decreases the probability of purchasing fresh beef by 1% and increases the probability of purchasing fully processed beef and fully processed chicken by 3% and 2% respectively. Households with respondents who have medium levels of trust have a lower probability of purchasing fresh poultry and higher probabilities of purchasing fully processed beef, fully processed poultry and semi-processed other meats as compared to households that have respondents who have low levels of trust. Medium trust reduces the probability of purchasing fresh poultry by 1% and increases the probabilities of purchasing fully processed beef, fully processed poultry and semi-processed other meats by 3%. However, trust does not significantly influence the probability of purchasing semi-processed beef, semi-processed poultry, all forms of pork products and fresh and fully processed other meats.

From the results, trust is generally an important determinant of consumers' probability to purchase different forms of meat products. Trusting consumers have generally been found to be more supportive of novel technologies (e.g. Roosen et al., 2015) and trust has been shown to ameliorate risk perceptions in other contexts. Although Drescher et al. (2012) found that low trusting consumers purchased less unprocessed and processed meat compared to those who have high trust, trust did not significantly influence expenditure shares of the meat products. Results in this study might be different from results obtained by Drescher et al. (2012) maybe because of different analytical tools and data are used in the analysis. In this study, questions about generalized trust in people and trust in food agents regarding the safety of food are used to group respondents. Although Drescher et al. (2012) used the same questions on trust in food agents as in this study, the researchers also included questions about respondent's optimism and pessimism regarding the safety of food, but not generalized trust in people. In this study the effect of trust on probability to purchase and demand for meat products are analysed. Drescher et al. (2012)

analysed the effect of trust on expenditure shares. We included prices of meat products in the demand modeld which were not included in the analysis by Drescher et al. 2012. We also use purchase data from 2002 to 2009 while Drescher et al. (2012) used data from July 2008 to July 2009. Drescher et al. (2012) classified products into fresh and processed but in this study meat products are classified into twelve groups according to meat type (beef, pork, poultry and other meats) and degree of processing (fresh, semi-processed and fully processed).

Total expenditure is positively related to the probability of purchasing all types of meat products which was expected. Own price of the different forms of meat products negatively influences the probability of purchasing different forms of meat products except for semi-processed beef, fresh pork and semi-processed poultry. The effect of price of the other forms of meat products have a positive effect on the probability of purchasing a given form of meat product (except for the effect of the price of semi-processed on fully processed beef, price of semi-processed pork on fresh pork, price of fresh poultry on semi-processed poultry, price of fully processed other meats on semi-processed and fully processed other meats.

Demographic characteristics also influence the probability to purchase different forms of meat products. Households with female respondents are more likely to purchase fresh beef, fresh pork and all three types of poultry products and less likely to purchase fully processed pork compared to households that have male respondents. Capps et al. (1985) found that female headed households spent more of their food dollar on non-convenience foods and less money on complex and manufactured convenience foods as compared to male headed households. Female headed households also prefer semi-processed and fully processed poultry as compared to male headed households which was not expected.

Households with older respondents are more likely to purchase more fresh meats and semi-processed pork and less likely to purchase semi-processed poultry, semi-processed other meats and all fully processed meats as compared to households with younger respondents. This result is generally consistent with results from previous studies, except for semi-processed pork. Capps et al. (1985) found that households with younger household heads spent less on non-convenience foods and more on convenience foods as compared to households with older household heads. Harris and Shiptsova (2007) found that households headed by older individuals had lower expenditures on ready meals as compared to households headed by younger individuals. Drescher et al. (2012) also found that households with older household heads spent more on fresh meat and less on processed meat as compared to households with younger household heads.

Compared to households with respondents who have lower levels of education, households with more educated respondents are more likely to purchase fresh poultry and fresh other meats and less likely to purchase all forms of pork products, fully processed poultry and semi-processed other meats. The level of education attained by the respondent is negatively related to probability of purchasing fresh pork which was not expected. Harris and Shiptsova (2007) found that more educated individuals had lower expenditures on ready meals. Drescher et al. (2012) found that households headed by more educated household heads purchased more fresh meat products and less processed meat products as compared to households with household heads that had lower levels of education.

Households with more people are more likely to purchase fully processed products (except beef), fresh and semi-processed pork and fresh and semi-processed other meats. Household size is negatively related to the probability of purchasing fresh beef, semi-processed beef and fresh poultry. Households with children less than 18 years old are more likely to purchase fully processed beef and fresh poultry compared to households that had no children less than 18 years of age.

Compared to respondents who responded in English in the surveys, those respondents who completed the survey in French are more likely to purchase all types of meat except fully processed pork (not significant) and fully processed other meats (negative relationship). Households in urban areas are more likely to purchase fresh beef, fully processed beef and fresh other meats and less likely to purchase semi-processed beef, fresh and semi-processed pork, fully processed poultry and semi-processed other meats as compared to households in rural areas.

Households with higher income are more likely to purchase more semi-processed poultry and fresh other meats and less likely to purchase semi-processed beef and fresh pork as compared to households with lower levels of income.

2.5.2 Demand model results for groups of consumers classified according to trust

Results from probit models used to calculate inverse Mills ratios and results from the demand system estimations are summarized in the Appendix (Table A5 and A6). R^2 values are lower for share equations as compared to the equation on total meat expenditure. Demographic variables influence the probability to purchase meat products across the three clusters and there are some variations in the results. Demographic variables also influence total expenditure and expenditure shares for the different forms of meat products.

The coefficients for inverse Mills ratios are significant in all expenditure share equations which implies that the dependent variables for these equations are censored such that including the inverse Mills ratios leads to estimates that are consistent and asymptotically efficient (Heien and Wessels, 1990). Coefficients for lagged quantities for the different forms of meat products and the lagged log of total expenditure are all significant which suggests the presence of habit formation in terms of the consumption of meat products.

Table 2.13 Expenditure elasticities of demand for the different forms of meat products

		Cluster		
		Low trust	Medium trust	High trust
Beef	Fresh	0.93***	0.92***	0.94***
		(0.02)	(0.01)	(0.01)
	Semi-processed	0.74***	0.74***	0.62***
		(0.07)	(0.05)	(0.14)
	Fully processed	0.48***	0.50***	0.42***
		(0.07)	(0.04)	(0.06)
Pork	Fresh	0.76***	0.77***	0.80***
		(0.03)	(0.02)	(0.02)
	Semi-processed	0.56***	0.57***	0.58***
		(0.07)	(0.04)	(0.05)
	Fully processed	0.30**	0.39***	0.50***
		(0.13)	(0.08)	(0.08)
Poultry	Fresh	0.79***	0.78***	0.74***
		(0.02)	(0.01)	(0.02)
	Semi-processed	0.48***	0.52***	0.46***
		(0.07)	(0.06)	(0.07)
	Fully processed	0.67***	0.67***	0.67***
		(0.04)	(0.03)	(0.03)
Other meats	Fresh	0.62***	0.60***	0.63***
		(0.06)	(0.04)	(0.06)
	Semi-processed	0.56***	0.41***	0.49***
		(0.11)	(0.06)	(0.07)
	Fully processed	6.51***	7.54***	7.15***
		(0.16)	(0.09)	(0.14)

***, **and * indicates significance at 1%, 5%, and 10% levels respectively. Standard errors are in parentheses

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track™ data

Results on expenditure elasticities are all positive and significant which shows that all forms of meat products are normal goods (Table 2.13). The expenditure elasticity for fully processed other meats is higher than expenditure elasticities for other forms of meat products and this result is consistent across the three household clusters. A 1% change in the consumer's budget leads to a 6.51%, 7.54% and 7.15% change in the consumption of fully processed meats households in the low, medium and high trust clusters. For the different forms of meat products (except fully processed other meats), expenditure elasticities are less than one for all clusters which shows that these meat products are necessary goods i.e. a 1% change in the consumer's budget will lead to a less than 1% change in the consumption of these products.

The expenditure elasticity for fully processed poultry (0.67) is the same across the three household clusters. Although expenditure elasticities are higher for the high trust cluster for fresh beef, semi-processed pork and fresh other meats as compared to the low and medium trust clusters, the differences are very small. Households in the high trust cluster have lower expenditure elasticities for semi-processed beef, fully processed beef, fresh poultry and semi-processed poultry and higher expenditure elasticities for fresh pork and fully processed pork as compared to households in the low and medium trust clusters. Households in the medium trust cluster have higher expenditure elasticities for fully processed other meats and lower expenditure elasticities for semi-processed other meats as compared to households in the low and high trust clusters.

Results on uncompensated price elasticities are summarized in Table 2.14. All significant own price elasticities have the expected negative sign. The magnitudes of significant own price elasticities are greater than the magnitude of expenditure elasticities for respective products which shows that consumers' demand of the different products in more responsive to prices as compared to total expenditure and this result is consistent with the result found by Capps et al. (1985) for convenience and non-convenience foods.

Own price elasticities for semi-processed beef, fresh pork, semi-processed pork (except for the high trust group), semi-processed poultry (medium trust group) and fresh other meats (except for the medium trust group) are not significantly different from zero. The demand for fresh beef (differences are very small), fully processed pork and fully processed poultry is more responsive to own price changes for households in the high trust cluster as compared to households in the medium and low trust clusters. The demand for fully processed beef, fresh and semi-processed poultry is more responsive to own price changes for households in the low trust cluster as compared to households in the medium and high trust clusters. The demand for semi-processed and fully processed other meats is less responsive to own price changes for households in the high trust cluster as compared to households in the medium and low trust cluster.

Results on cross price elasticities and elasticities of substitution are summarized in Tables 2.14 and 2.15 respectively. Elasticities of substitution are high in this study maybe because they are calculated for fresh, semi-processed and fully processed products from the same meat groups. Differences in elasticities of substitution across the three clusters are much bigger as compared to own price and expenditure elasticities.

Fresh beef and fully processed beef are complements only for the medium trust cluster. Semi-processed and fully processed beef are stronger complements for households in the high trust cluster as compared to households in the medium and low trust clusters. Fresh and semi-processed pork are stronger substitutes for households in the low trust cluster as compared to households in the high trust cluster (the elasticity of substitution between the two meats is not significant for the medium trust cluster).

Table 2.14 Uncompensated own and cross price elasticities of demand for the different forms of meat products

		Beef			Pork			Poultry			Other		
		Fresh	Semi	Fully	Fresh	Semi	Fully	Fresh	Semi	Fully	Fresh	Semi	Fully
Low trust													
Beef	Fresh	-4.57***	-0.19	-0.06									
		(0.73)	(0.21)	(0.18)									
	Semi	-5.21	-0.08	-1.51*									
		(5.89)	(6.22)	(0.91)									
	Fully	-0.56	-0.48*	-3.55***									
		(1.57)	(0.29)	(0.55)									
Pork	Fresh				-3.89	2.69*	1.32**						
					(2.74)	(1.44)	(0.62)						
	Semi				11.2*	-4.96	-1.96						
					(6.03)	(3.22)	(1.34)						
	Fully				12.9**	-4.59	-5.26***						
					(6.10)	(3.14)	(1.53)						
Poultry	Fresh							-5.44***	-1.00***	0.66*			
								(1.44)	(0.33)	(0.35)			
	Semi							-18.2***	-4.40**	-0.47			
								(5.99)	(1.58)	(1.59)			
	Fully							2.65*	-0.10	-9.08***			
								(1.42)	(0.35)	(0.48)			
Other meats	Fresh										-7.80	4.13**	6.93*
											(5.94)	(1.87)	(4.07)
	Semi										6.53**	-2.42**	-3.31
											(2.96)	(1.02)	(2.06)
	Fully										6.28*	-1.90	-10.9***
											(3.68)	(1.18)	(2.71)
Medium trust													
Beef	Fresh	-4.48***	0.11	-0.19*									
		(0.40)	(0.13)	(0.10)									
	Semi	2.98	2.94	-1.66***									
		(3.58)	(3.94)	(0.67)									
	Fully	-1.60*	-0.51***	-2.55***									
		(0.84)	(0.21)	(0.36)									
Pork	Fresh				-0.56	1.23	1.12***						
					(1.62)	(0.83)	(0.35)						
	Semi				5.25	-3.03	-0.55						
					(3.53)	(1.94)	(0.77)						
	Fully				11.9***	1.37	-5.58***						
					(3.74)	(1.90)	(0.95)						
Poultry	Fresh							-2.87***	-0.41*	1.29***			
								(0.96)	(0.23)	(0.23)			
	Semi							-7.08*	-0.15	1.29			
								(3.98)	(1.08)	(0.96)			
	Fully							4.31***	0.25	-8.80***			
								(0.78)	(0.18)	(0.28)			
Other	Fresh										-6.52*	4.21***	5.79**

meats											(3.58)	(1.13)	(2.42)
	Semi										4.58***	-3.20***	-2.25***
											(1.22)	(0.54)	(0.86)
	Fully										5.31***	-1.90***	-10.9***
											(2.21)	(0.72)	(1.66)
High trust													
Beef	Fresh	-4.69***	0.18	-0.03									
		(0.52)	(0.21)	(0.13)									
	Semi	4.88	2.42	-3.27***									
		(5.71)	(6.35)	(0.94)									
	Fully	-0.30	-1.07***	-2.58***									
		(1.11)	(0.31)	(0.43)									
Pork	Fresh				-1.24	2.30**	1.63***						
					(2.08)	(1.10)	(0.45)						
	Semi				10.1**	-5.28**	-2.05**						
					(4.86)	(2.64)	(1.05)						
	Fully				19.5***	-5.57**	-8.61***						
					(5.44)	(2.84)	(1.39)						
Poultry	Fresh							-4.58***	-0.83***	0.81***			
								(1.22)	(0.29)	(0.30)			
	Semi							-14.7***	-2.64**	-1.28			
								(5.15)	(1.37)	(1.23)			
	Fully							2.88***	-0.26	-9.14***			
								(1.06)	(0.25)	(0.37)			
Other	Fresh										-4.63	3.82***	4.24
meats											(4.39)	(1.38)	(2.95)
	Semi										4.79***	-2.39***	-3.10***
											(1.73)	(0.65)	(1.21)
	Fully										4.08	-2.38***	-8.85***
											(2.84)	(0.93)	(2.09)

***, **and * indicates significance at 1%, 5%, and 10% levels respectively. Standard errors are in parentheses

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track™ data

Table 2.15 Elasticities of substitution between the different forms of meat products

		Beef			Pork			Poultry			Other		
		Fresh	Semi	Fully	Fresh	Semi	Fully	Fresh	Semi	Fully	Fresh	Semi	Fully
Low trust													
Beef	Fresh	-14.6***											
		(2.46)											
	Semi	-16.9	-6.53										
		(20.0)	(592.8)										
	Fully	-1.41	-45.3*	-106.9***									
		(5.33)	(27.5)	(16.6)									
Pork	Fresh				-22.3								
					(16.3)								
	Semi				67.2*	-122.6	-						
					(35.7)	(79.9)							
	Fully				76.9**	-113.7	-306.1***						
					(36.2)	(78.1)	(89.2)						
Poultry	Fresh							-20.3***					
								(5.58)					
	Semi							-70.2***	-311.9***				
								(23.2)	(112.4)				
	Fully							10.9**	-6.66	-140.0***			
								(5.49)	(24.6)	(7.52)			
Other	Fresh										-215.4		
											(164.4)		
	Semi										181.5**	-105.5**	
											(82.1)	(44.5)	
	Fully										174.6*	-82.5	-266.7***
											(102.5)	(51.7)	(68.0)
Medium trust													
Beef	Fresh	-13.5***											
		(1.19)											
	Semi	10.3	252.0										
		(11.5)	(337.4)										
	Fully	-4.64*	-43.4**	-66.9***									
		(2.70)	(17.6)	(9.43)									
Pork	Fresh				-2.51								
					(9.44)								
	Semi				31.2	-74.7							
					(20.6)	(48.2)							
	Fully				69.6***	-33.7	-343.1***						
					(21.8)	(47.4)	(58.5)						
Poultry	Fresh							-11.5***					
								(4.13)					
	Semi							-29.8*	-10.9				
								(17.1)	(80.7)				
	Fully							19.1***	19.1	-124.8***			

								(3.33)	(13.7)	(3.95)			
Other	Fresh										-207.5*		
											(114.3)		
	Semi										146.6***	-110.7***	
											(39.2)	(18.9)	
	Fully										170.0**	-65.5***	-312.6***
											(70.7)	(25.1)	(48.4)
High trust													
Beef	Fresh	-13.6***											
		(1.61)											
	Semi	15.7	201.8										
		(17.6)	(529.0)										
	Fully	-0.50	-89.0***	-70.2***									
		(3.45)	(25.7)	(11.7)									
Pork	Fresh				-6.42								
					(12.1)								
	Semi				60.0**	-135.1**							
					(28.3)	(68.0)							
	Fully				114.3***	142.7**	-600.3***						
					(31.7)	(73.0)	(97.3)						
Poultry	Fresh							-19.2***					
								(5.34)					
	Semi							-63.7***	-204.1**				
								22.4)	(106.2)				
	Fully							13.2***	-19.2	-141.8***			
								(4.61)	(19.1)	(5.76)			
Other	Fresh										-135.6		
											(128.9)		
	Semi										141.2***	-87.6***	
											(50.9)	(23.8)	
	Fully										120.7	-87.2***	-243.5***
											(83.4)	(34.2)	(59.1)

***, **and * indicates significance at 1%, 5%, and 10% levels respectively. Standard errors are in parentheses.

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track™ data

Fresh and fully processed pork are stronger substitutes for households in the high trust cluster as compared to households in the low and medium trust clusters. Fresh and semi-processed poultry are stronger complements for households in the low trust cluster as compared to households in the medium and high trust clusters. Fresh and fully processed poultry are stronger substitutes for households in the medium trust cluster as compared to households in the low and high trust clusters. Fresh and semi-processed other meats are stronger substitutes for households in the low trust cluster as compared to households in the medium and high trust clusters. Fresh and fully processed other meats are stronger substitutes for households in the low trust cluster as compared to households in the medium trust cluster (the elasticity of substitution between these two meats is not significant for the high trust cluster). Semi-processed and fully processed other meats are stronger complements for households in the high trust cluster as compared to households in the medium trust clusters (the elasticity of substitution is not significant for the low trust cluster).

In summary, the magnitudes of the elasticities of substitution are generally higher between fresh and semi-processed products for the low trust cluster as compared to the medium and high trust clusters. The magnitudes of elasticities of substitution are generally higher between semi-processed and fully processed products for households in the high trust cluster as compared to households in the medium and low trust clusters. There is no consistent pattern in terms of elasticities of substitution between fresh and fully processed products.

2.5.3 Demand model results for the whole sample

Probit and demand models are also estimated for the whole sample and results are summarized in Table A5 and A6 in the appendix A. Price and expenditure elasticities are summarized in Table

A7. Elasticities of substitution are summarized in Table A8. Inverse Mills ratios are also significant for all share equations which shows that expenditure shares are censored and including inverse Mills ratios as explanatory variables leads to consistent and asymptotically efficient estimates. The lags of total expenditure and quantities are also significant for all total expenditure and share equations respectively which show that there is habit formation in terms of consumption of meat products. Differences in demographic variables also influence the demand for meat products.

All expenditure elasticities have the expected negative sign which is similar to results for the three clusters. Except for fully processed other meats, expenditure elasticities are all less than 1 which shows that the meats are necessary goods. Significant own price elasticities have the expected negative sign. Fully processed beef and semi processed beef, fully processed pork and semi-processed pork, fresh poultry and semi- processed poultry and fully processed other meats and semi-processed other meats are complementary goods. Fresh and semi-processed pork, fresh and fully processed pork, fresh and fully processed poultry, fresh and semi-processed poultry and fresh and semi-processed poultry are substitutes.

2.6 Conclusions

In this study, it is hypothesized that consumers who have lower levels of trust are more likely to purchase fresh meat products and less likely to purchase processed meat products as compared to those consumers who have high levels of trust. Probit models and demand system regressions are used to test the hypothesis. Survey data and data on meat purchases from ACNielsen Homescan™ are used in the analysis.

Results show that differences in trust lead to different choices of meat products (fresh, semi-processed and fully processed) which conforms to our theoretical model. Researchers should pay attention to the effect of trust on consumers' food choices. Households with respondents who have low trust are generally more likely to purchase fresh meat products and less likely to purchase processed meat products as compared to households with respondents who have higher levels of trust. Households in the low trust cluster generally substitute or complement fresh and semi-processed products more than households in the medium and high trust clusters. Households in the high trust cluster generally substitute or complement semi-processed and fully processed meat products more than households in the low and medium trust clusters. Results from this study are different from the results from a study by Drescher et al. (2012) where trust did not significantly influence expenditure shares for fresh and processed meat products. The reasons might be differences in data, analytical tools and classifications of products and households.

Changes in relative prices of different forms of meat products might lead to different responses in terms consumption by individuals that have different levels of trust. Monitoring generalized trust in people and trust in the food industry might help in predicting consumers' choice of food products in response to future food safety shocks and changes in relative prices. Differences in demographic characteristics of the respondent/households also drive consumers' preferences for different forms of meat products.

One of the limitations in this analysis is price data. In the future, given the availability of prices of the different products, more flexible functional forms such as the AIDS model or translog models could be used to assess the differences in demand for the different forms of meat products across consumer groups classified according to their generalized trust in people and trust in the food industry. It might also be important to assess substitutions between meats from the four different groups and see whether results change.

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3. TRUST AND CONSUMERS' PREFERENCES FOR PIG PRODUCTION ATTRIBUTES

3.0 Introduction

Natural, as a description of food or agricultural production, is an example of a credence attribute and it is a concept that is increasing in importance for consumers. However, what is meant by natural is somewhat in the eye of the beholder and varies across countries/regions and products. For example, the Canadian Food Inspection Agency (CFIA, 2014) states that it is difficult to have natural or naturally raised claims for meat products since raising animals involves intervention by people and most animals are given vaccines and medication and the feed usually includes, for example, additives, minerals and vitamins. The United States Department of Agriculture (USDA, 2014) states that naturally raised marketing claims for meat and meat products should be used on products from animals that were raised without antibiotics (not including ionophores), growth promotants or feed which contains animal byproducts. Siipi (2013) provides broader definitions of natural i.e. natural refers to lack of or minimal human intervention, authentic and familiar products and products that satisfy human nutritional requirements and moderate needs.

Although CFIA has suggested not using the word natural in describing or naming food products, many products do use the word (e.g. Schneider's Country Naturals bacon, wieners, ham among others (http://www.schneiders.ca/products/by-brand/country-naturals/). In the U.S., there is a current debate about the use of the word natural for foods which some suggest could include genetically modified (GM) products (Mientika, 2013). For certain products there are a plethora of lawsuits relating to the use of the word natural, for example, Kraft Food Group's natural cheese and Caprisun 100% juice (http://www.foodnavigator-usa.com/Trends/Natural-claims/Kraft-under-fire-over-natural-claims-on-fat-free-cheese-and-Capri-Sun), Jamba juice and General Mills Nature Valley bars (http://www.foodnavigator-usa.com/content/search?SearchText=natural+lawsuits&FromNews)).

From a practical perspective natural production could refer to a type of agricultural production which uses fewer controversial technologies. The concept of natural food is getting increasingly muddy given the proliferation of 'free from' products which may also be interpreted by many as more natural (e.g. President's Choice Free From beef, pork and chicken products from animals and chickens raised without antibiotics and hormones) (http://www.presidentschoice.ca/en_CA/familypage/FreeFrom.html).

Given the CFIA desire for no use of 'natural' in product descriptions because of potential stigma effects, in this study we focus on reference to traditional production methods, which we assume might be close to the image many consumers have of natural production. The demand for natural products could be for health and safety concerns. According to Siipi (2004), consumers may regard natural foods to be healthier.

Consumers' trust may reduce uncertainities when they make choices among products with credence attributes (Kjaernes et al., 2007) such as claims of being naturally produced. Although a number of studies have analysed consumers' preferences for natural products, there is limited information on whether the demand for natural products is related to high or low levels of trust in the food system. Trust is assumed to influence consumer behaviour directly and possibly indirectly through perceptions of risk or quality about food products (Figure 1.1). In this study, an attempt will be made to answer the following research question 'Does a consumer's level of trust (high or low) influence perceptions and preferences for a more natural type of production?' It is hypothesized that consumers who have lower levels of trust (both general and agent specific trust about food safety) are willing to pay higher premiums for pork produced under more traditional forms of production as compared to those consumers who have higher levels of trust. If willingness to pay (WTP) for natural pork is high for low trusting consumers, more natural pork available may bring some of the low trust people back to consuming pork. If WTP for natural pork is high for people who have high trust then the market response to the introduction of this product may be limited. In this study, an individual's level of trust is measured using questions on generalized trust in people and trust in agents in the food industry regarding the safety of food.

The study is related to traditionally raised or premium traditional type of pork production which is assumed to be considered to be more natural by consumers. Traditionally raised pork is defined as pork from a family farm production setting, reared outdoors or in bedded settings, with no subtherapeutic antibiotics or growth promotants, and no animal byproducts in feed. Premium traditional pork is defined as pork from a family farm production setting, produced with no sub-therapeutic antibiotics or hormones, and no animal by-products in feed (100% grain fed). The definitions of traditionally raised pork and premium traditional pork are consistent with the definitions by Siipi (2013) where natural refers to minimal human intervention, familiar products, whether the product satisfies human nutritional requirements and whether the product satisfies moderate needs.

To completely represent the characteristics of Canadian pork production and to ensure a clear focus on the 'natural' characteristics of interest, other attributes that are included in the analysis are the Canadian Pork label (country of origin implemented through the Canadian Pork Council) and on farm food safety accreditation (CQA® again a program created by the Canadian

Pork Council but not previously labelled for consumers). CQA® promotes best management practices to reduce or eliminate potential on-farm hazards that could compromise the safety of pork and it was introduced in Canada in 1998 (Canadian Pork International, 2014). Canadian Pork identifies fresh pork that is produced from hogs raised in Canada. CQA® and Canadian Pork labels may represent other concerns of the public related to food safety and country of origin respectively.

The analysis of the effect of trust on consumer's preferences for a natural attribute is conducted using data from choice experiments and surveys conducted in Edmonton in 2009 and 2011 and in Canada in 2011. For the Edmonton data, real pork chops are used in the choice experiments such that physical characteristics of the pork chops could play a role in the selection of pork (Ma (2012) found that hog grade, meat colour and shear force influenced consumer's choice of pork chops). Pictures of pork chops were used in the nationwide online choice experiments where marbling is the only physical attribute changing. The data collected in Edmonton in 2009 were also used by Goddard et al. (2011) and Ma (2012) and the national data were also used by Ma (2012). All people who participated in the surveys in Edmonton ate pork since they also participated in sensory experiments which are not included in this analysis (see Ma, 2012). The national sample is made up of both consumers and non-consumers of pork and is broadly representative of the Canadian population.

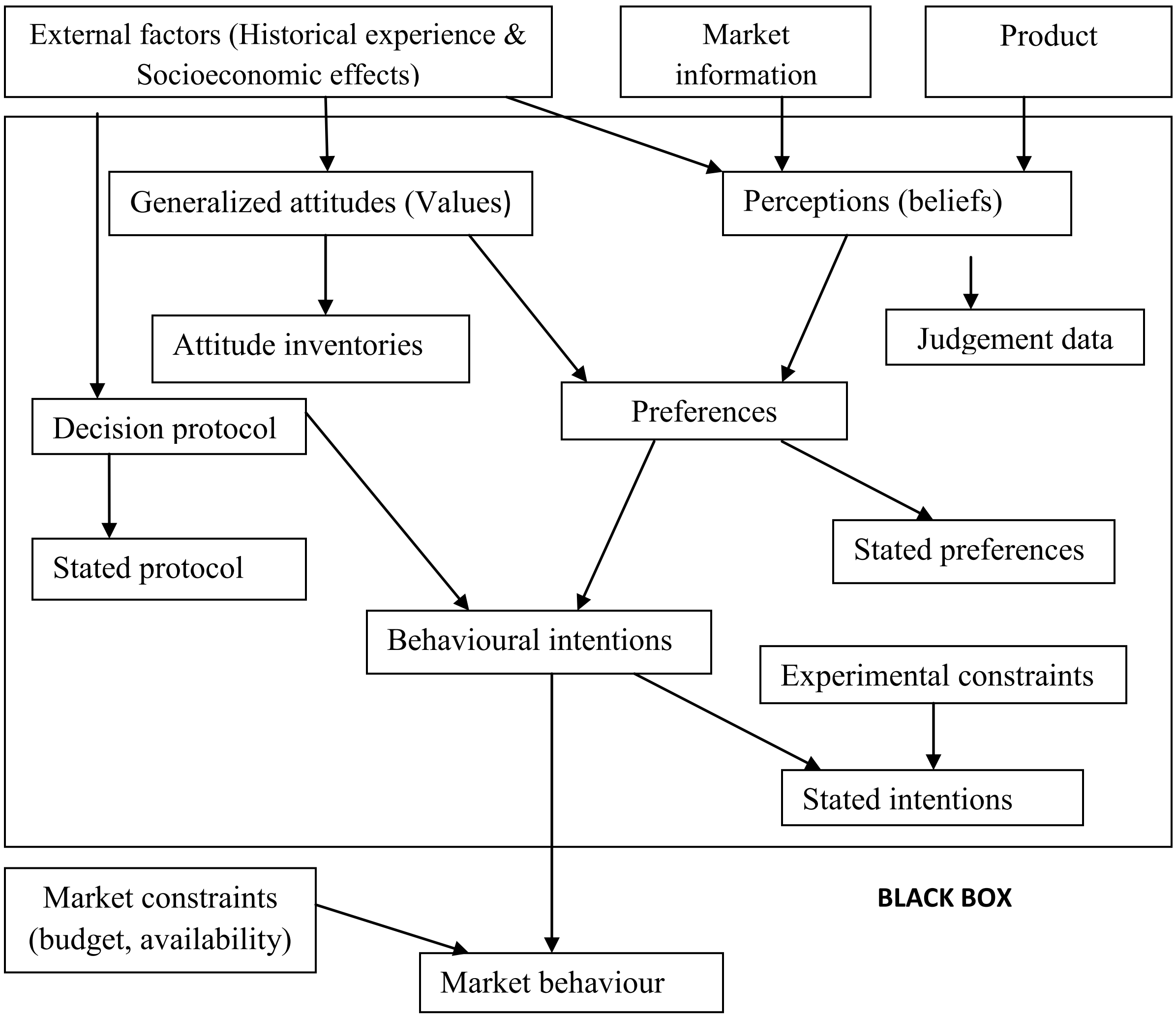
This research contributes to the literature by assessing whether having different levels of trust affects an individual's preferences for a natural production attribute. WTP results on consumer preferences for production attributes are important for agribusiness organisations that are interested in selling differentiated goods (Lusk and Hudson, 2004). This information might also help in predicting the types of products that are preferred by certain groups of consumers.

From a public policy perspective, understanding the role of trust and different types of certification as they relate to the demand for natural production can suggest mechanisms for industry or government to focus development on.

3.1 Theoretical framework

McFadden (1986 p. 276) describes the consumers' decision making process as the consumer being treated as an 'optimizing black box'. Generalized attitudes (values), perceptions (beliefs) about a product and decision protocols are latent (unobservable from the decision) variables. Market behaviour (e.g. purchase of a product and level of consumption) is the output of the decision making process. Past experiences and socioeconomic factors influence generalized attitudes, perceptions about a product and decision protocols. Perceptions about a product are also influenced by market information and characteristics of the product. Perceptions regarding the product and generalized attitudes influence preferences for products. Preferences for products are translated by decision protocols to influence behavioural intentions. Together with market constraints, behavioural intentions influence market behaviour.

In the current research, trust which might be an example of a generalized attitude, is assumed to influence consumer's stated choice of a pork product with a natural production attribute. Trust is defined by Rousseau et al. (1998, p. 395) as '… a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another.'



Source: McFadden (1986, p. 276)
Figure 3.1 Path diagram for consumer decision process

According to Lancaster (1966), consumers derive utility from the characteristics of goods not the goods themselves. In Lancaster's theory of value, goods are inputs and product attributes are outputs. In preference orderings, goods are ranked indirectly through their collection of attributes (Lancaster, 1966). The consumer's utility maximization process in the simplified model (Lancaster, 1966, p. 136) is represented as follows:

$$\max_{z_i} U = U(\mathbf{z}) \text{ subject to } \mathbf{px} \leq y \tag{3.1}$$

$$\mathbf{z} = B\mathbf{x}$$

$$\mathbf{z}, \mathbf{x} \geq 0$$

where **p** represents prices of the products, y income, **z** represents a collection of attributes, x represents the collection of goods available to the consumer.

In the current analysis, it is assumed that trust influences consumers' preferences for product attributes. Given that t represents trust, the utility function is therefore represented as follows:

$$U = U(t\mathbf{z}) \tag{3.2}$$

Consumer preferences for pork chops with a natural attribute are analysed using data from discrete choice experiments. Although revealed preference data show the current market situation, data from discrete choice experiments have information on trade-offs among attributes and is important in forecasting behavioural changes (Louviere et al., 2010; Lusk and Schroeder, 2004). Choice experiments are based on probability choice theory (random utility theory).

The random utility theory which is consistent with neoclassical economics of demand theory and Lancaster's theory of consumer demand is followed in the current research to assess consumer's choice of product attributes. It is assumed that attributes of the product (represented by **z**) and a vector (**d**) of socioeconomic variables, trust (generalized trust in people and trust in food agents regarding the safety of food) and habits influence consumer's choice of food products. Following Hanley et al. (1998, p. 414), for an individual n, for choice i, the indirect utility function (U) have a deterministic or observable component (V) and a random or unobservable component (ε) which is represented as follows:

$$U_{in} = V_{in} + \varepsilon_{in} \text{ where } V_{in} = f(\mathbf{z}_{in}\mathbf{d}_n) \tag{3.3}$$

The individual is assumed to be rational, that is, he/she chooses the alternative which yields the greatest utility. Given a complete choice set *C,* the individual *n* chooses alternative *i* over another alternative *j* if $U_i > U_j$ and the probability of choosing *i* over *j* is as follows:

$$\Pr ob(i \mid C) = \Pr ob\{V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}\} = \Pr ob\{V_i - V_j > \varepsilon_j - \varepsilon_i\} \qquad 3.4)$$

$$i, j \in C; \ \forall i \neq j$$

Although socioeconomic characteristics, trust, habits and product attributes are assumed to influence consumer's utility in the current analysis, there might be other factors that could influence consumer's preferences for natural pork e.g. risk or quality perceptions about consuming certain types of pork, risk attitudes about pork, confidence in animal welfare (e.g. Goddard et al., 2013), confidence in the safety of the products (e.g. Goddard et al., 2013; Ma, 2012) and environmental concerns (e.g. Grannis and Thilmany, 2002), for example**.**

3.2 Literature review

In some previous studies, natural meat is defined as meat which does not contain antibiotics and/ or growth hormones (Campiche et al., 2004; Goss et al., 2002; Feldkamp et al., 2005; Thilmany et al., 2003) while in other studies more characteristics of the natural attribute are added e.g. animals had access to grazing (Thilmany et al. 2003) and animals were not raised in small or crowded pens (Grannis and Thilmany, 2002; Thilmany et al., 2003) (see Table B1 in appendix B). Other animal production attributes examined in previous studies are assurances about humane treatment of animals (Hobbs et al., 2005), animal well-being (Ubilava et al., 2010; Nilsson et al., 2006), animal friendly (Nocella, 2010, certified for environmental sustainability (Ubilava et al., 2010; Nilsson et al., 2006) and the type of housing used in animal production (Tonsor et al., 2009; Uzea, 2009; Goddard et al., 2013; Mørkbak et al., 2010).

Contingent valuation (e.g. Campiche et al., 2004; Goss et al., 2002; Grannis and Thilmany, 2002; Umberger et al., 2009; Ziehl et al., 2005; Thilmany et al., 2003; Lusk et al., 2006; Nocella, 2010), auctions (e.g. Feldkamp et al., 2005; Hobbs et al., 2005) and discrete choice experiments (e.g. Carlsson et al., 2007; Tonsor et al., 2009; Ubilava et al., 2010; Uzea, 2009; Romanowska, 2009; Goddard et al., 2011, 2013; Nilsson et al., 2006; Mørkbak et., 2010) are used to collect data for the analysis of the probability of purchasing certain pork products with defined attributes. In the studies that assess consumers' preferences for animal production attributes, data (perceptions, stated preferences and focused willingness to pay questions) have been analysed using cluster analysis, random parameters logit (mixed logit), multinomial logit, probit, ordinary least squares, latent class, double bounded logit and ordered probit regressions.

From previous studies, there are certain consumers who prefer natural meats (e.g. Goss et al., 2002; Ziehl et al., 2005). In the study by Umberger et al. (2009), participants rated beef attributes including the price of product, whether the animal was grass-finished, whether the meat could be traced back to the farm, whether the meat was produced using natural production methods and whether the meat was tested for bovine spongiform encephalopathy (BSE) and the natural attribute ranked third out of five attributes after price and whether the meat was tested for BSE. Although results from previous studies generally show that consumers are willing to pay a premium for natural meat products, Feldkamp et al. (2005) found that participants were mostly willing to pay for certified Angus beef followed by choice beef and guaranteed tender beef and on average, they were not willing to pay a premium for natural steak as compared to a generic steak.

Goddard et al. (2013) assessed consumers' preferences for pork chops with the following animal welfare attributes (i) conventional housing, hoop housing or outdoor housing (ii) whether or not gestation stalls or sows in groups were used (iii) whether or not subtherapeutic antibiotics were used in the production process. Source of verification (government, a third party, farmers, food processors, food retailers or no certification) was also included in the choice experiments. In summary, results showed that verification of quality attributes is important and risk perceptions and consumer's interest in ethical issues or food safety influences WTP for the different attributes. Verification of production attributes was also shown to be important in other studies with most consumers willing to pay more for attributes verified by the government as compared to other sources of verification such as the industry, farmers and third parties (Uzea, 2009; Goddard et al., 2011; Innes and Hobbs, 2011; Romanowska, 2009).

Trust has been shown to play an important role in transactions where one party (farmers for example) might have more information about the product as compared to the other (consumers) i.e. there is information asymmetry (Janssen and Hamm, 2012). Frewer et al. (2005) states that trust in food agents is important for acceptance of animal production systems in situations where consumers are not interested in knowing the details about the systems. Although labels can be used to inform consumers about any production attribute, consumers need to trust that the attribute is present (if it is not verified by someone likely a third party) and use the label information when they make decisions (Olynk, 2012; Lobb and Mazzocchi, 2007).

Although a number of studies have assessed WTP for production atributes, only a few studies have explicitly included trust in the analysis. Romanowska (2009) analysed consumers' WTP for certification (government, industry and farmers) of credence attributes (free run, pasteurized and vitamin enhanced eggs) using multinomial logit and latent class regression models. Results from the analysis by Romanowska (2009) showed that generalized trust in people significantly influenced preferences for egg attributes and the government was the most preferred certifier of the attributes.

Ma (2012) used multinomial logit models and data for Edmonton (2009) and national data (2011) to assess consumers' preferences for conventional, uncertified traditionally raised, industry and government certified traditionally raised pork, CQA® and Canadian Pork labels and marbling (only in 2011). Respondents were grouped into four groups i.e. (i) respondents who stated that traditionally raised pork is healthier as compared to conventional pork (ii) respondents who stated that traditionally raised pork is not healthier as compared to conventional pork (iii) respondents who stated that traditionally raised pork is safer to eat as compared to conventional pork (iv) respondents who stated that traditionally raised pork is not safer to eat as compared to conventional pork. These groups exhibited different preferences for traditionally raised pork. In addition, results showed that there were some differences in willingness to pay for attributes between consumers who trust and those who do not trust people in general (generalized trust).

Nocella et al. (2010) assessed the effect of trust in farmers and other stakeholders in terms of meeting certification of animal-friendly standards on consumers' preferences for products in five European countries (France, German, United Kingdom, Italy and Spain). WTP data was collected for animal products (meat, dairy products and eggs) using contingent valuation methods and the data were analysed using double-bounded logit models. Results suggest that trust in farmers is significantly positively related to consumers' preferences for animal-friendly products for the pooled samples, for France, Germany and United Kingdom.

As well, some of the factors that could influence consumers' preferences for natural attributes are shopping habits (Grannis and Thilmany, 2002; Campiche et al., 2004; Romanowska, 2009), whether the individual reads labels (Campiche et al., 2004), whether the individual is price sensitive (Campiche et al., 2004), income (Grannis and Thilmany, 2002), concerns about the environment, feed additives (Grannis and Thilmany, 2002), generalized trust in people (Romanowska, 2009; Ma, 2012) and trust in agents involved in the supply of food (Nocella, 2010).

This study adds to the literature on the effect of trust on individual's preference for a natural type of production attribute. Results are compared across three data sets. The focus of this study is on animal husbandry methods although other aspects of the described 'traditional' production may be inferred by the respondents.

3.3 Empirical model

In this study, the aim is to assess the effect of trust on consumers' utility derived from consuming pork produced using natural production methods. The indirect utility function is represented as follows:

$$U_{in} = \gamma c_{in} + \beta_i \mathbf{z}_{in} + \theta_i (\mathbf{z}_{in} * \mathbf{d}_n) + \varepsilon_{in} \tag{3.5}$$

whereby c represent the price faced by individual n for choice i, γ is the coefficient on price, β represents the vector of parameters for the attributes (**z**) and θ represents coefficients of the interaction term between attributes and individual specific variables which include trust (**d**).

The natural production attributes included in this analysis are traditionally raised pork (Edmonton in 2009 and nationwide surveys in Canada in 2011) and premium traditional pork (Edmonton in 2011) (Table 3.1). These natural production attributes are compared to conventional pork production (which was described as standard hog production in Canada). Real pork chops are used in the experiments in Edmonton and pork chop pictures are used in the national experiments.

Table 3.1 Description of attributes

	Edmonton 2009	Edmonton 2011	Canada 2011	Description of attributes
Attribute		Attribute levels		
Production attributes	Conventional	Conventional	Conventional	Standard hog production in Canada
		Premium traditional		Pork from a family farm production setting, produced with no sub-therapeutic antibiotics or hormones, and no animal by-products in feed (100% grain fed)
	Uncertified traditionally raised		Uncertified traditionally raised	Pork from a family farm production setting, reared outdoors or in bedded settings, with no subtherapeutic antibiotics or growth promotants, and no animal byproducts in feed
	Traditionally raised certified by the Canadian pork industry		Traditionally raised certified by the Canadian pork industry	Pork from a family farm production setting, reared outdoors or in bedded settings, with no subtherapeutic antibiotics or growth promotants, and no animal byproducts in feed that is certified by the pork industry in Canada
	Government certified traditionally raised		Government certified traditionally raised	Pork from a family farm production setting, reared outdoors or in bedded settings, with no subtherapeutic antibiotics or growth promotants, and no animal byproducts in feed that is certified by the government
Price ($/kg)	8.82 11.02 13.23 15.43	8.82 11.02 13.23 15.45	8.82 11.02 13.23 15.43	Price per kg of pork chops with different attributes
On farm food safety accreditation (CQA®)	Yes No	Yes No	Yes No	CQA®) promotes best management practices to reduce or eliminate potential on-farm hazards that could compromise the safety of pork.
Canadian Pork label	Yes No	Yes No	Yes No	Canadian Pork identifies fresh pork that is produced from hogs raised in Canada
Marbling			Less Marbling More marbling	Intramuscular fat found between the bundles of muscle fibers

Source: Choice experiments for the thesis

The type of production system had four levels in the 2009 Edmonton and national experiments i.e. conventional pork, uncertified traditionally raised pork, government certified traditionally raised pork and Canadian pork industry certified traditionally raised pork. In the experiments in Edmonton in 2011, the production attribute had two levels i.e. premium traditional and conventional pork.

Prices of pork chops with different bundles of attributes ranged from $8.82 per kg to $15.45 per kg and there were four price levels in each survey. For the choice experiments, participants were provided with an information sheet which contained description of the attributes.

Search attributes such as marbling and credence attributes such as country of origin and quality assurance have been shown to influence consumer's preference for meat products. Therefore, the Canadian Pork label, CQA® label and marbling (only in the nationwide experiments) are included in the choice experiments. It is important to note that operations which supplied hogs for the conventional, traditionally raised pork and premium traditional pork in Edmonton all had on farm food safety accreditation (CQA®) (Goddard et al., 2011).

In Edmonton, choice experiments were conducted after participants completed sensory experiments for traditionally raised pork and conventional pork. In 2009, 200 hogs from a conventional production system and 200 hogs from a traditionally raised system were used in sensory and choice experiments in Edmonton. In the Edmonton study in 2011, 100 hogs from premium production system and 100 hogs from conventional production systems were used in the sensory and choice experiments.

Hogs were slaughtered at the same location in order to reduce differences in the quality of hogs and meat due to differences in the geography, management and techniques used in the slaughtering process. The slaughter facility grid was used to grade the hogs. Whole carcases were chilled overnight after slaughtering and the left and right loins were removed from the carcasses and they were prepared as boneless, trimmed to the silver skin, wrapped in a plastic sheeting and placed in groups of four into boxes that were bar coded and labelled. The boxes were placed in frozen storage for a short term. The frozen pork was transported to Alberta Agriculture and Rural Development Food Processing Development Centre (FPDC; Leduc, Alberta) and the boxes were labelled with animal numbers and the type of production (conventional or natural) and the boxes were returned to frozen storage at -24^{o}C. Before, further processing of loins, loin samples were put onto rolling racks and the loin samples were moved to a processing area (7^{o}C). Samples from each pair of loins were prepared for meat quality, economics experimentation and consumer testing.

From each animal, a loin section (at least 8 inches) was prepared and put in frozen storage for meat quality analysis. From the meat quality analysis, there is information that is not included in this analysis on hog carcass quality (hog grade index, settlement weight, probe lean yield) and meat quality i.e. average pH, average meat colour (L*- lightness, a* - amount of red or green and b*- amount of yellow or blue), drip loss percentage (the capacity of the meat to hold water), cooking loss percentage (amount of liquids and soluble matter lost when cooking the meat), and average shear force (objective measure of tenderness of the meat).

Two centimetre thick pork chops from one pork loin from each animal were prepared for the economics experiments. The pork chops were put in pairs on dri-loc pads in form trays covered with gas permeable stretch film (80 packages per day).

From each loin, pork chops (2cm thick) were prepared for the consumer testing. The pork chops were labelled and vacuum packaged (Multivac M855 rollstock thermoformer, Woodbridge, ON). The samples were put in boxes and refrigerated and they were moved to the Consumer Product Testing Centre (CPTC: Edmonton, AB) for consumer testing 2 days later. Each participant evaluated half of a pork chop from four different loins from two production systems. Before the sensory experiments, individually packaged pork chops were taken from storage, unpacked and set for cooking in batches of 2. The pork chops were grilled on an electric broiler/grill (Garland ED42, Russell Food Equipment, Edmonton, AB). The grill was preheated to 210^{o}C and the internal temperature for the pork chops was monitored. When the internal temperature reached 40^{o}C, the pork chops were flipped and they were removed from the grill when the internal temperature reached 72^{o}C. The pork chops were cooked for approximately 20 minutes. Panellists sat in individual testing boots and they completed the product evaluation questionnaire electronically (v. 5.0, Compusense Inc., Guelph, ON). Panellists were given the samples in a monadic manner on white foam plates (15cm) which were labelled with a sample-specific code.

There is data on sensory characteristics of the pork chops i.e. appearance of the grilled pork chops on the surface and inside, tenderness, juiciness, flavor and overall acceptability of the pork chops. Detailed information on the experimental procedures, animal slaughter dates and results on hog quality, meat quality, sensory quality and explanation of these attributes are found in Goddard et al. (2011) and Ma (2012). Only data from discrete choice experiments are included in this analysis.

There were 64, 32 and 128 possible combinations of attributes (production attributes, price, CQA®, Canadian pork and marbling (only in 2011) in the data sets for Edmonton (2009), Edmonton (2011) and the national sample respectively. Since including all the possible combinations of attributes would require more time for respondents to complete the choice experiments and could lead to fatigue, fractional factorial designs were used to design the choice experiments such that in all three choice experiments, participants chose between 8 pairs of pork chops and there was an 'I would not purchase either of these products' option. Respondents were provided information about the description of attributes. Prices were determined using actual prices of pork chops as a baseline.

Pork chops used in the choice experiments had labels containing the safe handling instructions, expiry date, and weight of the product, product price per kilogram and actual price. Pork chops from animals produced under a conventional production system did not have a production characteristic label but those that were uncertified traditionally raised, traditionally raised certified by the Canadian pork industry, government certified traditionally raised and premium traditional had labels stating the information. There were 4 versions of the choice sets in all the three data sets. Examples of the pork chop trays with labels are in Figures 3.2 and 3.3. In the choice experiments, participants were provided with the following information and a sheet containing the description of attributes.

ID#___________________ Session: Date and Time______________
Pork Chop Questions 1 Preferences for Pork Chops
In this experiment you are provided with 8 different pairs of pork chops that could be available for purchase in the retail grocery store or butcher where you typically shop. Pork chop prices vary from CN \$8.82/kg. to \$15.43/kg. For each pair of pork chops, please select the pork chop that you would purchase, or neither, if you would not purchase either pork chop. **It is important that you make your selections like you would if you were actually facing these choices in your retail purchase decisions.**

For your information in interpreting alternative pork chops please see the laminated information sheet. Conventional production refers to standard hog production in Canada.

Hypothetical bias and potential strategic behaviour are some concerns of this research since respondents did not actually purchase the pork products. In all the stated choice experiments, respondents were asked to behave as they would in a real grocery store. In the future other techniques such as 'cheap talk' could be used to try and reduce strategic behaviour and hypothetical bias.

Figure 3.2 An example of pork chops used in Edmonton choice experiments

Figure 3.3 An example of pork chops used in the national surveys

After completing the pork chop choice experiments, participants completed surveys. In the surveys, respondents were asked a number of questions including their generalized trust in people, trust in food agents regarding the safety of food, attitudes towards foods in general, risk perceptions and risk attitudes about consuming pork, animal production and human health concerns about food issues, habits regarding pork purchase and consumption and perceptions about conventional and traditionally raised pork.

