University of Alberta

The Value of Pork Quality in the Eyes of Consumers with Different Beliefs about Traditionally Raised Pork in Edmonton and in Canada

by

Lifen Ma

A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Science
in
Agricultural and Resource Economics

Department of Resource Economics and Environmental Sociology

Fall 2012
Edmonton, Alberta

Abstract

In this research the value of pork chops with different quality attributes were examined for consumers in Edmonton (with real pork, stated purchase experiments) and across Canada (online survey). Value is examined through stated choice experiments with packaged pork chops labeled with production system (traditionally raised and conventional), as Canadian pork and/or as coming from a farm with Canadian Quality Assurance®. In Edmonton, hog carcass, meat and sensory quality of the pork chops used in the experiments were also investigated. In the national survey marbling was varied and is examined in terms of its influence on pork chop choice. Consumers are studied by groups based on their prior beliefs about traditionally raised pork in comparison to conventional pork. The results suggest that consumer prior beliefs affect consumer purchases of pork chops and play an important role in marketing differentiated pork. The certification of production system was found to be important. Public policy implications include the importance of production system verification by credible independent sources, in this case, usually the government.

Acknowledgement

This thesis would not have been possible without the support of many people.

First and foremost, I would like to express my deepest gratitude to my supervisor Dr. Ellen Goddard for her excellent guidance, support and patience throughout the thesis project and for providing me opportunities to lean and develop many useful skills.

Special thanks to Dr. Heather Bruce who is in my supervisory committee for her encouragement, suggestions and editing of the thesis and the other members in the project team, Jennifer Janz, Stephen Moore, Graham Plastow, Mindy Gerlat and Violet Muringai for their input.

I would like to thank my examination committee, Dr. Mohapatra and Dr. Luckert for their valuable inputs and comments.

I would like to thank my fellow students and the staff in the Department of Resource Economics and Environment Sociology for their help and support throughout my graduate study.

I would also like to acknowledge collaborators Sturgeon Valley Pork, Alberta Pork, Canadian Pork Council, Western Swine Testing Association, IdentiGEN and the research funder – Alberta Advanced Education and Technology.

I would like to express my gratitude to my beloved family for their understanding, emotional and financial support and endless love.

Table of Contents

List of Tables

List of Figures

CHAPTER 1 BACKGROUND

1.1 INTRODUCTION

The Canadian pork industry cyclically faces difficult economic times. The period 2008 to 2009 was a period when a combination of negative factors including a strong Canadian dollar, trade barriers, decreasing consumption, low market prices, and high feed prices (Canadian Pork Council, 2009) seriously reduced the viability of the industry. To improve the profitability and competitiveness of the industry, product differentiation has been considered as a strategy to meet the various and evolving consumer preferences, domestically.

Quality differentiation is a key form of product differentiation, as quality is one key factor to success in food markets (Becker, 2002). Food quality can be defined differently by participants in the value chain based on their own economic interests and goals (Becker, 2002). For the pork industry to achieve success in product differentiation, pork must be produced to meet the final consumers' definitions of quality. Understanding what quality means to Canadians then becomes very important to effectively increasing the value of Canadian hog and pork production.

1.2 AN OVERVIEW OF THE CANADIAN PORK INDUSTRY

The pork industry is a vital contributor to Canada's agricultural economy. Pork accounted for over 40% of the total meat production in Canada from 2006 to 2010 with annual farm cash receipts amounting to over three billion dollars (Table 1.1), representing 6.53% to 9.15% of total farm cash receipts in Canada (Statistics Canada 2011).

Canada is one of the largest pork exporters in the world with pork products exported to over 143 countries currently (Canada Pork International, 2012). Exports accounted for over 50% of the pork production in the years 2006 to 2009 and accounted for 61% in 2010 (Table 1.2). In the last few years, the strong Canadian dollar which lowered the overall competitiveness of the industry in foreign markets, a worldwide economic recession and the outbreak of the H1N1 (swine flu) virus, which impacted the global demand for pork products, have created hardships in the Canadian hog industry (Rude et al., 2010). Additionally, the implementation of Country-of-Origin Labelling (COOL) program in the United States, the largest destination for Canadian pork, has inhibited trade in hogs and pork between the two countries (Canadian Pork Council, 2009; Rude et al., 2010). Statistics Canada reported that live hog exports in 2010 amounted to 5.7 million head, down 9.4% from 2009. Figure 1.1 shows that Canadian live hog exports have continued declining since their peak in 2007, with exports in 2009 down 31.9% from 2008. Domestic consumption is another concern for the Canadian pork industry. Table 1.2 shows that the proportion of domestic consumption of pork produced in Canada has been decreasing. Domestic consumers have shifted their consumption from red meat (e.g. pork and beef) to white meat (e.g. poultry and fish) which might be due to human health concerns (Iacobucci et al, 2012). Figure 1.2 shows that per capita pork consumption has decreased gradually over the past decade while the per capita consumption of chicken, a white meat has increased steadily. Pork is currently the third ranked meat as compared to beef and chicken. All these factors have contributed to lower market prices. The Canadian pork industry has been challenged to develop strategies to capitalize on, not only, the international opportunities but also domestic opportunities in order to maintain or even increase the industry's overall competitiveness and profitability (Canadian Pork Council, 2009).

Table 1.1 Farm Cash Receipt in Canada

	2006	2007	2008	2009	2010
	$ thousands				
Total farm cash receipts	37,016,513	40,846,861	46,0939,17	44,599,139	44,473,335
Pigs	3,386,647	3,302,308	3,189,905	2,912,410	3,363,820

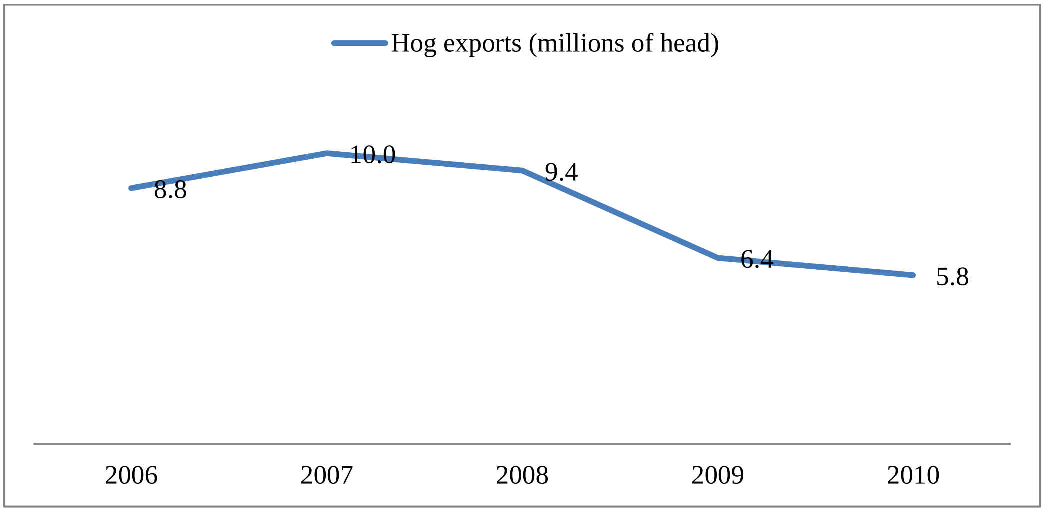
Source: Statistics Canada. CANSIM, table 002-0001 and Catalogue no. 21-011-X. (accessed: December 29, 2011).

Table 1.2 Pork Production and Consumption in Canada, 2006-2010

	2006	2007	2008	2009	2010
Production (tonnes x 1,000)	1899.66	1906.72	1947.83	1943.42	1925.93
Exports (tonnes x 1,000)	1093.83	1044.64	1147.59	1142.91	1179.58
Exports as a % of Production	58%	55%	59%	59%	61%
Import (tonnes x 1,000)	142.12	168.48	192.43	179.01	185.32
Domestic Disappearance (tonnes x 1,000)	763.56	825.77	789.15	787.7	739.81
% of Production Consumed in Canada	33%	34%	31%	31%	29%

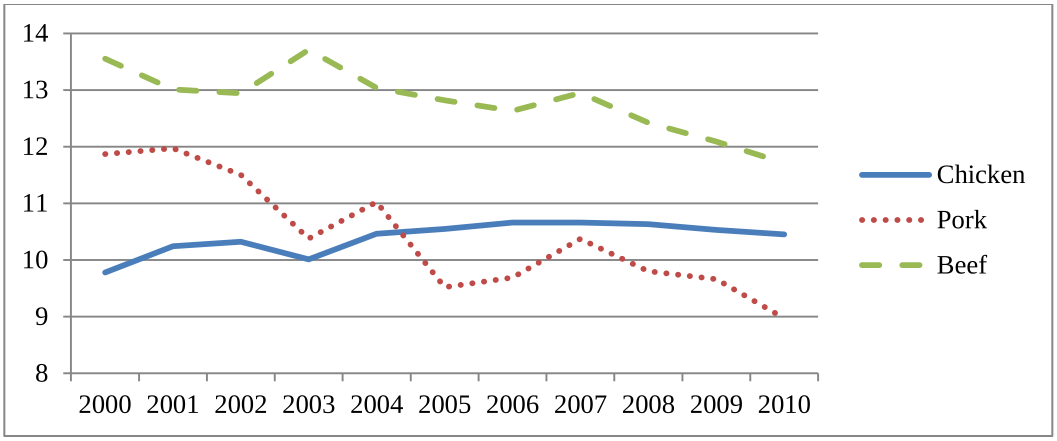
Source: Statistics Canada. CANSIM, table 002-0010 - Supply and disposition of food in Canada, annual (accessed: March 09, 2012).

Figure 1.1 Canadian Hog Exports, Annual, 2006-2010



Source: Statistics Canada. CANSIM, table 003-0088 - Hogs statistics, supply and disposition of hogs, quarterly (accessed: March 09, 2012).

Figure 1.2 Meat Available Adjusted for Losses (per Capita Consumption) in Canada (Kilograms per Person, Boneless Weight), Annual, 2000-2010



Source: Statistics Canada. CANSIM, table 002-0011 - Food available in Canada, annual (kilograms per person, per year unless otherwise noted) (accessed: March 09, 2012).

1.3 CONSUMER CONCERNS AND DEMANDS

The production of pork in 2010 was approximately two million tonnes which was almost twice as much as in 1990 (Statistics Canada, 2011). Although production and hog carcass lean yield have been successfully improved (Sather et al., 1998), the improvements may not have been enough for the industry to maintain and improve profitability in periods such as 2008-2009. Currently, participants in the pork supply chain are looking for opportunities to add value to their products (Canadian Pork Council, 2009).

To increasingly engage consumers with pork, a focus on consumer demand is necessary. Consumer perceptions, attitudes, and preferences are known to be keys to enhancing food product profitability (Yen, 2009; Xue et al., 2009; Sanders et al., 2007; Botonaki et al., 2006). Consumer tastes, preferences and attitudes can change rapidly due to changing incomes, food safety or health concerns and other factors in the social environment (Botonaki et al., 2006).

Obesity and the increasing incidence of many chronic diseases (e.g. cancer, cardiovascular disease and diabetes) that are linked to diet and lifestyle may be driving Canadian health concerns (Goddard et al. 2007; Agriculture and Agri-Food Canada, 2010). Kuperis et al. (1997) found that dietary fat and cholesterol were ranked as high health risks by 49.5% of Canadian respondents and were most frequently ranked as their most important concern. Unterschultz et al. (1996) also found fat trim of red meat (beef and pork) was one of the major concerns of Canadian consumers. Consumers are now becoming more interested in changing their diet through careful food choice to avoid potential health risks (Agriculture and Agri-Food Canada, 2010). Leaner pork has been observed to be strongly preferred by Canadian pork consumers from Quebec and Alberta (Ngapo et al., 2010). Outbreaks of food borne illness and animal-oriented disease such as BSE and H1N1 have resulted in increased consumer awareness and concerns about food safety and animal production (de Jonge et al., 2008; de Jonge et al., 2004; Nilsson et al., 2006; Hobbs et al., 2005). Heightened consumer concerns and awareness can lead to demands for improved quality, in terms of product, health, safety, and possibly even, production practices.

1.4 PRODUCTION PRACTICE

Production systems such as ‘organic’, ‘natural’, ‘free range’, ‘free of hormones’ and ‘free of antibiotics’ have been introduced as alternatives to conventional production in response to changing consumer preferences. Some researchers (Grannis and Thilmany, 2002; Harper and Makatouni, 2002; Nilsson et al., 2006; Yiridoe et al., 2007) suggest that these production practice preferences arise from concerns about food safety, animal welfare and environmental issues related to production practices. Organic food has been perceived as being produced naturally without pesticides or hormones, in an environmentally friendly manner, with animals that are not intensively raised, and is seen to be healthful and safe (Davies et al., 1995; Harper and Makatouni, 2002). Price premiums have been observed for naturally produced pork, pork produced without antibiotics, and pork certified as animal welfare friendly (Grannis and Thilmany 2002; Lusk et al., 2006; Nilsson et al., 2006; Ubilava et al. 2008). Naturally raised livestock is becoming a bigger feature of the livestock sector and is defined as being produced without growth stimulants, antibiotics, and without feeding animal by-products according to the claim published by the USDA in 2009 (http://www.gpo.gov/fdsys/granule/FR-2009-01-21/E9-1007/content-detail.html, accessed March 10, 2012).

In Canada, as the increasing use of claims such as “natural”, “fed no animal products and by-products”, “raised without using hormones”, “raised without using antibiotics” for meat, poultry and fish products (CFIA, 2011) has occurred, the Canadian Food Inspection Agency (CFIA) has developed guidelines on the use of natural, naturally raised, feed, antibiotic and hormone claims “to support Subsection 5.(1) of the Food and Drugs Act (FDA) and Section 7 of the Consumer Packaging and Labelling Act (CPLA) to promote clear and truthful labelling”(http://www.inspection.gc.ca/english/fssa/labeti/natall/instmpanie.shtml, accessed March 09, 2012). The use of “natural” and “naturally raised” claims on meat, poultry and fish products are restricted in Canada because ““natural” and “naturally raised” claims are considered acceptable only on products that were raised with minimal human intervention which is very difficult as none of the animals or fish raised in a farm are considered to be raised minimal human interventions” (http://www.inspection.gc.ca/english/fssa/labeti/natall/instmpanie.shtml, accessed March 09, 2012). More specific claims conveying information on the methods used to raise a particular animal regarding feed, the use of antibiotics or hormones (e.g. “grain fed”, “raised without the use of antibiotics” or “raised without the use of hormones”) can be made following the criteria in the guidelines (CFIA, 2011, http://www.inspection.gc.ca/english/fssa/labeti/natall/instmpanie.shtml, accessed March 09, 2012).

Meat products (e.g. pork, beef and chicken) claimed as “traditionally raised” now can be found in some food markets (e.g. The Garden Basket, Markham, ON and Metro Glebe, ON) or local farms. Those traditionally raised meat products are claimed to be from small family farms raised under a low stress environment without antibiotics or growth hormones and without animal by-products or additives in feed (http://www.beefconnections.ca/; . http://www.thegardenbasket.ca/departments/organic-beef-chicken-markham/; http://www.nicholyn.com/; http://www.traditionallyraised.ca/, accessed March 10, 2012). Traditionally raised products, specific to pork are labelled in various ways, for example, traditionally raised pork sold in Metro Glebe (ON) are labelled as "traditionally raised" while in the Garden Basket (Markham, ON) are labelled as "hormone and antibiotic free". Currently, pork labelled as traditionally raised is not easily found across markets in Canada; therefore, identifying how consumers think about "traditionally raised pork" and whether "traditionally raised" adds value to pork production may be important for the production and marketing of this type of pork.

1.5 QUALITY ASSURANCE

The growing consumer demand for food quality and safety, together with increased legal liability for food processors and retailers, is one driver of the demand for quality assurance in farm production (Unnevehr et al., 1999). The CQA® program which is an on-farm program based on the internationally recognized HACCP (Hazard Prevention Critical Control Point) principles was officially launched in 1998 by the Canadian Pork Council in order to provide a mechanism for producers to implement sound production practices to minimize or eliminate potential hazards which could affect the safety of pork (Canadian Pork Council, 2012). "Producers on the program must keep accurate on-farm records and protocols, and have these reviewed by a program validator once a year, the farm can become CQA® -recognized once it has met all the program standards" (http://www.cqa-aqc.ca/about-e.php, accessed March 06, 2012).

“The CQA program, to processors, is a guarantee that animals have been produced under stringent standards; to consumers, it means the pork products they choose are safe and wholesome” (http://manitobapork.com/canadian_quality_assurance.aspx, accessed March 06, 2012). According to Unnevehr et al. (1999, p. 1096), “ensuring quality should be achieved in the most cost efficient manner”. Quality assurance provides a market advantage by creating a “new” attribute for consumer purchase decisions (Walley et al., 1999). However, at present, Canadian consumers cannot observe this on farm food safety attribute at the point of purchase. The value of quality assurance in the eyes of consumers is therefore not clear, but the fact that it involves added costs for producers operating the program (Unnevehr et al., 1999; Walley et al., 1999) is clear. The industry is thus challenged to maintain this significant degree of additional record keeping and to improve food safety further in an efficient manner, if producers do not see additional economic gains.

1.6 COUNTRY OF ORIGIN

In addition to the U.S. restrictions on hogs and pork trade through COOL (Canadian Pork Council, 2009), increasing imports of pork to Canada from 2006 to 2010 (Table 1.2) have reduced the domestic market share of Canadian produced pork, making it important to increase the Canadian pork market share against imported pork and other substitutes (Canadian Pork Council, 2009).

Consumers have been found to prefer domestically produced products to imported products (Aubeeluck, 2010; Dransfield et al., 2005; Pouta et al., 2010; Unterschultz et al., 1996). Country of origin becomes more important as a product attribute after food safety incidents occur (e.g. BSE) (Ehmke, 2006). It has been found to be an important quality indicator, specifically, in terms of food safety and eating quality (Becker, 2000; Hoffmann, 2000). However, country of origin is also recognized to be a credence attribute that consumers cannot verify (Ehmke 2006; Becker 2000). Lack of information on country of origin can cause information asymmetries between consumers and the pork industry which can contribute to market failures (Ehmke, 2006).

In June 2008, the “Canadian Pork” label was introduced to offer Canadian consumers an opportunity to identify and choose Canadian pork (Kruse 2008, http://putporkonyourfork.com/media/pdf/News/PMC_NewsRelease_ON_FINAL.pdf, accessed April 23, 2012). It was reported that by January 2009, the label had been used by Safeway in Saskatchewan and Manitoba, Save-On-Food in Alberta and British Columbia, Loblaws Superstore in Western Canada, Sunterra in Alberta, Walmart Supercentres in Western Canada, Sobeys in Western Canada and in Ontario, and Sam’s Club in Ontario (Ontario Pork, 2009, http://www.thepigsite.com/downloads/download/190/, accessed November 3, 2011). Identifying whether this new label could boost sales of, or add value to Canadian pork is important, because the implementation of the campaign was aimed at supporting Canadian pork producers (Kruse, 2008).

1.7 DEFINITION OF VALUE-ADDING

Value-adding is an important and widely applied strategy in today’s agriculture and food industry under growing market competition and ever-changing consumer demands. It is a broad concept with various definitions (Zhang, 2010). Generally, value-adding can be described as strategies or activities to add value to a product, a hog in this study, by adding “new”, superior, or unique attributes that can motivate a consumer’s willingness to pay, such as branding, differentiated production practices (e.g. organically production practice), certification, and labelling of credence attributes (e.g. food safety, country of origin, production practice), etc. (USDA, Rural Development, 2011; Abrams et al., 2009; Martinez et al., 2007; Fairbairn and Gustafson, 2004). The Canadian pork industry is examining opportunities to add value to their products in order to increase or even to maximize returns. Consumers are increasingly interested in production practice, quality assurance and country of origin as discussed in the previous sections. It is worthwhile identifying whether traditionally raised, CQA® and Canada as the country of origin, and changing the nature of production when presented to consumers by labelling and certification add value to pork or not.

1.8 ECONOMIC PROBLEMS

The hog industry has faced a serious downturn during 2005 to 2009 with hog prices decreasing over time. Alternative production practices- "traditionally raised", the Canadian Quality Assurance (CQA®) program and the "Canadian Pork" label have been introduced to attempt to convey a higher quality pork message that could address consumers' increasing awareness of quality issues (e.g. choice of healthy food, animal welfare issues and food safety) surrounding food. Can the industry generate additional consumer interest by providing high quality and/or labelling credence attributes associated with production practice, with country of origin, and with on farm food safety? To ascertain whether this is possible, there are three areas that need to be considered if the industry wants to maximize consumer utility.

First, preferences for different types of pork quality in the eyes of consumers can impact consumer preferences.

Production practices have been found to influence quality attributes for either hog carcasses or pork muscles that might ultimately affect the quality of the end-point products (appearance attributes and sensory quality) sold to consumers (Becker, 2002). Technical measures of quality attributes are good indicators for producers and processors about the final quality attributes (appearance and sensory quality attributes). However, technical quality alone does not tell the whole story about the value of pork quality. It is important to identify the final consumers' attitudes, preferences, and values that are placed on the quality of the end-point products. The most important way for producers to maximize profit is to maximize consumer utility from pork purchases. Technical quality and consumer value should both be linked to hog grade and payment if pork producers are to receive efficient price signals. A combination of technical, sensory quality and consumer production preferences can enhance information flows, potentially increasing hog value.

Secondly, issues associated with information asymmetry in the supply chain need to be addressed.

Consumers make purchase decisions based on their evaluations of product attributes. Search quality attributes such as colour and marbling of the pork can be observed by consumers before purchase, experience quality attributes such as sensory quality can be observed after consumers have consumed the pork and may influence consumers' repeat purchases (Nelson, 1974). However, credence attributes, such as production practice, country of origin, health, and food safety programs in which consumers are becoming more interested, cannot be verified even after consumers purchase or/and consume the pork. Information asymmetry problems may increase consumers' uncertainty about their purchases of food products. The alternative "traditionally raised" production practice and the Canadian Quality Assurance (CQA®) program can only successfully add value to the pork if these new and/or advanced attributes are communicated to consumers (Grebitus, 2008).Labelling and certification could be effective signals to overcome asymmetry problems if consumers trust them. Meuwissen et al. (2003) defined certification as "a very broadly used term that involves assessment and approval by a (accredited) party on a (accredited) standard (p.172)". The effectiveness of certification schemes depends on consumer awareness and knowledge of the certification, consumer attitudes toward the certified attribute, and consumer trust in the certification and the certifying party (Meuwissen et al., 2003; Botonaki et al., 2006; Romanowska, 2009). Romanowska (2009) found that respondents had preferences for certification over no certification; quality certification increased the value of the certified attributes but the amount of increased value varied depending on the type of attribute. She also found that government was the preferred certifier for egg production practices as compared to industry and farmer. Because consumers have different degrees of faith in different certifying bodies as well as certification processes, whether it is industry, government or third party certification could also influence consumers' purchase decisions. Hobbs (2003) observed participants in their consumer panels had relatively high levels of trust in a federal government agency associated with assurance about production methods. U.S. consumers were observed to have more confidence in USDA certification of enhanced pork safety than in industry certification (Miller and Unnevehr, 2001). In the case of pork production, government and 3rd party certifiers, who would be the more trusted certifier?

Thirdly, the feasibility of the strategies relative to profit maximization needs to be assessed.

The ultimate aim of the various strategies conducted by industry is to maximize profit. Whether potential returns outweigh additional costs affects the value of new programs and initiatives. Introducing alternative production practices, implementing on-farm food safety programs, CQA®, involve additional costs. In addition, "the communication of information via labelling and certification schemes is a cost borne by producers and shared by consumers that can ensure a more efficient market as it allows consumers to effectively value the attributes of a product and make decisions reflecting their preferences" (Romanowska, 2009, p.2). Grannis and Thilmany (2002) estimated consumers' willingness to pay for natural pork which was defined as "meat produced from animals raised using environmentally sound practices with no antibiotics or hormones, and never confined to small or crowded pens" (p.476) and they identified consumers who would purchase natural pork in the United States. A substantial market segment was observed to be willing to pay a twenty-percent premium for natural pork. Consumers who gave the highest scores for the attribute importance of non- use of antibiotics and non-use of hormones were willing to pay higher price premiums for natural pork products than others.

Evaluation of the values of overall quality (hog carcass, meat quality, and sensory quality) of traditionally raised and conventional pork, of the certification of production practices, of the CQA® and “Canadian Pork” labels is essential for producers to decide whether or not these initiatives are valuable, to better understand consumers’ preferences and demands, and to better position their products in the market to achieve profit maximization.

1.9 OBJECTIVES

The aim of this study was

1. To evaluate pork quality across the supply chain for traditionally raised and conventional pork;
2. To establish consistency of value as measured across hog grading, meat quality, consumer sensory evaluation and purchase decisions;
3. To estimate the impact of consumer demographic characteristics and attitudes on their pork purchase decisions for pork chops produced and labelled with different production practices, certification, CQA® and Canadian pork labels (for Edmonton and national population samples).

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, literature related to the objectives of this thesis is reviewed. In the chapter a review of quality definitions and measurement methods (first part of the chapter) for addressing the objective of evaluating pork quality and establishing consistency of value across different quality measures at different stages in the pork marketing chain is proceeded. In the quality section, the definition of quality and a review of some important product-oriented quality characteristics of pork are included. This will clarify what the quality characteristics are, what factors contribute to their variation, and what methods and models have been used to measure them. To establish consistency of value, measuring the impact of different variables on the consumer purchase decision is critical information in the hog industry; therefore, consumer theory, stated preference methods, and econometric choice models are reviewed following the review of quality.

2.2 REVIEW OF QUALITY

To evaluate pork quality across the supply chain, it is important to understand what quality is and what characteristics/ attributes quality covers. Food quality is a complex concept with no unique definition, even though many attempts have been made to define it (Bernues et al., 2003; Brunsø et al., 2005). It has different definitions and covers different attributes in the eyes of different people at different stages of the value chain, depending on their economic interests and goals (Becker, 2002; Sundrum, 2007).

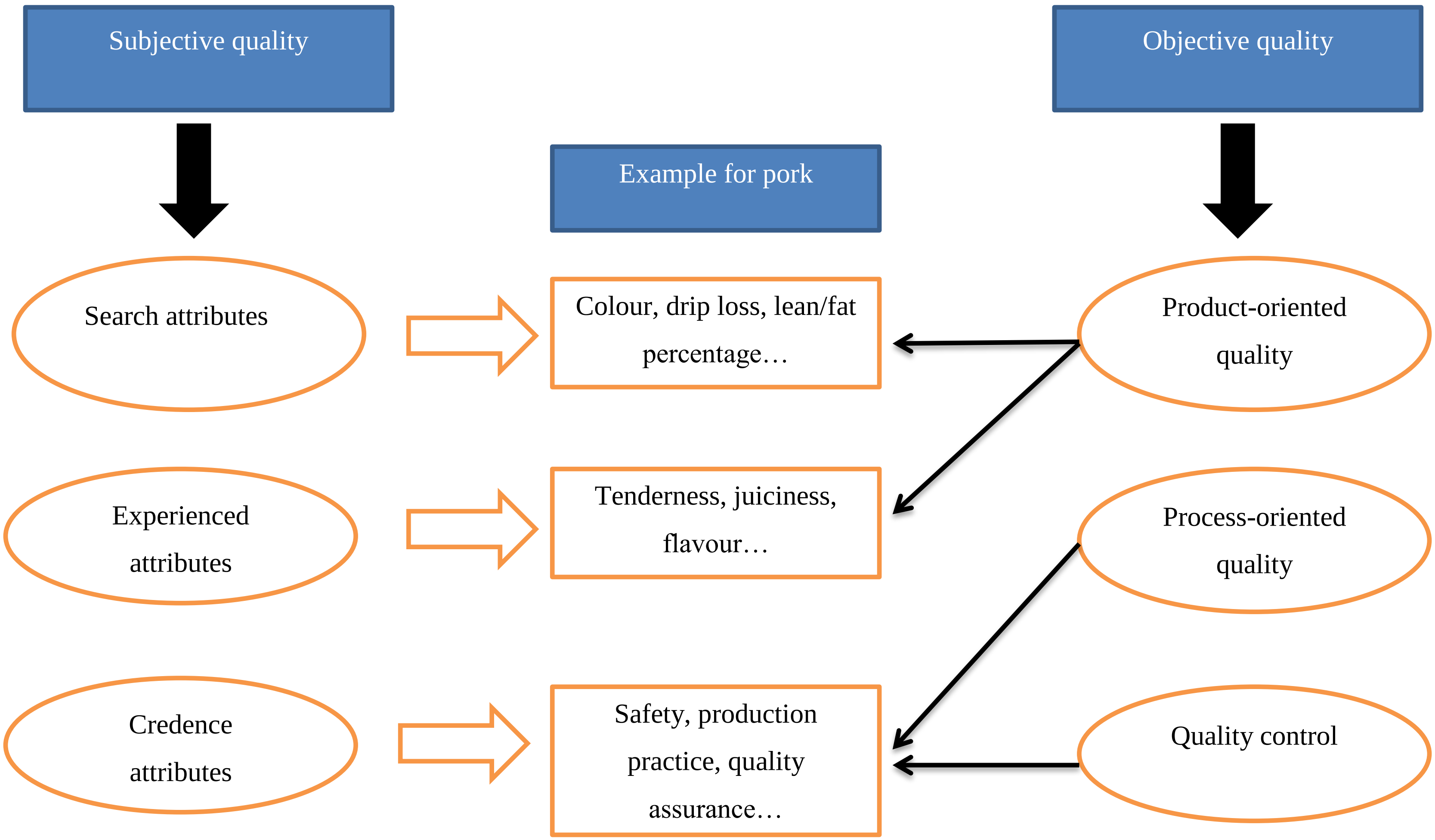
Although the term food quality is hard to define, there is a general agreement that quality includes both an objective and a subjective dimension (Grunert, 2005). Grunert (2005) defined objective quality as “the physical characteristics built into the product which are typically dealt with by engineers and food technologists" (p. 371) and subjective quality as "the quality as perceived by consumers" (p. 371). Objective quality includes product-oriented quality and covers all the physical characteristics of the product such as lean/fat percentage, colour, and pH value in the case of meat, while process-oriented quality refers to the way a product is produced which does not necessarily have any effect on physical properties of the product, including production practices without use of hormone or antibiotics. Quality control refers to standards to maintain the product-oriented quality at pre-specified levels, and it can be measured technically on the product itself or ascertained by documenting aspects of the production process objectively (Brunsø et al., 2005; Grebitus, 2008; Grunert, 1995). Subjective quality is consumer-oriented quality based on the perceptions of the individual consumer (Brunsø et al., 2005; Grebitus, 2008; Grunert, 1995).

Becker (2002) made a distinction between objective quality and subjectively perceived quality by using "*quality attributes* to denote those quality features of the product perceived as important by the consumer" (p.8) and "*quality characteristics* to denote those quality features which are scientifically measurable"(p.8).

In the economics of information approach, quality is separated into search, experience, and credence quality attributes according to the level of information available to consumers (Grebitus, 2008). Search and experience quality attributes (quality attributes can be assessed by consumers before and after purchase, respectively) were first introduced by Nelson (1974; 1970) and credence quality attributes (quality attributes cannot be identified by consumers either before or after purchase) were introduced by Darby and Karni in 1973 for the investigation of markets with information asymmetries between sellers and buyers. On the basis of the quality categories introduced by Nelson (1974; 1970) and Darby and Karni, (1973), Verbeke et al. (2005) categorized quality into intrinsic and extrinsic quality such that "intrinsic attributes are inextricably bound up with the core product including both “search” and “experience” attributes, while extrinsic attributes are related to the product without being a part of it (p.343)”.

Adapted from the graph of Ubilava (2006), Figure 2.1 provides a simple summary of the classifications of quality discussed above and shows the links between them.

Figure 2.1 Subjective and Objective Classification of Product Quality



Source: Ubilava (2006, p.18)

With respect to pork which is evaluated in this study, on the basis of subjective classification, product attributes can be divided into search attributes (meat quality) which can be observed by consumers before purchase, such as colour, drip loss, marbling and fat, experience attributes which only can be observed after consumers have consumed the pork, such as sensory quality (e.g. tenderness, juiciness, flavour) and credence attributes which cannot be verified even after the purchase or consumption, for example, country of origin, an on-farm food safety program and country of origin (Brunsø et al., 2005; Grebitus, 2008; Grunert, 1995). On the basis of objective classification, product attributes can be divided into product-oriented quality which covers all the physical characteristics of the products (carcass, meat and sensory quality), process-oriented quality (production practice) and quality control (quality assurance, on-farm safety program) (Brunsø et al., 2005; Grebitus, 2008; Grunert, 1995). On the basis of Figure 2.1, appearance meat quality attributes, product-oriented quality from the objective dimension, are search quality attributes which can be evaluated by consumers at the point of purchase and sensory quality is quality after eating the pork from the subjective dimension.

Product-oriented quality attributes of pork are reviewed in the following two subsections where 2.2.1 is about important pork quality characteristics in the supply chain including hog grading and technical meat quality and 2.2.2 is about the assessment of sensory quality attributes which are experience quality attributes from the consumer-oriented quality perspective.

2.2.1 PORK QUALITY IN THE SUPPLY CHAIN

2.2.1.1 Carcass Quality-Hog Grading

The quality and commercial value of hog carcasses are determined by hog carcass grading systems in many countries (Pomar et al., 2009). The grading systems are usually linked to payment systems to producers which are the bridges between producers and processors (Pomar et al., 2009). Both producers and processors have “the common objective of profit maximization” (Pomar et al., 2009, p. 496). In western Canada each processor has a hog carcass grading grid which is used to determine bonuses and discounts for a hog carcass, received by producers (Western Hog Exchange 2012). Hog producers try to produce high value hog carcasses that maximize their revenue by choosing optimal genetics, feeds and management practice while processors attempt to maximize their economic returns by establishing the grading systems which promote the production of carcasses with pork that meets their consumer demand (Pomar et al., 2009).

In Canada, plants establish the highest grade indexes within the grid where the best carcass value and pig meat yield are identified (Western Hog Exchange, 2012). “The intersection of two pork value factors, dressed Carcass Weight and Estimated Percent Lean Yield, within the grid establishes the grade index for a pork carcass” (Western Hog Exchange, https://www.westernhogexchange.com/gradingGrids.aspx?menu=218, accessed on January 10th, 2012). Table 2.1 is a grading grid for Sturgeon Valley Pork accessed on March 2011 from the Western Hog Exchange website. Based on this grid, carcasses with estimated lean yield percentage between 60.7 and 100 and dressed carcass weight between 90 kg and 99.9 kg receive the highest grade index of 116, which means these carcasses will receive 16% more than the average hog price at the time of sale. Producer settlement for a relative carcass value on the basis of the index can be calculated as: “Carcass value ($) =Average carcass weight (kg) × grade index (e.g. grading index of 116 is taken as 1.16) × average market price ($/kg)” (Vervaet, 2004, p. 110). Estimated percent lean yield and dressed carcass weight are measured objectively on the slaughter line. Percent lean yield is estimated by a mathematical equation which is based on extensive carcass cutouts (Western Hog Exchange, https://www.westernhogexchange.com/gradingGrids.aspx?menu=218, accessed on January 10th, 2012). The equation is formed by fat thickness and lean depth which can be measured by the Destron Electronic Probe at a point 7cm lateral to the center of the spine between the 3rd and 4th last ribs on the left side of the carcass (Western Hog Exchange, https://www.westernhogexchange.com/gradingGrids.aspx?menu=218, accessed on January 10th, 2012).

The lean yield is an important criterion for pork quality as consumers increasingly demand leaner pork because of increasing health concerns (Marcoux et al., 2003). The percentage lean yield was taken as an important determinant of the commercial value of a hog carcass under the hog grading system in Canada according to Fortin et al. (1984, p.142) while Marcoux et al. (2007) found that carcass value has only a weak correlation with various definitions of lean yield including the estimated lean yield implying that the value of some lean carcasses might be overestimated while the value of some fatter carcasses might be underestimated by taking lean yield as a criterion in evaluating carcass value. Whether the estimated lean yield is a primary determinant of quality in the hog grading systems and, if is, whether is the value of a hog carcass based on grading provides the same value to a hog producer and processor as it does to a consumer remain to be considered.

Carcass quality is not only an indicator of the value of the carcass, but is also related to the value of the end-point products because carcass quality attributes such as carcass weight and backfat thickness have been observed to be correlated to meat and sensory quality (Blanchard et al., 2000; Huff-Lonergan et al., 2002). How carcass quality relates to meat eating quality will be explored and discussed in the following sections.

Table 2.1 Western Hog Exchange – Grading Grids

Sturgeon Valley Pork Premium												
Yield Class Number	Estimated Lean Yield Percentage	0-69.9 kg	70-74.9 kg	75-79.9 kg	80-84.9 kg	85-89.9 kg	90-94.9 kg	95-99.9 kg	100-104.9 kg	105-109.9 kg	110-114.9 kg	115-999 kg
1	64.29-100	10	50	75	95	114	116	116	113	107	100	50
2	63-64.29	10	50	75	95	112	116	116	113	107	100	50
3	61.8-62.99	10	50	75	95	111	116	116	113	107	100	50
4	60.7-61.79	10	50	75	95	109	116	116	113	107	100	50
5	59.6-60.69	10	50	75	95	106	114	114	111	106	100	50
6	58.6-59.59	10	50	75	95	104	110	110	107	106	95	50
7	57.7-58.59	10	50	75	95	100	107	107	104	101	90	50
8	56.9-57.69	10	50	60	85	90	103	103	95	90	80	50
9	56.1-56.89	10	50	60	70	90	95	95	90	80	70	50
10	0-56.09	10	50	60	60	70	70	70	70	60	60	50

Source: Western hog exchange (https://www.westernhogexchange.com/gradingGrids.aspx?menu=218, accessed on March 05, 2011)

2.2.1.2 Meat Quality

"Meat quality is a combination of traits which can be objectively and/or subjectively measured that vary across markets" (Gunenc 2007, p.13). Table 2.2 shows that so far, the most commonly measured traits used in estimating pork quality are pH, drip loss, cooking loss, color, shear force and marbling (intramuscular fat).