Generalized trust in people is measured using the following General Social Survey question 'Generally speaking, would you say that most people can be trusted? 1. people can trusted 2. can't be too careful in dealing with people 3. don't know' (Glaeser et al., 2000). A dummy variable is created for generalized trust in people with 1 representing people can be trusted and 0 representing otherwise. This approach was used by Ma (2012) and Romanowska (2009).

Trust in retailers, food manufacturers, the government and farmers with regarding the safety of food is measured using statements adopted from de Jonge (2008). Using farmers as an example, the statements were as follows (i) Farmers have the competence to control the safety of food (ii) Farmers have sufficient knowledge to guarantee the safety of food products (iii) Farmers are honest about the safety of food (iv) Farmers are sufficiently open about the safety of food (v) Farmers take good care of the safety of our food (vi) Farmers give special attention to the safety of food. Responses were as follows 1. strongly disagree 2. disagree 3. neither agree, nor disagree 4. agree. 5. strongly agree. These questions have been used in the analysis of, for example, consumers' confidence in the safety of food (e.g. de Jonge, 2008; de Jonge et al., 2008a) and preferences for food attributes (Ding et al., 2012) and different forms of meat products (Drescher et al., 2012).

In previous studies, generalized attitudes are included in models using different ways. The first method is a latent class analysis whereby segments are characterized from attitudinal and socioeconomic variables (Boxall and Adamowicz, 2002; Morey et al., 2006; Aldrich et al., 2007; Ding et al., 2012). The latent class model is based on the assumption that the behaviour of an individual is influenced by observable characteristics and latent heterogeneity that changes with variables that are not observed by the researcher (Greene and Hensher, 2003). Since latent class models are semi-parametric, the researcher does not need to make strong or unjustifiable assumptions about the distribution of individual heterogeneity (Greene and Hensher, 2003). The second method involves the use of cluster analysis first and estimating choice models separately for each cluster and this approach was found to produce better results as compared to models estimated with the whole data set (Adamowicz and Boxall, 2001). The advantage of the second method is that it allows most freedom for differences in all parameters to show up. If models are estimated for different groups with different levels of trust, all parameters for variables in the model including demographic variables could be different across the different groups. The third way involves cluster analysis then including cluster membership as an explicit variable or variables in the estimation of random utility models (e.g. Aldrich et al., 2007) and this method is used in the current analysis. The third method is selected because differences in WTP across clusters can be easily calculated. Aldrich et al. (2007) found consistency in WTP estimates between models where heterogeneity was accounted for using cluster analysis and latent class analysis.

Cluster analysis is used to group the respondents into two groups (high trust and low trust) using questions on generalized trust in people and trust in food agents regarding the safety of food. Trust in food agents regarding the safety of food is assessed in this case because consumers might link natural to food safety. Individuals who perceived natural meat to be safer were willing to pay higher premiums for natural meat as compared to conventional meat products (Umberger et al., 2009).

There are different clustering techniques that could be used to group respondents (hierarchical, two-step and k-means clustering methods). Hierarchical clustering can be agglomerative (start with every individual as a different cluster and then merge into larger clusters according to their similarity) or divisive (start with the whole sample as one cluster and divide them into smaller clusters) (Everitt et al., 2011; Mooi and Sarstedt, 2011). K-means cluster analysis is used when the number of clusters is known in advance and it involves the specification of k-initial means and grouping of observations in a way which minimizes variation within a given cluster (Mooi and Sarstedt, 2011). Two-step cluster analysis is more suitable in situations where there is a large data set with categorical and continuous variables and observations are initially grouped into small clusters and then hierarchical cluster analysis is applied on the small clusters to form homogeneous clusters (Mooi and Sarstedt, 2011). In this study, k-means cluster analysis is used to group respondents into two clusters depending on their generalized trust in people and trust in food agents regarding the safety of food since data is categorical and the number of clusters needed for the analysis is known in advance. After k-means cluster analysis, a dummy variable labelled trust is created with 1 indicating high trust and 0 representing low trust and this variable is included in regression models. A dummy variable on trust is used instead of including the twenty-five statements on trust (i.e. generalized trust in people, trust in food manufacturers, retailers, the government and farmers) as separate variables in order to collapse the information since all of these variables would need to be interacted with the attributes in the regressions.

3.3.1 Conditional logit and random parameters logit models

Conditional and random parameters logit models are estimated to explain the probability that a consumer chooses a product with certain attributes. In the conditional logit model, independence of irrelevant alternatives is assumed but the random parameters logit model is more flexible (Greene and Hensher, 2003). For the conditional logit model, disturbances are independently and identically distributed (IID) with a type 1 extreme distribution (Green, 2008, p. 842) represented as follows:

$$F(\varepsilon_{ni}) = \exp(-\exp(-\varepsilon_{ni})) \tag{3.6}$$

Given that $\boldsymbol{\beta}$ is a vector of coefficients and **z** represents the vector for attributes, the probability of choosing alternative *i* for individual *n* is represented as follows:

$$P(Y_n = i) = \frac{\exp(\mathbf{z}_{ni}^{'}\boldsymbol{\beta})}{\sum_{j=1}^{J}\exp(\mathbf{z}_{ni}^{'}\boldsymbol{\beta})} \tag{3.7}$$

The random parameters logit model explicitly models heterogeneity in tastes and parameters can be calculated for each individual in the sample (Adamowicz and Boxall, 2001). In the random parameters logit model, substitution patterns are not restricted (Train, 2009). According to Train (2009, p. 135), the random parameters logit is a logit function evaluated at different parameters $(\beta' s)$ with the density function as the mixing distribution and the random parameters logit probabilities are represented as follows:

$$P_{ni} = \int L_{ni}(\boldsymbol{\beta}) f(\boldsymbol{\beta}) d\boldsymbol{\beta} \tag{3.8}$$

where $L_{ni}(\boldsymbol{\beta}) = \dfrac{e^{V_{ni}(\boldsymbol{\beta})}}{\sum_{j=1}^{J} e^{V_{nj}(\boldsymbol{\beta})}}$ which represents the logit probability evaluated at the parameters

and $f(\boldsymbol{\beta})$ is a density function .

If observed utility is linear in parameters i.e. $V_{ni}(\boldsymbol{\beta}) = \boldsymbol{\beta}'\mathbf{z}_{ni}$, the random parameters logit probability is represented as follows:

$$P_{ni} = \int \left(\frac{e^{\boldsymbol{\beta}'\mathbf{z}_{ni}}}{\sum_j e^{\boldsymbol{\beta}'\mathbf{z}_{nj}}} \right) f(\boldsymbol{\beta}) d\boldsymbol{\beta} \tag{3.9}$$

In the case where $f(\beta) = 1$, $\beta = b$ and 0 for $\beta \neq b$ the random parameters logit model becomes a simple logit model and the choice probability is as follows:

$$P_{ni} = \frac{e^{\mathbf{b}'\mathbf{z}_{ni}}}{\sum_i e^{\mathbf{b}'\mathbf{z}_{nj}}} \tag{3.10}$$

In the case where $f(\boldsymbol{\beta})$ is discrete**,** $\boldsymbol{\beta}$ takes values b_1...............b_M , with the probability that $\beta = b_m$ is s_m, the random parameters logit model becomes a latent class model with the choice probability represented as follows:

$$P_{ni} = \sum_{m=1}^{M} s_m \left(\frac{e^{\mathbf{b}_m'\mathbf{z}_{ni}}}{\sum_j e^{\mathbf{b}_m'\mathbf{z}_{nj}}} \right) \tag{3.11}$$

The mean and standard deviation of one or more random parameters show the sources of heterogeneity. According to Greene (2008, p. 851), the parameters across individuals in random parameters logit models are represented as follows:

$$\beta_{nk} = \beta_k + \mathbf{d}'\boldsymbol{\theta}_k + \sigma_k u_{nk} \tag{3.12}$$

u_{ik} is normally distributed with correlation matrix **R,** σ_k is the standard deviation of the kth distribution, $\beta_k + \mathbf{d}'\theta_k$ represents the mean of the distribution, **d** represents the individual specific variables and u_{ik} is an error term that is assumed to be independently and identically distributed.

Individual specific variables included in all models are gender, age, presence of children less than 18 years of age in the household, education, frequency of pork consumption and trust. In the models for the national data income, living in Quebec and living in a rural area are also included in the models. Income was not included in the analysis for the Edmonton sample because this information is not available for some respondents.

Both conditional and random parameters logit models are estimated in Nlogit 4.0. Random parameters logit models are estimated using Halton draws with 50 replications because stability of results were achieved at this number of draws in previous studies (Hensher, 2001; Scarpa and Alberini, 2006). Fifty Halton draws are also selected to allow the models to converge faster.

In the estimation of random parameters logit models, decisions have to be made on which parameters are random and their distribution. There are different distributions that could be used e.g. normal, triangular, uniform or lognormal distributions (Hensher and Greene, 2003). According to Hensher and Greene (2003), uniform distributions are more appropriate when there are dummy variables, lognormal distributions give non negative coefficients and large values of WTP. In this analysis, all product attributes with the exclusion of price of the product are assumed to be random parameters. Price was assumed to be fixed in order to avoid positive coefficients for this variable (Olsen, 2009). Normal distributions are assumed for the random parameters because they do not restrict the sign of the parameters.

WTP values are calculated in Nlogit 4.0 using the Krinsky and Robb method (Greene, 2007) with 5000 replications. For attribute k, mean WTP is calculated as follows:

$$WTP_k = \frac{-(\beta_k + \mathbf{d}'\boldsymbol{\theta}_k)}{\gamma} \tag{3.13}$$

where β_k is the coefficient for attribute k, **d** is a vector of individual specific variables and $\boldsymbol{\theta}_k$ represents the coefficients for the interaction terms between attribute k and individual specific variables and γ is the parameter for the price variable.

3.4 Data

The analysis of the linkages between trust and consumers' preferences for natural pork is based on three surveys and three choice experiments conducted between November 19 and December 17, 2009 (194 participants) and between October 13 and November 23, 2011 (122 participants) in Edmonton and nationally across Canada in July 2011 (1603 participants). Choice experiments and surveys in Edmonton were conducted at the Consumer Product Testing Centre (CPTC: Edmonton, Alberta). Participants were randomly selected from a panelist database maintained by the Sensory Evaluation Program and one of the criteria for choosing respondents was that they were supposed to be 'users and likers' of pork chops. National data was collected using online surveys by a marketing firm. In all surveys, demographic information of respondents was used in selecting the participants, with all participants being required to be at least 18 years of age.

Individual characteristics and habits of participants are summarized in Table 3.2. There are more females in the national sample as compared to males. The reason is that the survey targeted the person who did most of the grocery shopping for the household. On average, most respondents had at least a college degree. Most participants in all the surveys buy their pork from supermarkets.

Table 3.2 Summary statistics for some questions in the surveys

	Edmonton 2009	Edmonton 2011	Canada2011
% female	50.5	52.5	60.4
Average age of respondent (years)	42.2	41.2	51.7
	(14.1)	(14.6)	(14.9)
Average household size	2.31	2.33	2.18
	(0.70)	(0.74)	(0.72)
% having children < 18 years age in the household	26.3	32.8	26.0
Average years of education attained by respondent	15.7	15.6	13.9
	(1.74)	(1.89)	(1.76)
Household income (%) (see key below)			
I	3.60	7.38	14.5
II	17.5	17.2	18.8
III	29.4	29.5	26.5
IV	40.2	40.0	14.1
V			11.2
VI			7.70
VII			7.20
I'd rather not answer this question	9.30	13.9	
Average income			61,300.0
			(37,542.0)
% eating pork	100	100	81.7
How often do you eat pork? (%)			
Never	0.00	0.00	11.7
Fewer than two times per year	0.50	0.00	11.9
Once per month	30.9	24.6	34.2
Once per week	53.1	56.6	34.2
More than once per week	15.5	18.9	8.05
When you buy pork, is it usually from… (choose one) (%)			
a supermarket	94.3	92.6	81.3
a butcher's shop	2.10	4.90	7.60
another small shop	1.50	0.80	1.90
a farmer's market	2.10	0.80	1.20
another way (e.g. directly from a farm or through acquaintances)	0.00	0.80	7.90
Region (%)			
Maritimes			12.7
Quebec			13.2
Ontario			14.5
Manitoba			17.5
Saskatchewan			12.1
Alberta			13.6
British Columbia			16.5
Sample size	194	122	1603

Standard deviations are in parentheses. For income in the Edmonton samples I = ≤$19,999.00, II = between $20,000.00 and $49,999.00, III= between $50,000.00 and $89,999.00 and IV=≥$90,000.00. For the national sample, income categories are as follows I = ≤$24,999.00, II = between $25,000.00 and $39,999.00 III = between $40,000.00 and $64,999.00, IV = between $65,000.00 and $79,999.00, V = between $80,000.00 and $99,999.00, VI = between $100,000.00 and $119,999.00 and VII = ≥$120,000.00

Source: Data collected in surveys for the thesis

3.4.1 Generalized trust in people and trust in food agents regarding food safety

About 60% of respondents in the 2009 Edmonton sample, 56% in the 2011 Edmonton sample and 46% in the national sample stated that people can be trusted (Table 3.3). About 7% of respondents in the Edmonton samples and 4% in the national sample answered 'don't know' to the question on generalized trust in people. In the Canadian General Social Survey conducted by Statistics Canada (2008), 46.5% of the respondents stated that most people can be trusted.

The results on generalized trust in people for the national sample are similar to the results obtained by Statistics Canada (2008). However, more people in the sample in Edmonton generally trust people compared to results obtained in the General Social Survey. On average, most Canadians trust food agents since all the results are above average (given a scale of 1. strongly disagree … 5. strongly agree).

Results on k-means cluster analysis[3] are summarized in Table 3.4 and Table 3.5. About 68% of respondents in the 2009 Edmonton sample belong in the high trust cluster which represents people who generally trust and have higher levels of trust in retailers, food manufacturers, farmers and the government. About 60% and 50% of respondents in the 2011 Edmonton and national samples had high trust respectively. This shows that most of the participants in the Edmonton samples generally trust people and they trust food industry agents. This is not surprising given that these respondents belong to a panelist database composed of people who enjoy participating in food sensory experiments so the samples cannot be generalized to the general Canadian population but to people who consume pork. The characteristics of respondents for the high and low trust clusters are summarized in Table 3.6.

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[3] If we cluster respondents using only the questions on trust in food agents regarding the safety of food (i.e. excluding generalized trust in people), all households remain in their original clusters for the Edmonton samples. In the national sample, 99.6% remain in the original cluster while only 7 respondents move from the high to the low trust cluster.

Table 3.3 Generalized trust in people and trust in food agents regarding food safety

	Edmonton 2009	Edmonton 2011	Canada 2011
Generalized trust[4]			
People can be trusted	59.8%	55.7%	45.9%
Can't be too careful in dealing with people	33.5%	33.7%	49.8%
Don't know	6.70%	6.56%	4.30%
Trust in food agents (1. strongly disagree…5. strongly agree)	Average (standard deviation)		
The government			
has the competence to control the safety of food	4.03 (0.87)	3.84 (1.06)	3.43 (0.98)
has sufficient knowledge to guarantee the safety of food products	4.02 (0.92)	3.85 (1.06)	3.54 (0.95)
is honest about the safety of food	3.55 (1.00)	3.41 (1.05)	3.04 (0.96)
is sufficiently open about the safety of food	3.46 (1.04)	3.31 (1.13)	3.03 (0.98)
takes good care of the safety of our food	3.52 (0.95)	3.47 (0.99)	3.17 (0.95)
gives special attention to the safety of food	3.63 (1.02)	3.48 (1.07)	3.23 (0.95)
Farmers			
have the competence to control the safety of food	3.91 (0.82)	3.90 (0.81)	3.61 (0.80)
have sufficient knowledge to guarantee the safety of food products	3.68 (0.94)	3.76 (0.80)	3.60 (0.82)
are honest about the safety of food	3.51 (0.76)	3.34 (0.82)	3.43 (0.79)
are sufficiently open about the safety of food	3.34 (0.84)	3.28 (0.89)	3.40 (0.81)
take good care of the safety of our food	3.58 (0.76)	3.53 (0.77)	3.53 (0.78)
give special attention to the safety of food	3.47 (0.77)	3.35 (0.86)	3.47 (0.79)
Retailers			
have the competence to control the safety of food	3.54 (0.93)	3.40 (0.97)	3.30 (0.89)
have sufficient knowledge to guarantee the safety of food products	3.46 (0.97)	3.30 (1.03)	3.32 (0.87))
are honest about the safety of food	3.28 (0.87)	3.18 (0.91)	3.04 (0.83)
are sufficiently open about the safety of food	3.18 (0.83)	3.06 (0.84)	2.99 (0.86)
take good care of the safety of our food	3.38 (0.84)	3.33 (0.91)	3.16 (0.81)
give special attention to the safety of food	3.34 (0.84)	3.21 (0.90)	3.16 (0.85)
Food manufacturers			
have the competence to control the safety of food	3.77 (0.91)	3.64 (1.05)	3.61 (0.84)
have sufficient knowledge to guarantee the safety of food products	3.89 (0.85)	3.80 (0.84)	3.65 (0.83)
are honest about the safety of food	3.13 (0.92)	3.02 (0.88)	3.02 (0.89)
are sufficiently open about the safety of food	3.05 (0.92)	2.83 (0.95)	2.98 (0.92)
take good care of the safety of our food	3.54 (0.81)	3.33 (0.80)	3.25 (0.85)
give special attention to the safety of food	3.60 (0.81)	3.33 (0.94)	3.30 (0.85)
Sample size	194	122	1603

Source: Data collected in surveys for the thesis

[4] For the empirical analysis, the question on generalized trust in people is a dummy variable 1. people can be trusted 0. otherwise. More categories for the generalized trust in people question could be used in the future.

Table 3.4 Final clusters from k-means cluster analysis

	Edmonton 2009		Edmonton 2011		Canada 2011	
	Low trust	High trust	Low trust	High Trust	Low trust	High trust
Generalized trust in people	0	1	0	1	0	1
Food manufacturers						
have the competence to control the safety of food	3	4	3	4	3	4
have sufficient knowledge to guarantee the safety of food products	3	4	3	4	3	4
are honest about the safety of food	2	3	2	3	2	4
are sufficiently open about the safety of food	2	3	2	3	2	4
take good care of the safety of our food	3	4	3	4	3	4
give special attention to the safety of food	3	4	3	4	3	4
Retailers						
have the competence to control the safety of food	3	4	3	4	3	4
have sufficient knowledge to guarantee the safety of food products	3	4	3	4	3	4
are honest about the safety of food	3	4	3	4	3	4
are sufficiently open about the safety of food	3	3	3	3	3	4
take good care of the safety of our food	3	4	3	4	3	4
give special attention to the safety of food	3	4	3	4	3	4
The government						
has the competence to control the safety of food	3	4	3	4	3	4
has sufficient knowledge to guarantee the safety of food products	3	4	3	4	3	4
is honest about the safety of food	3	4	3	4	3	4
is sufficiently open about the safety of food	3	4	3	4	2	4
takes good care of the safety of our food	3	4	3	4	3	4
gives special attention to the safety of food	3	4	3	4	3	4
Farmers						
have the competence to control the safety of food	4	4	4	4	3	4
have sufficient knowledge to guarantee the safety of food products	3	4	3	4	3	4
are honest about the safety of food	3	4	3	4	2	4
are sufficiently open about the safety of food	3	4	3	4	2	4
take good care of the safety of our food	3	4	3	4	3	4
give special attention to the safety of food	3	4	3	4	3	4
Distances between final cluster centers	4.38		4.41		4.57	
Number of cases in each cluster	63 (32.5%)	131 (67.5%)	49 (40.2%)	73 (59.8%)	808 (50.4%)	795 (49.6%)
Sample size	194		122		1603	

Source: Data collected in surveys for the thesis

Table 3.5 Analysis of variance results from k-mean cluster analysis

	Edmonton 2009						Edmonton 2011						Canada 2011					
	Cluster		Error				Cluster		Error				Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.	Mean Square	df	Mean Square	df	F	Sig.	Mean Square	df	Mean Square	df	F	Sig.
General trust	2.2	1.0	0.2	192	9.5	0.0	2.4	1.0	0.2	120.0	10.2	0.0	11.4	1.0	0.2	1601.0	47.1	0.0
Manufacturers																		
competence	24.7	1.0	0.7	192.0	34.3	0.0	31.4	1.0	0.9	120.0	36.6	0.0	367.6	1.0	0.7	1601.0	503.8	0.0
knowledge	21.0	1.0	0.6	192.0	33.9	0.0	21.2	1.0	0.5	120.0	39.4	0.0	296.2	1.0	0.7	1601.0	417.3	0.0
honest	47.9	1.0	0.6	192.0	77.9	0.0	26.4	1.0	0.6	120.0	46.8	0.0	502.6	1.0	0.6	1601.0	826.8	0.0
open	50.3	1.0	0.6	192.0	85.3	0.0	31.9	1.0	0.6	120.0	49.3	0.0	519.4	1.0	0.6	1601.0	821.2	0.0
care	41.0	1.0	0.4	192.0	92.4	0.0	28.8	1.0	0.4	120.0	69.1	0.0	528.4	1.0	0.6	1601.0	935.0	0.0
attention	35.2	1.0	0.5	192.0	72.2	0.0	25.0	1.0	0.7	120.0	36.6	0.0	466.7	1.0	0.6	1601.0	759.7	0.0
Retailers																		
competence	28.4	1.0	0.7	192.0	39.6	0.0	28.1	1.0	0.7	120.0	38.6	0.0	162.2	1.0	0.5	1601.0	303.4	0.0
knowledge	14.6	1.0	0.9	192.0	16.7	0.0	34.6	1.0	0.8	120.0	43.7	0.0	182.4	1.0	0.6	1601.0	329.8	0.0
honest	42.5	1.0	0.5	192.0	78.2	0.0	32.4	1.0	0.6	120.0	57.6	0.0	193.3	1.0	0.5	1601.0	385.8	0.0
open	40.2	1.0	0.5	192.0	83.5	0.0	14.8	1.0	0.6	120.0	24.7	0.0	211.5	1.0	0.5	1601.0	398.8	0.0
care	30.0	1.0	0.5	192.0	54.5	0.0	30.8	1.0	0.6	120.0	52.8	0.0	206.2	1.0	0.5	1601.0	423.7	0.0
attention	25.8	1.0	0.6	192.0	44.4	0.0	29.6	1.0	0.6	120.0	51.5	0.0	203.5	1.0	0.5	1601.0	406.2	0.0
Government																		
competence	30.4	1.0	0.6	192.0	50.5	0.0	22.0	1.0	1.0	120.0	22.7	0.0	333.3	1.0	0.6	1601.0	562.9	0.0
knowledge	30.4	1.0	0.7	192.0	44.1	0.0	13.3	1.0	1.0	120.0	12.9	0.0	316.4	1.0	0.6	1601.0	561.6	0.0
honest	73.1	1.0	0.6	192.0	116.0	0.0	21.5	1.0	0.9	120.0	23.0	0.0	354.2	1.0	0.5	1601.0	757.5	0.0
open	76.1	1.0	0.7	192.0	110.7	0.0	33.3	1.0	1.0	120.0	32.6	0.0	403.2	1.0	0.5	1601.0	829.0	0.0
care	75.0	1.0	0.5	192.0	141.8	0.0	22.9	1.0	0.8	120.0	28.1	0.0	369.1	1.0	0.4	1601.0	857.8	0.0
attention	67.6	1.0	0.7	192.0	95.6	0.0	23.6	1.0	1.0	120.0	24.2	0.0	366.2	1.0	0.5	1601.0	746.8	0.0
Farmers																		
competence	4.1	1.0	0.7	192.0	6.2	0.0	7.9	1.0	0.6	120.0	12.9	0.0	240.5	1.0	0.6	1601.0	432.7	0.0
knowledge	6.4	1.0	0.9	192.0	7.4	0.0	8.0	1.0	0.6	120.0	13.8	0.0	250.4	1.0	0.5	1601.0	465.3	0.0
honest	11.5	1.0	0.5	192.0	21.9	0.0	21.1	1.0	0.5	120.0	41.9	0.0	482.4	1.0	0.5	1601.0	995.4	0.0
open	14.8	1.0	0.6	192.0	23.2	0.0	24.2	1.0	0.6	120.0	40.2	0.0	489.4	1.0	0.5	1601.0	913.4	0.0
care	12.8	1.0	0.5	192.0	25.0	0.0	18.2	1.0	0.5	120.0	40.3	0.0	474.7	1.0	0.4	1601.0	1124.3	0.0
attention	11.2	1.0	0.5	192.0	20.9	0.0	16.9	1.0	0.6	120.0	27.8	0.0	424.5	1.0	0.5	1601.0	918.3	0.0

Source: Data collected in surveys for the thesis

Table 3.6 Characteristics of the respondents with high trust and those with low trust

	Edmonton 2009		Edmonton 2011		Canada 2011	
	Low trust	High trust	Low Trust	High trust	Low trust	High trust
% female	58.7	46.6	46.9	56.2	59.8	61.1
Average age of respondent (years)	43.0	41.9	39.5	42.3	52.5	50.9
	(14.1)	(14.2)	(15.6)	(14.0)	(14.8)	(15.0)
Average household size	2.14	2.39	2.31	2.34	2.18	2.22
	(0.78)	(0.64)	(0.80)	(0.71)	(0.72)	(0.72)
% having children < 18 years	20.6	29.0	36.7	30.1	24.3	27.8
Average years of education	15.9	15.6	15.8	15.5	13.9	13.9
	(1.58)	(1.81)	(1.85)	(1.92)	(1.77)	(1.74)
Household income (%) (see key below)						
I	1.60	4.60	10.2	5.5	14.4	14.6
II	23.8	14.5	18.4	16.4	18.9	18.7
III	31.7	28.2	28.6	30.1	26.7	26.2
IV	28.6	45.8	24.5	37.0	13.6	14.6
V					11.8	10.6
VI					7.1	8.4
VII					7.5	6.9
I'd rather not answer this question	14.3	6.90	18.4	11.0		
Average income ($)					59,870.0	62,800.0
					(36,283.0)	(38,746.0)
How often do you eat pork? (%)						
Never	0.00	0.00	0.0	0.0	14.9	8.4
Fewer than two times per year	1.60	0.00	0.0	0.0	11.6	12.1
Once per month	36.5	28.2	22.4	26.0	33.8	34.6
Once per week	52.4	53.4	61.2	53.4	32.2	36.4
More than once per week	9.50	18.3	16.3	20.5	7.5	8.6
When you buy pork, is it usually from… (choose one) (%)						
a supermarket	93.7	94.7	85.7	97.3	77.8	84.8
a butcher's shop	1.60	2.30	12.2	0.0	8.7	6.5
another small shop	3.20	0.80	0.0	1.4	2.4	1.5
a farmer's market	1.60	2.30	2.0	0.0	1.6	0.9
another way (e.g. directly from a farm or through acquaintances)	0.00	0.00	0.0	1.4	9.5	6.3
Region (%)						
Maritimes					12.5	12.8
Quebec					11.9	14.5
Ontario					13.5	15.6
Manitoba					18.6	16.4
Saskatchewan					12.6	11.6
Alberta					13.1	14.1
British Columbia					17.8	15.1
Sample size	63	131	49	73	808	795

Standard deviations are in parentheses. For income in the Edmonton samples I = ≤$19,999.00, II = between $20,000.00 and $49,999.00, III= between $50,000.00 and $89,999.00 and IV=≥$90,000.00. For the national sample, income categories are as follows I = ≤$24,999.00, II = between $25,000.00 and $39,999.00 III = between $40,000.00 and $64,999.00, IV = between $65,000.00 and $79,999.00, V = between $80,000.00 and $99,999.00, VI = between $100,000.00 and $119,999.00 and VII = ≥$120,000.00

Source: Data collected in surveys for the thesis

3.5 Empirical Results

Results from conditional and random parameters logit models are reported in this section. Heterogeneity in tastes is assessed by interacting attributes with socioeconomic factors, trust and habits (frequency of eating pork) in the conditional logit models as well as by using random parameters logit models. Models for each of the three data sets are estimated separately and results are discussed in this section. Results from McFadden's R^2 show that the random parameters logit model is superior as compared to the conditional logit model for all three data sets. Both models perform better for the national data as compared to the Edmonton data. Results for conditional and random parameters logit models with no individual specific variables are also summarised in this section.

3.5.1 Conditional logit models with individual specific variables

Conditional logit models are estimated with individual specific variables and results are summarized in Table 3.7. WTP values are calculated for respondents who have high levels of trust and those respondents who have low levels of trust (Table 3.8). Respondents with high levels of trust in the 2009 Edmonton sample are willing to pay a higher premium ($3.01/kg) for traditionally raised pork certified by the Canadian pork industry over conventional pork as compared to respondents with low levels of trust (WTP value is not significantly different from 0 for the low trust group). Respondents who have low levels of trust are willing to pay a higher premium for Canadian Pork ($4.88/kg) (relative to pork chops that do not have the Canadian pork label) as compared to respondents who have high levels of trust in 2009 ($3.67/kg). In the 2011 Edmonton sample, people with high levels of trust are willing to pay more for pork that have information about on farm food safety accreditation (CQA®) (relative to pork chops that did not have the CQA® label) as compared to people who have low levels of trust.

Respondents who have high levels of trust in the national sample are willing to pay higher premiums for all attributes (uncertified traditionally raised pork, Canadian pork industry certified traditionally raised pork, government certified traditionally raised pork, Canadian Pork, CQA® and marbling) as compared to respondents who have low levels of trust maybe because they trust the information on the labels. However, both respondents with low and high levels of trust are willing to pay significant premiums for traditionally raised pork with or without certification, Canadian Pork and CQA®. Respondents in the national surveys are willing to pay higher premiums for government certified traditionally raised pork as compared to uncertified traditionally raised pork and Canadian pork industry certified traditionally raised pork.

Table 3.7 Conditional logit models with individual specific characteristics

	Edmonton 2009		Edmonton 2011		Canada 2011	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Price	-0.14***	0.02	-0.09***	0.02	-0.15***	0.01
Uncertified traditionally raised (TR)	-1.92*	1.09			-0.35	0.34
Premium traditional (PT)			0.10	0.94		
Canadian pork industry certified traditionally raised(CTR)	-1.33	1.00			-0.42	0.35
Government certified traditionally raised(GTR)	-0.87	1.10			-0.10	0.33
Canadian pork (CP)	1.38*	0.78	2.26**	0.91	-0.04	0.26
CQA®	-0.43	0.80	-0.11	0.92	-0.04	0.26
Less marbling					-0.30	0.26
Would not buy	-3.04***	0.23	-2.55***	0.27	-1.43***	0.08
TR*Female	-0.06	0.22			-0.11	0.07
TR*Age	0.01	0.01			-0.002	0.003
TR*Child	0.23	0.23			-0.04	0.09
TR*Education	0.07	0.06			-0.003	0.02
TR*Income					0.002**	0.001
TR*Rural					0.15*	0.09
TR*Quebec					0.05	0.10
TR*Eating frequency	0.06	0.16			0.36***	0.03
TR*Trust	-0.04	0.22			0.17***	0.07
PT*Female			-0.60***	0.18		
PT*Age			0.002	0.01		
PT*Child			0.35*	0.19		
PT*Education			-0.02	0.05		
PT*Eating frequency			0.10	0.14		
PT*Trust			0.11	0.19		

CTR*Female	0.11	0.20			0.14*	0.08
CTR*Age	0.002	0.01			-0.001	0.003
CTR*Child	0.29	0.22			0.04	0.09
CTR*Education	0.08	0.06			0.004	0.02
CTR*Income					0.002**	0.001
CTR*Rural					0.03	0.09
CTR*Quebec					-0.12	0.11
CTR*Eating frequency	-0.02	0.15			0.35***	0.03
CTR*Trust	0.08	0.21			0.18***	0.07
GTR*Female	0.03	0.22			0.03	0.07
GTR*Age	0.005	0.01			-0.01**	0.003
GTR*Child	0.08	0.23			-0.04	0.09
GTR*Education	0.06	0.06			0.005	0.02
GTR*Income					0.003***	0.001
GTR*Rural					0.14	0.09
GTR*Quebec					0.15	0.10
GTR*Eating frequency	0.002	0.16			0.40***	0.03
GTR*Trust	0.04	0.23			0.21***	0.07
CP*Female	-0.08	0.16	-0.05	0.19	0.01	0.06
CP*Age	-0.01	0.01	0.003	0.01	-0.085***	0.002
CP*Child	0.39**	0.17	-0.04	0.20	-0.15**	0.07
CP*Education	-0.05	0.04	-0.13***	0.05	0.01	0.02
CP*Income					0.001	0.001
CP*Rural					0.12*	0.07
CP*Quebec					0.18**	0.08
CP*Eating frequency	-0.002	0.11	-0.05	0.13	0.33***	0.03
CP*Trust	-0.16	0.16	0.06	0.19	0.24***	0.05
CQA®*Female	0.19	0.16	-0.08	0.19	0.10*	0.05
CQA®*Age	0.01*	0.005	0.003	0.01	-0.002	0.002
CQA®*Child	-0.27	0.17	0.26	0.20	0.09	0.07
CQA®*Education	0.04	0.04	0.03	0.05	-0.02	0.02
CQA®*Income					0.002**	0.001
CQA®*Rural					0.02	0.07
CQA®*Quebec					0.28***	0.08
CQA®*Eating frequency	-0.14	0.11	-0.12	0.14	0.28***	0.03
CQA®*Trust	-0.005	0.16	0.32*	0.18	0.05	0.05
Less marbling*Female					0.07	0.06
Less Marbling *Age					0.003	0.002
Less Marbling*Child					-0.06	0.07
Less marbling*Education					-0.02	0.02
Less marbling *Rural					0.005	0.07
Less Marbling *Quebec					0.13	0.8
Less marbling*Eating frequency					0.18***	0.03
Less marbling*Trust					0.08	0.05
Log likelihood	-1359.2		-895.9		-9979.1	
McFadden's R^2	0.06		0.05		0.15	
Sample size	194		122		1603	
Number of choice sets	8		8		8	

SE is standard error. ***, ** and * indicates significance at the 1%, 5% and 10% levels respectively. Uncertified traditionally raised pork, premium traditional, Canadian pork Industry certified traditionally raised pork and government certified traditionally raised pork are compared to conventional pork. Pork chops with the Canadian pork label are compared to pork chops that did not have the label. Pork chops with the CQA® label (on farm food safety accreditation) are compared to pork chops that did not have the label. Pork chops with less marbling are compared to pork chops that had more marbling.

Source: Data collected in choice experiments and surveys for the thesis

Table 3.8 Results on WTP for attributes from conditional logit models with individual specific variables

	Female, mean age, child/children < 18 present in the household, mean education, mean eating frequency and **high trust**		Female, mean age, child/children < 18 present in the household, mean education, mean eating frequency, **high trust,** urban, not living in Quebec and income	Female, mean age, child/children < 18 present in the household, mean education, mean eating frequency and **low trust**		Female, mean age, child/children < 18 present in the household, mean education, mean eating frequency, **low trust,** urban, not living in Quebec and income
Attribute	Edmonton 2009	Edmonton 2011	Canada 2011	Edmonton 2009	Edmonton 2011	Canada 2011
TR	-1.35		2.45***	-1.05		1.33**
	(1.85)		(0.61)	(2.08)		(0.60)
PT		0.16			-1.02	
		(2.24)			(2.40)	
CTR	3.01*		5.40***	2.45		4.25***
	(1.80)		(0.65)	(2.03)		(0.64)
GTR	2.87		5.95***	2.59		4.56***
	(1.84)		(0.63)	(2.06)		(0.62)
CP	3.67***	2.82	4.98***	4.88***	2.14	3.41***
	(1.36)	(2.36)	(0.49)	(1.57)	(2.47)	(0.47)
CQA®	1.24	6.98***	3.91***	1.28	3.49	3.60***
	(1.31)	(2.74)	(0.47)	(1.50)	(2.59)	(0.47)
Less marbling			0.78*			0.23
			(0.46)			(0.46)

Standard errors are in parenthesis. ***, ** and * indicates significance at the 1%, 5% and 10% levels respectively. TR - Uncertified traditionally raised pork, PT – Premium traditional pork, CTR – Canadian pork industry certified traditionally raised pork, GTR – government certified traditionally raised pork, CP - Canadian pork, CQA® - on farm food safety accreditation.

Source: Data collected in choice experiments and surveys for the thesis

3.5.2 Random parameters logit models with individual specific variables

Random parameters logit models are estimated for all three data sets with individual specific variables (Table 3.9). Results on derived standard deviations of parameter distributions are significantly different from zero (except for and Canadian Pork and CQA labels for the Edmonton 2011 survey). The significant standard deviations of parameter distributions show that there is heterogeneity in estimates of the parameters around the mean (Hensher et al., 2015). WTP values are also calculated for people who have high levels of trust and those with low levels of trust (Table 3.10).

From the results, participants in the 2009 survey in Edmonton who have high levels of trust are willing to pay $3.88 per kg for pork chops with the Canadian Pork label (relative to pork chops that did not have the Canadian pork label) while people with low levels of trust were willing to pay $5.30 per kg for the same pork chops. For the 2011 Edmonton sample, participants who have high levels of trust are willing to pay a premium of $7.43 for a kg of pork chops with the CQA® label (relative to pork chops without the CQA® label) while WTP for this attribute was not significantly different from zero for people who have low levels of trust.

Table 3.9 Results from random parameters logit models with individual specific variables

	Edmonton 2009		Edmonton 2011		Canada 2011	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Random parameters in utility functions						
TR	-2.19*	1.30			-0.37	0.45
PT			-0.01	1.23		
CTR	-1.35	1.36			-0.57	0.60
GTR	-0.85	1.30			-0.51	0.55
CP	1.59	1.08	2.56***	1.02	-0.15	0.49
CQA®	-0.57	1.02	-0.08	1.02	-0.32	0.40
Less marbling					-0.35	0.37
Non-random parameters in utility functions						
Price	-0.17***	0.02	-0.10***	0.02	-0.19***	0.007
Neither	-3.70***	0.27	-2.69***	0.29	-2.26**	0.10
Heterogeneity in mean						
TR*Female	-0.02	0.26			-0.06	0.10
TR*Age	0.01	0.01			-0.005	0.004
TR*Child	0.26	0.28			-0.11	0.12
TR*Education	0.08	0.07			-0.004	0.03
TR*Income					0.003**	0.001
TR*Rural					0.26**	0.12
TR*Quebec					0.07	0.14
TR*Eating frequency	0.08	0.19			0.42***	0.05
TR*Trust	-0.05	0.26			0.23***	0.09
PT*Female			-0.64***	0.24		
PT*Age			0.002	0.01		
PT*Child			0.36	0.26		
PT*Education			-0.02	0.06		
PT*Eating frequency			0.14	0.19		
PT*Trust			0.10	0.24		
CTR*Female	0.13	0.27			0.27**	0.13
CTR*Age	0.001	0.01			-0.005	0.005
CTR*Child	0.37	0.30			-0.04	0.16
CTR*Education	0.08	0.08			-0.02	0.04
CTR*Income					0.003*	0.002
CTR*Rural					0.12	0.17
CTR*Quebec					-0.04	0.21
CTR*Eating frequency	0.03	0.20			0.59***	0.06
CTR*Trust	0.04	0.28			0.30**	0.13
GTR*Female	0.04	0.26			0.15	0.13
GTR*Age	0.005	0.01			-0.01**	0.004

GTR*Child	0.12	0.28			-0.09	0.15
GTR*Education	0.06	0.07			0.01	0.03
GTR*Income					0.004***	0.002
GTR*Rural					0.25	0.16
GTR*Quebec					0.29	0.20
GTR*Eating frequency	0.004	0.18			0.62***	0.06
GTR*Trust	0.001	0.27			0.43***	0.12
CP*Female	-0.06	0.22	-0.08	0.21	0.05	0.11
CP*Age	-0.01	0.01	0.003	0.01	-0.01***	0.004
CP*Child	0.51**	0.24	-0.03	0.22	-0.22	0.14
CP*Education	-0.05	0.06	-0.14***	0.05	-0.01	0.03
CP*Income					0.002	0.001
CP*Rural					0.19	0.13
CP*Quebec					0.36**	0.18
CP*Eating frequency	0.03	0.15	-0.06	0.15	0.65***	0.05
CP*Trust	-0.24	0.22	0.06	0.21	0.41***	0.11
CQA®*Female	0.23	0.20	-0.08	0.21	0.13	0.09
CQA®*Age	0.01	0.01	0.004	0.01	-0.006*	0.003
CQA®*Child	-0.32	0.22	0.30	0.23	0.02	0.11
CQA®*Education	0.06	0.06	0.03	0.06	-0.01	0.02
CQA®*Income					0.002***	0.001
CQA®*Rural					0.07	0.11
CQA®*Quebec					0.52***	0.14
CQA®*Eating frequency	-0.16	0.14	-0.16	0.15	0.49***	0.04
CQA®*Trust	-0.02	0.21	0.35*	0.21	0.15*	0.08
Less marbling*Female					0.13	0.08
Less Marbling *Age					0.002	0.003
Less Marbling*Child					-0.17*	0.10
Less marbling*Education					-0.05**	0.02
Less marbling *Rural					0.002*	0.001
Less Marbling *Quebec					0.14	0.12
Less marbling*Eating frequency					0.35***	0.04
Less marbling*Trust					0.11	0.08
Diagonal values in Cholesky matrix						
NsTR	0.66***	0.19			0.87***	0.07
NsCTR	0.49*	0.27			0.15	0.16
NSGTR	0.19	0.18			0.15	0.17
NsPT			0.76***	0.16		
NsCP	0.23	0.30	0.29	0.27	0.65***	0.23
NsCQA®	0.57***	0.19	0.20	0.38	0.23**	0.10
NsLess marbling					0.06	0.16
Covariances of random parameters						
CTR:TR	-0.59***	0.18			-1.39***	0.11
GTR:TR	-0.40***	0.13			-1.13***	0.11
GTR:CTR	0.65***	0.26			1.97***	0.21
CP:TR	-0.34**	0.16			-0.70***	0.12
CP:CTR	0.37*	0.20			1.19***	0.18
CP:GTR	0.38**	0.17			1.47***	0.17
CQA®:TR	-0.16	0.15			-0.66****	0.08
CQA®:CTR	0.22	0.20			1.16***	0.14
CQA®:GTR	0.14	0.14			1.30***	0.13
CQA®:CP	0.12	0.28			1.21***	0.25
CP:PT			0.11	0.13		
CQA®:PT			-0.25	0.16		
CQA®:CP			-0.05	0.14		
Less marbling:TR					-0.30***	0.07
Less marbling:CTR					0.53***	0.12
Less marbling:GTR					0.54***	0.11
Less marbling:CP					0.76***	0.17
Less marbling:CQA®					0.61***	0.08
Standard deviations (sd) of parameter distributions						
sdTR	0.66***	0.19			0.87***	0.07
sdPT			0.76***	0.16		
sdCTR	1.02***	0.24			1.62***	0.09
sdGTR	0.67***	0.19			1.56***	0.09

sdCP	0.85***	0.27	0.32	0.25	1.46***	0.07
sdCQA®	0.62***	0.16	0.38	0.29	0.99***	0.07
sdLess marbling					0.76***	0.11
Log likelihood	-1318.2		-846.1		-9979.1	
McFadden's R^2	0.23		0.21		0.29	
Sample size	194		122		1603	
Number of choice sets	8		8		8	

***, ** and * indicates significance at the 1%, 5% and 10% levels respectively. SE is standard error. TR - Uncertified traditionally raised pork, PT – Premium traditional pork, CTR – Canadian pork industry certified traditionally raised pork, GTR – government certified traditionally raised pork, CP - Canadian pork, CQA® - on farm food safety accreditation

Source: Data collected in choice experiments and surveys for the thesis

Table 3.10 Results on WTP for attributes from random parameters logit models with individual specific variables

	Female, mean age, child/children < 18 present in the household, mean education, mean eating frequency and **high trust**		Female, mean age, child/children < 18 present in the household, mean education, mean eating frequency, **high trust,** urban, not living in Quebec and income	Female, mean age, child/children < 18 present in the household, mean education, mean eating frequency and **low trust**		Female, mean age, child/children < 18 present in the household, mean education, mean eating frequency, **low trust,** urban, not living in Quebec and income
Attribute	Edmonton 2009	Edmonton 2011	Canada 2011	Edmonton 2009	Edmonton 2011	Canada 2011
TR	-1.22		2.35***	-0.93		1.17*
	(1.79)		(0.63)	(2.00)		(0.64)
PT		-0.0002			-0.97	
		(2.77)			(2.98)	
CTR	3.12		5.13***	2.86		3.56***
	(1.95)		(0.84)	(2.20)		(0.85)
GTR	2.75		5.99***	2.74		3.76***
	(1.77)		(0.80)	(2.02)		(0.81)
CP	3.88***	2.81	4.95***	5.30***	2.21	2.83***
	(1.53)	(2.44)	(0.71)	(1.78)	(2.58)	(0.74)
CQA®	1.32	7.43***	3.96***	1.47	3.88	3.16***
	(1.36)	(2.85)	(0.57)	(1.56)	(2.71)	(0.59)
Less marbling			0.17			-0.40
			(0.52)			(0.54)

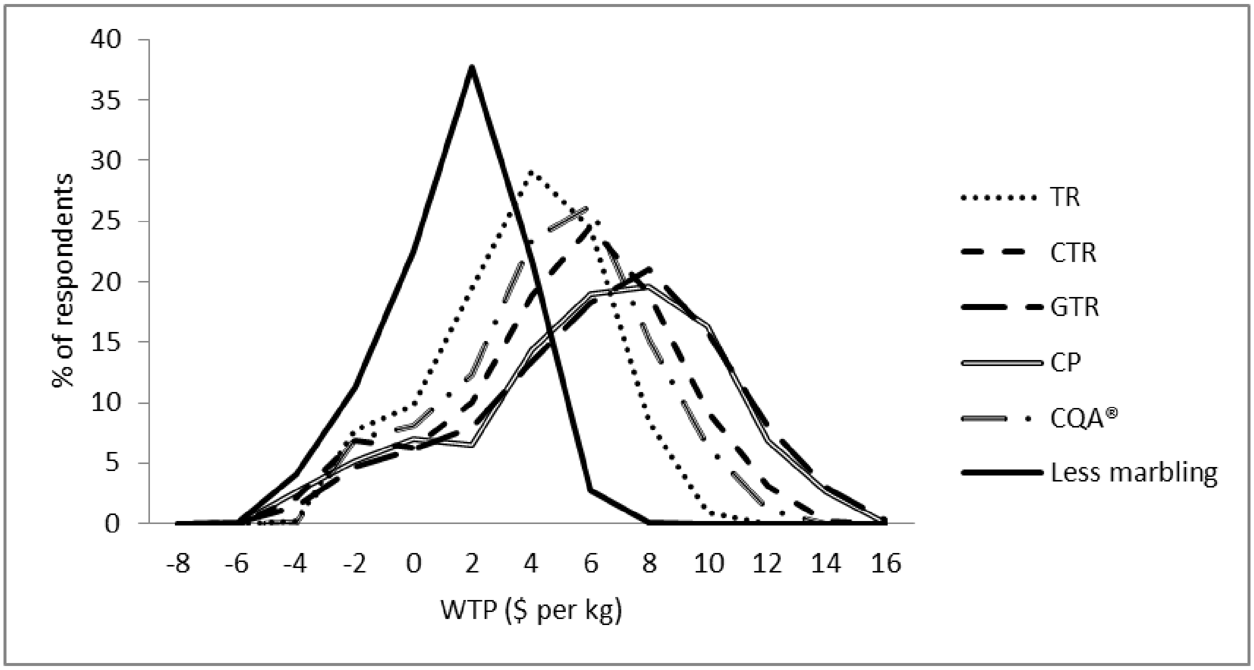
Standard errors are in parentheses. ***, ** and * indicates significance at the 1%, 5% and 10% levels respectively
TR - Uncertified traditionally raised pork, PT – Premium traditional pork, CTR – Canadian pork industry certified traditionally raised pork, GTR – government certified traditionally raised pork, CP - Canadian pork, CQA® - on farm food safety accreditation

Source: Data collected in choice experiments and surveys for the thesis

Respondents in the national sample who have high levels of trust are willing to pay a premium of $2.35 per kg for traditionally raised pork over conventional pork while those with low levels of trust are willing to pay $1.17 per kg. The amount that respondents are willing to pay for traditionally raised pork also increases when it has certification. WTP increases even more when traditionally raised pork is certified by the government as compared to traditionally raised pork that is not certified or that is certified by the Canadian pork industry and this result is robust between the conditional logit and random parameters logit models. Respondents with high levels of trust are also willing to pay a premium for Canadian Pork and pork with on farm food safety accreditation (relative to pork without these labels) as compared to respondents with low levels of trust in the national sample. Respondents with high levels of trust are willing to pay a premium of $4.95 per kg for pork with a Canadian Pork label while people with low levels of trust are willing to pay $2.83 per kg for the same pork chops. Lastly, respondents with high levels of trust are willing to pay $3.96 per kg for pork chops with on farm food safety accreditation while respondents with low levels of trust are willing to pay $3.16 per kg. WTP values for marbling from the random parameters logit are not significantly different from 0 for both the low and high trust clusters.

Although, the magnitude of the WTP estimates slightly varies between the conditional and random parameters logit, the results are mostly consistent between the two models in terms of the significance of WTP estimates (except for marbling in the national data and certified traditionally raised pork in the 2009 Edmonton data.