Table 2.2 Meat Quality Traits Investigated in Previous Studies

	pH	Water holding capacity	Cooking loss	Color	Shear force	Marbling (intramuscular fat)	Others
Aaslyng et al. (2007)	√			L*, a*, b*		√	Water content, the composition of fatty acids in the phospholipids and the triglycerides
Aaslyng et al. (2003)	Ultimate	Drip loss	√			√	Water content, internal reflection, protein content, thawing loss
Brewer et al. (2001)						√	
Brewer and McKeith (1999)				L*, a*, b*			
O'Mahony et al. (1991)						√	
Bryhni et al. (2003)	1 min, 45 min and 24 h (ultimate)	Drip loss		L*, a*, b*			
Moeller et al. (2010)	ultimate	Loin purge loss		L*, a*, b*	Warner-Bratzler shear (WBS) force	√	

Purslow et al. (2008)	√	Drip loss	√	L*, a*, b*	WBS force	√	firmness
Casteels et al. (1995)	45 min and ultimate	Water holding capacity		L*, a*, b*		√	Fiber Optic Probe (a measure of the light scattering in meat), Pork Quality Meter (defines the conductivity of the meat)
DeVol et al. (1988)	4h and 48 h (final)		√	color	WBS force	√	firmness
Fernandez et al. (1999)						√	
Huff-Lonergan et al. (2002)	48 h	Drip loss	√	Subjective color	Star Probe penetration force	√	firmness
Norman et al. (2003)	√			L*, a*, b*, chroma, hue angle	WBS force		
Otto et al. (2004)	45min, 24, 48 and 72 h	Drip loss		L*, a*, b*			
Fjelkner-Modig & Persson (1986)	ultimate		√	EEL-color value		√	
Jonsäll, Johansson, &			√				

Lundström (2001)							
Blanchard et al. (2000)					WBS force	√	

pH

Intramuscular pH is a result of the accumulation of hydrogen ions resulting from the conversion of muscle glycogen into lactic acid during post-mortem anaerobic glycolysis (Huapaya, 1997; Miller, 2002) and "is most commonly measured in fresh meat because it affects technological ability, and most sensory traits (Gunenc, 2007, p. 19)". Based on Miller (2002), pH in pork is affected by genetics, breeds, stress pre-slaughter and the type of stunning method used during the slaughter process. Animals carrying the halothane gene have pale, soft and exudative (PSE) meat because of the rapid pH decline post-mortem characteristic of halothane gene. Another gene that results in low ultimate pH is the Rendement Napole (RN-) gene. Animals with the RN- gene have higher amounts of muscle glycogen than pigs without the RN^- gene, which is converted to increased levels of hydrogen ions post-mortem and results in a lower ultimate muscle pH. Pigs that suffer short-term pre-slaughter stress also have meat with pH values lower than normal that is pale, soft and exudative (PSE) and have cooked meat which is drier, tougher and not as flavourful as pork with a normal pH value (5.5 to 5.7). The effect of stunning on pH is also due to the induction of short-term stress. Contrary to the effect of short-term stress, long-term pre-slaughter stress results in a rate of pH decline post-mortem lower than normal and an ultimate pH which is higher than normal. Intramuscular pH has also been found to be different in meat from different production systems, for example, Millet et al. (2004) found that organic housed hogs had meat with a lower mean muscle pH than conventional housed hogs and Enfält et al. (1997) found the ultimate pH was significantly lower in outdoor reared pork than in indoor reared pork. Based on the previous studies (Casteels et al., 1995; DeVol et al., 1988; Enfält et al., 1997; Fernandez et al., 1999a; Fjelkner-Modig and Persson, 1986; Gunenc, 2007; Hansen et al., 2006; Millet et al., 2004; Olsson et al., 2003; Pugliese et al., 2005; van der Wal et al., 1997), pH is usually measured at 45 minutes, 1 hour (initial pH) or 24 and 48 hours (ultimate pH) post-mortem electronically using a pH meter with a glass electrode, a Xerolyte electrode or a Radiometer combination electrode.

Miller (2002) suggested that "ultimate pH should be considered an important quality variable as it accounts for short-term pre-slaughter stress effects and the subsequent visual and eating quality of meat (p.53)". The optimum range of ultimate pH measured at 24 hours post-mortem in the guidelines for certified pork provided by the Central Marketing Agency for Agriculture Products (CMA) in Germany was between 5.4 and 5.8 (Honikel, 1993; Huapaya, 1997) while Gunenc (2007) referred to a normal ultimate pH as being between 5.6 and 5.8, levels for the best quality pork (RFN-Reddish pink, Firm and Non-exudative). A rapid decline rate for pH (5.6 to 5.5) is considered to be an indication of PSE (Pale, Soft and Exudative) meat and meat with a pH lower than 5.4 has low water-holding capacity and results in very light colour as compared to one with high pH (Gunenc, 2007). Aaslyng et al. (2007) observed that "meat with lower pH has higher L* value (lighter colour) and higher pH has lower L* value (darker colour) (p.65)" and the ultimate pH was found to be positively correlated with tenderness ($r= 0.49$, $p < 0.05$) and overall acceptability ($r=0.53$, $p < 0.001$) of cooked pork by Enfält et al., (1997). In conclusion, pork with a high pH value has a high probability of having high water-holding capacity, reduced drip loss and of being tender and juicy.

Water-Holding Capacity and Drip Loss

Water holding capacity (WHC) of meat is often measured as drip loss and is defined as "the ability of the post-mortem muscle to retain water even though external pressure is applied to it" (Gunenc, 2007, p. 17). It is an important pork quality trait that affects consumers' evaluation of appearance and sensory quality of pork (Gunenc, 2007; Huapaya, 1997; Trienekens, 2010). Poor water holding capacity means high drip loss which results in an unattractive appearance (Gunenc, 2007) and most consumers have been observed to prefer a pork chop without drip loss (Ngapo et al., 2010; Ngapo et al., 2007; Ngapo et al., 2004; Chen et al., 2010;

Verbeke et al., 2005). Poor water holding capacity can also result in poor eating quality for pork because juiciness and drip loss have been observed to be negatively correlated ($r = -0.31$, $p = 0.06$) (Enfält et al., 1997).

Factors affecting drip loss (WHC) of pork include genotype, sex, live animal handling (e.g. nutrition, production system, rearing system), season, slaughter date/weight, mode of stunning, rate of pH decline and ultimate or 24h post-mortem pH, storage time, storage conditions, and physical disruption of the product (i.e. size of cuts) (Casteels et al., 1995; Gunenc, 2007; Hansen et al., 2006; Millet et al., 2004; Olsson et al., 2003; Pugliese et al., 2005; Trienekens, 2010). Drip loss differences between product systems have been found vary, for example, Nilzén et al. (2001) and Enfält et al. (1997) found that free-range and outdoor reared hogs had meat with higher drip loss than indoor reared hogs while Pugliese et al. (2005) found indoor reared hogs had meat with higher drip loss than outdoor reared hogs.

Cooking Loss

Cooking loss was described as "a combination of liquid and soluble matter lost from the meat during cooking" by Aaslyng et al. (2003, p. 285), and it is usually measured by weighing raw and cooked meat and calculating the differences between the weights (Palka and Daun, 1999; Bejerholm and Aaslyng, 2004). Cooking loss can be affected by cooking method, genotype and production system (Bejerholm and Aaslyng, 2004; Bertram et al., 2003; Olsson et al., 2003). Olsson et al. (2003) found pork from organically raised hogs had lower cooking loss than conventional pork while Enfält et al. (1997) found that production system did not affect cooking loss. With respect to the correlation between cooking loss and raw meat quality indicators such as pH and water holding capacity, previous findings are inconsistent. Bertram et al. (2003) found that pH and the water holding capacity measured as drip loss had no significant correlation with cooking loss in their study. High cooking loss was observed in the pork with low water holding capacity and low pH by Aaslyng et al. (2003)

while cooking loss was not different between pork having medium or high water holding capacity and pH. A higher cooking loss in meat could be expected to result in lower sensory quality as negative correlations have been found between cooking loss and sensory quality such as juiciness (DeVol et al., 1988; Hodgson et al., 1991).

Colour

"Meat color, the major visual factor affecting meat quality, is imbedded within the muscle fibre component as meat color is a result of pigment-containing proteins that can either absorb or reflect light (Miller, 2002, p.35)". Differences in meat colour are associated with pre-slaughter factors, such as genotype, breed, rearing/housing system, feeding/nutrition, season, slaughter weight, slaughter age, and carcass chilling conditions early post-mortem (Miller, 2002). A pork chop with a pH which is lower than 5.4 appears much lighter than the one with a pH higher than 5.4 (Gunenc, 2007).

Meat colour can be measured subjectively by using a standard colour scale (e.g. The Agriculture Standard and The Japanese Colour Standard) or measured objectively following an instrumental method (e.g. EEL reflectance spectrophotometer method, Hennessy Grading Probe, CIELAB colour space method (L*, a*, b*) (Huapaya, 1997). The L* a* b* color system which "represents human sensitivity to color most closely (Huapaya, 1997, p. 14)" is "an international standard for color measurement (Gunenc, 2007, p. 26)". "L* represents the lightness of the meat where 0=black and 100=white, a* and b* are chromaticity coordinates such that the a* axis represents the amount of red (+) or green (-) and the b* axis represents the amount of yellow (+) or blue (-)" (Huapaya, 1997, pp. 14–15). These three color measurements have been found to be significantly different in pork from different production systems, for example, Pugliese et al. (2005) found that outdoor reared hogs had meat with lower L* (darker), higher a* (redder) and higher b* (more yellow) as compared to indoor reared hogs while some researchers found no differences between production systems in terms of these color measurements, such as van der Wal et al. (1993) who compared free ranged hogs to regularly fattened hogs and Olsson et al. (2003) who compared organically raised pork to conventional pork.

Shear Force

Because the evaluation of meat tenderness by sensory panel is expensive, time-consuming and very laborious, shear force was developed as a mechanical measure of tenderness which can be measured by the Warner-Bratzler shear force (WBSF) method or the slice shear force (SSF) method (Van Oeckel et al., 1999; O'Diam, 2009). O'Diam (2009) found WBSF to be a more robust method of objective tenderness measurement for pork as compared to SSF. A pork chop with higher shear force value can be expected to be less tender based on the observed negative correlation between shear force measures and tenderness scores in previous studies (Enfält et al., 1997; Huff-Lonergan et al., 2002; Olsson et al., 2003).

Factors contributing to variation in shear force can be categorized as factors related to testing method (e.g. core orientation, cooking method and shearing methodology) and factors related to animal and handling pre-slaughter and post-mortem (e.g. breed, production practice, sex, slaughter day, post-mortem storage) (Van Oeckel et al., 1999; Apple et al., 1999; O'Diam, 2009; van der Wal et al., 1993; Enfält et al., 1997; Miller, 2002; Pugliese et al., 2005). van der Wal et al. (1993) compared free range pork to regularly fattened pork and found that shear force was higher in free range pork than in regularly fattened pork. Similar results were found by Enfält et al. (1997) and Pugliese et al. (2005) who compared outdoor reared pork to indoor reared pork and found that shear force was higher in outdoor reared pork than indoor reared pork.

Marbling

Marbling (intramuscular fat) the major components of which are triglyceride and phospholipid constituents, is "the visible fat in the muscle"

(Huapaya, 1997, p. 7; Wood, 1990). "Marbling can be measured objectively (visually or electronically) through computer assisted scanning or by laboratory analysis and it also can be evaluated subjectively by comparing the marbling of meat with a standard marbling scale" (Huapaya, 1997, p. 8).

A small amount of marbling (e.g. a level of intramuscular fat between 1.5% and 3.5%) is necessary to ensure favourable sensory quality of cooked pork in terms of juiciness, flavour and tenderness (Fortin et al. 2005; Fernandez et al., 1999; Huapaya 1997). Breed, shire, genotype, feeding, rearing, production system, sex, slaughter date, carcass weight and fatness have been found to contribute to the variation in marbling or intramuscular fat content (Casteels et al., 1995; Fjelkner-Modig and Persson, 1986; Hansen et al., 2006; Millet et al., 2004; Olsson et al., 2003; Pugliese et al., 2005). Organically produced pigs were found to have meat with lower intramuscular fat than conventional pigs by Olsson et al. (2003) while outdoor reared pigs were found to have a higher percentage of intramuscular fat in meat than indoor reared pigs by Pugliese et al. (2005). Wood (1990) suggested that an increase in carcass weight and fatness can result in a higher level of marbling.

Meat quality covers many characteristics, Huapaya (1997) pointed out that in marketing, appearance and technological qualities are the most important aspects of meat quality and Table 2.2 shows that meat colour (e.g. L*, a* and b*), marbling (amount of intramuscular fat), water holding capacity (drip loss from raw meat and loss from cooking), pH and shear force (the objective measurement of tenderness) are the most commonly measures in estimating meat quality. There is no single definition for the best quality meat because preferences vary across markets and countries (Gunenc, 2007; PIC, 2003), for example, Ngapo et al., (2007a) found that consumers in Ireland and Australia preferred pork with light red colour and no marbling while consumers in Taiwan preferred pork with dark red colour and consumers in Korea preferred marbled pork. Table 2.3 provides a summary of standards for those main quality traits which can be taken as reference in determining meat quality in the current study.

Table 2.3 Review of Standards for pH, Drip Loss, Cooking Loss, Colour, Shear Force and Marbling

	pH	Drip loss	Cooking loss	Colour	Shear force	Marbling (intramuscular fat)
Aaslyng et al. (2007)	Standard: 5.55-5.64, low <5.4, high >5.8					High ≥2.2%
Aaslyng et al. (2003)	High >5.65, medium: 5.65-5.45, low < 5.45.	high >=4%, medium 2-4%, low <=2%				High > 2.2%, medium 1.4-2.2%, low < 1.4%
Brewer et al. (2001)						low ≤ 1%, medium 2-2.5%, high 3-2.5%
Brewer and McKeith (1999)				L*: PSE (56.96±2.58[a]), normal (51.51 ± 0.81), DFD (38.00 ±2.11). a*: PSE (8.89 ± 0.22), normal (11.09 ±0.40), DFD (10.33 ± 0.31). b*: PSE (18.42 ± 0.94), normal (19.41 ± 0.32),		

				DFD (13.73 ± 1.08)		
Bryhni et al. (2003)				Standard: L*=92.30, a*=0.32, b*=0.33		
Moeller et al. (2010)	<5.5, 5.5–5.8, and >5.8			L*>55, 49–55, and <49		<2.0, 2.0 − 4.0, and >4.0%
Fernandez et al. (1999)	PSE meat: $pH_{40min} \leq 6.1$. DFD meat: $pH_u \geq 6.0$.					High (associated with a risk of meat rejection by consumers) ≥ 3.5%
Gunenc (2007)	pH_u: Normal: 5.8-5.6, PSE meat: 5.6-5.5	RFN: 7.58(Bag Method-2day), 9.67 (Bag Method-4day), 12.64 (Centrifuge), 55.98 (Cotton-rayon Material). PSE: 9.62(Bag Method-2day), 11.12(Bag Method-4day), 14.27(Centrifuge),		PFN: L*=57.16, a*=7.10, b*=10.14; PSE: L*=61.11, a*=7.13, b*=12.05		

		113.32(Cotton-rayon Material)				
Lee et al. (2000)	pH_u: PSE: 5.36±0.1, RSE:5.48±0.2, RFN:5.63±0.1, DFD:6.18±0.2	PSE:9.6±1.9, RSE:8.1±1.1, RFN: 4.0±1.3, DFD: 1.3±0.4		L*: PSE:52.8±0.1, RSE:47.5±1.2, RFN: 45.3±2.0 DFD:39.2±2.2		
van Laack et al. (1994)	pH_u: PSE and RSE: 5.4±0.1, PFN: 5.5±0.1, RFN: 5.6±0.1, DFD: 5.9±0.5	Unacceptable >5.0%		L*: pale: ≥ 58.0, normal: 52.0-58.0, dark: ≤52.0		
Joo et al. (1995)	pH_u: PSE: <5.5, RSE:<5.6, RFN:5.6-5.9, DFD:>6.0	PSE: >8.0%, RSE>5.0%, RFN:<5.0%, DFD:<2.0%		L*: PSE: >50, RSE>43-50, RFN:43-50, DFD: <43		
NPPC (1998)	Target: 5.6-5.9	Target: <2.5%			WBS < 7 lb. (3.2 KG)	Target: 2-4%
PIC (2003)	pH_{45min}: standard: 5.6-6.8, optimum: 6.7-	Standard: 3-6%, less is more desirable	Standard: 16-24%, greater than 25% indicates a pork	L*: Standard: 38-55		Standard: NPB marbling score: 1-10. Optimum:

	6.3. pH$_u$: standard: 5.2-6.4, optimum: 6.1-5.7.		quality problem			2

[a]: mean and standard error.

PSE: Pale, soft and exudative. RSE: reddish pink, soft and exudative. RFN (best): reddish pink, firm and non-exudative. DFD: dark, firm and dry.

Bag Method-2day, Bag Method-4day, Centrifuge, Cotton-rayon Material: four different methods of measuring drip loss (water holding capacity).

2.2.2 SENSORY QUALITY

Sensory quality is experience quality that could play an important role in consumers' repeat purchases (Brewer et al., 2001; Bryhni, 2002). Consumer preferences and evaluations of sensory quality and factors that influence pork sensory quality have been studied (Aaslyng et al., 2007; Brewer et al., 2001; Bryhni et al., 2003; Moeller et al., 2010; O'Mahony et al., 1991). Previous studies evaluating sensory quality of pork are summarized in Table 2.4 in terms of objective, methodology and data analysis.

Table 2.4 Methodologies for Pork Sensory Quality Assessment

Citation	Objective	Methodology	Data Analysis
The impact of sensory quality of pork on consumer preference Aaslyng et al. (2007)	To estimate the effect of the sensory quality of pork on consumer preference by using pork of different eating quality	**Consumer testing (hedonic analysis**): Roskilde: n=213, in a sensory laboratory; Holstebro: n=162, in a focus room; samples were served in random order between sessions; each consumer rated nine samples on an unstructured liking scale from 0 (dislike very much) to 15 (like very much). **Sensory descriptive analysis**: nine assessors had undergone a basic training programme in sensory assessment, determined odour, flavour, texture and appearance of the samples on a 15 cm unstructured line scale ranging from 0 (no intensity) to 15 (very high intensity), samples were served in a randomised order	"An **analysis of variance** was used for analysis of the raw meat determinations and the mean values of the assessors per piece of meat for the sensory attributes: $Y_i = \mu + \delta_i + e_i$ where μ≈general level, δ_i≈ fixed effect of set of samples (i=1…9), and e_i ≈ random error" (p.64). "The sensory characteristics were analysed in a PCA and correlated characteristics were grouped. The model used to analyse the variation of consumer preferences (**a general linear model**): $y_{ijkl} = \mu + \alpha_i + \beta_{j(i)} + \Delta + \sum_{s=1,\dots s} b_s \times z_s + \sum_{s=1,\dots s} b\alpha_{si} \times z_s + \sum_{s=1,\dots,s} b\beta_{sj(i)} \times z_s + \sum_{s=1,\dots,s} b\Delta_s\ z_s + \varepsilon_{kl(j(i))}$" (p.64). "The model was divided into a consumer part and a meat part" (p.64). "The main effects were μ≈constant, α_i≈ effect of location i=1,2, $\beta_{j(i)}$≈ effect of session j=1,2,…,J_i, Δ≈ effect of age and gender,

			and z_s: sensory components s=1,…,S, $\alpha_{si} \times z_s$: interaction between sensory components and place of residence, $b\beta_{sj(i)} \times z_s$: interaction between sensory components and session" (p.64).
Marbling effects on quality characteristics of pork loin chops: consumer purchase intent, visual and sensory characteristics Brewer et al. (2001)	To evaluate whether consumers detect differences among pork loin chops with low, medium and high amounts of marbling when visually evaluated, when prepared under standardized conditions, and when prepared at home	**On-site sensory evaluation** (n=150): First, each panellist selected a package of chops from among 20 packages displayed in a retail case with equal numbers of packages of low, medium and highly marbled chops. Second, each panellist **visually evaluated** pork chops. Purchase intent was evaluated prior to visual characteristics using a 5-point category scale where 1= wouldn't buy and 5= would buy. Colour, marbling and overall acceptability were visually evaluated using a 5-point category scale. Third, sensory evaluation: samples were evaluated for flavour intensity, juiciness, tenderness, and oiliness/fattiness using five point scale where 1= not at all and 5=very much.	"One-way ANOVA for differences due to marbling group were conducted using the **GLM** procedure of SAS" (p.154). "Means and standard deviations were calculated for sensory characteristics in various marbling" (p.154). "Least square means were calculated for individual sensory characteristics within five purchase intent categories" (p.154). **"Pearson correlation coefficients** were calculated between sensory characteristics" (p.157).

		Consumer demographic characteristics data were collected. **In-home sensory evaluation:** evaluation on fresh samples participants chose at the beginning of the on-site sensory evaluation for the same attributes	
Consumer preferences for pork chops with different levels of intramuscular fat O'Mahony et al. (1991)	To investigate whether differences in the level of the intramuscular fat (marbling) in pork chops influenced consumer purchasing behaviour and eating satisfaction.	**Mail-out consumer product test** with paired samples of different levels of intramuscular fat: "each consumer received 2 packs of frozen chops, one from a loin of high intramuscular fat, and one from a loin of low intramuscular fat" (p.231), "received an explanatory letter, and a questionnaire asking their opinion in relation to the appearance and eating attributes (tenderness, juiciness, flavour and overall eating on a scale from 1=very good to 7=very poor) of each of the test samples" (p.231).	"The data was analysed using SPSS PC. Hypotheses were tested using χ^2 for basic hypothesis testing and the Wilcoxan Signed Ranks Test for ratings of the samples in the product test" (p.231).
Consumer and sensory investigations in relation to physical/ chemical	"To investigate consumer and profiling data using multivariate data techniques	**Sensory profiling**: in the sensory laboratory, eight assessors evaluated samples in duplicates in a randomized	An ANOVA Partial Least Squares Regression (**APLSR**): Consumption frequency/liking data

aspects of cooked pork in Scandinavia Bryhni et al.(2003)	to gain insight into the sensory reasons for consumer liking and consumption of pork" (p.738).	order in sessions of six samples, attributes were rated on an unstructured line scale ranging from 0 (none) to 100 (very strong). **Consumer studies**: consumer liking of each of eight pork samples after tasting from 1 (like very little) to 9 (like very much); questionnaire of consumer demographics and consumption frequency.	average over individual consumers = country + adrenaline injection (normal/elevated pH) + meat ageing + warmed-over flavour + cooking temperature. Mean sensory profiling data (**APLSR** analysis): **sensory profiling data averaged over consumers from each country** = country + adrenaline injection (normal/elevated pH) + meat ageing + warmed-over flavour + cooking temperature. Mean consumer question responses and sensory profiling data(Partial Least Squares Regression): consumer question response for liking average over individual consumers from each country = sensory profiling data averaged over individual consumers from each country
Consumer perceptions of pork quality as affected by pork quality attributes and end-point cooked temperature	"To evaluate the potential independent and interactive influences of commonly measured pork quality indicators on consumer	**Consumer taste panel**: "consumers were provided samples from eight different chops with five different consumers assessing each chop" (p.16); consumers liking (1= dislike	**Ordered logistical regression:** DV: consumer response (liking scale). IDV: "primary model: Cooked temperature, pH, IMF, L*, a*, b*, WBS, as linear and quadratic effects,

Moeller et al. (2010)	perceptions of pork eating quality across four cooked temperature" (p.14).	extremely and 8=like extremely) of juiciness, tenderness, flavour and their evaluations of the levels (e.g. 1= extremely dry and 8= extremely juicy) of those attributes were rated on an 8-point scale. Consumers were also asked how likely they would purchase the sample if it were available at a reasonable price with options from 1 (definitely would not buy) to 5 (definitely would buy).	and the two-way interactions among independent variables were tested" (p16). Plant of origin and city of testing; final model: "cooked temperature was not significant but was maintain in all final models to assess temperature effects correctly. Plant of origin and both a* and b* colour values were not significant and were removed from final models" (p.16). "The influence of cooked temperature on shear force was analyzed using a standard mixed model with a fixed effect of temperature and a random effect for plant of origin" (p.16).

Based on the summary in Table 2.4, consumer tests/taste panels and trained/expert/experience panels are most commonly applied in the evaluation of sensory quality. Consumer sensory tests can be described as follow based on the previous studies (Aaslyng et al., 2007; Brewer et al., 2001; Bryhni et al., 2003; Beaulieu et al., 2010; Moeller et al., 2010) ,

1. Evaluations are usually performed in laboratory conditions with all participants seated at separated booths or individual tables with distance between them in order to avoid any distraction and communication during assessment;
2. Pork samples are cooked under control (e.g. controlled final internal temperature);
3. Each cooked sample labelled/identified with a three-digit number is served to the consumer for evaluation in random order;
4. Category and/or unstructured liking scales are used to rate attributes and acceptability of products;
5. "Distilled water and unsalted soda crackers could be provided to clear the palate of residual between samples (Beaulieu et al, 2010, p. 9)"
6. Consumers are usually asked to complete a questionnaire of their demographics after the tasting test.

Trained panel evaluation is also performed in a laboratory facility. Sensory attributes (descriptive terms) are developed for assessors to evaluate. Samples cooked under control are presented to assessors in random order. Distilled water and unsalted crackers could also be provided. Unstructured line scales are more widely used in trained panels where assessors can evaluate sensory attributes in a greater degree of freedom that may give higher degree of discrimination than structured line scales or category scales (O'Sullivan and Kerry, 2009).

Consumer tests, the subjective measurements, were basically conducted to assess consumer preferences, acceptability or purchase intent based on sensory evaluation of the product while a trained panel, the objective measurement, was conducted for sensory profiling/testing/ descriptive analyses to describe the general quality or a specified attribute variation/differences between samples of different treatments (Bryhni et al., 2003; O'Sullivan and Kerry, 2009). Therefore, consumer tests are commonly applied in consumer studies while trained panel evaluations are more widely applied in studies of meat science. Some researchers (Aaslyng et al., 2007; Bryhni et al., 2003) combine consumer tests and descriptive analysis. In the research by Aaslyng et al. (2007), each consumer rated nine cooked pork samples on an unstructured liking scale from 0 (dislike very much) to 15 (like very much) in a consumer sensory test; a nine-member trained panel determined odour, flavour, texture, and appearance of the randomly served samples on a 15 cm unstructured line scale ranging from 0 (no intensity) to 15 (very high intensity). Effects of sensory quality attributes and their interaction terms with consumer demographics (i.e. location, gender, and age) on consumer liking were estimated by using a general linear model. Their results indicated that tenderness, fried flavour and juiciness had a positive influence on the liking of cooked pork for most of the consumers. Older consumers were observed to place more emphasis on tenderness than younger consumers. Bryhni et al. (2003) observed similar results that pork which was juicy, tender, and without off-flavour received higher consumer liking by conducting similar sensory tests and running partial least square regression on the variation of consumer preferences. In consumer sensory testing, hedonic scales (e.g. 9-, 7- and 5-hedonic scales) are the most commonly used affective scales and the 9-point hedonic scale is the classic scale that have been demonstrated to be optimum for collecting hedonic data (Moskowitz et al, 2004).

Odour, appearance, flavour and texture are the sensory properties commonly measured in pork studies. A summary of attributes describing those properties is presented in Table 2.5 based on the descriptive terms developed by Aaslyng et al. (2007) and Bryhni et al. (2003) for sensory descriptive analysis of pork. In a consumer sensory test, attributes to be evaluated are not as many and specific as in an expert panel evaluation considering the consumers' capability to understand the attributes and provide reliable information (Moskowitz et al., 2004). Appearance, tenderness, juiciness, flavour and the overall eating experience are the attributes usually asked in a consumer sensory test of meat products and have been found to play important role in consumer acceptance or liking (Moeller et al., 2010; Aaslyng et al., 2007; Sitz et al., 2005; Feuz et al., 2004; Killinger et al., 2004; Norman et al., 2003; Brewer et al., 2001; Fernandez et al., 1999b; O'Mahony et al., 1991).

Table 2.5 Sensory Attributes Evaluated for Pork

Odour	Appearance	Flavour	Texture
Boiled meat	Cooking colour	Boiled meat	Hardness
Fried meat	Meat colour	Fried meat	Crunchy fibres
Oily	Structure	Piggy	Juiciness
Piggy	Uneven colour	Sourish	Fibrousness
Sourish	Pores	Metallic	Crumbliness
Sweet		Mushroom	Tenderness
Warmed over		Sweet	Chewing rest
Other		Bitter	
		Fatty	
		Warmed over	
		Other	

Source: Aaslyng et al. (2007, p. 63) and Bryhni et al. (2003, p. 740).

2.2.3 VARIATION IN PRODUCT-ORIENTED QUALITY TRAITS

In Table 2.6 research related to correlations between different quality parameters and the identification of factors that contribute to variation in the important product-oriented quality parameters is summarized.

Table 2.6 Studies of Variation of Product-Oriented Quality Attributes

Citation	Objective	Methodology	Data Analysis
Modelling quality variations in commercial Ontario pork production Purslow et al. (2008)	"To identify factors and signalling mechanisms contributing to poor meat quality" (p.123).	"Animal behavioural assessments were carried out both on-farm and during handling at the abattoir" (p.125). Carcass and meat quality were evaluated technically.	**Linear statistical model** using Partial Least Squares analysis: Input variables with low center-scaled b estimate (close to 0) and low variance in prediction (Vip > 0.8) were rejected as poor candidates for inclusion in the model. DV: The end-product quality variables (Water-holding capacity (% drip loss); Toughness (WB shear force); Colour (L*-value)). IDV: Principal input variable; Biochemical and gene expression measures and post-mortem carcass conditions.
Consumer-rated quality characteristics as related to purchase intent of fresh pork Brewer and McKeith (1999)	"To evaluate consumer perception of colour, wet-dry appearance, and acceptability characteristics of PSE, DFD and normal pork and relate these characteristics to purchase intent" (p.171).	**Consumer evaluation** Packaged samples were labeled with 3-digit (random) code numbers. Consumers evaluated samples using 5-point scales for purchase intent, pink colour, wet/dry appearance and overall acceptability. "Each participant evaluated three samples,	**"Pearson correlation coefficients** were calculated among evaluative factors" (p.171) (purchase intent, colour, appearance and acceptability); regression equations for prediction of purchase intent of the overall and three muscle conditions pork based on acceptability, colour and wet/dry

		one of each of the three muscle conditions (PSE, normal, DFD)" (p.171). "Data from incomplete questionnaires were discarded" (p.171).	appearance **(linear, quadradic and cubic effects**) using the **MAXR** procedure (SAS institute, Inc., 1993).
The relationship between carcass, meat and eating quality of three pig genotypes Casteels et al. (1995)	"To concentrate on how the pork of different genotypes is evaluated by the consumer (subjective definition), in terms of tenderness, taste and juiciness, and the relationship with objective meat quality measurements (objective definition)" (p.254). "Illuminating different factors involved in the variability of the meat quality, like slaughter conditions, halothane gene frequency and IMF content" (p.255).	**"Taste panel** for the sensory evaluation of pork which consisted of a priority-test with three descriptors: tenderness, juiciness and taste intensity" (p.257). "Three pieces of meat, originating from animals belonging to three different genetic groups, were compared to each other by members of a taste panel" (p.257) ranging from the worst to the best quality from 1 to 3. "The comparison of three animals each time was repeated four times by different persons" (p.257).	**General Linear Model**: DV: carcass, intrinsic, and sensory meat quality parameters; IDV: genotype, slaughter date, and slaughter weight. The **global and partial correlation coefficients** were calculated between carcass, intrinsic and sensory meat quality parameters.
Variation in composition and palatability traits and	"To assess the status of the industry with regard to	**Sensory panel evaluation**: a six-member **experienced sensory panel**	**Stepwise regression** procedures were used to determine best model for sensory

relationships between muscle characteristics and palatability in a random sample of pork carcasses DeVol et al. (1988)	carcass and palatability traits and to evaluate the relationship between certain muscle characteristics and palatability in a random sample of pork carcasses" (p. 386).	that had previous sensory experience and were familiar with the ballot. "Palatability traits (juiciness, tenderness, connective tissue amount and pork flavour intensity) were evaluated using a 15-cm, unstructured line scale anchored on the ends and center (0 = extremely dry, tough, abundant or bland and 15 = extremely juicy, tender, none or intense)" (p. 386).	quality prediction. DV: tenderness, WBS force, juiciness, flavour; IDV: carcass, and chemical and physical properties of the muscle (last rib fat thickness, percentage of IMF, percentage of moisture, 4-h pH, sex, final pH, percentage of cooking loss). **Product-moment correlation coefficients/simple correlation coefficients** between different quality parameters.
Influence of intramuscular fat content on the quality of pig meat – 1. Composition of the lipid fraction and sensory characteristics of m. longissimus lumborum Fernandez et al. (1999a)	"To examine the influence of intramuscular fat (IMF) content on sensory attributes (appearance and eating attributes)" (p.59).	Four IMF groups were determined on the basis of IMF variability. **Sensory analyses**: "Raw samples were evaluated individually by a **trained panel** of 12 members" (p.61). "Colour, smell intensities, and marbling were evaluated on raw samples; Smell intensity, flavour, juiciness and toughness were evaluated after cooking on a 7 points discrete scale from 1= very low to 7 = very high	"Analyses of variance were performed using the **General Linear Model** procedure of SAS" (p.61). "The model included the main effect of slaughter day and IMF groups" (p.61) on carcass characteristics, quality traits of muscle and sensory quality. DV: % muscle, pH, L*, a*, b*, colour intensity, marbling, smell intensity, flavour, juiciness, toughness; IDV: slaughter date and intramuscular fat.

		intensity” (p.61).	
Influence of intramuscular fat content on the quality of pig meat 2. Consumer acceptability of m. longissimus lumborum Fernandez et al. (1999b)	To test “consumer acceptability of pork chops with varying IMF levels” (p.67).	**Tests of acceptability by consumers**: two experiments, one with rib-eye (LL muscle trimmed of backfat), and one with entire chops trimmed of backfat; same procedure: “consumers were asked to express their willingness to purchase and consume the meat on a three point scale (yes, maybe, no), to evaluate the aspect of raw meat, and texture and taste of cooked meat on a five point scale (from 1, least desirable to 5, most desirable); and to express an overall rating of the samples (from 1, least favourable to 10, most favourable)” (p. 68).	“The influence of IMF class on the distribution of consumer responses was tested using the **Friedman non-parametric test**” (p. 68) (an alternative of repeated measures of ANOVA, when the assumption of normality or equality of variance is not met).
Correlations among selected pork quality traits Huff-Lonergan et al. (2002)	“To determine phenotypic associations between specific biochemical and physical-sensory characteristics to obtain a better understanding of how changes in specific traits may influence pork quality”	**Sensory evaluation**: a highly **trained professional** sensory panel evaluated juiciness, tenderness, chewiness, pork flavour, and off-flavour of the samples using a 10-point category scale which was anchored on the left end with a term representing a low degree of each attributes and on the right end of	“Associations between traits (carcass characteristics, biochemical measurements of muscle, meat quality characteristics and sensory characteristics) were determined by calculating **correlations**” (p.619)**.**

	(p.618).	the scale was a term representing a high degree of each characteristic.	
Pork loin colour relative to sensory and instrumental tenderness and consumer acceptance Norman et al. (2002)	"To document the effect of pork colour on fresh pork tenderness, consumer acceptance, and develop a descriptive analysis profile for boneless pork chops of different colour classifications" (p.927).	Phase I: **consumer "in-home" study**: The attributes of overall liking, liking of tenderness, liking of juiciness, and liking of flavour were scored on a nine-point hedonic scale where 1=dislike extremely and 9= like extremely. A **simulated retail display** was conducted to determine consumers purchase preferences after the 'in-home' testing. Phase II: **descriptive analysis**: trained panellists evaluated the cooked chops using a 10cm unstructured line scale to generate and modify a list of reference for pork attributes.	**"Pearson correlation coefficients** were used to detect correlations between WBS, CIE L*, a*, and b* values, and cooking data" (p.929). **Stepwise multiple regression:** DV: WBS; IDV: CIE L*, a*, and b* colour values. **"Multivariate analysis of variance** was used to analyze the descriptive panel data" (p.929).
Comparison of different methods for determination of drip loss and their relationships to meat quality and carcass characteristics in pigs	"To analyze the relationship between drip loss measurements and other meat quality and carcass traits" (p.402).	"Data collection was conducted on nine slaughter days under commercial abattoir conditions" (p.402).	"Meat quality and carcass traits were analyzed by analysis of variance using **the general linear model** procedure (GLM)" (p.403). "Model used for the analysis of meat traits:

Otto et al. (2004)			$Y_{ijklm} = \mu + L_i + F_{ij} + D_k + S_l + e_{ijklm}$" (p.403). DV: drip loss; IDV: line, farm within line, slaughter day and sex. **"Correlations** were calculated from the residuals after adjustment for the fixed effects described in the analysis of variance" (p.403).
Carcass properties as related to sensory properties of pork Fjelkner-Modig and Persson (1986)	"To investigate carcass and meat-quality traits of purebred Hampshire, Swedish Landrace and Swedish Yorkshire pigs, and to relate these traits to the sensory properties of porcine meat" (p.103).	"Sensory properties were assessed by an **expert panel**: profile attributes including visible juiciness (1=none, 9=very large); initial juiciness (1=none, 9=very large); elasticity (1= not elastic, 9 = very elastic); hardness (1= very soft, 9 = very hard); stringiness (1 = none, 9 = very large); chewing time (1= very short, 9 = very long); chewing residual (1 = none, 9 = very large); total flavor (1 = weak, 9 = very strong)" (p.104).	**Partial correlation coefficients** between rearing, carcass and meat quality traits; Stepwise **multiple linear regressions**: DV: sensory attributes; IDV: live weight gain, slaughter age, backfat thickness, percent lean in carcass; pH, EEL-colour value, sarcomere length, intramuscular lipid content.
Sensory quality and cooking loss of ham muscle (M. biceps femoris) from pigs reared	"To evaluate the sensory characteristics and cooking loss of ham from pigs of different genotype and sex	**Sensory evaluation: trained nine-member panel** assessed odour intensity, porosity, juiciness, acidulous taste, tenderness, and total	**General linear model:** DV: sensory quality attributes, cooking loss; IDV: genotype, sex and rearing system.

indoors and outdoors Jonsäll et al. (2001)	and on different rearing systems" (p.245).	meat taste on a scale from 0 to 100.	
The influence of carcass backfat and intramuscular fat level on pork eating quality Blanchard et al. (2000)	"To evaluate the contribution of fatness level towards pork eating quality" (p.145).	**Trained sensory panel** was used to evaluate the eating quality characteristics, juiciness, tenderness, pork flavour, abnormal flavour and overall acceptability on lean and pork odour, abnormal odour and board odour on fat using a scale of 1-8.	**Pearson product moment correlation**s were calculated. "721 animals were divided into seven groups for each of the traits: shear force, sensory panel tenderness, juiciness and overall acceptability" (p.149) to investigate the theory that a 'threshold' for fatness (particularly IMF) rather than a simple linear relationship with eating quality exists. "Each of the seven groups contained 103 samples with those in group 1 having the highest score for each respective trait, and those in group 7 containing samples with the lowest scores" (p.149). **Analysis of variance** was then calculated.

Table 2.6 shows that correlation coefficients have been widely used in meat science studies to identify the relationship between two quality traits while various types of regression have been applied to estimate factors contributing to explaining the variation in individual attributes. Correlations between different quality traits are discussed first in the following paragraphs.

Tenderness has been observed to have positive correlations with pH, intramuscular fat, backfat thickness, and carcass weight, while it has negative correlations with drip loss percentage and cooking loss percentage (Blanchard et al., 2000; Casteels et al., 1995; Enfält et al., 1997; Devol et al., 1988). However opposite results have been observed by Olsson et al. (2003) in that they found tenderness to be negatively correlated with pH and positively correlated to cooking loss percentage. Regarding shear force which is the technical measure of tenderness, backfat thickness (Blanchard et al., 2000; Huff-Lonergan et al., 2002), carcass weight (Huff-Lonergan et al., 2002), colour a*, and colour b* (Norman et al., 2003) have also been observed to be negatively correlated, while pH value (DeVol et al., 1988; Norman et al., 2003; Olsson et al., 2003), drip loss percentage (Olsson et al. 2003), and colour L* have been found to be positively correlated with shear force. Correlations between shear force and cook loss percentage vary. DeVol et al. (1988) and Olsson et al. (2003) observed cook loss percentage to be negatively correlated with shear force while Hodgson et al. (1991) observed a positive correlation. Tenderness, either objectively or subjectively, measured have been found to only have consistent correlations with backfat thickness and carcass weight such that pork chops from heavier carcasses or carcass is with thicker backfat can be expected to be less tender. Correlations between tenderness and meat quality attributes such as pH, drip loss and cooking loss differ in different studies.