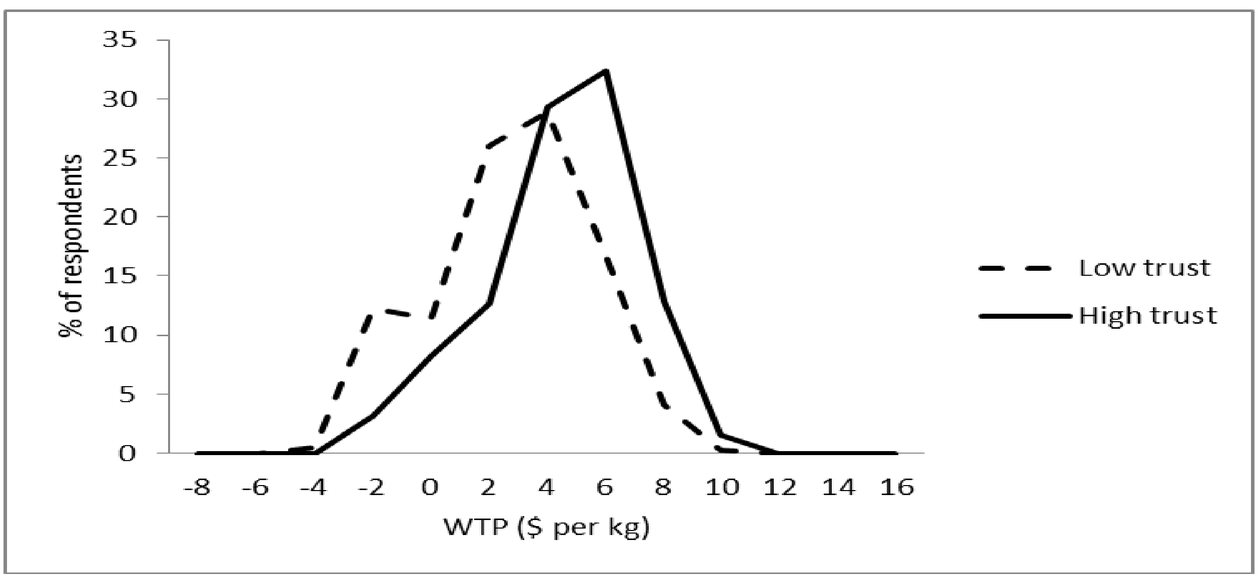
Individual's WTP for each attribute was calculated using coefficients from the random parameters logit model and actual values of individual specific variables for each respondent for the national data. Distributions of individual WTP values for each attribute for the whole sample and for the two trust groups are summarised in Figures 3.4 and 3.10 respectively.



TR - Uncertified traditionally raised pork, PT – Premium traditional pork, CTR – Canadian pork industry certified traditionally raised pork, GTR – government certified traditionally raised pork, CP- Canadian pork, CQA® - on farm food safety accreditation

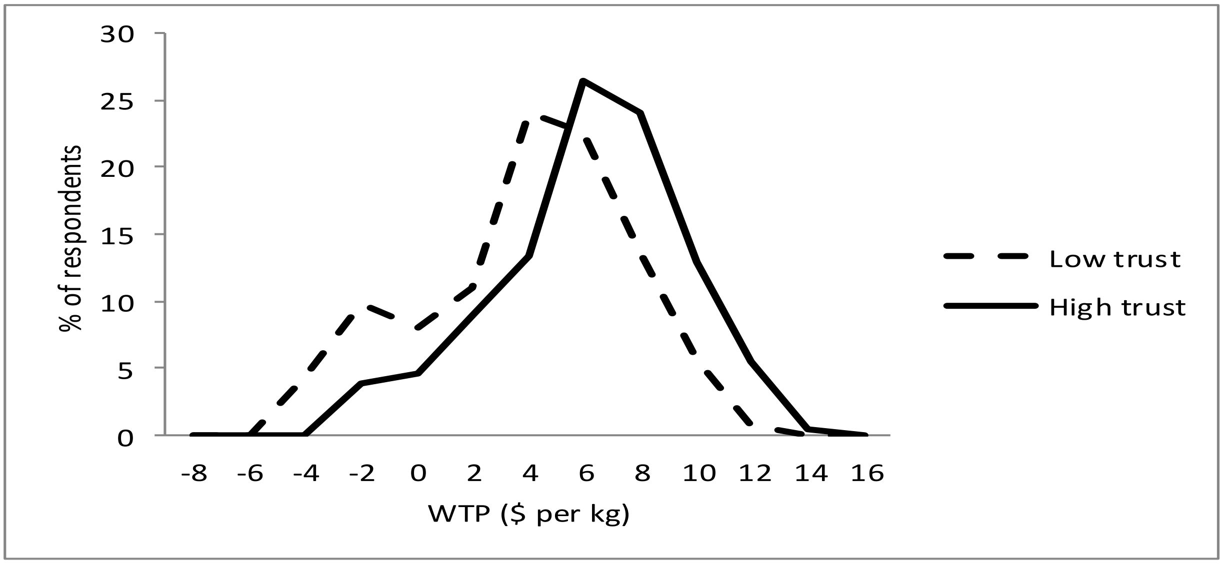
Source: Data collected in choice experiments and surveys for the thesis

Figure 3.4 Distribution of individual WTP for attributes, national sample



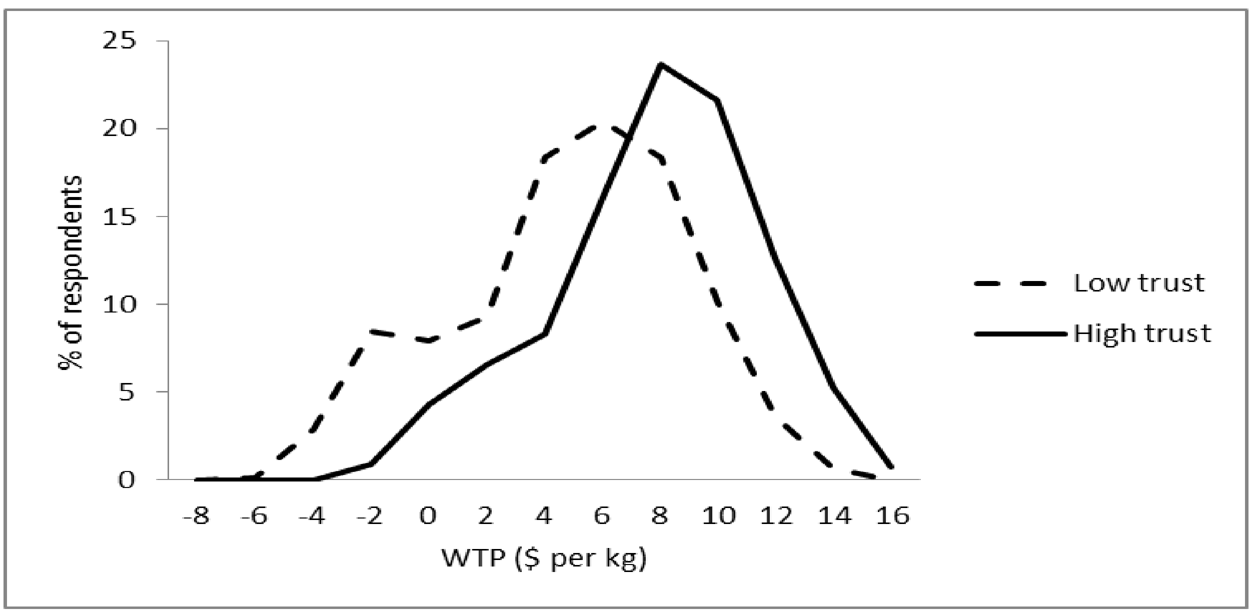
Source: Data collected in choice experiments and surveys for the thesis

Figure 3.5 Distribution of individual WTP for uncertified traditionally raised pork (TR), national sample



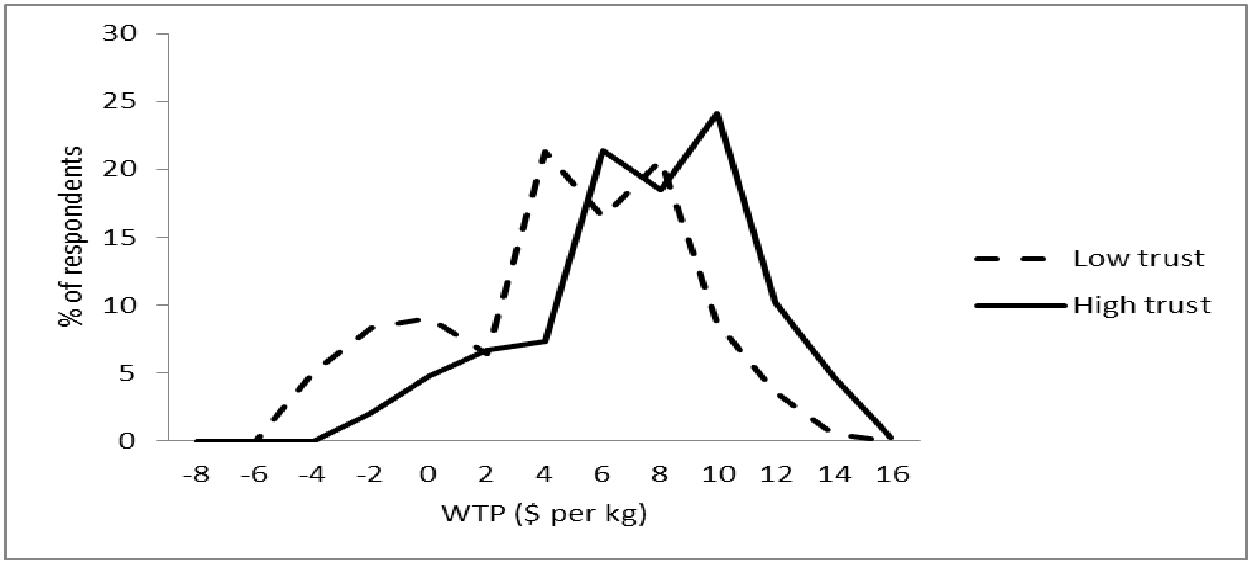
Source: Data collected in choice experiments and surveys for the thesis

Figure 3.6 Distribution of individual WTP for Canadian pork industry certified traditionally raised pork (CTR), national sample



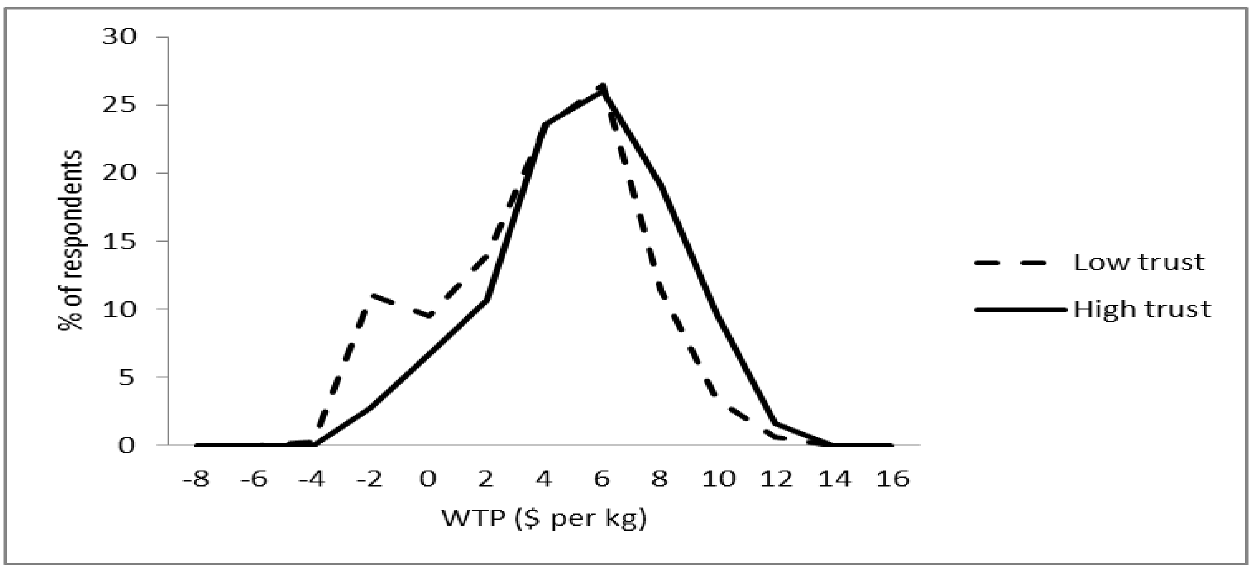
Source: Data collected in choice experiments and surveys for thesis

Figure 3.7 Distribution of individual WTP for government certified traditionally raised pork (GTR), national sample



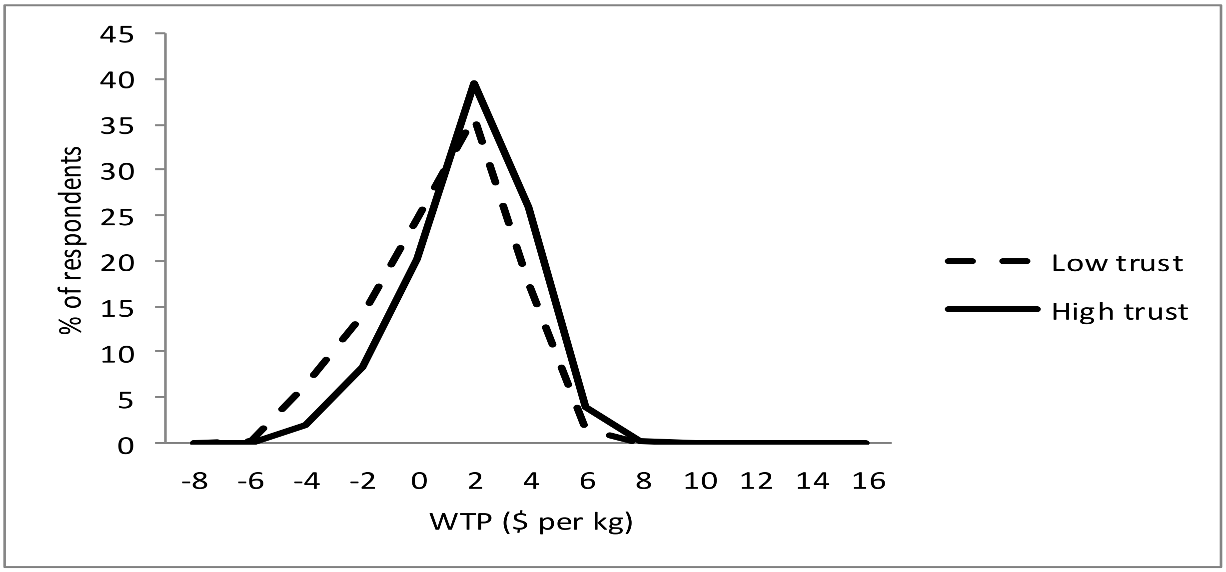
Source: Data collected in choice experiments and surveys for the thesis

Figure 3.8 Distribution of individual WTP for Canadian Pork (CP), national sample



Source: Data collected in choice experiments and surveys for the thesis

Figure 3.9 Distribution of individual WTP for CQA®, national sample



Source: Data collected in choice experiments and surveys for the thesis
Figure 3.10 Distribution of individual WTP for less marbling, national sample

Results also show that government certified traditionally raised pork and Canadian Pork are the attributes that are most preferred by respondents. Consumers have been shown to prefer government certified products in previous studies (e.g. Goddard et al., 2011; Goddard et al., 2013; Romanowska, 2009; Uzea, 2009). Marbling had the lowest WTP values as expected. Respondents with high levels of trust are willing to pay more for all attributes as compared to those respondents with low levels of trust (Figures 3.5 to 3.10).

3.5.3 Conditional logit models without individual specific variables

From the conditional logit model without individual characteristics (Table 3.11), participants are not willing to pay a premium for traditionally raised pork without certification relative to conventional pork in the 2009 Edmonton sample while the opposite is true for participants in the national sample where respondents are willing to pay a premium of $2.67 per kg of the pork chops. Willingness to pay for traditionally raised pork increases when there is certification especially by the government which is consistent with results from previous studies.

Table 3.11 Conditional logit model results without individual specific variables

	Edmonton 2009		Edmonton 2011		Canada 2011	
	Coefficient	Mean WTP ($/kg)	Coefficient	Mean WTP ($/kg)	Coefficient	Mean WTP ($/kg)
Price	-0.13***		-0.09***		-0.15***	
	(0.02)		(0.02)		(0.01)	
TR	-0.28***	-2.07***			0.39***	2.67***
	(0.11)	(0.85)			(0.04)	(0.28)
PT			0.03	0.32		
			(0.09)	(1.01)		
CTR	0.12	0.87			0.61***	4.14***
	(0.10)	(0.78)			(0.04)	(0.23)
GTR	0.31***	2.28***			0.81***	5.52***
	(0.11)	(0.86)			(0.04)	(0.33)
CP	0.30***	2.22***	0.26***	2.79**	0.74***	5.03***
	(0.07)	(0.60)	(0.09)	(1.14)	(0.03)	(0.25)
CQA®	0.27***	2.01***	0.36***	3.86***	0.46***	3.10***
	(0.07)	(0.58)	(0.09)	(1.26)	(0.03)	(0.22)
Less marbling					0.09***	0.63***
					(0.03)	(0.18)
Would not buy	-3.01***		-2.54***		-1.27***	
	(0.23)		(0.27)		(0.08)	
Log likelihood	-1371.86		-872.44		-12507.9	
McFadden's R^2	0.05		0.03		0.08	
Sample size	194		122		1603	
Number of choice sets	8		8		8	

Standard errors are in parentheses. ***, ** and * indicates significance at the 1%, 5% and 10% levels respectively
TR- Uncertified traditionally raised pork, PT – Premium traditional pork, CTR – Canadian pork industry certified traditionally raised pork, GTR – government certified traditionally raised pork, CP- Canadian pork, CQA® - on farm food safety accreditation

Source: Data collected in choice experiments for the thesis

In the 2009 Edmonton sample, willingness to pay for pork chops that had government certification is $2.28 per kg (relative to conventional pork). In the national sample, the premium that participants are willing to pay for government certified traditionally raised pork ($5.52 per kg) is higher than the amount they are willing to pay for traditional pork certified by the

Canadian pork industry ($4.14 per kg). In all three samples, participants are willing to pay a premium for the Canadian Pork label compared to pork that did not have this label and willingness to pay values ranged from $2.22 to $5.03 per kg. Participants in all the three samples are also willing to pay a premium for on farm food safety accreditation (CQA label ®) as compared to pork chops that were not labelled as such and willingness to pay values ranged from $2.01 to $3.86 per kg. Participants in the national sample are willing to pay more for pork with less marbling (WTP is $0.63 per kg) as compared to pork that had more marbling. Therefore, consumers' welfare increases when the natural attribute is certified. On farm food safety accreditation and the source of pork are also important for consumers of pork.

3.5.4 Random parameters logit models without individual specific variables

Results from random parameters logit models without individual characteristics are summarised in Table 3.12 and willingness to pay values are summarised in Table 3.13. Respondents are not willing to pay a premium for uncertified traditionally raised pork (relative to conventional pork) in the Edmonton (2009) sample. For the national sample, respondents are willing to pay a premium of $2.89 per kg for uncertified traditionally raised pork over conventional pork. The coefficient for uncertified traditionally raised pork is negative and significant for the Edmonton 2009 sample and positive and significant for the national sample. Respondents in the Edmonton sample like consuming pork such that they might be indifferent between traditionally raised and conventional pork. The national sample contains both consumers and non-consumers of pork, maybe that's why on average there is preference for natural pork over conventional pork. Willingness to pay values are high for government certified traditionally raised pork in the 2009 Edmonton and the national samples as compared to uncertified traditionally raised pork and traditionally raised pork certified by the Canadian pork industry. In all three samples, participants are willing to pay more for Canadian Pork and CQA® labels.

Table 3.12 Random parameters logit model without individual specific variables

	Edmonton 2009		Edmonton 2011		Canada 2011	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Random parameters in utility functions						
TR	-0.35***	0.13			0.55***	0.05
PT			0.05	0.13		
CTR	0.17	0.14			0.83***	0.07
GTR	0.35***	0.13			1.09***	0.07
CP	0.38***	0.11	0.32***	0.11	1.02***	0.06
CQA®	0.34***	0.10	0.43***	0.11	0.71***	0.05
Less marbling					0.10**	0.04
Nonrandom parameters in utility functions						
Price	-0.17***	0.02	-0.10***	0.02	-0.19***	0.01
Neither	-3.67***	0.27	-2.70***	0.29	-2.25**	0.10
Diagonal values in Cholesky matrix						
NsTR	0.69***	0.19			1.03***	0.07
NsCTR	0.45	0.30			0.20	0.14
NSGTR	0.17	0.18			0.82***	0.13
NsPT			0.86***	0.16		
NsCP	0.29	0.32	0.38*	0.22	0.59***	0.19
NsCQA®	0.59***	0.20	0.25	0.38	0.44***	0.09
NsLess marbling					0.19	0.12
Covariances of random parameters						
CTR:TR	-0.64***	0.18			-1.86***	0.13
GTR:TR	-0.43***	0.13			-1.62***	0.12
GTR:CTR	0.67***	0.26			2.75***	0.26
CP:TR	-0.31*	0.16			-1.07***	0.13
CP:CTR	0.34	0.21			1.97***	0.20
CP:GTR	0.35**	0.17			2.29***	0.21
CQA®:TR	-0.17	0.16			-0.96****	0.10
CQA®:CTR	0.24	0.23			1.73***	0.16
CQA®:GTR	0.14	0.16			1.82***	0.15
CQA®:CP	-0.002	0.41			1.61***	0.22
CP:PT			0.13	0.16		
CQA®:PT			0.27*	0.15		
CQA ®:CP			0.02	0.12		
Less marbling:TR					-0.45***	0.08
Less marbling:CTR					0.80***	0.12
Less marbling:GTR					0.54***	0.11
Less marbling:CP					0.37***	0.18
Less marbling:CQA®					0.31***	0.12
Standard deviations (sd) of parameter distributions						
sdTR	0.69***	0.19			1.03***	0.07
sdPT			0.86***	0.16		
sdCTR	1.03***	0.24			1.81***	0.10
sdGTR	0.68***	0.19			1.81***	0.13
sdCP	0.86***	0.27	0.41*	0.22	1.69***	0.21
sdCQA®	0.66***	0.15	0.44	0.27	1.21***	0.10
sdLess marbling					0.89***	0.07
Log likelihood	-1328.8		-859.2		-10178.1	
McFadden's R^2	0.22		0.20		0.28	

Sample size	194	122	1603
Number of choice sets	8	8	8

SE is standard error. ***, ** and * indicates significance at the 1%, 5% and 10% levels respectively
TR- Uncertified traditionally raised pork, PT – Premium traditional pork, CTR – Canadian pork industry certified traditionally raised pork, GTR – government certified traditionally raised pork, CP- Canadian pork , CQA® - on farm food safety accreditation
Source: Data collected in choice experiments for the thesis

Table 3.13 WTP results for attributes from random parameters logit model without individual specific variables

	Edmonton 2009	Edmonton 2011	Canada 2011
	Mean WTP ($/per kg)		
TR	-2.14***		2.89***
	(0.84)		(0.29)
PT		0.53	
		(1.29)	
	1.03		4.33***
CTR	(0.84)		(0.38)
	2.12***		5.65***
GTR	(0.82)		(0.40)
CP	2.28***	3.17***	5.33***
	(0.67)	(1.26)	(0.35)
CQA®	2.06***	4.29***	3.73***
	(0.62)	(1.35)	(0.27)
Less marbling			0.52**
			(0.22)

Standard errors are in parentheses. ***, ** and * indicates significance at the 1%, 5% and 10% levels respectively
TR- Uncertified traditionally raised pork, PT – Premium traditional pork, CTR – Canadian pork industry certified traditionally raised pork, GTR – government certified traditionally raised pork, CP- Canadian pork, CQA® - on farm food safety accreditation
Source: Data collected in choice experiments for the thesis

3.6 Consumers' perceptions about traditionally raised pork as compared to conventional pork

In order to try to understand whether there are differences in people's perceptions about conventional and traditional production methods, respondents were asked to compare pork from the two production systems in terms of taste, freshness, healthfulness, presence of hormones, presence of antibiotics and safety. Responses were anchored as follows: 0. not applicable/no opinion 1. strongly disagree 2. disagree 3. neutral/no difference 4. Agree 5. strongly agree. For all attributes, most respondents generally answered 'neutral or no difference'. The respondents who answered 'not applicable or no opinion' are removed from the sample and average responses are calculated for this question (Table 3.14). There are no significant differences between mean responses for high and low trust clusters for the attributes in the Edmonton samples. Since these respondents enjoy eating pork, respondents who have high levels of trust and those respondents who have low levels of trust might be indifferent between traditionally raised pork and conventional pork. For the national sample, respondents who have high trust perceived traditionally raised pork to be better than conventional pork in terms of taste, freshness, healthfulness, presence of hormones and antibiotics and safety as compared to those respondents in the low trust cluster.

Table 3.14 In comparisons to conventional pork, I believe that traditionally raised pork… (1. strongly disagree … 5. strongly agree)

	Edmonton 2009			Edmonton 2011			Canada 2011		
	Total sample	Low trust	High trust	Total sample	Low trust	High trust	Total sample	Low trust	High trust
	Average (standard deviation)								
tastes better	3.37 (0.83)	3.44 (0.77)	3.32 (0.86)	3.29 (0.81)	3.37 (0.77)	3.23 (0.84)	3.42 (0.94)	3.33 (0.96)	3.50[a] (0.90)
is fresher	3.22 (0.80)	3.33 (0.78)	3.14 (0.80)	3.21 (0.83)	3.29 (0.79)	3.15 (0.86)	3.32 (0.92)	3.25 (0.94)	3.40[a] (0.90)
Is healthier	3.40 (0.79)	3.48 (0.77)	3.36 (0.80)	3.15 (0.92)	3.20 (0.99)	3.11 (0.87)	3.40 (0.96)	3.33 (1.01)	3.48[a] (0.90)
Does not contain hormones	3.25 (0.94)	3.23 (1.00)	3.26 (0.92)	3.04 (1.00)	3.11 (0.99)	2.98 (1.01)	3.33 (1.02)	3.21 (1.06)	3.44[a] (0.96)
Does not contain antibiotics	3.24 (0.94)	3.25 (1.02)	3.22 (0.91)	3.02 (1.01)	3.03 (0.98)	3.02 (1.03)	3.31 (1.02)	3.22 (1.05)	3.40[a] (0.99)
Is safer to eat	3.36 (0.87)	3.44 (0.90)	3.31 (0.86)	3.12 (0.87)	3.26 (0.85)	3.02 (0.87)	3.36 (0.95)	3.28 (0.98)	3.44[a] (0.91)
Sample size	138	48	90	82	35	47	1348	676	672

[a] implies that the means are significantly different at 10% level of significance. There were 46 respondents in the Edmonton 2009 sample, 40 in the Edmonton sample and 255 in the national sample that answered 'don't know' to some or all questions in Table 3.14.

Source: Data collected in surveys for the thesis

3.6.1 Individual WTP for attributes by perceptions about traditionally raised pork as compared to conventional pork for the national sample

Respondents in the high and low trust clusters for the national sample are grouped based on their responses to the questions on whether traditionally raised pork tastes better, is fresher, is healthier, does not contain hormones or antibiotics and is safer to eat as compared to conventional pork.

Average individual's WTP is calculated for each attribute using results from random parameters logit models for the national data and results are summarised in Table 3.15. Welsh t-test results show that WTP values for different attributes are significantly different between respondents who have high levels of trust and those respondents with low levels trust and between people who agree and those who stated 'not applicable/no opinion', are neutral or disagree with the statements that traditionally raised pork tastes better, is fresher, is healthier, contains hormones, contains antibiotics and is safer to eat as compared to conventional pork.

Results show that respondents in the high trust cluster are willing to pay higher premiums for all attributes as compared to those respondents in the low trust cluster regardless of their perceptions about traditionally raised pork over conventional pork (in terms of taste, healthiness, freshness, safety and whether it contains hormones or antibiotics). Respondents who agree that traditionally raised pork tastes better, is fresher, is healthier, does not contain hormones or antibiotics and is safer to eat as compared to conventional pork are willing to pay higher premiums for all attributes as compared to respondents who state 'not applicable/no opinion', are neutral or disagree with the statements.

Table 3.15 Average individuals' WTP by perceptions about traditionally raised pork for the national sample

		TR		CTR		GTR		CP		CQA®		Less marbling	
	#	WTP	SD	WTP	SD	WTP	SD	WTP	SD	WTP	SD	WTP	SD
Low trust													
does not taste better	530	1.51	2.81	2.54	3.78	3.44	4.09	3.24	4.24	2.60	3.36	-0.27	2.31
taste better	278	2.32	2.51	3.61	3.32	4.62	3.65	4.39	3.69	3.50	2.93	0.36	2.08
is not fresher	566	1.61	2.82	2.65	3.78	3.56	4.12	3.36	4.25	2.69	3.36	-0.18	2.31
is fresher	242	2.22	2.49	3.51	3.31	4.51	3.58	4.28	3.62	3.43	2.88	0.24	2.08
is not healthier	513	1.56	2.83	2.59	3.80	3.49	4.10	3.31	4.26	2.67	3.37	-0.22	2.34
is healthier	295	2.20	2.53	3.47	3.35	4.46	3.70	4.20	3.72	3.33	2.95	0.23	2.06
contains hormones	548	1.62	2.79	2.66	3.76	3.56	4.05	3.39	4.20	2.70	3.32	-0.16	2.31
does not contain hormones	260	2.15	2.58	3.42	3.40	4.34	3.79	4.16	3.80	3.36	3.04	0.17	2.10
contains antibiotics	550	1.60	2.81	2.64	3.77	3.55	4.05	3.36	4.21	2.69	3.31	-0.19	2.34
does not contain antibiotics	258	2.19	2.54	3.48	3.36	4.48	3.77	4.22	3.77	3.38	3.04	0.24	2.02
is not safer to eat	549	1.62	2.79	2.67	3.75	3.59	4.07	3.40	4.21	2.74	3.36	-0.16	2.31
is safer to eat	259	2.15	2.60	3.41	3.41	4.39	3.75	4.13	3.79	3.28	2.96	0.17	2.10
High Trust													
does not taste better	471	3.11	2.56	4.71	3.39	6.37	3.68	6.01	3.78	3.96	3.01	0.61	2.17
taste better	324	3.90	2.27	5.78	3.13	7.53	3.36	7.23	3.35	4.91	2.74	1.17	1.90
is not fresher	521	3.20	2.56	4.83	3.40	6.49	3.69	6.11	3.76	4.04	3.01	0.66	2.13
fresher	274	3.87	2.24	5.74	3.11	7.52	3.31	7.25	3.33	4.93	2.71	1.18	1.88
is not healthier	471	3.18	2.52	4.28	3.35	6.46	3.66	6.08	3.76	4.04	3.02	0.66	2.10
is healthier	324	3.80	2.35	5.68	3.23	7.41	3.43	7.12	3.43	4.81	2.76	1.11	1.98
contains hormones	480	3.18	2.53	4.76	3.37	6.46	3.66	6.12	3.77	4.07	3.02	0.67	2.12
does not contain hormones	315	3.82	2.34	5.73	3.17	7.43	3.42	7.09	3.41	4.78	2.76	1.10	1.95
contains antibiotics	488	3.22	2.52	4.83	3.39	6.53	3.67	6.18	3.76	4.10	3.01	0.69	2.11
does not contain antibiotics	307	3.77	2.35	5.64	3.17	7.34	3.43	7.02	3.44	4.75	2.78	1.08	1.96
is not safer to eat	496	3.21	2.53	4.83	3.35	6.51	3.65	6.13	3.75	4.06	3.00	0.67	2.11
is safer to eat	299	3.81	2.32	5.66	3.23	7.41	3.43	7.12	3.42	4.82	2.77	1.12	1.96

SD is standard deviation, Welsh t tests show that all WTP values are significantly different (at ≤5%) between people who have high trust and those with low trust and between people who agree and who do not agree or have no opinion about whether traditionally raise pork tastes better, is fresher, is healthier, contains hormones, contains antibiotics and is safer to eat as compared to conventional pork

TR - Uncertified traditionally raised pork, PT – Premium traditional pork, CTR – Canadian pork industry certified traditionally raised pork, GTR – government certified traditionally raised pork, CP- Canadian pork, CQA® - on farm food safety accreditation

Source: Data collected in choice experiments and surveys for the thesis

3.6.2 Factors influencing consumers' perceptions about traditionally raised pork for the national data

Respondents who answered 'not applicable/no opinion' were removed from the sample in the analysis of the factors that influence perceptions about traditionally raised pork as compared to conventional pork. Principal component analysis is used to determine the principal factors for the questions on consumers' perceptions about traditionally raised pork over conventional pork for the national sample (Table 3.16).

Table 3.16 Principal component analysis results of perceptions about traditionally raised pork for the national sample

	Quality perceptions	Health and safety perceptions
taste better	0.81	0.43
is fresher	0.85	0.26
is healthier	0.91	0.12
does not contain hormones	0.84	-0.46
does not contain antibiotics	0.84	-0.45
is safer	0.89	0.10
Eigen values	4.41	0.69
Cronbach's alpha	0.93	
Sample size	1418	

Source: Data collected in surveys for the thesis

Two principal components are identified from the analysis labelled quality perceptions and health and safety perceptions. The Cronbach's α is above 0.90 which shows that there is good internal consistency. A log-linear regression model is estimated with the dependent variable being the weighted sum (using results for the first principal component) of responses to the six questions on consumers' perceptions about traditionally raised pork over conventional pork. The independent variables are gender, age, presence of children less than 18 years of age in the household, education, household income, whether or not the respondent lives in a rural area, whether or not the respondent lives in Quebec, frequency of consumption of pork and the dummy variable for cluster membership (1=high trust, 0=low trust).

Table 3.17 Factors influencing perceptions about traditionally raised pork

	Coefficient	SE
Constant	2.79***	0.08
Gender	0.01	0.02
Age	-0.0013**	0.006
Child	-0.02	0.02
Education	-0.002	0.01
Income	0.00001	0.0002
Rural	0.02	0.02
Quebec	-0.01	0.02
Frequency of eating pork	0.03***	0.01
High trust (base=low trust)	0.05***	0.02
R^2	0.02	
Log likelihood	-411.4	
Sample size	1418	

SE is standard error. ***, ** and * indicates significance at the 1%, 5% and 10% levels respectively

Source: Data collected in surveys for the thesis

Respondents who have high levels of trust perceive traditionally raised pork as being better than conventional pork in terms of taste, freshness, safety, healthfulness, not containing hormones or antibiotics as compared to those respondents who have lower levels of trust (Table 3.17). Respondents who consume pork more frequently also perceive traditionally raised pork to be better than conventional pork as compared to those respondents who consume pork less frequently. Younger respondents perceive traditionally raised pork as being better than conventional pork as compared to older respondents.

3.6.2 Comparison of premiums of pork chops in this research and those in the market

Premiums were calculated for conventional pork chops and pork chops with other attributes (e.g. pork that is free from antibiotics or hormones, 100% vegetarian fed, raised without ractopine, animal care certified, raised on Canadian farms) in local shops. Premiums of pork with such attributes over conventional pork ranged from \$0.66 to \$6.61 (see Table 3.18). The actual premiums in the retail markets are comparable to the ones obtained in this study. However, most of the attributes in the retail markets did not exist at the time the study was done but they are current data.

Table 3.18 Prices of pork chops in different shops

Date	Store	Description of attribute	Price of conventional chops ($/kg)	Price of pork chops with the attribute/s ($/kg)	Premium for pork chops with the attribute/s over conventional pork ($/kg)
2016 Jan	Superstore	Free from-no antibiotics, no hormones, vegetable or grain fed	10.98	13.88	2.9
	Superstore	Lethbridge heritage pork-grain fed	10.98	15.28	4.3
2016 Jan	TNT	Raised without ractopine and vegetable fed	8.8	14.75	5.95
	TNT	Antibiotic free	8.8	15.41	6.61
2016 Jan	Sobeys	Grainfield Natural meat co. no antibiotics no hormones animal care certified raised on Canadian farms 100% vegetarian fed	16.29	16.95	0.66

Source: Data collected in stores in Edmonton

3.7 Conclusions

In this study, the aim is to assess whether different levels of trust explain differences in consumer preferences for natural or traditionally raised pork. It is hypothesized that consumers who have lower levels of trust are willing to pay higher premiums for natural pork as compared to those consumers who have higher levels of trust. Data from choice experiments and surveys conducted in Edmonton in 2009 and 2011 and across Canada in 2011 are used in the conditional and random parameters logit models explaining the probability of purchasing pork with different attributes. K-means cluster analysis is used to group respondents into two clusters (i.e. low and high trust). A dummy variable on trust is included as an explicit variable in conditional and random parameters logit models explaining the probabilities that people prefer pork with attributes including traditional raised.

Results from the random parameters logit models which performed better than the conditional logit models show that respondents with high levels of trust are willing to pay a higher premium for the CQA label as compared to people who have low levels of trust for the 2011 Edmonton sample. Respondents in the 2009 Edmonton sample with low levels of trust are willing to pay a higher premium for Canadian Pork as compared to respondents with high levels of trust. Respondents in the national sample who have high levels of trust are willing to pay more for pork with the following attributes (traditionally raised, government certified traditionally raised, Canadian pork industry certified traditionally raised, Canadian pork and CQA®) as compared to respondents who have low levels of trust.

The results suggest different probabilities of purchasing pork with a credence attribute (traditionally raised) on the basis of trust which conforms to our theoretical framework. However, results generally contradict the hypothesis that consumers who have lower levels of trust might be willing to pay a higher premium for a natural attribute as compared to consumers who have high levels of trust. People with higher levels of trust might be willing to pay more for the labels because they believe in the authenticity of the information on the labels. Liu and Perrewe (2006) found positive relationships between perceived authenticity and trust. Compared to respondents who have high levels of trust, respondents who have low levels of trust are willing to pay less for the natural attribute maybe because natural is still a nebulous concept such that people with low levels of trust might be less willing to pay a higher premium as compared to people with high levels of trust. Nocella (2010) also found a positive relationship between trust and preference for animal friendly products.

Although high trusting consumers are willing to pay a higher premium for traditionally raised pork as compared to consumers with low levels of trust, both groups of consumers are willing to pay significant premiums for traditionally raised pork. Lack of trust might not be the main driver of consumers' demand for natural pork since both low trusting and high trusting consumers are willing to pay significant premiums for traditionally raised pork over conventional pork. There might be other beliefs that are also driving people's preferences for natural pork, maybe health concerns or taste. In the current study respondents who perceived traditionally raised pork to be better than conventional pork in terms of taste, freshness, safety, health and not containing hormones and antibiotics are willing to pay significant higher premiums as compared to those respondents who perceived otherwise. Ma (2012) found that individuals who perceived traditionally raised pork to be safer and healthier than conventional pork were willing to pay higher premiums for traditionally raised pork as compared to conventional pork. Those individuals who did not perceive traditionally raised pork to be safer or healthier than conventional pork were willing to pay a higher premium for conventional pork with other attributes than traditionally raised pork (Ma, 2012). Compared to respondents who have low levels of trust, respondents who have high levels of trust rated traditionally raised pork more positively in terms of taste, freshness, safety, health and not containing hormones and antibiotics.

Using the survey data trust was also examined as a determinant of the individual's attitudes towards traditionally raised pork. A number of different attitude statements were collapsed into one factor using principal component analysis and a regression was estimated to explain that factor with demographic, pork purchase and trust variables. There was a statistically significant link between high trust cluster membership and higher attitudes towards the quality of pork from traditionally raised systems. In this way trust influences both attitudes and behavioural intention for pork with this particular credence attribute.

Open communication, transparency and honesty (Hobbs and Goddard, 2015) might enhance trust in the food industry. Certification of the natural attribute by the government is important for both consumers with high and low levels of trust.. In conclusion, trust is an important determinant of consumers' preferences for product attributes.

In this study, generalized trust in people and trust in the food industry regarding the safety of food is analysed. In the future, there might be need to assess consumers' trust in the natural attribute and link it to consumers' preference for the natural attribute and see whether results change. Although results show that there is potential for natural pork, it is important to assess whether consumers' willingness to pay offset the increased production costs for natural pork.

In the current analysis trust is included as a dummy variable in the conditional and random parameters logit models. Estimating separate models for different groups with different levels of trust allow all parameters for variables in the models including the demographic variable interactions to vary across groups. In the future, there might be a need to assess consumers' trust in other characteristics that could influence preference for natural such as trust in animal welfare and link it to consumers' preference for the natural attribute and see whether results change. Trust variables could also be included explicitly rather than the cluster membership. However in this analysis we have 25 variables, that is why we collapsed the trust information using cluster analysis.

3.8 References

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4. TRUST AND HUMAN HEALTH RISK PERCEPTIONS ABOUT BOVINE SPONGIFORM ENCEPHALOPATHY AND CHRONIC WASTING DISEASE

4.0 Introduction

Transmissible spongiform encephalopathies (TSEs) or prion diseases have affected animals in a number of countries. Bovine spongiform encephalopathy (BSE) in cattle and chronic wasting disease (CWD) in elk, white-tailed deer and mule deer are examples of such TSEs. There have been 20 cases of BSE in Canadian born cattle (that is 19 cases in Canada and 1 case in the United States (U.S.) (Canadian Food Inspection Agency, 2016a), 3 domestic cases in the U.S. and 36 cases in Japan as of February, 2016 (World Organisation for Animal Health, 2016). There have been 77 domestic cervid herds in Canada that have been confirmed to be infected with CWD and subsequently depopulated as of February 2016 (Canadian Food Inspection Agency, 2016b). CWD has been detected in free ranging cervids in two provinces (Saskatchewan and Alberta) in Canada (Canadian Food Inspection Agency, 2016c) and in 20 states in the U.S. (Centers for Disease Control and Prevention, 2015).

Results from previous studies have shown that BSE affected demand for beef in Canada (Yang and Goddard, 2011c; Ding et al., 2011; Pritchett et al., 2007; Wang et al., 2011) and created trade barriers (CWD, Kahn et al. 2004 and BSE, Le Roy and Klein, 2005). Directly (consumer behaviour) or indirectly (trade barriers), responses to animal disease likely arise through risk perceptions and the outcomes affect the welfare of both consumers and producers. These effects may be even more profound where there are significant differences between subjective and technical risk assessments (Yeung and Morris, 2001). The focus in this paper is on assessing the factors affecting human health risk perceptions about BSE and CWD, outside

Europe where much of the previous analytical research has been carried out.

Trust has been shown to be one of the factors that influences consumers' perceptions about the animal disease risks (e.g. Needham and Vaske, 2008 (CWD), Setbon et al., 2005 (BSE), Muringai et al., 2011 (BSE) and Muringai and Goddard, 2011 (BSE)). However, there are still limited studies that assess the effect of different types of trust (generalized trust and institutional trust) and the different dimensions of trust in institutions on human health concerns about animal diseases which is the focus of this research. In this study, the following research questions are addressed (1) Does consumer trust significantly ameliorate human health risk perceptions about BSE and CWD? (2) Are there differences between human health risk perceptions about BSE or CWD as compared to other food safety incidents such as *Listeria*, *Salmonella*, *E. coli* among others? The second research question will show the relative ranking of BSE in relation to other food safety issues. (3) Are there cross country differences in terms of consumer concerns about BSE and CWD? It is hypothesized that trust (both general and agent specific trust about food safety) is negatively related to consumers' human health risk perceptions about BSE and CWD. In this study we are trying to answer the above questions using data from surveys conducted in Canada (in 2009 and 2010), the U.S. (two surveys in 2010) and Japan (in 2009).

Beef is more commonly eaten than venison (and venison can be more easily eaten as a result of hunting rather than purchase) in North America so human health risk perceptions about beef and venison might arise from different factors regardless of similarities between the causes of the animal diseases, BSE and CWD. A multiple product comparison might help identify if there is a direct link between any animal disease and risk perceptions about derived consumer ready particular products. Undertaking the comparison may help show whether the links between the presence of an animal disease and risk perceptions is related to familiarity or frequency of consumption of the product, across the different sampled populations. In reality, there is no necessity for either BSE or CWD to impact on human health (BSE as long as specified risk material controls are in place should not affect human health and to date there is no established link between consumption of meat from cervid animals with CWD and human health) and media coverage (government or industry releases around the outbreaks of the diseases) has reiterated that fact. Whether the public believes or disbelieves this publicly available information may be reflected in people's risk perceptions and intended behaviours. If the public trust particular agents who may be sources of information, they will trust the information about risks provided to them by the information sources (Slovic, 1999; Hansen et al., 2003). Distrust in particular agents might lead the public to think that the information source distorts the information, for example (Hansen et al., 2003). Trust or distrust in various agents may be part of the reason for an individual's risk perceptions in the face of public information about the lack of risk.

The research is focused on behaviour of individuals in the face of two specific animal disease occurrences across time. Reactions to animal disease outbreaks could affect livelihoods, trade and human health. Knowledge of whether people are aware of BSE and CWD and how they assess the possible disease impacts as they relate to meat could help predict changes in meat consumption behaviour. These responses may impact on health (e.g. people stopping eating either meat, including venison in rural areas, may have reduced protein or iron in their diet) and on markets. All other things equal and given that BSE (with specified risk material policies in place) and CWD might pose little to no risk to humans, do trusting or non-trusting consumers respond more or less to certain animal diseases affecting market level consumption and prices?

Understanding consumer human health risk perceptions about BSE and CWD and the factors that drive them is important in uncovering whether or not patterns exist in population responses, should patterns exist then prediction of responses to similar future animal disease incidents could be simpler if risk perceptions are known, regardless of product. Understanding what reactions might occur and which individuals might react in different ways might also assist in public or private risk communication. Information on the link between BSE/CWD and human health risk perceptions about beef and venison and the socioeconomic factors that significantly influence such linkages might assist in policy making (role of government in management of animal diseases) and in the formulation of public and private risk management strategies. The comparison of animal disease effects on meat risk perceptions across countries is important because of the increasing importance of international trade, international trade restrictions arising from animal diseases and potential differences in national demands for regulation in response to animal diseases. Countries with consumers who have higher concerns about animal diseases and lower levels of trust (in general or in food industry agents) might find it more difficult politically to lower trade barriers in the face of animal disease presence in export partners. Under those circumstances exporters may wish to provide exhaustive transparency, traceability and product quality assurances, in different ways than for other consumers with higher trust levels.

4.1 Theoretical framework

Risk is technically defined as 'a combination of the probability or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence' (Royal Society, 1992, p. 4). Risk perceptions refer to 'intuitive risk judgements' (Slovic, 1987, p. 280) and in some studies risk perceptions are defined as the 'likelihood of one's exposure to the content of the risk' (Kalogeras et al., 2012, p. 59). In this study, the definition posed by Slovic (1987) that risk perceptions are 'intuitive risk judgements' is used in the context of human health concerns about beef and venison in the face of animal diseases (BSE and CWD). The definition of trust by Rousseau et al. (1998, p. 395) i.e. trust is '… a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another' is used in this study.

In the case of food issues, consumers might feel vulnerable to the actions of agents that are involved in ensuring food safety, for example, the government, farmers, retailers and food manufacturers. Trust could affect consumer's risk perceptions about consuming the affected meat (e.g. beef in the case of BSE or cervid meat in the case of CWD) and ultimately consumption of the meat products. In addition, consumers might have increased risk perceptions about exposure to affected animals which might make them choose other forms of protective measures e.g. hunters might choose not to hunt in CWD infected areas (Figure 4.1).

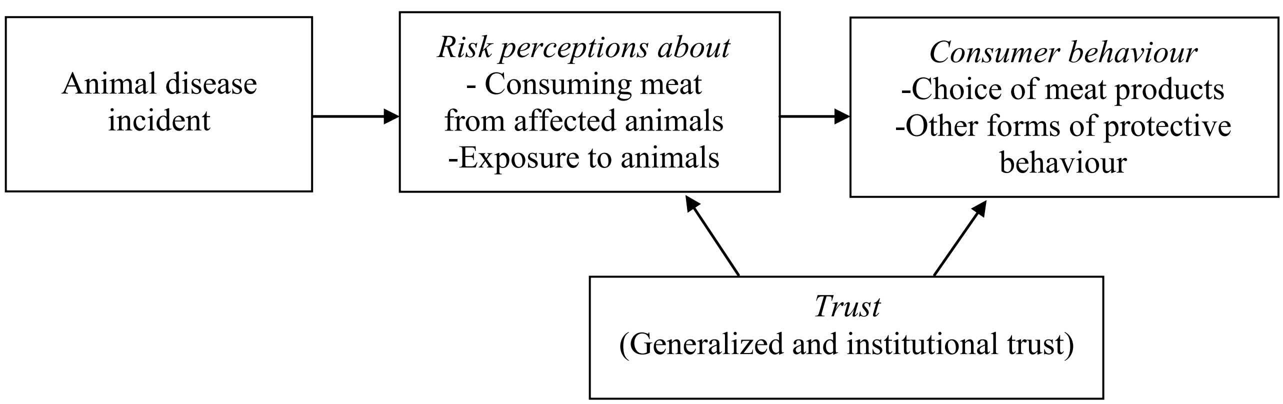


Figure 4.1 Relationship between trust, risk perceptions and consumer behaviour.

In the case of CWD, consumers might also be concerned about the effects of the disease on wildlife directly and indirectly on other animals that live in the same environment, even domestic animals that come in contact with wild animals. Consumers might also stop consuming meat imported from affected regions or countries.

In this study, the focus is not on analysing consumer behaviour, but on identifying the determinants of animal disease risk perceptions since they have been shown to affect consumption of meat products (Yang and Goddard, 2011a, Wang et al., 2011 and Myae, 2015). The main hypothesis is that trust (both general and agent specific trust about food safety) is negatively related to consumers' human health concerns about BSE and CWD.

The expected utility framework describes consumer's value of risky outcomes (Varian, 2010 and Eom, 1994). In the case of food risks, given that there is a probability of an adverse health event (π), it is assumed that there can be two states of outcome i.e. occurrence or non-occurrence of an adverse event which are associated with the following probabilities π and $1-\pi$. Assuming that the food risk affects product x, while z is a composite good, the state dependent utility function is specified as follows: $U_i(x,z)$ where i represent occurrence (1) or non-occurrence (2) of the adverse health event. According to Eom (1994, p. 761), given that π is the probability of the adverse health event, y is income and p is the relative price, the expected state dependent utility maximization problem is represented as follows:

$$\max_{X,Z} EU = \pi U_1(x,z) + (1-\pi)U_2(x,z) \text{ subject to } y = px + z \qquad (1)$$

Solving the above utility maximization problem, yields the following optimal demand

$$x^* = (p, y) \qquad (2)$$

The state dependent indirect utility function is

$$EV(p,\pi,Y) = \pi V_c(y,p) + (1-\pi)V_{nc}(y,p) \qquad (3)$$

In this study, it is assumed that in the case of a food safety event trusting consumers might derive greater utility from consuming the product as compared to non-trusting consumers during a perceived food safety event. This effect is represented by $U_i(tx, z)$ with t representing trust. The utility maximization process above, is therefore changed to:

$$\max_{X,Z} \ E(U) = \pi U_1(tx, z) + (1-\pi)U_2(tx, z) \ \text{subject to} \ y = px + z \tag{4}$$

Quantities of the meat demanded result as follows: $x^* = (p, y, t)$ (5)

In the expected utility framework specified above, the individual is assumed to know and understand the technical level of risk (π) (Viscusi, 1989). However, this assumption has been criticized in the literature because differences between judgements of risks by experts and the public have been identified (Slovic et al., 1985). Viscusi (1989) developed prospective reference theory using a Bayesian updating framework to incorporate risk perceptions into the expected utility framework. In this case, risk perceptions are updated by consumers when they get new information (Viscusi, 1989). Risk perceptions are therefore conceptualised following previous studies (e.g. Viscusi, 1991, Tonsor et al., 2009, Liu et al., 1998 and Eom, 1994).

In the Bayesian updating framework, current risk perceptions are assumed to be a weighted average of prior perceived risk, direct or indirect experiences and information communicated to the person by different sources (Viscusi, 1991). Let π_a be prior perceived risk, π_b be risk perception based on direct or indirect personal experiences, π_c be the risk information communicated to the individual by different sources and α, θ and γ be weights which represents the fractions of informational content associated with prior risk perceptions, experiences and new risk information respectively. Current risk perceptions (π) are therefore represented as follows:

$$\pi = \alpha\pi_a + \theta\pi_b + \gamma\pi_c \tag{6}$$

Consumers might get information about the risk of BSE and CWD from public sources such as the media, government and food industry. If people trust the agent providing the information, they will trust the risk information provided to them by these sources of information

(Slovic, 1999, Hansen et al., 2003). Therefore, risk perceptions about animal diseases that are based on information on the existence of an incident or outbreak of the disease about animal diseases (π_c) could be influenced by consumers' generalized trust in people and trust in agents that are responsible for managing and communicating risks about animal diseases.

In this study, some of the food agents are not responsible for communicating information about animal diseases but they may just be the first available contact for the public in an outbreak of the disease. In cases where the animal disease information states that there are no risks associated with an animal disease, some consumers might still be concerned about the disease because they do not trust the source of information. Those consumers' who trust might have lower risk perceptions even if the information states that there is a risk because they trust the source of information to take care of any potential problems.

Since human health risk perceptions in the current study are measured only for one period for BSE in Japan and for CWD in Canada and the U.S., and since the surveys in Canada and the U.S. (for BSE) were not targeted to the same people, there is no information on prior risk perceptions. Therefore, risk perceptions in this study are assumed to be influenced by experiences, generalized trust in people and trust in food agents regarding the safety of food and these variables are included in empirical models. There are other approaches that could have been used to analyse risk perceptions besides the one followed in this research e.g. social construction analysis (McRoberts et al., 2011).

4.2 Literature review

Different theories have been developed in order to explain differences in risk perceptions. In the expected utility theory which, utility depends on probabilities of risk and the levels of consumption (Varian, 2010) and risk is an objective probability and individuals are assumed to know the technical risk (Eom, 1994). In prospect theory (Kahneman and Tversky, 1979), it was shown that changes in reference points influenced outcomes of risky decisions and individuals are risk averse in situations where there are gains and risk seeking when there are losses. Tversky and Kahneman (1974) state that people use heuristics (rules of thumb) in making decisions and these heuristics can lead to errors in judgements. In the psychometric paradigm (Fischhoff et al., 1978; Slovic et al., 1984; Slovic, 1987; Slovic et al., 2004) the focus is on the impact of affect/emotion and stigma on risk perceptions. In psychometric studies, individuals are asked to judge the characteristics of risks in terms of their attributes e.g. for example, familiarity, voluntariness, dread, knowledge and whether the risk could be controlled (Slovic et al., 1984; Boholm, 1998). In cultural theory, the aim is to understand the interpretation of risk by societal groups and how they trust or distrust institutions that create or regulate risks (Douglas and Widalvsky, 1982). In cultural theory, risks are constructed socially and politically (Glendon et al., 2006). In the social amplification of risk framework, risk perceptions are assumed to be amplified or attenuated through information transfer (Kasperson et al., 1988). In this analysis we follow the expected utility framework since we are focusing on consumers' risk perceptions about animal diseases in relation to food consumption.

Current risk perceptions could be measured using different methods, for example, in some studies (Setbon et al., 2005; Viscusi, 1991; Zinner, 2013) respondents are asked about the probability of contracting certain diseases (Table C1 in appendix C). Yang and Goddard (2011c) constructed risk perceptions about BSE from market level data. In other studies, the psychometric approach is used (Fife-Schaw and Rowe, 1996; Slovic et al., 1982; Fischhoff et al., 1978; Kirk et al., 2002; Sparks and Shephard, 1994) while in other studies respondents are asked to rate perceived risks of different issues on Likert scales (e.g. Krewski et al., 2006; Viklund, 2003; Poortinga and Pidgeon, 2005; Siegrist et al., 2005, 2007; Dosman et al., 2001; Eiser et al., 2002; Allum, 2007, Flynn et al., 1994; Sjöberg, 1999; Lemyre et al., 2006; Nigatu et al., 2014). In a number of statements are used in the assessment of risks of consuming meat products (Pennings et al., 2002; Schroeder et al., 2007;Tonsor et al., 2009; Myae, 2015; Yang and Goddard, 2011a, b; Muringai and Goddard, 2011). In other studies, social construction analysis of risk is conducted in different contexts (e.g. Conroy et al., 2013; Austen, 2009).

Risk perceptions are influenced by psychological, social, cultural and political characteristics (Slovic, 1999). In previous studies, factors such as seriousness of the hazard, personal experience, media, demographic factors and trust are important factors that influence risk perceptions about food risks. Gender was found to influence risk perceptions with females generally having higher human health risk perceptions as compared to males (Flynn et al., 1994; Finucane et al., 2000; Dosman et al., 2001; Tonsor et al., 2009; Brug et al., 2004; de Zwart et al., 2007; Davidson and Freudenburg, 1996; Knight and Warland, 2005; Viscusi, 1991; Muringai and Goddard, 2011; Muringai et al., 2011; Krewski et al., 2006). Older respondents were found to have higher risk perceptions as compared to younger respondents (e.g. Dosman et al., 2001; Knight and Warland, 2005; Muringai and Goddard, 2011; Krewski et al., 2006). More educated individuals were found to be less concerned about human health risks in different contexts as compared to less educated respondents (Dosman et al., 2001; Krewski et al., 2006). The presence of young children in the household was also found to influence risk perceptions (Dosman et al., 2001; Knight and Warland, 2005). Media coverage of risks (Wahlberg and Sjöberg, 2000; Yang and Goddard, 2011c) and framing of the problem (Sitkin and Weingart, 1995) has also been shown to influence risk perceptions. de Jonge et al. (2008a) found that respondents who tend to worry were less optimistic and more pessimistic about food safety. In this analysis, we assess the effects of gender, age and education, presence of children in the household and worry trait on human health risk perceptions about BSE and CWD.

In terms of animal disease concerns, Lemyer et al. (2009) assessed risk perceptions about BSE and CWD and compared them to other food safety risks in Canada. Respondents were mostly concerned about growth hormones, mercury in fish, pesticides, food additives and antibiotics used in livestock. BSE and CWD were not perceived as serious risks by respondents. Respondents were also asked about the risk of BSE to their health, the health of Canadians in general, Canadian economy and international relations of Canada. Respondents perceived the risk of BSE to Canadians in general to be higher than the risks to their own health and BSE was perceived as an important social, economic, foreign trade and political issue.

Myae (2015) analysed the effect of risk perceptions and attitudes about consuming venison, media coverage of BSE and CWD on consumer purchases of meat products. Media coverage of CWD led to shifts in consumption from venison, bison, pork and chicken to beef. Media coverage of BSE led to a shift in consumers' consumption from beef to venison, bison, chicken and turkey. Risk perceptions and risk attitudes about consuming venison significantly influenced expenditures on meat.

Muringai et al. (2011) analysed consumers' knowledge and human health risk perceptions about BSE and the effects of human health risk perceptions on consumers' agreement to pay for BSE tested beef. Results showed that knowledge of BSE significantly influenced human health concerns about BSE in Canada (negatively), U.S. (negatively) and Japan (positively). In this study generalized trust in people was included in the analysis of the factors that influence BSE risk perceptions while in this study we include both generalized trust and trust in food agents. Consumers' human health concerns about BSE positively influenced agreement to pay a premium for BSE-tested beef in Canada and the U.S. Muringai and Goddard (2011) found that consumers' who had high risk perceptions about consuming beef had a higher self-reported reduction in their consumption of beef due to BSE in Canada and Japan.

Yang and Goddard (2011c) found that information about BSE in the media influenced consumer's BSE risk perceptions. Yang and Goddard (2011a) found that media coverage of BSE influenced beef demand but the response was different across consumer groups classified according to their perceptions and attitudes towards risks about consuming beef. Yang and Goddard (2011b) found that risk perceptions about consuming beef significantly influenced expenditure on beef but the effect was weaker as compared to risk attitudes.

Zimmer et al. (2011) analysed hunter perceptions and behaviour in response to CWD in Alberta, Canada. In summary, results suggested that most hunters did not significantly change their behaviour due to CWD levels in terms of consumption of deer meat, the species which they hunted and hunting sites. Forty eight percent and thirty-two percent of respondents stated that CWD is a threat to the health of animals and humans respectively (Zimmer et al., 2011). Zimmer et al. (2012) found that increased levels of CWD negatively affected hunters. Truong (2013) found that urban hunters were less likely to visit areas with prevalence of CWD while rural hunters were more likely to visit areas affected by the disease.

Miller and Shelby (2009) assessed hunters' concerns about CWD as compared to other diseases such as BSE, Lyme disease, *E. coli*, *Salmonella* and the West Nile virus in the U.S. Hunters were more concerned about Lyme disease and West Nile virus as compared to BSE, CWD, *E. coli* and *Salmonella*. Twenty percent and 36% of the respondents stated that there was no risk of being infected with CWD and BSE respectively. Veeman and Li (2007) compared risk perceptions about BSE and other food issues in Canada between two periods and found that the perceived risk of BSE was lower in 2005 than in 2003, perhaps due to effective communication about the disease.

In summary, there are different theories that are used to explain differences in people's risk perceptions. Differences in demographic variables (gender, education, age and presence of young children in the household) could also influence risk perceptions.

4.2.1 Trust and its impact on risk perceptions

Trust have been found to influence risk perceptions about nuclear power (e.g. Viklund, 2003), biotechnology (e.g. Siegrist, 2000), environmental health risks (Flynn et al., 1994), animal disease outbreaks (e.g. Muringai and Goddard, 2011; Muringai et al., 2011) consumption of meat products (Tonsor et al., 2009; Lobb et al., 2007; Wang et al., 2011) and confidence in food products (de Jonge et al., 2008a). Trust can be examined, for example, at a generalized level i.e. trust in most people (General Social Survey question) (Glaeser et al., 2000; Siegrist et al., 2005) or at an institutional level in different contexts (e.g. Roosen et al., 2015; de Jonge et al., 2008a, Allum, 2007; Poortinga and Pidgeon, 2003; Metlay, 1999; Peters et al., 1997; Renn and Levine, 1991). Trust has been shown to simplify the decision making process in situations where there is risk and uncertainty (Lewis and Weigert, 1985; Earle, 2010) i.e. it can operate as a social decision heuristic (Kramer, 1999). Trust has also been shown to be important in risk communication and management (Slovic, 1999). Trust and distrust have also been analysed in the context of safety (e.g. Conchie and Donald, 2008) and security (e.g. Flavián and Guinalíu, 2006; Shin, 2010).

There are two main forms of trust that are identified in the literature i.e. cognition-based trust (calculative trust) and affect-based trust (relational trust) (Earle, 2010; McAllister, 1995; Lewis and Weigert, 1985). Cognition-based trust is grounded on whether the individual perceives the peer as being competent, while affect-based trust is based on perceptions about whether individuals care or have concern for each other (McAllister, 1995). There are still debates about what makes people trust or distrust other individuals or institutions i.e. dimensions of trust (Earle, 2010; Poortinga and Pidgeon, 2003). For example, Renn and Levine (1991) found five dimensions of trust which are competence, objectivity, fairness, consistency and faith. Kasperson et al. (1992) identified four dimensions of trust which are commitment, competence, caring and predictability. Some authors found that trust is made up of two main dimensions i.e. socio-relational (affect-based trust or commitment) and ability (cognition-based trust or competence) factors (Metlay, 1999; de Jonge et al., 2008a; Earle, 2010; McAllister, 1995; Lewis and Weigert, 1985). Poortinga and Pidgeon (2003) found two dimensions of trust i.e. general trust (competence, care, fairness and openness) and scepticism. Similarity of values and intentions has also been shown to influence trustworthiness (Earle and Cvetkovich, 1995).

Wang et al. (2011) assessed the effect of generalized trust in people, trust in the government, food manufactures, scientists, consumer organisations and media sources on consumers' response to BSE in different provinces in Canada using negative binomial regressions. In summary, results generally show that trust influences consumers' purchases of beef in the case of BSE incidents. Participants who perceived that BSE is an important risk to their family purchased fewer units of beef after BSE incidents in Alberta and Ontario.

Using a bivariate Tobit model, Tonsor et al. (2009) examined the factors that influence beef risk perceptions in Canada, U.S. and Japan. In summary, results showed that trust in doctors, researchers and a consumer group and trust in industry, grocer and government as sources of food safety information ameliorated risk perceptions about consuming beef.

Needham and Vaske (2008) analysed the effect of hunters' trust in wildlife agencies on risk perceptions about CWD in the U.S using confirmatory factor analysis. In summary, results showed that hunters were concerned about CWD in terms of getting ill from consuming meat infected by the disease. Value similarity significantly influenced hunters' trust in wildlife agencies. There was a negative relationship between trust in wildlife agencies and risk perceptions about CWD.

Setbon et al. (2005) assessed the factors that influenced perceived risk of BSE/vCJD in France using bivariate correlation analysis and multivariate analysis. Results from the multivariate analysis showed that social trust in public authorities was negatively related to anticipatory risk assessments and people's worry about BSE in both surveys.

Using a structural equation model, Chen (2013) assessed the relationships between generalized trust in people, trust in the government, trust in food manufacturers, trust in farmers, trust in retailers, trust in consumer association and food safety perceptions. In summary, results showed that trust in food manufacturers and retailers significantly positively influenced food safety risk perceptions. Industry specific trust (trust in the government and consumer association) is related to supplier-level specific trust (trust in food manufacturers, farmers and retailers).

Although results vary in some studies, trust has been generally shown to ameliorate risk perceptions. This study extends the literature on the effects of trust on consumer's risk perceptions and behaviour by focusing on the effects of consumers' generalized trust in people and dimensions of trust in the food industry on their human health risk perceptions about two animal diseases (BSE in Canada, the U.S. and Japan and CWD in Canada and the U.S.).

4.3 Empirical methods

The empirical models are represented as follows:

$$RP_i = \alpha_{0i} + \alpha_{2i}\mathbf{x} + \alpha_{1i}\mathbf{t}_{ji} + \alpha_{3i}\mathbf{d}_i + \varepsilon_i \tag{4.7}$$

where *RP* represents human health risk perceptions for either BSE or CWD for respondent *i*. Whether or not an individual consumes beef in the case of BSE and cervid meat in the case of CWD and whether the respondents had heard about CWD before responding to the survey are used as proxies for experience $\mathbf{x}$. The variable $\mathbf{t}$ represents generalized trust in people and trust in food agents regarding the safety of food while $\mathbf{d}$ is a vector of demographic and worry trait variables and ε represents error terms.

Ordered probit regressions are used to estimate equation 4.7 because respondents rated their human health risk perceptions about BSE and CWD risk perceptions on an ordinal Likert scale (Greene, 2008). In this study, we are assessing human health concerns about consuming beef and cervid meat in the presence of BSE and CWD respectively since the questions refer to food issues. Respondents are asked the following questions 'Would you say that the following food issues are an important risk to human health in our society, are not a very important risk or no risk at all?' The food issues are *Salmonella* food poisoning, BSE (mad cow disease), GM foods (genetically modified), products from livestock housed in large numbers, in cages or other restricted conditions, pesticides, *Listeriosis* (*Listeria*) food poisoning, unhealthy eating, additives like preservatives, colouring), food allergies, *E. coli* food poisoning and unreasonable food prices. In the second set of surveys in Canada and the U.S. 'animal diseases such as chronic wasting disease' was added. Responses are anchored as follows: 0. no risk 1. not very important risk 2. important risk. 3. don't know . Similar scales were used in other studies in the assessment of human health risk perceptions. Lemyre et al. (2006) and Krewski et al. (2006) assessed the perceived human health risks of a number of hazards in Canada with the following scales: almost no health risk, slight health risk, moderate health risk, high health risk and don't know/no opinion. Similar scales (excluding the 'don't know' response) were used by Krewski et al. (2012) in the assessment of perceived risks of different hazards among physicians and toxicologists in Canada. Dosman et al. (2001) assessed the human health risks of food additives, bacteria and pesticides and Flynn et al. (1994) assessed risk perceptions about environment risks using the same scales as the ones used by Krewski et al. (2012). Nigatu et al. (2014) assessed the perceived human health risks of climate change among university students in Ethiopia and responses were anchored as follows: don't know, not serious, somewhat serious and very serious. Li (2006) and Veeman and Li (2006; 2007) assessed food safety and environmental risk perceptions using the following Likert scales: 1. high risk … 4 almost no risk and 5. don't know.

In the second set of surveys in Canada and the U.S., participants also responded to the following statement 'I, or my family, have concerns about eating elk and deer meat because of CWD 0. don't know 1. strongly disagree 2. somewhat disagree 3. neither agree, nor disagree 4. somewhat agree 5. strongly agree'. Two additional statements were used for venison because we were not sure how people would respond to animal diseases in wildlife in a list of other food issues.

The response 'don't know' is treated differently across studies in the analysis of risk perceptions. In some studies, 'don't know' is treated as missing data and the respondents are omitted from the analysis (e.g. Lemyre et al., 2006). In some related studies, 'don't know' responses are also treated as missing responses but values are imputed from observed data e.g. Veeman and Li (2006) used averages of risk responses to replace 'don't know' responses. According to Manisera and Zuccolotto (2014), another possible method involves treating don't know' responses as one of the ordinal ratings. In the current study, people with 'don't know' responses for human health risk perceptions about BSE and CWD questions are omitted from the analysis following Lemyre et al. (2006) since these questions are used as dependent variables in the ordered probit regressions.

Generalized trust in people is measured using the General Social Survey (GSS) question 'Generally speaking, would you say that most people can be trusted 1. people can trusted 2. can't be too careful in dealing with people 3. don't know' (Glaeser et al., 2000). The GSS survey question measures relational trust among people in general (Earle, 2010). The GSS's trust question has been criticized for being vague, abstract and difficult to interpret since there might be differences in people's definitions of 'most people' and trustworthiness (Glaeser et al., 2000). Although this question is not a perfect measure of generalized trust in people, it is important in showing the degree of trustworthiness in a society (Glaeser et al., 2000).

Following de Jonge (2008), trust in the government, farmers, food manufacturers and retailers regarding food safety is assessed using six statements. Using farmers as an example, the statements were as follows (i) Farmers have the competence to control the safety of food (ii) Farmers have sufficient knowledge to guarantee the safety of food products (iii) Farmers are honest about the safety of food (iv) Farmers are sufficiently open about the safety of food (v) Farmers take good care of the safety of our food (vi) Farmers give special attention to the safety of food. Responses are as follows 1. strongly disagree 2. disagree 3. neither agree, nor disagree 4. agree. 5. strongly agree. Similar statements are included in the survey for the government, food manufacturers and retailers. The same questions were also used in other studies (e.g. de Jonge et al., 2008a; Drescher et al., 2012; Ding et al., 2012; Wang et al., 2011).

Since it has been shown that trust is multi-dimensional (Earle, 2010), principal component analysis is used to determine the number of the dimensions of consumers' trust in food agents that exist in this study, regarding the safety of food using the questions stated above. In principal component analysis, correlated variables are changed to linearly uncorrelated variables (Jolliffe, 2002). Results from the principal component analysis (see Table C2 in appendix) show that there are two principal components for trust in each food agent i.e. one mainly made up of perceptions about whether food agents are open, honest and whether they care or pay attention to food safety (commitment) and the other mainly made up of people's perceptions about the competence and knowledge of food agents in terms of controlling or guaranteeing the safety of food (competence) and this is consistent with results from previous studies (de Jonge et al., 2008a; Metlay, 1999; Earle, 2010). For all the principal components, Cronbach's α values are all close to 0.90 which shows that there is good internal consistency. The two principal components (competence and commitment) for each food agent (the government, farmers, retailers and food manufacturers) are included in the regressions as separate variables.

The variable 'experience' in the models was measured by asking people about their consumption of beef and cervid meat and the questions are as follows: 'Do you eat beef?' 0. yes 1. no. 'Do you eat or have you ever eaten venison (deer, elk or moose meat)?' 0. yes 1. no. Since most people do not consume cervid meat, people were asked about their knowledge of CWD and the question is as follows: 'Before responding to this survey, had you heard of chronic wasting disease (CWD)?' 0. no 1. yes. In the surveys, there were no questions about people's prior knowledge about BSE. Personal experiences were found to influence risk perceptions about meat consumption (Tonsor et al., 2009).

Worry in general is accounted for in this study because it might bias the animal disease concerns upward. Elements from the Penn State worry questionnaire (Meyer et al., 1990; de Jonge, 2008; de Jonge et al., 2008a) were used to measure the degree to which respondents tended to worry in general and the questions were phrased as follows with responses anchored on a 5 point scale 1. not at all typical ... 5. very typical: (i) Many situations make me worry (ii) I know I shouldn't worry about things, but I just cannot help it (iii) I notice that I have been worrying about things. Principal component analysis was used to collapse the three statements on worry trait and the analysis yielded one principal component. Cronbach's α values are all greater than 0.90 which shows that there is good internal consistency (Table C3). The questions on worry trait were also used by Wang et al. (2011) in the assessment of Canadian consumers' response to BSE.

4.4 Data

Data were collected through online surveys in Canada (in 2009 and 2010), two surveys in the U.S. (in 2010) and Japan (in 2009). The online surveys were administered to major food shoppers through professional market research companies. The main focus of the 2009 Canadian survey, the first survey in the U.S. (U.S. 2010a) and the Japanese survey was on beef consumption and BSE. The main focus of the 2010 Canadian survey and the second U.S. survey (U.S. 2010b) was on beef and cervid meat consumption, BSE and CWD. The questionnaires had questions on generalized trust in people, trust in agents (the government, farmers, retailers and food manufacturers), and trust in information from these agents, animal production concerns and human health concerns about different issues related to food safety.

For the second set of surveys in Canada and the U.S., samples were recruited not to be representative of the population but to be made up of primary shoppers with at least 50% of the population in each country to have had some experience eating venison in their lives. This was to ensure a reasonable sample of people who could make informed statements about venison which is a less popular meat as compared to beef. In their study in the U.S., Abrams et al. (2011) found that out of 11,635 respondents, 59.8% of the respondents ate venison one or two times per year when they had the highest level of consumption.

Since the second surveys in Canada and the U.S. have questions about both BSE and CWD, after deleting the 'don't know' responses the samples are separated. Canada 2010_1 and U.S. 2010b_1 are samples where 'don't know responses for BSE human health risk perceptions are deleted. Canada 2010_2 and U.S. 2010b_2 are samples where 'don't know' responses for CWD human health risk perceptions are deleted. Deleting 'don't know' responses for the questions about BSE and CWD in the same sample would lead to significant losses of data. The original sample sizes and number of respondents who answered 'don't know' to the questions on human health risk perceptions about BSE and CWD are in Table 4.1.

Table 4.1 Number of respondents with 'don't know' responses to BSE and CWD human health risk perceptions

	Canada 2009	Canada 2010	U.S. 2010a	U.S. 2010b	Japan 2009
Original sample sizes	1437	1107	1079	1016	1940
	Number of 'don't know' responses				
Would you say that BSE is an important risk to human health in our society, is not a very important risk or no risk at all?	38 (2.64%)	23 (2.08%)	61 (5.65%)	107 (10.5%)	95 (4.90%)
Would you say that animal diseases such as chronic wasting disease in wild and farmed deer and elk are an important risk to human health in our society, is not a very important risk or no risk at all?	-	88 (7.95%)	-	129 (12.7%)	-
I, or my family, have concerns about eating elk and deer meat because of CWD	-	120 (10.8%)	-	101 (9.94%)	-

Source: Data collected in surveys for the thesis

Table 4.2 Summary statistics of variables

Survey	Canada 2009	Canada 2010_1	Canada 2010_2	U.S. 2010a	U.S. 2010b_1	U.S. 2010b_2	Japan 2009
% female	46.7	43.4	43.3	52.8	59.0	58.9	50.1
Average age (years)	46.3 (13.9)	48.0 (13.0)	47.4 (13.0)	54.9 (12.3)	41.1 (14.3)	41.1 (14.3)	40.2 (12.5)
% of households having children < 18 years	27.4	27.6	28.3	18.5	30.6	30.3	35.3
Average years of education	14.6 (1.90)	14.6 (1.92)	14.7 (1.92)	14.5 (1.98)	14.2 (1.97)	14.2 (1.98)	14.2 (1.94)
% eat beef	93.7	93.9	93.3	91.9	91.3	92.2	92.1
% eat venison	-	62.1	63.9	-	56.3	58.4	-
% heard about CWD	-	42.3	46.4	-	23.3	24.7	-
Competence regarding food safety (1. strongly disagree…5. strongly agree)							
The government	3.51 (0.93)	3.50 (0.87)	3.50 (0.87)	3.29 (0.93)	3.26 (1.01)	3.26 (1.02)	2.61 (0.98)
Farmers	3.58 (0.80)	3.48 (0.81)	3.47 (0.82)	3.63 (0.73)	3.60 (0.82)	3.60 (0.82)	3.07 (0.85)
Food manufacturers	3.74 (0.77)	3.69 (0.76)	3.69 (0.76)	3.60 (0.76)	3.54 (0.83)	3.53 (0.84)	3.27 (0.87)
Retailers	3.09 (0.93)	3.06 (0.89)	3.06 (0.89)	3.33 (0.82)	3.33 (0.89)	3.32 (0.88)	2.63 (0.84)
Commitment regarding food safety (1. strongly disagree…5. strongly agree)							
The government	3.05 (0.88)	3.01 (0.82)	3.02 (0.82)	2.98 (0.90)	3.00 (0.99)	2.99 (0.99)	2.34 (0.82)
Farmers	3.47 (0.71)	3.44 (0.68)	3.43 (0.68)	3.46 (0.71)	3.42 (0.81)	3.42 (0.81)	2.80 (0.75)
Food manufacturers	3.09 (0.81)	3.08 (0.77)	3.07 (0.77)	3.07 (0.79)	3.12 (0.89)	3.12 (0.89)	2.71 (0.75)
Retailers	3.05 (0.76)	3.02 (0.74)	3.01 (0.74)	3.18 (0.77)	3.19 (0.85)	3.19 (0.85)	2.47 (0.73)
Generalized trust in people							
% people can be trusted	50.5	52.7	53.9	41.0	34.9	35.1	44.8
% can't be too careful in dealing with people	46.2	44.7	44.2	55.9	60.8	60.8	21.1
% don't know	3.22	2.58	1.94	3.14	4.29	4.16	34.1
Would you say that BSE is an important risk to human health in our society, is not a very important risk or no risk at all (0. no risk … 2. important risk)	1.54 (0.61)	1.40 (0.59)	-	1.68 (0.57)	1.51 (0.60)	-	1.87 (0.38)
Would you say that animal diseases such as chronic wasting disease in wild and farmed deer and elk are an important risk to human health in our society, is not a very important risk or no risk at all (0. no risk … 2. important risk)	-	1.37 (0.60)	1.35 (0.61)	-	1.50 (0.46)	1.48 (0.64)	-
I, or my family, have concerns about eating elk and deer meat because of CWD (0. strongly disagree…4. strongly agree)	-	1.86 (1.21)	1.87 (1.20)	-	2.07 (1.25)	2.06 (1.25)	-
Worry trait (average of three statements) (1. not at all typical…5. very typical	2.58 (0.96)	2.51 (0.93)	2.50 (0.93)	2.78 (1.09)	3.09 (1.11)	3.09 (1.11)	3.18 (0.86)
Sample size	1399	1084	930	1018	909	818	1845

Standard deviations are in parentheses

Source: Data collected in surveys for the thesis

The majority of respondents (over 90%) consume beef in all the three countries. Less than 65% of respondents consumed cervid meats in Canada and the U.S. (Table 4.2). About 51% and 53% of respondents in the Canada 2009 and 2010 surveys respectively stated that people can be trusted. About 41% and 35% in the U.S. 2010a and U.S. 2010b surveys stated that people can be trusted. In Japan, 45% of respondents stated that people can be trusted. In Canada and the U.S., small percentages (less than 5%) of respondents answered 'don't know' to the question on generalized trust in people while in Japan 34% of respondents answered 'don't know' to the same question. The results presented in this study may not be completely representative of the populations in Canada and the U.S., but they provide information for the demographic segments shown in Table 4.2. Given that all the samples used in the current study were completed online, the samples are composed of mainly people that are literate and have some computer skills. For consistency, the same survey questions were used across similar surveys.

4.5 Results and Discussions

4.5.1 Regression Results

Results from ordered probit regressions on the factors that influence consumers human health risk perceptions about BSE and CWD in Canada, U.S. and Japan are summarised in Tables 4.3 and 4.4. Marginal effects are calculated for each possible response to the question about human health risks of BSE and CWD and they show the effect of a change in a dependent variable on the probability of choosing a certain response. In this paper, marginal effects are reported for the highest option (important risk).

In Canada and the U.S. (first survey), respondents who trust people in general are less likely to state that BSE is an important risk to human health as compared to respondents who do not generally trust people and this result is consistent with previous findings on risk perceptions (e.g. Siegrist et al., 2005). Generalized trust in people reduces the probability of stating that BSE is an important risk to human health by 6% in the 2009 survey in Canada, 8% in Canada in 2010 and 5% in the U.S. (first survey). Generalized trust in people also reduces the probability of stating that CWD is an important risk to human health by 7% (first question) and 3% (second question) in Canada. Therefore, generalized trust in people ameliorates risk perceptions about BSE in Canada and the U.S. and CWD in Canada. However, generalized trust in people does not significantly influence human health risk perceptions about BSE in Japan and CWD in the U.S.

Beliefs about the commitment of food manufacturers regarding the safety of food ameliorate human health risk perceptions about BSE and CWD in Canada and the U.S. (second survey for BSE and second question for CWD). Respondents who perceive retailers to be committed to providing safe food in Japan and the U.S. (first survey) are also less likely to state that BSE is an important risk to their health as compared to those respondents believed otherwise. Individuals who perceived farmers to be committed to providing safe food are also less likely to state CWD as an important human health risk in Canada and the U.S. (second question for both countries) as compared to those respondents who stated otherwise. However, beliefs about the commitment of the government in providing safe food are positively related to human health risks of BSE in the U.S. and CWD in Canada and the U.S. (first question) and this was not expected.

Table 4.3 Ordered probit regression results on factors influencing individuals' human health concerns about BSE

	Would you say that BSE is an important risk to human health in our society, are not a very important risk or no risk at all? 0. no risk … 2. important risk									
	Canada 2009		Canada 2010 _1		U.S. 2010a		U.S. 2010b_1		Japan 2009	
Parameter	Estimates (SE)	ME (Y=2)	Estimates (SE)	ME (Y=2)	Estimates (SE)	ME (Y=2)	Estimates (SE)	ME (Y=2)	Estimates (SE)	ME (Y=2)
Constant	1.83 (0.30)***		1.59 (0.34)***		1.99 (0.38)***		2.25 (0.32)***		1.80 (0.33)***	
Female	0.19 (0.07)***	0.07***	0.08 (0.08)	0.03	0.17 (0.09)**	0.06**	0.22 (0.08)***	0.09***	0.50 (0.08)***	0.09***
Education	-0.06 (0.02)***	-0.02***	-0.04 (0.02)*	-0.01*	-0.09 (0.02)***	-0.03***	-0.07 (0.02)***	-0.03***	-0.02 (0.02)	-0.003
Age	0.01 (0.003)***	0.01***	0.01 (0.003)***	0.005***	0.02 (0.004)***	0.01***	0.01 (0.003)***	0.003***	0.01 (0.003)***	0.002***
Children <18yr	0.01 (0.07)	0.004	0.14 (0.08)*	0.06*	-0.05 (0.12)	-0.02	0.08 (0.09)	0.03	0.10 (0.08)	0.02
Worry	0.04 (0.04)	0.01	0.14 (0.04)***	0.06***	0.07 (0.05)	0.02	0.23 (0.04)***	0.09***	0.08 (0.03)**	0.01**
Generalized trust	-0.16 (0.07)**	-0.06**	-0.20 (0.08)***	-0.08***	-0.15 (0.09)*	-0.05*	-0.13 (0.09)	-0.05	0.07 (0.08)	0.01
Commitment										
The government	-0.002 (0.003)	-0.001	-0.02 (0.04)	-0.01	0.18 (0.05)***	0.06***	0.11 (0.06)**	0.04**	0.04 (0.05)	0.01
Farmers	-0.03 (0.04)	-0.01	-0.02 (0.04)	-0.01	-0.07 (0.05)	-0.02	-0.06 (0.05)	-0.02	0.05 (0.05)	0.01
Retailers	-0.02 (0.04)	-0.01	-0.04 (0.05)	-0.02	-0.11 (0.06)*	-0.04*	0.04 (0.06)	0.01	-0.13 (0.06)**	-0.02**
Manufacturers	-0.07 (0.04)*	-0.03*	-0.11 (0.05)**	-0.04**	-0.07 (0.07)	-0.02	-0.11 (0.07)*	-0.04*	-0.08 (0.05)	-0.01
Competence										
The government	0.005 (0.04)	0.002	0.03 (0.04)	0.01	0.04 (0.05)	0.01	0.01 (0.05)	0.004	0.09 (0.04)*	0.01*
Farmers	0.08 (0.04)**	0.03**	0.04 (0.04)	0.02	-0.09 (0.05) *	-0.03*	-0.004 (0.05)	-0.002	0.11 (0.04)***	0.02***
Retailers	0.057 (0.03)*	0.02*	-0.05 (0.04)	-0.02	0.10 (0.05)**	0.03**	-0.02 (0.05)	-0.01	-0.01 (0.04)	-0.002
Manufacturers	-0.005(0.04)	-0.002	0.03 (0.04)	0.01	0.06 (0.05)	0.02	0.05 (0.05)	0.02	-0.04 (0.05)	-0.006
Do not eat beef	0.26 (0.14)*	0.10*	0.17 (0.15)	0.07	0.05 (0.16)	0.01	0.02 (0.14)	0.01	0.20 (0.17)	0.03
μ_1	1.35 (0.06)***		1.78 (0.07)***		1.05 (0.07)***		1.49 (0.07)***		1.06 (0.08)***	
Log likelihood	-1333.1		-901.2		-680.3		-742.6		-706.4	
McFadden Pseudo R^2	0.04		0.04		0.06		0.04		0.07	
Sample size	1399		1084		1018		909		1845	

SE- robust standard error, ME-marginal effects, *** significant at 1%, **significant at 5%, and *significant at 10% level

Source: Data collected in surveys for the thesis

Table 4.4 Ordered probit regression results on factors influencing individuals' human health concerns about CWD

	Canada 2010_2				U.S. 2010b_2			
	Would you say that animal diseases such as chronic wasting disease in wild and farmed deer and elk are an important risk to human health in our society, are not a very important risk or no risk at all (0. no risk... 2. important risk)		I, or my family, have concerns about eating elk and deer meat because of CWD (0. strongly disagree 4. strongly agree)		Would you say that animal diseases such as chronic wasting disease in wild and farmed deer and elk are an important risk to human health in our society, are not a very important risk or no risk at all (0. no risk... 2. important risk)		I, or my family, have concerns about eating elk and deer meat because of CWD (0. strongly disagree 4. strongly agree)	
Parameter	Estimates (SE)	ME (Y=2)	Estimates (SE)	ME (Y=4)	Estimates (SE)	ME (Y=2)	Estimates (SE)	ME (Y=4)
Constant	1.26 (0.36)***		0.49 (0.33)		1.60 (0.33)***		0.85(0.30)***	
Female	0.10 (0.08)	0.04	0.10 (0.07)	0.02	0.16 (0.09)*	0.06*	-0.08 (0.08)	-0.02
Education	-0.03 (0.02)	-0.01	-0.004 (0.02)	-0.001	-0.06 (0.02)***	-0.02***	-0.0004 (0.02)	-0.0001
Age	0.02 (0.003)***	0.01***	0.01 (0.003)***	0.002***	0.01 (0.003)***	0.005***	0.01 (0.003)***	0.002***
Children <18yr	0.03 (0.09)	0.01	0.02 (0.08)	0.004	0.02 (0.10)	0.01	0.08 (0.09)	0.02
Worry	0.15 (0.04)***	0.06***	0.18 (0.04)***	0.03***	0.24 (0.05)***	0.10***	0.21 (0.04)***	0.05***
Generalized trust	-0.19 (0.08)**	-0.07**	-0.16 (0.08)**	-0.03**	0.06 (0.09)	0.02	0.02 (0.08)	0.01
Commitment								
Government	0.08 (0.05)*	0.03*	0.08 (0.04)*	0.01*	0.13 (0.06)**	0.05**	0.08 (0.05)	0.02
Farmers	-0.03 (0.04)	-0.01	-0.08 (0.04)**	-0.01**	-0.05 (0.06)	-0.02	-0.17 (0.05)***	-0.04***
Retailers	0.03 (0.05)	0.01	0.03 (0.04)	0.01	-0.02 (0.06)	-0.01	0.02 (0.06)	0.004
Manufacturers	-0.13 (0.05)**	-0.05**	-0.14 (0.05)***	-0.03***	-0.12 (0.07)*	-0.05*	0.07 (0.06)	0.02
Competence								
Government	-0.06 (0.04)	-0.02	-0.08 (0.04)**	-0.02**	0.02 (0.05)	0.01	0.04 (0.04)	0.01
Farmers	-0.03 (0.04)	-0.01	-0.09 (0.04)***	-0.02***	0.03 (0.05)	0.01	0.02 (0.04)	0.005
Retailers	0.04 (0.04)	0.02	0.04 (0.04)	0.01	0.01 (0.05)	0.003	0.01 (0.04)	0.002
Manufacturers	0.02 (0.04)	0.01	0.003 (0.04)	0.001	0.04 (0.05)	0.02	-0.12 (0.05)***	-0.03***
Do not eat venison	0.12 (0.08)	0.05	0.21 (0.07)***	0.04***	0.10 (0.09)	0.04	-0.06 (0.08)	-0.02
Heard about CWD	-0.12 (0.08)	-0.05	-0.03 (0.07)	-0.01	0.04 (0.10)	0.02	-0.02 (0.09)	-0.01
μ_1	1.76 (0.07)***		0.71 (0.04)***		1.29 (0.07)***		0.53 (0.04)***	
μ_2			1.71 (0.04)***				1.55 (0.04)***	
μ_3			2.33 (0.06)***				2.09 (0.05)***	
Log likelihood	-793.4		-1371.8		-702.1		-1219.3	
McFadden Pseudo R^2	0.05		0.03		0.04		0.02	
Sample size	930		930		818		818	

SE- robust standard error, ME-marginal effects, *** significant at 1%, **significant at 5%, and *significant at 10% level

Source: Data collected in surveys for the thesis

Beliefs in the competence of farmers regarding the safety of food in the U.S. (first survey) ameliorate human health risk perceptions about BSE. Beliefs in the competence of the government and farmers in Canada (second question) ameliorate risk perceptions about CWD. Beliefs in the competence of food manufacturers in the U.S. (second question) also ameliorate human health risk perceptions about CWD. However, individuals who perceived the government as being competent in providing safe food are more concerned about BSE in Japan as compared to those respondents who perceived otherwise. Respondents who perceived that farmers in Canada (2009) and Japan and retailers in Canada (2009) and the U.S. (first survey) as competent in providing safe food are more concerned about BSE as compared to those respondents who perceived otherwise.

The results on the effect of beliefs in the commitment of the government in the U.S. on human health risk perceptions about BSE and commitment of farmers in Canada and the U.S. on CWD human health risk perceptions contradict the hypothesis that beliefs about the commitment of institutions ameliorates risk perceptions. Results on the effect of beliefs about the competence of the government in Japan, farmers in Canada and Japan and retailers in the U.S. on human health concerns about BSE were also not expected. This implies that such beliefs are not sufficient in ameliorating human concerns about the two animal diseases.

Compared to males, female respondents are generally more concerned about the human health risks of BSE in all three countries and CWD in the U.S. The marginal effect of gender of the respondent on the probability of stating that BSE and CWD are important human health risks range from 0.06 to 0.09. Females were also found to be more concerned about food and other risks in previous studies (e.g. Flynn et al., 1994; Dosman et al., 2001; Tonsor et al., 2009; Siegrist et al., 2005; Krewski et al., 2006). Respondents who had more years of education are less likely to state that BSE is an important human health risk in Canada and the U.S. and CWD in the U.S. (first question) and marginal effects range from -0.01 to -0.03. Older respondents are more concerned about BSE in all the three countries and CWD in both Canada and the U.S. and this is consistent with previous studies (e.g. Dosman et al., 2001; Siegrist et al., 2005). The marginal effect of age of the respondent on the probability of the respondent stating that BSE and CWD are important human health risks range from 0.002 to 0.01. Respondents who generally worry are more concerned about BSE in the second surveys in Canada and the U.S. and in Japan and CWD in both Canada and the U.S. and this was expected. Respondents who do not consume beef in Canada (2009 survey) are more likely to state that BSE is an important risk as compared to those respondents who consume the meat. Respondents who do not consume venison in Canada (second question) are more likely to have higher human health concerns about CWD as compared to those respondents who consume the meat. Whether or not the respondent heard about CWD does not drive human health concerns about CWD in both Canada and the U.S.

In summary, results show that there are generally cross country differences in terms of the effect of trust on human health risk perceptions about both BSE and CWD. Results on the effect of trust on BSE and CWD risk perceptions also generally vary across food agents. It is important to note that the effect of generalized trust and beliefs about the commitment of food manufacturers regarding the safety of food is consistent between the two diseases in Canada. Perceptions about the commitment of food manufacturers also ameliorate risk perceptions about the two diseases in the U.S. From the results, perceptions about the commitment of food agents seem to ameliorate human health risk perceptions about animal diseases more than perceptions about the competence of food agents regarding food safety. In Canada, respondents who do not consume beef or venison are more concerned about BSE and CWD respectively maybe because they do not consume the meat because of health risk perceptions.

4.5.2 Consumer concerns about BSE and CWD in Canada and the U.S. and BSE in Japan

Consumers' perceptions about the human health risks of BSE and CWD are compared to other food issues (*Salmonella* food poisoning, GM foods, conditions in which animals are raised, pesticides, *Listeria*, unhealthy eating, additives, food allergies, *E. coli* food poisoning and unreasonable food prices. Net concerned percentages (Roselius, 1971) are calculated in order to assess the relative ranking of BSE and CWD as compared to other food issues. Net concerned percentages are calculated as follows: Net concerned percentage= ((no. of 'important risk' responses-no. of 'no risk' responses)/sample size)*100.

In the first surveys, BSE ranked 7th out of 11 food issues in Canada, 6th out of 11 issues in the U.S. and 2nd out of 8 issues in Japan (Table 4.5). In the second set of surveys, BSE ranked 8th (first data set), 9th (in the second data set) out of 12 issues in Canada and 7th out of 12 issues in the U.S. In the first surveys in Canada and the U.S., respondents are mostly concerned about *E. coli* food poisoning. In the second surveys in Canada and the U.S., respondents are mostly concerned about *Salmonella* food poisoning. In Japan, respondents are mostly concerned about pesticides. Schroeder et al. (2007) also found that Canadian and U.S. respondents were mostly concerned about *E. coli* food poisoning. However, in Japan most respondents were concerned about BSE (Schroeder et al., 2007). Results from Lemyre et al. (2009) also showed that Canadians were not highly concerned about the effects of BSE to their health. The percentage of respondents who state BSE as an important risk to their health decreases between the first and second surveys in Canada and the U.S.

Table 4.5 Would you say that the following food issues are an important risk to human health in our society, are not a very important risk or no risk at all? (Net concerned percentages)

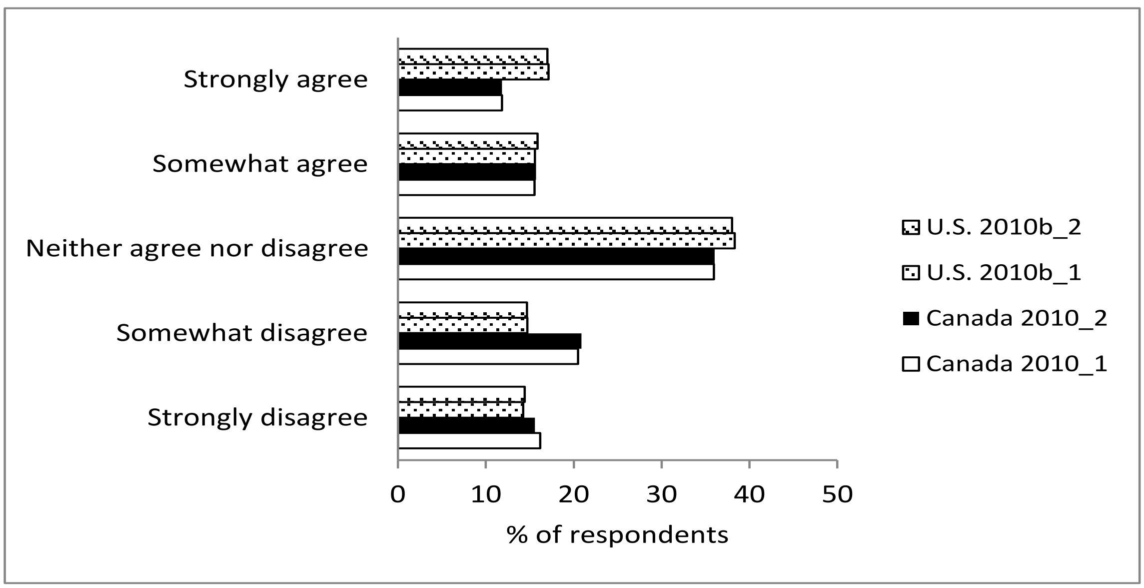
	Canada 2009	U.S. 2010a	Japan 2009	Canada 2010_1	Canada 2010_2	U.S. 2010b_1	U.S. 2010b_2
Net Concerned percentages							
Salmonella food poisoning	71.7	78.8	83.3	78.6	79.1	80.0	79.9
BSE (mad cow disease)	53.8	68.1	86.6	40.3	38.5	50.7	51.2
GM foods	41.8	42.6	37.8	31.9	31.8	42.2	42.6
Products from livestock housed in large numbers, in cages or other restricted conditions	49.6	56.3	-	39.2	38.9	49.9	50.7
Pesticides	70.3	72.7	87.3	67.6	67.6	66.0	66.6
Listeriosis (Listeria) food poisoning	73.2	74.1	-	69.9	69.7	67.0	67.7
Unhealthy eating	74.4	70.8	53.6	71.5	72.3	63.0	64.1
Additives (like preservatives, colouring)	56.7	49.2	46.7	43.7	43.8	42.8	44.0
Food allergies	50.1	51.1	63.1	56.2	56.3	51.6	53.0
E. coli food poisoning	75.4	81.6	-	73.6	73.5	76.3	76.6
Unreasonable food prices	43.2	46.8	34.3	32.2	33.0	40.9	41.4
Animal diseases such as chronic wasting disease in wild and farmed deer and elk	-	-	-	37.1	35.4	49.8	48.4
Distribution of responses to the BSE question (%)							
No risk at all	6.22	5.56	1.52	5.63	5.84	5.72	5.85
Not very important risk	33.8	21.1	10.4	48.4	49.8	37.8	37.1
Important risk	60.0	74.2	88.1	45.9	44.4	56.4	57.1
Distribution of responses to the CWD question (%)							
No risk at all				6.52	7.03	8.03	8.19
Not very important risk				49.9	50.9	34.2	35.2
Important risk				43.6	42.6	57.8	56.6

-, Question not included in the survey

Source: Data collected in surveys for the thesis

Animal diseases such as CWD in farmed elk and deer ranked 10th in Canada and 9th in the U.S. out of 12 food issues that could raise concerns in the public. About 43% of the respondents in Canada and 57% in the U.S. stated that animal diseases such as CWD were an important risk to human health.

When asked about the following statement 'I, or my family, have concerns about eating elk and deer meat because of CWD' most respondents neither agreed, nor disagreed with this statement (Figure 4.1). Averages for this question (Figure 4.2) are statistically different at a 1% level of significance which shows that U.S. respondents are more concerned about CWD as compared to Canadian respondents.



Source: Data collected in surveys for the thesis

Figure 4.2 I, or my family, have concerns about eating elk and deer meat because of CWD

Awareness of CWD was low amongst U.S. respondents as compared to Canadian respondents. About 44% of respondents in Canada and 24% of the respondents in Canada the U.S. stated that they had heard about CWD.

In summary, there are cross country differences in terms of people's human health concerns about BSE and CWD. In Canada and the U.S., respondents are more concerned about BSE as compared to CWD. The reason might be that most people are familiar with the human health effects of BSE as compared to CWD. Awareness of risks was shown to influence risk perceptions in previous studies (Fife-Schaw and Rowe, 1996). Human health concerns about BSE are very high in Japan where about 88% of the respondents stated that BSE is an important risk to human health.