Juiciness has been generally observed to be negatively correlated with shear force (Enfält et al., 1997; Hodgson et al., 1991; Olsson et al., 2003), colour L*, colour a* (Casteels et al., 1995), and backfat thickness (Blanchard et al., 2000; DeVol et al., 1988); and to be positively correlated with IMF (Olsson et al., 2003;

Blanchard et al., 2000; Enfält et al., 1997; Casteels et al., 1995). However correlations of juiciness and pH, drip loss and cook loss percentage varied in sign in different studies.

Flavour was observed to have a positive correlation with cook loss percentage (Blanchard et al., 2000; DeVol et al., 1988) and carcass weight (Blanchard et al., 2000), while having a negative correlation with drip loss (Huff-Lonergan et al., 2002). Its correlations with other quality parameters (pH, shear force, IMF, and backfat) vary in sign in different studies.

Huff-Lonergan et al. (2002) observed that backfat thickness was positively correlated with pH, drip loss percentage, cook loss percentage, while Casteels et al. (1995) observed that backfat thickness was negatively correlated with pH. Huff-Lonergan et al. (2002) also found that carcass weight was negatively correlated with cooking loss percentage but positively correlated with drip loss percentage. Colour L* and colour a*, which have negative correlations with pH value (Norman et al., 2003), were also observed to be positively correlated to backfat thickness by Casteels et al. (1995).

Drip loss percentage and cook loss percentage, which were observed to be positively correlated (Olsson et al., 2003), were found to have negative correlations with pH value and have positive correlations with colour a* (Norman et al., 2003; Olsson et al., 2003; Otto, et al., 2004). Their relationship with colour L* and colour b* were adverse that Otto et al. (2004) observed drip loss percentage was positively correlated with colour L* and colour b* while Norman et al. (2003) observed cook loss percentage was negatively correlated to the two colour parameters.

With respect to factors affecting the variation in quality, genotype, sex, management strategy (e.g. feeding), rearing system (e.g. indoor vs. outdoor), production system (e.g. conventional vs. organic), slaughter weight, slaughter date, stunning, etc. have all been detected to contribute to the variance in hog carcass, meat and sensory quality (Casteels et al., 1995; Channon et al., 2004; D'Souza and Mullan, 2002; Fjelkner-Modig and Persson, 1986; Jonsäll et al., 2001; Olsson et al., 2003; Purslow et al., 2008). As compared to indoor-reared pigs, outdoor-reared pigs were observed to have leaner carcasses with thinner backfat, have meat with lower pH value, higher drip loss, less IMF and water, higher shear force value and higher colour L* and colour b* (lighter and more yellow in meat) (Enfält et al., 1997; Pugliese et al., 2004). Enfält et al. (1997) reported that outdoor rearing lowered the sensory quality as measured by tenderness, juiciness, and overall acceptance, while Pugliese et al. (2004) and Jonsäll et al. (2001) did not find any rearing effect on measures of cooking loss, tenderness of the meat. In comparison to conventionally raised pigs, organically raised pigs in the research conducted by Olsson et al. (2003) had lower carcass lean meat contents and thicker side fat. Fresh meat from this production system had lower water-holding capacity (higher drip loss) and cooking loss. van der Wal et al. (1997) found that the day of slaughter significantly affected most of the meat quality parameters including pH and colour in their study and Casteels et al. (1995) observed that genotype, slaughter date and slaughter weight together explained over than 20% of the variance in carcass quality traits (i.e. fat thickness), meat quality traits (i.e. pH, L*, a* and water-holding capacity, IMF), and sensory quality parameters (i.e. tenderness and juiciness).

Different quality parameters (i.e. carcass, meat, and sensory quality) have been observed to be correlated, therefore, in additions to factors mentioned above, some of those parameters in the earlier stages could contribute to the variability in the end-point product attributes. Purslow et al. (2008) estimated the most important variables (i.e. principal production variables (i.e. gender, kill date, genotype), peri-mortem biochemical measures and post mortem carcass condition variables (i.e. pH, carcass grade index, carcass weight)) that influence the end-product quality (water-holding capacity, toughness, and colour L* value) by using Partial Least Squares regressions. Slaughter day and pH were strong contributors to the variation in those three meat quality parameters. Norman et al. (2003) observed colour readings (Chroma, L* and b*) explained 19% of the variation in

Warner-Bratzler shear force (WBS). DeVol et al. (1988) observed that carcass (i.e. fat thickness) and meat quality traits (i.e. fat percentage, pH, cooking loss percentage) explained 21%, 26% and 13% of the variation in tenderness, juiciness, and flavour, respectively.

In these studies aimed at estimating variation in product-oriented quality characteristics, general linear models including partial least squares regressions, stepwise regressions have been widely applied in estimating factors contributing to the variation in different quality parameters. When there exists multicollinearity among explanatory variables, partial least squares regression and principal component analysis can be used to overcome the problems.

2.2.4 CONCLUSION

A traditionally raised production system which is introduced as an alternative to a conventional system raising hogs is to be evaluated in this study. Based on the review, hogs from different production systems have been found to be different in quality in terms of carcass, meat and sensory quality. Therefore in this research the value of hogs from the traditionally raised production system is to be investigated and compared to conventional hogs based on both objective and subjective dimensions in the eyes of different participants in the pork value chain (players in the supply chain vs. final pork consumers).

Product-oriented quality attributes belonging to the objective quality category are what the players in the supply chain usually focus on and heavily invest in (Brunsø et al., 2005; Grunert, 1995). At the point of slaughter, data on hog grades are collected since hog grade which determines the quality and the commercial value of a hog carcass is important to both producers and processors. Warm carcass weight and predicted lean yield data are also collected as the interaction of those two factors in the grading grid determines the grade index for a hog carcass. pH, colour, drip loss percentage, cooking loss percentage and shear force are the meat quality traits to be measured because they are the most measured attributes that are either important visual factors affecting consumers' evaluation of fresh meat or factors affecting technological and sensory quality. With respect to sensory quality, consumer testing is conducted to assess consumer acceptance of pork chops from the two production systems. The 9-point hedonic scale, which is the classic hedonic scale that has been demonstrated to be optimum for collecting hedonic data (Moskowitz et al., 2004), is used by panellists to evaluate sensory quality attributes including appearance, tenderness, juiciness, flavour and overall acceptability. Some professionals suggest that only overall liking or acceptability which is regarded as the most critical information should be asked of consumers because they believe that consumers do not have the capability to provide any reliable individual attribute assessments because they cannot understand product attributes or that adding individual attribute liking forces consumers on attributes which they might not have paid attention to otherwise (Moskowitz et al., 2004; Popper, et al., 2004) . However, product developers not only need to know the overall acceptability or liking of a product, but also why a product is acceptable or not acceptable to a consumer which can be identified by asking the individual attribute questions. Appearance, tenderness, juiciness and flavour have been widely asked in meat sensory studies and been identified to play an important role in consumers' acceptance of a product implying that consumers have the ability to judge these attributes. Results of previous studies about the effects of attribute liking questions on the overall liking/acceptability rating differ, Popper et al. (2004) found that attribute liking questions tended to alter overall liking ratings while Vickers et al. (1993) have found that attribute liking had no effect on overall liking in their study. Therefore, consumer sensory test in this study will assess both the attribute and overall acceptability of cooked pork.

Correlation coefficients between quality attributes within each production system and factors contributing to the variations in individual quality attributes need to be identified for the pork industry to optimize product quality. In addition to production system, day of slaughter is also expected to contribute to explaining hog grade, meat quality and sensory quality traits as Casteels et al. (1995) and van der Wal et al. (1997) have found it significantly affected most of the intrinsic quality parameters they studied. The hypotheses for the estimations of investigated quality traits in this study are as follows: 1. Production system and slaughter day are expected to contribute to the variation in hog grade; 2. production system, slaughter day and hog grade are expected to contribute to the variability in meat quality traits; 3. in addition to production system and slaughter day, hog grade and meat quality traits are also expected to contribute to explaining the variation in sensory quality trait as suggested by DeVol et al. (1988).

2.3 CONSUMER THEORY

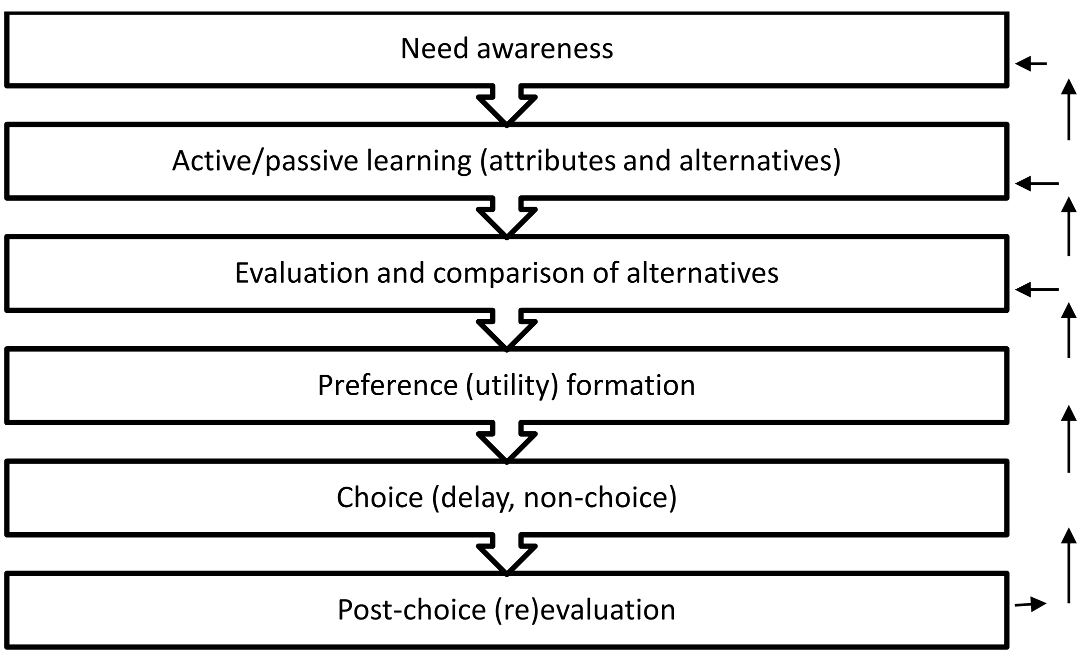
Quality is regarded as one of the main factors that determine success in today's highly competitive food markets and food industries have invested heavily in quality improvement. However, quality varies for different participants in the food value chain. "Only when producers can translate consumer needs into product characteristics which can be observed and are viewed as higher value by consumers, will quality be a competitive parameter for producers" (Grunert, 2005, p.371). To establish the pork chops with the highest consumer value, pork chops with different physical attributes, different labelling attributes and different prices can be selected by consumers. Therefore, the rest of this chapter is a review of consumer theory, stated preference methods, and econometric choice models.

In traditional microeconomic consumer theory it is assumed that every consumer makes choice decisions with the intention of maximizing utility subject to his/her budget constraint. Given a number of bundles of goods, a consumer will choose the one that yields their highest level of utility. In 1966, Lancaster developed a new approach to consumer theory supposing that a consumer's utility is derived from the properties or characteristics of the goods, which breaks away from the traditional approach that a consumer's utility is derived from goods directly. Economists have done a lot of work that contributed to advances in explaining consumer choice behaviour and in predicting consumer responses to alternative products or marketing programs, which is vital in assessing potential profitability ex ante.

Louviere et al. (2000) presented a conceptual framework which is consistent with economic theory for studying consumer choice behaviour by integrating ideas from a diverse set of studies on decision making. They provided an overview of a consumer's choice process as shown in Figure 2.2 and formalized the relationships implied by the framework as shown in Figure 2.3.

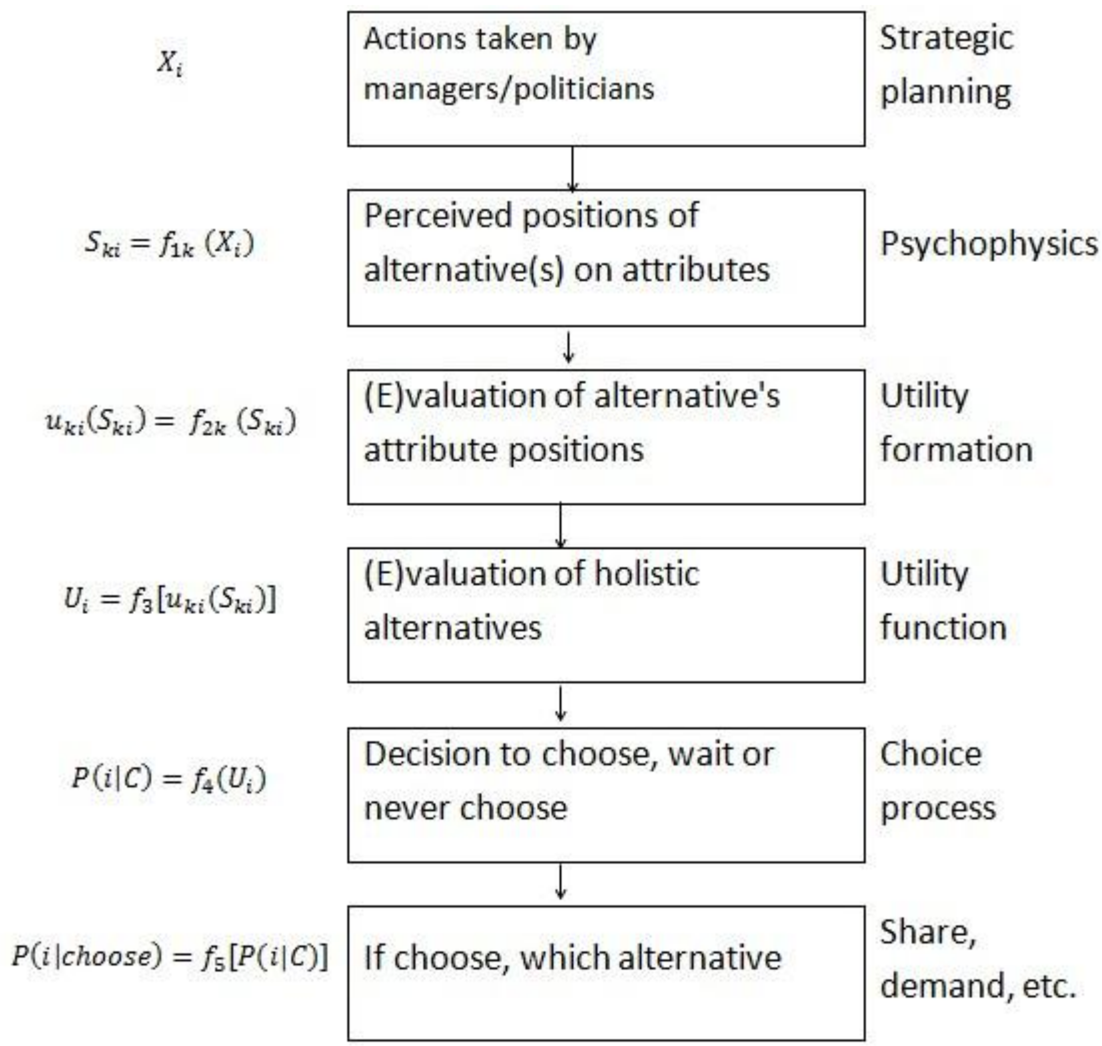
Consumers search for the right products with attributes that are available to fulfill their needs and goals. During this process, they form preferences (expectations) for the alternatives based on their evaluations of the attributes of each alternative, and choose the one that maximizes their utility.

Figure 2.2 Overview of The Consumer's Choice Process



Source: Louviere et al. (2000, p. 8).

Figure 2.3 Functional Relationships Implied by the Framework

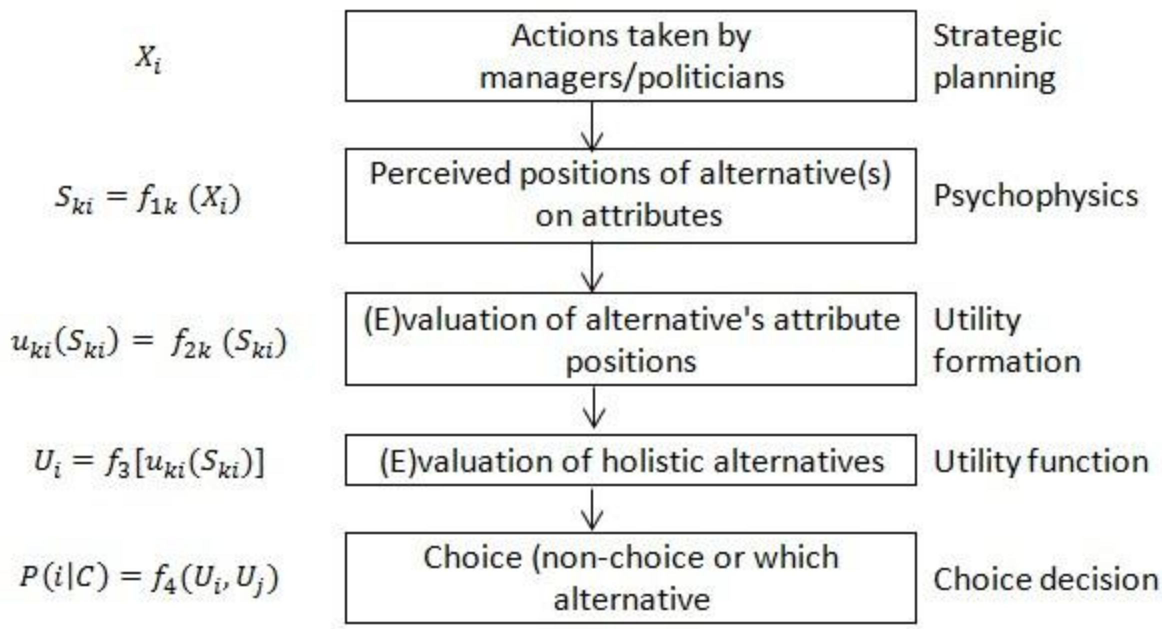


Source: Louviere et al. (2000, p. 9)

In Figure 2.3, X_i is the commodity (alternative) *i*, S_{ki} is the level of attribute *k* associated with alternative *i*, $u_{ki}(S_{ki})$ is the utility (preference) derived from the perceived level of the attribute *k* associated with the alternative *i*, U_i is the utility derived from alternative *i* based on preferences on its attributes, $P(i|C)$ is the possibility to choose *i* from the choice set, and $P(i|choose)$ is the possibility to choose *i* in the considered choice set.

On the basis of the framework of consumer's choice process by Louviere et al. (2000), consumers first decide to choose or not choose, if decide to choose, and then make choice in the considered choice set. However, for the stated choice experiments, which "provide a theoretically acceptable way to measure and model non-choice" based on the random utility models of discrete choice (Adamowicz et al., 1998, p.24), non-choice is simply treated as another discrete option faced by consumers following Louviere and Woodworth (1983) and Anderson et al. (1992), simplifying the two steps process to one step as shown in Figure 2.4 below.

Figure 2.4 An adjusted consumer choice process framework



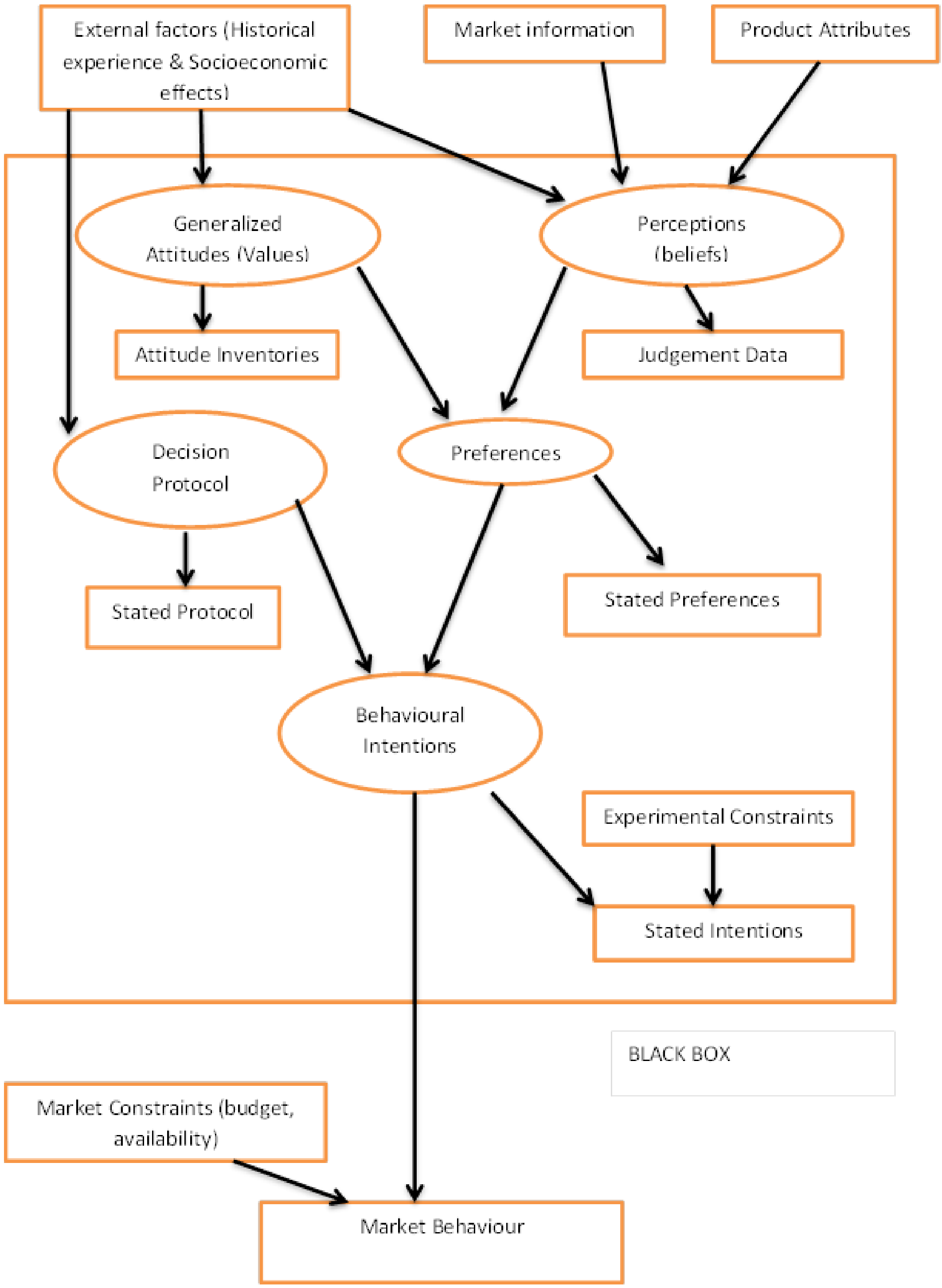
Source: Louviere et al. (2000, p. 9)

Integrating 2.3 or 2.4 into 2.2 "allows explanation of the choice behaviour in terms of:

1. Physically observable and measurable characteristics,
2. Psychophysical variables (consumer beliefs/perceptions of the products), and holistic measures of each alternative's utility (Louviere et al., 2000, p.10)."

McFadden (1986) presented a more detailed diagram (Figure 2.5) elaborating explanatory inputs for the consumer decision process with an interest in extending economic choice theory to incorporate data from psychometrics. The consumer is treated as an “optimizing black box” where product attributes, market information, consumer historical experience and socioeconomic characteristics, generalized attitudes and values, perceptions and beliefs are all inputs contributing to his/her market behaviour (e.g. choice and purchase of product), the output of the decision process. Consumers form perceptions and beliefs about a product based on the observed product attributes and market information, his/her historical experience, and socioeconomic factors. A consumer’s historical experience and socioeconomic factors also influence his/her attitudes and decision protocols. Consumer perceptions (beliefs) together with generalized attitudes determine preferences, “and preferences are translated by decision protocols into behavioural intentions, taking into account constraints on choice (p.277).”

Figure 2.5 Path Diagram for the Consumer Decision Process



Source: McFadden (1986, p.276).

Consumer demographic (or socioeconomic) characteristics (e.g. age, gender, income, education), perceptions, beliefs, attitudes have been observed to have significant influence on consumer preferences, choices, and willingness to pay (WTP) (Yen, 2009; Xue et al., 2009; Sanders, Moon, and Kuethe, 2007; Bukenya and Wright, 2007; Verhoef, 2005; Grannis and Thilmany, 2002; Baker and Burnham 2001). Yen (2009) observed that respondents who preferred non-GM food over GM food were less willing to buy GM pork, and respondents who agreed that scientists can be trusted to safety develop GM technology were more willing to choose GM pork indicating that consumer choices of GM products are consistent with their attitudes to GM food. Sanders et al. (2007) conducted a survey consisting of contingent valuation questions to elicit consumer WTP for hypothetical new pork chops and found that respondents who thought marbling is important for pork were more willing to pay for hypothetical pork chops certified to have consistently more marbling, suggesting that consumers' perceptions of a specific product or attribute affect their choices and/or WTP for that product or attribute. Participants in the study by Verhoef (2005) were asked for their perceptions of the attributes of organic meat in comparison to the attributes of ordinary meat on a 5- point scale, the question was as "How do you think of the ….. of organic meat in comparison to the ….. of ordinary meat? Are these attributes (taste, smell, succulence, outside, and freshness) much worse, worse, as good as, better or much better than those of ordinary meat? (p.265)" Results showed that respondents who thought the attributes of organic meat were better than ordinary meat were more likely to purchase organic meat. According to Baker and Burnham (2001), "socioeconomic (or demographic) and psychographic variables are two of the most common bases for market segmentation (p.390)." They observed that consumers who tended to believe the products of genetically modified organisms (GMOs) enhance the quality or safety of foods were more likely to accept the GMO foods. All the above literature suggests that consumers' perceptions and beliefs about a product or the attributes of a product are important in identifying their preferences and purchase decisions and in this study, consumers with different perceptions and beliefs about traditionally raised pork when comparing it to conventional pork could be expected to differ in their choices and WTP for pork from the two production systems.

2.4 RANDOM UTILITY THEORY

Following the assumptions of the traditional microeconomic consumer theory that a consumer makes choice decisions with the goal of maximizing his/her utility subject to a budget constraint, given a bundle of alternatives, consumer *q* will choose alternative *i* over *j* if and only if

$$U_{iq} > U_{jq} \tag{2-1}$$

However, an analyst can hardly observe the set of determinants that affect consumer preferences and choices of the alternative exactly (Adamowicz et al., 1998; Louviere et al., 2000). Random utility was first introduced by Thurstone (1927) in the field of psychophysics, and "it has been widely accepted in modern microeconomic theory, following the work of McFadden (1986)" (Yen, 2009, p.13). Following Adamowicz et al. (1998), a consumer's utility function for good *i* can be

$$U_{iq} = V_{iq} + \varepsilon_{iq} \, , \tag{2-2}$$

where U_i is the unobservable, true utility derived from alternative i; V_i is the systematic (observable) component of utility; and ε_i is the unobservable (random) component.

The presence of the random component helps to avoid econometric problems such as omitted variables, and it also allows the analyst to model the probability of consumer choice. The probability that a consumer will choose the *i-th* alternative from a choice set, *C*, can be expressed as

$$P(i|C) = \Pr\left[U_{iq} > U_{jq}\right] = \Pr\left[(V_{iq} + \varepsilon_{iq}) > (V_{jq} + \varepsilon_{jq})\right], \forall j \epsilon C. \tag{2-3}$$

Combining Lancaster (1966)'s new approach to consumer theory and the work of Adamowicz et al. (1998), equation (2-3) then can be rewritten as

$$P(i|C) = Pr\left[\left(\beta' X_{iq} + \varepsilon_{iq}\right) > \left(\beta' X_{jq} + \varepsilon_{jq}\right)\right], \forall\, j \in C. \tag{2-4}$$

where β is a k-vector of utility coefficients associated with a vector x of explanatory variables which could be related to product attributes. Adamowicz et al. (1998) also mentioned that choices may differ systematically from one consumer to another; therefore, individual difference (i.e. socio-demographic, belief and perceptions) can be included in the set of explanatory variables to account for as many of these differences as possible.

2.5 STATED PREFERENCE – CHOICE EXPERIMENTS

Stated and revealed preference elicitation methods have been widely used in economic studies to assess the determinants of consumer utility based on the Lancaster (1966)'s consumer theory and random utility theory (Uzea, 2009). The revealed preference method generally helps to analyze and understand the actual purchase decisions for existing market products made by different individuals and households (Uzea, 2009). The revealed preference method can only be used to model the value of products or product attributes actually available in the market place (Louviere et al., 2000), while stated preference methods allow examination of hypothetical products and attribute combinations that are not available in the market or modelling the value of new products or new product attributes prior to their introduction (Louviere et al., 2000; Uzea, 2009). In a stated preference experiment, consumers are most often asked to make hypothetical trade-offs between different alternatives (products or attributes) to elicit their willingness to pay or purchase intent (Lagerkvist et al., 2006; Uzea, 2009). Relationships between attributes can be controlled which allows "mapping of utility functions with technologies different from existing ones" (Louviere et al., 2000, p.24). Stated preference experiments are very flexible in measuring different types of preferences and they have been widely applied in research on the environment, marketing, and transportation (Uzea, 2009).

Contingent valuation methods (CV), conjoint analysis, and discrete choice experiments (CEs) are the three types of stated preference methods that have been employed in different literatures (Uzea, 2009).

In a survey based on contingent valuation, consumers are asked whether they would be willing to pay a premium to purchase a product regarded as having an individual or combination of differentiated attributes (Sanders et al., 2007; Uzea, 2009). Consumers who respond positively are provided with higher bid prices to elicit their maximum willingness to pay (Sanders et al., 2007; Uzea, 2009). In some studies, lower bid prices are provided to the consumers who respond negatively to identify their willingness-to-pay (Uzea, 2009). The contingent valuation method only allows researchers to derive willingness to pay for one product or one attribute of a product, estimation of willingness to pay for one attribute relative to others is limited (Uzea, 2009).

Choice experiments are alternatives to contingent valuation methods of eliciting willingness to pay (WTP). The choice experiments "arose from conjoint analysis" (Adamowicz et al. 1998, p.1) but "differ from typical conjoint methods in that individuals are asked to choose from alternative bundles of attributes instead of ranking or rating them" (Adamowicz et al. 1998, p.1).

The choice experiments have been identified to have several advantages in examining values of product attributes which are as follows:

First, CEs are consistent with random utility theory that consumers derive utility from consuming the attributes embodied in goods, but not from consuming the goods themselves (Lagerkvist et al., 2006; Adamowicz et al., 1998).

Second, CEs allow valuation of multi attribute and estimation of trade-offs between different attributes (Lagerkvist et al., 2006; Uzea, 2009).

Third, CEs closely simulate an actual purchase situation where consumers choose one alternative from a choice set and a no-choice option included in the choice could enhance the realism of the experiments (Uzea, 2009; Lagerkvist, et al., 2006; Lusk and Hudson, 2004).

Table 2.7 Consumer Stated Preference Studies for Pork

Citation	Objective	Methodology	Data Analysis	Attributes
Economic studies				
Consumer preferences for safety characteristics in pork Mørkbak, et al. (2010)	"To provide information that can guide governmental intervention strategies to increase demand-driven supply of food safety; To rank safety attributes relative to other quality characteristics that consumer associate with pork" (p.775).	Stated preference method – **discrete choice experiments**, based on Lancaster's consumer theory and random utility theory, with two alternatives plus a third status quo alternative; **an internet-based survey**; N=1,322 Danish consumers.	**Mixed logit** model (can accommodate correlations in the unobserved part of the utility): DV: choice; IDV: attributes of alternative minced pork.	Production (indoor vs. outdoor); country of origin (domestic vs. foreign); labelled Salmonella-free or not; use of antimicrobial agents; Price; fat percentage of the minced pork.
Canadian consumer valuation of farm animal welfare and quality verification: the case of pork Uzea (2009)	"To assess Canadian consumer's preference for farm animal welfare and quality verification provided by different stakeholders in Canada" (p.7).	**On-line internet survey**, stated preference **choice experiment**- three alternative pork chops with different levels of attributes plus a choice of "I would not buy any of these products".	Evaluation of CE data: **Multinomial Logit model, Random Parameters Logit model, Latent Class Logit model**: DV=Choice, IDV= Attributes of pork chops; **Ordered Probit** model to evaluate trust: DV: perceptions of the trustworthiness of verification by different stakeholders, IDV: respondents' opinions of the stakeholders are knowledgeable, are transparent and accountable, or act according to respondents' best interests.	Housing system (conventional, hoop, and outdoor); gestation stalls (Gestation stalls used vs. group pens used); use of antibiotics; organization verifying (farmer, processor, supermarket, government, independent third-party, none), price.

Consumer willingness to pay for livestock credence attribute claim verification Olynk et al. (2010)	"To estimate consumer WTP for verification of production process attribute claims by different verifying parties" (p.262).	**An online consumer survey** with a **choice experiment** for pork chops: direct and indirect questioning (to select what they believed the average American would choose), three options-two alternative products and a no-purchase option ("I choose not to purchase either of these two products"), n=669.	Random parameters logit (**mixed logit**): DV: choice, IDV: price, dummy variables for verification by different entities relative to self-verification, interaction terms between the verification entity and other product attributes.	Price, individual crates/stalls (not permitted vs. permitted), pasture access (not required vs. required), antibiotic use (not permitted vs. permitted), certified trucking/transport (not required vs. required), certification entity (self-certification, consumer group, private, third party, and USDA-PVP)
Consumer willingness-to-pay for fresh pork attributes Sanders et al. (2007)	"To examine preferences of Illinois consumers for attributes associated with fresh pork chops by analyzing whether and how much consumers would be willing to pay for a fresh pork product certified to be superior to regular pork products in terms of four taste-related attributes: tenderness, juiciness, leanness and marbling" (p. 164).	A survey was used to collect consumers' preferences about pork products and **contingent valuation methods** included in the survey were used to assess the value that consumers place on each of the four taste-related attributes. A **cheap talk** script was used to test for potential hypothetical bias.	**Probit models** were used to estimate whether or not to pay a premium: DV: binary variable (willing to pay for pork chops that are juicier, leaner, tenderer, and more marbled or not). Payment card interval data models (**Maximum Likelihood estimation**) were used to estimate the amount of premium for each attribute: DV: WTP value. IDV (for both models): experimental binary variable (whether the cheap talk script was present in the questionnaire), certifying agency, current meat consumption behaviour (whether have purchased branded or premium-priced fresh pork or beef in the past four months),	Fresh pork chops that are certified by USDA, Pork Producers Association, or absence of certifying agency (**certifying agency**) to be consistently juicier, leaner, tenderer, more marbled (**taste-related** superior) than standard USDA inspected products.

			consumer perceptions about pork attributes (price, juiciness, tenderness, marbling, leanness, and taste), health concerns, knowledge of marbling, age, sex, income, education, household size, and race.	
Differences in U.S. consumer preferences for certified pork chops when facing branded vs. non-branded choices Ubilava et al. (2008)	"To reveal and compare representative consumer's WTP for selected informational attributes of branded and non-branded pork" (p.2)	**A choice experiment** (**mailed survey**) was used to obtain the stated preference of individual U.S. consumers for branded or non-branded pork attributes as free of antibiotic, environmentally certified, and livestock well-being	**Conditional logit** model: treats individual as homogeneous in their consumption decisions; **Mixed logit** model (random parameter logit model): homogeneity assumption is relaxed and parameters are individual-specific. Two models: one with alternatives including the brand attributes and one with non-branded alternatives only. DV: choice IDV: brand attribute, price, product-specific characteristics, and interaction terms between product specific characteristics	Environmentally friendly production, antibiotic use, animal welfare certification, brand
Marketing opportunities for certified pork chops Nilsson et al. (2006)	"To characterize the demand and the potential marketability of credence certification programs for fresh pork cuts in United States" (p.567).	**Choice experiment (by mail)**: there are five alternatives, including a non-purchase option. Each alternative has five attributes: brand, price, and indicators for the certification programs	**Latent class model**: captures consumer heterogeneity via the error term and allows the indirect utility function to follow a discrete finite support. DV: choice IDV: brand, price, environmentally certified, certified for animal well-being, certified free of antibiotics, interaction terms between different certification	Brand (Hormel, Tyson, store brand, no brand), price, environmentally certified, certified for animal well-being, certified free of antibiotics

Consumers' willingness-to-pay for selected pork attributes in the republic of Georgia Ubilava (2006)	"To introduce some certainty concerning Georgian consumers' willingness to pay for selected pork attributes" (p.7) (colour, producer of origin, Stated Quality Assurance and store location)	**Choice experiment approach** (**in person survey without real samples**): to collect information about consumers' preferences for selected pork attributes (pork colour, state quality assurance, information about the producer and the store location); there are three alternatives including a "purchase neither" option. N= 159.	**Conditional logit** model: DV: choice; IDV: price, colour (fresh or not), producer origin, state quality assurance and store location	price, colour (if the colour of the meat is appealing, associates with "fresh" perception of meat), producer origin, state quality assurance and store location (convenient or not)
Quality certification vs. product traceability: Consumer preferences for informational attributes of pork in Georgia Ubilava and Foster (2009)	"To estimate consumers' preferences for food safety attributes with the goal of reducing the uncertainty concerning Georgian consumers' WTP for selected pork attributes" (p.306).	A **choice experiment**: to collect information about consumers' preferences for selected pork attributes (pork colour, state quality assurance, information about the producer and the store location); there are three alternatives including a no purchase option	**Conditional logit** model: treats individuals as homogenous in their consumption decision; **Mixed logit** model: the homogeneity assumption is relaxed and some of the attribute parameters are assumed to be individual-specific. DV: choice IDV: price, pork colour, quality certification from a governmental agency, producer traceability, store location and interaction terms between different attributes	price, colour (if the colour of the meat is appealing, associates with "fresh" perception of meat), producer origin, state quality assurance and store location (convenient or not)
Valuing animal welfare with choice experiments: an application to Swedish pig production Liljenstolpe (2005)	To estimate consumers' willingness to pay for animal welfare attributes when buying pork fillet among Swedish respondents.	**Choice experiment (questionnaire)**: four different survey versions, each containing four choice sets, each choice set included three alternatives. The first alternative referred to a base scenario, no additional price was attached, alternative 2 and 3 included an increase of the price due to higher level of	**Multinomial logit** model; Random parameter logit model (**mixed logit**): in order to be more consistent with statistical models of human behaviour. It is believed that the preferences are heterogeneous across respondents. DV: choice IDV: 13 animal welfare attributes and the socio-demographic variables (sex,	Price, transport (transports according to existing regulations and limited by time/distance; mobile slaughter system), castration (with/without anaesthesia, no castration), housing system, feed, mixing

		animal welfare. N=1,250	income and non-vegetarian)	of unfamiliar pigs allowed or not, minimum restriction of straw
Consumer preferences for biopreservatives in beef and pork packaging and testing the importance of product of origin Unterschultz et al. (1996)	"To evaluate Western Canadian consumers' preferences regarding the potential use of biopreservatives in fresh red meat packages (beef and pork) and the effect product origin on consumers' purchasing decision" (p. e).	**Mailed survey**: scaling method; **Stated preference method**: there are three alternatives where alternative C is to be chosen if neither descriptions of the product in alternatives A nor B are preferred. N = 530.	**Multinomial nested logit** models: DV: choice IDV: the price of the product, whether packaging includes biopreservatives, outside fat trim/ or fat content, product origin and packaging date ; family size, age, and income group	Price, whether packaging includes biopreservatives, outside fat trim/ or fat content, product origin (Alberta, Canada, U.S. or no origin is displayed) and packaging date
Characteristics of consumers demanding and their willingness to pay for certified safer pork Miller and Unnevehr (2001)	"To examine the relationship between consumer characteristics and attitudes about pork safety and willingness to pay for certified enhanced pork safety" (p.102).	A state wide **telephone survey**/ interview: The frequency of fresh pork consumption; Consumer concerns about pork products and their safety; Consumer willingness to pay for a certified safer pork product; Consumer confidence in certifying institutions; Socioeconomic and demographic data. N = 609.	For pork safety concern estimation: **binary logit** models: DV: dummy variable of pork safety concern (concern or not) IDV: education, gender, children, age, rural or urban, race, income, frequency of consumption. For WTP: **logit** models; **Multiple-bounded logistic regression** in which the evaluation of interactions is not allowed, providing less information about demographic determinants. DV: WTP for a certified safer pork product (4-level categorical variables); IDV: logit models: gender, ethnicity, location, income, concern, concern*education, concern * age;	Certified safer

			Multiple-bounded logistic regression: gender, location, income, concern, bid value	
Consumer Preferences for Animal Welfare Attributes: The Case of Gestation Crates Tonsor et al. (2009)	"(1) estimate consumer willingness-to-pay for alternative pork production practice attributes including use of gestation crates; (2) examine whether these preferences are related to preferences for farm size and country-of-origin attributes; (3) evaluate whether or under what conditions banning use of gestation crates may be justified on grounds of economic welfare enhancement; and (4) identify the distribution of welfare impacts of gestation crate bans across consumers" (p.714).	**A mail out survey** of consumers which included **choice experiment** that consumers were presented with a set of eight simulated shopping scenarios, each of which involved two pork alternatives varied at different price levels and pork chop attributes (farm size, production practice and country of origin) and an option "Neither is preferred". N=205.	**Random parameters logit** and **latent class models**. DV: choice IDV: Price and pork attributes	Price, farm size (large, median, small), production practice (typical, labeled gestation crate-free, gestation crate ban) and country of origin (United States, Canada, Brazil)
Valuing Environmental, Health and Social Benefits using Choice Modeling: a Comparison of the Implicit Prices of Food Attributes for Rural and Urban Consumers	"Primary, to measure and compare rural and urban consumer willingness to pay for specific food attributes of milk, tomatoes, and pork. Secondary, to calculate and evaluate changes in consumer welfare due to the	**Stated preference choice experiment (door-to-door distributed)**: the choice set presented four labelled alternatives respect to production practices with various sets of attributes. Sample size: 376 for rural and 368 for urban.	Two **multinomial logit** models were estimated for each product. DV: choice IDV: Model 1: only the alternatives' attributes and an alternative-specific constant (production system). Model 2: expanded to include non-attributes (socio-economic and demographic characteristics	Production systems (conventional, GM, organic, environmental management system), price, risk to human health, impact on the environment, and animal welfare

Yen (2009)	consumption of alternative products with various sets of attributes" (p.9).		(gender, income, education, language) and respondents' attributes and beliefs to food safety, food standard regulation, and factors influencing food purchasing decisions)	

A summary of the existing literature studying consumer preferences and behaviour for pork products is presented in Table 2.7. Although both stated preference methods, choice experiments and contingent valuation have been applied to elicit consumer willingness to pay for pork attributes, choice experiments have been more frequently used because of their advantages in evaluation of multiple attributes. Choice experiments allow estimation of trade-offs between different attributes, as compared to contingent valuation which is limited in valuation of one product or one attribute of a product (Uzea, 2009). Consumers were asked to make choices between alternatives with different combinations of attributes in the previously conducted choice experiments, whereas consumers were asked how much they were willing to pay for a product or an attribute or how much they were willing to pay more for the quality-improved products as compared to the conventional ones in the non-choice experiments (Dransfield et al., 2005; Miller and Unnevehr, 2001; Sanders et al., 2007). The choice experiments are usually conducted online, in person, door-to-door and by mail using a survey instrument. Real product samples are seldom used in the previous studies on pork although they have been used in for many other products such as Salmon (Alfnes and Steine, 2005; Olesen et al., 2010). Different probabilistic choice models can be derived to estimate data from the choice experiments, depending on the assumption about the distribution of the random component (error term) in the consumer utility function (Adamowicz et al., 1998). Multinomial logit models, conditional logit models and random parameter logit models (mixed logit models) have been commonly applied in the reviewed literature.