4.6 Conclusion

In this study, the effect of trust on BSE and CWD human health risk perceptions is examined in the context of consumers' concerns about animal diseases. Consumers' human health concerns about BSE and CWD are also compared to actual food safety issues such as *Listeria, Salmonella and E. coli* and across countries. Five datasets from surveys conducted in Canada, the U.S. and Japan are used in this study and data are analysed using net concerned percentages, principal component analysis and ordered probit regressions.

Respondents in Canada and the U.S. are more concerned about the human health risks of real food safety incidents such as *E. coli* food poisoning as compared to BSE while BSE ranked highly in terms of raising human health concerns among respondents in Japan and these results are consistent with the results found by Schroeder et al. (2007). Canadian respondents are least concerned about the human health risks of BSE as compared to U.S. and Japanese respondents. In Canada and the U.S., respondents are less concerned about the human health risks of CWD as compared to other food issues (except GM foods and unreasonable prices in both countries and additives in the U.S.). On average, Canadians are also less concerned about the human health risks of eating elk and deer meat to them or their families as compared to U.S. respondents and the difference is statistically different.

There are two principal components explaining people's trust in food agents regarding food safety labelled as competence and commitment and this is consistent with previous literature (e.g. de Jonge et al., 2008a; Earle, 2010). Results on the effect of the two trust dimensions and generalized trust in people on human health concerns about BSE and CWD are generally different across countries and between the two diseases. Human health concerns about BSE are ameliorated by generalized trust in people (Canada and U.S.), beliefs in the commitment of food manufacturers (Canada and U.S.) and retailers (U.S and Japan) and competence of farmers (U.S.) regarding food safety. Human health concerns about CWD are ameliorated by generalized trust in people (Canada), beliefs in the commitment of farmers and food manufacturers (Canada and U.S.), competence of the government (Canada), farmers (Canada) and food manufacturers (U.S.) regarding food safety.

Therefore, trust or distrust is an important driver of consumers' risk perceptions about BSE and CWD but the direction of the effects of some trust variables on risk perceptions are not as expected in some cases. The worry trait and differences in demographic variables of respondents also influence consumers' risk perceptions about BSE and CWD. Whether or not the individual consumes the beef or venison significantly influences consumers' risk perceptions about BSE and CWD respectively in Canada. Given the negative link between trust in different agents for their ability to manage food safety and risk perceptions, monitoring public trust in food agents could generally assist in the short term estimates of the impact of future animal disease incidents on consumption of meat products.

About 50% in 2009 and 47% in 2010 of Canadian respondents, 59% of U.S. respondents in the first data set in 2010 and 65% in the second data set and 55% of Japanese respondents stated that they do not generally trust people. Compared to Canada and the U.S., more respondents in Japan have competence and commitment (trust in agents) scores less or equal to 2.5 given a scale that range between 1 and 5. In Canada, 60% and about 45% in 2009 and 2010 respectively state that BSE is an important risk to human health. In the U.S., 74% and about 57% in the first and second surveys respectively state that BSE is an important risk to human health. In Japan, 88% of the respondents stated that BSE is an important risk to human health. About 36% and 48% of respondents in Canada and the U.S. respectively stated that CWD is an important risk to human health. The numbers of people who stated that BSE is an important risk to human health are high enough to destabilize the market if they stop consuming beef (especially in Japan) and cervid meat in Canada and the U.S. Since there are low levels of trust and high levels of risk perceptions about BSE in Japan, there is need for exporters to provide exhaustive transparency, traceability and product quality assurances. Information about BSE could also target females and older people because they are more concerned about BSE and CWD.

In conclusion, trust is an important determinant of consumers' choice of meat products indirectly through its effect on human health risk perceptions about animal disease. Animal disease outbreaks have been shown to have large impacts on sales of consumer products. This research suggests that part of the explanation of differing responses in different countries may be related to trust in food industry agents. In future research, there might be a need to assess the relationship between consumers' human health risk perceptions about BSE and CWD and their purchases of beef and cervid meats. The more expensive process will be to collect data on household purchases of meat products, human health risk perceptions about animal diseases, generalized trust in people and trust in food agents. This approach will be an extension to studies by, for example, Yang and Goddard 2011a, b and Myae, 2015) who analysed the effect of meat risk perceptions and risk attitudes on household meat expenditures. Future studies could also focus on other types of risk perceptions about BSE and CWD besides consuming the products e.g. their risk perceptions about having contact with animals, risk of wild animal to domestic animal spread and the types of protective behaviour they undertake.

Further research could also include using different specification of the risk perception associated with certain food products – in terms of single or multiple statements and different Likert scale lengths (5 levels or 7 levels). Use of a different conceptual model such as psychometric approach might also be important resulting in different data being collected and different models being estimated to understand more about the link between animal disease risk perception and intended behaviour.

The focus in this paper was on breadth – across products, across countries of risks of animal diseases of a certain type. The results suggest quite heterogeneous responses across diseases and countries. It would be worth investigating whether those risk perceptions are stable across time or variable by diseases incidence and possibly media coverage. For example, changes in trust in manufacturers, the government and farmers, changes in concerns about BSE and animal diseases in general were found to significantly influence consumers' risk perceptions about eating beef in Canada (Muringai and Goddard, forthcoming).

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5. SUMMARY OF THE THESIS, IMPLICATIONS AND FUTURE DIRECTIONS

5.0 Introduction

Consumers are increasingly concerned about agricultural production issues, animal diseases and food processing methods. Such concerns might influence their perceptions and preferences for food products which might negatively affect their consumption of some food products which could affect public health. There is therefore a need to analyse the factors that drive consumers' perceptions, intentions and actual behaviour. In this study, it is assumed that trust is important in situations where there is risk and uncertainty. Trust could also influence consumer behaviour in situations where there is information asymmetry e.g. credence attributes such as food safety and production attributes.

The overall objective in this dissertation is to examine the linkages between trust, perceptions, intentions and actual behaviour. The specific objectives are as follows: (i) to determine the linkages between trust and the demand for different forms of meat products (fresh, semi-processed and fully processed products) (ii) to examine the linkages between trust, perceptions and preferences for traditionally raised pork and other product attributes (country of origin, on farm food safety accreditation and marbling) (iii) to determine the effect of trust on consumers' human health risk perceptions about bovine spongiform encephalopathy (BSE) and chronic wasting disease (CWD).

Trust does not generate utility, but it could influence perceptions and preferences which could lead to changes in demand for food products and budget allocations. The theoretical model used in this study states that trust can influence consumer demand for food products through affecting preferences (utility) and risk or quality perceptions about consuming the products. In this thesis we show that trust influences demand for fresh, semi-processed and fully processed meat products, preferences for pork attributes and human health risk perceptions about BSE and CWD to confirm linkages between trust, utility and demand based on our theoretical model.

The three studies are linked in that the effect of trust on consumers' perceptions and/or behaviour is analysed in three different contexts and trust is measured at both the generalized level and institutional level (trust in food agents regarding food safety) using the same questions across the studies. However, different data sets and empirical tools are used in the analyses except for cluster analysis on the trust statements for the first two studies. In the following sections summaries of research methods and findings for the three studies, implications, limitations and future directions of the research are provided.

5.1 Trust and consumers' demand for different forms of meat products

In the first study, it is hypothesized that consumers who have lower levels of trust (both general and agent specific trust about food safety) are more likely to purchase fresh meat products and less likely to purchase processed meat products as compared to those consumers who have higher levels of trust. For this analysis, ACNielsen™ data on meat purchases for the period 2002 to 2009 and two surveys conducted in 2008 and 2011 for the same households are used in the analysis. Data are analysed using cluster analysis, probit and demand system models. Households are clustered into three groups using k-means cluster analysis and questions on generalized trust in people and trust in the government, farmers, manufacturers and retailers regarding the safety of food. Demand system models are estimated for the three clusters separately.

In summary, results show that households with respondents who have high levels of trust are less likely to purchase fresh beef and more likely to purchase fully processed beef and fully processed poultry as compared to households with respondents who have low levels of trust. In addition, households with respondents who have medium levels of trust are less likely to purchase fresh poultry and more likely to purchase fully processed beef, fully processed poultry and semi-processed other meats as compared to households that have respondents who have low levels of trust.

The demand for fresh pork, fully processed pork and fully processed other meats is less responsive to changes in the consumers' budget for households in the low trust cluster as compared to households in the medium and high trust clusters. The demand for semi-processed beef, fully processed beef, fresh poultry and semi-processed poultry is less responsive to the consumer's budget for households in the high trust cluster as compared to households in the low and medium trust clusters. The demand for semi-processed other meats is more responsive to the consumers' budget for households in the low trust cluster as compared to households in the medium and high trust clusters. Although expenditure elasticities are higher for fresh beef, semi-processed pork, and fresh other meats for the high trust cluster as compared to the medium and low trust clusters, the differences are very small. The expenditure elasticity for fully processed poultry is the same across the three clusters.

Differences between own price elasticities for fresh beef are very small across the three clusters. Changes in prices of fully processed pork and fully processed poultry will lead to bigger changes in the demand for these products for households in the high trust cluster as compared to households in the low and medium trust clusters. Changes in prices of fully processed beef and fresh and semi-processed poultry will lead to higher changes in the demand for these products for households in the low trust cluster as compared to households in the medium and high trust clusters. Own price elasticities for semi-processed and fully-processed other meats are lower for households in the high trust cluster as compared to households in the low and medium trust clusters. Households in the low trust cluster generally substitute or complement fresh and semi-processed products more than households in the high and medium trust clusters. Households in the high trust cluster generally substitute or complement semi-processed and fully processed meat products as compared to households in the low and medium trust clusters.

5.2 Trust and consumers' perceptions and preferences for pork production attributes

In the second study, it is hypothesized that consumers who are lower levels of trust (both general and agent specific trust about food safety) maybe willing to pay higher premiums for natural pork as compared to those consumers who have higher levels of trust. Natural pork in this study refers to pork from pigs raised using traditional production methods. The hypothesis is tested using cluster analysis, conditional and random parameters logit models and data from choice experiments and surveys in Canada in 2011 and in Edmonton in 2009 and 2011. In the Edmonton (2009) and the national choice experiments, the production attribute had four levels (conventional pork, uncertified traditionally raised pork, Canadian pork industry certified traditionally raised pork, government certified traditionally raised pork). In the Edmonton (2011) survey the production attribute had two levels (conventional pork and premium traditional pork). Traditionally raised pork is defined as pork from a family farm production setting, reared outdoors or in bedded settings, with no subtherapeutic antibiotics or growth promotants, and no animal byproducts in feed. Premium traditional pork is defined as pork from a family farm production setting, produced with no sub-therapeutic antibiotics or hormones, and no animal byproducts in feed (100% grain fed). Real pork chops are used in the choice experiments in Edmonton since respondents also participated in sensory experiments. Pork chop pictures are used in the national choice experiments and respondents completed the choice experiments and surveys online through a marketing firm. Other attributes that are included in this study are country of origin (Canadian Pork), on farm food safety accreditation (CQA®) and marbling (only in the national choice experiments). K-means cluster analysis is used to group respondents into two groups using questions on generalized trust in people and trust in the government, farmers, manufacturers and retailers regarding the safety of food. A dummy variable (0. low trust and 1. high trust) is included explicitly in conditional and random parameters logit models.

In summary, results from the random parameters logit models which performed better than the conditional logit models show that respondents in the national sample who have high trust are willing to pay more for pork chops with the following attributes (uncertified traditionally raised, government certified traditionally raised, Canadian pork industry certified traditionally raised, Canadian Pork and CQA®) over conventional pork as compared to respondents who have low levels of trust. Willingness to pay is higher for government certified traditionally raised pork in the national sample as compared to uncertified traditionally raised and Canadian pork industry certified traditionally raised pork. Respondents in the 2011 Edmonton sample who have high levels of trust are willing to pay a higher premium for the CQA® label (relative to pork which did not have the label) as compared to respondents who have low levels of trust for the 2011 Edmonton sample. Respondents in the 2009 Edmonton sample with low levels of trust are willing to pay a higher premium for Canadian Pork (relative to pork which did not have the label) as compared to respondents with high levels of trust. Respondents with high levels of trust rated traditionally raised pork more positively (in comparison to conventional pork) in terms of taste, freshness, safety, health and not containing hormones and antibiotics as compared to those respondents who have low levels of trust.

5.3 Trust and consumers' human health risk perceptions about BSE and CWD

In the third study, it is hypothesized that trust (both general and specific to food safety and various agents) is negatively related to consumers' human health risk perceptions about BSE and CWD. This hypothesis is tested using ordered probit regressions and data from surveys conducted in Canada in 2009 and 2010, in the U.S. in 2010 (two surveys) and in Japan in 2009. Respondents in Canada and the U.S. are less concerned about BSE and CWD as compared to other real food safety incidents such as *E. coli* food poisoning while BSE is one of the major food concerns in Japan. Questions about generalized trust in people and trust in the government, farmers, retailers and manufacturers regarding the safety of food are also used in the analysis. Competence and commitment are the two principal components explaining people's trust in food agents regarding the safety of food that are identified in this which is consistent with literature. The two principal components for each agent (for all the four agents) and generalized trust are included as explanatory variables in the ordered probit regressions.

The effect of the trust variables on human health concerns about BSE and CWD are generally different across countries and between the two diseases. In summary, human health risk perceptions about BSE are negatively related to generalized trust in people (Canada and U.S.), beliefs in the commitment of food manufacturers (Canada and U.S.) and retailers (U.S and Japan) and competence of farmers (U.S.) regarding food safety. Human health risk perceptions about CWD are negatively related to generalized trust in people (Canada), beliefs in the commitment of farmers and food manufacturers (Canada and U.S.), competence of the government (Canada), farmers (Canada) and food manufacturers (U.S.) regarding food safety.

5.4 Implications

From the analysis, results generally show that trust is important in determining consumers' perceptions and stated and actual behaviour. Researchers should pay attention to the effect of trust on consumers' food choices. Since trust significantly influences consumers choice between fresh and processed products, monitoring consumers' generalized trust in people and trust in the food industry might help in predicting their choice of food products in response to future food safety shocks and changes in prices and incomes. Food consumption choices made my consumers are important in influencing public health.

Both low trusting and high trusting consumers prefer traditionally raised pork. Although certification of traditionally raised pork by the Canadian pork industry is also preferred by consumers, they mostly prefer government certification of the attribute. There is a need to set standards for traditionally raised products and certification of the attribute especially by the government is important in enhancing consumer welfare. This shows that the government has an important role in certifying the natural attribute. The success of products with a natural attribute is significantly influenced by consumers trust in the food industry thus it is important to ensure the credibility of the food industry. Open communication, transparency and honesty might enhance trust in the industry (Hobbs and Goddard, 2015; Selnes, 1998).

In the marketing literature, there are different ways of building trust in brands e.g. providing value consistently and ensuring that consumers have positive experiences with a given brand (Delgado-Ballester and Munuera-Alemán, 2005). The same principles apply to trust in food institutions in relation to quality and safety of food products.

Trust or distrust is an important driver of consumers' risk perceptions about BSE and CWD. Monitoring public trust in food agents could generally assist in the elicitation of public concerns and responses to future animal disease incidents. There is need for exporters to Japan to provide exhaustive transparency, traceability and product quality assurances since there are low levels of trust and high levels of risk perceptions about BSE.

5.5 Limitations and future directions

In this thesis, generalized trust in people and trust in farmers, the government, retailers and food manufacturers regarding the safety of food is measured. Although the results suggest that these types of trust are important in determining consumers' choice of fresh and processed products, perceptions and preferences for a natural attribute and human health risk perceptions, there might be a need to assess trust in other contexts other than food safety. In other studies, it is shown that consumer perceptions about issues such as fairness influence consumer behaviour. Future studies could focus on the interrelationships between trust and fairness and their effects on consumers' choice between different forms of food products, preference for natural attributes and human health risk perceptions about animal diseases. In this analysis, generalized trust is measured using the General Social Survey question 'Generally speaking, would you say that most people can be trusted? 1. people can be trust 2. can't be too careful in dealing with people 3. don't know'. Although this question shows the degree of trustworthiness in a society it is criticised for being unclear, abstract and difficult to interpret (Glaeser et al., 2000). Generalized trust could be assessed using questions on trust in strangers (e.g. Glaeser et al., 2000; Ding et al.,

2015) since people in the food chain are likely strangers not friends or relatives so trust in strangers is more relevant. In the current study, the generalized trust variable was a dummy variable. In the future more categories could be included in the surveys for this study.

There are different ways of incorporating trust data into explanatory models of actual or stated behaviour. In the first paper, models are estimated for different groups of households classified according to responses to questions on generalized trust and trust in food agents regarding food safety. In additions, dummies for trust cluster are included as explanatory variables for probability to purchase different forms of meat products. In the second paper, a dummy variable on cluster membership is included in the regressions. In the third paper, generalized trust and principal components on trust in food agents regarding food safety are included as explanatory variables in the regressions. Further research could try all approaches with all types of data. In this thesis, the factors that influence trust were not analysed. Further research might assess what causes the movements in trust in the first paper. Understanding those influences is likely critical to being able to change trust should some condition negatively affect trust levels.

In the first paper, one of the limitations is prices. In this study, proxy prices are used and it is assumed that all households in Canada face the same price for random weighted meat products. This assumption was made because the data on actual prices for random weighted meat products was not available. When price data are available, it might be necessary to use more flexible demand models such as the AIDS and Translog models to see whether the results change. It is also necessary to assess substitutions among the twelve meat categories which was not feasible in the current analysis. In the current analysis, 371 households who participated in the surveys were not included in the analysis because they did not record meat purchases in some years. Future analysis could look at this group of respondents to see the effect of trust and risk perceptions on their consumption of meat products.

In the second paper, consumers' perceptions and willingness to pay for a natural attribute are assessed. In the future, there is need to assess whether consumers' willingness to pay offset the increased production costs for natural pork. In the samples in Edmonton were composed of only consumers of pork since respondents had to participate in sensory experiments. This might be the reason why the models did not perform very well with these samples. In the future, there might be need to assess consumers' trust in other characteristics that could influence preference for natural such as trust in animal welfare and link it to consumers' preference for the natural attribute and see whether results change. There might be need to assess the linkages between trust and consumers' preferences for other natural meat products such as beef or poultry to see whether results change. In this analysis, the dummy variables on trust are included in the conditional and random parameters logit models. In the future, the models could be estimated for the two trust clusters separately since this allows all parameters to be different by level of trust. Trust also influenced perceptions about the credence attribute studied.

Hypothetical bias and strategic behaviour are some of the limitations of the second paper because respondents did not make actual purchases of products. Respondents might do not state their actual preferences. In the future, cheap talk could be used in the surveys in order to mitigate the effects of strategic behaviour and hypothetical bias.

In the third paper, the effect of trust on human health risk perceptions about BSE and CWD are analysed. In the future, the linkages between trust, consumers' human health risk perceptions about BSE and CWD and their purchases of beef and cervid meats could be assessed. Studies in the future could also focus on other types of risk perceptions about BSE and

CWD instead of just the consumption of the affected meat products (e.g. their risk perceptions about coming into contact with affected animals, the risk of the disease spreading between domestic and wild animals) and the types of protective behaviour undertaken by the public. In this analysis, one of the requirements for recruiting respondents in the surveys that focused on CWD was that half of the sample ate cervid meats. In the future, a more representative sample of respondents could be used. Future studies could use different scales in terms of the number of points of the Likert scale or multiple statements for measuring risk perceptions. In addition, different approaches such as the psychometric approach might be used which could lead to different data and analytical tools being used in order to understand linkages between animal disease risk perceptions and intended behaviour. Future studies could also assess whether animal disease risk perceptions are stable across time or vary by disease incidence and media coverage. In Japan, a high proportion of respondents (34%) of the respondents answered ‘don’t know’ to the question on generalized trust in people. Future analysis could be conducted with the people who answered ‘don’t know’ excluded from the samples to see whether results change.

In this analysis, it is assumed that trust directly and indirectly (through perceptions) influence consumer stated or actual behaviour. Models are estimated to test the link between trust and perceptions (risk or quality), trust and stated preferences for traditionally raised pork as compared to conventional pork and trust and actual purchases of meat products (classified according to degree of processing). The link between perceptions and behaviour are not tested in the current study. In the future, the linkage between trust, perceptions and consumer intentions or actual behaviour could be tested using causal mediation analysis, for example, using regression equations (Moon and Balasubramanian, 2004) or using structural equation models (Hsin Hsin, and Wen, 2008).

In the k-means cluster analysis, generalized trust in people is a dummy variable while statements on trust in food institutions are on a five point scale. In the future, there might be a need to standardize the variables so that they contribute the same to distance and similarity. However, excluding the variable on generalized trust did not significantly change the cluster membership of all households.

Trust could be incorporated in models using different ways (i) including trust as separate explanatory variables or interact the variable on trust with other explanatory variables (ii) using cluster analysis to group respondents or households and include cluster membership as an explanatory variable (iii) estimate models for different groups of respondents or households (classified according to trust). Given the questions on generalized trust in people and trust in food agents, we would recommend including generalized trust and variables for trust in food agents as explanatory variables because we can see the effect of each variable on the dependent variable. However, for random utility models (where trust variables have to be interacted with attributes) and demand systems, given that there are 25 statements on trust, we would recommend estimating models for groups of respondents (classified according to trust) separately. Estimating models for the different groups allow all parameters in the model to change.

In the second paper we test both perceptions about the product (taste, freshness, healthiness) and 'health risks' (safer, presence of antibiotics or hormones). Perceptions of risk might not be completely separated from perception of the natural attribute because people could judge the natural attribute based on their risk perception. The difference between traditionally raised and conventional could be some characteristics of the products and also health risks. In the future, consumers' willingness to pay for product attributes and health risks could be assessed.

For example, information about the presence of hormones or antibiotic could be included as attributes of the product.

The media has been shown to influence consumers' perceptions and behaviour. However, the media is not included in this analysis which could bias the results. In the future, variables on trust in the media could be included in the analysis and determine whether results change. There might be endogeneity problems between trust and the dependent variables due to, for example, omitted variables. In the future, other methods that could correct for endogeneity could be used e.g. control function approach.

Likert scales were used for the questions on trust and risk perceptions. People might respond differently to Likert scales. In the future, other quantitative measures could be used to assess risk perceptions, for example, probability of contracting a disease. In this study, we measure risk perceptions at one point but we do not measure changes in risk perceptions at different time periods. In the future risk perceptions could be tracked across time for the same respondents.

In the first study, households with respondents who had lower levels of trust preferred products with minimal levels of processing as compared to those households that had respondents who have higher levels of trust. In the second study, respondents who had lower levels of trust are willing to pay lower premiums for traditionally raised pork as compared to respondents who had higher levels of trust. The reason might be that natural is still a nebulous concept such that people less trusting people are willing to pay lower premiums for natural products as compared to those people with higher levels of trust.

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APPENDIX A

Table A1 Previous studies on demand for meat products

Author/s	Type of products	Data	Analytical methods	Measurement and treatment of the trust (if applicable)	Summary of results
Ahmad and Anders (2012)	Processed chicken and seafood	Nielsen Market Track 2000-2006 weekly scanner data for Canada	Hedonic pricing model	n/a	-Value in chicken and seafood is added through brands, the size of the product, type of meat cut and the species (in the case of fish) and the degree of processing -Consumers prefer natural and health attributes as compared to highly processed products
Burton and Young (1996)	Beef and veal, lamp, pork and poultry	-Number of articles about BSE in newspapers -Quantity and expenditure data from National Food Surveys in Great Britain	Dynamic AIDS model	n/a	BSE had a significant short-run and long-run impact on beef market shares
Capps et al. (1985)	Food categorised into non-convenience, basic convenience, complex convenience and manufactured convenience	Nationwide Food Consumption Survey in the U.S.	AIDS model	n/a	-Budget shares were more responsive to prices as compared to total expenditure - Income and own prices influenced the demand for convenience and non-convenience foods more than cross prices -Socio-economic factors also influenced shares of different food categories
Ding et al. (2013)	Beef, pork, poultry and other meats	Nielsen Homescan® data for January 2002 to December 2005 and 2008 survey in Canada		Generalized trust in people was measured as follows ‘Generally speaking, would you say that most people can be trusted, or that you can’t be too careful in dealing with people?’	-Trust did not significantly influence consumer’s response to the first BSE case in Canada -However, trust mitigated the negative effects of the second and third cases of BSE in Canada

Drescher et al. (2012)	Fresh and processed meat	Nielsen Homescan^{TM} data for July 2007 to July 2008 and a 2008 survey in Canada	Engel functions and Kruskal-Wallis t test	Perceptions about the competence, knowledge, openness, honesty, care and attention of the government, farmers, retailers and food manufacturers regarding the safety of food -Consumer optimism and pessimism about food safety was also measured	-Low trust consumers had low purchases of meat especially processed meat - However, there was no significant relationship between trust and expenditures for fresh or processed meats in the Engel functions -Meat expenditures were influenced by education, age and location of the respondent (living in urban areas and Prairies)
Goddard et al. (2010)	Fresh, semi-processed and fully processed meats beef, pork, chicken and other meats	Canadian retail level scanner data	Translog	n/a	-Strong substitutions among fresh, semi-processed and fully processed products for beef. -Fresh chicken is also a substitute for fully processed chicken
Harris and Shiptsova,(2007)	Ready foods	ACNielsen Homescan panel data for 1999 for U.S.	Ordinary least squares regression	n/a	-Household income, price, age of household head, household size, living in an urban or suburban area, poverty, education, whether there are children in the household influence expenditure on ready meals
Lambert et al. (2006)	Meat and fish	Canada's Food Expenditure Surveys for 1992 and 1996	QUAIDS	n/a	-There are regional differences among Hicksian, Marshallian and expenditure elasticities -As compared to demand for fish, meat demand was more responsive to prices and total expenditure
Lobb et al. (2007)	Chicken	Face to face, in-home interviews in the U.K.	Order probit regression simultaneous equation modelling and principal component analysis	Trust in information sources	The likelihood to purchase chicken was negatively influenced by trust in food safety information from the media
Marsh et al. (2004)	Beef, pork , poultry and other consumption goods	-Food Safety Inspection Service data on pork beef, and poultry recalls for the period 1982-1998 -Disappearance data from the United States Department of Agriculture, Economic Research Service and price data -media recall indices	Rotterdam demand model	n/a	-Demand was influenced by meat recalls but the effect was small as compared to price and income effects -Newspaper coverage did not influence demand for products
Myae (2015)	Venison, bison, beef, pork, chicken, turkey	-Nielsen Homescan^{TM} (2003-2009) and survey data (2011) for the same	Probit regressions and translog demand model -Households were	n/a	-Media coverage of BSE led to decreased beef consumption but it led to increased consumption of venison, bison, chicken and

	and seafood	households in Canada	classified according to where they purchase traditional meats and their source venison (retail stores, hunting or other sources)		turkey. -Media coverage of CWD led to decreased consumption of venison, bison, pork and chicken but led to increased beef consumption -Risk perceptions and risk attitudes about venison influenced consumers' preferences for venison
Piggott and Marsh (2004)	Beef, pork, poultry	-Disappearance data from the United States Department of Agriculture, Economic Research Service for the period 1982-1999 -Food safety indices from the media	Generalized AIDS model	n/a	-Demand was influenced by food safety concerns but the impact was small as compared to price effects -Demand was also influenced by seasonality and time trends
Salvanes and DeVoretz (1997)	Fresh and processed meat and fish	Canadian 1986 Food Expenditure Survey Public Use Microdata Files	LA-AIDS Model I: Red meat, white meat, fish/other seafood and residual food Model II: fresh red meat, fresh white meat, processed meat, fresh fish, processed fish and residual food Model III: red meat, white meat, processed meat, fresh fish, cured fish, canned fish and other fish	n/a	-Demand for meat and fish should not be estimated separately while they can be estimated separately when the products are grouped into fresh and processed products.
Yang and Goddard (2011a)	Beef, pork, chicken, turkey and seafood	Canadian Nielsen Homescan^{TM} data (2002 to 2007) and a survey administered in 2008	K-mean cluster analysis and Translog	n/a	-Demographic factors and information about BSE significantly influenced total meat expenditure and meat demand for households. -There were differences in purchasing behaviour among the different consumer clusters with more risk averse consumers having more elastic demand for beef
Yang and Goddard (2011b)	Beef, pork, chicken, turkey and seafood	Canadian Nielsen Homescan^{TM} data (2002 to 2007) and a survey administered in January 2008	Two step cluster analysis and regression analysis	n/a	-Risk attitudes and perceptions influence purchases for meat products
Zhang (2010)	Fresh, semi-processed and fully processed beef,	ACNielsen Homescan^{TM}, ACNielsen MarketTrack^{TM} and Nielsen Media	Probit regressions and Working-Leser demand systems	n/a	-Younger households that had more people in the household and higher incomes were more likely to choose fully processed

	pork, poultry and other meats), shop for meat purchases and brands of fully processed meat products (national versus store brands	Measurement™ data for 2002-2007 Ontario and Alberta, Canada		poultry products in Ontario -Older respondents who had higher incomes in Alberta would more likely purchase fully processed products such as seafoods

Table A2 Meat classifications

Beef	Pork	Poultry	Other meats
Beef	bacon	Capon	all types
Calves	ham	Chicken	bacon beef
Veal	pork	cornish hens	bacon turkey
		Duck	beef/pork
		Emu	beef/pork/chicken
		Fowl	beef/shrimp
		Goose	bison
		guinea fowl	bison/pork
		Ostrich	boar
		Partridge	buffalo
		Pheasant	chicken/bacon
		Poultry	chicken/pork
		Quail	elk
		Turkey	frog
		turkey/chicken	goat
			horse
			lamb
			not applicable
			pork/lamb
			pork/veal
			rabbit
			turkey/pork
			turkey/veal
			veal/pork/beef
			venison
			beef/bacon
			assorted
			elk/pork
			ostrich/emu/deer
			pork/lamb/ham/turkey
			venison/pork
			mutton
			not applicable
			pork/buffalo
			hare
			chicken/beef
			kangaroo
			fish

Source: Author’s classification of products in ACNielsen Homescan™ purchase panel

Table A3 ACNielsen Homescan™ panel meat product processed form table

Fresh meat		Semi-processed meat		Fully processed meat	
340561	ALL TYPES	363885	BACON	340537	SCALLOPINI
345061	ASSORTED	340528	SAUSAGE	340524	SCHNITZEL
340531	BACKS	356417	ALOUETTE	317447	SLICES
364811	BREAST	394361	BROCHETTE	345040	BALLS
353575	CASINGS	363900	BROCHETTES	410596	BAVETTE
340506	CHOPS	365095	CARVED	129258	BITES
450802	CHOPS W/FILLET	425822	CHOPPETTES	340563	BURGERS
436511	CHUB	340555	COTTAGE ROLL	129250	CHIPS
351077	CHUNK	371000	DRUMLETS	364953	CHOMPERS
317632	CUBES	340558	HEAD	365082	CRISPS
340533	CUT UP	321308	KABOB	364861	CUTLET
129253	DICED	340509	KABOBS	340508	CUTLETS
340530	DRUMSTICKS	364924	MEATBALL	436512	CUTLETS/DRUMMETTES
345070	ESCALOPE	340536	MEATBALLS	365089	DINO SNACKS
340513	FILLETS	340526	ROULADEN	364975	DUMPLING
365032	FINGERLINGS	345006	SALT	340554	FINGERS
353256	FLAP	345046	SAUSAGE MEAT	365090	FLINGS
129261	GROUND	340748	SAUSAGES	365084	FRANKFURTERS
340527	LONDON BROIL	363895	SKEWERS	365046	FRIES
340539	MEDALLIONS	363901	SOUVLAKI	364960	FRITTERS
340560	MINCED	363898	STIRFRY	340562	MEATLOAF
129263	MINI			340517	NUGGETS
129227	N/A			344949	PATTIES
129239	NOT APPLICABLE			340521	PAUPIETTES
468358	OSSO BUCCO			365129	PEROGIES
317578	PIECES			346623	POPCORN
350888	PORTION			340540	SATAY
428240	RIB FINGERS			356405	SAUSAGE CHAPLET
352967	RIB STRIP			355660	SAUSAGE KABOB
345031	RIBLETS			345044	SAUSAGE PATTIES
340518	RIBS			364961	SNACKOSAURS
370999	RINGOS			365094	SNAKE BITES
365036	RINGS			410823	SPIEDINI
340507	ROAST			365120	SPIRALS
319240	ROLL			364979	STEAKETTE
356409	ROSETTE			340552	STEW
372928	SCRUNCHIONS			129249	STICKS
353574	SLAB			365031	STIX
340516	SPLIT			129260	STRIPS
356958	SPLIT/TIPPED			364931	TEAZERS
340512	STEAK			357815	TENDERS
375130	STEAK/CUBED			340515	TOURNEDOS
372576	STEAK/ROAST			363886	SLICE
363894	STEAKS			129242	SLICED/PIECE
364111	UNSPECIFIED				
129243	WHOLE				
364830	WINGS				

Source: Zhang (2010, p. 17)

Table A4 ACNielsen Homescan™ panel meat processed type table

Fresh meat		Semi-processed meat		Fully processed meat	
343873	AIR CHILLED	139657	BASTED	370997	BAKED
345502	ANGUS	345068	BASTED/GRADE A	368110	BATTERED
446497	ANGUS GRADE AAA	355657	BASTED/STUFFED	340868	BREADED
344999	BRAISING	139693	BBQ	347249	BREADED/FAST FRY
355289	BROILER	349972	BRAISING/SEASONED	361541	BREADED/GRAIN FED
363270	BROILER/GRADE A	345060	CORNED	353577	BREADED/TENDERIZED
310656	BUTTERFLIED	139673	CORNMEALED	368098	BURRITOS
413242	CALIFORNIA STYLE	345100	CURED	368096	CASSEROLE
454407	CANADIAN ANGUS	345099	CURED/CORNMEAL	355665	CHICKEN FRIED
346191	CUBED	139670	DELICATED	045337	CHILI
99976	DRY	350881	DOUBLE SMOKED	368108	CHIMICHANGAS
139654	FAST FRY	356688	FRENCH STYLE/MARINTD	368113	COOKED
139692	FREE RANGE	363013	FRENCH STYLE/SEASOND	368095	CORNDOGS
347426	FRENCH STYLE	366374	FRENCHED SEASONED	139689	COUNTRY STYLE
382313	FRENCH STYLE/ANGUS	357826	FRENCHED/GRAIN FED	352675	CRISPY
139662	FRENCHED	357823	FRENCHED/SEASONED	368114	CROQUETTES
354334	FRENCHED/GRILLING	352679	GARDEN STYLE	368109	DIM SUM
139655	FRYER	356402	GRILLING/MARINATED	099973	DINNER
345065	FRYER FREE RANGE	139660	MARINATED	368104	EMPANADA
344954	FRYER GRADE A	346983	MARINATED/SEASONED	368105	ENCHILADAS
344967	FRYER/UTILITY	344974	MARINATING	139298	FAJITA
139688	FRYING	360469	MARINATING/ANGUS	368117	FILLO
344953	GRADE A	354336	MATURE/SEASONED	462862	FILO
353258	GRADE A/MARINATED	346197	PEAMEAL	368387	FRENCHED/BREADED
354339	GRADE AAA	352964	PICKLED	045315	FRIED
343879	GRAIN FED	367197	ROASTED/BASTED	368091	GRILLED
355654	GRAIN FED/TENDERIZED	345098	ROASTED/SEASONED	350884	MECHOUI
344950	GRILLING	349791	ROASTING/STUFFED	368094	PASTRY
360470	GRILLING/ANGUS	345004	SALTED	368115	PATTIES
444255	HOTEL STYLE	361539	SALTED/CURED	139219	PIE
353254	MATURE	045311	SEASONED	368107	POTSTICKER
343210	MILK FED	416019	SEASONED/ANGUS	368090	PREPARED
416020	MILK FED/HOTEL STYLE	345069	SEASONED/BBQ	368100	QUESADILLA
345007	MILK FED/TENDERIZED	407174	SEASONED/DELICATED	374025	QUICK
345012	MINUTE	345027	SEASONED/FAST FRY	382315	QUICK/ANGUS
365511	MINUTE/FAST FRY	344966	SEASONED/FRYER	345071	RANCH CUT
45305	N/A	343877	SEASONED/GRILLING	344989	ROASTED
340746	NEW ENGLAND STYLE	344973	SEASONED/STUFFED	110130	ROTI
345775	NEW YORK STYLE	139671	SMOKED	352970	ROTISSERIE
344945	NOT APPLICABLE	314401	ST LOUIS STYLE	368092	SAMOSAS
370998	POT ROAST	361544	ST LOUIS/SEASONED	368102	SANDWICH
340556	PREMIUM OVEN	139267	STIR FRY	368106	SAUSAGE PASTA
368093	ROAST	099965	STUFFED	345028	SEASONED/BREADED
139653	ROASTER	310653	STUFFED/BASTED	368116	SHEPHERD PIE
345063	ROASTER GRADE A	353259	STUFFED/FRYER	139676	SLOW COOKED
348173	ROASTER UTILITY	496255	STUFFED/CURED	368097	STEW
345032	ROASTING	357819	STUFFED/MILK FED	368101	TAQUITOS
352981	ROLLED			353589	TENDERIZED/BREADED
345015	SIMMERING			368118	TORNADOS
346193	SIMMERING/FAST FRY			368120	WONTON
345041	STEWING			368099	WRAPS
351076	SUGARBUSH			110376	BLACK FOREST
139663	TENDERIZED				
365510	TENDERIZED/FAST FRY				
434599	TENDERIZED/GRILLING				
344964	TEXAS STYLE				
361952	TRIMMED				
352673	TUSCANY				
110204	UNSPECIFIED				
139661	UTILITY				
354337	UTILITY/MATURE				
346196	VERMONT				
361950	YOUNG/GRADE A				

Source: Zhang (2010, p. 18-19)

Table A5 Results from probit models used to calculate inverse Mills ratios

	Whole sample			Low trust			Medium trust			High trust		
	Estimate	SE	Marginal effect	Estimate	SE	Marginal effect	Estimate	SE	Marginal effect	Estimate	Error	Marginal effect
Fresh beef												
Constant	2.649*	1.443		3.682	3.324		2.407	2.083		2.674	2.566	
Female	0.093**	0.039	0.0110**	-0.190**	0.088	-0.02**	0.158***	0.055	0.018***	0.178***	0.071	0.022**
Age	0.005**	0.002	0.001**	0.002	0.005	0.0003	0.006*	0.003	0.001*	0.005	0.004	0.001
Education	0.008	0.010	0.001	-0.032	0.024	-0.004	0.022	0.014	0.002	0.014	0.016	0.002
Household size	-0.177***	0.021	-0.021***	-0.091**	0.047	-0.01**	-0.259***	0.032	-0.028***	-0.110***	0.034	-0.013***
French	0.343***	0.045	0.036***	0.773***	0.170	0.067***	0.253***	0.063	0.026***	0.464***	0.076	0.050***
Urban	0.189***	0.037	0.022***	0.299***	0.087	0.035***	0.109**	0.051	0.012**	0.259***	0.065	0.031***
Income	-0.013**	0.006	-0.001**	-0.025*	0.014	-0.003*	0.004	0.010	0.0004	-0.031***	0.011	-0.004***
Expenditure	0.006***	0.0003	0.001***	0.007***	0.001	0.001***	0.006***	0.0004	0.001***	0.004***	0.0004	0.001***
Price of fresh beef	-0.339***	0.134	0-.039***	-0.394	0.310	-0.046	-0.353*	0.193	-0.039*	-0.334	0.241	-0.040
Price of semi-processed beef	0.074	0.053	0.009	0.110	0.123	0.013	0.074	0.077	0.008	0.047	0.094	0.006
Price of fully processed beef	-0.004	0.030	-0.0004	-0.041	0.068	-.005	0.014	0.044	0.001	0.002	0.053	0.0002
Log likelihood	-3056.0			-587.4			-1498.6			-924.4		
R^2	0.18			0.23			0.19			0.14		
% correct predictions	92			91			93			92		
# of observations	14616			2808			7560			4248		
Semi-processed beef												
Constant	-0.490	0.907		-0.335	2.079		0.131	1.267		-1.649	1.674	
Female	-0.031	0.024	-0.010	-0.094*	0.057	-0.029*	-0.018	0.034	-0.006	-0.016	0.045	-0.005
Age	-0.0018	0.0014	-0.001	-0.002	0.003	-0.001	0.0004	0.002	0.0001	-0.006**	0.003	-0.002**
Education	0.007	0.006	0.002	0.035***	0.014	0.011**	0.010	0.008	0.003	-0.017*	0.010	-0.006*
Household size	-0.040***	0.013	-0.013***	0.008	0.031	0.002	-0.035**	0.018	-0.011**	-0.090***	0.024	-0.028***
French	0.308***	0.026	0.101***	0.282***	0.075	0.091***	0.318***	0.036	0.104***	0.299***	0.046	0.097***
Urban	-0.077***	0.023	-0.024***	-0.240***	0.054	-0.074***	0.004	0.033	0.001	-0.124***	0.043	-0.039***
Income	-0.014***	0.004	-0.004***	-0.002	0.009	-0.001	-0.018***	0.006	-0.006***	-0.014*	0.007	-0.004*
Expenditure	0.001***	0.0001	0.0004***	0.001***	0.0002	0.0003***	0.001***	0.0001	0.0004***	0.002***	0.0001	0.0005***
Price of fresh beef	-0.139	0.087	-0.043	-0.228	0.199	-0.069	-0.206*	0.121	-0.064*	0.035	0.160	0.011
Price of semi-processed beef	0.148***	0.034	.046***	0.181**	0.077	0.055**	0.105**	0.047	0.033**	0.206***	0.062	0.065***
Price of fully processed beef	-0.065***	0.019	-0.020***	-0.059	0.043	-0.018	-0.0398	0.026	-0.012	-0.115***	0.034	-0.036***
Log likelihood	-8078.4			-1506.8			-4173.5			-2367.1		
R^2	0.09			0.09			0.10			0.10		
% correct predictions	72			74			72			72		
# of observations				2808			7560			4248		
Fully processed beef												
Constant	1.399	0.866		-1.123	1.965		3.670	1.209		-0.994	1.615	
Female	0.019	0.023	0.007	-0.005	0.054	-0.002	-0.009	0.033	-0.003	0.090**	0.043	0.031**
Age	-0.010***	0.001	-0.003***	-0.001	0.003	-0.0003	-0.015***	0.002	-0.005***	-0.005*	0.003	-0.002*
Education	-0.003	0.005	-0.001	-0.024*	0.013	-0.008*	-0.003	0.008	-0.001	0.017*	0.010	0.006*
Household size	0.040***	0.012	0.014***	0.047*	0.029	0.0.17*	0.017	0.017	0.006	0.082***	0.023	0.029***
French	0.132***	0.026	0.047***	0.288***	0.074	0.103***	0.076**	0.036	0.027**	0.132***	0.045	0.046***
Urban	0.109***	0.022	0.039***	0.130***	0.051	0.046***	0.113***	0.031	0.039***	0.089**	0.041	0.031**
Income	0.002	0.004	0.001	0.025***	0.009	0.009***	0.006	0.005	0.002	-0.026***	0.007	-0.009***
Expenditure	0.001***	0.0001	0.0004***	0.001***	0.0002	0.0003***	0.001***	0.0001	0.0004***	0.001***	0.0001	0.0005***

Price of fresh beef	0.186**	0.083	0.066**	0.290	0.187	0.103	0.008	0.115	0.003	0.439***	0.154	0.153***
Price of semi-processed beef	-0.187***	0.032	-0.066***	-0.008	0.073	-0.003	-0.236***	0.045	-0.083***	-0.226***	0.060	-0.079***
Price of fully processed beef	-0.140***	0.018	-0.050***	-0.213***	0.041	-0.076	-0.105***	0.025	-0.037***	-0.158***	0.034	-0.055***
Log likelihood	-9082.3			-1737.9			-4689.3			-2607.8		
R^2	0.14			0.13			0.14			0.15		
% correct predictions	65			66			65			66		
# of observations	14616			2808			7560			4248		
Fresh pork												
Constant	-0.973***	0.300		-0.421	0.688		-1.342***	0.418		-0.861	0.546	
Female	0.167***	0.033	0.028***	0.212***	0.070	0.039***	0.199***	0.045	0.033***	0.099	0.064	0.015
Age	0.014***	0.002	0.002***	0.014***	0.004	0.002***	0.014***	0.003	0.002***	0.016***	0.003	0.002***
Education	-0.032***	0.008	-0.005***	-0.025	0.019	-0.004	-0.041***	0.011	-0.007***	-0.016	0.015	-0.002
Household size	0.029	0.019	0.005	0.032	0.041	0.006	0.011	0.026	0.002	0.065*	0.035	0.010*
French	0.387***	0.039	0.058***	0.644***	0.120	0.093***	0.319***	0.053	0.048***	0.391***	0.070	0.056***
Urban	-0.138***	0.032	-0.0223***	-0.180***	0.068	-0.032***	-0.137***	0.044	-0.022***	-0.109*	0.061	-0.017*
Income	-0.009*	0.005	-0.001*	-0.008	0.011	-0.001	0.007	0.007	0.001	-0.038***	0.009	-0.006***
Expenditure	0.004***	0.0002	0.001***	0.004***	0.0004	0.001***	0.004***	0.0003	0.001***	0.004***	0.0004	0.001***
Price of fresh pork	0.163	0.106	0.027	0.211	0.229	0.038	0.266*	0.150	0.043*	-0.077	0.201	-0.012
Price of semi- processed pork	-0.236***	0.062	-0.039***	-0.256**	0.131	-0.046*	-0.299***	0.087	-0.048***	-0.096	0.116	-0.015
Price of fully processed pork	0.150***	0.043	0.025***	0.046	0.092	0.008	0.165***	0.059	0.027***	0.209***	0.084	0.032***
Log likelihood	-4259.5			-901.2			0-2185.5			-1157.3		
R^2	0.19			0.19			0.18			0.22		
% correct predictions	88			87			88			89		
# of observations	14616			2808			7560			4248		
Semi-processed pork												
Constant	-0.614***	0.217		-0.873*	0.500		-0.493*	0.304		-0.774**	0.401	
Female	0.007	0.023	0.002	0.010	0.054	0.004	0.019	0.033	0.007	-0.013	0.043	-0.005
Age	0.006***	0.001	0.002***	0.007***	0.003	0.003***	0.005***	0.002	0.002***	0.009***	0.003	0.003***
Education	-0.021***	0.006	-0.007***	-0.023*	0.013	-0.008*	-0.016**	0.008	-0.006**	-0.021**	0.010	-0.007**
Household size	0.052***	0.013	0.019***	0.026	0.029	0.009	0.082***	0.017	0.029***	0.023	0.023	0.008
French	0.065***	0.026	0.023***	0.148**	0.073	0.053**	0.031	0.036	0.011	0.061	0.045	0.022
Urban	-0.162***	0.022	-0.058***	-0.126***	0.051	-0.045***	-0.195***	0.031	-0.070***	-0.139***	0.041	-0.050***
Income	-0.0002	0.004	-0.0001	0.006	0.008	0.002	0.003	0.005	0.001	-0.011	0.007	-0.004
Expenditure	0.002***	0.0001	0.001***	0.002***	0.0001	0.001***	0.002***	0.0001	0.001***	0.002***	0.0001	0.001***
Price of fresh pork	0.320***	0.075	0.114***	0.316*	0.171	0.113*	0.324***	0.103	0.116***	0.316**	0.140	0.113**
Price of semi-processed pork	-0.357***	0.044	-0.128***	-0.377***	0.100	-0.135***	-0.345***	0.061	-0.123***	-0.365***	0.082	-0.131***
Price of fully processed pork	0.044	0.029	0.016	0.083	0.067	0.030	0.015	0.041	0.005	0.070	0.054	0.025
Log likelihood	-9104.2			-1754.1			-4686.5			-2650.3		
R^2	0.13			0.13			0.13			0.12		
% correct predictions	66			66.0			67			66		
# of observations	14616			2808			7560			4248		
Fully processed pork												
Constant	2.392***	0.219		1.58***	0.507		2.893***	0.306		1.912***	0.405	
Female	-0.040*	0.024	-0.014*	-0.001	0.055	-0.0002	-0.015	0.033	-0.005	-0.095**	0.044	-0.033**
Age	-0.006***	0.001	-0.002***	0.009***	0.003	0.003***	-0.013***	0.002	-0.005***	-0.002	0.003	-0.001
Education	-0.016***	0.006	-0.006***	0.011	0.013	0.004	-0.024***	0.008	-0.008***	-0.016	0.010	-0.005
Household size	0.073***	0.012	0.025***	0.105***	0.029	0.035***	0.053***	0.017	0.018***	0.091***	0.023	0.031***
French	0.004	0.026	0.002	0.067	0.074	0.023	-0.068*	0.036	-0.023*	0.083*	0.045	0.029*
Urban	-0.029	0.023	-0.010	0.020	0.052	0.007	-0.051	0.032	-0.018	-0.007	0.042	-0.003