Credence attributes such as production practices (e.g. rearing systems, feeding, use of antibiotics/hormone, environment friendly), animal welfare, country of origin, quality assurance have been widely studied in the previous studies. With respect to search quality attributes, fat content/ outside fat trim, and colour have been studied as attributes in some of the previous choice experiments (Mørkbak et al., 2010; Ubilava, 2006; Ubilava and Foster, 2009; Unterschultz et al., 1996). Mørkbak et al. (2010) conducted an online survey consisting of a discrete choice experiment to assess consumer preferences for safety characteristics in pork. A total of 1322 Danish consumers participated in the survey where they were asked to choose between two hypothetical minced pork products (A and B) and the minced pork product they usually purchased (C) for six shopping scenarios. Alternative A and B were presented to respondents with different levels of attributes including price, production (conventional 'indoor' vs. alternative 'outdoor'), place of origin (domestic vs. foreign), Salmonella-free (labelled vs. not labelled), fat percentage (3-6, 7-10, 11-13 and above 13) and use of antimicrobial agents (existing rules vs. tightened rules). Their results showed that low fat received the highest price premiums as compared to other credence attributes. Unterschultz et al. (1996) also estimated consumer preferences for pork about visible fat by asking consumers (n=530) from the four western provinces in Canada (B.C., Alberta, Saskatchewan and Manitoba) to complete stated preference questions in a mailed survey. Respondents were asked to choose from three alternatives where A and B described products including different product characteristics (price, whether packaging includes biopreservatives, outside fat trim (no visible fat, trace of visible fat, about ¼ inch visible fat and more than ¼ inch visible fat), product origin and packaging date) and C was to be chosen if neither products in alternatives A and B were acceptable. In the study by Ubilava (2006), 159 Georgian respondents were asked to complete a survey including a hypothetical choice experiment. Each respondent completed 12 choice sets for pork with different attributes including price, colour (appealing colour associated with "fresh" perception of meat), producer of origin (label containing name and location), state quality assurance (the product carries the label issued by the state body assuring that product (production process) was inspected for safety standards and convenient store location (no extra trip to the store). Each choice set had three options, two product alternatives and an option of 'I would not purchase any of them'. A sample choice set is shown as Table 2.8. Georgian consumers were found to be willing to pay higher price premiums for colour which is a physical attribute of pork than credence attributes related to food safety regulation.

With respect to sensory quality attributes, Sanders et al. (2007) used the contingent valuation method to examine Illinois consumers' (n=1163) willingness to pay for hypothetical fresh pork chops described as being certified to be consistently juicier, leaner, tender, and more marbled in a mailed survey and found that about one-half of the respondents were willing to pay premiums for the attributes of juiciness, leanness, and tenderness. Tenderness and juiciness had the highest estimated premiums ($0.37). Physical and sensory quality attributes estimated in those previous studies were described hypothetically and therefore not evaluated on real products, whether different levels of these attributes could be distinguished by consumers and influence consumers choices and WTP when real samples of pork are presented to consumers is an open question.

Table 2.8 Sample Choice Set in the Study by Ubilava (2006)

	Alternative	Alternative	Alternative
Price	8.5 GEL/kg	9.5 GEL/kg	I would not
Color	Yes	Yes	
Info About Producer	No	Yes	purchase
State Quality Assurance	Yes	Yes	
Convenient Location	Yes	No	any of them
If I was buying pork, I would	☐	☐	☐

Source: Ubilava (2006, p.34)

As compared to the revealed preference method, the stated preference method is the one that is most relevant to this study allowing the evaluation of consumers' preferences for pork with combinations of attributes that are not available in the market yet. Out of the three types of stated preference methods, the discrete choice experiments are the most suitable for this study to estimate trade-offs between different attributes. Although price and credence attributes have been the most commonly evaluated attributes in the literature, some researchers (Mørkbak et al., 2010; Ubilava, 2006; Ubilava and Foster, 2009;

Unterschultz et al., 1996) also included physical attributes such as colour, visible fat in their choice experiments in addition to prices and credence attributes. In this study, physical attributes as well as price and credence attributes will be used in the choice experiments in Edmonton and national studies, which allow the comparison of the value of physical attributes and credence attributes by consumers. Real pork chops will be presented to participants in the choice experiment in Edmonton in order to identify whether differences in individual physical attributes of fresh pork chops can be distinguished by consumers and have effects on their choices or not. This also allows us to associate those physical attributes affecting consumer purchase decisions with other characteristics and factors in the supply chain helping the pork industry produce products with consistent quality attributes preferred by consumers. Because a larger sample of consumers at different locations is involved in the national survey, alternatives will be presented to participants as photographs online with computer-modified marbling as suggested by Verbeke et al. (2005).

2.6 REVIEW OF MEAT SCIENCE STUDIES ABOUT CONSUMER PREFERENCES FOR PORK APPEARANCE ATTRIBUTES

In the economics field, in only a few studies (Mørkbak et al., 2010; Ubilava, 2006; Ubilava and Foster, 2009; Unterschultz et al., 1996) appearance and sensory quality attributes of pork have been examined while in the field of meat science, consumer preferences for appearance and sensory quality attributes of pork have been widely studied. Since consumer appreciation of sensory quality attributes has been reviewed in 2.2, consumer preferences for appearance quality attributes are reviewed in the following two subsections.

2.6.1 CONSUMER PREFERENCES FOR APPEARANCE QUALITY ATTRIBUTES

At the point of first purchase, appearance attributes are important quality cues for consumers in evaluating fresh meat with limited information (Brunsø et al., 2005). They are taken as predictors of experience quality attributes, for example, eating quality (Grebitus, 2008; McEachern and Schröder, 2004; Sundrum, 2007). There have been many studies (Brewer et al., 2001; Chen et al., 2010; Fortomaris et al., 2006; Ngapo et al., 2010; Ngapo et al., 2004, 2007a, 2007b; Verbeke et al., 2005) conducted to identify the most important appearance characteristics of fresh pork in determining consumer choices. Colour, fat cover, marbling and drip loss have been the most frequently studied characteristics. In most of those studies (Chen et al., 2010; Fortomaris et al., 2006; Ngapo et al., 2004, 2010, 2007a, 2007b; Verbeke et al., 2005) consumers were asked to choose their preferred pork chops from a book of computer-modified images with 8 choice sets. Each choice set contained "photographs of 16 commercial pork chops that were computer-modified to give two levels of each of the characteristics: fat cover (averages of 8% or 17% chop surface area for lean or fat chops, respectively), colour (average CIELAB L* of 64 or 56, and a* of 18 or 24 for light and dark red chops, respectively), marbling (absent or about 1.5% of the muscle area) and drip (absent or 5.5% of the chop area)" (Ngapo et al., 2010, p.3). Consumers were also asked to finish a questionnaire on socio-demographic information for the estimation of individual demographic and cultural influences on their preferences for pork chops. Different consumer clusters varying by demographics in different countries had different preferences for the appearance attributes of fresh pork chops, but generally, colour and fat cover were found to be the most influential factors, there were consistent preferences for pork chops with no drip while preferences for colour (dark or light), fat cover (lean or fat), marbling vary by demographics and countries (Chen et al., 2010; Fortomaris et al., 2006; Ngapo et al., 2004, 2010, 2007a, 2007b; Verbeke et al., 2005). Canadian consumers in Alberta and Quebec were observed to prefer pork chops that are light red in colour, with thin fat cover, no marbling and no drip (Ngapo, et al., 2010).

2.6.2 CONSUMER PURCHASE INTENT BASED ON VISUAL EVALUATION OF REAL MEAT

Brewer et al. (2001) evaluated whether consumers detect differences among pork loin chops with low, medium and high amounts of marbling when they are visually evaluated. In the Meat Sale Room at the University of Illinois, 150 panellists, recruited from the resident population in the Champaign-Urbana, Illinois area, visually evaluated pork chops in a display under fluorescent light (GE cool white, 1,860 lux). Purchase intent was evaluated first using a 5-point category scale where 1=wouldn't buy and 5 = would buy. Then colour, marbling and overall acceptability were visually evaluated using a 5-point category scale ranging from very light pink to dark pink, very lean to highly lean, very unacceptable to very acceptable. Means and standard deviations of these evaluations were calculated in three marbling categories (low, medium and high) containing an average of 1.05, 2.33 and 3.46% fat, respectively. Results showed that consumers were able to distinguish marbling differences and had higher overall acceptability scores and purchase intent means for pork chops with a low or medium amount of marbling than those with a higher level of marbling. Lean pork chops were also observed to be darker pink than highly marbled chops based on consumer evaluations. Means for appearance characteristics of chops in the purchase intent categories also showed chops in the higher purchase intent category were darker pink.

Brewer and McKeith (1999) conducted another similar study to evaluate consumer perception of colour, wet-dry appearance, and acceptability characteristics of PSE (pale, soft and exudative), DFD (dark, firm and dry) and normal pork and related these characteristics to purchase intent. Consumers were found to have the ability to discriminate among pork of varying colours and appearance (wet/dry). Comparing means for visual characteristics of pork in different purchase intent groups, pork chops that appeared to be the most wet were observed to be in the "would buy" category, which was different from the results of the literature discussed about consumer preferences for appearance attributes of fresh pork chops that no drip was preferred. A more intensely pink sample was also observed to have higher purchase intent. Pearson correlation coefficients in this study indicated a relationship between overall acceptability and purchase intent ($r = 0.58$), while the relationships between colour, wet/dry appearance, and overall acceptability were relatively low ($r < 0.2$). The best prediction equation for purchase intent included acceptability, colour and wet/dry appearance (linear, quadradic and cubic effects).

Consumers have been found to have the ability to distinguish appearance quality attributes with different levels and generally consumers have been found to prefer pork with low fat/lean (consistent with the results found in marketing economic studies) and no drip. Although colour is an important cue for consumers, preferences for it differ among consumers.

Consumers try to form expected sensory quality based on appearance attributes of the pork at retail place (Grebitus, 2008; McEachern and Schröder, 2004; Sundrum, 2007). However studies have found that there is a disparity between consumers liking and/or purchase intent for pork based on visual evaluation and that based on sensory evaluation, liking of pork with different levels of marbling is a typical case. Fernandez et al. (1999b) found a decrease in consumer willingness to eat and purchase in correspondence with an increase in intramuscular fat (marbling) level before tasting the pork. Acceptability of the pork improved later after consumers had eaten the meat based on their perceptions of texture (e.g. juiciness and tenderness) and taste. They suggested that consumer perception of texture and taste of pork increase with increasing intramuscular fat or marbling level up to 3.5%, a threshold that is considered to decrease consumer acceptability due to increased visual fat. Brewer et al. (2001) also found that the pork with a low or a medium marbling level received higher consumer acceptability based on the visual evaluation while pork with higher marbling levels was scaled higher in tenderness, juiciness and flavor. Only pork with appearance attributes that attract consumers to purchase and have consistent preferred sensory qualities can maximize returns. The choice experiments using real pork chops in Edmonton will allow us to assess consumer preferences for pork appearance quality attributes and the consumer sensory tests will allow us to estimate whether consumer acceptability of sensory quality attributes differ from preferences for appearance attributes and ultimately identify pork quality attributes with consistent value to consumers.

2.7 SUMMARY

In this study quality definition from different dimensions, basically, focusing on suppliers and final consumers is the objective. In any highly competitive market, the critical quality characteristics of pork are determined by final consumers. In response to consumers' increasing interests in production systems, traditionally raised pork is one type of production system introduced by the Canadian pork industry as an alternative to conventional pork. New production systems are an attempt to capture price premiums and increase returns. However to achieve higher returns traditionally raised pork needs to be valued more highly than conventional pork by consumers. However based on this review, previous results about differences in quality between production systems varied by study making it necessary to evaluate and compare quality between products from traditionally raised and conventional systems in the current study. In addition, quality of a product in general, specifically pork, is complex consisting of multiple dimensions. Quality characteristics regarding hog carcass, meat and sensory quality across the supply chain will be measured in this study for traditionally raised and conventional pork. Different quality parameters from both objective and subjective dimensions as defined by Grunert (2005) were decided based on literature review. Sensory quality, objectively belonging to product-oriented quality, is experience quality from a subjective dimension, a quality which plays an important role in consumer repeat purchases. Sensory quality traits will be assessed by consumer acceptance of the pork chops from the two production systems. The review of relationships between different quality traits and determinants of individual traits provides the background necessary to identify relationships between quality traits within each of the studied production systems and for estimating the variation in the individual traits which is important to product quality optimization. Identifying the value of pork with different quality attributes in the eyes of final consumers is important for quality differentiation and profit maximization strategies. Consumers make purchase decisions based on their perceptions about a product through search, experience and credence (which could be informed by labeling or certifications) attributes. Consumer preferences about production system, certification of production system, country of origin and on farm food safety control which are credence attributes that consumers cannot observe either before or after consuming the products will be assessed through choice experiments and calculated WTP for pork chops with different labels. Based on the review of consumer theory, random utility theory and previous economic studies estimating consumer preferences and WTP, consumer stated choice experiments, which have been widely applied because of their advantages in the evaluation of multiple attributes, will be used to collect data on consumer preferences and WTP for pork chops with different combinations of quality attributes in this study. Consumers have been found to be able to distinguish pork with different levels of appearance quality attributes such as colour, drip loss, marbling and have preferences for those attributes. In previous studies the value of appearance quality attributes for consumers has been identified through hypothetical experiments where respondents made choices between hypothetical alternatives described in questionnaires rather than real products. In the current study, pork chops will be presented to participants as photographs with marbling as the only variable physical indicator controlled with two levels, less marbling and more marbling, in the national online survey. Real pork chops will be provided to respondents in the Edmonton experiment from slaughtered hogs from the two production systems in order to identify whether consumers can distinguish differences in appearance quality attributes in packaged fresh pork chops and whether these attributes affect their choices and willingness to pay for specific pork chops as compared to credence quality attributes. The number of alternatives in the consumer stated choice experiments conducted in previous studies differ, there will be three alternatives designed in the choice experiment in this study similar to most of the previous studies (Mørkbak et al., 2010; Olynk et al., 2010; Tonsor et al., 2009; Ubilava, 2006; Ubilava and Foster, 2009; Unterschultz et al., 1996), two product alternatives and a no-choice option of "I would not purchase either of these products". The no-choice option has been included in many choice experiments to avoid forcing respondents to choose one alternative from a choice set since in real life a consumer might not buy any of the alternatives if none of them offers sufficient utility. Adamowicz et al. (1998) suggested that "one should design stated choice (SC) experiments to allow one to observe and model non-choice because it is such an obvious element of real market behaviour" (p.23). Goos et al. (2010) also strongly recommend including a non-choice option in each choice set when designing a choice experiment. Based on consumer theory, not only product attributes but also consumer characteristics contribute to explaining consumers' purchase decisions, therefore, a survey is also designed in order to understand consumers' attitudes and perceptions about food quality and their effects on consumers' choices.

From the literature, technical quality traits (carcass, meat and sensory quality traits) and consumer choices and willingness to pay for pork with different quality attributes (e.g. credence attributes presented by labels or certification and appearance attributes) have been assessed separately in meat science studies and economic studies, respectively. There is lack of research which has linked what is assessed in meat science, in consumer science and that in economic studies together. This study is to link hog grading, meat and sensory quality and consumer choices and willingness to pay to identify the optimal quality combinations of pork and for the pork industry to produce animals with quality attributes which have consistent values across the pork value chain so that profit maximization can be achieved.

CHAPTER 3 METHODOLOGY

3.1 INTRODUCTION

The aim of this chapter is to give a detailed description of the methods used to collect data in this study. Data in this study were collected in Edmonton in 2009 and across Canada in 2011. In the Edmonton research, data were collected in terms of hog grade, meat quality, consumer sensory quality, consumer stated preferences and consumer attitudes and perceptions of quality in order to estimate the quality of pork from two different production systems (traditionally raised versus conventional) and to assess consumer willingness to pay for pork from the two production systems labeled as Canadian pork or with Canadian Quality Assurance (CQA®) label. A national survey was conducted online asking participants to choose packaged pork chops with the same labels as examined in the Edmonton experiment which allows us to get a broader sample of consumers and have a better understanding of consumer purchases of pork chops in Canada.

3.2 DATA COLLECTION IN EDMONTON

In this research, the quality of pork is estimated through hog carcass information (e.g. hog grade), instrumental meat quality measurements, consumer sensory testing and consumer stated preferences for real packaged pork products from conventional and traditionally raised hogs. DNA markers are used to track pork chop identity through the various stages of analysis. Most of the description about the data collection in Edmonton below is similar to the description in the paper by Goddard et al. (2011).

Data for this study were collected in 2009 over the period October to December. Over the course of the study, 200 hogs from each of two specific operations (conventional and traditionally raised) were transported to, and processed on 5 different dates at Sturgeon Valley Pork (SVP; St. Albert, AB) according to a single slaughter and sample harvest process, with 40 hogs from each production system harvested on each occasion. The aim of sourcing hog from two operations and slaughtering all hogs at the same facility was to minimize differences in hog and meat quality associated with geography, management and slaughter techniques. The hogs were graded with respect to the SVP (Sturgeon Valley Pork) grid.

Following slaughter and processing, whole carcasses were chilled overnight. On the following day, both left and right shortloins were removed from each carcass, prepared as boneless, trimmed to the silverskin, wrapped in plastic sheeting, placed in groups of four (two loins from each of two carcasses) in bar-coded and labelled boxes, and moved to short-term (between 6 and 16 days) frozen storage.

In advance (1-4 days) of further processing, the frozen, boxed product was shipped to the Alberta Agriculture and Rural Development Food Processing Development Centre (FPDC; Leduc, AB) where the boxes in each shipment were labelled according to production system (Conventional, Traditionally raised) and animal number (1-200), and returned to frozen storage (-24°C). Prior to further processing, the loins were removed from the boxes, organized onto rolling racks, and returned to the freezer. On the morning of further processing, the racks of loin samples were moved to the processing area (7°C). From each pair of loins (i.e. the left/right loins collected from a given carcass), samples were prepared for each of the three analysis streams: meat quality analyses, economics experimentation, and consumer sensory testing.

For meat quality analyses, a loin section of at least 22 cm (8 inches) was prepared from each animal, vacuum packaged, and placed in frozen storage. At the conclusion of all sample collection days, boxed, frozen samples were shipped to the University of Alberta for analysis. Meat quality indicators, pH (average), colour (average colour L*, average colour a*, average colour b*), drip loss and cooking loss (percentages) and shear force (average), were measured.

One pork loin from each pair was prepared as a series of 2 cm thick pork chops for use in the economics experiment. The pork chops were placed in pairs (superficial surfaces towards the outside) on dri-loc pads in labelled foam trays (approximately 14 x 20 x 2 cm, Cryovac, Sealed Air Corporation, local representative: Leduc, AB), and overwrapped (Torrey 450E hand wrapper, Halford Hide, Edmonton, AB) with gas permeable stretch film. 80 packages were required for each evaluation day. The packages were placed in boxes, held in refrigerated storage, and then transported to the Alberta Agriculture and Rural Development Consumer Product Testing Centre (CPTC; Edmonton, AB) where the economics experiment was conducted two days later in conjunction with consumer sensory testing.

For consumer testing, two 2 cm thick chops were cut from one loin in each loin pair, labelled, and individually vacuum packaged (Multivac M855 rollstock thermoformer, Woodbridge, ON). These samples were boxed and placed in refrigerated storage, then transported to the CPTC for evaluation two days later.

Consumer panellists were recruited from the panellist database maintained by the Alberta Agriculture Consumer Product Testing Centre Sensory Evaluation Program. To be eligible for participation, the panellists were required to be "users and likers" of pork chops and available to attend a 90 minute test session encompassing both the consumer test and the economics experiment. Demographic information (age, gender, income bracket, education level) was also collected from eligible panellists such that the final list of participants contained a balanced representation of the adult population in Edmonton, as compared to the Census from 2006. Ultimately, 197 consumer panellists participated in the study, and each was compensated with a $60 honorarium.

Consumer Sensory Testing

With a participant target of 200 consumer panellists, the testing of 200 pork chops from each production system was designed such that each panellist evaluated samples (sample = ½ pork chop) from four different pork loins within each production system treatment. This plan resulted in 8 treatment combinations (2 production systems x 4 replicate loins) assessed by each panellist and four replicate consumer evaluations (panellist blocks) within each pork loin. Treatment presentation order was balanced across panellist blocks according to a Latin square design. On each test day, five 90-minute evaluation sessions were scheduled, with a maximum of 8 panellists attending each session.

Immediately prior to each evaluation session, 32 individually packaged pork chops (16 per treatment x 2 treatments) were removed from refrigerated storage, unpackaged, and organized for cooking in two batches of 16. Cooking was conducted by grilling the chops on an electric broiler/grill (Garland ED-42, Russell Food Equipment, Edmonton, AB), preheated to 210°C, while monitoring internal product temperature. The samples were flipped when their internal temperature reached 40°C, and removed from the grill when a final internal temperature of 72°C was reached. Total cook time for any given pork chop was ~20 minutes. Cooked chops were labelled and moved to the sample preparation area where they were cut in half, the halves were individually wrapped in aluminum foil, re-labelled with a treatment-specific three-digit code, and placed in an environmental chamber (60°C) until required for serving at the start of the evaluation session (within ~5 minutes).

Upon arrival at the CPTC, panellists received verbal instructions about the evaluation task, reviewed a project information sheet, and completed both an Alberta Agriculture and Rural Development waiver and a University of Alberta research consent form. Panellists were then seated at individual testing booths where the cooked product evaluation questionnaire was presented electronically using Compusense five software (v. 5.0, Compusense Inc., Guelph, ON). Samples were presented to the panellists in a sequential monadic manner, according to the predetermined experimental design, on 15 cm white foam plates, labelled with sample-specific three-digit codes. Unsalted crackers and room temperature water were provided as palate cleansers. Panellists were asked to provide opinions about the appearance, tenderness, juiciness, flavour, and overall acceptability of each sample using 9-point hedonic scales on which 1=dislike extremely and 9=like extremely. Additional questionnaire space was provided in which panellists could record unstructured commentary about each sample. At the conclusion of sample evaluation, demographic data (gender, age, household structure, education level, employment status, income bracket, and typical pork shopping venue) were collected from each panellist. Questionnaire for cooked product evaluation is attached as appendix A.

After the consumer sensory testing, panellists were then instructed to proceed to a separate room to complete the economics experiment which included a survey of consumer attitudes and perceptions about food quality and relative issues and consumer stated preference choice experiments.

Economics Experiment

All packaged pork chops were labelled with the normal fresh meat product label containing safe handling instructions, best before date, product price, weight and actual package price. Products were priced at four different levels (from $8.82 per kg to $15.07 per kg). In addition, based on a fractional factorial design, products were labelled as traditionally raised (if they were from that operation) certified by the Canadian pork industry or by government or uncertified, as Canadian pork or as CQA® pork which results in a total of 16 combinations as presented in Table 3.2 for the identification of the best combination of pork attributes. Panellists were provided with an information sheet showing what the various labels meant (Appendix B) and were asked to complete a stated preference exercise, for eight pairs of real packaged pork chops. There are three options for each choice set, two product alternatives (A and B) and a no-choice option labeled as "I would not purchase either of these products". Figure 3.1 and 3.2 provide examples of choice sets. The levels of product attributes are summarized in Table 3.1.

Table 3.1 Summary of Attributes, Edmonton Experiment

Price (CN $/kg)	Country of Origin	Production Practice	Quality Assurance	None
$8.82	Canadian Pork (CP)	Conventional (CON)	CQA® (CQA)	I would not purchase either of these products
$11.02	Not Canadian Pork	Traditionally Raised (TR)	Not CQA®	
$13.23		Industry Certified Traditionally Raised (CTR)		
$15.43		Government Certified Traditionally Raised (GTR)		

Table 3.2 Combinations of Pork Credence Attributes

Conventional	Traditionally raised	Industry certified traditionally raised	Government certified traditionally raised
Conventional with Canadian pork label	Traditionally raised with Canadian pork label	Industry certified traditionally raised with Canadian pork label	Government certified traditionally raised with Canadian pork label
Conventional with CQA®	Traditionally raised with CQA®	Industry certified traditionally raised with CQA®	Government certified traditionally raised with CQA®
Conventional with both Canadian pork and CQA® labels	Traditionally raised with both Canadian pork and CQA® labels	Industry certified traditionally raised with both Canadian pork and CQA® labels	Government certified traditionally raised with both Canadian pork and CQA® labels

Figure 3.1 Example of a Choice Set - Edmonton

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.

CHOICE SET 1

Pork chop Attribute	**A**	**B**	**C**
Price ($/kg.)	$15.43	$15.43	I would not purchase either of these products
Country of Origin	Canadian Pork		
Production Practice	Traditionally Raised Certified	Traditionally Raised	
Quality Assurance		CQA®	
I would choose . . .	○	○	○

Figure 3.2 Example of a Choice Set - Edmonton

Panellists were also asked to complete a survey of their attitudes and perceptions about food quality and relative issues (Appendix C) after finishing the stated choice experiment, which allowed us to estimate consumer choices with respect to both product and consumers. A large part of the survey was designed based on a similar survey in the study by Romanowska (2009) aimed at understanding determinants of consumer choices of certification of eggs with credence attributes. The first question was designed to measure a general level of consumer trust, which was: "Generally speaking, would you say that most people can be trusted?" Respondents were given three options which were: "People can be trusted", "Can't be too careful in dealing with people" and "Don't know". This is one of the attitudinal survey questions which are used by most social scientists to measure trust (Glaeser et al., 2000). When there is a lack of knowledge about food, consumers have been found to use trust in actors and regulators in food chain as compensation (Berg, 2004; de Jonge, 2008; Green et al. , 2003; Siegrist and Cvetkovich, 2000; van Kleef et al., 2006). de Jonge (2008) found that "consumer trust in societal actors strongly influence general consumer confidence in the food safety and the strength of the relationship between them depends on the specific actor in food chain, the specific dimension of trust, and the specific combinations between actors and different dimensions of trust" (p.8). As de Jonge also stated general consumer confidence results in particular food choice behaviours, it is assumed that consumer trust affects consumer choices of pork chops with different quality attributes. Results observed by Romanowska (2009) showed that general trust had a more significant effect on the certifying agent than the product attribute in the case of eggs.

In the study by Miller and Unnevehr (2001) examining the relationship between consumer characteristics and attitudes about pork safety and willingness to pay for enhanced pork safety, individuals who were more concerned about pork safety were observed to be willing to pay more for enhanced safety and lower consumption of pork was found to be associated with higher pork safety concern. In their survey, a question regarding pork consumption was: "How often do you eat pork products such as pork chops, bacon, sausage, or ham at home? Would you say… (1) Never? (2) Less than once a month? (3) 1-2 times per month? (4) 3-4 times per month? (5) Or more times per month? (p.118)" Bryhni (2002) and Bryhni et al. (2003) also found a positive relationship between pork consumption frequency and consumer liking of pork such that consumers who eat pork more often were more satisfied with the sensory quality of pork. The respondents in their studies were asked to answer a question as "How often do you eat pork (e.g. roast pork, loin chops)?" with four options namely "Less than once a month", "One to three times a month", "One to three times a week", and "four times a week or more often" (Bryhni, 2002, p.259). These results lead to a hypothesis that consumption frequency of pork can influence consumer choices and willingness to pay that those consumers who eat pork more often may be stable with pork quality and have a lower probability of choosing new quality enhanced pork chops. Participants in this study were asked a question of pork eating frequency as

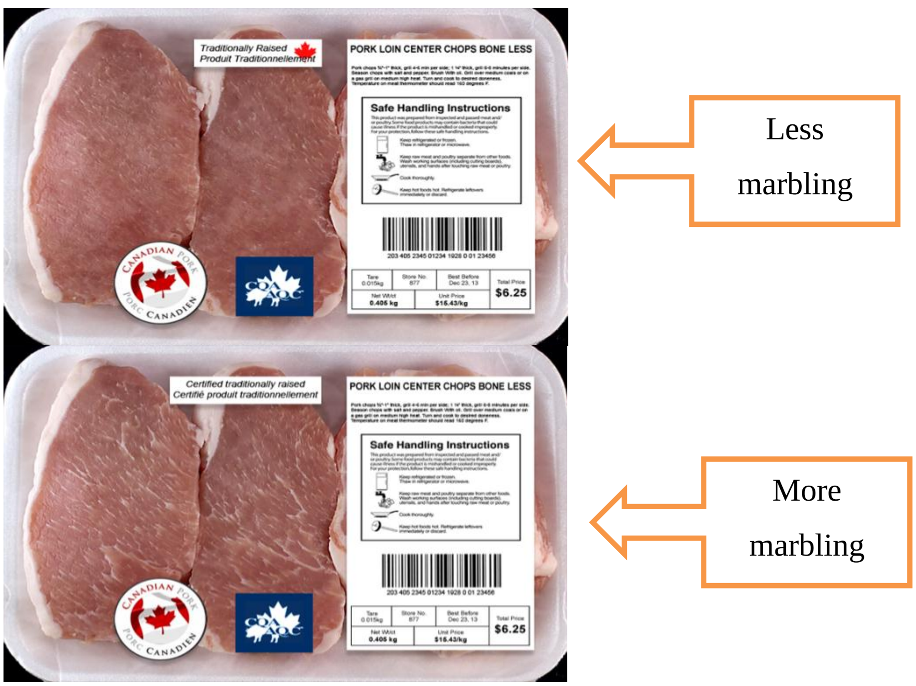
“How often do you eat pork?” with four options ranked from 1 to 4 which were “Fewer than two times per year”, “Once per month”, “Once per week”, and “More than once per week”.

Respondents were also asked to compare traditionally raised pork to conventional pork in terms of taste, freshness, healthiness, containing hormones, containing antibiotics and safeness to eat in order to identify the effect of consumers’ prior beliefs about traditionally raised pork on their choices and willingness to pay for pork chops with different quality attributes. The questions were posed as follows: “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”. Respondents were given options as follows: “Strongly agree”, “Agree”, “Neutral/ No difference”, “Disagree”, “Strongly disagree”, and “N/A / No opinion”. These questions were similar to those used by Romanowska (2009) comparing free range eggs and vitamin enhanced eggs to normal eggs. Verhoef (2005) also asked people to compare organic meat to ordinary meat by using a question as follow: “How do you think of the … of organic meat in comparison to the … of ordinary meat? Are these attributes (taste, smell, succulence, outside, and freshness) much worse, worse, as good as, better or much better than those of ordinary meat? (p.265)” and found that people who thought the attributes of organic meat were better than ordinary meat were more likely to purchase organic meat on the basis of which, a hypothesis for this study as people who think the attributes of traditionally raised pork are better than conventional pork are more likely to choose traditionally raised pork and be willing to pay more for traditionally raised pork as compared to conventional pork.

3.3 NATIONAL SURVEY

In order to enhance demographic variation and get a better understanding of consumer preferences for pork chops with different combinations of quality attributes across Canada, in July 2011, 1603 Canadians completed a national online survey with stated choice for pork chops with the same labels (same experimental design) as examined in the Edmonton experiments. The differences between the experiments in Edmonton and in Canada are that, because the sample in the national survey is large and at different location across the country, alternatives were presented as photographs instead of real pork chops as suggested by Verbeke et al. (2005) and marbling was the only variable physical quality indicator which was controlled at two levels, less marbling and more marbling. Figure 3.3 shows an example choice set of pork chops with less and more marbling.

Figure 3.3 Examples of Pork Chops with Less and More Marbling – National



3.4 SUMMARY

In this chapter, experimental design and procedures of this research were detailed. For the Edmonton study, hog grade and measures of meat quality were collected for 200 hogs from each of the production systems. A total of 197 pork consumers participated in both consumer sensory testing and economics experiment including consumer stated choice experiment and a survey of consumer attitude and perceptions about food quality and relative issues. Due to missing data, data on sensory quality evaluation is only available for 180 hogs from each of the production systems. A total of 1603 Canadians participated in the national online survey with no missing data providing a large number of responses which can be the basis for better predictability of consumer purchases of pork chops in Canada with a wider range of demographic variation. On the other hand, comparing results from the Edmonton sample to the results from a national sample will allow a better understanding about whether the sample from the Edmonton study is representative of the national population in terms of their attitudes, choices and willingness to pay for traditionally raised pork.

CHAPTER 4 EMPIRICAL RESULTS FOR MODELLING OF DISTINCTIONS BETWEEN TRADITIONALLY RAISED AND CONVENTIONAL PORK

4.1 INTRODUCTION

The aim of this chapter is to present study results characterizing the differences between traditionally raised and conventional pork in terms of hog characteristics, meat quality and sensory quality. First, descriptive statistics for hog carcass, meat and sensory quality traits including the minimum, maximum and mean values, standard deviation, and coefficients of variation allowing comparison of the variability between variables measured in different units are presented by slaughter day for the two production systems in order to summarize and compare the performance of traditionally raised and conventional hogs slaughtered on the five different days. Second, the correlation coefficients among hog grade, meat and sensory quality traits, which were calculated for the two production systems by slaughter day in order to understand the correlations among different quality traits and to observe if correlations are different between the two production systems, are discussed. In the last section, equations to predict hog grade, meat quality and sensory quality were estimated simultaneously by multivariate regression analysis. These regression equations were focused on identifying whether attributes differ by production system and by slaughter day within each production system. All of those analyses will provide important information to the pork supply chain.

4.2 COMPARISONS OF HOG CARCASS, MEAT AND SENSORY QUALITY TRAITS ACROSS SLAUGHTER DAYS FOR THE TWO PRODUCTION SYSTEMS

Statistical analysis was done regarding hog carcass, meat and sensory quality parameters by slaughter days for the two production systems in order to do comparisons between the two production systems (Appendix D). Casteels et al. (1995) and van der Wal et al. (1997) found day of slaughter significantly affected most of the intrinsic quality parameters they investigated and Enfält et al. (1997), van der Wal et al. (1997), Olsson et al. (2003), Pugliese et al. (2004) etc. have found some differences in quality between different production systems, therefore differences regarding different quality traits across slaughter days between the two production systems would be expected. The slaughter dates of hogs from the two production systems are listed in Table 4.1 below.