Income	-0.0004	0.004	-0.0001	0.018**	0.009	0.006**	-0.0003	0.005	-0.0001	-0.010	0.007	-0.004
Expenditure	0.001***	0.0001	0.0003***	0.001***	0.0002	0.0003***	0.001***	0.0001	0.0004***	0.001***	0.0001	0.0004***
Price of fresh pork	-0.076	0.076	-0.026	-0.321*	0.173	-0.108*	-0.040	0.105	-0.014	0.018	0.141	0.006
Price of semi-processed pork	-0.020	0.044	-0.007	0.080	0.101	0.027	-0.046	0.062	-0.016	-0.043	0.083	-0.015
Price of fully processed pork	-0.222***	0.030	-0.076***	-0.161**	0.068	-0.053**	-0.224***	0.041	-0.076***	-0.259***	0.0553	-0.088***
Log likelihood	-8757.9			-1654.3			-4528.6			-2541.4		
R^2	0.08			0.09			0.08			0.07		
% correct predictions	68			70			68			69		
# of observations	14616			2808			7560			4248		
Fresh poultry												
Constant	-0.668	0.511		-1.368	1.152		0.618	0.713		-2.344**	1.011	
Female	0.258***	0.037	0.033***	0.396***	0.084	0.051***	0.214***	0.051	0.028***	0.299***	0.077	0.034***
Age	0.008***	0.002	0.001***	0.024***	0.005	0.003***	-0.002	0.003	-0.0003	0.012***	0.004	0.001***
Education	0.026***	0.009	0.003***	0.033	0.023	0.004	0.004	0.012	0.0005	0.063***	0.017	0.007***
Household size	-0.049**	0.021	-0.006**	0.100**	0.048	0.012**	-0.144***	0.028	-0.018***	0.002	0.044	0.0002
French	0.188***	0.043	0.022***	0.144	0.134	0.016	0.184***	0.058	0.022***	0.257***	0.079	0.027***
Urban	0.037	0.035	0.005	-0.142*	0.076	-0.017*	0.088*	0.049	0.011*	0.131*	0.070	0.014*
Income	-0.010*	0.006	-0.001*	-0.017	0.013	-0.002	-0.013	0.008	-0.002	0.001	0.012	0.0001
Expenditure	0.005***	0.0004	0.001***	0.005***	0.001	0.001***	0.005***	0.001	0.001***	0.006***	0.001	0.001***
Price of fresh poultry	-0.222***	0.073	-0.027***	-0.363**	0.166	-0.043**	-0.228**	0.100	-0.029**	-0.142	0.146	-0.160
Price of semi-processed poultry	0.068**	0.031	0.008**	0.119	0.074	0.014	0.043	0.041	0.005	0.085	0.063	0.009
Price of fully processed poultry	0.112***	0.024	0.014***	0.121**	0.055	0.014**	0.115***	0.033	0.015***	0.103**	0.047	0.011**
Log likelihood	-3190.4			-602.9			-1715.2			-828.6		
R^2	0.19			0.18			0.19			0.22		
% correct predictions	92			92			91			92		
# of observations				2808			7560			4248		
Semi-processed poultry												
Constant	0.945***	0.342		2.407***	0.806		0.889*	0.475		0.223	0.628	
Female	0.102***	0.025	0.029***	0.072	0.060	0.020	0.103***	0.035	0.030***	0.119***	0.046	0.034***
Age	-0.008***	0.001	-0.002***	-0.004	0.003	-0.001	-0.012***	0.002	-0.003***	-0.005**	0.003	-0.002**
Education	-0.007	0.006	-0.002	-0.029**	0.014	-0.008**	0.003	0.008	0.001	-0.013	0.011	-0.004
Household size	0.008	0.013	0.002	0.003	0.030	0.001	-0.008	0.018	-0.002	0.035	0.024	0.010
French	0.385***	0.027	0.120***	0.335***	0.076	0.102***	0.351***	0.037	0.110***	0.470***	0.047	0.145***
Urban	0.009	0.024	0.003	-0.072	0.056	-0.020	0.016	0.034	0.005	0.048	0.044	0.014
Income	0.017***	0.004	0.005***	0.031***	0.009	0.009***	0.010*	0.006	0.003*	0.025***	0.007	0.007***
Expenditure	0.001***	0.00005	0.0003***	0.001***	0.0001	0.0002***	0.001***	0.0001	0.0003***	0.001***	0.0001	0.0003***
Price of fresh poultry	-0.411***	0.046	-0.120***	-0.593***	0.107	-0.166***	-0.382***	0.064	-0.112***	-0.359***	0.085	-0.104***
Price of semi-processed poultry	0.066***	0.020	0.019***	0.064	0.046	0.017	0.068***	0.028	0.020***	0.062*	0.037	0.018*
Price of fully processed poultry	0.051***	0.016	0.015***	0.040	0.036	0.011	0.049**	0.022	0.014**	0.062**	0.029653	0.018**
Log likelihood	-7583.0			-1403.900			-3961.4			-2198.5		
R^2	0.06			0.05			0.07			0.07		
% correct predictions	76			78			76			75		
# of observations				2808			7560			4248		
Fully processed poultry												
Constant	-4.223***	0.327		-4.223***	0.742		-3.584***	0.456		-5.511***	0.614	
Female	0.056**	0.025	0.017**	0.153***	0.057	0.047***	0.031	0.035	0.010	0.028	0.047	0.008

Age	-0.022***	0.001	-0.007***	-0.018***	0.003	-0.006***	-0.025***	0.002	-0.008***	-0.017***	0.003	-0.005***
Education	-0.010*	0.006	-0.003*	-0.013	0.013	-0.004	-0.005	0.008	-0.001	-0.014	0.011	-0.004
Household size	0.066***	0.013	0.020***	0.006	0.030	0.002	0.075***	0.018	0.023***	0.102***	0.025	0.030***
French	0.177***	0.027	0.054***	0.210***	0.077	0.065***	0.133***	0.038	0.041***	0.205***	0.048	0.060***
Urban	-0.068***	0.024	-0.021***	-0.020	0.054	-0.006	-0.132***	0.033	-0.040***	-0.001	0.044	-0.0004
Income	0.003	0.004	0.001	0.026***	0.009	0.008***	-0.007	0.006	-0.002	0.003	0.008	0.001
Expenditure	0.001***	0.0001	0.0003***	0.001***	0.0001	0.0002***	0.001***	0.0001	0.0003***	0.001***	0.0001	0.0004***
Price of fresh poultry	1.801***	0.047	0.547***	1.727***	0.106	0.533***	1.726***	0.065	0.529***	2.014***	0.089	0.585***
Price of semi-processed poultry	-0.011	0.021	-0.003	0.015	0.047	0.005	-0.015	0.028	-0.005	-0.022	0.039	-0.007
Price of fully processed poultry	-0.755***	0.018	-0.229***	-0.757***	0.042	-0.234***	-0.734***	0.025	-0.225***	-0.803***	0.034	-0.233***
Log likelihood	7827.4			-1528.900			-4084.2			-2182		
R^2	0.29			0.27			0.28			0.32		
% correct predictions	74			72			73			75		
# of observations	14616			2808			7560			428		
Fresh other meats												
Constant	-5.479***	0.191		-5.833***	0.447		-5.264***	0.265		-5.768***	0.354	
Female	-0.034	0.023	-0.012	-0.007	0.055	-0.002	-0.028	0.033	-0.010	-0.057	0.043	-0.020
Age	0.014***	0.001	0.005***	0.016***	0.003	0.006***	0.013***	0.002	0.004***	0.018***	0.003	0.006***
Education	0.039***	0.006	0.013***	0.037***	0.013	0.013***	0.036***	0.008	0.013***	0.047***	0.010	0.016***
Household size	0.030***	0.012	0.011***	0.006	0.031	0.002	0.027	0.017	0.009	0.059***	0.023	0.020***
French	0.232***	0.025	0.082***	0.143**	0.073	0.049**	0.260***	0.035	0.092***	0.218***	0.044	0.077***
Urban	0.039*	0.022	0.014*	0.106**	0.052	0.036**	0.058*	0.031	0.020*	-0.038	0.042	-0.013
Income	0.014***	0.004	0.005***	0.014	0.009	0.005	0.026***	0.005	0.009***	-0.010	0.007	-0.003
Expenditure	0.001***	0.00005	0.0003***	0.001***	0.0001	0.0004***	0.001***	0.0001	0.0003***	0.001***	0.0001	0.0004***
Price of fresh other meats	-0.623***	0.034	-0.216***	-0.741***	0.078	-0.252***	-0.568***	0.046	-0.198***	-0.649***	0.062	-0.225***
Price of semi-processed other meats	0.454***	0.028	0.158***	0.535***	0.065	0.182***	0.429***	0.039	0.149***	0.451***	0.052	0.156***
Price of fully processed other meats	0.609***	0.029	0.211***	0.690***	0.068	0.234***	0.559***	0.041	0.194***	0.650***	0.055	0.225***
Log likelihood	-8904.4			-1675.2			-4618.6			-2587.4		
R^2	0.10			0.12			0.09			0.11		
% correct predictions	67			68.			66			67		
# of observations	14616			2808			7560			4248		
Semi-processed other meats												
Constant	-0.568***	0.179		-0.712*	0.414		-0.624***	0.247		-0.389	0.334	
Female	-0.017	0.023	-0.006	0.030	0.054	0.011	0.000	0.032	0.0001	-0.080*	0.043	-0.029*
Age	-0.004***	0.001	-0.001***	-0.009***	0.003	-0.003***	-0.003	0.002	-0.001	-0.002	0.003	-0.001
Education	-0.018***	0.005	-0.007***	-0.019	0.013	-0.007	-0.009	0.008	-0.003	-0.034***	0.010	-0.012***
Household size	0.056***	0.012	0.020***	0.011	0.030	0.004	0.061***	0.017	0.022***	0.081***	0.023	0.029***
French	0.507***	0.026	0.187***	0.616***	0.072	0.229***	0.447***	0.036	0.164***	0.540***	0.044	0.196***
Urban	-0.082***	0.022	-0.030***	-0.045	0.051	-0.017	-0.125***	0.031	-0.046***	-0.063	0.041	-0.023
Income	-0.006	0.004	-0.002	-0.021**	0.009	-0.007***	0.001	0.005	0.0003	-0.006	0.007	-0.002
Expenditure	0.001***	0.0001	0.0004***	0.001***	0.0002	0.0004***	0.001***	0.0001	0.0004***	0.001***	0.0001	0.0005***
Price of fresh other meats	0.290***	0.034	0.106***	0.169**	0.076	0.062**	0.385***	0.047	0.141***	0.200***	0.063	0.071***
Price of semi-processed other meats	-0.107***	0.027	-.003891***	-0.021	0.062	-0.008	-0.159***	0.038	-0.058***	-0.067	0.051	-0.024
Price of fully processed other	-0.178***	0.029	-0.065***	-0.069	0.066	-0.025	-0.244***	0.040	-0.089***	-0.134***	0.054	-0.048***

meats												
Log likelihood	-9293.7			-1786.9			-4827.9			-2644.6		
R^2	0.11			0.1			0.11			0.13		
% correct predictions	64			63			64			65		
# of observations	14616			2808			7560			4248		
Fully processed other meats												
Constant	-12.28***	0.250		-11.92***	0.554		-12.32***	0.355		-12.72***	0.466	
Female	-0.019	0.027	-0.005	-0.052	0.060	-0.014	-0.031	0.037	-0.008	0.024	0.049	0.006
Age	-0.003**	0.002	-0.001**	-0.003	0.003	-0.001	-0.003	0.002	-0.001	-0.002	0.003	-0.0006
Education	-0.003	0.006	-0.001	0.024*	0.014	0.007*	-0.017**	0.009	-0.005**	0.003	0.011	0.001
Household size	0.109***	0.014	0.030***	0.030	0.032	0.009	0.146***	0.019	0.039***	0.102***	0.027	0.027***
French	-0.059**	0.029	-0.016**	-0.022	0.081	-0.006	-0.010	0.041	-0.003	-0.154***	0.051	-0.041***
Urban	-0.005	0.025	-0.001	-0.053	0.056	-0.015	-0.028	0.035	-0.008	0.051	0.047	0.014
Income	0.008*	0.004	0.002*	0.003	0.009	0.001	0.017***	0.006	0.004***	-0.006	-0.718	-0.002
Expenditure	0.001***	0.0001	0.0002***	0.0005***	0.0001	0.0001***	0.0006***	0.0001	0.0002***	0.001***	0.0001	0.0003***
Price of fresh other meats	-0.818***	0.034	-0.222***	-0.731***	0.077	-0.204***	-0.803***	0.048	-0.216***	-0.925***	0.064	-0.245***
Price of semi-processed other meats	0.957***	0.034	0.260***	0.880***	0.076	0.246***	0.970***	0.047	0.261***	1.007***	0.063	0.267***
Price of fully processed other meats	1.200***	0.034	0.325***	1.127***	0.075	0.314***	1.181***	0.047	0.318***	1.302***	0.063	0.346***
Log likelihood	-6999.3			-1381.0			-3591.2			-1996.7		
R^2	0.33			0.30			0.33			0.35		
% correct predictions	74			73			75			76		
# of observations	14616			2808			7560			4248		

***, **and * indicates significance at 1%, 5%, and 10% levels respectively. SE is standard error

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track™ data

Table A6 Results from the demand system

	Whole sample		Low trust		Medium trust		High trust	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Log(total expenditure								
Constant	-0.934***	0.378	-2.818***	0.928	-0.2784	0.482	-1.111*	0.6786
Female	-0.013	0.012	0.027	0.031	-0.036**	0.018	-0.004	0.020
Age	-0.0004	0.001	0.002	0.002	-0.0013	0.001	-0.001	0.001
Education	-0.007*	0.004	-0.032***	0.008	0.0060	0.006	-0.007	0.008
Household size	0.117***	0.011	0.092***	0.025	0.143***	0.015	0.090***	0.022
French	0.006	0.014	0.051	0.042	-0.0175	0.020	0.010	0.022
Urban	0.001	0.011	-0.010	0.028	0.0051	0.016	-0.009	0.020
Log of income	0.049	0.038	0.249***	0.082	-0.0570	0.052	0.074	0.075
Sum(share*price)	1.444***	0.163	2.398***	0.398	1.143***	0.209	1.428***	0.293
Lag(log of total expenditure)	0.590***	0.022	0.536***	0.055	0.592***	0.025	0.633***	0.034
Trend	-0.028***	0.004	-0.016	0.011	-0.031***	0.006	-0.028***	0.008
R^2	0.627		0.560		0.630		0.630	
Durbin-Watson	1.524		1.370		1.500		1.660	
Share of fresh beef								
Constant	2.952***	0.221	3.096***	0.498	2.868***	0.299	3.070***	0.432
Female	-0.005	0.003	-0.020***	0.007	-0.0006	0.004	-0.004	0.006
Age	0.001***	0.0002	-0.001***	0.0004	0.002***	0.0003	0.0004	0.0004
Education	-0.001	0.001	-0.003*	0.002	0.002**	0.001	-0.005***	0.001
Household size	-0.012***	0.002	-0.007**	0.004	-0.010***	0.002	-0.015***	0.003
French	0.053***	0.003	0.079***	0.010	0.049***	0.005	0.044***	0.006
Urban	0.015***	0.003	0.009	0.007	0.015***	0.004	0.013***	0.005
Income	-0.0001	0.001	0.001	0.001	-0.0006	0.001	-0.0004	0.001
Log(total expenditure)	-0.022***	0.003	-0.021***	0.006	-0.025***	0.004	-0.019***	0.004
Lag(quantity)	0.004***	0.0002	0.003***	0.001	0.004***	0.0002	0.004***	0.0002
Inverse Mills ratio	0.084***	0.003	0.093***	0.006	0.081***	0.004	0.084***	0.004
Log(price of fresh beef)	-1.104***	0.091	-1.055***	0.214	-1.085***	0.125	-1.194***	0.168
Log(price of semi-processed beef)	0.026	0.032	-0.055	0.062	0.0348	0.042	0.059	0.069
Log(price of fully processed beef)	-0.038*	0.023	-0.018	0.052	-0.061*	0.032	-0.011	0.041
Trend	-0.019***	0.003	-0.017***	0.006	-0.021***	0.004	-0.016***	0.005
R^2	0.338		0.320		0.330		0.370	
Durbin-Watson	0.977		0.960		1.010		0.950	
Share of semi-processed beef								
Constant	-0.056	0.154	0.176	0.299	-0.1110	0.202	-0.084	0.336
Female	-0.001	0.001	-0.003**	0.001	-0.0008	0.001	0.0005	0.001
Age	-0.0001***	0.00003	-0.0001**	0.0001	-0.0001	0.00004	-0.0001	0.0001
Education	-0.0002	0.0001	-0.000003	0.0002	0.00004	0.0002	-0.0004**	0.0002
Household size	-0.00003	0.0002	-0.0001	0.0005	0.0001	0.0003	-0.00004	0.001
French	0.003***	0.001	0.005***	0.002	0.002***	0.001	0.003***	0.001
Urban	-0.001**	0.0005	-0.001	0.001	-0.0007	0.001	-0.001	0.001
Income	-0.00004	0.0001	0.0004***	0.0002	-0.0002**	0.0001	-0.0001	0.000
Log(total expenditure)	-0.003***	0.001	-0.003***	0.001	-0.003***	0.001	-0.005***	0.002
Lag(quantity)	0.004***	0.0004	0.005***	0.001	0.004***	0.001	0.002***	0.001
Inverse Mills ratio	0.025***	0.001	0.022***	0.001	0.025***	0.001	0.026***	0.001
Log(price of semi-processed beef)	0.039	0.035	0.010	0.065	0.0460	0.046	0.041	0.076
Log(price of fully processed beef)	-0.024***	0.006	-0.016*	0.010	-0.019***	0.008	-0.039***	0.011
Trend	-0.001	0.002	-0.002	0.003	0.0001	0.002	-0.002	0.004
R^2	0.340		0.400		0.370		0.290	
Durbin-Watson	1.554		1.460		1.580		1.570	
Share of fully processed beef								
Constant	0.461***	0.049	0.441***	0.112	0.490***	0.067	0.425***	0.093
Female	-0.004***	0.001	-0.006**	0.003	-0.0022	0.002	-0.005**	0.002
Age	-0.001***	0.0001	-0.0003**	0.0001	-0.001***	0.0001	-0.0005***	0.0002
Education	-0.001***	0.0003	-0.003***	0.001	-0.001*	0.0004	0.000	0.0005
Household size	0.004***	0.001	0.002*	0.001	0.005***	0.001	0.005***	0.001
French	-0.010***	0.001	-0.002	0.002	-0.011***	0.002	-0.013***	0.002
Urban	0.001	0.001	0.005**	0.002	0.0021	0.002	-0.003	0.002
Income	0.001***	0.0002	0.002***	0.000	0.001*	0.0003	-0.0003	0.0004
Log(total expenditure)	-0.019***	0.001	-0.017***	0.002	-0.019***	0.001	-0.021***	0.002
Lag(quantity)	0.007***	0.001	0.005***	0.001	0.007***	0.001	0.007***	0.001
Inverse Mills ratio	0.039***	0.001	0.040***	0.002	0.039***	0.001	0.038***	0.002

Log(price of fully processed beef)	-0.063***	0.009	-0.084***	0.018	-0.059***	0.013	-0.058***	0.016
Trend	-0.001	0.001	-0.004**	0.002	-0.001	0.002	-0.001	0.002
R^2	0.353		0.360		0.360		0.340	
Durbin-Watson	1.239		1.340		1.200		1.270	
Share of fresh pork								
Constant	-0.695***	0.159	-0.075	0.358	-0.713***	0.226	-1.085***	0.277
Female	0.006***	0.002	0.001	0.005	0.007**	0.003	0.008**	0.004
Age	0.001***	0.0001	0.001***	0.0003	0.001***	0.0002	0.001***	0.0002
Education	-0.004***	0.001	-0.004***	0.001	-0.004***	0.001	-0.004***	0.001
Household size	0.005***	0.001	0.004	0.003	0.004***	0.002	0.006***	0.002
French	0.005**	0.002	0.024***	0.007	0.005	0.003	-0.003	0.004
Urban	-0.015***	0.002	-0.011**	0.005	-0.018***	0.003	-0.014***	0.004
Income	-0.0001	0.0004	0.001	0.001	0.001	0.001	-0.002***	0.001
Log(total expenditure)	-0.038***	0.002	-0.041***	0.005	-0.040***	0.003	-0.035***	0.004
Lag(quantity)	0.005***	0.0002	0.005***	0.0003	0.004***	0.0002	0.005***	0.0003
Inverse Mills ratio	0.067***	0.002	0.067***	0.004	0.069***	0.003	0.065***	0.004
Log(price of fresh pork)	-0.066	0.200	-0.487	0.462	0.075	0.277	-0.041	0.357
Log(price of semi-processed pork)	0.307***	0.104	0.452*	0.243	0.211	0.142	0.394**	0.189
Log(price of fully processed pork)	0.226***	0.044	0.222**	0.105	0.192***	0.061	0.280***	0.078
Trend	0.010***	0.003	-0.001	0.006	0.011***	0.004	0.016***	0.004
R^2	0.301		0.300		0.290		0.340	
Durbin-Watson	1.233		1.240		1.220		1.280	
Share of semi-processed pork								
Constant	-0.173**	0.077	-0.311*	0.180	-0.110	0.104	-0.187	0.141
Female	-0.0002	0.001	-0.005	0.003	0.002	0.001	-0.002	0.002
Age	0.00004	0.0001	0.000	0.0002	0.0001	0.0001	0.0001	0.0001
Education	-0.001***	0.0003	-0.002***	0.001	-0.001	0.0004	-0.001***	0.001
Household size	0.005***	0.001	0.005***	0.001	0.005***	0.001	0.003***	0.001
French	-0.011***	0.001	-0.013***	0.002	-0.011***	0.002	-0.012***	0.002
Urban	-0.008***	0.001	-0.008***	0.003	-0.001***	0.002	-0.008***	0.002
Income	-0.0001	0.0002	-0.0001	0.0004	-0.00001	0.0003	-0.0003	0.0003
Log(total expenditure)	-0.017***	0.001	-0.018***	0.003	-0.017***	0.002	-0.016***	0.002
Lag(quantity)	0.005***	0.0003	0.005***	0.001	0.005***	0.0003	0.007***	0.001
Inverse Mills ratio	0.040***	0.001	0.042***	0.002	0.041***	0.001	0.035***	0.001
Log(price of semi-processed pork)	-0.118**	0.056	-0.159	0.130	-0.082	0.078	-0.166	0.103
Log(price of fully processed pork)	-0.048**	0.023	-0.079	0.054	-0.022	0.031	-0.080**	0.041
Trend	0.004***	0.001	0.006**	0.003	0.003*	0.002	0.004**	0.002
R^2	0.349		0.350		0.360		0.340	
Durbin-Watson	1.462		1.530		1.520		1.350	
Share of fully processed pork								
Constant	-0.141***	0.040	-0.094	0.101	-0.133**	0.056	-0.157***	0.062
Female	-0.002**	0.001	-0.001	0.002	-0.002**	0.001	-0.002	0.001
Age	-0.0001**	0.00004	0.0001	0.0001	-0.0002***	0.0001	0.00003	0.0001
Education	-0.0004**	0.0002	-0.0003	0.001	-0.001**	0.0003	-0.0001	0.0002
Household size	0.003***	0.0004	0.003***	0.001	0.003***	0.001	0.003***	0.001
French	-0.002***	0.001	0.002	0.003	-0.004***	0.001	-0.001	0.001
Urban	0.0003	0.001	0.004***	0.002	-0.000004	0.001	-0.001	0.001
Income	0.0003***	0.0001	0.008***	0.0003	0.0003	0.0002	0.0002	0.0002
Log(total expenditure)	-0.010***	0.001	-0.012***	0.002	-0.010***	0.001	-0.007***	0.001
Lag(quantity)	0.005***	0.001	0.007***	0.002	0.005***	0.001	0.004***	0.001
Inverse Mills ratio	0.028***	0.001	0.030***	0.002	0.028***	0.001	0.025***	0.001
Log(price of fully processed pork)	-0.084***	0.011	-0.073***	0.026	-0.074***	0.015	-0.109***	0.020
Trend	0.005***	0.001	0.004***	0.001	0.005***	0.001	0.005***	0.001
R^2	0.308		0.320		0.310		0.320	
Durbin-Watson	1.326		1.150		1.360		1.470	
Share of fresh poultry								
Constant			2.901***	1.107	0.824	0.677	2.018**	0.847
Female	1.560***	0.481	0.044***	0.007	0.006	0.004	0.007	0.005
Age	0.013***	0.003	0.001**	0.0004	-0.0002	0.0002	0.0004	0.0003
Education	0.0002	0.0002	0.002	0.002	0.004***	0.001	0.007***	0.001
Household size	0.005***	0.001	-0.003	0.005	0.0002	0.002	0.0002	0.003
French	-0.0001	0.002	-0.055***	0.008	-0.021***	0.004	-0.013***	0.005
Urban	-0.024***	0.003	-0.002	0.007	0.013***	0.004	0.015***	0.005
Income	0.010***	0.003	0.003**	0.001	-0.001*	0.001	0.004***	0.001

Log(total expenditure)	0.001*	0.001	-0.055***	0.006	-0.051***	0.003	-0.059***	0.004
Lag(quantity)	-0.055***	0.002	0.003***	0.001	0.004***	0.0002	0.004***	0.000
Inverse Mills ratio	0.004***	0.0002	0.065***	0.005	0.080***	0.004	0.074***	0.006
Log(price of fresh poultry)	0.076***	0.003	-1.146***	0.371	-0.434**	0.224	-0.822***	0.281
Log(price of semi-processed poultry)	-0.683***	0.160	-0.257***	0.084	-0.095*	0.053	-0.190***	0.066
Log(price of fully processed poultry)	-0.152***	0.038	0.171*	0.091	0.302***	0.055	0.185***	0.068
Trend	0.243***	0.039	-0.023***	0.009	-0.006	0.006	-0.017***	0.007
R^2	0.266		0.240		0.280		0.270	
Durbin-Watson	1.020		0.960		1.040		1.070	
Share of semi-processed poultry								
Constant	0.371***	0.114	0.698***	0.259	0.181	0.162	0.511***	0.202
Female	0.003***	0.001	0.002	0.001	0.004***	0.001	0.002**	0.001
Age	-0.0002***	0.00004	-0.0003***	0.0001	-0.0003***	0.0001	-0.0001*	0.0001
Education	-0.0002	0.0002	0.000	0.0004	-0.0003	0.0002	-0.0001	0.0002
Household size	0.001***	0.0004	0.002*	0.001	0.0001	0.001	0.002***	0.001
French	0.004***	0.001	0.003	0.002	0.003***	0.001	0.006***	0.001
Urban	0.001	0.001	-0.001	0.002	0.0001	0.001	0.004***	0.001
Income	0.001***	0.000	0.001**	0.0003	0.001***	0.0002	0.001***	0.0002
Log(total expenditure)	-0.007***	0.001	-0.007***	0.001	-0.006***	0.001	-0.007***	0.001
Lag(quantity)	0.005***	0.001	0.006***	0.001	0.004***	0.001	0.004***	0.001
Inverse Mills ratio	0.033***	0.001	0.036***	0.002	0.032***	0.001	0.032***	0.001
Log(price of semi-processed poultry)	-0.009	0.010	-0.048**	0.022	0.011	0.014	-0.021	0.018
Log(price of fully processed poultry)	0.003	0.009	-0.007	0.022	0.017	0.013	-0.016	0.016
Trend	-0.002***	0.001	-0.005**	0.002	-0.001	0.001	-0.004**	0.002
R^2	0.349		0.410		0.320		0.380	
Durbin-Watson	1.530		1.460		1.540		1.580	
Share of fully processed poultry								
Constant	1.051***	0.116	1.163***	0.266	0.958***	0.163	1.146***	0.205
Female	-0.001	0.002	-0.0001	0.004	-0.004*	0.002	0.002	0.003
Age	-0.001***	0.0001	-0.001***	0.0003	-0.002***	0.0002	-0.001***	0.0002
Education	-0.001***	0.0004	0.000	0.001	-0.002***	0.0006	-0.0004	0.001
Household size	0.006***	0.001	0.002	0.002	0.006***	0.001	0.006***	0.002
French	-0.005***	0.002	-0.009**	0.004	-0.005**	0.003	-0.002	0.003
Urban	-0.004***	0.002	-0.0001	0.004	-0.005**	0.002	-0.006**	0.003
Income	-0.00005	0.0003	-0.0004	0.001	-0.0004	0.0004	0.001	0.001
Log(total expenditure)	-0.022***	0.001	-0.021***	0.002	-0.023***	0.002	-0.021***	0.002
Lag(quantity)	0.006***	0.001	0.005***	0.002	0.005***	0.001	0.006***	0.001
Inverse Mills ratio	0.044***	0.001	0.049***	0.003	0.044***	0.001	0.042***	0.002
Log(price of fully processed poultry)	-0.535***	0.014	-0.522***	0.031	-0.546***	0.019	-0.523***	0.024
Trend	-0.011***	0.001	-0.012***	0.003	-0.010***	0.002	-0.012***	0.002
R^2	0.408		0.380		0.410		0.440	
Durbin-Watson	1.084		1.070		1.090		1.100	
Share of fresh other meats								
Constant	-0.285***	0.026	-0.294***	0.062	-0.261***	0.035	-0.322***	0.047
Female	-0.003***	0.001	-0.003	0.003	-0.001	0.002	-0.007***	0.002
Age	0.001***	0.0001	0.001***	0.0002	0.0005***	0.0001	0.001***	0.0001
Education	0.002***	0.0003	0.002**	0.001	0.002***	0.0004	0.003***	0.0005
Household size	0.002***	0.001	0.002	0.001	0.001	0.001	0.005***	0.001
French	-0.001	0.001	-0.011***	0.002	0.0001	0.002	0.002	0.002
Urban	0.003***	0.001	0.009***	0.003	0.005***	0.001	-0.003	0.002
Income	0.001***	0.0002	0.001***	0.0005	0.001***	0.0003	0.0002	0.0003
Log(total expenditure)	-0.013***	0.001	-0.014***	0.002	-0.013***	0.001	-0.012***	0.002
Lag(quantity)	0.008***	0.001	0.009***	0.001	0.008***	0.001	0.008***	0.001
Inverse Mills ratio	0.042***	0.001	0.046***	0.002	0.041***	0.001	0.041***	0.002
Log(price of fresh other meats)	-0.170**	0.084	-0.246	0.214	-0.173	0.112	-0.124	0.149
Log(price of semi-processed other meats)	0.134***	0.027	0.149**	0.068	0.132***	0.035	0.130***	0.047
Log(price of fully processed other meats)	0.182***	0.057	0.250*	0.147	0.182**	0.076	0.144	0.100
Trend	0.001	0.001	-0.001	0.003	0.001	0.001	0.002	0.002
R2	0.376		0.390		0.360		0.400	
Durbin-Watson	1.170		1.080		1.160		1.280	

Share of semi-processed other meats								
Constant	0.077***	0.015	-0.031	0.032	0.094***	0.021	0.111***	0.026
Female	-0.004***	0.001	-0.001	0.002	-0.005***	0.002	-0.003**	0.002
Age	-0.0003***	0.0001	-0.0002**	0.0001	-0.0001*	0.0001	-0.001***	0.0001
Education	-0.0004*	0.0002	0.0001	0.0003	-0.00001	0.0003	-0.001**	0.0005
Household size	0.003***	0.001	0.001	0.001	0.004***	0.001	0.001	0.001
French	0.010***	0.001	0.013***	0.003	0.007***	0.002	0.012***	0.002
Urban	-0.002**	0.001	0.001	0.002	-0.004***	0.001	-0.002	0.002
Income	-0.001***	0.0001	0.000	0.0003	-0.001***	0.0002	-0.001***	0.0003
Log(total expenditure)	-0.015***	0.001	-0.010***	0.002	-0.017***	0.002	-0.014***	0.002
Lag(quantity)	0.007***	0.0005	0.004***	0.001	0.007***	0.001	0.008***	0.001
Inverse Mills ratio	0.031***	0.001	0.029***	0.002	0.033***	0.001	0.029***	0.001
Log(price of semi-processed other meats)	-0.050***	0.011	-0.032	0.023	-0.063***	0.016	-0.038**	0.018
Log(price of fully processed other meats)	-0.072***	0.018	-0.076	0.047	-0.065***	0.025	-0.084***	0.033
Trend	-0.0004	0.0003	0.001	0.001	-0.001	0.0005	-0.0004	0.001
R^2	0.314		0.300		0.310		0.350	
Durbin-Watson	1.266		1.410		1.300		1.140	

***, **and * indicates significance at 1%, 5%, and 10% levels respectively. SE is standard error

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track™ data

Table A7 Own price, cross price and expenditure elasticities for meat products (whole sample)

		Beef			Pork			Poultry			Other			Expenditure
		Fresh	Semi	Fully	Fresh	Semi	Fully	Fresh	Semi	Fully	Fresh	Semi	Fully	
Beef	Fresh	-4.54***	0.08	-0.12*										0.93***
		(0.29)	(0.10)	(0.07)										(0.01)
	Semi	2.27	2.40	-2.11***										0.70***
		(2.75)	(3.02)	(0.48)										(0.05)
	Fully	-1.05*	-0.67***	-2.73***										0.47***
		(0.62)	(0.15)	(0.25)										(0.03)
Pork	Fresh				-1.38	1.80***	1.32***							0.78***
					(1.17)	(0.61)	(0.26)							(0.01)
	Semi				7.71***	-3.97***	-1.21**							0.57***
					(2.60)	(1.41)	(0.57)							(0.03)
	Fully				14.2***	-3.03**	-6.32***							0.40***
					(2.77)	(1.42)	(0.70)							(0.06)
Poultry	Fresh							-3.88***	-0.64***	1.03***				0.77***
								(0.67)	(0.16)	(0.16)				(0.01)
	Semi							-11.3***	-1.66 **	0.23				0.49***
								(2.81)	(0.75)	(0.69)				(0.04)
	Fully							3.61***	0.05	-8.95***				0.67***
								(0.58)	(0.14)	(0.20)				(0.02))
Other	Fresh										-6.15**	4.05***	5.51***	0.61***
											(2.55)	(0.81)	(1.73)	(0.03)
	Semi										4.93***	-2.85***	-2.65***	0.46***
											(0.98)	(0.40)	(0.68)	(0.04)
	Fully										5.11***	-2.02***	-10.3***	7.21***
											(1.60)	(0.52)	(1.19)	(0.08)

***, **and * indicates significance at 1%, 5%, and 10% levels respectively .Standard errors are in parentheses

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track™ data

Table A8 Elasticities of substitution among meat products (whole sample)

		Beef			Pork			Poultry			Other		
		Fresh	Semi	Fully	Fresh	Semi	Fully	Fresh	Semi	Fully	Fresh	Semi	Fully
Beef	Fresh	-13.6***											
		(0.94)											
	Semi	7.96	208.3										
		(8.80)	(261.3)										
	Fully	-2.88	-57.3***	-74.3***									
		(2.00)	(13.2)	(6.78)									
Pork	Fresh				-7.32								
					(6.83)								
	Semi				45.7***	-99.0***							
					(15.2)	(35.5)							
	Fully				83.7***	-75.8**	-397.8***						
					(16.2)	(35.8)	(44.1)						
Poultry	Fresh							-15.6***					
								(2.85)					
	Semi							-47.4***	-123.9**				
								(11.9)	(56.3)				
	Fully							15.9***	4.07	-132.3***			
								(2.44)	(10.2)	(3.01)			
Other	Fresh										-185.5**		
											(77.3)		
	Semi										149.6***	-104.6***	
											(29.7)	(14.6)	
	Fully										161.9***	-67.1***	-281.9***
											(48.5)	(19.1)	(33.4)

***, **and * indicates significance at 1%, 5%, and 10% levels respectively. Standard errors are in parentheses
Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track™ data

Table A9 Generalized trust in people and trust in food agents for excluded households that were in both surveys

	2008 survey	2011survey
Generalized trust in people		
people can be trusted	50.1%	49.1%
can't be too careful when dealing with people	42.9%	45.6%
don't know	7.0%	5.4%
Trust in food agents regarding the safety of food (1. strongly disagree… 5. strongly agree)		
	Average (standard deviation)	
The government		
has the competence to control the safety of food	3.31 (1.01)	3.41 (1.06)
has sufficient knowledge to guarantee the safety of food products	3.37 (1.01)	3.50 (1.03)
is honest about the safety of food	2.89 (0.95)	2.98 (1.02)
is sufficiently open about the safety of food	2.88 (0.94)	2.95 (0.98)
takes good care of the safety of our food	2.95 (0.94)	3.03 (1.00)
gives special attention to the safety of food	3.03 (0.96)	3.07 (1.02)
Farmers		
have the competence to control the safety of food	3.39 (0.91)	3.43 (0.87)
have sufficient knowledge to guarantee the safety of food products	3.33 (0.89)	3.36 (0.90)
are honest about the safety of food	3.25 (0.78)	3.29 (0.84)
are sufficiently open about the safety of food	3.18 (0.80)	3.19 (0.81)
take good care of the safety of our food	3.30 (0.74)	3.32 (0.79)
give special attention to the safety of food	3.24 (0.77)	3.28 (0.81)
Retailers		
have the competence to control the safety of food	3.10 (0.94)	3.16 (0.94)
have sufficient knowledge to guarantee the safety of food products	3.07 (0.93)	3.17 (0.95)
are honest about the safety of food	2.96 (0.83)	2.97 (0.84)
are sufficiently open about the safety of food	2.92 (0.82)	2.97 (0.85)
take good care of the safety of our food	3.12 (0.83)	3.13 (0.82)
give special attention to the safety of food	3.09 (0.82)	3.12 (0.86)
Food manufacturers		
have the competence to control the safety of food	3.36 (0.93)	3.50 (0.93)
have sufficient knowledge to guarantee the safety of food products	3.46 (0.89)	3.57 (0.90)
are honest about the safety of food	2.82 (0.84)	2.92(0.90)
are sufficiently open about the safety of food	2.82 (0.83)	2.82(0.94)
take good care of the safety of our food	2.99 (0.85)	3.14 (0.90)
give special attention to the safety of food	3.03 (0.84)	3.16 (0.90)
Sample size	371	371

Standard deviations are in parentheses

Source: Data collected in ACNielsen Homescan™ surveys

Table A10 Average meat expenditures for excluded households that were in both surveys

Year	# of households	Household meat expenditures	
		Average ($)	Standard deviation ($)
2002	196	159.5	186.9
2003	327	254.8	300.1
2004	328	270.5	321.8
2005	298	232.2	273.2
2006	293	230.6	267.3
2007	296	222.3	266.8
2008	326	228.2	290.7
2009	254	174.9	195.6

Source: Data from ACNielsen Homescan™ purchase panel and survey and ACNielsen Market Track^{TM} data

APPENDIX B

Table B1 Previous studies on consumer preference for meat or egg production attributes

Author/s	Approach to elicit WTP	Attributes	Measurement of trust	Analytical methods	Summary of results
Campiche et al. (2004)	Dichotomous choice contingent valuation method	*Natural and regular beef sirloin steaks* -Natural refers to no use of antibiotics or growth hormones	n/a	Multinomial logit model	Individual's likelihood to buy natural beef was influenced by his/her perceptions about natural products and meat buying behaviour
Carlsson et al. (2007)	Discrete choice experiments	*Eggs with three production attributes* -Production system (battery cage production system, free-range system when battery cages are allowed, free-range system when battery cages are not allowed -GMO attributes (GMO's are allowed, GMO's are not allowed) -Omega 3 (product enriched with Omega-3 or not) -Origin (Produced in the EU but not in Sweden, produced in Sweden) -Price	n/a	-Multinomial logit model Random parameters logit model	-Participants were willing to pay a premium for eggs produced from a free range system when battery cages are not allowed and eggs from a free range system when battery cages are allowed but the difference in WTP was not sufficient to ban battery cages
Feldkamp et al. (2005)	Auctions-Becker-DeGroot-Marschak (BDM) mechanism	*Beef steaks* -natural (no hormones or antibiotics used in the production process), generic, guaranteed tender, USDA choice and certified Angus beef	n/a		-On average, participants were not willing to pay more for a natural steak over a generic steak -Participants were willing to pay the highest premium for certified Angus beef followed by USDA choice beef
Goddard et al. (2011)	Discrete choice experiments	*Pork* -Conventional pork, traditionally raised pork, government certified traditionally raised pork, Canadian pork industry certified traditionally raised pork, Canadian Pork label, CQA® label and meat colour (L*)	n/a	-Multinomial logit model	-Consumers were willing to pay a higher premium for government certified as compared to industry certified traditionally raised pork -Highest WTP was for conventional pork with the Canadian Pork and CQA® labels

		and Price			
Goddard et al. (2013)	Discrete choice experiments	*Eggs* -Regular, pasteurized and free-run eggs with verification by the government, industry or farmers *Pork chops* -conventional housing, hoop housing or outdoor housing, use of gestation stalls or sows in groups and whether or not sub-therapeutic antibiotics are used in the production process with no certification, certification from the government, a third party, farmers, food processors or food retailers -Price	n/a	-Multinomial logit model -Random parameter logit model	-Participants were willing to pay a high premium for government verification of attributes compared to other sources of verification -There was a negative relationship between the following (i) WTP for pasteurized eggs and confidence in the safety of eggs regardless of the source of certirification (ii) WTP for free run eggs with certification from the government, industry or farmers and confidence in the safety of eggs (iv) WTP for animal welfare attributes and consumer confidence in current animal welfare conditions
Goss et al. (2002)	Dichotomous choice contingent valuation method	*Natural beef* no hormones or antibiotics used in the production process	n/a	Chi square tests	-Consumers can be categorized into three groups i.e. (i) individuals who will always purchase natural beef as compared to regular beef regardless of price (ii) those who will purchase natural beef as long as it is below their reservation price (iii) those who will always purchase regular beef -Few respondents associated natural beef with environmental concerns and brands did not matter
Grannis and Thilmany (2002)	Contingent valuation method	*Pork chops and ham*-natural meat-defined as 'meat produced from animals raised using environmentally sound practices with no antibiotics or hormones, and never confined to small or crowded pens.'	n/a	-Probit regressions	WTP for natural pork is positively influenced by -income -frequency of consumption of pork -previous purchase of natural beef -concern about feed additives -environmental concerns
Hobbs et al. (2005)	Vickerey second price experimental auctions	*Pork and beef sandwiches* -Assurances about humane animal treatment -Additional food safety assurances - Traceability plus food safety and humane animal treatment assurances	n/a	Ordinary least square estimations	Participants were more willing to pay for sandwiches that were traceable, that had additional food safety and human animal treatment assurances compared to sandwiches that were only traceable

Lusk et al. (2006)	-Choice based conjoint analysis-real pork chops -Contingent valuation	*Pork* -Sub-therapeutic antibiotics -Regular pork	n/a	-Multinomial logit model -Equilibrium displacement model	-Antibiotic free pork was preferred to regular pork
Ma (2012)	Discrete choice experiments –real pork chops in 2009 and pork chop pictures in 2011	*Pork chops* -Production attributes-conventional, traditionally raised, government certified traditionally raised and Canadian pork industry certified traditionally raised pork -Canadian pork label -CQA ® label -Price -Marbling was included only in 2011	'Generally speaking, would you say that most people can be trusted? 1. people can be trusted 2. can't be too careful in dealing with people 3. don't know'	-Multinomial logit model	-Individuals who perceived that traditionally raised pork was healthier or safer compared to conventional pork were willing to pay a premium for traditionally raised pork than those people who perceived otherwise -People who perceived traditionally raised as not healthier or safer were willing to pay a premium for conventional pork with additional information (Canadian pork and CQA® labels -Generalized trust in people also influenced consumer preferences for pork attributes
Mørkbak et al. (2010)	-Discrete choice experiments	*Minced pork* -Production attribute-indoor or outdoor -Country of origin (produced in Denmark or a foreign country) -Fat content (%)- 3-6, 7-10, 11-13 or above 13 - Labelled or not labelled salmonella free -Existing or tightened rules for use of antimicrobial agents -Price	n/a	Random parameters logit model	-Participants were willing to pay more for antimicrobial and salmonella free minced pork -Consumers were willing to pay a premium for minced pork with less fat content
Nilsson et al. (2006)	Discrete choice experiments	*Pork chops* -Brand- Tyson, Hormel, Store brand, no brand -Environmentally certified or not -Certified for animal well-being or not -Certified free from antibiotics or not -Price	n/a	Latent class model	-There is a group of consumers willing to buy certified pork
Nocella (2010)	Contingent valuation method	Certified animal friendly -Omnivores were asked about meat, dairy products and eggs	-The Fishbein attitude model whereby participants were asked about their	Double bounded logit	Trust in farmers positively influenced WTP for animal friendly products

		-Vegetarians were asked about cheese, other dairy products and eggs	perceptions about farmers and other stakeholders regarding movement of animals in stalls; inspection of animals daily; providing a balanced diet; banning mutilations; reducing the use of selection to exploit productivity; make enough room for animals and trained staff and permitting animals to rest during transportation and before they are slaughtered -Participants were also asked about their confidence regarding whether farmers and other stakeholders who operate under a certified scheme would actually comply with the standard given 5 point scale 'extremely unlikely' to 'extremely likely'		
Romanowska (2009)	-Discrete choice experiments (real choice and stated preference experiments)	-Generic, free-run, vitamin enhanced and pasteurized eggs -Certification by government, industry or farmers -Price	'Generally speaking, would you say that most people can be trusted? 1. people can be trusted 2. can't be too careful in dealing with people 3. don't know' -Trust in food agents was assessed but it was not included in the regression models	Multinomial logit and latent class models	-Trust, shopping habits and demographic characteristics influenced preferences for attributes -Government certified eggs were most preferred by participants
Thilmany et al. (2003)	Contingent valuation method	*Beef - Natural and organic* Natural meat refers to meat '… coming from animals raised using sound grazing practices with no antibiotics or hormones, and never confined to small or crowded pens.'	n/a	Market share curves	-There were regional differences in the demand of natural beef - Ground natural beef was less sensitive to price as compared to natural steak

Tonsor et al. (2009)	Discrete choice experiments	*Pork* -Production attributes-typical, gestation crate free and gestation crate ban -Country of origin (Canada, U.S. and Brazil) -Farm size (small, medium and large) -Price	n/a	-Latent class model -Random parameters logit model	-Banning gestation crates would not increase welfare if voluntary certification of pork produced with no gestation crates is provided
Ubilava et al. (2010)	Discrete choice experiments	*Pork* -Pork certified to be free from antibiotics -Environmentally certified pork -Pork certified for animal wellbeing -Price	n/a	Random parameters logit model	-Participants were willing to pay a premium for antibiotic free pork but not for environmentally certified or pork certified for animal wellbeing
Umberger et al. (2009)	Contingent valuation method	Natural and regional beef products -Ground beef -Rib eye steaks	n/a	Probit and ordered probit regressions	-People with the following characteristics were willing to pay a premium for natural beef: (i) perceive human treatment of animals as important (ii) people who perceived natural beef as safer as compared to conventional beef (iii) people who are young, with no children at home, have high incomes and have a small share of income used for groceries -People who were price sensitive were not willing to pay a premium for natural beef
Uzea (2009)	Discrete choice experiments	*Pork* -Housing for pigs- conventional housing, hoop housing and outdoor system -Gestation stalls-used or not used -Use or non-use of antibiotics in raising the pigs -Certification-farmer, processer, supermarket, government, independent third party or no certification -Price	Perceptions about the accuracy of information, knowledge, transparency, accountability and whether the stakeholders work or act in the best interest of consumers in the provision of information about the welfare of pigs	Multinomial logit, Random parameters logit and latent class models -In addition graphical analysis was used to assess welfare impact for different market scenarios for pork in terms of labelling and animal welfare	-Perceived knowledge about animal welfare strongly drive trust in the organisation -Respondents were willing to pay more for government verification than verification from other agents

Ziehl et al. (2005)	Contingent valuation method	Natural and regionally produced beef -ground beef, ribeye steaks, chilli verde and beef stroganoff	n/a	Cluster analysis	Five segments of consumers -price sensitive consumers who were less willing to pay for natural beef (19%) -consumers concerned about production attributes but are not willing to pay a higher price for natural beef (27%) -brand seekers with high income, fewer children, less price sensitive and live in larger cities, are interested in production attributes but are less willing to pay a premium for fresh natural meats (22%) -consumers who are willing to pay a premium for natural beef but are less concerned about production issues and are more price sensitive, have high incomes, children and live in urban areas (19%) -consumers interested in production issues are willing to pay a premium for natural beef and are less price sensitive (13%).