Table 4.1 Hogs Slaughtered on the Five Slaughter Days for the Two Production Systems (Conventional and Traditionally Raised)

Treatment	Hog Numbers	Slaughter date
Conventional	C1-40	04/11/2009
Traditionally Raised	N1-40	05/11/2009
Conventional	C41-80	10/11/2009
Traditionally Raised	N41-80	12/11/2009
Conventional	C81-120	17/11/2009
Traditionally Raised	N81-120	19/11/2009
Conventional	C121-160	24/11/2009
Traditionally Raised	N121-160	26/11/2009
Conventional	C161-200	01/12/2009
Traditionally Raised	N161-200	03/12/2009

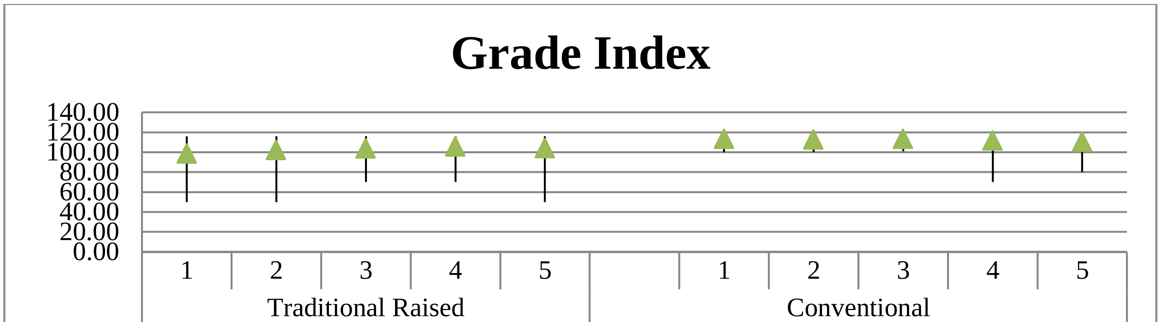
The measures of hog carcass quality, meat and sensory quality for the hogs from each of the five slaughter days show differences across the two production systems. In the case of hog carcass quality [1](Figure 4.1), differences in standard

[1] Hog carcass quality including settlement weight, probe lean yield and hog grade was measured at Sturgeon Valley Pork (SVP; St. Albert, Alberta, Canada).

deviations (Appendix D) between the two production systems show that there is a greater dispersion of grade indexes for the traditionally raised hogs as compared to the conventional hogs and traditionally raised hogs generally had lower means for hog grades. Means of settlement weight for the five slaughter days for traditionally raised hogs were significantly different, hogs slaughtered on Nov. 5^{th}, 2009 had a significant in heavier average settlement weight than hogs slaughtered on other days, but there is no significant difference observed between the two production systems (Appendix E).

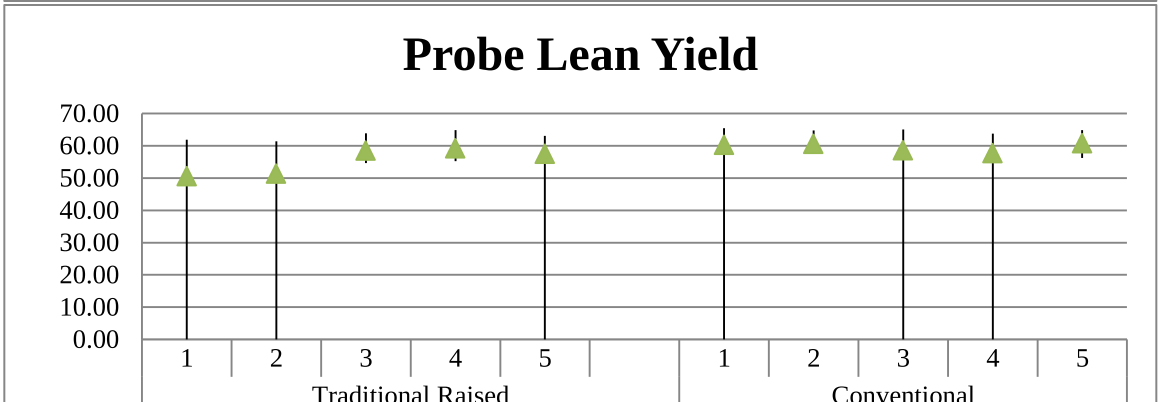
Probe lean yield, which was referred to by Fortin et al. (1984) as a primary determinant of carcass value in the hog grading system, was observed to have a lower mean for traditionally raised hogs as compared to conventional hogs. With regard to differences across slaughter days, there is a wider distribution of probe lean yield for the traditionally raised hogs slaughtered on Nov. 5^{th}, Nov. 12^{th}, and Dec. 13^{th} and conventional hogs slaughtered on Nov. 4^{th}, Nov 17^{th} and Nov.24^{th}; the means of probe lean yields across the five slaughter days were not significantly different (Appendix D) within the conventional system while average probe lean yields were significantly higher from hogs slaughtered on the last three days as compared to hogs slaughtered on the first two days within the traditionally raised system. Statistics regarding carcass weight in this study confirm results observed in the previous studies that carcass weight is not significantly different between hogs from outdoor or free range rearing and indoor or regular rearing systems (van der Wal et al., 1993; Enfält et al., 1997; Sather et al., 1998). In the case of carcass lean yield, results from previous studies vary, results in this study are in accordance with what Olsson et al. (2003) and van der Wal et al. (1993) found conventionally raised hogs had higher lean meat percentage than organically or free range raised hogs. Measures of carcass quality also show some differences across hogs slaughtered on different days which is similar to results observed by van der Wal et al. (1993) who assessed quality of free range hogs as compared to regularly farmed hogs. In their experiments hogs were slaughtered in three slaughterhouses while hogs in this study were slaughtered in the same slaughter facility.

Figure 4.1 Comparison of Hog Carcass Quality (Hog Grade Index, Settlement Weight (kgs) and Probe Lean Yield (%)) across Slaughter Days for the two Production Systems



	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	116.00	116.00	116.00	116.00	116.00		116.00	116.00	116.00	116.00	116.00
min	50.00	50.00	70.00	70.00	50.00		100.00	100.00	101.00	70.00	80.00
▲mean	98.60	102.18	103.78	105.50	104.05		113.33	112.68	113.35	111.55	110.38

	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	117.00	119.00	108.00	105.50	109.00		114.50	107.00	106.50	107.00	106.50
min	86.50	84.00	83.00	86.00	83.00		85.50	85.50	85.00	86.50	81.50
▲mean	98.45	93.96	94.69	93.33	95.38		94.05	95.01	94.08	94.38	94.74



	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	61.90	61.40	63.90	64.90	63.10		65.50	64.80	65.10	63.80	64.90
min	0.00	0.00	54.60	55.20	0.00		0.00	57.50	0.00	0.00	56.20
▲mean	50.58	51.36	58.48	59.14	57.48		60.21	60.58	58.61	57.63	60.76

In the case of meat quality[2], pH, which is known as an important meat quality indicator influencing the water-holding capacity and the colour of the meat (Enfält et al., 1997), had significantly lower mean values for traditionally raised pork as compared to conventional pork. Both traditionally raised and conventional pork across five slaughter days show very limited variation in pH. Conventional hogs slaughtered on November 17th and November 24th had meat with lower pH mean values than hogs slaughtered on the other three days but the differences were not significant according to the significance test at the 10% significant level. Traditionally raised meat showed significant differences across the five slaughter days; traditionally raised hogs slaughtered on the last three days had meat with higher pH, on average, than hogs slaughtered on the first two days. The means of the average pH values of meat from traditionally raised and conventional hogs slaughtered on the five different days fall between 5.47 and 5.55 which fall into the optimum range of pH in the guidelines for certified pork provided by the Central Marketing Agency for Agriculture Products (CMA) in Germany (Honikel, 1993) while they are slightly lower than the normal range of pH (between 5.8 and 5.6, levels for the best quality pork which is reddish pink, firm and non-exudative) referred to by Gunenc (2007). The differences between production systems in the present study are similar to the results observed by Enfält et al. (1997) who estimated the effects of outdoor rearing on carcass, technological and sensory meat quality in pigs reared conventionally indoors and outdoors in a 50000 m^2 area from August to November, slaughtered and graded in a commercial slaughter house. Nilzén et al. (2001), Pugliese et al. (2004) and Gentry et al. (2002) found no differences in pH values between free range/outdoor-reared and indoor-reared pork meat. According to the literature review in chapter 2 (2.2.1), traditionally raised pork with lower pH value is expected to have lower water-holding capacity (higher drip loss percentage) and lighter colour (L*) as compared to conventional pork.

[2] Meat quality indicators (pH, colour L*, colour a*, colour b*, drip loss percentage, cooking loss percentage, and shear force) were measured by technical staff under the supervision of Dr. Heather Bruce in facilities at Agri-Food Discovery Place, the Department of Agricultural, Food & Nutritional Science, University of Alberta, Edmonton, Canada.

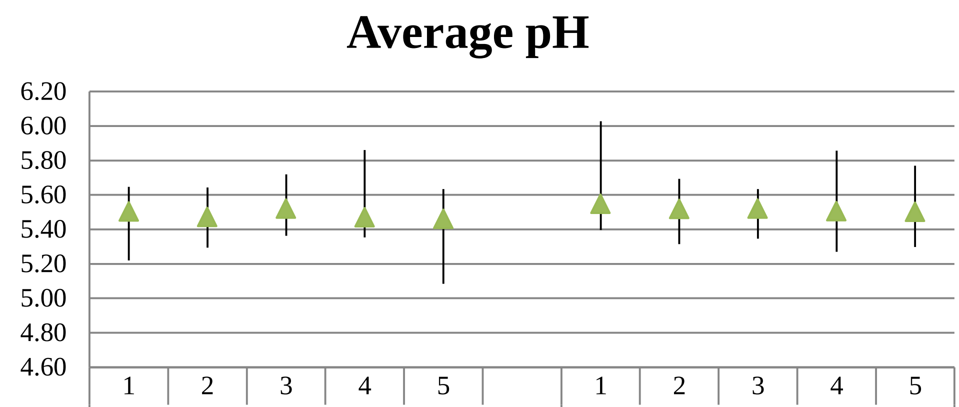
Colour is an important meat quality that affects consumer choices at the point of purchase. Average colour L*, a* and b* which measure lightness, the amount of red (+) or green (-) and the amount of yellow (+) or blue (-), respectively, of meat were shown to be significantly higher in traditionally raised meat than in conventional meat, indicating that traditionally raised pork was lighter, redder and more yellow in colour than conventional pork. The observed significantly lighter colour in traditionally raised pork is in agreement with our assumptions based on the previous observed relationship between pH and colour but further analysis is carried out to prove this relationship. The variation in colour L* is significantly smaller than the variations in colour a* and colour b* across the five different slaughter days for both of the production systems. For traditionally raised meat, the three measures of colour were all observed to be significantly different across the five slaughter days while for conventional meat, only colour L* was observed to be significantly different across different slaughter days. Colour a* and b* were also observed to be significantly different for their indoors overall sample pork from hogs slaughtered on different days by van der Wal et al. (1993). Gentry et al. (2002) studied the effects of outdoor rearing on pork quality by designing experiments with pigs raised indoors and outdoors at the university farm during summer and winter months, they did not find any differences in instrumental colour measurements (L*, a* and b* values) between treatments for pigs raised and finished during both summer and winter periods. van der Wal et al. (1993) found no differences in the three colour measurements between free range and regularly fattened hogs and Olsson et al. (2003) did not find any differences between organically raised and conventional pork, either. Pugliese et al. (2004) assessed the effects of rearing system (outdoor and indoor) on meat characteristics of Cinta Senese pigs. They found that outdoor-pigs in their study had darker colour than indoor-pigs which is in opposition to the results in this study while the redder colour they observed in outdoor meat is similar to the results observed in the present study.

For drip loss percentage which measures water-holding capacity of meat, a large degree of variability was observed in both production systems. There is no significant difference found between two treatments, this is different from the expectation based on the reviewed relationship between drip loss and pH and the observed pH statistics in the current study. For both traditionally raised and conventional hogs, mean values of drip loss percentage of meat from hogs slaughtered on the five different days were significantly different where meat from hogs slaughtered on the first and last days had lower drip loss percentage than meat from hogs slaughtered on the other days. van der Wal et al. (1993) also observed significant differences in drip loss in meat from hogs slaughtered on different days though they did the test for an overall sample rather than separating it into free range and regular. Differences regarding drip loss between traditionally raised and conventional pork observed is also similar to what van der Wal et al. (1993) found but different from results observed by Enfält et al. (1997), Nilzén et al. (2001) and Gentry et al. (2002) who found that outdoor-reared or free range hogs had meat with significantly higher drip loss as compared to indoor-reared hogs.

Cooking loss which “is a combination of liquid and soluble matters lost from the meat during cooking (Aaslyng et al., 2003, p.285)” was found to be significantly higher in traditionally raised pork than in conventional pork and it had a relatively small dispersion in meat for hogs from both production systems. For traditionally raised hogs, there are no significant differences in drip loss of meat from hogs slaughtered on different days; while for conventional hogs, drip loss varies significantly across the five slaughter days. The significant differences between production systems observed in this study are different from what was observed by Enfält et al. (1997) and van der Wal et al. (1993) in that they did not find any significant differences in cooking loss between indoor/regularly rearing and outdoor/free range rearing systems and it is opposite to results found by Olsson et al. (2003) that pork from organically raised hogs had lower cooking loss than the conventional pork. Cooking loss has been considered to be a potential characteristic affecting the sensory quality of pork according to previous studies reviewed in chapter 2 but its effects varied in different studies, further analyses such as correlation coefficients will be used to assess the relationships for the samples in this study.

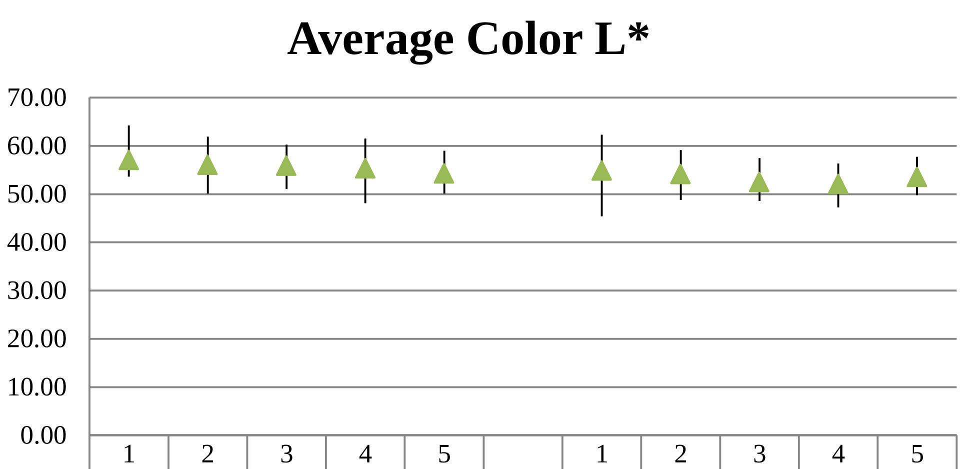
Shear force, which is an objective measure of tenderness in meat, was observed to be widely dispersed for meat from both systems. Significantly higher shear force values were found in traditionally raised meat as compared to conventional meat. The mean shear force values differed across slaughter days for meat from both production systems where hogs slaughtered on the first day had meat with significantly lower shear force values as compared to hogs slaughtered on the following days, differences in shear force with respect to slaughter day was also observed in the study by van der Wal et al. (1993) for an overall sample. Differences between production systems in this study agree with van der Wal et al. (1993) who observed higher shear force values in free range pork as compared to regularly fattened pork as well as Enfält et al. (1997) and Pugliese et al. (2004) who found outdoor-reared hogs had meat with higher shear force than indoor-reared pork. Lower scores in tenderness for traditionally raised pork would be expected based on the negative correlation between shear force and tenderness according to the literature.

Figure 4.2 Comparison of Meat Quality across Slaughter Days for the two Production Systems - pH



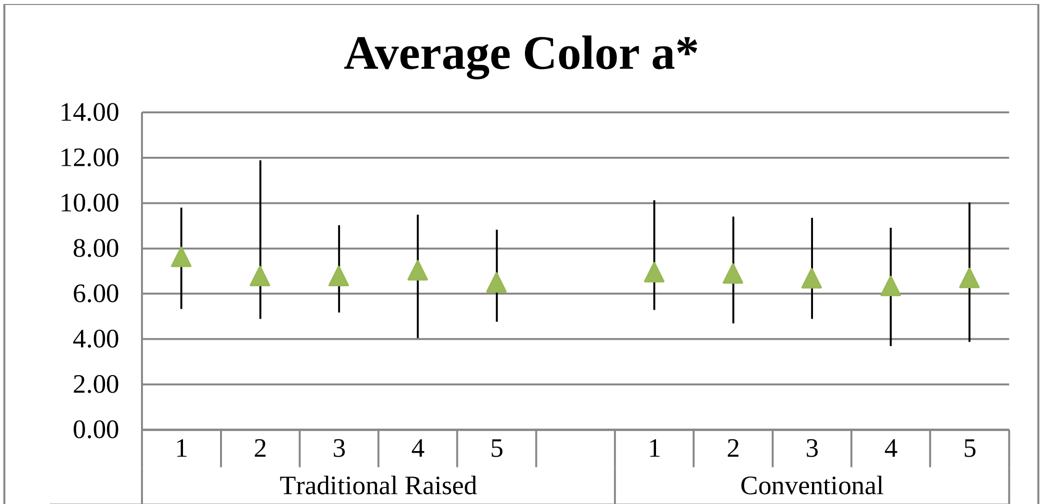
	Traditional Raised 1	Traditional Raised 2	Traditional Raised 3	Traditional Raised 4	Traditional Raised 5		Conventional 1	Conventional 2	Conventional 3	Conventional 4	Conventional 5
max	5.65	5.64	5.72	5.86	5.63		6.03	5.69	5.63	5.86	5.77
min	5.22	5.29	5.36	5.35	5.08		5.40	5.31	5.35	5.27	5.30
▲mean	5.50	5.47	5.52	5.47	5.46		5.55	5.52	5.52	5.50	5.50

Figure 4.3 Comparison of Meat Quality across Slaughter Days for the Two Production Systems – Colour L*



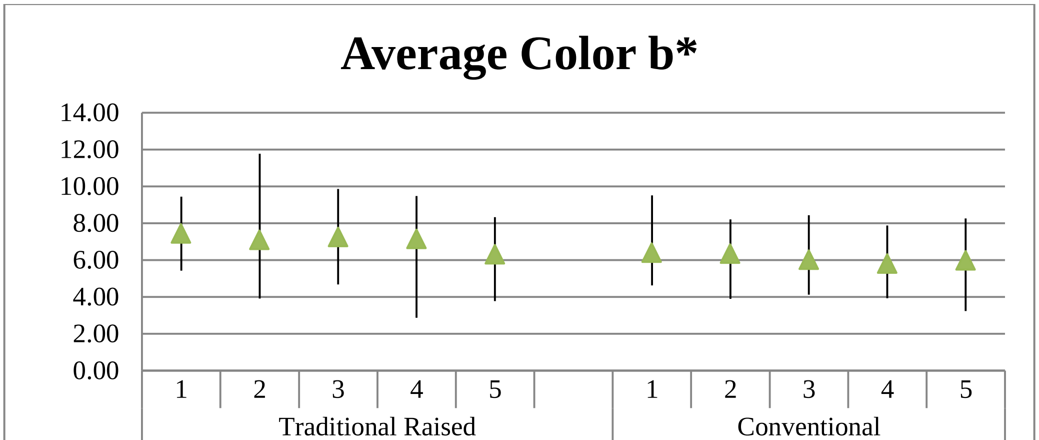
	Traditional Raised 1	Traditional Raised 2	Traditional Raised 3	Traditional Raised 4	Traditional Raised 5		Conventional 1	Conventional 2	Conventional 3	Conventional 4	Conventional 5
max	64.24	61.90	60.29	61.55	59.00		62.33	59.12	57.44	56.38	57.73
min	53.64	50.09	51.04	48.15	50.09		45.40	48.80	48.59	47.23	49.75
▲mean	57.03	56.03	55.84	55.31	54.23		54.87	54.15	52.43	52.06	53.52

Figure 4.4 Comparison of Meat Quality across Slaughter Days for the Two Production Systems – Colour a*



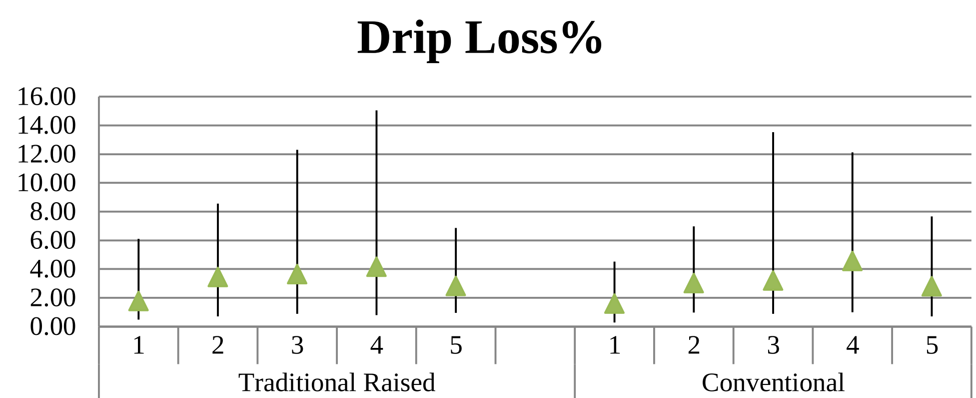
	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	9.80	11.88	9.02	9.49	8.83		10.13	9.40	9.35	8.91	10.03
min	5.33	4.89	5.17	4.04	4.76		5.29	4.70	4.89	3.69	3.88
▲mean	7.62	6.77	6.78	7.03	6.50		6.94	6.88	6.67	6.34	6.69

Figure 4.5 Comparison of Meat Quality across Slaughter Days for the Two Production Systems – Colour b*



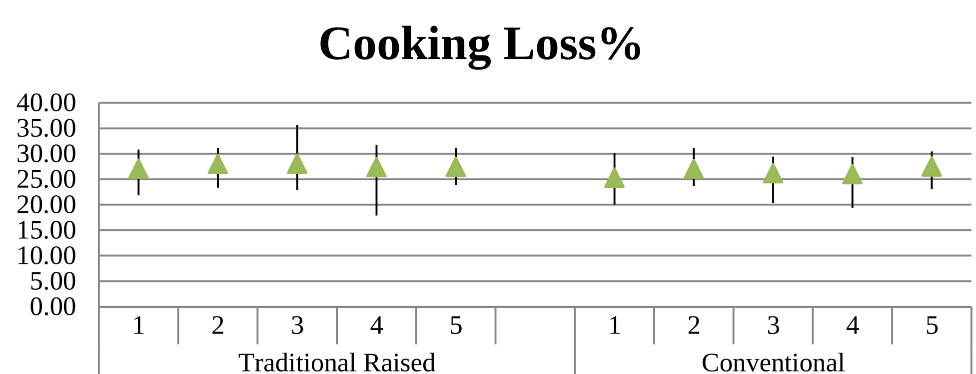
	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	9.45	11.78	9.87	9.48	8.34		9.52	8.21	8.45	7.88	8.26
min	5.42	3.92	4.69	2.87	3.78		4.63	3.91	4.13	3.94	3.25
▲mean	7.43	7.10	7.25	7.15	6.31		6.40	6.34	6.01	5.80	5.98

Figure 4.6 Comparison of Meat Quality across Slaughter Days for the Two Production Systems – Drip Loss Percentage



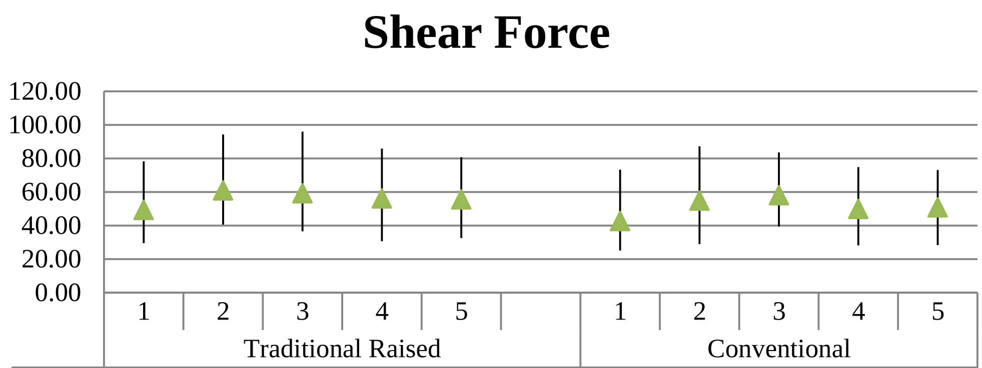
	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	6.11	8.55	12.29	15.03	6.87		4.52	6.98	13.53	12.13	7.67
min	0.49	0.71	0.89	0.81	0.96		0.30	0.97	0.88	1.00	0.70
▲mean	1.78	3.45	3.64	4.15	2.81		1.58	3.02	3.19	4.56	2.78

Figure 4.7 Comparison of Meat Quality across Slaughter Days for the Two Production Systems – Cooking Loss Percentage



	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	30.82	31.13	35.63	31.68	31.15		30.18	31.09	29.45	29.31	30.48
min	21.83	23.35	22.84	17.90	23.93		20.04	23.66	20.34	19.40	23.06
▲mean	27.02	27.95	28.05	27.37	27.38		25.29	27.00	26.12	25.96	27.50

Figure 4.8 Comparison of Meat Quality across Slaughter Days for the Two Production Systems – Shear Force



	Traditional Raised 1	Traditional Raised 2	Traditional Raised 3	Traditional Raised 4	Traditional Raised 5		Conventional 1	Conventional 2	Conventional 3	Conventional 4	Conventional 5
max	78.25	94.28	95.97	86.00	80.80		73.30	87.33	83.65	74.80	73.20
min	29.50	40.62	36.71	30.77	32.57		25.16	28.97	39.55	28.30	28.41
▲mean	49.24	60.83	59.16	56.18	55.56		42.62	54.81	58.07	49.90	50.79

197 consumer panellists rated the sensory characteristics of cooked pork chops from the two production systems on a 9-point hedonic scale where 1 = dislike extremely and 9 = like extremely. Janz (2010) [3]reported that significant differences were observed between the two production systems regarding four sensory quality attributes, appearance of outside grilled surface, tenderness, juiciness and overall acceptability, however there was no practical significant differences between treatments because the absolute differences observed were never more than ½ a scale unit suggesting that the conventional and traditionally raised pork in this study were not different in terms of the acceptability of sensory quality characteristics evaluated by consumer panellists. Being similar to statistics observed in present study, Gentry et al. (2004) also found hogs reared indoor and outdoor during winter months produced pork with similar juiciness, tenderness, and flavour scores evaluated by the sensory panel, while Enfält et al. (1997) observed that outdoor-reared hogs had significantly lower scores in tenderness, juiciness and overall acceptability than outdoor-reared hogs and Jonsäll et al. (2001) found that ham muscle from pigs reared outdoors received significantly

[3] Sensory quality measures were analyzed by Dr. Jenifer Janz at the Alberta Agriculture and Rural Development Food Processing Development Centre, Leduc, Alberta, Canada.

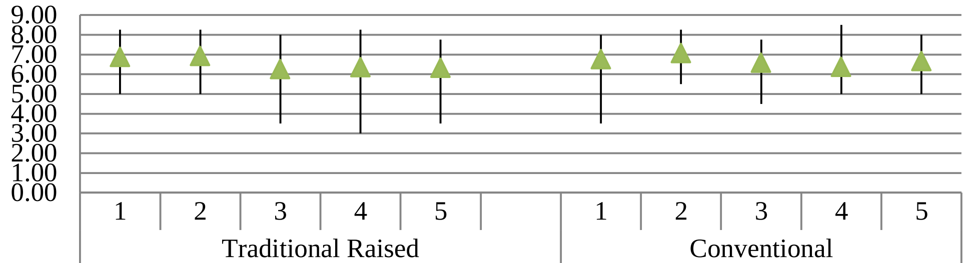
lower juiciness score than pigs reared indoors but there was no differences in tenderness which are different from results in this study.

With regard to differences in sensory quality traits across the five slaughter days, the means of appearance of outside grilled surface, inside meat surface and tenderness across different slaughter days were observed to be significantly different at the 1% significant level for both traditionally raised and conventional pork (Appendix D) while the means of juiciness, flavour and overall acceptability across slaughter days were only significantly different for traditionally raised pork. In the case of outside appearance, for traditionally raised pork, means were slightly higher in the meat from hogs slaughtered on the first two days than in meat from hogs slaughtered on the last three days while the differences in the variability are opposite to the mean differences; for conventional pork, the mean was higher in the meat from hogs slaughtered on the second day while the variability was relatively small as compared to meat from hogs slaughtered on the other days. Differences regarding inside appearance and tenderness for both traditionally raised and conventional pork were similar to the differences just discussed regarding outside appearance. In the cases of juiciness, flavour and overall acceptability, means for traditionally raised decreased from day one to day five. Coefficients of variation in Appendix E show similar variability in all the sensory quality traits in meat from hogs in both production systems.

The comparison discussed above highlights some significant differences across the five slaughter days between traditionally raised and conventional production system regarding carcass, meat and sensory quality characteristics and variability was also observed in those measurements. In order to get a better understanding of the relationships between various quality parameters, correlation coefficients were calculated and will be discussed in the following subsection.

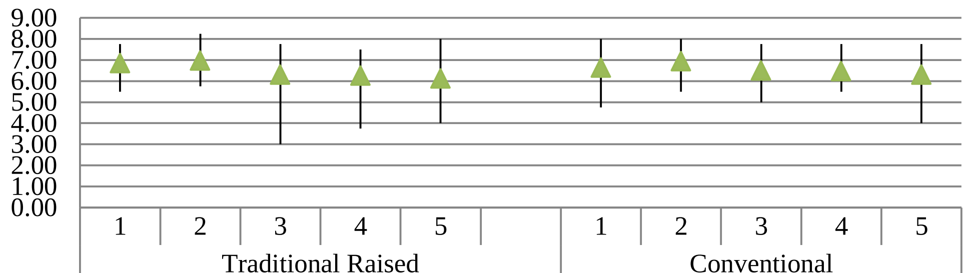
Figure 4.9 Comparison of Sensory Quality (Appearance of Outside and Inside Surface and Tenderness) across Slaughter Days for the Two Production Systems

Appearance of Outside Grilled Surface



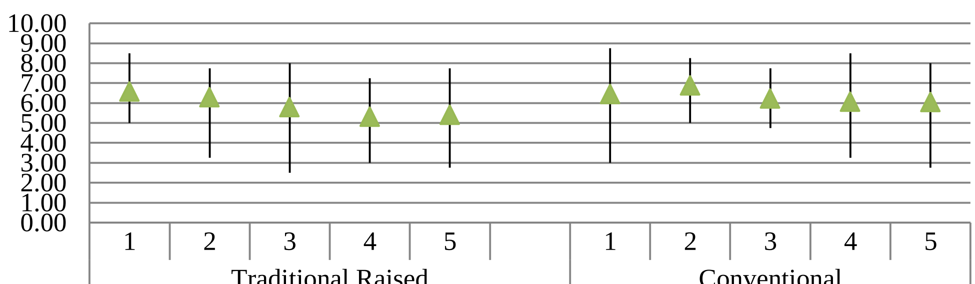
	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	8.25	8.25	8.00	8.25	7.75		8.00	8.25	7.75	8.50	8.00
min	5.00	5.00	3.50	3.00	3.50		3.50	5.50	4.50	5.00	5.00
▲mean	6.86	6.92	6.26	6.34	6.32		6.75	7.07	6.58	6.38	6.66

Appearance of Inside Meat Surface



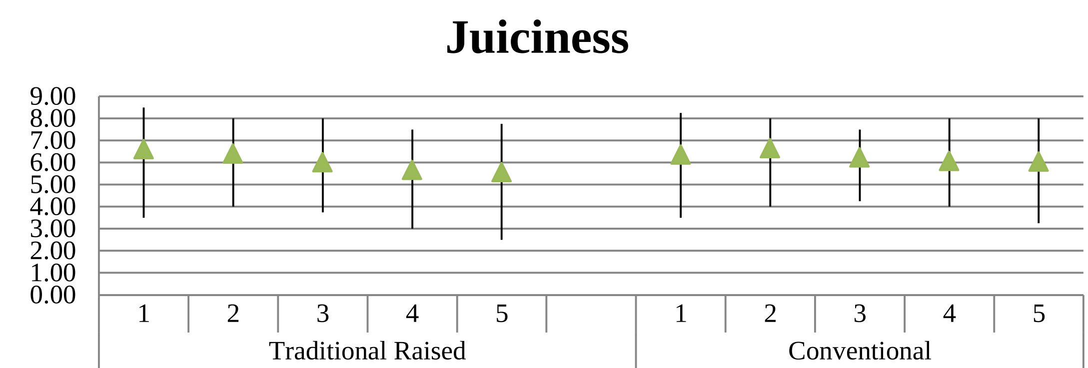
	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	7.75	8.25	7.75	7.50	8.00		8.00	8.00	7.75	7.75	7.75
min	5.50	5.75	3.00	3.75	4.00		4.75	5.50	5.00	5.50	4.00
▲mean	6.85	6.98	6.30	6.26	6.13		6.64	6.94	6.50	6.48	6.31

Tenderness

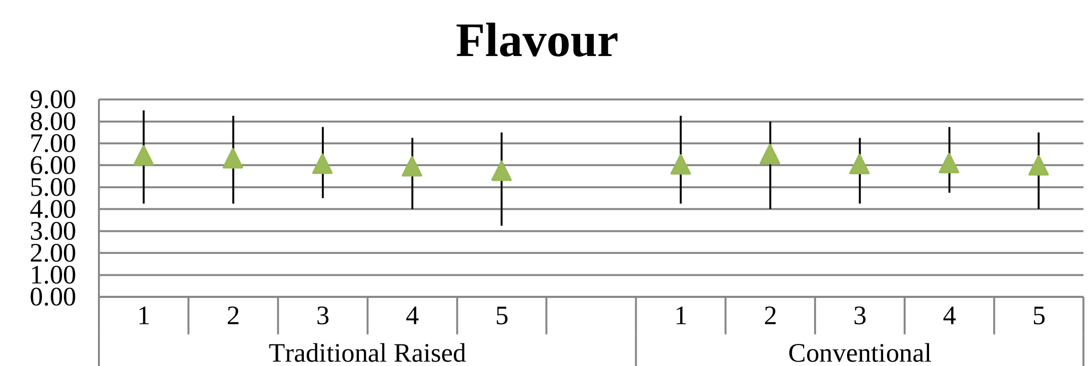


	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	8.50	7.75	8.00	7.25	7.75		8.75	8.25	7.75	8.50	8.00
min	5.00	3.25	2.50	3.00	2.75		3.00	5.00	4.75	3.25	2.75
▲mean	6.58	6.28	5.79	5.32	5.41		6.45	6.89	6.23	6.08	6.04

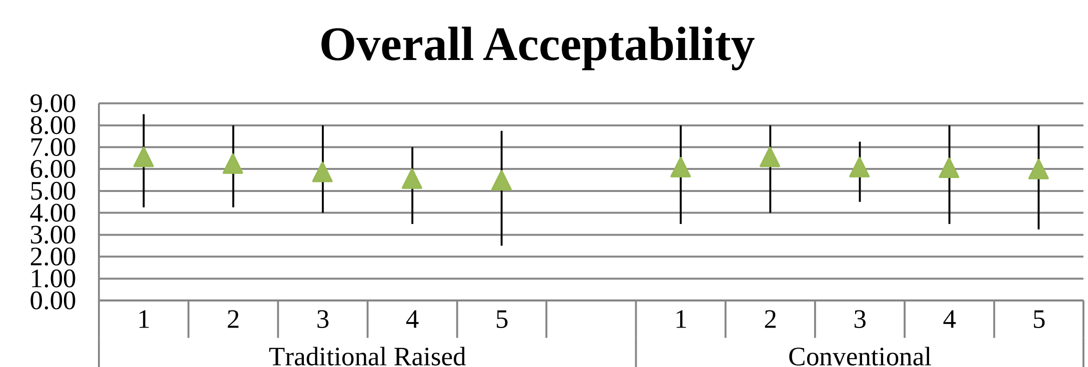
Figure 4.10 Comparison of Sensory Quality (Juiciness, Flavour and Overall Acceptability) across Slaughter Days for the Two Production Systems



	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	8.50	8.00	8.00	7.50	7.75		8.25	8.00	7.50	8.00	8.00
min	3.50	4.00	3.75	3.00	2.50		3.50	4.00	4.25	4.00	3.25
▲mean	6.60	6.40	6.01	5.66	5.56		6.35	6.65	6.23	6.07	6.04



	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	8.50	8.25	7.75	7.25	7.50		8.25	8.00	7.25	7.75	7.50
min	4.25	4.25	4.50	4.00	3.25		4.25	4.00	4.25	4.75	4.00
▲mean	6.45	6.33	6.07	5.95	5.75		6.04	6.51	6.06	6.11	6.00



	Traditional Raised 1	2	3	4	5		Conventional 1	2	3	4	5
max	8.50	8.00	8.00	7.00	7.75		8.00	8.00	7.25	8.00	8.00
min	4.25	4.25	4.00	3.50	2.50		3.50	4.00	4.50	3.50	3.25
▲mean	6.55	6.25	5.86	5.56	5.49		6.08	6.55	6.08	6.06	6.00

4.3 CORRELATIONS AMONG IMPORTANT HOG CARCASS, MEAT AND SENSORY QUALITY TRAITS WITHIN EACH PRODUCTION SYSTEM

As discussed in 4.2 that the interaction of dressed carcass weight and estimated lean yield within the grid establishes the grade index (Western Hog Exchange, 2012), thus correlations can be expected between grade index and carcass weight and estimated lean yield. For both traditionally raised and conventional hogs, only the negative correlation coefficients between grade index and carcass weight are statistically significant, however, correlations varied across the five slaughter days. Estimated lean yield was observed to be strongly and positively correlated with grade index for traditionally raised hogs slaughtered on the last three days (Appendix F) and for conventional hogs slaughtered on the second and the last days (Appendix G). These strong and positive correlations observed on different slaughter days, in some extent, agree with Fortin et al. (1984) that the lean yield is a primary determinant of carcass value in the hog grading system.

Regarding relationships between meat quality traits, for the conventional sample, pH value is negatively related to L*, b*, drip loss percentage and cooking loss percentage indicating that conventional meat with lower pH value had lighter colour (higher L* value), higher drip loss and cooking loss which meets our expectations. b* is strongly and positively correlated with a* and L*, shear force value is negatively correlated with L*, a*, and b* while it is positively related to drip loss and cooking loss. The conventional sample slaughtered on different days did not have significant differences in correlations between meat quality traits. Correlations observed for the traditionally raised sample are similar to what was observed for the conventional sample. The only difference is that drip loss and cooking loss in the traditionally raised sample have no significant correlation coefficients with other meat quality traits. Significant correlations between pH and other meat quality traits are similar to the results in the study of Huff-

Lonergan et al. (2002) that a lower ultimate pH in pork meat was related to lighter colour, higher drip loss percentage and higher cooking loss percentage in meat. The significant and positive correlation coefficients between shear force value and drip loss and cooking loss are similar to their results as well indicating that meat with higher drip loss and cooking loss would tend to be less tender. In the study of Norman et al. (2003), b* was also observed to have strong and significant correlation coefficients with L* and a* as what observed in current study.

For both of the production systems, sensory quality traits are found to be significantly and positively correlated, similar to results in previous studies (Brewer et al., 2001; Casteels et al., 1995; Davis et al., 1975; Huff-Lonergan et al., 2002; Skelley et al., 1973). The correlations between tenderness, juiciness, flavour and overall acceptability were higher than 0.80 indicating that cooked pork with higher scores for tenderness, juiciness and flavour had higher overall acceptability. Tenderness and juiciness were also strongly correlated with a correlation coefficient of 0.79 for the conventional sample and 0.78 for the traditionally raised sample.

There are more significant correlations observed from the traditionally raised sample than the conventional sample regarding the relationships between hog carcass quality and meat and sensory quality. For the conventional sample, hog grade index is negatively correlated with cooking loss percentage of meat while carcass weight is positively correlated with shear force value of meat and outside appearance acceptability of cooked meat, these results indicate that conventional hogs in this study with higher grade indexes had meat with lower cooking loss and the heavier carcasses had higher shear force values in meat but received higher scores in the acceptability of appearance of outside grilled surface of cooked meat. For the traditionally raised sample, carcass weight has more significant correlations with meat quality traits as compared to estimated lean yield and hog grade index. It is positively correlated with L*, a*, b* and shear force and it is negatively correlated with cooking loss percentage, while grade index is only negatively correlated with L* and b*. Sensory quality traits, appearance of inside meat surface, tenderness, juiciness, flavour and overall acceptability, were significantly and negatively correlated with grade index implying that traditionally raised hogs with higher grade indexes might have lower acceptability in terms of eating quality as evaluated by consumers. None of the carcass quality traits are observed to have significant correlations with meat or sensory quality traits for the traditionally raised hogs slaughtered on the first day or on the last day. Carcass weight is observed to be significantly and positively correlated with shear force value in both samples indicating that hogs with heavier carcass weights had higher shear force values, this is different from the observations of Huff-Lonergan et al. (2002) who found that the instrumental measurement of tenderness of pork had no significant correlation with hog carcass weight as well as Beattie et al. (1999) and Martin et al. (1980) who found hog carcass weight had no significant effect on shear force value. Colour L*, a* and b* are found to be positively correlated to carcass weight in the traditionally raised sample which was similar to the findings of Beattie et al. (1999) and Martin et al. (1980) but different from the observations of Huff-Lonergan et al. (2002) and Sutton et al. (1997) who found measures of colour had no significant relationships with carcass weight. The negative correlation between carcass weight and cooking loss percentage within the traditionally raised sample is similar to the result observed by Beattie et al. (1999) that carcass weight had a negative effect on cooking loss percentage while Huff-Lonergan et al. (2002) found the correlation coefficient between the two variables was not significant.

When considering relationships between meat and sensory quality, for the conventional sample, pH did not have any significant correlations with the sensory quality traits. All the sensory quality traits except the appearance of inside meat surface are positively correlated with L*, outside and inside appearance and flavour were also positively correlated to colour a* and b*, these results indicate that conventional pork in this study with lighter, redder and more yellow colour received higher scores in the consumer sensory test. Tenderness, juiciness, flavour and overall acceptability are negatively correlated with drip loss percentage and shear force value implying that conventional pork with higher drip loss and shear force had lower consumer acceptability in terms of tenderness, juiciness, flavour and overall acceptability. There is no significant correlation between any meat and sensory quality traits observed from the conventional hogs slaughtered on November 17 and December 1. For the traditionally raised sample, there are more significant correlations observed. pH value is observed to be positively correlated with the appearance of inside meat surface, tenderness and overall acceptability which differed from the results in conventional sample indicating that traditionally raised pork with higher pH value had more desirable appearance of inside meat surface, was more tender and had higher overall acceptability to consumers. The three instrumental colour measurements are significantly and positively correlated with most of the sensory quality traits. Cooking loss percentage had a significant and positive correlation with the appearance of outside grilled surface indicating that traditionally raised pork with higher drip loss had higher scores for the appearance of outside grilled surface. Drip loss and shear force were also observed to have negative correlation coefficients with the sensory traits as with the conventional pork, but those correlations are insignificant in the traditionally raised sample. The correlations between meat and sensory quality traits were not strong because the magnitudes of them were never more than 0.30 for both conventional and traditionally raised pork. With respect to correlations between pH value and sensory quality attributes, Huff-Lonergan et al. (2002) found that pH value was significantly and positively related to tenderness, juiciness and flavour. Skelley et al. (1973) also found that pH was positively correlated to flavour and juiciness. Davis et al. (1975) found pH value was significantly and positively correlated to juiciness and overall satisfaction and it had no significant correlations with flavour and tenderness. DeVol et al. (1988) also found a positive correlation between pH and juiciness but a negative correlation between pH and flavour, tenderness had no significant correlation with pH in their study, either. pH value was found to be significantly and positively correlated with juiciness in those studies while there is no significant correlation observed in current study. The negative correlation observed between pH and flavour by DeVol et al. (1988) is different from the positive correlation observed from the traditionally raised sample in present study. The significant correlations observed for the traditionally raised sample were weak (r =0.16), and those along with the insignificant correlations observed for the conventional sample is in agreement with Skelley et al. (1973) that there were no meaningful correlations between pH value and sensory quality attributes evaluated by consumer panellists. Huff-Lonergan et al. (2002) found that darker pork was more tender in their study which is different from the results in this study that lighter pork was observed to be more tender. a* was observed to have some significant correlations with the sensory quality parameters while Casteels et al. (1995) observed no significant correlations. DeVol et al. (1988) found that cooking loss had no significant correlation with tenderness but it had a positive correlation with flavour and a negative correlation with juiciness. Hodgson et al. (1991) also found a negative correlation between cooking loss and juiciness in their study and a negative correlation between cooking loss and overall palatability rating. Correlations observed between cooking loss and sensory quality ratings from both samples in this study differ from the results that cooking loss had no significant correlations with sensory quality in the conventional sample and was only significantly correlated with the appearance of outside grilled surface in the traditionally raised sample. Negative correlations between drip loss and sensory quality traits and between shear force and sensory quality traits are similar to results observed by Huff-Lonergan et al. (2002), Hodgson et al. (1991), Skelley et al. (1973) and Davis et al. (1975).

Significant correlations were observed among many of the quality traits giving a better understanding about the complex relationships among quality characteristics which are important in determining the value of animals. There are some results which are similar to the previous studies but there are also some are different from the previous studies. Many factors could result in those differences, for example, differences in production systems which are just as the differences observed in current study between the two production systems, genetics, seasons, differences in measuring, etc.

Table 4.2 Correlation Coefficients: Hog, Meat and Sensory Quality Indicators for Traditionally Raised Sample

		Hog			Meat							Sensory					
		Weight	Yield	Grade	pH	L*	a*	b*	Drip Loss	Cook Loss	Shear Force	Outside	Inside	Tenderness	Juiciness	Flavour	Overall
Hog	Weight	1	-.02	-.29**	.07	.21**	.17*	.21**	.019	-.19**	-.22**	.07	.05	.10	.10	.15*	.13
	Yield		1	.05	.03	-.12	.04	-.02	.09	-.06	.06	-.05	-.13	-.07	-.06	-.05	-.07
	Grade			1	-.03	-.19**	-.06	-.15*	.03	.02	.12	-.09	-.24**	-.25**	-.24**	-.30**	-.31**
Meat	pH				1	-.16*	-.01	-.15*	.03	-.13	.01	.13	.16*	.16*	.12	.14	.16*
	L*					1	.04	.54**	-.11	-.09	-.37**	.21**	.24**	.19*	.19*	.16*	.23**
	a*						1	.71**	.03	-.10	-.17*	.09	.09	.24**	.21**	.22**	.23**
	b*							1	.10	-.13	-.31**	.12	.18*	.22**	.21**	.24**	.25**
	Drip Loss								1	.11	.15*	-.04	-.03	-.05	-.08	.01	-.05
	Cook Loss									1	.41**	.15*	.12	.07	.02	.00	.05

	Shear Force									.	1	-.02	-.09	-.07	-.04	-.05	-.09
Sensory	Outside											1	.70**	.44**	.45**	.42**	.53**
	Inside												1	.57**	.62**	.60**	.69**
	Tenderness													1	.78**	.72**	.87**
	Juiciness														1	.75**	.85**
	Flavour															1	.87**
	Overall																1

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Table 4.3 Correlation Coefficients: Hog, Meat and Sensory Quality Indicators for Conventional Sample

		Hog			Meat							Sensory					
		Weight	Yield	Grade	pH	L*	a*	b*	Drip Loss	Cook Loss	Shear Force	Outside	Inside	Tenderness	Juiciness	Flavour	Overall
Hog	Weight	1	.07	-.16*	.01	.03	-.10	-.04	-.03	.06	.17*	.17*	.13	.09	.09	.05	.09
	Yield		1	.11	-.01	-.02	.08	.05	-.05	.02	-.10	-.05	-.08	.02	-.01	.00	.01
	Grade			1	.07	-.05	-.05	-.04	.02	-.22**	-.04	-.01	-.09	-.03	-.09	-.04	-.06
Meat	pH				1	-.24**	-.08	-.24**	-.16*	-.28**	-.14	-.02	.02	.14	.08	.04	.11
	L*					1	.04	.49**	-.38**	-.05	-.27**	.20**	.14	.23**	.17*	.23**	.21**
	a*						1	.74**	-.05	-.02	-.22**	.12	.14	-.00	.02	.15*	.06
	b*							1	-.12	-.05	-.28**	.21**	.20**	.09	.07	.21**	.12
	Drip Loss								1	.06	.16*	-.09	-.08	-.22**	-.18*	-.16*	-.17*
	Cook Loss									1	.39**	.13	.07	-.05	.00	-.02	-.02
	Shear Force										1	-.10	-.09	-.26**	-.16*	-.11	-.21**

Sensory	Outside											1	.61**	.32**	.37**	.33**	.45**
	Inside												1	.44**	.48**	.40**	.51**
	Tenderness													1	.79**	.64**	.82**
	Juiciness														1	.65**	.83**
	Flavour															1	.80**
	Overall																1

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

4.4 ANALYSES OF DETERMINANTS OF HOG GRADE, MEAT AND SENSORY QUALITY TRAITS

4.4.1 THE REGRESSION MODEL

Knowing the different measures of meat quality, sensory quality, hog grade back to production system and slaughter day is important to the industry. Significant differences have been found between traditionally raised and conventional systems across five slaughter days in terms of hog carcass, meat and sensory quality traits. Significant correlations among those parameters have also been found which are in agreement with the results in previous studies, therefore, production system, slaughter day should have significant effects on predicting hog grade, measures of meat quality (pH, colour L*, colour a*, colour b*, drip loss percentage, cooking loss percentage and shear force) and consumer acceptability of sensory quality traits (appearance of outside grilled surface, appearance of inside meat surface, tenderness, juiciness, flavour and overall acceptability). Hog grade index, which is the indicator of carcass quality determining the bonuses or the discount received by producers, should also help to predict meat quality indicators and scores for sensory quality traits, and scores for sensory quality traits should be related to meat quality indicators as well. Different results regarding the relationships between different quality indicators have been observed both in current study and previous studies, Gondret et al. (2006) and Fernandez and Tornberg (1992) suggested that quadratic rather than liner relationships between different quality attributes could be the cause of the previous controversies among studies. Therefore, for those quality traits taken as explanatory variables, both linear and quadratic terms will be included in the regressions. Production system is taken as 1 if the hog is from the traditionally raised system and 0 if the hog is from the conventional system. The five slaughter days are also taken as dummies and the dummy for the last slaughter day was excluded from the equations as the base day to avoid the problem of perfect multicollinearity with the constant. A model including regression equations for estimating hog grade, meat and sensory quality parameters is as follows,

Hog grade index = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy);

pH = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2);

Colour L = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2);*

Colour a = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2);*

Colour b = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2);*

Drip loss = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2);

Cooking loss = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2);

Shear force = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2);

Appearance of outside grilled surface = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2, pH, pH^2, L, L*^2, a*, a*^2, drip loss, drip loss^2, cooking loss, cooking loss^2, shear force, shear force^2);*

Appearance of inside meat surface = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2, pH, pH^2, L, L*^2, a*, a*^2, drip loss, drip loss^2, cooking loss, cooking loss^2, shear force, shear force^2);*

Tenderness = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2, pH, pH^2, L, L*^2, a*, a*^2, drip loss, drip loss^2, cooking loss, cooking loss^2, shear force, shear force^2);*

Juiciness = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2, pH, pH^2, L, L*^2, a*, a*^2, drip loss, drip loss^2, cooking loss, cooking loss^2, shear force, shear force^2);*

Flavour = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2, pH, pH^2, L, L*^2, a*, a*^2, drip loss, drip loss^2, cooking loss, cooking loss^2, shear force, shear force^2);*

Overall acceptability = f (constant, production system dummy, slaughter day1 dummy, slaughter day2 dummy, slaughter day 3 dummy, slaughter day4 dummy, grade, grade^2, pH, pH^2, L, L*^2, a*, a*^2, drip loss, drip loss^2, cooking loss, cooking loss^2, shear force, shear force^2).*

In considering econometric specifications of the data are important. The first is that some of the dependent variables are bounded (Table 4.4) and thus ordinary least squares regression techniques are not appropriate. Alternative estimators such Tobit and ordered probit should be used. Tobit models can be used for the continuous bounded independent variables (hog grade and meat quality traits except colour a* and b*) and ordered probit models can be used for the dependent variables which have ordered responses (sensory quality traits by individual respondent). However the above equations are also linked and it is likely that the error terms across equations are related (the disturbances in the equations may include factors that are commonly affecting all of the dependent variables on the basis of the review in chapter 2, which means that the disturbances can be correlated (Greene, 2007)). In that case a systems estimator (such as multivariate regression) is appropriate. In the results reported below the results from estimation of the equations as a system are reported, tests of individual equations estimated as Tobit regressions[4] produced almost identical results. Estimating the regression equations as a system rather than estimating each equation separately can generate efficiencies (Kmenta and Gilbert, 1970). A linear multivariate regression model will be applied to analyze the data. Maximum likelihood estimates will be "obtained by concentrating variance parameters out of the multivariate likelihood and then maximizing the negative of the log determinant of the residual covariance matrix" (Hall and Cummins, 2009, p.246)

Table 4.4 Bounded independent variables

Traits	min	max	
Hog Grade	10	116	Bounded (continuous)
pH	0	14	Bounded (continuous)
Colour L*	0	100	Bounded (continuous)
Colour A*	-	+	continuous
Colour B*	-	+	continuous
Drip Loss	0%	100%	Bounded (continuous)
Cooking Loss	0%	100%	Bounded (continuous)
Shear Force	0 kg	100 kg	Bounded (continuous)
Consumer Acceptability Of Sensory			
Outside Appearance	1	9	Bounded (ordinal)

[4] Tobit models were applied for all the bounded variables except for colour a* and b*. The sensory quality variables were also estimated as Tobit regressions because the average values per pork chop, across respondents, which are continuous and not discrete, were used for the estimations.

Inside Appearance	1	9	Bounded (ordinal)
Tenderness	1	9	Bounded (ordinal)
Juiciness	1	9	Bounded (ordinal)
Flavour	1	9	Bounded (ordinal)
Overall Acceptability	1	9	Bounded (ordinal)

4.4.2 REGRESSION RESULTS

Results from the model with all the regressions estimated simultaneously are in Table 4.5 below.

Table 4.5 Multivariate Regression Results

Number of observations = 360 Log likelihood = -7578.01 Schwarz B.I.C. = 8353.80			
Parameter	Estimate	Standard Error	Hog Grade
Constant	111.54***	1.23	R-squared = .17
Production System	-8.66***	1.05	
Slaughter Day1	-2.34	1.81	
Slaughter Day2	1.27	1.62	
Slaughter Day3	1.46	1.56	
Slaughter Date4	1.24	1.58	
Constant	5.53***	0.20	pH
Production System	-0.03***	0.01	R-squared = .08
Grade	-0.00	0.00	
Grade^2	0.00	0.00	
Slaughter Day1	0.06***	0.02	
Slaughter Day2	0.01	0.01	
Slaughter Day3	0.04***	0.01	
Slaughter Day4	0.01	0.01	
Constant	51.69***	5.44	Colour L*
Production System	2.00***	0.29	R-squared = .24
Grade	0.06	0.12	
Grade^2	-0.00	0.00	
Slaughter Day1	1.60***	0.44	
Slaughter Day2	1.19***	0.39	
Slaughter Day3	0.38	0.38	

Slaughter Day4	-0.21	0.38	
Constant	5.98**	2.61	Colour a* R-squared = .03
Production System	0.19	0.14	
Grade	0.02	0.06	
Grade^2	-0.00	0.00	
Slaughter Day1	0.46**	0.21	
Slaughter Day2	0.23	0.19	
Slaughter Day3	0.15	0.18	
Slaughter Day4	0.09	0.18	
Constant	5.05*	2.61	Colour b* R-squared = .17
Production System	0.82***	0.14	
Grade	0.03	0.06	
Grade^2	-0.00	0.00	
Slaughter Day1	0.57***	0.21	
Slaughter Day2	0.54***	0.19	
Slaughter Day3	0.52***	0.18	
Slaughter Day4	0.34*	0.18	
Constant	8.65*	4.87	Drip Loss Percentage R-squared = .11
Production System	0.33	0.26	
Grade	-0.14	0.11	
Grade^2	0.00	0.00	
Slaughter Day1	-0.89**	0.40	
Slaughter Day2	0.31	0.35	
Slaughter Day3	0.53	0.34	
Slaughter Day4	1.58***	0.34	
Constant	29.23***	4.64	Cooking Loss Percentage R-squared = .12
Production System	0.84***	0.25	
Grade	-0.02	0.10	
Grade^2	-0.00	0.00	
Slaughter Day1	-1.33***	0.38	
Slaughter Day2	0.31	0.34	
Slaughter Day3	-0.34	0.32	
Slaughter Day4	-0.74**	0.33	
Constant	76.15***	27.46	Shear Force R-squared = .12
Production System	5.29***	1.47	

Grade	-0.61	0.60	
Grade^2	0.00	0.00	
Slaughter Day1	-6.31***	2.24	
Slaughter Day2	5.15***	1.99	
Slaughter Day3	5.27***	1.92	
Slaughter Day4	-0.33	1.94	
Constant	-6.22	76.13	Appearance of Outside Grilled Surface R-squared = .17
Production System	-0.40***	0.11	
Grade	0.07	0.04	
Grade^2	-0.00	0.00	
pH	1.26	28.80	
pH^2	-0.00	2.62	
Colour L*	-0.27	0.48	
Colour L*^2	0.00	0.00	
Colour a*	0.16	0.31	
Colour a*^2	-0.01	0.02	
Drip Loss%	0.00	0.06	
Drip Loss%^2	0.00	0.00	
Cooking Loss%	0.55*	0.30	
Cooking Loss%^2	-0.01	0.01	
Shear Force	-0.01	0.02	
Shear Force^2	0.00	0.00	
Slaughter Day1	0.17	0.16	
Slaughter Day2	0.42***	0.14	
Slaughter Day3	-0.10	0.14	
Slaughter Day4	-0.10	0.14	
Constant	48.76	69.21	Appearance of Inside Meat Surface R-squared = .21
Production System	-0.36***	0.10	
Grade	0.05	0.04	
Grade^2	-0.0004*	0.0002	
pH	-17.23	26.18	
pH^2	1.67	2.38	
Colour L*	-0.33	0.44	
Colour L*^2	0.003	0.004	
Colour a*	0.004	0.28	

Colour a*^2	0.003	0.02	
Drip Loss%	0.01	0.05	
Drip Loss%^2	-0.0004	0.004	
Cooking Loss%	0.48*	0.27	
Cooking Loss%^2	-0.01	0.004	
Shear Force	-0.001	0.02	
Shear Force^2	-0.00004	0.0002	
Slaughter Day1	0.39***	0.15	
Slaughter Day2	0.70***	0.13	
Slaughter Day3	0.21*	0.12	
Slaughter Day4	0.20	0.12	
Constant	89.67	94.26	Tenderness
Production System	-0.71***	0.14	R-squared = .25
Grade	-0.02	0.05	
Grade^2	0.00002	0.0003	
pH	-40.82	35.66	
pH^2	3.91	3.24	
Colour L*	0.68	0.59	
Colour L*^2	-0.01	0.01	
Colour a*	0.04	0.39	
Colour a*^2	0.003	0.03	
Drip Loss%	-0.10	0.07	
Drip Loss%^2	0.01	0.01	
Cooking Loss%	0.37	0.37	
Cooking Loss%^2	-0.01	0.01	
Shear Force	-0.02	0.03	
Shear Force^2	0.0001	0.0002	
Slaughter Day1	0.46**	0.20	
Slaughter Day2	0.87***	0.17	
Slaughter Day3	0.31*	0.17	
Slaughter Day4	0.03	0.17	
Constant	254.03***	94.09	Juiciness
Production System	-0.54***	0.14	R-squared = .19
Grade	-0.003	0.05	
Grade^2	-0.0001	0.0003	

pH	-97.99***	35.59	
pH^2	9.01***	3.23	
Colour L*	0.30	0.59	
Colour L*^2	-0.002	0.01	
Colour a*	-0.44	0.39	
Colour a*^2	0.04	0.03	
Drip Loss%	-0.07	0.07	
Drip Loss%^2	0.004	0.01	
Cooking Loss%	0.85**	0.36	
Cooking Loss%^2	-0.02**	0.01	
Shear Force	-0.01	0.03	
Shear Force^2	0.0001	0.0002	
Slaughter Day1	0.45**	0.20	
Slaughter Day2	0.71***	0.17	
Slaughter Day3	0.39**	0.17	
Slaughter Day4	0.15	0.17	
Constant	133.34*	79.33	Flavour
Production System	-0.35***	0.12	R-squared = .17
Grade	-0.06	0.04	
Grade^2	0.0002	0.0002	
pH	-57.12*	30.01	
pH^2	5.33*	2.73	
Colour L*	0.74	0.50	
Colour L*^2	-0.01	0.005	
Colour a*	0.01	0.33	
Colour a*^2	0.01	0.02	
Drip Loss%	0.001	0.06	
Drip Loss%^2	-0.001	0.01	
Cooking Loss%	0.52*	0.31	
Cooking Loss%^2	-0.01*	0.01	
Shear Force	-0.002	0.02	
Shear Force^2	0.00001	0.0002	
Slaughter Day1	0.08	0.17	
Slaughter Day2	0.46***	0.15	
Slaughter Day3	0.16	0.14	

Slaughter Day4	0.19	0.14	
Constant	131.54	85.97	Overall Acceptability R-squared = .21
Production System	-0.57***	0.13	
Grade	-0.02	0.05	
Grade^2	-0.00	0.0002	
pH	-55.70*	32.52	
pH^2	5.25*	2.95	
Colour L*	0.64	0.54	
Colour L*^2	-0.01	0.01	
Colour a*	-0.05	0.35	
Colour a*^2	0.01	0.02	
Drip Loss%	-0.04	0.06	
Drip Loss%^2	0.003	0.01	
Cooking Loss%	0.37	0.33	
Cooking Loss%^2	-0.01	0.01	
Shear Force	-0.001	0.02	
Shear Force^2	-0.0001	0.0002	
Slaughter Day1	0.26	0.18	
Slaughter Day2	0.62***	0.16	
Slaughter Day3	0.24	0.15	
Slaughter Day4	0.12	0.15	

*** 1% significant level; ** 5% significant level; * 10% significant level.

Prediction of Hog Grade

As shown in the table above, approximately 17% of the variation in hog grade can be explained by production system and slaughter days. The production system dummy is negative and statistically significant at the 1% significant level, this indicates that holding the other variables fixed, the estimated hog grade index for a traditionally raised hog carcass is 8.66 units lower than a conventional hog carcass which is close to the results of descriptive statistics. Coefficients of the slaughter day dummies are insignificant indicating that slaughter days do not affect the prediction of hog grade which is also in agreement with our descriptive statistics.

Prediction of Meat Quality Traits

pH

Production system, hog grade (linear and quadratic), and slaughter days explain approximately 8% of the variability in pH value of pork in this study. The production system dummy, slaughter day1 and slaughter day3 are statistically significant at the 1% significant level. Holding the other variables fixed, traditionally raised pork is estimated to have a lower average pH than conventional pork; as compared to hogs slaughtered on December 1^{st} or December 3^{rd} (slaughter day5), hogs slaughtered on November 4^{th} or November 5^{th} and hogs slaughtered on November 17^{th} or November 19^{th} (slaughter day3) are estimated to have meat with higher average pH values. Neither the linear nor the quadratic variable of hog grade has any significant effect on the prediction of pH value of meat.

Colour L - Lightness*

Production system dummy, hog grade (linear and quadratic), and slaughter day dummies explain approximately 24% of the variation in colour L* of meat in the overall studied sample. Coefficients of the production system dummy, slaughter day1 and day2 dummies are significant at the 1% significant level. Traditionally raised hogs are estimated to have meat with an average value of colour L* which is 2.00 units higher than conventional hogs. As compared to hogs slaughtered on December 1^{st} or December 3^{rd} (slaughter day5), hogs slaughtered on November 4^{th} or November 5^{th} (slaughter day1) and hogs slaughtered on November 10^{th} or November 12^{th} (slaughter day2) had significantly lighter colour (higher values in colour L*). The linear and quadratic terms of hog grade do not have any significant impact on predicting colour L*.

Colour a - Represent the Amount of Red (+) or Green (-)*

Production system dummy, hog grade (linear and quadratic), and slaughter day dummies explain only about 3% of the variation in colour a*. Neither production system or hog grade has significant effect on the prediction. The dummy for slaughter day1 is positive and significant at the 5% significant level indicating that the hogs slaughtered on November 4th or November 5th are estimated to have an average value of colour a* which is 0.46 units higher than the hogs slaughtered on December 1st or December 3rd (slaughter day5).

Colour b - Represent the Amount of Yellow (+) or Blue (-)*

Approximately 17% of the variation in colour b* can be explained by the variables of production system, hog grade (linear and quadratic) and slaughter days. Except for the linear and quadratic variables of hog grade, variables of production system and slaughter days all show significant effects on the expected value of colour b*. Meat from a traditionally raised hog is estimated to have an average value of colour b* that is 0.82 units lower than meat from a conventional hog which means that traditionally raised pork is expected to be more yellow in colour than conventional pork. The positive coefficients of the slaughter day dummies show that hog slaughtered on the first four slaughter days are expected to have more yellow meat than hogs slaughtered on the last slaughter day.

Drip Loss Percentage

Approximately 11% of the variation in drip loss percentage can be explained by production system dummy, linear and quadratic terms of hog grade and dummies of slaughter days. The coefficients of production system dummy, linear and quadratic terms of hog grade are not significant indicating that these variables do not affect the prediction of drip loss percentage. The slaughter day1 variable has a significantly negative coefficient at the 5% significant level while the slaughter day4 has a significantly positive coefficient at the 1% significant level, which indicates that as compared to the hogs slaughtered on the last day (December 1st or December 3rd), hogs slaughtered on the first day (November 4th or November 5th) are expected to have meat with approximately 0.89 percent lower in drip loss while hogs slaughtered on the fourth day (November 24th or

November 26th) are expected to have meat with approximately 1.58 percent higher in drip loss.

Cooking Loss Percentage

The variables of production system, hog grade (linear and quadratic) and slaughter days can explain approximately 12% of the variability in cooking loss percentage. Production system dummy has a significantly positive coefficient at the 1% significant level indicating that traditionally raised pork is estimated to have 0.84 percent higher cooking loss than conventional pork. The coefficients of slaughter day1 and day4 are significantly negative at the 1% and 5% significant levels indicating that hogs slaughtered on the first (November 4th or November 5th) and the fourth (November 24th or November 26th) days are estimated to have 1.33 and 0.74 percent, respectively, lower cooking loss than hogs slaughtered on the last day (December 1st or December 3rd). It could imply that hogs slaughtered in the early and late November had meat with better water-holding capacity during the cooking than hogs slaughtered in December.

Shear Force

Approximately 12% of the variation in shear force value of meat can be explained by production system, hog grade (linear and quadratic) and slaughter days. The dummy of production system has a significantly positive coefficient at the 1% significant level indicating that pork from the traditionally raised system is expected to have a shear force value which is 5.29 units higher than pork from the conventional system. The coefficient of slaughter day1 is negative and significant at the 1% significant level while the coefficients of slaughter day2 and slaughter day3 are positive and significant at the 1% significant level indicating that as compared to the meat from hogs slaughtered on the last day (December 1st or December 3rd), meat from hogs slaughtered on the first day are estimated to have about 6.31 units lower shear force value while meat from hogs slaughtered on day2 (November 10th or November 12th) and day3 (November 17th or November 19th) are estimated to have approximately 5.15 and 5.27, respectively, units higher shear force values. The linear and quadratic terms of hog grade do not show any significant effect on the prediction of shear force value.

The significant effects of production system and the day of slaughter on meat quality measurements are in agreement with the results observed in the previous studies (Bee et al., 2004; Casteels et al., 1995; de Vries et al., 1994; Enfält et al., 1997; Lebret et al., 2006; Nilzén et al., 2001; Pugliese et al., 2005; Purslow et al., 2008; van der Wal et al., 1993). Production system, slaughter days and hog grade (linear and quadratic) explained a considerable part of the variation of colour L*, however, for other measurements, only moderate or very small proportion of the variation can be explained. According to Purslow et al. (2008), "Pork meat quality is affected by numerous factors including breed, genotype, feeding, pre-slaughter handling, stunning and slaughter practices, chilling, and storage conditions (p. 124)", which makes it reasonable that regression variables in this model only can explain a small portion of the variance. de Vries et al. (1994) found that 10-29% of the variation in pH, colour L*, drip loss percentage, cooking loss percentage and shear force can be explained by genotype, 11-25% can be explained by slaughter days and 12-29% can be explained by breeding organization and sex. Casteels et al. (1995) found that 12-26% of the variation in ultimate pH, L* and a* can be explained by genotype, slaughter days and slaughter weight. Kill date which was a factor confounded with individual producers was observed to be a very strong contributor to the variability in drip loss, L* and shear force which explained 16% to 35% of the variation of individual parameters. All those results combined results in this study suggest that slaughter day plays an important role in determining meat quality. Further study to extend the model to include more relevant regression variables in estimating the meat quality of pork is necessary.

The Predictions of Consumer Acceptability of Sensory Quality Traits

Appearance of Outside Grilled Surface

The production system, linear and quadratic terms for hog grade and meat quality traits, and the dummy variables for slaughter day variation can explain approximately 17% of the variability in the score for the appearance of outside grilled surface. The negative and significant coefficient on production system shows that traditionally raised pork is estimated to have 0.40 units lower in score for the appearance of outside grilled surface as compared to conventional pork. The linear coefficient of cooking loss is significantly positive at the 10% significant level indicating that 1% increase in cooking loss increases the predicted score for the appearance of outside grilled surface by 0.55 units. The coefficient of slaughter day 2 is positive and significant at the 1% significant level showing that the scores for the appearance of outside grilled surface of cooked pork from hogs slaughtered on November 10^{th} or November 12^{th} are expected to be 0.42 units higher than pork from hogs slaughtered on the last day.

Appearance of Inside Meat Surface

The explanatory variables explain approximately 21% of the variation in the score for the appearance of inside meat surface for cooked pork. The coefficient of production system dummy is negative and significant at the 1% significant level indicating that the expected score for the appearance of inside meat surface for the traditionally raised pork is 0.36 units lower than the score for the conventional pork. Cooking loss has a significant linear effect on the predicted variable at the 10% significant level with an elasticity of 2.03 showing that a 1 percent increase in cooking loss percentage increases the score of appearance of inside meat surface by about 2.03 percent. The coefficients on slaughter day1, day2 and day3 are significantly positive at the 1% and 10% significant levels which indicates that pork chops from hogs slaughtered on these days are estimated to have higher consumer rating scores (estimates of 0.39, 0.70 and 0.21, respectively as shown in Table 4.5) for appearance of inside meat surface than pork chops from hogs slaughtered on the last day.

Tenderness

Approximately 25% of the variation in the score for tenderness of cooked pork can be explained by the variables of production system, hog grade, meat quality traits and slaughter days. The coefficient of production system dummy is significantly negative at the 1% significant level indicating that traditionally raised pork is expected to have a score for tenderness which is 0.71 units lower than conventional pork. The dummy variables of slaughter day1, day2 and day3 are significantly positive at the 5%, 1% and 10% significant levels, respectively. This shows that as compared to pork chops from hogs slaughtered on the last day, pork chops from hogs slaughtered on the first three days are expected to receive significant higher scores for tenderness (0.46, 0.87 and 0.31 units higher, respectively). Shear force which is taken as a technical measure of tenderness does not have any significant effect on tenderness.

Juiciness

The variables of production system, hog grade, meat quality traits and slaughter days explain about 19% of the variability in consumer rating score for juiciness. Production system dummy has a significantly negative coefficient at the 1% significant level showing that cooked pork from the traditionally raised system is estimated to receive a juiciness score of 0.54 lower than pork from the conventional system. pH is negative and significant at the 1% significant level while pH^2 is positive and significant at the 1% significant level. The elasticity of juiciness with respect to pH is $-88.06+16.19\times pH$ indicating that pH value of raw meat is estimated to decrease the rating score for juiciness of cooked pork until it reaches a point of 5.44, after which the percentage change in juiciness becomes positive due to a 1% increase in pH. In contradiction to the effects of pH, coefficient of the linear term of cooking loss is significantly positive while coefficient of the quadratic term is significantly negative. The elasticity of juiciness with respect to cooking loss percentage is 3.88-0.18×cooking loss, which suggests that cooking loss percentage has a diminishing effect on the estimated juiciness score that the percentage change in juiciness is positive when there is a 1% change in cooking loss percentage, after the cooking loss percentage reaches to 21.25, the percentage change in juiciness becomes negative. Coefficients on slaughter day1, day2 and day3 are significantly positive indicating that hogs slaughtered on these days are expected to have meat receiving juiciness scores of 0.45, 0.71 and 0.39 units higher, respectively, than hogs slaughtered on the last day.

Flavour

Approximately 17% of the variation in flavour of cooked pork can be explained by the regression variables. Production system has a significantly negative effect on the predicted flavour score at the 1% significant level that the traditionally raised pork is expected to have flavour score of 0.35 units lower than the conventional pork. The coefficient of the linear term of pH is significantly negative at the 10% significant level while the coefficient of the quadratic term of pH is significantly positive at the 10% significant level. The elasticity of flavour with respect to pH is -51.42+9.60×pH, which suggests that pH value of raw meat is estimated to have an increasing effect on flavour that after the point of 5.36, the negative percentage change in flavour due to a one percent change in pH turns to be positive. The coefficient of slaughter day2 is significant and positive indicating that pork chops from hogs slaughtered on November 10^{th} or November 12^{th} are expected to receive scores for flavour which are 0.46 units lower than pork chops from hogs slaughtered on the last day.

Overall acceptability

Production system, hog grade, meat quality traits and slaughter days explain about 21% of the variability in consumer overall sensory acceptability. The production system dummy has a negative and significant coefficient at the 1% significant level indicating that traditionally raised pork is expected to have a score for the overall acceptability which is 0.57 lower than conventional pork. Both of the linear and quadratic terms of pH have significant coefficients at the 10% significant level with the linear one as negative while the quadratic one as positive. The elasticity of overall acceptability with respect to pH is -50.89+9.59×pH, which suggests that pH value of the raw meat has an increasing effect on the overall acceptability where the percentage change in overall acceptability is negative due to a one percent change in pH, after the point of 5.30, it becomes positive. The coefficient of slaughter day2 is significant at the 1% significant level and it is positive indicating that hogs slaughtered on that day are expected to receive a score for the overall acceptability of cooked pork which is 0.62 units higher than hogs slaughtered on the last day.

Production system was observed to have significant effects on predicting consumer acceptability of sensory quality traits where traditionally raised is estimated to have a negative effect. This is similar to the results observed by Enfält et al. (1997) and Jonsäll et al. (2001) who observed rearing system had significant negative effect on some of the sensory traits (tenderness, juiciness, overall acceptability). Slaughter days were also observed to have significant effects on consumer acceptability of pork sensory quality in this study while Casteels et al. (1995) found that slaughter day did not have significant effects on tenderness, juiciness and taste in their study. As a representative variable of carcass quality, neither the linear nor quadratic term of hog grade showed significant effect on the consumer evaluation of pork sensory quality traits, which suggest that carcass quality does not contribute to the explanation of the variation in sensory quality traits. Although there is no previous study found to estimate influence of hog grade on sensory quality, similar results regarding carcass quality traits on sensory quality traits were found. Slaughter weight estimated by Casteels et al. (1995), backfat thickness and percent lean in carcass for sample from the Landrace breed estimated by Fjelkner-Modig and Persson (1986), which are important carcass quality traits, were found have no significant effect on the sensory properties, either. However, Fjelkner-Modig and Persson (1986) found that backfat thickness and percent lean in carcass contributed to the explanation of variation in sensory properties for samples from the Hampshire and Yorkshire breeds. Meat quality parameters did not show any significant effect on tenderness which is similar to the results observed by Fjelkner-Modig and Persson (1986) for samples from the Hampshire breed, but for the samples from the Yorkshire breed in their study, meat quality measurements, pH and EEL-colour value were observed to contribute to the explanation of the variation in tenderness. They suggested that breed must be considered when estimating the influence of carcass and meat quality traits on sensory quality of pork. pH showed an increasing effect on predicting juiciness, flavour and overall acceptability that both the linear and quadratic terms of it are significant in this study while no significant quadratic effect of pH was found by Moeller et al. (2010), they only found a significant linear effect of pH on sensory quality responses that responses improved as pH increased which is similar to what observed by DeVol et al. (1988) that they found pH had a positive effect on juiciness. In opposition to pH, cooking loss was observed to have a diminishing effect on juiciness which is different from the result observed by DeVol et al. (1988) who found that cooking loss negatively affected juiciness. Colour L*, a* and b* did not show significant effect in this study which is similar to the results in the study by Moeller et al. (2010). In the present study, 17-25% of the variation in sensory quality traits can be explained by production system, slaughter days, linear and quadratic terms of hog grade and meat quality traits. In the study by Fjelkner-Modig and Persson (1986), for pork from the Yorkshire breed, 9-24% of the variance of sensory properties can be explained by live-weight gain, slaughter age and percent lean in carcass, and another 14-19% of the variance can be explained by pH, EEL-colour and intramuscular-lipid content while for pork from the Landrace breed, 21-47% of the variation can be explained by those meat quality measurements. In the study by Casteels et al. (1995), 32-67% of the variation in tenderness, juiciness and taste intensity can be explained by genotype, slaughter day and slaughter weight. As compared to those previous studies, regression variables in this study explained a considerable part of the variation in sensory quality traits, more variables such as genotype and breed can be taken into consideration when estimating the determinants of sensory quality of pork in further studies.

4.5 CONCLUSION

Statistics on carcass and meat quality traits show significant differences between the traditionally raised system and the conventional system. As compared to conventional hogs, traditionally raised hogs had lower percent lean yield and hog grade, had meat with lower average pH, which was lighter (higher value in L*), redder (higher value in a*), and had more yellow colour (higher value in b*), higher cook loss percentage and higher shear force value. For sensory quality, traditionally raised pork received significantly lower mean scores for appearance of outside grilled surface, tenderness, juiciness, and overall acceptability, but the absolute difference between treatments was small which was never more than ½ a scale unit suggesting there was no practical differences between the two production systems in terms of consumer acceptability of sensory quality traits. Differences across the five slaughter days were also observed for the samples from the two production system but more significant differences were observed from the traditionally raised system.

The correlation coefficients suggest that there are more significant relationships between carcass quality and meat and sensory quality observed from the traditionally raised hogs than from the conventional hogs. Numerous significant correlations between traits were observed within the three categories for both types of hogs. In agreement with previous studies that the colour (L* and b*) and water-holding capacity (drip loss and cooking loss) are significantly correlated to pH. The correlations between the six sensory quality traits are strong and positive.

Results of the multivariate regression analysis suggest that production system and slaughter days are important contributors to explaining the variation in hog grade, meat and sensory quality traits which are as expected but the negative effects of niche production system (traditionally raised) are contrary to expectation. Hog grade did not have a significant effect on predicting meat or sensory quality traits though it was observed to have significant correlations with some of those traits. The observed significant linear and quadratic effects of pH and cooking loss indicate that they also play an important role in determining the sensory quality of pork.