APPENDIX C

Table C1 Summary on empirical studies on risk perceptions and factors influencing them

Author/s	Type of risk/s	Measurement of risk perceptions	Measurement of trust (if applicable)	Analytical methods	Determinants of risk perceptions
Allum (2007)	GM food	'How much risk for (you personally or people in general) do you think is associated with GM food?' 1. no risk ... 5. very great risk	-Competence (expertise, understanding, consideration of evidence and appropriate response to the risk) -Care, honesty and shared value similarity (whether they have similar values and whether they think alike)	Confirmatory factor analysis	-Shared values had a negative impact on risk perceptions -Competence had a mediating role between shared values and risk perceptions
Brug et al. (2004)	Severe acute respiratory syndrome (SARS), other diseases and accidents	Respondents were asked about the likelihood of them getting SARS -They were also asked about their worries about SARS e.g. their family or other persons getting infected with SARS -They were also asked about their likelihood of contracting the common cold, cancer, heart attack, food poisoning, HIV/AIDS, traffic accidents and accident at home	n/a	Correlation and regression analysis	-Women perceived the risk of SARS as being high as compared to men -Less educated respondents were more worried about SARS as compared to respondents with more years of education
de Zwart et al. (2007)	Avian influenza and other infectious diseases	Respondents were asked about seriousness of Avian Influenza and their vulnerability to the disease	n/a	Multivariate analysis	Risk perceptions were generally higher for females and older respondents as compared to males and younger respondents respectively
Dosman et al. (2001)	Food additives, pesticides and bacteria in food	'How much of a health risk are … (food additives, pesticides or bacteria in food) to the Alberta public?' 0. almost no health risk ... 3. high health risk	n/a	Ordered probit regressions	Income, education, number of children, age and gender
Eiser et al. (2002)	Food additives, pesticides, food irradiation and genetic engineering	-'I personally am very much at risk from .. The average person is at risk from ...'. 1. completely disagree..9. completely agree - A number of questions aimed at eliciting information on perceived risk of genetic engineering were also asked.	Respondents were asked their perceptions about trustworthiness of information	Correlation analysis	Correlation between trust and perceived risk was reduced when acceptance was controlled for
Eom (1994)	Pesticide risk	Risk attributes were included in choice experiments and respondents were asked about their risk perceptions about pesticide residues. 1. no risk … 10.very serious risk	n/a	Probit regressions	n/a
Fife-Schaw and Rowe (1996)	Saturated fats, colourings, preservatives, glykoalkaloids, Listeria, botulism, traditional proc, irradiated food, pesticide residues, growth hormones,	A number of questions aimed at eliciting perceptions about different food risks e.g. likelihood of risks, degree of harm, level of control of risks, knowledge of the risks of scientist among others.	n/a	Principal components analysis	Seriousness and awareness of hazards

	cholesterol, sugar, sweetener, lectins, Salmonella, organically grown, genetically altered, metals, nitrates, BSE and Campylobacter				
Fischhoff et al. (1978)	Food preservatives, alcohol beverages, food coloring, pesticides, bicycles, commercial aviation, contraceptives, electric power, firefighting, general (private) aviation, hand guns, high school and college football, home appliances, hunting, large construction, motor cycles, mountain climbing, nuclear power, police work, prescription antibiotics, railroads, skiing, smoking, spray cans, surgery, swimming, vaccination and x-rays	Risks were judged in terms of the following characteristics: voluntariness, immediacy of effect, known of risk by people who are exposed to it, known to science, controllability, newness, chronic-catastrophic, common-dread, severity of consequences on scales of 1-7.	n/a	Correlations, factor analysis and regression analysis	-Perceived acceptable risk could be predicted by seriousness of consequences and perceived benefits -Two dimensions of perceived risk were identified i.e. certainty of death and whether the technology is new, involuntary, not known very well and whether or not the risk is delayed
Flynn et al. (1994)	Pesticides and bacteria in food, food irradiation, genetically engineered bacteria, street drugs, cigarette smoking, AIDS, nuclear waste, stress, chemical pollution, sun tanning, ozone depletion, alcohol, motor vehicle accidents, outdoor air quality, blood transfusions, climate change, nuclear power plants, coal/oil plants, storms and floods, hi-volt power lines, radon in home, VDTs, medical X-rays and commercial air travel	Rating of the public health risks on a Likert scales 1. almost no risk ... 4. high health risk	'… government and industry can be trusted with making the proper decisions to manage the risks from technology' '… agree that we can trust the experts and engineers who build, operate, and regulate nuclear power plants'	Regression analysis	Gender, race and trust
Knight and Warland (2005)	Pesticides and chemical residues, Salmonella and fat	Respondents were asked about their level of concern about pesticides and chemical residues, salmonella and fat and their level of concern was measured using Likert scales 1. no concern … 4. very concerned	-'Government and business can be trusted to make the right decisions about the risks of new technologies' -Trust in the food system was measured by asking people about their perceptions about safety of imported , restaurant and food in grocery stores or supermarkets and the job being done by farmers, processors and the government inspectors regarding the safety of food	Logistic regression analysis	Knowledge, control, experience, world view on perceptions about business rules, science and technology, trust in food system, gender, race, age, presence of children and education
Krewski et al. (2006)	Cigarette smoking, obesity, unprotected sex, stress, physical inactivity, wait lists of health care, fast food, poverty, air pollution, pesticides, homelessness, family violence, suntanning, street crime,	Perceived risk was measured using the following scales: almost no health risk, slight health risk, moderate health risk, high health risk and do not know/ no opinion	n/a	Chi-squared and t-tests	Women, older respondents, respondents with low levels of education and respondents living in Quebec (except for fast foods) were generally more concerned about the risks as compared to men, younger

	nuclear power plants, unemployment, breast implants, drinking alcohol, genetically modified foods, flu epidemics, high voltage power lines, genetic makeup, prescription drugs, West Nile virus, blood transfusions, tap water, medical x-rays, vaccines, laser eye surgery and natural health products				respondents, more educated respondents and respondents living in other regions respectively
Lemyre et al. (2006)	38 hazards	Perceived risk was measured using the following scales: almost no health risk, slight health risk, moderate health risk, high health risk and do not know/ no opinion	n/a	Principal component analysis	Women, respondents with lower levels of education and respondents with lower levels of income had higher risk perceptions as compared to men, respondents with higher levels of education and higher incomes respectively. There were differences in risk perceptions across regions
Lemyre et al. (2009)	BSE, CWD, growth hormones, mercury in fish, pesticides, food additives, antibiotic use in livestock, improper food labelling, imported food, GM foods, artificial sweeteners, bacteria, agroterrorism, food irradiation, food packaging , ta water, foot and mouth disease and bottled water	-'What level of risk to Canadians would you say there is related to the following?' -'Do you think mad cow disease represents a risk to your health, represents a risk to the health of Canadians I general, poses a risk to the Canadian economy, and poses a risk to Canadian international relations?' -'Do you worry that wild game could have a similar illness to mad cow disease? ' -'Would you or your family stop eating wild game if these animals were found to have a similar illness to mad cow disease?' Responses were as follows: not at all, a little, moderately, very much ad extremely	-'How much confidence do you have in the following groups: government inspection agencies, government health agencies, politicians, the beef industry, research scientists?' -'When you want credible information about mad cow disease, to what extent would you turn to the following sources: government inspection agencies, government health agencies, politicians, the beef industry, research scientists, friends and relatives, health professionals, the internet, television, radio, newspaper, public information brochures, and scientific journals?' Responses were as follows: not at all, a little, moderately, very much ad extremely	Descriptive analysis	n/a
Li (2006)	-Bacteria contamination, pesticide residues, hormones in food additives, antibiotics, BSE, food additives, genetic modification/ engineering, fat and cholesterol content -Risk perceptions about environmental risks were also assessed	Perceived risk was measured on the following scale 1. high risk … 4 almost no risk and 5. don't know	n/a	Probit, ordered probit and seemingly unrelated regression	Economic and demographic factors influenced risk perceptions -Women and respondents living in Quebec had higher risk perceptions as compared to men and people living in other provinces respectively
Miller and Shelby (2009)	BSE, CWD, Salmonella, E. Coli, Lyme disease and West Nile	-'Please give your opinion of the risk of the following:' 1 no risk ...4. high risk	n/a	Correlation and K-mean cluster	n/a

	Virus	- 'CWD poses some risk to deer, but not to humans' - 'CWD may pose some risk to humans, but not enough is known to be sure' - 'CWD can possibly infect humans if they eat meat from animals infected with it'		analysis	
Muringai and Goddard (2011)	1.Livestock production concerns (feed, conditions in which animals are raised, GM animal feeds, animal diseases, BSE, origin of products, antibiotics in meat and animals genetically modified for meat/poultry or dairy production) 2. Human health concerns (Salmonella food poisoning, BSE, GM foods, pesticides, additives, food allergies, unhealthy eating, unreasonable food prices, products from livestock housed in restricted conditions and Listeriosis) 3. beef and poultry risk perceptions	1. 'To what extent are you concerned about the following issues?' (1) not at all concerned, (2) minor concerns, (3) some concerns, (4) major concerns, and (5) very concerned 2. 'Would you say the following food issues are an important risk to human health in our society, is not a very important risk or no risk at all?' 1. don't know … 4. important risk. 3. 'When eating beef I am exposed to' 1. very little risk . . . 5. high risk (5) 'I think eating beef is risky' 1. strongly disagree . . . 5. strongly agree (6) 'For me eating beef is ...1.not risky . . . 5. risky	'Generally speaking, would you say that most people can be trusted' (1) people can be trusted (2) can't be too careful in dealing with people (3) don't know.	Ordered probit regressions	Demographic factors and trust significantly influence animal production and human health concerns. Risk perceptions about consuming beef were positively related to reduction in beef consumption due to BSE
Muringai et al. (2011)	BSE	Would you say … is an important risk to human health in our society, is not a very important risk or no risk at all?' 1. don't know … 4. important risk	'Generally speaking, would you say that most people can be trusted?' (1) people can be trusted (2) can't be too careful in dealing with people (3) don't know	Ordered probit regressions	-Knowledge about BSE significantly influences human health concerns about the disease in Canada (-) and Japan (+) -Trust significantly influence human health concerns about BSE in Canada (-), U.S. (-) and Japan (positively). -Demographic factors also influence human health concerns about BSE.
Needham and Vaske (2008)	CWD	-'Inadvertently eating meat from an animal infected with CWD' 1. no risk … 9. extreme risk -'Becoming ill as a result of contracting a disease caused by CWD' 1. no risk … 9. extreme risk -'Because of CWD, how concerned are you about your own health' 1. not concerned … 9. extremely concerned -'Because of CWD, I have concerns about eating deer /elk meat' 1. strongly disagree ... 7. strongly agree	Trust in the wildlife agency was assessed regarding provision of best, enough, truthful and timely information, making good deer/elk management decisions with respect to CWD and whether they properly manage CWD in the state	Confirmatory factor analysis	Trust in wildlife agency
Nigatu et al. (2014)	Climate change	Perceptions about the threat of the human health impact of climate change: don't	n/a	Bivariate logistic regression	Students who knew about climate change were more concerned about

		know, not serious , somewhat serious and very serious			it as compared to those who did not know about it.
Pennings et al. (2002)	BSE and beef food safety risk	-Questions on people's perceptions about contracting Creutzfeldt–Jacob Disease from consuming beef - 'When eating beef, I am exposed to …' 1. much risk … 9. not much risk -'I think eating beef is risky' 1.strongly disagree to 9. strongly agree -'For me, eating beef is …' 1. risky ... 9. not risky	n/a	Logistic regressions	n/a
Poortinga and Pidgeon (2005)	GM food	-People were asked about the human health and environmental risks of GM with responses anchored as follows: 1. no risks … 7. very high risks	Trust in risk regulators was assessed using the following questions: - 'I feel that current rules and regulations are sufficient to control GM food' -' I feel confident that the British government adequately regulates GM food' 1. totally disagree… 5 totally agree	Correlation analysis	Negative correlations between trust and perceived risk but correlation between these two variables decreased after controlling for acceptability of GM food
Schroeder et al. (2007)	Beef food safety risks	-Questions that elicited consumer perceptions about the presence and probable impacts of potential beef food safety concerns (E. Coli O157:H7, BSE, Salmonella, Listeria, Staphylococcus aureus and Campylobacter . Responses were anchored as follows: don't know, very low risk, low risk, moderate risk, high risk and very high risk - 'I consider eating beef..' 1. not risky..10. highly risky -'When eating beef, I am exposed to …' 1. no risk at all …10. very high risk -'Eating beef is risky' 1. strongly disagree … 10. strongly agree	n/a	Double-hurdle model	n/a
Setbon et al. (2005)	BSE and other risks (cancers due to tobacco, traffic accidents, chemicals in human food supply, asthma from air pollution, GMOs, diseases related to bad diet, AIDS, nosomical infections, radiation from nuclear power plants, food bacteria, MCD, food allergies, Hepatitis B vaccination, radiation from medical X-ray exams, radiation from mobile phone sets)	-Respondents were asked to predict the number of people who could die because vCJD in the future (anticipatory risk assessments) -Respondents were asked about their worry of BSE and other risks to their health on a Likert scale 0. personally not worried at all about the risk ... 20. personally extremely worried about the risk	-'The French government waited too long before taking the necessary measures' -'The French government took the right measures at the right time' -'The European Commission took the right measures at the right time' -'All measures needed to stem MCD were taken'	Correlation and regression analysis	Anticipatory risk assessment was significantly influenced by change in consumption of beef, whether it is legitimate to reduce consumption of beef, outrage, social trust and level of knowledge -Worry about BSE was significantly influenced by whether the individual preferred beef, and the variables which also influenced anticipatory risk assessments excluding level of knowledge
Siegrist et al. (2005)	Pesticide residues, GM foodstuff, electromagnetic fields from cellphones and antennas ,	Participants stated their perceived risk of hazards to the Swiss society as a whole on a Likert scale 1. no risk at all … 5. very	-'If given a chance, most people would try to take advantage of you' -'Most people are too busy looking out	Principal component analysis,	General trust and confidence

	Radiation from medical x-rays, extreme weather events, nuclear power waste, crime and recession	high risk	for themselves to be helpful' -'You can't trust strangers anymore' -'When dealing with strangers, one is better off using caution before trusting them' -'Most people are basically honest' -Most people tell a lie when they can benefit doing so Responses were as follows: 1. don't agree at all … 5. agree absolutely	regressions and correlations	
Siegrist et al. (2007)	Nanotechnology	Participants rated risks on a five point scale 1. not risky at all ... 5. very risky	'How much trust do you have in the following institutions regarding their responsibility in utilizing nanotechnology in the food domain?' 1. no trust … 5. very high trust -food industry, science/research, and pharmaceutical industry	Analysis of variance and path analysis	Trust positively influenced affect and affect negatively influenced risk perceptions
Sitkin and Weingart (1995)	Risky decisions	Participants were asked about their risk perceptions about decisions made	n/a	Regression analysis	Problem framing influenced risk perceptions
Sjöberg (1999)	Nuclear power	The public and experts judged the risk of nuclear power to people in general	Trust in experts, responsible politicians, pertinent authorities, nuclear industry and personnel was measured	Correlation analysis	Trust was negatively correlated with perceived risk of nuclear waste
Tonsor et al. (2009)	Beef risk perceptions	-'I consider eating beef…' 1. not at all risky … 10.highly risky -'When eating beef I am exposed to…' 1. no risk at all… 10. very high risk -'Eating beef is risky' 1. strongly disagree… 10. strongly agree	'Please indicate how trustworthy you consider each source'1. not trustworthy … 5. trustworthy. The sources of information were family physician, dietician, government food agencies, university scientists ⁄ educators, private researchers⁄ consultants, retail grocer or butcher, food industry sources consumer groups.	Factor analysis and bivariate tobit models	Gender, income, age, reliance on observable and credence product characteristics, trust in industry, grocer and government and trust in doctors, previous experiences
Viklund (2003)	34 different risks (nuclear and other) risks	Risk perceptions were judged on Likert scale 0. no risk at all … 7. a very large risk and don't know	-General trust was measured by people's beliefs about general honesty, social harmony, political institutions and corporations -Specific trust was measured with the following question 'How much do you trust the authorities in your country when it comes to protecting people against the following types of risks?'	Correlation analysis	-There was a negative relationship between trust and perceived risk -General trust predicted risk perceptions more than specific trust
Viscusi (1991)	Cigarette smoking	Individuals were asked to state the number of people out of 100 smokers they think who would get lung cancer	n/a	Probit and ordinary least squares regressions	Age, gender, whether the individual is a past smoker or not and whether the individual heard that cigarette smoking is dangerous or is bad but not dangerous to one's health
Yang and Goddard 2011a	BSE	Risk perceptions were constructed from expenditure data	n/a	Predictive difference	Information about BSE influenced BSE risk perceptions

				approach	
Yang and Goddard 2011b	Beef	‘When eating beef, my household is exposed to . . .’ very little risk … great deal of risk) ‘Members of my household think eating beef is risky’ (strongly disagree … strongly agree) ‘For members of my household, eating beef is . ..’ (not risky to risky)	n/a	K- means cluster and demand system analyses	Quantity and content of media information about BSE influenced meat demand
Yang and Goddard 2011c	Beef	‘When eating beef, my household is exposed to . . .’ very little risk … great deal of risk) ‘Members of my household think eating beef is risky’ (strongly disagree … strongly agree) ‘For members of my household, eating beef is . ..’ (not risky to risky)	n/a	Two-step cluster and regression analyses	Risk attitudes influenced beef expenditures more than risk perceptions.
Zimmer et al. (2011)	CWD	Individuals were asked about their perceptions about the threat of CWD	n/a	Poisson regressions	n/a
Zinner (2013)	Heart disease	Parents were asked to predict their own, their child’s and an average individual’s chance of getting heart disease by the age of 75.	n/a	Ordinary least squares, Seemingly Unrelated regressions	Gender, age, whether the parent smokes, body mass index, variables relating to medical condition, family history, diet and exercise

Table C2 Results from principal component analysis of the variables on trust in food agents

	The government		Farmers		Retailers		Food manufacturers	
	Commitment	Competence	Commitment	Competence	Commitment	Competence	Commitment	Competence
Canada 2009								
…has/have the competence to control the safety of food	0.70	0.60	0.76	0.56	0.71	0.63	0.66	0.64
… has/have sufficient knowledge to guarantee the safety of food products	0.69	0.62	0.75	0.56	0.71	0.63	0.65	0.67
… is/are honest about the safety of food	0.88	-0.26	0.84	-0.34	0.84	-0.32	0.86	-0.29
… is/are sufficiently open about the safety of food	0.86	-0.33	0.86	-0.34	0.82	-0.36	0.84	-0.35
…take/s good care of the safety of our food	0.88	-0.21	0.90	-0.16	0.86	-0.18	0.89	-0.20
…give/s special attention to the safety of food	0.86	-0.19	0.88	-0.14	0.83	-0.21	0.85	-0.16
Eigen values	4.00	0.99	4.16	0.90	3.80	1.10	3.85	1.13
Cronbach α	0.90		0.91		0.88		0.89	
Canada 2010_1								
..has/have the competence to control the safety of food	0.69	0.61	0.76	0.57	0.73	0.59	0.65	0.66
… has/have sufficient knowledge to guarantee the safety of food products	0.63	0.68	0.76	0.56	0.72	0.61	0.61	0.70
… is/are honest about the safety of food	0.85	-0.24	0.83	-0.35	0.82	-0.33	0.86	-0.24
… is/are sufficiently open about the safety of food	0.84	-0.31	0.84	-0.32	0.83	-0.35	0.84	-0.31
…take/s good care of the safety of our food	0.87	-0.21	0.88	-0.18	0.85	-0.19	0.88	-0.22
…give/s special attention to the safety of food	0.84	-0.23	0.85	-0.17	0.84	-0.18	0.83	-0.24
Eigen values	3.77	1.08	4.07	0.91	3.84	1.01	3.69	1.19
Cronbach α	0.88		0.90		0.88		0.87	
Canada 2010_2								
..has/have the competence to control the safety of food	0.70	0.59	0.76	0.57	0.73	0.59	0.65	0.66
… has/have sufficient knowledge to guarantee the safety of food products	0.66	0.65	0.77	0.56	0.71	0.61	0.62	0.70
… is/are honest about the safety of food	0.85	-0.24	0.83	-0.36	0.81	-0.34	0.86	-0.24
… is/are sufficiently open about the safety of food	0.84	-0.32	0.84	-0.31	0.83	-0.34	0.84	-0.30
…take/s good care of the safety of our food	0.87	-0.21	0.88	-0.18	0.85	-0.20	0.88	-0.21
…give/s special attention to the safety of food	0.84	-0.22	0.85	-0.17	0.83	-0.17	0.82	-0.25
Eigen values	3.81	1.03	4.05	0.92	3.82	1.02	3.69	1.18
Cronbach α	0.88		0.90		0.88		0.87	
US 2010a								
…has/have the competence to control the safety of food	0.76	0.46	0.75	0.52	0.73	0.53	0.67	0.58
… has/have sufficient knowledge to guarantee the safety of food products	0.68	0.62	0.75	0.52	0.68	0.62	0.63	0.65
… is/are honest about the safety of food	0.88	-0.28	0.85	-0.34	0.86	-0.31	0.86	-0.28
… is/are sufficiently open about the safety of food	0.86	-0.30	0.82	-0.34	0.85	-0.27	0.82	-0.36
…take/s good care of the safety of our food	0.90	-0.16	0.89	-0.11	0.87	-0.16	0.88	-0.18
…give/s special attention to the safety of food	0.88	-0.16	0.87	-0.12	0.86	-0.20	0.87	-0.12
Eigen values	4.13	0.82	4.06	0.79	3.95	0.91	3.81	1.02

Cronbach α	0.91		0.90		0.89		0.88	
US 2010b_1								
…has/have the competence to control the safety of food	0.81	0.43	0.79	0.49	0.76	0.54	0.72	0.55
… has/have sufficient knowledge to guarantee the safety of food products	0.77	0.52	0.78	0.50	0.79	0.48	0.73	0.54
… is/are honest about the safety of food	0.88	-0.28	0.87	-0.30	0.86	-0.29	0.87	-0.32
… is/are sufficiently open about the safety of food	0.89	-0.27	0.87	-0.27	0.87	-0.27	0.85	-0.34
…take/s good care of the safety of our food	0.92	-0.13	0.90	-0.15	0.90	-0.17	0.90	-0.15
…give/s special attention to the safety of food	0.89	-0.15	0.88	-0.16	0.88	-0.17	0.89	-0.10
Eigen values	4.44	0.65	4.31	0.70	4.28	0.73	4.15	0.85
Cronbach α	0.93		0.92		0.92		0.91	
US 2010b_2								
…has/have the competence to control the safety of food	0.82	0.41	0.79	0.47	0.78	0.52	0.73	0.53
… has/have sufficient knowledge to guarantee the safety of food products	0.78	0.52	0.78	0.49	0.80	0.46	0.73	0.55
… is/are honest about the safety of food	0.89	-0.28	0.87	-0.29	0.87	-0.30	0.87	-0.30
… is/are sufficiently open about the safety of food	0.89	-0.25	0.87	-0.27	0.87	-0.25	0.86	-0.34
…take/s good care of the safety of our food	0.92	-0.12	0.90	-0.14	0.90	-0.15	0.90	-0.15
…give/s special attention to the safety of food	0.90	-0.18	0.88	-0.16	0.87	-0.19	0.90	-0.10
Eigen values	4.50	0.63	4.33	0.67	4.31	0.70	4.18	0.82
Cronbach α	0.93		0.92		0.92		0.91	
Japan 2009								
…has/have the competence to control the safety of food	0.77	0.51	0.77	0.53	0.79	0.50	0.73	0.59
… has/have sufficient knowledge to guarantee the safety of food products	0.77	0.51	0.80	0.46	0.80	0.48	0.74	0.58
… is/are honest about the safety of food	0.88	-0.09	0.87	-0.15	0.87	-0.14	0.86	-0.21
… is/are sufficiently open about the safety of food	0.87	-0.28	0.84	-0.36	0.87	-0.28	0.84	-0.35
…take/s good care of the safety of our food	0.89	-0.25	0.90	-0.18	0.89	-0.22	0.89	-0.23
…give/s special attention to the safety of food	0.86	-0.28	0.87	-0.21	0.86	-0.26	0.85	-0.23
Eigen values	4.27	0.74	4.26	0.72	4.32	0.69	4.03	0.97
Cronbach α	0.91		0.92		0.92		0.90	

Source: Data collected in surveys for the thesis

Table C3 Results from principal component analysis for the worry trait variables

	Canada 2009	Canada 2010_1	Canada 2010_2	US 2010a	U.S. 2010b_1	U.S. 2010b_2	Japan 2009
Many situations make me worry	0.91	0.91	0.91	0.93	0.92	0.92	0.91
I know I shouldn't worry about things, but I just cannot help it	0.92	0.92	0.92	0.93	0.93	0.93	0.93
I notice that I have been worrying about things	0.92	0.93	0.93	0.94	0.94	0.93	0.93
Eigen values	2.54	2.55	2.55	2.60	2.59	2.58	2.54
Cronbach α	0.91	0.91	0.91	0.92	0.92	0.92	0.91

Source: Data collected in surveys for the thesis

Table C4 Would you say that the following food issues are an important risk to human health in our society, are not a very important risk or no risk at all? (0. no risk…2. important risk)

	Canada 2009	U.S. 2010a	Japan 2009	Canada 2010_1	Canada 2010_2	U.S. 2010b_1	U.S. 2010b_2
Salmonella food poisoning	1.72	1.79	1.83	1.79	1.79	1.80	1.80
	(0.51)	(0.48)	(0.41)	(0.42)	(0.42)	(0.45)	(0.45)
BSE (mad cow disease)	1.54	1.68	1.87	1.40	1.39	1.51	1.51
	(0.61)	(0.57)	(0.38)	(0.59)	(0.60)	(0.60)	(0.61)
GM foods	1.42	1.43	1.38	1.32	1.32	1.42	1.43
	(0.69)	(0.71)	(0.67)	(0.69)	(0.69)	(0.69)	(0.69)
Products from livestock housed in large numbers, in cages or other restricted conditions	1.50	1.56	-	1.39	1.39	1.50	1.51
	(0.64)	(0.62)		(0.65)	(0.64)	(0.67)	(0.66)
Pesticides	1.70	1.73	1.87	1.68	1.68	1.66	1.67
	(0.53)	(0.52)	(0.38)	(0.52)	(0.53)	(0.57)	(0.56)
Listeriosis (Listeria) food poisoning	1.73	1.74	-	1.70	1.70	1.67	1.68
	(0.48)	(0.52)		(0.49)	(0.49)	(0.55)	(0.55)
Unhealthy eating	1.74	1.71	1.54	1.72	1.72	1.63	1.64
	(0.50)	(0.57)	(0.61)	(0.49)	(0.48)	(0.60)	(0.58)
Additives (like preservatives, colouring)	1.57	1.49	1.47	1.44	1.44	1.43	1.44
	(0.59)	(0.67)	(0.59)	(0.60)	(0.60)	(0.67)	(0.66)
Food allergies	1.50	1.51	1.63	1.56	1.56	1.52	1.53
	(0.63)	(0.65)	(0.57)	(0.57)	(0.57)	(0.64)	(0.62)
E. coli food poisoning	1.75	1.82	-	1.74	1.73	1.76	1.77
	(0.47)	(0.46)		(0.47)	(0.47)	(0.50)	(0.50)
Unreasonable food prices	1.43	1.47	1.34	1.32	1.33	1.41	1.41
	(0.69)	(0.73)	(0.73)	(0.74)	(0.73)	(0.74)	(0.74)
Animal diseases such as chronic wasting disease in wild and farmed deer and elk	-	-	-	1.37	1.35	1.50	1.48
				(0.60)	(0.61)	(0.64)	(0.64)

Standard deviations are in parentheses

Source: Data collected in surveys for the thesis

Table C5 Percentage of respondents with competence and commitment scores not greater than 2.5 given a scale of 1 to 5

	Canada 2009	U.S. 2010a	Japan 2009	Canada 2010_1	Canada 2010_2	U.S. 2010b_1	U.S. 2010b_2
Competence							
Government	18.9	23.0	54.0	16.9	16.6	25.2	25.7
Farmers	13.4	9.00	30.5	16.6	16.9	10.7	11.2
Retailers	33.7	19.9	51.4	32.5	32.9	20.6	20.7
Food manufacturers	9.6	11.2	23.7	9.9	10.0	12.8	13.2
Commitment							
Government	30.8	33.3	62.4	31.3	30.8	33.2	33.1
Farmers	10.4	9.90	36.4	10.3	10.2	12.2	12.6
Retailers	28.3	20.9	55.6	27.0	27.6	21.8	21.9
Food manufacturers	27.9	27.3	41.9	26.8	27.2	25.3	25.8

Source: Data collected in surveys for the thesis

APPENDIX D

Chapter 2: Canadian – Food Opinions Survey (University of Alberta Survey) – March 2008

Note: The questions used in the analysis were available in in the 2011 survey

Outgoing sample: 5000 households
Complete respondents: 4090 households
Fielded date: 3/3/2008
Closeout date: 3/29/2008
Response rate: 81.8%

		Column location, length
Household Id number		**1,8**
Survey number (580303,580304,580305,580306)		**10,6**
Nielsen proprietary field		**16,6**
Standard demo breaks:		
Sub-Division/(region)		**22,1**
1=Maritimes	**5=Rem. Ontario**	
2=Montreal	**6=Man/Sask**	
3=Rem. Quebec	**7=Alberta**	
4=Toronto	**8=BC**	
Region:		
Maritimes=1	**Ontario =4/5**	
Quebec=2/3	**Total West=6,7,8**	
Income		**23,2**
03/11 = under $20k	**21/23 = $50-$69k**	
13/15 = $20-$29k	**26/99 = $70K+**	
16/17 = $30-$39k	**26 = $70 - $99,999**	
18/19 = $40-$49k	**27/99 = $100k+**	
Age and Presence of Children		**25,1**
9=adult	**2,4,6,7 = any 6 to 12**	
1/7=with kids	**3,5,6,7 = any 13 to 17**	
1,4,5,7 = any under 6		
1=under 6 only	**5=under 6 and 13 to 17**	
2=6 to 12 only	**6=6 to 12 and 13 to 17**	
3=13 to 17 only	**7= under 6, 6 to 12 and 13 to 17**	
4=under 6 and 6 to 12	**9= no child in the household**	
HHLD age		**26,1**
1/3 = <35	**8 = 55/64**	
4/5 = 35/44	**9 = 65+**	
6/7 = 45/54		
blank		**27,1**
Household Size		**28,1**
1=1 member		
2=2 members		
3=3 members		
4=4 members		
5=5 members		
6=6 members		
7=7 members		
8=8 members		
9=9+ members		

Language **29,1**
1=English
2=French
3=unknown

blank **30,1**

Household Head Education **31,1**
1=Elementary School
2=Some High School
3=Completed High School
4=Some Technical or College
5=Completed Technical or College
6=Some University
7=Completed University

National Urban vs Rural **32,1**
1=urban
2=rural

Please have the Head of the Household who does the majority of the grocery shopping complete the survey.

General Trust
1. Generally speaking, would you say that most people can be trusted? **40,1**

1=People can be trusted
2=Can't be too careful in dealing with people
3=Don't know

How much do you trust each of the following groups of people?
Cannot be trusted at all - 1
Somewhat untrustworthy - 2
Slightly untrustworthy - 3
Somewhat trustworthy - 4
Can be trusted a lot - 5
Don't know - 6

2. People in your family 41,1
3. People in your neighbourhood 42,1
4. People you work or go to school with 43,1
5. Doctors or nurses 44,1
6. Scientists 45,1
7. Consumer Organizations 46,1
8. Environmental organizations 47,1
9. Media sources 48,1
10. Strangers 49,1
11. How often do you lend money to your friends? 50,1

Never - 1
Infrequently - 2
Moderately often - 3
Frequently - 4
Regularly - 5
Prefer not to say - 6

Please indicate to what extent you find the following statements characteristic of yourself.
Not at all typical - 1
2 - 2
Somewhat typical - 3
4 - 4
Very typical - 5

12. Many situations make me worry 51,1
13. I know I shouldn't worry about things, but I just cannot help it 52,1
14. I notice that I have been worrying about things 53,1

Food Attitudes
Strongly disagree - 1
Disagree - 2
Neither agree nor disagree - 3
Agree - 4
Strongly agree - 5

15. I am optimistic about the safety of food products. 54,1
16. I am confident that food products are safe. 55,1
17. I am satisfied with the safety of food products. 56,1
18. Generally, food products are safe. 57,1
19. I worry about the safety of food. 58,1
20. I feel uncomfortable regarding the safety of food. 59,1
21. As a result of the occurrence of food safety incidents ,I am suspicious about certain food products. 60,1

Perceived safety of meat
Please indicate how much confidence you, generally, have in the safety of the following product groups. Give your answer on a scale from 1 ("No confidence at all") to 5 ("Complete confidence").
No confidence at all – 1
2 - 2
3 - 3
4 - 4
Complete confidence - 5

22. Beef 61,1
23. Chicken / poultry 62,1

Attitudes towards eating beef

24. Do you, or does any member of your household, eat beef? 63,1
1=Yes
2=No – skip to 'Trust in Food Industry' section (Q31)

25. When eating beef, my household is exposed to … 64,1

Very little risk - 1
2 - 2
3 - 3
4 - 4
A great deal of risk - 5

26. Members of my household accept the risks of eating beef 65,1

Strongly disagree – 1
2
3
4
Strongly agree – 5

27. Members of my household think eating beef is risky 66,1
Strongly disagree – 1
2
3
4
Strongly agree – 5

28. For members of my household, eating beef is … 67,1
Not risky – 1
2
3
4
Risky - 5

29. For members of my household, eating beef is worth the risk 68,1
Strongly disagree – 1
2
3
4
Strongly agree – 5

30. My household is … the risk of eating beef 69,1
Not willing to accept – 1
2
3
4
Willing to accept - 5

Trust in food industry
Strongly disagree - 1
Disagree - 2
Neither agree nor disagree - 3
Agree - 4
Strongly agree - 5

Manufacturers
31. Manufacturers have the competence to control the safety of food 70,1
32. Manufacturers have sufficient knowledge to guarantee the safety of food products 71,1
33. Manufacturers are honest about the safety of food 72,1
34. Manufacturers are sufficiently open about the safety of food 73,1
35. Manufacturers take good care of the safety of our food 74,1
36. Manufacturers give special attention to the safety of food 75,1

Retailers
37. Retailers have the competence to control the safety of food 76,1
38. Retailers have sufficient knowledge to guarantee the safety of food products 77,1
39. Retailers are honest about the safety of food 78,1
40. Retailers are sufficiently open about the safety of food 79,1
41. Retailers take good care of the safety of our food 80,1
42. Retailers give special attention to the safety of food 81,1

Government
43. The government has the competence to control the safety of food 82,1
44. The government has sufficient knowledge to guarantee the safety of food products 83,1
45. The government has honest about the safety of food 84,1
46. The government has sufficiently open about the safety of food 85,1
47. The government takes good care of the safety of our food 86,1
48. The government gives special attention to the safety of food 87,1

Farmers
49. Farmers have the competence to control the safety of food 88,1
50. Farmers have sufficient knowledge to guarantee the safety of food products 89,1
51. Farmers are honest about the safety of food 90,1
52. Farmers are sufficiently open about the safety of food 91,1
53. Farmers take good care of the safety of our food 92,1
54. Farmers give special attention to the safety of food 93,1
Animal production related concerns

55. To what extent are you concerned about the following issues? 94,1

Not at all concerned - 1
Minor concerns - 2
Some concern - 3
Major Concerns - 4
Very concerned - 5

55. The feed given to livestock	95,1
56. Conditions in which food animals are raised	96,1
57. Genetically modified animal feeds	97,1
58. Animal diseases	98,1
59. BSE (mad cow disease) and Creutzfeldt Jakob Disease (vCJD)	99,1
60. The origin of products/ animals	100,1
61. Antibiotics in meat	101,1

Recall of media coverage on BSE (mad cow disease)

62. Have you seen, heard, or read about BSE (mad cow disease)?" 102,1

1=Yes
2= No **– end survey**

63. To what extent have you seen, heard, or read any news messages in the media about BSE (mad cow disease) over the past five years? 103,1

Very few messages - 1
Few messages - 2
Some messages - 3
Frequent messages - 4
Many messages - 5

64. If a Canadian cow is found with BSE (mad cow disease) the risk to my family is: 104,1

Very low - 1
Low - 2
Neither low nor high - 3
High - 4
Very high - 5

65. If you have any awareness of a BSE (mad cow disease) incident in Canada over the past five years, where did you get your information from? Please scan all that apply.
(1=selected; 0=not selected)

Friends and family	105,1
Newspapers	106,1
Magazines	107,1
Radio	108,1
TV	109,1
Internet	110,1
Other	111,1
Don't know/Don't Recall	112,1

66. If you have any awareness of a BSE (mad cow disease) incident in Canada over the past five years, has this had any impact on your confidence in the safety of beef products? 113,1

1=A very small impact
2=Some impact
3=Moderate impact
4=Large impact
5=A very large impact
6=Don't know

Chapter 3: Edmonton survey (2009 and 2011)

ID#___________________ **Session: Date and Time______________**

Examining Consumer Food Preferences

1. Generally speaking, would you say that most people can be trusted?

People can be trusted	Can't be too careful in dealing with people	Don't know
❒	❒	❒

2. We would like to know whether you, in general, worry a lot in daily life. Please indicate to what extent you find the following statements characteristic of yourself. Give your answer on a scale from 1 ("not at all typical") to 5 ("very typical").

	not at all typical		somewhat typical		very typical
	1	2	3	4	5
Many situations make me worry	❒	❒	❒	❒	❒
I know I shouldn't worry about things, but I just cannot help it	❒	❒	❒	❒	❒
I notice that I have been worrying about things	❒	❒	❒	❒	❒

3. Attitudes toward food.	strongly disagree	disagree	neither agree, nor disagree	agree	strongly agree
	1	2	3	4	5
I am optimistic about the safety of food products	❒	❒	❒	❒	❒
I am confident that food products are safe	❒	❒	❒	❒	❒
I am satisfied with the safety of food products	❒	❒	❒	❒	❒
Generally, food products are safe	❒	❒	❒	❒	❒
I worry about the safety of food	❒	❒	❒	❒	❒
I feel uncomfortable regarding the safety of food	❒	❒	❒	❒	❒
As a result of the occurrence of food safety incidents I am suspicious about certain food products	❒	❒	❒	❒	❒

4. Please indicate how much confidence you, generally, have in the safety of the following product groups. Give your answer on a scale from 1 ("no confidence at all") to 5 ("complete confidence").

	no confidence at all				complete confidence
	1	2	3	4	5
Natural meat	❒	❒	❒	❒	❒
White eggs	❒	❒	❒	❒	❒

Brown eggs	❐	❐	❐	❐	❐
Free range eggs	❐	❐	❐	❐	❐
Chicken	❐	❐	❐	❐	❐
Pork	❐	❐	❐	❐	❐
Fresh fruits and vegetables	❐	❐	❐	❐	❐
Organic beef	❐	❐	❐	❐	❐

5. What do you think about eating pork?

	1	**2**	**3**	**4**	**5**	
When eating pork, I am exposed to …						
very little risk	❐	❐	❐	❐	❐	*a great deal of risk*
I accept the risks of eating pork						
strongly disagree	❐	❐	❐	❐	❐	*strongly agree*
I think eating pork is risky						
strongly disagree	❐	❐	❐	❐	❐	*strongly agree*
For me, eating pork is …						
not risky	❐	❐	❐	❐	❐	*risky*
For me, eating pork is worth the risk						
strongly disagree	❐	❐	❐	❐	❐	*strongly agree*
I am … the risk of eating pork						
not willing to accept	❐	❐	❐	❐	❐	*willing to accept*

Below is a list of statements related to food manufacturers, retailers, government and farmers. For each, please indicate how much you agree or disagree using the scale provided.

6. Food manufacturers	**strongly disagree** **1**	**disagree** **2**	**neither agree, nor disagree** **3**	**agree** **4**	**strongly agree** **5**
Manufacturers have the competence to control the safety of food	❐	❐	❐	❐	❐
Manufacturers have sufficient knowledge to guarantee the safety of food products	❐	❐	❐	❐	❐
Manufacturers are honest about the safety of food	❐	❐	❐	❐	❐
Manufacturers are sufficiently open about the safety of food	❐	❐	❐	❐	❐
Manufacturers take good care of the safety of our food	❐	❐	❐	❐	❐
Manufacturers give special attention to the safety of food	❐	❐	❐	❐	❐

7. Grocery stores	**strongly disagree**	**disagree**	**neither agree, nor disagree**	**agree**	**strongly agree**
	1	**2**	**3**	**4**	**5**
Grocery stores have the competence to control the safety of food	❒	❒	❒	❒	❒
Grocery stores have sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
Grocery stores are honest about the safety of food	❒	❒	❒	❒	❒
Grocery stores are sufficiently open about the safety of food	❒	❒	❒	❒	❒
Grocery stores take good care of the safety of our food	❒	❒	❒	❒	❒
Grocery stores give special attention to the safety of food	❒	❒	❒	❒	❒

8. Government	**strongly disagree**	**disagree**	**neither agree, nor disagree**	**agree**	**strongly agree**
	1	**2**	**3**	**4**	**5**
The *government* has the competence to control the safety of food	❒	❒	❒	❒	❒
The *government* has sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
The *government* is honest about the safety of food	❒	❒	❒	❒	❒
The *government* is sufficiently open about the safety of food	❒	❒	❒	❒	❒
The *government* takes good care of the safety of our food	❒	❒	❒	❒	❒
The *government* gives special attention to the safety of food	❒	❒	❒	❒	❒

9. Farmers	**strongly disagree**	**disagree**	**neither agree, nor disagree**	**agree**	**strongly agree**
	1	**2**	**3**	**4**	**5**
Farmers have the competence to control the safety of food	❒	❒	❒	❒	❒
Farmers have sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
Farmers are honest about the safety of food	❒	❒	❒	❒	❒
Farmers are sufficiently open about the safety of food	❒	❒	❒	❒	❒
Farmers take good care of the safety of our food	❒	❒	❒	❒	❒
Farmers give special attention to the safety of food	❒	❒	❒	❒	❒

To what extent do you think the following individuals and organizations are responsible for guaranteeing the safety of food? Please give your answer on a scale from 1 (“not at all responsible”) to 5 (“completely responsible”).

10. To what extent do you think … is/are responsible for the safety of food?	**not at all responsible** 1	2	3	4	**completely responsible** 5	**don't know** 6
Farmers	❐	❐	❐	❐	❐	❐
The government	❐	❐	❐	❐	❐	❐
Manufacturers of food	❐	❐	❐	❐	❐	❐
Retailers	❐	❐	❐	❐	❐	❐
Canadian Food Inspection Agency (CFIA)	❐	❐	❐	❐	❐	❐
The Consumers' Association of Canada (CAC)	❐	❐	❐	❐	❐	❐
The consumer	❐	❐	❐	❐	❐	❐

11. To what extent are you concerned about the following issues?	**Not at all concerned** 1	**Minor concerns** 2	**Some concerns** 3	**Major Concerns** 4	**Very concerned** 5
The feed given to livestock	❐	❐	❐	❐	❐
Conditions in which food animals are raised	❐	❐	❐	❐	❐
Genetically modified animal feeds	❐	❐	❐	❐	❐
Animal diseases (e.g. Avian Flu)	❐	❐	❐	❐	❐
The origin of products/ animals	❐	❐	❐	❐	❐
Antibiotics in meat	❐	❐	❐	❐	❐
Animals genetically modified for meat, egg or dairy production	❐	❐	❐	❐	❐

12. Consumer practices	**Occasionally** 1	**Regularly** 2	**Never** 3
How often do you purchase food for your own household? Is it….	❐	❐	❐
How often do you buy pork? Is it…	❐	❐	❐

13. Consumer practices	**Fewer than two times per year** 1	**Once per month** 2	**Once per week** 3	**More than once per week** 4
How often do you eat pork?	□	□	□	□

14. Thinking about buying pork, would you say that the following characteristics are unimportant, matter a bit or are important to you?	**Not important at all**	**Somewhat unimportant**	**Neutral**	**Somewhat important**	**Very important**
	1	**2**	**3**	**4**	**5**
The pork is tasty	❐	❐	❐	❐	❐
The pork is safe to eat	❐	❐	❐	❐	❐
The pigs are raised in an environmentally friendly way	❐	❐	❐	❐	❐
The shop is easily accessible	❐	❐	❐	❐	❐
The price is low	❐	❐	❐	❐	❐

We would now like to know your own involvement with food issues

15. Have you been involved in any of the following situations during the last twelve months?	**Yes**	**No**	**Don't know**
	1	**2**	**3**
Complained to a retailer about food quality	❐	❐	❐
Refused to buy certain food types or brands in order to express your opinion on a political or social issue	❐	❐	❐
Bought particular foods or brands in order to encourage or support their sale	❐	❐	❐
Participated in organised consumer boycotts	❐	❐	❐
Been member of an organisation that works for the improvement of food	❐	❐	❐
Taken part in any other kind of public or political action in order to improve the food we buy(contacted a politician, signed up for a petition, supported a campaign with money, distributed leaflets, collected petitions or money, participated in demonstration etc.)	❐	❐	❐

16. Consumer Voice	**Very little**	**Little**	**Some**	**A Lot**	**Don't know**
	1	**2**	**3**	**4**	**5**
To what degree do you think that your voice as a consumer matters? Is it…	❐	❐	❐	❐	❐
To what degree are you confident that the foods bought for your household are not harmful?	❐	❐	❐	❐	❐

17.	**no trust in information at all**	**some trust**	**moderate trust**	**high trust**	**complete trust in information**	**don't know**
To what extent do you trust information about the safety of food provided by …?						
Farmers	❐	❐	❐	❐	❐	❐

The government	❒	❒	❒	❒	❒	❒
Manufacturers of food	❒	❒	❒	❒	❒	❒
Retailers	❒	❒	❒	❒	❒	❒
Canadian Food Inspection Agency (CFIA)	❒	❒	❒	❒	❒	❒
The Consumers' Association of Canada (CAC)	❒	❒	❒	❒	❒	❒

18. Please rank the importance of the following characteristics of two different types of pork in comparison to conventional pork.

Statement	Strongly Agree	Agree	Neutral / No difference	Disagree	Strongly Disagree	N/A / No opinion
In comparison to conventional pork, I believe that organic pork:						
Tastes better	❒	❒	❒	❒	❒	❒
Is fresher	❒	❒	❒	❒	❒	❒
Is healthier	❒	❒	❒	❒	❒	❒
Does not contain hormones	❒	❒	❒	❒	❒	❒
Does not contain antibiotics	❒	❒	❒	❒	❒	❒
Is safer to eat	❒	❒	❒	❒	❒	❒
In comparison to conventional pork, I believe that traditionally raised pork:						
Tastes better	❒	❒	❒	❒	❒	❒
Is fresher	❒	❒	❒	❒	❒	❒
Is healthier	❒	❒	❒	❒	❒	❒
Does not contain hormones	❒	❒	❒	❒	❒	❒
Does not contain antibiotics	❒	❒	❒	❒	❒	❒
Is safer to eat	❒	❒	❒	❒	❒	❒

19. Standards for production claims such as "traditionally raised" are set by (one only):

	True	False
Industry		
Government		
Farmer		
Third Party		

20. These production claims (traditionally raised) can be certified by:

	True	False
Industry		
Government		
Farmer		
Third Party		

21. In the case of production claims, certification by one of the above organizations means:

	True	False
All pork is routinely traced to ensure the production claims listed on the labels are true		
Pork is randomly selected and sporadically traced to ensure the production claims on the labels are true		
Pork is never traced as production claims on the labels are assumed true		

22. Would you say that the following food issues are an important risk to human health in our society, are not a very important risk or no risk at all?

	Important	Not very important	No risk	Don't know
	1	**2**	**3**	**4**
Salmonella food poisoning	❐	❐	❐	❐
BSE (mad cow disease)	❐	❐	❐	❐
GM foods (genetically modified)	❐	❐	❐	❐
Products from livestock housed in large numbers, in cages or other restricted conditions	❐	❐	❐	❐
Pesticides	❐	❐	❐	❐
Listeriosis (Listeria) food poisoning	❐	❐	❐	❐
Eating pork when the H1N1 (swine flu) virus exists in the country	❐	❐	❐	❐
Additives (like preservatives, colouring)	❐	❐	❐	❐
Unhealthy eating	❐	❐	❐	❐
E. coli food poisoning	❐	❐	❐	❐
Unreasonable food prices	❐	❐	❐	❐
Food Allergies	❐	❐	❐	❐

Chapter 4: Canada survey about BSE and beef consumption

Note: The questions used in the analysis were asked in the in the U.S. and Japan

Draft Canadian Survey
Food Safety, Animal Testing and Traceability

1. In which of the following age groups do you fall?

1. ❒ 15-19
2. ❒ 20-24
3. ❒ 25-29
4. ❒ 30-39
5. ❒ 40-49
6. ❒ 50-64
7. ❒ 65+

2. Please indicate your gender.

1. ❒ Male
2. ❒ Female

3. How many people live in your household?

1. ❒ 1
2. ❒ 2
3. ❒ 3 +

4. How many children younger than 18 live in your house?

1. ❒ No home living children < 18 years
2. ❒ 1
3. ❒ 2
4. ❒ 3
5. ❒ 4
6. ❒ More than 4

5. What is your position in the household? **ONLY ONE ANSWER POSSIBLE**

1. ❒ Head of household/main income
2. ❒ Partner of head of household
3. ❒ Child
4. ❒ Other family member
5. ❒ Other person (no family)

6. What is your marital status? **ONLY ONE ANSWER POSSIBLE**

1. ❒ Married/Living together/Common Law
2. ❒ Single
3. ❒ Divorced/Separated

4. ❒ Widowed

7. What is the highest level of education you've achieved? **ONLY ONE ANSWER POSSIBLE**

1. ❒ Elementary school
2. ❒ Secondary (high) school
3. ❒ Technical/ business school/Community college
4. ❒ University
5. ❒ Post graduate studies (Masters or PhD)

8. Which of the following best describes your employment status? **ONLY ONE ANSWER POSSIBLE**

1. ❒ Employed full-time or self-employed
2. ❒ Employed part-time
3. ❒ Homemaker
4. ❒ Student and full-time employed
5. ❒ Student and part-time employed
6. ❒ Student only
7. ❒ Retired
8. ❒ Unemployed
9. ❒ Other

9. What is the approximate range of your total household income? **ONLY ONE ANSWER POSSIBLE**

1. ❒ $ 24,999 or under
2. ❒ Between $ 25,000 and $ 39,999
3. ❒ Between $ 40,000 and $ 64,999
4. ❒ Between $ 65,000 and $ 79,999
5. ❒ Between $ 80,000 and $ 99,999
6. ❒ Between $ 100,000 and $ 119,999
7. ❒ $ 120,000 or more

10. Which region do you live in? **ONLY ONE ANSWER POSSIBLE**

1. ❒ Maritimes
2. ❒ Quebec
3. ❒ Ontario
4. ❒ Manitoba
5. ❒ Saskatchewan
6. ❒ Alberta
7. ❒ British Columbia

11. Do you live in a city, in a town or in the countryside? **ONLY ONE ANSWER POSSIBLE**

1.	❐	In a city (>100.000 inhabitants)
2.	❐	In a town (> 10.000 inhabitants)
3.	❐	In the countryside/rural district

Section: General Trust

12. Generally speaking, would you say that most people can be trusted?

People can be trusted	Can't be too careful in dealing with people	Don't know
1	2	3
❐	❐	❐

13. We would like to know whether you, **in general**, worry a lot in daily life. Please indicate to what extent you find the following statements characteristic of yourself. Give your answer on a scale from 1 ("not at all typical") to 5 ("very typical").

	not at all typical	untypical	somewhat typical	typical	very typical
	1	2	3	4	5
Many situations make me worry	❐	❐	❐	❐	❐
I know I shouldn't worry about things, but I just cannot help it	❐	❐	❐	❐	❐
I notice that I have been worrying about things	❐	❐	❐	❐	❐

14. **Please indicate your level of agreement with the following statements**	strongly disagree	disagree	neither agree, nor disagree	agree	strongly agree
	1	2	3	4	5
I am optimistic about the safety of food products	❐	❐	❐	❐	❐
I am confident that food products are safe	❐	❐	❐	❐	❐
I am satisfied with the safety of food products	❐	❐	❐	❐	❐
Generally, food products are safe	❐	❐	❐	❐	❐
I worry about the safety of food	❐	❐	❐	❐	❐
I feel uncomfortable regarding the safety of food	❐	❐	❐	❐	❐
As a result of the occurrence of food safety incidents I am suspicious about certain food products	❐	❐	❐	❐	❐

Assessment of food industry

15. These statements are about your trust in individuals and institutions with respect to the safety of food. We distinguish between the government, farmers, retailers, and manufacturers of food products. Please indicate to what extent you agree with each statement.