CHAPTER 5 CONSUMER CHOICE MODEL RESULTS AND ANALYSIS – EDMONTON VERSUS CANADA

5.1 INTRODUCTION

The aim of this chapter is to understand consumers' preferences and purchase decisions for pork chops with various quality attributes including credence attributes which are production practice, certification for production practice, country of origin (the Canadian pork label) and the label of Canadian Quality Assurance (CQA®) and physical quality indicators by using econometric methods to analyze data collected from economic experiments and surveys in Edmonton and in Canada. Multinomial logit (MNL) models were developed to analyze the data and provide the basis for estimating willingness to pay (WTP) for different attributes for each of the samples. Before dealing with the models, the demographics and survey responses from both of the samples are summarized in order to compare the study sample demographics to the Edmonton and Canada Census data from 2006, respectively, and to compare the survey responses between the two samples. Models and model results for the two samples will be presented in separate sections followed by a section where the model results between the two samples will be compared.

5.2 DEMOGRAPHICS

A summary of the demographic characteristics of the Edmonton sample and the national sample is presented in Table 5.1.

The demographic characteristics of the Edmonton sample were compared to Edmonton Census data from 2006. The percentages of males and female were representative of the population and the groups of the sample in the age categories of 18 to 24 and 30 to 39 were close representations of the population. As compared to the population, the sample had greater percentages of people in the age categories of 40 to 49 and 50 to 59 while had 7.3% less people in the age category of over 64. Education levels and employment rate of the sample were higher than those of the population. The sample had a lower percentage of one-person households and a higher percentage of two-person households than the population data. Data from the sample show that the percentage of people who were married/living together/common law was 30% higher than the percentage of people who were single/divorced/separated/windowed while the census data show that the percentage of people who were single/divorced/separated/windowed was 38% higher than the percentage of people who were married/living together/common law. 73.6% of the sample had no children in the household which was 47.2% higher than that of the population indicated by the census. Overall, the Edmonton sample was representative of the Edmonton population in terms of gender and some age categories but it differs from the general population in terms of other observed demographic characteristics.

The demographic characteristics of the national sample were compared to Canada population census data from 2006. Both the sample and the population had more female than males but the difference in the sample was 18.2% higher than the difference in the population. The percentages of respondents in the age categories of 18 to 24, 25 to 29, 30 to 39 and 40 to 49 were representative of the population. People in the sample had slightly higher education levels than people in the population. The employment rate of the national sample was 4.6% higher than the population census, which is opposite to the comparison between the Edmonton sample and population. As in the Edmonton sample, the national sample also had 32% more people who married/living together/common law than people who were single/divorced/separated/windowed while the population census showed 4.2% more people who were single/divorced/separated/windowed than people who were married/living together/common law. The percentage of the sample that had no children in the household was 35.5% higher than that of the general population. The sample in this study had similar percentages of respondents from different regions while the population census in 2006 shows that the percentages of people in Quebec and Ontario were higher than the percentages of people in the other regions. Percentages of population living in rural and urban areas in the survey sample are close to the census. Similar to the Edmonton sample, the national sample was representative of the population in terms of some age categories as well as rural and urban population, but there were also some differences between the sample and the general population (2011 survey data compared to 2006 Census data).

Table 5.1 Demographic Characteristics of the Edmonton Sample and the National Sample

		Edmonton Survey (N=197)	Edmonton Census 2006	National Survey (N=1603)	Canada Population Census 2006
Gender	Male	49.2%	49.5%	39.9%	49.0%
	Female	50.8%	50.5%	60.1%	51.0%
Age	18-24	12.2%	9.1%	4.5%	6.6%
	25-29	13.7%	8.5%	5.0%	6.3%
	30-39	17.3%	14.3%	14.2%	13.4%
	40-49	22.3%	15.9%	16.5%	16.5%
	50-64	29.9%	16.7%	37.9%	19.1%
	Over 64	4.6%	11.9%	21.8%	13.7%
Education	Elementary	0.0%	21.9%	2.6%	23.7%
	Secondary/High School	15.2%	25.8%	29.4%	25.5%
	Technical/College/ University	68.0%	52.3%	60.2%	44.0%
	Post Graduate Studies	16.8%		7.7%	6.5%
Employment Rate		84.8%	68.4%	57.8%	62.4%
Income (Median)		$50,000 to $89,999	$57,085	$45,000 to $59,999	$53,634
Household Size	1	13.20%	26.4%	18.5%	26.8%
	2	42.60%	33.2%	44.8%	33.6%
	>3	44.20%	40.3%	36.7%	39.7%
Marital Status	Married/Living Together/Common Law	65.0%	31.0%	66.0%	47.9%
	Single/Divorced/Separated/Windowed	35.0%	69.0%	34.0%	52.1%
Number of Children < 18 years	0	73.6%	26.4%	74.0%	38.5%
	1	9.6%	33.2%	12.3%	27.3%
	2	13.7%	40.5%	9.2%	24.0%
	3	3.0%	26.43%	3.1%	10.3%
	4			1.0%	

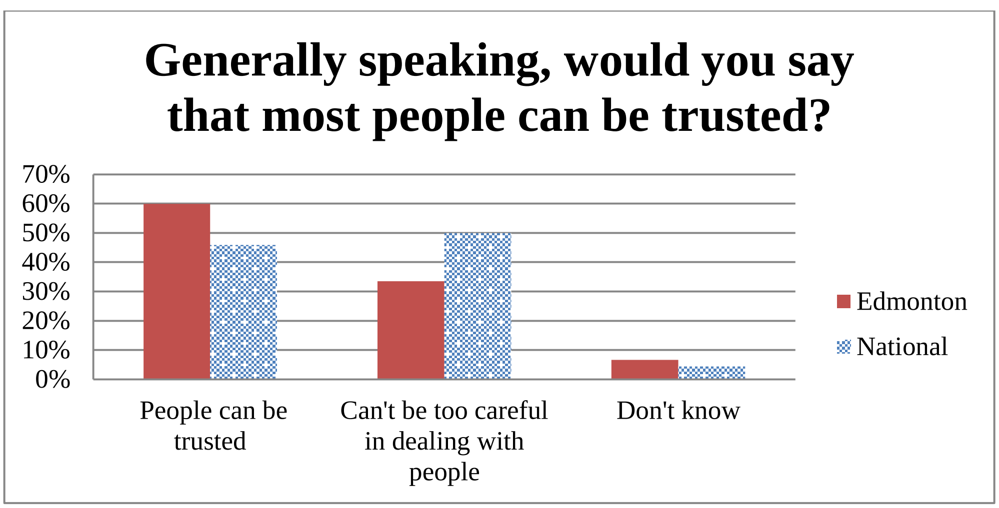
	>4			0.5%	
Which region do you live in?	Maritimes			12.7%	5.6%
	Quebec			13.2%	23.9%
	Ontario			14.5%	38.5%
	Manitoba			17.5%	3.6%
	Saskatchewan			12.1%	3.1%
	Alberta			13.6%	10.4%
	British Columbia			16.5%	13.0%
	Rural			18.7%	20.0%
	Urban			81.3%	80.0%

Source: Statistics Canada-2006 Census

5.3 SURVEY ANALYSIS

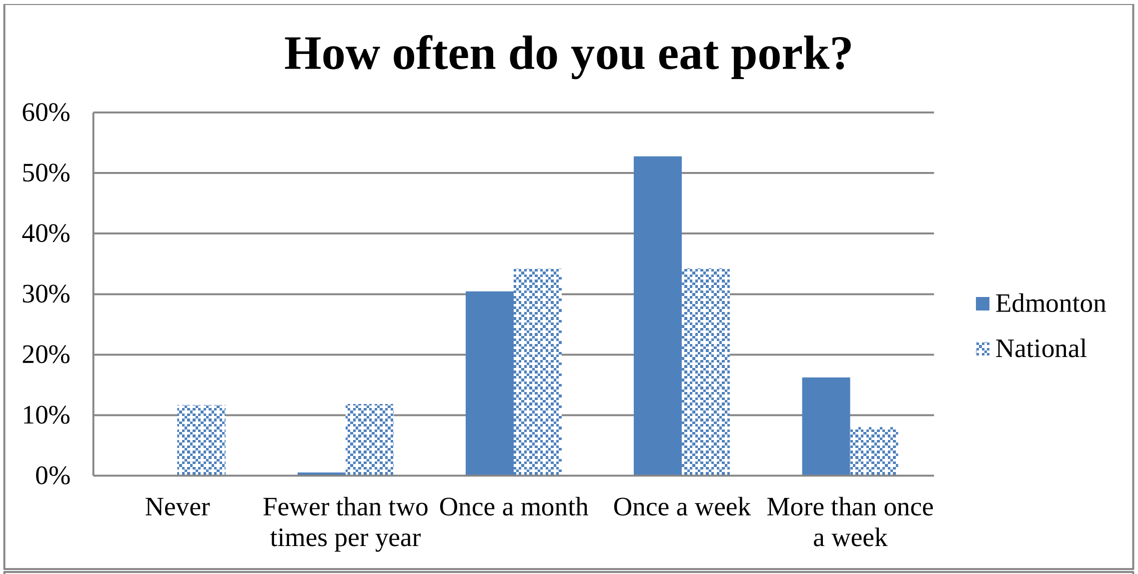
Frequency analyses of responses to various survey questions show some differences between the Edmonton sample and the national sample. Respondents in Edmonton appeared to have a higher degree of trust than the national respondents (Figure 5.1), as 60% of the Edmonton respondents thought that people can be trusted while 50% of the national respondents thought that "you can't be too careful in dealing with people". These differences were significant at the 1% significant level. The distribution of the responses from the Edmonton sample is similar to the observations by Romanowska (2009).

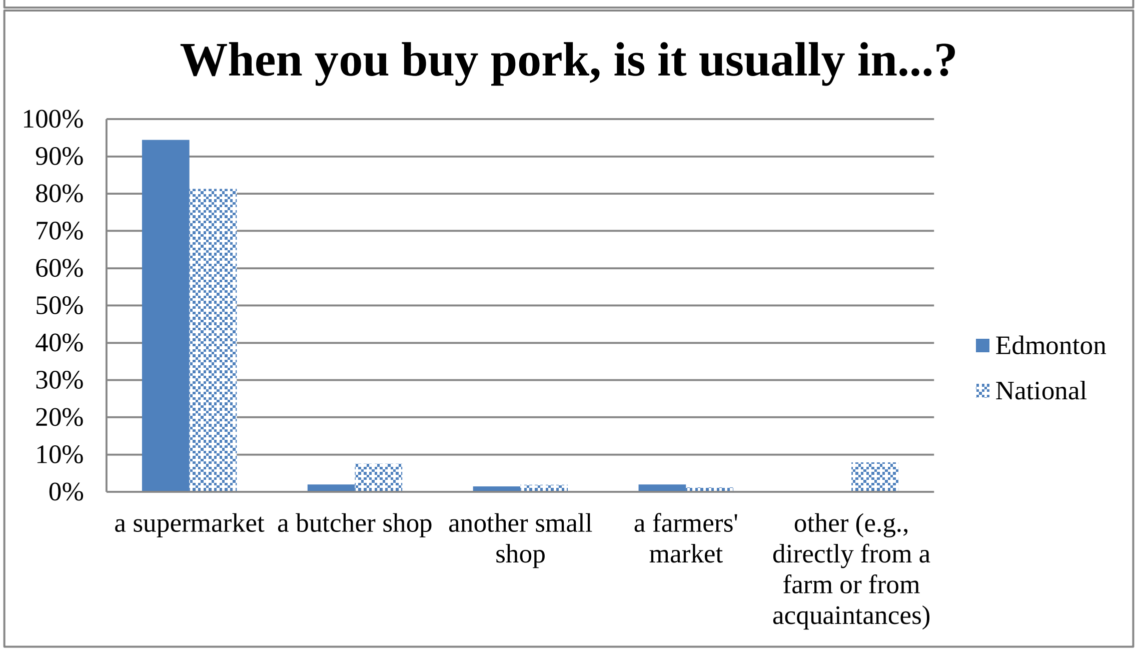
Figure 5.1 Differences in General Trust between the Edmonton Sample and the National Sample



With respect to pork consumption habits (Figure 5.2), Edmonton respondents were observed to eat pork more often than national respondents such that 69% of the sample belonged to a high eating frequency group (once or more than once per week), while 46% of the national sample belonged to a low eating frequency group (once or fewer than two times per year) and 12% of them had never eaten pork. People participating in both of the surveys were asked a question as "When you buy pork, is it usually in 'A supermarket', 'A butcher shop', 'Another small shop', 'A farmer's market' or 'Other (e.g. directly from a farm or from acquaintances'?". Respondents in both of the studies usually buy pork in supermarkets, but there were more respondents in the national sample buying pork in a butcher shop and or directly from a farm or from acquaintances (there was no respondents in the Edmonton sample buying pork directly from a farm or from acquaintances).

Figure 5.2 Differences in Pork Consumption Habits between the Edmonton Sample and the National Sample





In the national survey, respondents were also asked their food preferences. 82% of the respondents stated that they eat pork regarding the question asking if they eat pork or not (Figure 5.3). When asked a question as “Which of the following best describes your food preferences” with options as “I eat meat and fish”, “I eat fish but don’t eat meat”, “I do eat meat but don’t eat fish” and “I am a vegetarian (i.e., I do not eat meat or fish)", most of the respondents answered that they eat meat and fish (81%) while only 3% of them stated that they eat fish but don't eat meat and 2% said they are vegetarians (Figure 5.4).

Figure 5.3 Consumers' Food Preferences, National Sample

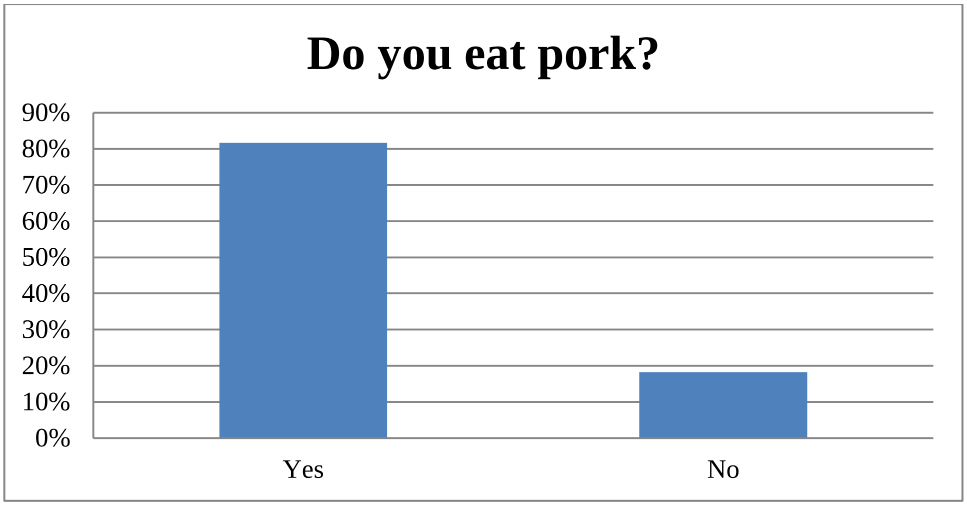
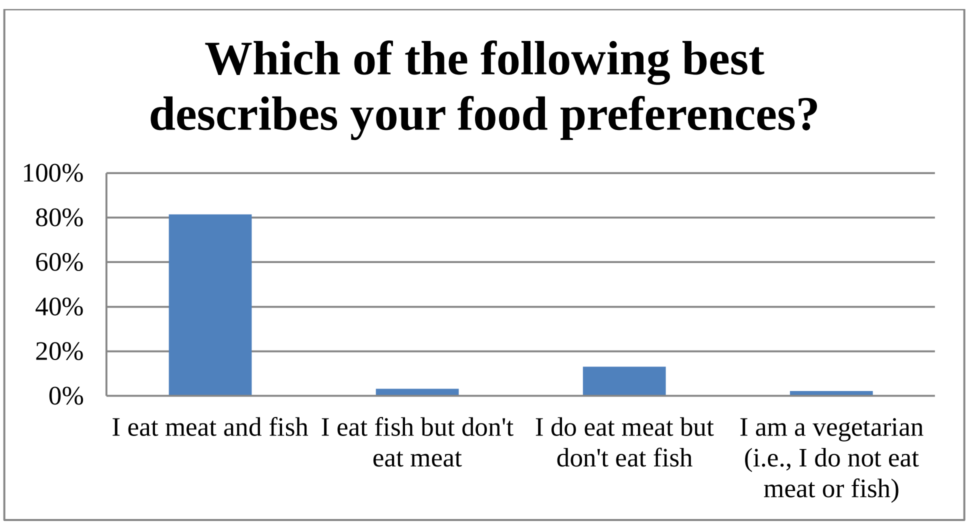


Figure 5.4 Consumers' Food Preferences, National Sample



Frequency distributions of responses to the statements in a question asking consumer beliefs about traditionally raised pork as compared to conventional pork were similar in both of the samples (Figure 5.5 and 5.6). T-tests did not show any significant differences regarding responses to the various statements between the two samples. When asked if they believe that traditionally raised pork tastes better, is fresher, is healthier, does not contain hormones, does not contain antibiotics, and is safer to eat as compared to conventional pork, there were more respondents choosing "Neutral/No difference" than choosing other answers for all the statements suggesting that there could be some uncertainty about the traditionally raised system in terms of the final quality of pork to consumers. However, there were more responses of positive beliefs (strongly agree and agree) in the traditionally raised pork than the responses of negative beliefs (strongly disagree and disagree). People with different beliefs about traditionally raised pork could have differences in purchasing traditionally raised pork.

Figure 5.5 Beliefs about Traditionally Raised Pork, Edmonton Sample

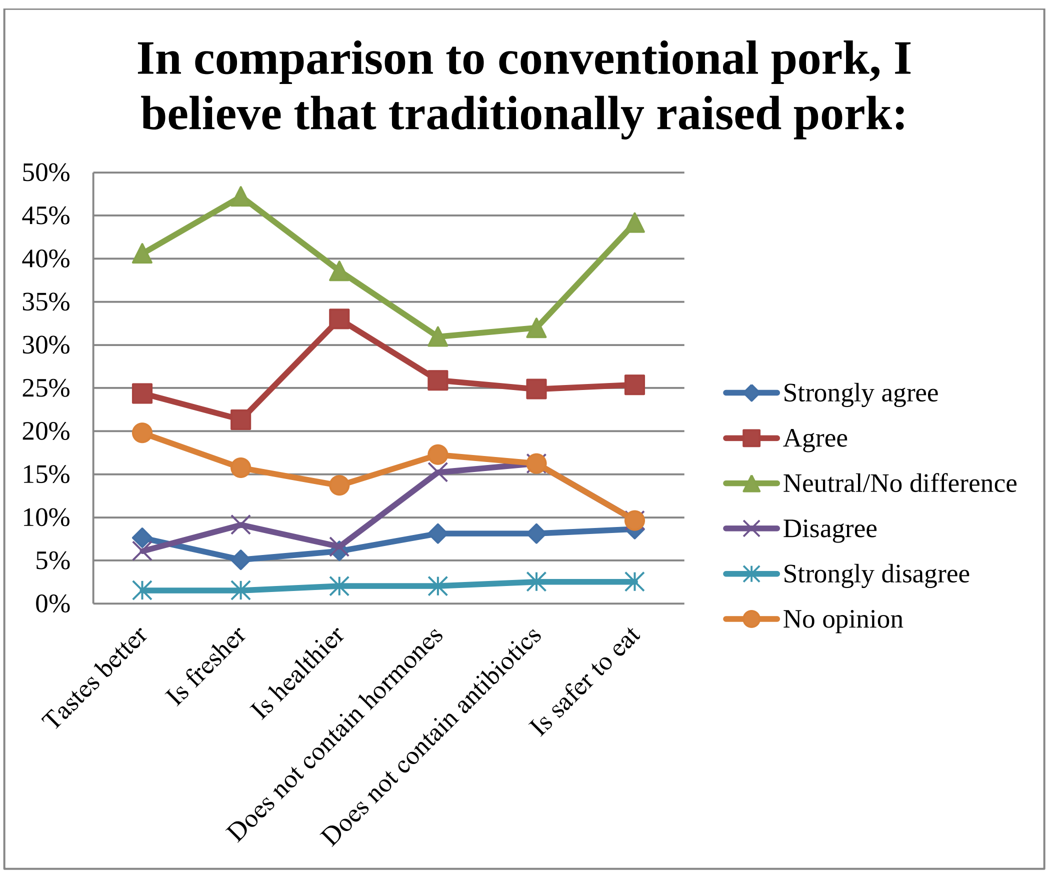
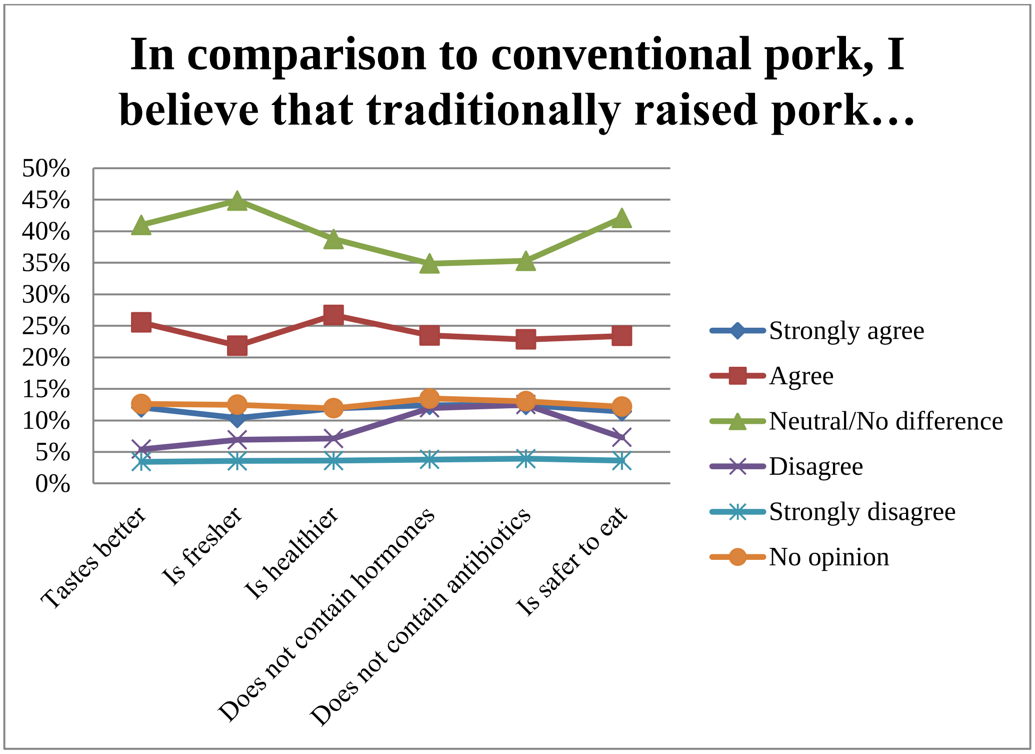


Figure 5.6 Beliefs about Traditionally Raised Pork, National Sample



5.4 MODEL FOR CONSUMER CHOICE EXPERIMENT

In this research, consumer stated preference data were collected from choice experiments in the Edmonton study and the national study where each participant was asked to make choice of three options, two alternative packages of pork chops with different attributes and an option of "I would not purchase either of these products". Probabilistic choice models were necessary and multinomial logit regressions, which have been widely used to estimate consumer choices and the willingness to pay for different product attributes based on the random utility theory (Liljenstolpe, 2005; Ubilava, 2006; Ubilava and Foster, 2009; Ubilava et al., 2008; Uzea, 2009; Yen, 2009), were developed to explain consumer choices of pork chops and to calculate consumer willingness to pay for pork chops with different quality attributes.

Following McFadden (1974) if the random terms are assumed to be independent and identically distributed with type 1 extreme value distribution,

$$F(\varepsilon_{iq}) = \exp(-\exp(-\varepsilon_{iq})), \tag{5-1}$$

then the conditional logit model ("it is often labeled the multinomial logit model" (Greene, 2007, p. 842) which expressed as:

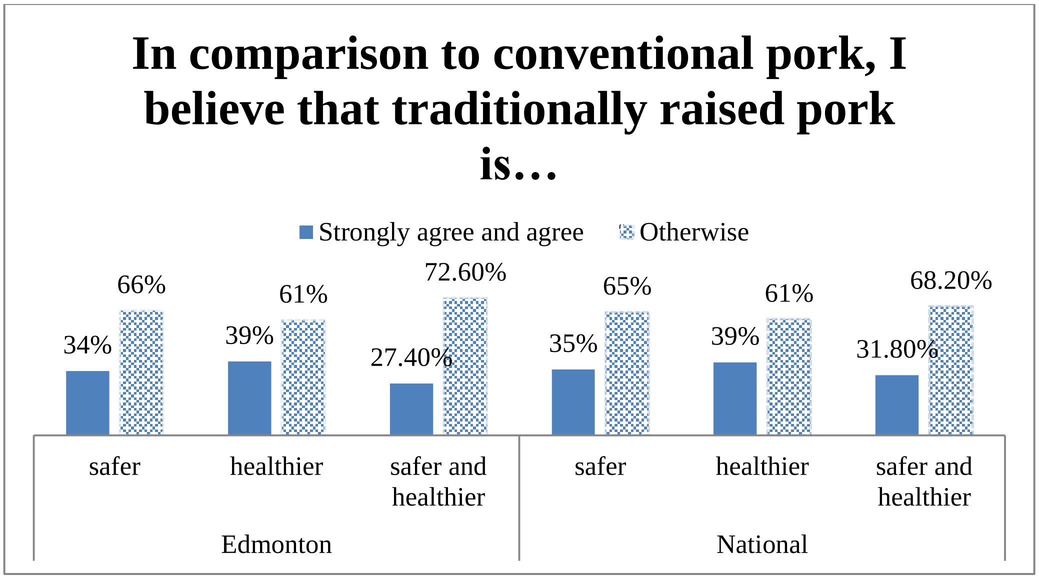
$$P_{iq} = \exp(V_{iq}) / \sum_{i=1} \exp(V_{jq}), \tag{5-2}$$

can be utilized to estimate the probabilities of consumer choices. Based on Lancaster (1966)'s new approach to consumer theory, equation (5-2) can be written as:

$$P_{iq} = \exp(\beta' X_{iq}) / \sum_{i\epsilon C} \exp(\beta' X_{iq}), \tag{5-3}$$

Respondents from both of the samples in this research were found to have different beliefs about traditionally raised pork as compared to conventional pork in terms of tastes, freshness, healthiness, containing hormones, containing antibiotics and safeness to eat. As discussed in chapter 2, consumer perceptions, attitudes, and beliefs have been identified to play an important role in consumer preferences and decision making process. In order to assess the effect of consumers' prior beliefs about traditionally raised pork on their choices and WTP for pork chops with different quality attributes, consumers both in Edmonton and across Canada were studied as groups based on their beliefs about traditionally raised – believing traditionally raised pork is healthier or safer to eat than conventional pork or not. 34% of the Edmonton sample and 35% of the national sample who strongly agreed and agreed that traditionally raised pork was safer to eat than conventional pork were clustered as a group with "safer" belief, while the others were taken as a group with "not safer" belief. 39% of each sample who thought traditionally raised pork was healthier to eat than conventional pork was clustered as "healthier" belief groups while the others were as "not healthier" groups.

Figure 5.7 Consumers' Prior Beliefs about Traditionally Raised Pork - Edmonton Sample versus National Sample



Socio-economic and demographic characteristics for the four groups for the Edmonton sample were summarized and are presented in Appendix H. The characteristics of the group of respondents who believed that traditionally raised pork was healthier to eat than conventional pork were similar to the characteristics of the group of respondents who believed that traditionally raised pork was safer to eat than conventional pork.

In the group that believed traditionally raised pork was healthier to eat than conventional pork, the proportion of male was 9% smaller than the proportion of female; while in the group that did not believe traditionally raised pork was healthier to eat than conventional pork, the proportion of female was 3.4% smaller than the proportion of male. The proportions of respondents at the age of 25-29, 30-39, and 40-49 were larger in the group believing that traditionally raised pork is healthier to eat than in the group that did not believe traditionally raised pork is healthier to eat than conventional pork while the proportion of respondents at the age of 50 and over in the group with belief that traditionally raised pork is healthier than conventional pork was 16.1% smaller than in the group that did not think traditionally raised pork is healthier than conventional pork. The distributions of education levels were similar between the two groups with different beliefs about traditionally raised pork in terms of healthiness with the proportion of respondents with technical/college/university education being the highest within each group, but the proportion of respondents with technical/college/university and graduate education was 14.9% higher in the group of respondents who did not believe that traditionally raised pork is healthier than conventional pork than in the other group of sample with the opposite belief. As compared to the group of sample that believed traditionally raised pork is healthier to eat than conventional pork, the group of sample that did not believe traditionally raised pork is healthier to eat than conventional pork had an 11.1% smaller proportion of respondents employed full-time or self-employed, had fewer students but more retired respondents which can be expected as there were more older respondents in this group. The proportion of respondents with no children younger than 18 years in the group of sample that did not agreed that traditionally raised pork is healthier than conventional pork was 77.5% which is 10% higher than the proportion in the group of sample that agreed with the statement. The proportion of respondents who stated that people can be trusted was 15.2% higher in the group that did not believe that traditionally raised pork is healthier to eat than conventional pork than in the other group. Over 90% of the respondents in both of the groups usually buy pork in supermarket but there were more respondents in the group that thought traditionally raised pork is healthier to eat than conventional pork usually shop in a butcher’s shop, another small shop, or in a farmers’ market.

For the two groups clustered based on the responses to the statement that traditionally raised pork is safer to eat than conventional, similar to the two groups discussed above, there were more women in the sample that agreed with the statement while there were more men in the sample that did not agree with the statement. The proportions of respondents in different age groups or with different levels of education were similar between the two groups. As compared to the sample that agreed with the statement, the sample that did not agree with the statement had 6.7% fewer respondents who were employed full-time or self-employed while had 8.5% more respondents who were employed part-time. 11.4% more of the respondents had income between $50,000 and $89,999 in the group of sample that did not agree with the statement than in the group of the sample agreed with the statement.

Socio-economic and demographic characteristics for the four groups for the national sample were summarized and are presented in Appendix I. As what has been observed from the Edmonton sample, from the national sample, characteristics of the sample that agreed with the statement that traditionally raised pork is healthier to eat than conventional pork were similar to the characteristics of the sample that agreed with the statement that traditionally raised pork is safer to eat than conventional pork while characteristics of the group of respondents who did not agree with the statement that traditionally raised pork is healthier to eat than conventional were similar to the characteristics of the group of respondents who did not agreed with the statement that traditionally raised pork is safer to eat than conventional pork.

For the two groups of respondents clustered based on the responses to the statement that traditionally raised pork is healthier to eat than conventional pork, in the group that agreed with the statement, the proportion of female was 24.4% higher than the proportion of males while in the group that did not agree with the statement, the proportion of female was 18.6% than that of males. There were more older respondents in the group of respondents who did not agree with the statement than in the group of respondents who agreed with the statement that 38% and 22.7% of the respondents in the group that did not agree with the statement were in the 50-64 and 65-and-over age groups, respectively, while 36.8% and 18.4% of the respondents in the group of respondents who agreed with the statement were in the same age groups. There were more respondents in the group that did not agree with the statement were retired or unemployed than in the group that agreed with the statement. 30.6% and 5.1% of the respondents in the group that did not agree with the statement were retired and unemployed, respectively, while 26% and 3.9% of the respondents in the group that agreed with the statement were retired and unemployed, respectively. In the group that did not agree with the statement, there were more respondents from Manitoba (18%) than from other regions while in the group that agreed with the statement, there were more respondents from Ontario (17%) than from other regions. There were 65% more respondents from urban area than from rural area in the group that did not agree with the statement while there were 58.4% more respondents from urban area than from rural area in the group that agreed with the statement. 78% of the respondents in the group that did not agree with the statement stated that they eat pork while 87.6% of the respondents in the group that agreed with the statement stated that they eat pork. 14.8% of the respondents in the group that did not agree with the statement had never had pork while only 6.6% of the respondents in the group that agreed with the statement had never had pork. There were more respondents belonging to the higher pork eating frequency group (eat pork once a week and more than once a week) in the group that agreed with the statement than in the group that did not agree with the statement.

For the respondent groups clustered based on the responses to the statement that traditionally raised pork is safer to eat than conventional pork, in the respondent group that did not agree with the statement, there were 19.4% more female than males, while in the respondent group that agreed with the statement, there were 23.6% more female than males. There were 5.8% more older respondents (at the age of 50-and-over) in the group that did not agree with the statement than in the group that agreed with the statement and therefore there were more respondents who were retried in the group that did not agree with the statement than in the group that agreed with the statement. The proportion of respondents from Manitoba was the highest (18.2%) in the respondent group that did not agree with the statement while the proportion of respondents from Ontario was the highest (17.9%) in the respondent group that agreed with the statement. There were 65.4% more unban respondents than rural respondents in the respondent group that did not think traditionally raised pork is safer to eat than conventional pork, while there were 58.4% more unban respondents than rural respondents in the respondent group that believed that traditionally raised pork is safer to eat than conventional pork. The proportion of respondents who eat meat and fish in the group that agree with the statement was 4.5% larger than in the group that did not agree with the statement. There were more respondents who had never had pork (7.9%) and fewer respondents who belonged to a higher pork eating frequency group (eat pork once a week or more than once a week) (4.3%) in the group that did not agree with the statement than in the group that agreed with the statement.

Table 5.2 shows that there were more responses of "I would not purchase either of these products" (Choice C) given by respondents who did not think traditionally raised pork is safer or healthier to eat than conventional pork for both of the samples with bigger differences (more than 10%) between groups observed from the national sample.

Table 5.2 Distribution of Choices by Respondent Group

Edmonton				
Choice	Healthier	Not Healthier	Safer	Not Safer
C	6.4%	8.2%	6.8%	7.8%
A	46.0%	41.6%	46.1%	41.8%
B	47.7%	50.3%	47.1%	50.4%
Canada				
Choice	Healthier	Not Healthier	Safer	Not Safer
C	14.1%	25.6%	14.5%	24.7%
A	46.9%	40.1%	46.8%	40.5%
B	39.0%	34.4%	38.7%	34.8%

Healthier: the group of respondents who agreed that traditionally raised pork was healthier than conventional pork; Not healthier: the group of respondents who did not agree that traditionally raised pork is healthier than conventional pork; Safer: the group of respondents who agreed that traditionally raised pork was safer than conventional pork; Not safer: the group of respondents who did not agree that traditionally raised pork is safer than conventional pork.

Differences were found between groups of respondents with different beliefs about traditionally raised pork in terms of demographic characteristics, survey and experiment responses, therefore, differences in terms of consumer preferences and willingness to pay for pork with different quality attributes are expected between groups with different beliefs about traditionally raised pork and four multinomial logit regressions were developed for the four groups of respondents for each sample.

5.5 MULTINOMIAL LOGIT MODEL FOR THE EDMONTON SAMPLE

5.5.1 VARIABLES

In the stated preference experiment used to elicit data used in this model respondents made choices from three options, two alternatives of real packaged pork chops (A and B) and a choice of "I would not purchase either of these products" (C). For the multinomial logit model which is run by using TSP version 5.1 software, the dependent variable is CHOICE which took on the value of 1 if C ("I would not purchase either of these products") was chosen, 2 if A was chosen and 3 if B was chosen. The independent variables are product attributes and their interactions with demographic and attitudinal variables which can be found in Table 5.3. Credence attributes production system (conventional or traditionally raised), certifying body (industry or government), country of original (Canadian pork) and quality assurance (CQA®) are included in the model in the way as they are presented in Table 3.2 as this was how they were presented to respondents in the experiment, the variable of conventional production was the base pork chop for comparison. Hog grade, meat quality attributes and the overall sensory acceptability were also included in the regressions, to test if they have any contribution in explaining the probability of selecting a particular pork chop and/or affect the value of a pork chop. Demographic variables gender, age, education and children were included based on the review in chapter 2 and the descriptive statistics in the previous sections. Income is not included as 13% of the sample that believed traditionally raised pork was healthier than conventional pork and 16.4% of the sample that believed that traditionally raised pork was safer than conventional pork did not reveal their level of income. As discussed in chapter 3, consumer general trust and pork eating frequency are also expected to affect the probability of choosing a particular pork chop.

Table 5.3 Variable Descriptions in Model, Edmonton Sample

Variable	Description
PRICE	Dollar price of product.
N	The “none” option.
TR	Dummy variable =1 if the package of pork chops is traditionally raised, 0 otherwise.
CTR	Dummy variable =1 if package of pork chops is traditionally raised and certified by the Canadian pork industry, 0 otherwise.
GTR	Dummy variable =1 if package of pork chops is traditionally raised and certified by government, 0 otherwise.
CP	Dummy variable =1 if package of pork chops is labeled as Canadian pork, 0 otherwise.
CQA	Dummy variable =1 if package of pork chops is labeled with the Canadian Quality Assurance (CQA®), 0 otherwise.
TRCP	Attribute interaction term =1 if package of pork chops is traditionally raised and is labeled as Canadian pork, 0 otherwise.
TRCQA	Attribute interaction term =1 if package of pork chops is traditionally raised and is labeled with the Canadian Quality Assurance (CQA®), 0 otherwise.
TRCPCQA	Attribute interaction term =1 if package of pork chops is traditionally raised and has the Canadian pork label and the

	CQA® label.
CTRCP	Attribute interaction term =1 if package of pork chops is labeled as the pork industry certified traditionally raised and has the Canadian pork label on it, 0 otherwise.
CTRCQA	Attribute interaction term =1 if package of pork chops is labeled as the pork industry certified traditionally raised and has the CQA® label on it, 0 otherwise.
CTRCPCQA	Attribute interaction term =1 if package of pork chops is labeled as the pork industry certified traditionally raised and has the Canadian pork and CQA® labels on it, 0 otherwise.
GTRCP	Attribute interaction term =1 if package of pork chops is labeled as government certified traditionally raised and has the Canadian pork label on it, 0 otherwise.
GTRCQA	Attribute interaction term =1 if package of pork chops is labeled as government certified traditionally raised and has the CQA® label on it, 0 otherwise.
GTRCPCQA	Attribute interaction term =1 if package of pork chops is labeled as government certified traditionally raised and has the Canadian pork and CQA® labels on it, 0 otherwise.
CONCP	Interaction term between conventional production system (CON) and Canadian pork label, equal to 1 if package of pork chops is conventional and has the Canadian pork label on it, 0 otherwise.
CONCQA	Interaction term between conventional production system (CON) and the Canadian Quality Assurance (CQA®), equal to 1 if package of pork chops is conventional and has the CQA® label on it, 0 otherwise.
CONCPCQA	Attribute interaction term equal to 1 if package of pork chops is conventional and has the Canadian pork and CQA® labels on it, 0 otherwise.

GRAD	Hog grade index
MQPH	pH (meat quality trait)
MQCL	Colour L* (meat quality trait)
MQCA	Colour a* (meat quality trait)
MQCB	Colour b* (meat quality trait)
MQDL	Drip loss percentage (meat quality trait)
MQCKL	Cooking loss percentage (meat quality trait)
MQSF	Shear force (meat quality trait)
CSEN	Consumer overall acceptability of sensory quality
GENDER (pork attribute/attribute interaction)	Interaction term between GENDER which took the value of 1 if the respondent is a male and 0 otherwise and pork attribute or attribute interaction.
AGE (pork attribute/attribute interaction)	Interaction term between age and pork attribute or attribute interaction.
CHILD (pork attribute/attribute interaction)	Interaction term between CHILD which took the value of 1 if the respondent had a child or children younger than 18 years in household and 0 otherwise and pork attribute or attribute interaction.
EDUC (pork attribute/attribute interaction)	Interaction term between education and pork attribute or attribute interaction.
EATF (pork attribute/attribute interaction)	Interaction term between pork eating frequency levels and pork attribute or attribute interaction.
TRUS (pork attribute/attribute interaction)	Interaction term between TRUS which took the value of 1 if the respondent believed people can be trusted and 0 otherwise and pork attribute or attribute interaction.