DISPLAY IN DIFFERENT ORDER, I.E.:

1.	**GOVERNMENT**	**FARMERS**	**RETAILERS**	**MANUFACTURERS**
2.	**FARMERS**	**RETAILERS**	**MANUFACTURERS**	**GOVERNMENT**
3.	**RETAILERS**	**MANUFACTURERS**	**GOVERNMENT**	**FARMERS**
4.	**MANUFACTURERS**	**GOVERNMENT**	**FARMERS**	**RETAILERS**

GOVERNMENT	**strongly disagree** 1	**disagree** 2	**neither agree, nor disagree** 3	**agree** 4	**strongly agree** 5
The government has the competence to control the safety of food	❒	❒	❒	❒	❒
The government has sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
The government is honest about the safety of food	❒	❒	❒	❒	❒
The government is sufficiently open about the safety of food	❒	❒	❒	❒	❒
The government takes good care of the safety of our food	❒	❒	❒	❒	❒
The government gives special attention to the safety of food	❒	❒	❒	❒	❒

FARMERS	**strongly disagree** 1	**disagree** 2	**neither agree, nor disagree** 3	**agree** 4	**strongly agree** 5
Farmers have the competence to control the safety of food	❒	❒	❒	❒	❒
Farmers have sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
Farmers are honest about the safety of food	❒	❒	❒	❒	❒
Farmers are sufficiently open about the safety of food	❒	❒	❒	❒	❒
Farmers take good care of the safety of our food	❒	❒	❒	❒	❒
Farmers give special attention to the safety of food	❒	❒	❒	❒	❒

RETAILERS	**strongly disagree** 1	**disagree** 2	**neither agree, nor disagree** 3	**agree** 4	**strongly agree** 5
Retailers have the competence to control the safety of food	❒	❒	❒	❒	❒
Retailers have sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
Retailers are honest about the safety of food	❒	❒	❒	❒	❒
Retailers are sufficiently open about the safety of food	❒	❒	❒	❒	❒
Retailers take good care of the safety of our food	❒	❒	❒	❒	❒
Retailers give special attention to the safety of food	❒	❒	❒	❒	❒

MANUFACTURERS OF FOOD	strongly disagree 1	disagree 2	neither agree, nor disagree 3	agree 4	strongly agree 5
Manufacturers have the competence to control the safety of food	❐	❐	❐	❐	❐
Manufacturers have sufficient knowledge to guarantee the safety of food products	❐	❐	❐	❐	❐
Manufacturers are honest about the safety of food	❐	❐	❐	❐	❐
Manufacturers are sufficiently open about the safety of food	❐	❐	❐	❐	❐
Manufacturers take good care of the safety of our food	❐	❐	❐	❐	❐
Manufacturers give special attention to the safety of food	❐	❐	❐	❐	❐

16. **To what extent are you concerned about the following issues?**

	Not at all concerned 1	Minor concerns 2	Some concerns 3	Major Concerns 4	Very concerned 5
The feed given to livestock	❐	❐	❐	❐	❐
Conditions in which food animals are raised	❐	❐	❐	❐	❐
Genetically modified animal feeds	❐	❐	❐	❐	❐
Animal diseases	❐	❐	❐	❐	❐
BSE and Creutzfeldt Jakob Disease (vCJD)	❐	❐	❐	❐	❐
The origin of products/ animals	❐	❐	❐	❐	❐
Antibiotics in meat	❐	❐	❐	❐	❐
Animals genetically modified for meat/poultry or dairy production	❐	❐	❐	❐	❐

17. To what extent do you think the following individuals and organizations are responsible for guaranteeing the safety of food? Please give your answer on a scale from 1 (“not at all responsible”) to 5 (“completely responsible”).

	Not at all responsible 1	Minor responsibility 2	Some responsibility 3	Major responsibility 4	Completely responsible 5
To what extent do you think … is/are responsible for the safety of food?					
Farmers	❐	❐	❐	❐	❐
The government	❐	❐	❐	❐	❐
Manufacturers of food	❐	❐	❐	❐	❐
Retailers	❐	❐	❐	❐	❐
The Consumers’ Association of Canada (CAC)	❐	❐	❐	❐	❐
The consumer	❐	❐	❐	❐	❐

18. Various individuals and organizations provide information about the safety of food. Please indicate to what extent you trust the information provided by the following sources, where 1 refers to "no trust in information at all" and 5 refers to "complete trust in information".

	No trust in information at all **1**	**Some trust in information** **2**	**Trust most information** **3**	**Trust majority of information** **4**	**Complete trust in information** **5**
To what extent do you trust information about the safety of food provided by …?					
Farmers	❒	❒	❒	❒	❒
The government	❒	❒	❒	❒	❒
Manufacturers of food	❒	❒	❒	❒	❒
Retailers	❒	❒	❒	❒	❒
The Consumers' Association of Canada	❒	❒	❒	❒	❒

19. Please answer the following questions. Give your answer on a scale from 1 ("insignificant") to 5 ("a great deal").

	Insignificant **1**	**Very little** **2**	**Minor** **3**	**Some** **4**	**A great deal** **5**
How much risk do you think there is to **you personally** of experiencing negative consequences from eating unsafe foods?	❒	❒	❒	❒	❒
How much risk do you think there is to **the average Canadian person** of experiencing negative consequences from eating unsafe foods?	❒	❒	❒	❒	❒
How much control do you think **you personally** have over the safety of food?	❒	❒	❒	❒	❒
How much control do you think **the average Canadian person** has over the safety of food?	❒	❒	❒	❒	❒
How much knowledge do you think **you personally** have about the safety of food?	❒	❒	❒	❒	❒
How much knowledge do you think **the average Canadian person** has about the safety of food?	❒	❒	❒	❒	❒

20a. Do you recall a particular incident over **the past six months** where the safety of food was compromised or threatened? Your memory can be based on personal experience, but also on information you received through the news media.

❒ Yes [>>20b]

❒ No [>>21]

20b. [after this question, continue with 21]

Which incident(s) do you recall? Could you indicate when the incident occurred?

MORE THAN ONE ANSWER POSSIBLE

	DESCRIPTION OF INCIDENT	WHEN DID THE INCIDENT OCCUR?
INCIDENT 1	________________________________	________________________________
INCIDENT 2	________________________________	________________________________
INCIDENT 3	________________________________	________________________________

21. Please indicate how much confidence you, generally, have in the safety of the following product groups. Give your answer on a scale from 1 (“no confidence at all”) to 5 (“complete confidence”).

	no confidence at all **1**	**some** **2**	**reasonable** **3**	**high** **4**	**complete confidence** **5**
Beef	❒	❒	❒	❒	❒
Pork	❒	❒	❒	❒	❒
Chicken / poultry	❒	❒	❒	❒	❒
Fish	❒	❒	❒	❒	❒
Meat replacers / substitutes	❒	❒	❒	❒	❒
Canned products	❒	❒	❒	❒	❒
Products sold in jars	❒	❒	❒	❒	❒
Fresh vegetables and fruit	❒	❒	❒	❒	❒
Precut and washed fresh vegetables	❒	❒	❒	❒	❒
Milk products	❒	❒	❒	❒	❒
Cheese	❒	❒	❒	❒	❒
Eggs	❒	❒	❒	❒	❒
Bread products	❒	❒	❒	❒	❒
Frozen products	❒	❒	❒	❒	❒
Ready-to-eat meals	❒	❒	❒	❒	❒
Vitamin supplements	❒	❒	❒	❒	❒
Baby food	❒	❒	❒	❒	❒
Confectionery products	❒	❒	❒	❒	❒
Processed Meat	❒	❒	❒	❒	❒

22. We would like to ask some more questions about your opinion regarding poultry (chicken and turkey) and beef.

[DISPLAY CHICKEN AND BEEF RANDOMLY, ALSO DISPLAY ITEMS RANDOMLY WITHIN TYPE]

What do you think about poultry?

	1	**2**	**3**	**4**	**5**	
not safe	❒	❒	❒	❒	❒	safe

not trustworthy	❒	❒	❒	❒	❒	trustworthy
contains harmful substances	❒	❒	❒	❒	❒	does not contain harmful substances
What do you think about beef?						
not safe	❒	❒	❒	❒	❒	safe
not trustworthy	❒	❒	❒	❒	❒	trustworthy
contains harmful substances	❒	❒	❒	❒	❒	does not contain harmful substances

23a.

[DISPLAY CHICKEN AND BEEF RANDOMLY, SHOW ITEMS WITHIN TYPE OF MEAT ALSO RANDOMLY]

Do you eat beef?

❒	Yes	**Routing: Continue with [23b]**
❒	No	**Routing: Continue with [24a]**

23b.

What do you think about eating beef?

When eating beef, I am exposed to …						
	1	**2**	**3**	**4**	**5**	
very little risk	❒	❒	❒	❒	❒	a great deal of risk
I accept the risks of eating beef						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
I think eating beef is risky						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
For me, eating beef is …						
not risky	❒	❒	❒	❒	❒	risky
For me, eating beef is worth the risk						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
I am … the risk of eating beef						
not willing to accept	❒	❒	❒	❒	❒	willing to accept

24. Please provide the approximate percentage of your beef consumption over the past year that would include the following beef products (your best guess is fine, they should add to 100%, skip question if you do not consume beef):

ground or minced (e.g., hamburger)	___%
roasts	___%
steaks	___%
sausage, brats, hotdogs, beef luncheon meats, deli meats	___%

organ meats (e.g., liver, tongue, tripe, etc.)	___%
other (please list_________________)	___%

25a. Do you eat poultry?

❒	Yes	**Routing: Continue with [25b]**
❒	No	**Routing: Continue with [26]**

25b. What do you think about eating poultry?

	1	2	3	4	5	
When eating poultry, I am exposed to …						
very little risk	❒	❒	❒	❒	❒	a great deal of risk
I accept the risks of eating poultry						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
I think eating poultry is risky						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
For me, eating poultry is …						
not risky	❒	❒	❒	❒	❒	risky
For me, eating poultry is worth the risk						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
I am … the risk of eating poultry						
not willing to accept	❒	❒	❒	❒	❒	willing to accept

26. Imagine you have a question about the safety of your food. To what extent would you use the following information sources to discover more information about food safety?

	Definitely not		**Use occasionally**		**Definitely**
	1	**2**	**3**	**4**	**5**
Neighbours	❒	❒	❒	❒	❒
The Consumers' Association of Canada	❒	❒	❒	❒	❒
Dietician or family doctor	❒	❒	❒	❒	❒
Product labels	❒	❒	❒	❒	❒
Family	❒	❒	❒	❒	❒
Agriculture and Agri-Food Canada	❒	❒	❒	❒	❒
Provincial ministry of agriculture	❒	❒	❒	❒	❒
Health Canada	❒	❒	❒	❒	❒
Provincial ministry of health	❒	❒	❒	❒	❒

Research institutes	❐	❐	❐	❐	❐
Food manufacturers	❐	❐	❐	❐	❐
Friends and acquaintances	❐	❐	❐	❐	❐
Scientists	❐	❐	❐	❐	❐
Retailers or supermarkets	❐	❐	❐	❐	❐
Canadian Food Inspection Agency	❐	❐	❐	❐	❐

27. The next questions are about news messages in the media about the safety of food. Those messages may concern **actual incidents**, but may also provide **background information** about the safety of food products in general, and so not be related to a particular incident. We would like to know to what extent you recall news messages about actual incidents or about background information. Please answer the following questions for **the most recent message** that you recall.

What was the most recent message about?

____

27b. [after this question, continue with 27c]

Was the most recent message positive or negative?

❐ Positive

❐ Negative

27c. [after this question, continue with 28]

How alarming did you find the most recent message?

not alarming at all	**slightly**	**somewhat**	**moderately**	**very alarming**
1	**2**	**3**	**4**	**5**
❐	❐	❐	❐	❐

28. The following questions have to do with different factors that influence the safety of food. Could you please indicate to what extent you agree with the following statements?

	strongly disagree **1**	**disagree** **2**	**neither agree, nor disagree** **3**	**agree** **4**	**strongly agree** **5**
I am in control over the safety of the food products that I eat	❐	❐	❐	❐	❐
The safety of food products is mainly influenced by how I handle food products	❐	❐	❐	❐	❐
The safety of food products is mainly influenced by parties in the food chain other than myself	❐	❐	❐	❐	❐
The safety of food products cannot be controlled, but is mainly determined by coincidental factors	❐	❐	❐	❐	❐

29. How often are you involved in the daily grocery shopping for your household?

never	once in a while	occasionally	frequently	always
1	2	3	4	5
❒	❒	❒	❒	❒

30. Do you ever buy organic products?

never	once in a while	occasionally	frequently	always
1	2	3	4	5
❒	❒	❒	❒	❒

31. Which of the following best describes your food preferences?

1	❒	I eat meat and fish
2	❒	I eat fish but don't eat meat
3	❒	I do eat meat but I don't eat fish
4	❒	I am a vegetarian (I don't eat either meat or fish)

32. Please answer with the following: 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree)

	strongly disagree	**disagree**	**neither agree, nor disagree**	**agree**	**strongly agree**
	1	**2**	**3**	**4**	**5**
I think that government food safety regulations protect me adequately	❒	❒	❒	❒	❒
I would like to see stronger food safety standards imposed in Canada	❒	❒	❒	❒	❒
I would pay more for a product with a higher than average level of food safety	❒	❒	❒	❒	❒
I do not eat meat prepared by someone outside my household	❒	❒	❒	❒	❒
I am confident that food in restaurants is safe to eat.	❒	❒	❒	❒	❒
I would be willing to pay a premium for beef that would guarantee animals were tested to ensure that they would not transmit the human variant of BSE?	❒	❒	❒	❒	❒
I purchase meat based: a. on the brand name	❒	❒	❒	❒	❒

b. country of origin	❒	❒	❒	❒	❒
c. on the price	❒	❒	❒	❒	❒

33. How often do you buy beef? Is it…	Never	Occasionally	Regularly
	1	2	3
	❒	❒	❒

34. When you buy beef, is it **usually in** ……………….. (One ONLY)		
a supermarket,	❒	1
a butcher's shop	❒	2
another small shop	❒	3
a farmer's market	❒	4
or another way (directly from a farm or through acquaintances)	❒	5

35. Thinking about buying beef, would you say that the following characteristics are unimportant, matter a bit or are important to you?	Unimportant 1	Matters a bit 2	Important 3
the beef tastes good	❒	❒	❒
the beef is lean	❒	❒	❒
the beef is safe to eat	❒	❒	❒
the price is low	❒	❒	❒
the shop is easily accessible	❒	❒	❒

36. When buying beef, would you say that the following safety and quality concerns are unimportant, matter a bit or are important to you?	Unimportant 1	Matters a bit 2	Important 3
You know the staff personally	❒	❒	❒
You know where the beef originates from	❒	❒	❒
Local hygiene inspectors visit the place regularly	❒	❒	❒
Canadian authorities practice strict hygienic standards for beef	❒	❒	❒
Canada establishes good food safety regulations for beef	❒	❒	❒
You know the shop from previous experience	❒	❒	❒
The beef is labeled with full product information	❒	❒	❒

37. Do you prefer imported beef from New Zealand, Australia, United States or other?
(one answer only)

Imported beef from Australia	❐	1
Imported beef from New Zealand	❐	2
Imported beef from the United States	❐	3
Imported beef from ____________________ please identify	❐	4
I avoid imported beef as much as possible	❐	5

38. Would you say that the following food issues are an important risk to human health in our society, are not a very important risk or no risk at all?

	Important	Not very	No risk	Don't know
	1	**2**	**3**	**4**
Salmonella food poisoning	❐	❐	❐	❐
BSE (mad cow disease)	❐	❐	❐	❐
GM foods (genetically modified)	❐	❐	❐	❐
Products from livestock housed in large numbers, in cages or other restricted conditions	❐	❐	❐	❐
Pesticides	❐	❐	❐	❐
Listeriosis (Listeria) food poisoning	❐	❐	❐	❐
Unhealthy eating	❐	❐	❐	❐
Additives (like preservatives, colouring)	❐	❐	❐	❐
Food allergies	❐	❐	❐	❐
E. coli food poisoning	❐	❐	❐	❐
Unreasonable food prices	❐	❐	❐	❐

	No	Yes
39. Over the past four years, have you lowered your beef consumption because of food safety concerns?	**1**	**2**
	❐	❐

If yes, reduced by roughly _______% (please give your best estimate

40. Whether you have ever knowingly purchased beef produced in another country or not, what is your perception of the level of food safety of beef by country of origin?

Your Perceived Level of Food Safety	Very Low	Low	Moderate	High	Very High	No Opinion
	1	**2**	**3**	**4**	**5**	**6**
Unknown Country of Origin	❐	❐	❐	❐	❐	❐
Australia	❐	❐	❐	❐	❐	❐
Brazil	❐	❐	❐	❐	❐	❐
Canada	❐	❐	❐	❐	❐	❐

New Zealand	❒	❒	❒	❒	❒	❒
USA	❒	❒	❒	❒	❒	❒

41. Have you ever heard of traceability in the food industry	Yes	No
	1	**2**
	❒	❒

42. Please indicate the importance of the use of traceability under each of the following circumstances.				
	Very important	Somewhat important	Somewhat unimportant	Not important at all
	1	**2**	**3**	**4**
To withdraw products should they prove to be dangerous	❒	❒	❒	❒
To offer reassurance as to the quality of products that people purchase	❒	❒	❒	❒
To provide information about every stage of the manufacturing process	❒	❒	❒	❒
To provide better information on product ingredients	❒	❒	❒	❒
To fight counterfeiting	❒	❒	❒	❒
To offer guarantees as to food being produced using environmentally sustainable production methods	❒	❒	❒	❒
To help people in choosing "healthy" products	❒	❒	❒	❒
To provide specific information for "at risk" individuals (weakened immune system, for example)	❒	❒	❒	❒

43. Tell me which of the following phrases you consider to be important information provided on food labels?					
	Very important	Somewhat important	Neutral	Somewhat unimportant	Not important at all
	1	**2**	**3**	**4**	**5**
The list of ingredients that make up a product	❒	❒	❒	❒	❒
The list of allergens	❒	❒	❒	❒	❒
Information about GMOs (genetically modified organisms or ingredients)	❒	❒	❒	❒	❒
The country of origin of a product	❒	❒	❒	❒	❒
Information about dietary norms (recommended daily allowances)	❒	❒	❒	❒	❒
The name of a product's manufacturer (the brand)	❒	❒	❒	❒	❒
The different intermediaries involved in the manufacture of a product	❒	❒	❒	❒	❒

44. **For you, who should guarantee the traceability of a product?**

	Manufacturers	Government	Consumer associations	Scientists	Media
	1	**2**	**3**	**4**	**5**
	❒	❒	❒	❒	❒

45. When you buy beef, how important are the following factors to you?

	Very Important	**Somewhat Important**	**Not Important**
	1	**2**	**3**
Product Leanness (fat)	❒	❒	❒
Food borne disease	❒	❒	❒
The use of antibiotics in livestock production	❒	❒	❒
The use of hormones in livestock production	❒	❒	❒
BSE or Mad cow disease	❒	❒	❒
Product Nutritional Information	❒	❒	❒
Price	❒	❒	❒
Product Flavor	❒	❒	❒
Product Tenderness	❒	❒	❒
Product Juiciness	❒	❒	❒
Product Preparation Ease	❒	❒	❒
Product Preparation Time	❒	❒	❒
Product Freshness (i.e., "Sell by Date" in U.S.; "Packaged on Date" in Canada; "Best Before" Date in Japan)	❒	❒	❒
Product Color	❒	❒	❒
Product Labeled Natural	❒	❒	❒
Product Labeled Organic	❒	❒	❒
Traceability of Product Back to Farm	❒	❒	❒
Country of Origin of Product	❒	❒	❒

46. **If you had a problem with a product, who would you hold responsible? More than one may apply**					
	Restaurant	Manufacturer	Government	Retailer	Farmer
	1	**2**	**3**	**4**	**5**
	❒	❒	❒	❒	❒

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

Touching the contagious meat	❒
Eating beef steak	❒
Blood transfusions from people who have variant Creutzfeldt-Jakob disease	❒
Drinking milk	❒

48. How has your consumption of beef changed since you first heard about BSE?

Increased dramatically	Increased slightly	Remained the same	Decreased slightly	Decreased dramatically
1	**2**	**3**	**4**	**5**
❐	❐	❐	❐	❐

Eating beef brain	❐
None of the above	❐

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

❐ Seafood

❐ Pork

❐ Chicken

❐ Lamb

❐ Organic beef

❐ Grass-fed beef

❐ Other ____________

Draft Canadian Survey _Canada
Food Safety, Animal Testing and Traceability – CWD
Note: The same survey was used in the U.S.

1. In which of the following age groups do you fall?

1. ❒ 18 -24
2. ❒ 25 -29
3. ❒ 30 -39
4. ❒ 40 -49
5. ❒ 50 -64
6. ❒ 65+

2. Please indicate your gender.

1. ❒ Male
2. ❒ Female

3. How many people live in your household?

1. ❒ 1
2. ❒ 2
3. ❒ 3 +

4. How many children younger than 18 live in your house?

1. ❒ No home living children < 18 years
2. ❒ 1
3. ❒ 2
4. ❒ 3
5. ❒ 4
6. ❒ More than 4

5. What is your position in the household? **ONLY ONE ANSWER POSSIBLE**

1. ❒ Head of household/main income
2. ❒ Partner of head of household
3. ❒ Child
4. ❒ Other family member
5. ❒ Other person (no family)

6. What is your marital status? **ONLY ONE ANSWER POSSIBLE**

1. ❒ Married/Living together/Common Law
2. ❒ Single
3. ❒ Divorced/Separated
4. ❒ Widowed

7. What is the highest level of education you've achieved? **ONLY ONE ANSWER POSSIBLE**

1.	❐	Elementary school
2.	❐	Secondary (high) school
3.	❐	Technical/ business school/Community college
4.	❐	University
5.	❐	Post graduate studies (Masters or PhD)

8. Which of the following best describes your employment status? **ONLY ONE ANSWER POSSIBLE**

1.	❐	Employed full-time or self-employed
2.	❐	Employed part-time
3.	❐	Homemaker
4.	❐	Student and full-time employed
5.	❐	Student and part-time employed
6.	❐	Student only
7.	❐	Retired
8.	❐	Unemployed
9.	❐	Other

9. What is the approximate range of your total household income? **ONLY ONE ANSWER POSSIBLE**

1.	❐	$ 24,999 or under
2.	❐	Between $ 25,000 and $ 39,999
3.	❐	Between $ 40,000 and $ 64,999
4.	❐	Between $ 65,000 and $ 79,999
5.	❐	Between $ 80,000 and $ 99,999
6.	❐	Between $ 100,000 and $ 119,999
7.	❐	$ 120,000 or more

10. Which region do you live in? **ONLY ONE ANSWER POSSIBLE**

1.	❐	Maritimes
2.	❐	Quebec
3.	❐	Ontario
4.	❐	Manitoba
5.	❐	Saskatchewan
6.	❐	Alberta
7.	❐	British Columbia
8.	❐	Yukon, Northwest Territories or Nunavut

11. Do you live in a city, in a town or in the countryside? **ONLY ONE ANSWER POSSIBLE**

1.	❒	In a city (>100.000 inhabitants)
2.	❒	In a town (> 10.000 inhabitants)
3.	❒	In the countryside/rural district

Section: General Trust

12. Generally speaking, would you say that most people can be trusted?

People can be trusted	**Can't be too careful in dealing with people**	**Don't know**
1	**2**	**3**
❒	❒	❒

13. We would like to know whether you, **in general**, worry a lot in daily life. Please indicate to what extent you find the following statements characteristic of yourself. Give your answer on a scale from 1 ("not at all typical") to 5 ("very typical").

	not at all typical	**untypical**	**somewhat typical**	**typical**	**very typical**
	1	**2**	**3**	**4**	**5**
Many situations make me worry	❒	❒	❒	❒	❒
I know I shouldn't worry about things, but I just cannot help it	❒	❒	❒	❒	❒
I notice that I have been worrying about things	❒	❒	❒	❒	❒

14. **Please indicate your level of agreement with the following statements**	**strongly disagree**	**disagree**	**neither agree, nor disagree**	**agree**	**strongly agree**
	1	**2**	**3**	**4**	**5**
I am optimistic about the safety of food products	❒	❒	❒	❒	❒
I am confident that food products are safe	❒	❒	❒	❒	❒
I am satisfied with the safety of food products	❒	❒	❒	❒	❒
Generally, food products are safe	❒	❒	❒	❒	❒
I worry about the safety of food	❒	❒	❒	❒	❒
I feel uncomfortable regarding the safety of food	❒	❒	❒	❒	❒
As a result of the occurrence of food safety incidents I am suspicious about certain food products	❒	❒	❒	❒	❒

Assessment of food industry

15. These statements are about your trust in individuals and institutions with respect to the safety of food. We distinguish between the government, farmers, retailers, and manufacturers of food products. Please indicate to what extent you agree with each statement.

DISPLAY IN DIFFERENT ORDER, I.E.:

1.	**GOVERNMENT**	**FARMERS**	**RETAILERS**	**MANUFACTURERS**
2.	**FARMERS**	**RETAILERS**	**MANUFACTURERS**	**GOVERNMENT**
3.	**RETAILERS**	**MANUFACTURERS**	**GOVERNMENT**	**FARMERS**
4.	**MANUFACTURERS**	**GOVERNMENT**	**FARMERS**	**RETAILERS**

GOVERNMENT	**strongly disagree 1**	**disagree 2**	**neither agree, nor disagree 3**	**agree 4**	**strongly agree 5**
The government has the competence to control the safety of food	❒	❒	❒	❒	❒
The government has sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
The government is honest about the safety of food	❒	❒	❒	❒	❒
The government is sufficiently open about the safety of food	❒	❒	❒	❒	❒
The government takes good care of the safety of our food	❒	❒	❒	❒	❒
The government gives special attention to the safety of food	❒	❒	❒	❒	❒

FARMERS	**strongly disagree 1**	**disagree 2**	**neither agree, nor disagree 3**	**agree 4**	**strongly agree 5**
Farmers have the competence to control the safety of food	❒	❒	❒	❒	❒
Farmers have sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
Farmers are honest about the safety of food	❒	❒	❒	❒	❒
Farmers are sufficiently open about the safety of food	❒	❒	❒	❒	❒
Farmers take good care of the safety of our food	❒	❒	❒	❒	❒
Farmers give special attention to the safety of food	❒	❒	❒	❒	❒

RETAILERS	**strongly disagree 1**	**disagree 2**	**neither agree, nor disagree 3**	**agree 4**	**strongly agree 5**
Retailers have the competence to control the safety of food	❒	❒	❒	❒	❒
Retailers have sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
Retailers are honest about the safety of food	❒	❒	❒	❒	❒
Retailers are sufficiently open about the safety of food	❒	❒	❒	❒	❒

Retailers take good care of the safety of our food	❒	❒	❒	❒	❒
Retailers give special attention to the safety of food	❒	❒	❒	❒	❒

MANUFACTURERS OF FOOD	**strongly disagree** **1**	**disagree** **2**	**neither agree, nor disagree** **3**	**agree** **4**	**strongly agree** **5**
Manufacturers have the competence to control the safety of food	❒	❒	❒	❒	❒
Manufacturers have sufficient knowledge to guarantee the safety of food products	❒	❒	❒	❒	❒
Manufacturers are honest about the safety of food	❒	❒	❒	❒	❒
Manufacturers are sufficiently open about the safety of food	❒	❒	❒	❒	❒
Manufacturers take good care of the safety of our food	❒	❒	❒	❒	❒
Manufacturers give special attention to the safety of food	❒	❒	❒	❒	❒

16. **To what extent are you concerned about the following issues?**

	Not at all concerned **1**	**Minor concerns** **2**	**Some concerns** **3**	**Major Concerns** **4**	**Very concerned** **5**
The feed given to livestock	❒	❒	❒	❒	❒
Conditions in which food animals are raised	❒	❒	❒	❒	❒
Genetically modified animal feeds	❒	❒	❒	❒	❒
Animal diseases	❒	❒	❒	❒	❒
BSE and Creutzfeldt Jakob Disease (vCJD)	❒	❒	❒	❒	❒
The origin of products/ animals	❒	❒	❒	❒	❒
Antibiotics in meat	❒	❒	❒	❒	❒
Animals genetically modified for meat/poultry or dairy production	❒	❒	❒	❒	❒

17. To what extent do you think the following individuals and organizations are responsible for guaranteeing the safety of food? Please give your answer on a scale from 1 ("not at all responsible") to 5 ("completely responsible").

	Not at all responsible **1**	**Minor responsibility** **2**	**Some responsibility** **3**	**Major responsibility** **4**	**Completely responsible** **5**
To what extent do you think … is/are responsible for the safety of food?					

Farmers	❐	❐	❐	❐	❐
The government	❐	❐	❐	❐	❐
Manufacturers of food	❐	❐	❐	❐	❐
Retailers	❐	❐	❐	❐	❐
The Consumers' Association of Canada (CAC)	❐	❐	❐	❐	❐
The consumer	❐	❐	❐	❐	❐

18. Various individuals and organizations provide information about the safety of food. Please indicate to what extent you trust the information provided by the following sources, where 1 refers to "no trust in information at all" and 5 refers to "complete trust in information".

	No trust in information at all **1**	**Some trust in information** **2**	**Trust most information** **3**	**Trust majority of information** **4**	**Complete trust in information** **5**
To hat extent do you trust information about the safety of food provided by …?					
Farmers	❐	❐	❐	❐	❐
The government	❐	❐	❐	❐	❐
Manufacturers of food	❐	❐	❐	❐	❐
Retailers	❐	❐	❐	❐	❐
The Consumers' Association of Canada	❐	❐	❐	❐	❐

19. Please answer the following questions. Give your answer on a scale from 1 ("insignificant") to 5 ("a great deal").

	Insignificant **1**	**Very little** **2**	**Minor** **3**	**Some** **4**	**A great deal** **5**
How much risk do you think there is to **you personally** of experiencing negative consequences from eating unsafe foods?	❐	❐	❐	❐	❐
How much risk do you think there is to **the average Canadian person** of experiencing negative consequences from eating unsafe foods?	❐	❐	❐	❐	❐
How much control do you think **you personally** have over the safety of food?	❐	❐	❐	❐	❐
How much control do you think **the average Canadian person** has over the safety of food?	❐	❐	❐	❐	❐
How much knowledge do you think **you personally** have about the safety of food?	❐	❐	❐	❐	❐
How much knowledge do you think **the average Canadian person** has about the safety of food?	❐	❐	❐	❐	❐

20a. Do you recall a particular incident over **the past six months** where the safety of food was compromised or threatened? Your memory can be based on personal experience, but also on information you received through the news media.

❒ Yes [>>20b]

❒ No [>>21]

20b. [after this question, continue with 21]

Which incident(s) do you recall? Could you indicate when the incident occurred?

MORE THAN ONE ANSWER POSSIBLE

	DESCRIPTION OF INCIDENT	WHEN DID THE INCIDENT OCCUR?
INCIDENT 1	______________________________	______________________________
INCIDENT 2	______________________________	______________________________
INCIDENT 3	______________________________	______________________________

21. Please indicate how much confidence you, generally, have in the safety of the following product groups. Give your answer on a scale from 1 ("no confidence at all") to 5 ("complete confidence").

	no confidence at all	**some**	**reasonable**	**high**	**complete confidence**
	1	**2**	**3**	**4**	**5**
Beef	❒	❒	❒	❒	❒
Pork	❒	❒	❒	❒	❒
Chicken / poultry	❒	❒	❒	❒	❒
Fish	❒	❒	❒	❒	❒
Meat replacers / substitutes	❒	❒	❒	❒	❒
Canned products	❒	❒	❒	❒	❒
Products sold in jars	❒	❒	❒	❒	❒
Fresh vegetables and fruit	❒	❒	❒	❒	❒
Precut and washed fresh vegetables	❒	❒	❒	❒	❒
Milk products	❒	❒	❒	❒	❒
Cheese	❒	❒	❒	❒	❒
Eggs	❒	❒	❒	❒	❒
Bread products	❒	❒	❒	❒	❒
Game meat – venison, deer, elk etc.	❒	❒	❒	❒	❒
Frozen products	❒	❒	❒	❒	❒
Ready-to-eat meals	❒	❒	❒	❒	❒
Vitamin supplements	❒	❒	❒	❒	❒
Baby food	❒	❒	❒	❒	❒
Confectionery products	❒	❒	❒	❒	❒
Processed Meat	❒	❒	❒	❒	❒

22. We would like to ask some more questions about your opinion regarding venison or game meat and beef.
[DISPLAY VENISON AND BEEF RANDOMLY, ALSO DISPLAY ITEMS RANDOMLY WITHIN TYPE]

What do you think about venison (deer, elk or moose meat)?						
	1	**2**	**3**	**4**	**5**	
not safe	❒	❒	❒	❒	❒	safe
not trustworthy	❒	❒	❒	❒	❒	trustworthy
contains harmful substances	❒	❒	❒	❒	❒	does not contain harmful substances
What do you think about beef?						
not safe	❒	❒	❒	❒	❒	safe
not trustworthy	❒	❒	❒	❒	❒	trustworthy
contains harmful substances	❒	❒	❒	❒	❒	does not contain harmful substances

23a.

[DISPLAY VENISON AND BEEF RANDOMLY, SHOW ITEMS WITHIN TYPE OF MEAT ALSO RANDOMLY]

Do you eat beef?

❒	Yes	**Routing: Continue with [23b]**
❒	No	**Routing: Continue with [24a]**

23b.

What do you think about eating beef?

When eating beef, I am exposed to …						
	1	**2**	**3**	**4**	**5**	
very little risk	❒	❒	❒	❒	❒	a great deal of risk
I accept the risks of eating beef						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
I think eating beef is risky						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
For me, eating beef is …						
not risky	❒	❒	❒	❒	❒	risky
For me, eating beef is worth the risk						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
I am … the risk of eating beef						

not willing to accept	❒	❒	❒	❒	❒	willing to accept

24. Please provide the approximate percentage of your beef consumption over the past year that would include the following beef products (your best guess is fine, they should add to 100%, skip question if you do not consume beef):

ground or minced (e.g., hamburger)	___%
roasts	___%
steaks	___%
sausage, brats, hotdogs, beef luncheon meats, deli meats	___%
organ meats (e.g., liver, tongue, tripe, etc.)	___%
other (please list_________________)	___%

25a. Do you eat or have you ever eaten venison (deer, elk or moose meat)?

❒ Yes **Routing: Continue with [25b]**

❒ No **Routing: Continue with [26]**

25b. What do you think about eating venison?

	1	2	3	4	5	
When eating venison, I am exposed to …						
very little risk	❒	❒	❒	❒	❒	a great deal of risk
I accept the risks of eating venison						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
I think eating venison is risky						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
For me, eating venison is …						
not risky	❒	❒	❒	❒	❒	risky
For me, eating venison is worth the risk						
strongly disagree	❒	❒	❒	❒	❒	strongly agree
I am … the risk of eating venison						
not willing to accept	❒	❒	❒	❒	❒	willing to accept

26. Imagine you have a question about the safety of your food. To what extent would you use the following information sources to discover more information about food safety?

	Definitely not		Use occasionally		Definitely
	1	2	3	4	5
Neighbours	❐	❐	❐	❐	❐
The Consumers' Association of Canada	❐	❐	❐	❐	❐
Dietician or family doctor	❐	❐	❐	❐	❐
Product labels	❐	❐	❐	❐	❐
Family	❐	❐	❐	❐	❐
Agriculture and Agri-Food Canada	❐	❐	❐	❐	❐
Provincial ministry of agriculture	❐	❐	❐	❐	❐
Health Canada	❐	❐	❐	❐	❐
Provincial ministry of health	❐	❐	❐	❐	❐
Research institutes	❐	❐	❐	❐	❐
Food manufacturers	❐	❐	❐	❐	❐
Friends and acquaintances	❐	❐	❐	❐	❐
Scientists	❐	❐	❐	❐	❐
Retailers or supermarkets	❐	❐	❐	❐	❐
Canadian Food Inspection Agency	❐	❐	❐	❐	❐

27. The next questions are about news messages in the media about the safety of food. Those messages may concern **actual incidents**, but may also provide **background information** about the safety of food products in general, and so not be related to a particular incident. We would like to know to what extent you recall news messages about actual incidents or about background information. Please answer the following questions for **the most recent message** that you recall.

What was the most recent message about?

____

27b. [after this question, continue with 27c]

Was the most recent message positive or negative?

❐ Positive

❐ Negative

27c. [after this question, continue with 28]
How alarming did you find the most recent message?

not alarming at all	slightly	somewhat	moderately	very alarming
1	2	3	4	5
❐	❐	❐	❐	❐

28. The following questions have to do with different factors that influence the safety of food. Could you please indicate to what extent you agree with the following statements?

	strongly disagree 1	disagree 2	neither agree, nor disagree 3	agree 4	strongly agree 5
I am in control over the safety of the food products that I eat	❒	❒	❒	❒	❒
The safety of food products is mainly influenced by how I handle food products	❒	❒	❒	❒	❒
The safety of food products is mainly influenced by parties in the food chain other than myself	❒	❒	❒	❒	❒
The safety of food products cannot be controlled, but is mainly determined by coincidental factors	❒	❒	❒	❒	❒

29. How often are you involved in the daily grocery shopping for your household?

never	once in a while	occasionally	frequently	always
1	2	3	4	5
❒	❒	❒	❒	❒

30. Do you ever buy organic products?

never	once in a while	occasionally	frequently	always
1	2	3	4	5
❒	❒	❒	❒	❒

31. Do you ever eat meat from animals you or someone else has hunted?

never	tried it once	occasionally	frequently	regularly
1	2	3	4	5
❒	❒	❒	❒	❒

32. Have you ever ordered venison (deer, elk or moose meat) in a restaurant?

never	tried it once	occasionally	frequently	regularly
1	2	3	4	5
❒	❒	❒	❒	❒

33. Which of the following best describes your food preferences?

1	❒	I eat meat and fish
2	❒	I eat fish but don't eat meat
3	❒	I do eat meat but I don't eat fish
4	❒	I am a vegetarian (I don't eat either meat or fish)

34. Please answer with the following: 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree)

	strongly disagree	**disagree**	**neither agree, nor disagree**	**agree**	**strongly agree**
	1	**2**	**3**	**4**	**5**
I think that government food safety regulations protect me adequately	❒	❒	❒	❒	❒
I would like to see stronger food safety standards imposed in Canada	❒	❒	❒	❒	❒
I would pay more for a product with a higher than average level of food safety	❒	❒	❒	❒	❒
I do not eat meat prepared by someone outside my household	❒	❒	❒	❒	❒
I am confident that food in restaurants is safe to eat.	❒	❒	❒	❒	❒
I would be willing to pay a premium for beef that would guarantee animals were tested to ensure that they do not transmit the human variant of BSE?	❒	❒	❒	❒	❒
I purchase meat based: d. on the brand name	❒	❒	❒	❒	❒
e. country of origin	❒	❒	❒	❒	❒
f. on the price	❒	❒	❒	❒	❒

35. How often do you buy beef? Is it…	Never	Occasionally	Regularly
	1	**2**	**3**
	❒	❒	❒

36. When you buy beef, is it **usually in ……………….**.. (One ONLY)

a supermarket,	❒	**1**
a butcher's shop	❒	**2**
another small shop	❒	**3**
a farmer's market	❒	**4**
or another way (directly from a farm or through acquaintances)	❒	**5**

37. When you obtain/buy deer, elk or moose meat, is it **usually from** ………………..	(One ONLY)	
a supermarket,	❒	**1**
a butcher's shop	❒	**2**
your own hunting experience	❒	**3**
a farmer's market	❒	**4**
or another way (directly from a farm or through acquaintances)	❒	**5**

38. Thinking about buying meat, would you say that the following characteristics are unimportant, matter a bit or are important to you?	Unimportant	Matters a bit	Important
	1	**2**	**3**
the meat tastes good	❒	❒	❒
the meat is lean	❒	❒	❒
the meat is safe to eat	❒	❒	❒
the price is low	❒	❒	❒
the shop is easily accessible	❒	❒	❒

39. When buying meat, would you say that the following safety and quality concerns are unimportant, matter a bit or are important to you?	Unimportant	Matters a bit	Important
	1	**2**	**3**
You know the staff personally	❒	❒	❒
You know where the meat originates from	❒	❒	❒
Local hygiene inspectors visit the place regularly	❒	❒	❒
Canadian authorities practice strict hygienic standards for meat	❒	❒	❒
Canada establishes good food safety regulations for meat	❒	❒	❒
You know the shop from previous experience	❒	❒	❒
The meat is labeled with full product information	❒	❒	❒

Traceability

40. Have you ever heard of traceability in the food industry	Yes	No
	1	**2**
	❒	❒

41. Please indicate the importance of the use of traceability under each of the following circumstances.	Very important	Somewhat important	Somewhat unimportant	Not important at all
	1	**2**	**3**	**4**
To withdraw products should they prove to be dangerous	❒	❒	❒	❒
To offer reassurance as to the quality of products that people purchase	❒	❒	❒	❒
To provide information about every stage of the manufacturing process	❒	❒	❒	❒
To provide better information on product ingredients	❒	❒	❒	❒
To fight counterfeiting	❒	❒	❒	❒
To offer guarantees as to food being produced using environmentally sustainable production methods	❒	❒	❒	❒
To help people in choosing "healthy" products	❒	❒	❒	❒
To provide specific information for "at risk" individuals (weakened immune system, for example)	❒	❒	❒	❒

42. Tell me which of the following phrases you consider to be important information provided on food labels?	Very important	Somewhat important	Neutral	Somewhat unimportant	Not important at all
	1	**2**	**3**	**4**	**5**
The list of ingredients that make up a product	❒	❒	❒	❒	❒
The list of allergens	❒	❒	❒	❒	❒
Information about GMOs (genetically modified organisms or ingredients)	❒	❒	❒	❒	❒
The country of origin of a product	❒	❒	❒	❒	❒
Information about dietary norms (recommended daily allowances)	❒	❒	❒	❒	❒
The name of a product's manufacturer (the brand)	❒	❒	❒	❒	❒
The different intermediaries involved in the manufacture of a product	❒	❒	❒	❒	❒

43. **For you, who should guarantee the traceability of a product?**					
	Manufacturers	Government	Consumer associations	Scientists	Media
	1	**2**	**3**	**4**	**5**
	❒	❒	❒	❒	❒

44. **If you had a problem with a product, who would you hold responsible? More than one may apply**					
	Restaurant	Manufacturer	Government	Retailer	Farmer
	1	**2**	**3**	**4**	**5**
	❒	❒	❒	❒	❒

45. **By which of the following ways, may humans get mad cow disease? (Check all that apply)**	
Touching the contagious meat	❒
Eating beef steak	❒
Blood transfusions from people who have variant Creutzfeldt-Jakob disease	❒
Drinking milk	❒
Eating beef brain	❒
None of the above	❒

Chronic Wasting Disease

- Chronic wasting disease (CWD) is a progressive, fatal, degenerative disease of the brain belonging to a group of diseases called Transmissible Spongiform Encephalopathies (TSEs).
- Other examples of TSEs are Scrapie, BSE (mad cow disease) and CJD (the most common TSE found in humans). All TSEs are ultimately fatal.
- CWD affects elk, mule deer and white-tailed deer, has no current treatment or vaccine and is the only TSE to occur in free-ranging species.
- There is currently no scientific evidence that CWD can be transmitted to humans. However, people are advised not to eat meat from any animal infected with a TSE.
- There is currently no evidence that CWD can be contracted by livestock such as cattle, sheep, goats, horses or bison.

46. Before responding to this survey, had you heard of chronic wasting disease (CWD)?

Yes	☐	No	☐

47. If you had heard of CWD before this survey, did you know that CWD can infect deer, before responding to this survey?

Yes	☐	No	☐

48. If you had heard of CWD before this survey, did you know that CWD can infect elk, before responding to this survey?

Yes	☐	No	☐

CWD in wild population of deer and elk

- Chronic wasting disease is thought to have been introduced into Saskatchewan farmed elk in the late 1980s via affected elk imported from the United States, but it was not recognized in farmed elk until 1996. Shortly after the detection of CWD on game farms, wildlife agencies in the prairie provinces began surveillance programs to determine the presence of the disease amongst free-ranging deer and elk.
- No cases of chronic wasting disease have been found in Manitoba, Ontario, Quebec, British Columbia or the Maritimes.

- Saskatchewan has found 186 mule deer, 54 white tailed deer and 3 elk with chronic wasting disease out of 43,118 animals tested to the end of 2008.
- A total of 62 cases of CWD have been found in wild Alberta deer out of nearly 20,000 wild animals tested.
- To date, no cases of CWD have been found in wild elk in Alberta.
- The first confirmed case of CWD in a wild Alberta deer occurred in September, 2005, almost 3 years after CWD was found in farmed elk and deer.
- All known cases of CWD in wild deer occurred near the Alberta-Saskatchewan border.
- Rates of CWD infection in the area remain low (less than 1%, that is, less than 10 out of every 1000 tested animals were found to be infected. The rate differs among local deer populations and between mule deer and white-tailed deer.

CWD on prairie elk and deer farms

- Alberta began conducting voluntary testing for CWD in farmed and wild elk and deer in the fall of 1996.
- In August, 2002 Alberta initiated a mandatory surveillance program for all farmed elk and deer.
- To date, only 3 farmed elk or deer have tested positive for CWD in Alberta; all in 2002. These 3 cases occurred on two farms with both having their herds subsequently depopulated (destroyed).
- Since 2002, more than 45,000 farmed deer or elk in Alberta have been tested for CWD with no new cases found. Alberta's elk and deer farms are currently considered CWD free.
- Saskatchewan continues to find some evidence of chronic wasting disease in farmed deer and elk with four cases found in 2008 and 2 cases found to date in 2009.
- Alberta and Saskatchewan test all farmed deer and elk (Manitoba has a similar program for farmed elk) for CWD prior to meat from those animals being sold – other parts of Canada have voluntary testing protocols for farmed deer and elk and no animals have been found.

49. Before responding to this survey, did you know that although CWD has been found in farmed elk and deer in Alberta *in the past*, it is *currently* only being found in Alberta in wild deer?

Yes	☐	No	☐

50. Before responding to this survey did you know that CWD has been found in farmed deer and elk in Saskatchewan?

Yes	☐	No	☐

51. Please indicate your level of agreement with the following statements on a scale from strongly disagree to strongly agree.

	Strongly Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly Agree	Don't know
The threat of CWD has been exaggerated.	☐	☐	☐	☐	☐	☐
Effort should be taken to eliminate CWD from the country.	☐	☐	☐	☐	☐	☐
CWD should be contained to its current geographical area.	☐	☐	☐	☐	☐	☐
I think there is a potential for CWD to be transferred to humans	☐	☐	☐	☐	☐	☐
I, or my family, have concerns about eating elk and deer meat because of CWD.	☐	☐	☐	☐	☐	☐
I believe that eating elk and deer meat will cause CWD infections in humans.	☐	☐	☐	☐	☐	☐

52. Would you say that the following food issues are an important risk to human health in our society, are not a very important risk or no risk at all?

	Important	Not very	No risk	Don't know
Salmonella food poisoning	❐	❐	❐	❐
BSE (mad cow disease)	❐	❐	❐	❐
GM foods (genetically modified)	❐	❐	❐	❐
Products from livestock housed in large numbers, in cages or other restricted conditions	❐	❐	❐	❐

Pesticides	❒	❒	❒	❒
Listeriosis (Listeria) food poisoning	❒	❒	❒	❒
Unhealthy eating	❒	❒	❒	❒
Additives (like preservatives, colouring)	❒	❒	❒	❒
Food allergies	❒	❒	❒	❒
E. coli food poisoning	❒	❒	❒	❒
Unreasonable food prices	❒	❒	❒	❒
Animal diseases such as chronic wasting disease in wild and farmed deer and elk	❒	❒	❒	❒

53. **Provincial governments in CWD affected areas have conducted a variety of programs to address CWD in the wild. Please rate how acceptable the following provincial management programs would be to you on a scale from highly unacceptable to highly acceptable. (complete even if CWD has not been found in your province/region to date).**

	Highly Unacceptable	Somewhat Unacceptable	Neutral	Somewhat Acceptable	Highly Acceptable	Don't know
Culling (eradication) of elk herds in the areas where CWD is most concentrated.	☐	☐	☐	☐	☐	☐
Culling (eradication) of deer herds in the areas where CWD is most concentrated.	☐	☐	☐	☐	☐	☐
Mandatory submission of heads* for testing in certain Wildlife Management Units (regions of a province)	☐	☐	☐	☐	☐	☐
Voluntary submission of heads for the entire province.	☐	☐	☐	☐	☐	☐
Educational Materials placed on the webpage of Alberta Sustainable Resource Development or other similar provincial organization.	☐	☐	☐	☐	☐	☐
Open public meetings to discuss CWD issues.	☐	☐	☐	☐	☐	☐
Mailouts and advertisements in local newspapers.	☐	☐	☐	☐	☐	☐
Freezer locations for deer head submission*.	☐	☐	☐	☐	☐	☐
Providing additional hunting tags** for to hunters who submit the heads of their killed animals in certain Wildlife Management Units or provincial regions	☐	☐	☐	☐	☐	☐
Take no action towards controlling CWD and simply allow it to run its natural course	☐	☐	☐	☐	☐	☐

* The only effective method of testing for CWD is examination of brain or lymph tissue, requiring the submission of heads from killed animals to a government agency, Alberta Fish & Wildlife Division in Alberta for example, for testing. Similar tests are conducted in Yukon, Saskatchewan and Manitoba and occasionally in other provinces where there are concerns about the possibility of CWD.

** Hunters are required to obtain an appropriate tag to hunt an animal of a certain species within certain Wildlife Management Units (or regions of a particular province). In this example, a hunter would be issued a new tag if they submit the head for testing and therefore could hunt an additional animal.