5.5.2 MODEL SPECIFICATION AND GOODNESS-OF-FIT MEASURE

Likelihood ratio test was used for model specification to determine the model which has the greater explanatory power for the four respondent groups. The likelihood ratio test is a test to determine the model significance by comparing the log-likelihood value of the estimated "full" model to the log-likelihood value of a base comparison model which is estimated with constant terms only (Romanowska, 2009). The likelihood ration test is chi-squared distribution with degrees of freedom equal to the number of additional parameters estimated in the "full" model (Hensher et al., 2005). The test is as follow:

$-2\ (LL_{basedmodel} - LL_{estimatedmodel}) \sim \chi^2$ (difference in number of parameters between the two models) (5-4)

Due to singularity problems, in the regressions for groups of respondents who agreed traditionally raised pork is safer and healthier than conventional pork, demographic interaction variables with CONCPCQA were excluded and in the regression for the group of respondents who did not agree that traditionally raised pork is not healthier than conventional pork, the interaction term between education and CONCPCQA was excluded.

Variables of hog grade and its interaction terms with demographics were taken as one set, in the same way a set of variables for each meat quality trait and consumer overall sensory acceptability were tested for significance (Table 5.4). The test of significance for each set of variables regarding hog grade, colour L*, colour a*, colour b*, pH, drip loss, cooking loss, shear force, and overall sensory acceptability, respectively, was done individually by using likelihood ratio tests - running a regression with each set of variable added to the original regression individually and comparing it to the base regression.

The results of the likelihood ratio tests in Table 5.5 show that hog grade and its interaction terms with demographic variables significantly improved the explanatory power of the regression for the group of respondents who did not agree that traditionally raised pork is healthier to eat than conventional pork at a 10% significant level, colour L* and its interaction terms with demographic variables significantly improved the explanatory power of the regression for the group of respondents who did not agree that traditionally raised pork is safer to eat than conventional pork, colour a* and its demographic interaction variables significantly improved the explanatory power of the regression for the group of respondents who agreed that traditionally raised pork is safer to eat than conventional pork, and shear force and its demographic interaction variables significantly improved the explanatory power of the regression for both of the groups of respondents who believed that traditionally raised pork is safer and is healthier to eat than conventional pork. These sets of variables with regard to hog grade, colour L*, colour a* and shear force were included in regressions for all four groups in order to do a comparison. Likelihood ratio test statistics indicate that hog grade, colour L*, colour a*, shear force, and their demographic interaction variables together significantly improved the explanatory power of the regressions for respondent groups with beliefs that traditionally raised pork is safer and is healthier to eat than conventional pork.

The demographic interactions which were not significant in any of the four regressions were dropped because results of likelihood ratio test in Appendix J show that those demographic interaction variables are jointly zero and do not improve the explanatory power of the models as compared to the models without them.

Table 5.4 Individual Sets of Variables Regarding Hog Grade, Meat Quality Traits and Consumer Overall Sensory Acceptability, Edmonton Sample

Hog Grade	**Colour L***	**Colour a***	**Colour B***	**pH**	**Drip Loss**	**Cook Loss**	**Shear Force**	**Overall Sensory**
GRAD	MQCL	MQCA	MQCB	MQPH	MQDL	MQCKL	MQSF	CSEN
AGEGRAD	AGEL	AGEA	AGEB	AGEPH	AGEDL	AGECL	AGESF	AGEOALL
EDUCGRAD	EDUCL	EDUCA	EDUCB	EDUCPH	EDUCDL	EDUCCL	EDUCSF	EDUCOALL
GENDERGRAD	GENDERL	GENDERA	GENDER B	GENDERP H	GENDERD L	GENDERC L	GENDERS F	GENDEROALL
CHILDGRAD	CHILDL	CHILDA	CHILDB	CHILDPH	CHILDDL	CHILDCL	CHILDSF	CHILDOALL
EATFGRAD	EATFL	EATFA	EATFB	EATFPH	EATFDL	EATFCL	EATFSF	EATFOALL
TRUSGRAD	TRUSL	TRUSA	TRUSB	TRUSPH	TRUSDL	TRUSCL	TRUSSF	TRUSOALL

Table 5.5 Results of Likelihood Ratio Test of the Significance of Individual Sets of Variables Regarding Hog Grade, Meat Quality Trait, and Consumer Overall Sensory Acceptability by Group, Edmonton Sample

	SAFER			NOT SAFER			HEALTHIER			NOT HEALTHIER		
	Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject
Hog Grade	8.38 (.30)	7	Accept	7.20 (.41)	7	Accept	2.07 (.96)	7	Accept	12.25 (.09)	7	Reject
Colour L*	10.02 (.19)	7	Accept	12.53 (.08)	7	Reject	8.48 (.29)	7	Accept	9.13 (.24)	7	Accept
Colour a*	16.80 (.02)	7	Reject	2.87 (.90)	7	Accept	9.01 (.25)	7	Accept	4.64 (.70)	7	Accept
Colour b*	7.38 (.39)	7	Accept	6.88 (.44)	7	Accept	4.74 (.69)	7	Accept	5.15 (.64)	7	Accept
pH	9.23 (.24)	7	Accept	5.48 (.60)	7	Accept	5.61 (.59)	7	Accept	5.95 (.55)	7	Accept
Drip Loss Percentage	7.50 (.38)	7	Accept	8.96 (.26)	7	Accept	4.08 (.77)	7	Accept	7.66 (.36)	7	Accept
Cook Loss Percentage	7.85 (.35)	7	Accept	4.07 (.77)	7	Accept	11.64 (.11)	7	Accept	2.59 (.92)	7	Accept

Shear Force	12.62 (.08)	7	Reject	6.88 (.44)	7	Accept	13.62 (.06)	7	Reject	6.22 (.51)	7	Accept
Consumer Overall Acceptability of Sensory	1.73 (.97)	7	Accept	9.86 (.20)	7	Accept	1.79 (.97)	7	Accept	8.29 (.31)	7	Accept
Final regressions with the significant sets of technical quality variables were tested (the sets of variables of grade, colour L*, colour a* and shear force)												
Grade, Colour L*,Colour a* and Shear Force	52.10 (.00373)	28	Reject	37.60 (.11)	28	Accept	40.15 (.06)	28	Reject	31.36 (.30)	28	Accept

Healthier: the group of respondents who agreed that traditionally raised pork was healthier than conventional pork; Not healthier: the group of respondents who did not agree that traditionally raised pork is healthier than conventional pork; Safer: the group of respondents who agreed that traditionally raised pork was safer than conventional pork; Not safer: the group of respondents who did not agree that traditionally raised pork is safer than conventional pork.

For a linear regression model the R^2 measure is used as a goodness-of-fit measure to indicate the accuracy with which the model approximate the observed data, however for a conditional logit model used in this study, the McFadden R^2 suggested by McFadden (1974), which sometimes referred to as the likelihood ratio index, is used as a goodness-of-fit measure. As in the study by Romanowska (2009, p. 98) the formula is:

$$\text{McFadden } R^2 = 1- (LL_{estimatedmodel} / LL_{basedmodel}) \quad (5\text{-}5)$$

5.5.3 REGRESSION RESULTS AND WTP

Parameter estimates for the final multinomial logit regression for each respondent group are shown in Table 5.6. Marginal effects were also calculated for the explanatory variables in the model and those with significant coefficients were presented in Appendix K. Marginal effects for a continuous variable can be calculated by differentiating (5-3) with respect to a particular x_m following Green (2007).

$$\frac{\partial P_{ij}}{\partial x_{im}} = \left[P_{ij}\ (1(j = m) - \ P_{im})\right]\beta,\ \ m = 1, \ldots, J. \quad (5\text{-}6)$$

Equation to obtain marginal effect for a dummy variable is as:

$$ME_{x_{ij}} = P_{ij}\left(x_{ij} = 1\right) - P_{ij}\left(x_{ij} = 0\right) \quad (5\text{-}7)$$

The maximization of the likelihood using the probabilities derived in (5-3) gives the estimates of the marginal utilities associated with the attributes and allows for their use in welfare measures (Grafton et al. 2004, p. 267). There are two main methods of welfare measures for the Attribute Based Stated Choice Methods (ABSCM), one is the “state of the world” approach and the other one is the welfare measure for stated choice excises with multiple alternatives (fits to this study) which “involves the expected value of the maximum of utility (or utility for each alternative and the probability of choosing each alternative) arising from the multiple alternatives (Grafton et al., 2004, p.268)”. The expected value of the base case, conventional pork in this study, is compared to the expected value of the “changed” case. The expression for welfare for multinomial logit models is (Grafton et al. 2004, p.268):

$$\frac{1}{\beta_{\$}}\ (\ln \textstyle\sum_{i=1}^{C} e^{V_i^1} - \ \ln \textstyle\sum_{i=1}^{C} e^{V_i^0}) \quad (5\text{-}8)$$

where $\beta_{\$}$ is an estimate of the marginal utility of money. V_i is the conditional indirect utility associated with alternative i. The alternatives are indexed by i =

1, …, C. The superscript 0 indicates the base situation and the superscript 1 indicates the "changed" situation.

The value of or consumer willingness to pay (WTP) for pork chops with different quality attributes as compared to the conventional pork (the constant base in this study) can be calculated based on the coefficients in a conditional logit model (Romanowska, 2009) by using the equation as:

$$WTP_i = -\frac{\hat{\beta}_i}{\hat{\beta}_{price}}, \tag{5-9}$$

where $\hat{\beta}_i$ is the coefficient on attribute i and $\hat{\beta}_{price}$ is the coefficient on price.

In the regressions estimated in study, the pork attributes were interacted with consumer characteristic variables, based on Hu et al. (2009) the equation for calculating WTP will be as:

$$WTP_i = \frac{\hat{\beta}_i + \sum \hat{\beta}_{ia} * \bar{a} + \sum \hat{\beta}_{ib} * b}{\hat{\beta}_{price}}, \tag{5-10}$$

where $\hat{\beta}_i$ is the coefficient on attribute i, $\hat{\beta}_{ia}$ is the coefficient on the interaction term between attribute i and characteristic a which is a continuous variable, $\bar{a}$ is the mean value of a, $\hat{\beta}_{ib}$ is the coefficient on the interaction term between attribute i and characteristic b which is a dummy variable taking as one or zero and $\hat{\beta}_{price}$ is the coefficient on price. The results of the WTP for pork chops with different quality attributes as compared to the conventional pork with no labels are presented by group in Appendix M.

Table 5.6 Results of Multinomial Logit Regressions for the Four Respondent Groups from Edmonton

	Healthier		Not Healthier		Safer		Not Safer	
	Dependent variable: CHOICE		Dependent variable: CHOICE		Dependent variable: CHOICE		Dependent variable: CHOICE	
	Number of observations = 518		Number of observations = 772		Number of observations =469		Number of observations = 821	
	Log likelihood = -389.06		Log likelihood = -640.94		Log likelihood = -359.31		Log likelihood = -673.76	
	Schwarz B.I.C. = 573.44		Schwarz B.I.C. = 837.09		Schwarz B.I.C. = 540.75		Schwarz B.I.C. = 871.72	
	Number of Choices = 1554		Number of Choices = 2316		Number of Choices = 1407		Number of Choices = 2463	
	McFadden R^2 = 0.15		McFadden R^2 = 0.10		McFadden R^2 = 0.14		McFadden R^2 = 0.10	
Parameter	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
PRICE	-0.18***	0.03	-0.16***	0.03	-0.19***	0.04	-0.16***	0.03
N	-6.08***	2.12	-7.21***	1.72	-4.74**	2.21	-8.01***	1.67
CONCP	-1.39	1.70	0.95	1.01	-2.22	1.71	1.64	1.02
CONCQA	-0.45	3.49	6.38***	2.23	3.81	4.06	4.24**	1.93
CONCPCQA	2.72*	1.50	-1.58**	0.77	1.40	1.49	-0.72	0.77
TR	0.73	0.59	0.67	0.50	0.84	0.65	0.88*	0.47
TRCP	-0.77	1.66	2.54*	1.46	-1.67	1.92	2.23*	1.32
TRCQA	-0.02	0.78	-0.60	0.66	0.15	0.86	-0.56	0.62
TRCPCQA	-2.25***	0.85	-0.03	0.63	-2.00**	0.87	-0.07	0.62
CTR	1.54	1.47	-0.05	0.99	2.95*	1.55	-0.78	0.98
CTRCP	-1.41	2.53	-0.23	1.98	-3.43	2.67	1.36	1.88
CTRCQA	-1.78	1.91	3.58***	1.39	-2.93	1.98	3.60***	1.34
CTRCPCQA	5.61*	3.17	-5.78***	2.19	6.11*	3.22	-5.97***	2.15
GTR	-1.49	1.32	1.10	0.87	-1.16	1.28	1.30	0.87
GTRCP	0.48	0.59	0.58	0.47	0.32	0.61	0.55	0.48
GTRCQA	2.09	2.15	2.61	1.64	3.02	2.07	2.00	1.67
GTRCPCQA	1.56	2.72	-2.98	1.91	1.71	2.62	-2.97	1.96

GENDERCONCP	0.82	0.60	-0.39	0.42	1.14*	0.62	-0.57	0.41
GENDERCONCQA	0.35	0.80	0.04	0.54	0.51	0.77	-0.31	0.53
GENDERCTR	-0.71*	0.39	0.26	0.27	-0.46	0.40	0.23	0.26
GENDERGTR	-0.17	0.58	0.55	0.42	0.07	0.58	0.40	0.43
GENDERGTRCP	0.33	0.74	-0.54	0.53	0.90	0.79	-0.52	0.52
GENDERGTRCPCQA	-0.71	0.85	-0.04	0.58	-1.48	0.91	0.16	0.56
AGECONCQA	0.05	0.03	0.03	0.02	0.00	0.03	0.05***	0.02
AGETRCQA	0.01	0.02	0.02**	0.01	0.02	0.01	0.01	0.01
CHILDTRCP	0.47	0.48	-0.06	0.44	0.44	0.52	-0.06	0.41
CHILDCTR	1.03**	0.40	-0.25	0.34	1.21***	0.42	-0.41	0.32
CHILDGTRCP	1.31***	0.50	-0.50	0.38	0.94*	0.53	-0.22	0.36
EDUCCONCQA	-0.11	0.18	-0.36**	0.15	-0.23	0.21	-0.28**	0.13
EDUCTRCP	0.14	0.10	-0.15*	0.09	0.17	0.12	-0.12	0.08
EDUCCTRCP	-0.11	0.11	0.12	0.09	0.01	0.12	0.05	0.08
EATFCONCP	0.61	0.54	0.16	0.31	0.97*	0.53	-0.11	0.32
EATFCTR	-0.22	0.51	0.36	0.33	-0.61	0.51	0.59*	0.33
EATFCTRCP	1.28*	0.77	-0.67	0.48	1.19	0.74	-0.71	0.48
EATFCTRCQA	0.74	0.69	-0.95**	0.46	1.05	0.70	-0.95**	0.45
EATFCTRCPCQA	-2.15*	1.15	1.78**	0.73	-2.20*	1.13	1.85**	0.73
EATFGTR	0.98**	0.41	-0.06	0.24	0.90**	0.39	-0.06	0.25
EATFGTRCQA	-0.49	0.72	-0.72	0.52	-0.77	0.66	-0.50	0.55
EATFGTRCPCQA	-0.78	0.89	0.98*	0.59	-0.77	0.82	0.91	0.63
TRUSCONCQA	-0.07	0.88	-0.89	0.64	0.66	0.88	-1.33**	0.61
TRUSTR	-1.96***	0.59	-0.35	0.48	-1.41**	0.65	-0.86*	0.45
TRUSTRCQA	0.89	0.54	-0.09	0.44	0.28	0.58	0.22	0.42
TRUSCTR	-1.20**	0.49	-0.37	0.40	-0.95*	0.54	-0.67*	0.37
TRUSGTR	-1.64***	0.50	-0.37	0.42	-1.26**	0.56	-0.86**	0.40

GRAD	0.01	0.03	0.03	0.02	0.04	0.03	0.03	0.02
EATFGRAD	0.00	0.01	-0.01*	0.01	-0.02*	0.01	-0.01	0.01
TRUSGRAD	-0.02*	0.01	-0.01	0.01	0.00	0.01	-0.02**	0.01
MQCL	-0.05	0.07	-0.09*	0.05	-0.13*	0.07	-0.09*	0.05
AGEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHILDL	0.00	0.01	0.01	0.01	-0.01	0.01	0.02**	0.01
EATFL	0.00	0.02	0.01	0.01	0.05**	0.02	0.00	0.01
TRUSL	0.04	0.03	0.02	0.02	-0.01	0.03	0.05**	0.02
MQCA	0.45	0.37	0.08	0.27	0.28	0.38	0.27	0.27
AGEA	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00
EDUCA	-0.01	0.01	0.00	0.01	0.01	0.01	-0.01	0.01
EATFA	-0.12	0.11	-0.01	0.07	-0.17	0.11	-0.01	0.07
MQSF	-0.09***	0.03	-0.04**	0.02	-0.05*	0.03	-0.05***	0.02
EATFSF	0.02**	0.01	0.01*	0.01	0.01	0.01	0.01**	0.01
TRUSSF	0.02*	0.01	0.01	0.01	0.02*	0.01	0.01	0.01

*** 1% significant level; ** 5% significant level; * 10% significant level.

5.5.3.1 Results for the Group of Consumers Who Agreed that Traditionally Raised Pork was Healthier to Eat than Conventional Pork

Regression Results

The McFadden R^2 from the regression for this group is 0.15. However, this R^2 statistics is not exactly comparable to the R^2 statistics of a linear regression, because a multinomial logit regression is non-linear (Romanowska, 2009; Hensher et al., 2005). A figure mapping out the direct empirical relationship between the two indices was provided by Hensher et al. (2005) on page 338, a McFadden R^2 of 0.15 is approximately equivalent to an R^2 of 0.4 in a linear regression.

The coefficients for price and the "none" option are highly significant at the 1% significant level and have negative signs as expected. Marginal effects calculated for price show that one unit increase in price will decrease the probability of choosing the product by approximately 0.003.

The CONCPCQA coefficient is significant at the 10% significance level and has a positive sign. Marginal effects indicate that the probability of a respondent in this group choosing conventional pork with Canadian pork label and CQA® label is approximately 0.17 to 0.18 higher than the probability of choosing other types of pork. In opposition to conventional pork, the significantly negative coefficients and marginal effects of TRCPCQA (at the 1% significant level) and CTRCPCQA (at the 10% significant level) show that the probabilities of a respondent in this group choosing traditionally raised pork and industry certified traditionally raised pork with the Canadian pork label and CQA® labels are approximately 0.02 and 0.01, respectively, lower than the probability of choosing the other types of pork.

The coefficient on shear force which is a physical quality attribute is negatively significant at the 1% significant level indicating that a pork chop with higher shear force is less likely to be chosen by respondents. This result meets our expectation, because shear force is an indicator of tenderness of cooked pork, even though it did not show any significant effect on the prediction of consumer liking of tenderness in this study, a significantly negative correlation coefficient between them was observed.

Demographic interactions of CHILDCTR, CHILDGTRCP, EATFCTRCP, EATFGTR, EATFSF and TRUSSF have significant and positive coefficients while GENDERCTR, EATFCTRCPCQA, TRUSTR, TRUSCTR, TRUSGTR and TRUSGRAD have significant and negative coefficients.

The probability of a man in this group choosing a package of industry certified traditionally raised pork chops is 0.01 lower than the probability of a woman choosing this type of pork.

The probabilities of a respondent who had children under 18 years old at home choosing a package of industry certified traditionally raised pork chops and government certified traditionally raised pork chops with Canadian pork label are approximately 0.03 and 0.07, respectively, higher than the probabilities of a respondent who had no child in the household choosing these types of pork.

Respondents who ate pork more often were more likely to choose industry certified traditionally raised pork labeled as Canadian pork and traditionally raised pork certified by government while they were less likely to choose industry certified traditionally raised pork labeled as Canadian pork and CQA®. With respect to physical quality attributes, pork chops with higher shear force are more likely to be chosen by respondents with a higher pork eating frequency.

The probabilities of a respondent who thought people can be trusted choosing traditionally raised pork, industry certified traditionally raised pork, government certified traditionally raised pork and pork from a hog carcass with higher grade are approximately 0.03, 0.03, 0.04 and 0.04, respectively, lower than the probabilities of a respondent who did not think people can be trusted choosing those types of pork; but the probability of a respondent who thought people can be trusted choosing a pork chop with higher shear force is approximately 0.02 higher than the probability of a respondent who did not think people can be trusted choosing a pork chop with higher shear force.

<u>Willingness to Pay</u>

For pork with neither the Canadian pork label nor the CQA® label, the highest WTP is for industry certified traditionally raised pork from female respondents who did not think people can be trusted and had children in their household ($10.88/kg), male respondents who thought people can be trusted and had no children in household were willing to pay a lower price for industry certified traditionally raised pork as compared to conventional pork. Government certified traditionally raised pork only received significant WTP from female respondents. The uncertified traditionally raised pork had a lower value than conventional pork in the eyes of respondents who thought that people can be trusted while it had no difference in the eyes of respondents who did not think people can be trusted. The results suggest that for traditionally raised pork with neither the Canadian pork label nor the CQA® label, consumers who think traditionally raised pork is healthier to eat than conventional pork have preferences for certified over uncertified pork.

For pork with the Canadian pork label, the highest WTP is for the government certified traditionally raised pork, $11.80/kg from male respondents who had children in household. Female respondents who had children in their household were willing to pay a premium which is $1.82/kg lower than male respondents for government certified traditionally raised pork and respondents who had no children in their household were not willing to pay more for government certified traditionally raised pork with the Canadian Pork label. Industry certified traditionally raised pork received no significant WTP from this group of respondents while uncertified traditionally raised pork received a WTP of $10.29/kg from respondents who had children in household which is $2.63/kg higher than from respondents who had no children in household. Conventional pork with this label also received a WTP of $6.23/kg from male respondents.

For pork with the CQA® label, respondents who thought people can be trusted were willing to pay $7.78/kg more for uncertified traditionally raised pork than conventional pork with no Canadian pork label or CQA® label.

For pork with both the Canadian Pork label and CQA® labels, the WTP for conventional pork was significant and positive, $15.17/kg, while the value for uncertified traditionally raised pork was significant and negative.

The results of WTP regarding physical quality attributes show that the value of pork with higher colour L* (lightness) was lower in the eyes of respondents who did not think people can be trusted and had children in household and the value for the pork chops with higher shear force (tenderness) value were also lower in the eyes of respondents who did not think that people can be trusted.

These results suggest that consumer general trust affects consumers' preferences for physical quality attributes.

Table 5.7 WTP ($/kg) for Pork Chops with Different Quality Attributes as Compared to Conventional Pork from Respondents Who Agreed that Traditionally Raised Pork is Healthier than Conventional Pork

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
No labels	Uncertified traditionally raised	-6.85	-6.85			-6.85	-6.85
	Industry certified traditionally raised			6.95	10.88	-5.43	
	Government certified traditionally raised		6.81		6.81		6.81
With Canadian pork label	Conventional	6.23		6.23		6.23	0.00
	Uncertified traditionally raised	10.29	10.29	10.29	10.29	7.66	7.66
	Industry certified traditionally raised						
	Government certified traditionally raised	11.80	9.99	11.80	9.99		
With CQA® label	Conventional						
	Uncertified traditionally raised	7.78	7.78			7.78	7.78
	Industry certified traditionally raised						
	Government certified traditionally raised						
With Canadian pork and CQA® labels	Conventional	15.17	15.17	15.17	15.17	15.17	15.17
	Uncertified traditionally raised	-12.50	-12.50	-12.50	-12.50	-12.50	-12.50
	Industry certified traditionally raised						
	Government certified traditionally raised						
Physical attributes	Grade						
	Color L*			-0.36	-0.36		
	Color a*						
	Shear force			-0.11	-0.11		

5.5.3.2 Results for the Group of Consumers Who Did Not Agree that Traditionally Raised Pork is Healthier to Eat than Conventional Pork

Regression Results

The McFadden R^2 of the regression for this group is 0.10, which can be translated as an R^2 of approximately 0.3 for a linear regression equivalent.

Similar to the results for the group of respondents who agreed that traditionally raised pork was healthier to eat than conventional pork, the coefficients for price and the "none" option are highly significant at a 1% significant level and have negative signs. One unit increase in price decreases the probability of choosing a product by approximately 0.001units.

Respondents in this group were more likely to choose conventional pork with the CQA® label, uncertified traditionally raised pork with the Canadian Pork label and industry certified traditionally raised pork with the CQA® label while they were less likely to choose conventional and industry certified traditionally raised pork with both the Canadian pork and CQA® labels. Conventional pork with the CQA® label increased the probability of pork being chosen by approximately 0.02 units while traditionally raised pork with Canadian pork label and industry certified traditionally raised pork with the CQA® label only increased the probability by approximately 0.001 and 0.005, respectively. A pork chop with higher shear force value or higher colour L* value was less likely to be chosen as expected; one unit higher in shear force value and colour L* value will decrease the probability of choice by 0.0002 and 0.0004 units, respectively.

The coefficient of AGETRCQA is positively significant at the 5% significant level indicating that older respondents in the group were more likely to choose uncertified traditionally raised pork with the CQA® label; one year of additional age increased the probability of choosing a product by approximately 0.0001units.

The coefficients for the interaction terms between education and conventional pork with the CQA® label and uncertified traditionally raised pork with the Canadian pork label are significant at the 5% and 10% significance level, respectively. One more year of education will decrease the probabilities of choosing conventional pork with the CQA® label and uncertified traditionally raised pork with the Canadian pork label by approximately 0.01 and 0.001units, respectively.

Pork eating frequency had a significant and negative effect on the probability of choosing industry certified traditionally raised pork with the CQA® label at the 5% significance level while it had a significant and positive effect on the probabilities of choosing industry certified and government certified traditionally raised pork with both the Canadian pork label and the CQA® label. The significant and negative coefficient of EATFGRAD shows that respondents who ate pork more often were less likely to choose pork from hog carcass with higher carcass grades while the significant and positive coefficient of EATFSF shows that respondents who ate pork more often were more likely to choose pork chops with higher shear force than people who consumed pork less frequently. This is similar to the result for the respondents who agreed that traditionally raised pork is healthier to eat than conventional pork.

Willingness to Pay

For pork with neither the Canadian pork label nor the CQA® label, uncertified traditionally raised pork had no significant WTP while both industry and government certified traditionally raised pork had significant and positive WTP. Government certified traditionally raised pork received the highest WTP ($9.16/kg) from men which was $3.41/kg higher than from women. The results suggest that consumers who do not think that traditionally raised pork is healthier than conventional pork prefer certified to uncertified traditionally raised pork.

For pork with the Canadian pork label, only conventional pork received significant WTP with a value of $2.40/kg higher from women than from men.

For pork with the CQA® label, as compared to traditionally raised pork, conventional pork was preferred by this group of respondents such that it received higher WTP values than industry certified traditionally raised pork. Regarding the WTP for conventional pork with the CQA® label, the highest value was from men who did not think that people can be trusted; respondents who did not think that people can be trusted were willing to pay a higher value than respondents who thought that people can be trusted and men were willing to pay a higher value than women.

The values of conventional pork with both Canadian Pork label and the CQA® label were lower in the eyes of the group of respondents which is in opposition to the results from the respondents who thought that traditionally raised pork is healthier to eat than conventional pork. There was no significant WTP for uncertified, industry and government certified traditionally raised pork with both of the labels from this group of respondent.

The results of WTP for the physical quality attributes show that the value of pork from hogs with higher hog grades was viewed as lower by respondents who thought that people can be trusted and the value of pork with lighter colour (higher L*) was also viewed as lower by respondents in this group.

Table 5.8 WTP ($/kg.) for Pork Chops with Different Quality Attributes as Compared to Conventional Pork from Respondents Who Did Not Agree that Traditionally Raised Pork is Healthier than Conventional Pork – Edmonton

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
No labels	Uncertified traditionally raised						
	Industry certified traditionally raised			6.05		5.31	3.73
	Government certified traditionally raised	9.16	5.75	9.16	5.75	9.16	5.75
With Canadian pork label	Conventional	6.22	8.62	6.22	8.62	6.22	8.62
	Uncertified traditionally raised						
	Industry certified traditionally raised						
	Government certified traditionally raised						
With CQA® label	Conventional	6.97	6.74	12.47	12.24	6.97	6.74
	Uncertified traditionally raised						
	Industry certified traditionally raised	5.22	5.22	5.22	5.22	5.22	5.22
	Government certified traditionally raised						
With Canadian pork and CQA® labels	Conventional	-9.75	-9.75	-9.75	-9.75	-9.75	-9.75
	Uncertified traditionally raised						
	Industry certified traditionally raised						
	Government certified traditionally raised						
Physical attributes	Grade	-0.09	-0.09			-0.09	-0.09
	Color L*			-0.33	-0.33	-0.29	-0.29
	Color a*						
	Shear force						

5.5.3.3 Results for the Group of Consumers Who Agreed that Traditionally Raised Pork was Safer to Eat than Conventional Pork

<u>Regression Results</u>

The McFadden R^2 statistic of the regression for this group was 0.14; it can be mapped onto a linear R^2 close to 0.40.

As expected, price and the “none” option had highly significant negative effects on the choices of this group. One unit increases in price would decrease the probability of choosing a product by 0.01.

The coefficients for uncertified and industry certified traditionally raised pork with both the Canadian pork and the CQA® labels are significant and positive at the 5% and 10% significant level, respectively, while coefficient for industry certified traditionally raised pork without labels is significant and negative at the 10% significant level suggesting that the Canadian pork and the CQA® labels play an important role in the evaluation and choices of traditionally raised pork made by these respondents. Regarding physical attributes, respondents who agreed that traditionally raised pork is safer to eat than conventional pork were less likely to choose pork chops with higher colour L* value (lighter colour) and higher shear force, similar to the results for the respondents who did not think traditionally raised pork is healthier to eat than conventional pork.

The coefficient for the interaction term between gender and conventional pork with the Canadian pork label is significantly positive at the 10% significant level, marginal effects show that the probability of a man choosing conventional pork with the Canadian pork label is 0.11 higher than the probability of a woman choosing this type of pork.

The coefficients for the interaction terms of child (if there is a child under 18 years old in the household) with industry certified traditionally raised pork and with government certified traditionally raised pork with the Canadian pork label were significant and positive at the 1% and 10% significant level, respectively.

The probabilities of a respondent with children in the household choosing industry certified traditionally raised pork and government certified traditionally raised pork with the Canadian pork label are approximately 0.11 and 0.09, respectively, higher than the probabilities of a respondent with no child in household choosing those types of pork

Respondents in this group with higher pork eating frequency were more likely to choose conventional pork with the Canadian pork label, government certified traditionally raised pork and pork with a higher colour L* value (lighter colour) while they were less likely to choose industry certified traditionally raised pork with both the Canadian pork label and the CQA® labels and pork from a hog with a higher hog grade.

The coefficients for the interaction terms of trust with uncertified traditionally raised, with industry certified traditionally raised and with government certified traditionally raised pork were significant and negative. The probabilities of a respondent who thought people can be trusted choosing uncertified traditionally raised pork, industry certified traditionally raised pork and government certified traditionally raised pork are approximately 0.08, 0.08 and 0.10, respectively, lower than the probabilities of a respondent who did not think that people can be trusted choosing those types of pork. TRUSSF is positive and significant at the 10% significant level showing that respondents who thought people can be trusted were more likely to choose pork with a higher shear force value, this result is the same as the result for the respondents who thought that traditionally raised pork is healthier to eat than conventional pork.

Willingness to Pay

For pork with no labels, respondents who had children in their household were willing to pay more for industry certified traditionally raised pork ($5.52/kg to $13.11/kg) than conventional pork with no label (respondents who did not think people can be trusted were willing to pay a higher price premium as compared to respondents who thought people can be trusted and women were willing to pay a higher price premium as compared to men) while respondents who did not have a child in their households were not willing to pay more for it. All respondents in this group were willing to pay more for government certified traditionally raised pork as compared to conventional pork with no label, men were willing to pay a premium of $7.95/kg, close to the amount that women were willing to pay ($7.57/kg). Uncertified traditionally raised pork had no significant WTP suggesting that certified traditionally raised pork is preferred to uncertified traditionally raised pork when there is no Canadian Pork label or CQA® label.

Pork with the Canadian pork label, as compared to the conventional pork with no label, had a value of $9.02/kg higher in the eyes of male respondents while it had no significant higher value in the eyes of female respondents. Uncertified traditionally raised pork received significant WTP from all respondents with respondents who had children in their households were willing to pay a higher premium than respondents who did not have a child in their households ($7.95/kg vs. $5.57/kg). Industry certified traditionally raised pork had no significant higher value than conventional pork without a label while government certified traditionally raised pork received price premiums from all respondents who had children in their households with a price premium being $4.46/kg higher from male respondents than from female respondents.

For pork with the CQA® label, the male respondents who thought people can be trusted were willing to pay $7.13/kg more for conventional pork with this label as compared to the same pork without a label. Uncertified traditionally raised pork received significant WTP from respondents who thought people can be trusted while industry certified and government certified traditionally raised pork received no significant WTP from this group of respondents. These results suggest that for consumers who believe that traditionally raised pork is safer to eat than conventional pork, the CQA® label is more likely to be able to generate price premiums from those who think people can be trusted.

For pork with both the Canadian pork label and CQA® labels, no positive and significant WTP was received which suggests that increasing the quantity of label information does not necessarily to increase the value of a pork chop in the eyes of consumers.

With respect to the physical quality attributes, the pork chops with higher colour a* value received a value of $0.90/kg higher than pork chop with lower a* value which is as expected, suggesting that consumers prefer pork with redder colour.

Table 5.9 WTP ($/kg.) for Pork Chops with Different Quality Attributes as Compared to Conventional Pork from Respondents Who Agreed that Traditionally Raised Pork is Safer than Conventional Pork – Edmonton

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
No labels	Uncertified traditionally raised						
	Industry certified traditionally raised	5.52	7.98	10.65	13.11		
	Government certified traditionally raised	7.95	7.57	7.95	7.57	7.95	7.57
With Canadian pork label	Conventional	9.02		9.02		9.02	
	Uncertified traditionally raised	7.95	7.95	7.95	7.95	5.57	5.57
	Industry certified traditionally raised						
	Government certified traditionally raised	11.66	6.80	11.66	6.80		
With CQA® label	Conventional	7.13				7.13	
	Uncertified traditionally raised	6.25	6.25			6.25	6.25
	Industry certified traditionally raised						
	Government certified traditionally raised						
With Canadian pork and CQA® labels	Conventional						
	Uncertified traditionally raised	-10.80	-10.80	-10.80	-10.80	-10.80	-10.80
	Industry certified traditionally raised						
	Government certified traditionally raised	-10.58		-10.58		-10.58	
Physical attributes	Grade						
	Color L*						
	Color a*	0.90	0.90	0.90	0.90	0.90	0.90
	Shear force						

5.5.3.4 Results for the Group of Consumers Who Did Not Agree that Traditionally Raised Pork is Safer to Eat than Conventional Pork

Regression Results

The McFadden R^2 which measures the goodness of fit for the regression of this group is 0.10, which can be approximately equivalent to an R^2 of 0.3 in a linear regression based on the map given by Hensher et al. (2005).

The coefficients for price and the "none" option were significant at 1% significance level and had negative signs as expected. Marginal effects show that if the price of a particular alternative increases by one unit decreases the probability of choosing that alternative by 0.0003 or 0.0004.

The coefficients for CONCQA, TR, TRCP and CTRCQA are positive and significant at the 1, 5 and 10% significance levels indicating that respondents who did not think traditionally raised pork is safer to eat than conventional pork were more likely to choose conventional pork and industry certified traditionally raised pork with the CQA® label, uncertified traditionally raised pork and uncertified traditionally raised pork with the Canadian pork label; whereas the coefficient for CTRCPCQA is negative and significant at the 1% significant level indicating that these respondents were less likely to choose industry certified traditionally raised pork with both labels (Canadian pork and CQA®). Similar to the respondents who did not think traditionally raised pork is healthier to eat than conventional pork and the respondents who thought traditionally raised pork is safer to eat than conventional pork, respondents who did not think traditionally raised pork is safer to eat than conventional pork were less likely to choose pork chops with higher colour L* and shear force values.

The coefficient for the interaction term between age and conventional pork with the CQA® label was significantly positive at the 1% significant level. One year of additional age increases the probability of choosing conventional pork with the CQA® label by 0.001.

The coefficient for the interaction term between child in household and colour L* was significantly positive at the 5% significance level. The probability of a respondent with children in household choosing pork with higher colour L* value (lighter colour) is approximately 0.002 or 0.003 higher than the probability of a respondent with no child in his/her household choosing lighter colour pork.

The interaction term for years of education with CONCQA has a significantly negative coefficient at the 5% significance level. One more year of education decreases the probability of choosing the package of conventional pork chops with the CQA® label by 0.003.

The coefficients for interaction terms of pork eating frequency with CTR, CTRCPCQA, and with shear force are significant and positive at the 1 and 5% significance levels while the coefficient for the interaction term of pork eating frequency with CTRCQA is significantly negative at the 5% significance level. One level higher pork eating frequency increases the probabilities of choosing industry certified traditionally raised pork and industry certified traditionally raised pork with both the Canadian pork label and CQA® label by approximately 0.002, but decreases the probability of choosing industry certified traditionally raised pork with only the CQA® label by approximately 0.005. A respondent who eats pork more often is more likely to choose pork chops with higher shear force.

Trust had significantly negative interaction coefficients with CONCQA, TR, CTR, GTR and hog grade while it had significant positive interactions with colour L*. The probabilities of a respondent who thought that people can be trusted choosing conventional pork with the CQA label, uncertified traditionally raised pork, industry certified traditionally raised pork, government certified traditionally raised pork and pork from a carcass with higher hog grade are approximately 0.06, 0.003, 0.002, 0.004 and 0.00003, respectively, lower than the probabilities of a respondent who did not think people can be trusted choosing these types of pork; but the probability of a respondent who thought that people can be trusted choosing pork with a higher colour L* value is 0.005 higher than the probability of a respondent who did not think that people can be trusted choosing pork with lighter colour.

Willingness to Pay

For pork with neither the Canadian pork label nor the CQA® label, respondents in this group who did not think people can be trusted were willing to pay $5.37/kg more for uncertified traditionally raised pork as compared to conventional pork without a label. Industry certified traditionally raised pork had no significantly higher value than conventional pork in the eyes of respondents of this group while government certified traditionally raised pork received a WTP of $9.25/kg from the male respondents and $6.81/kg from the female respondents. The results suggest that government is the preferred certifier for traditionally raised pork without a label for consumers who do not think traditionally raised pork is safer to eat than conventional pork.

For pork with the Canadian pork label, only conventional pork received significant WTP from respondents who did not think traditionally raised pork is safer to eat than conventional pork. Female respondents were willing to pay higher values than male respondents for this type of pork ($8.11/kg vs. $4.63/kg).

For pork with the CQA® label, higher significant WTP values were found for conventional pork from respondents who did not think that people can be trusted ($9.51/kg from men and $11.40/kg from women) as compared to industry certified traditionally raised pork which was the only type of traditionally raised pork that received significant WTP ($5.58/kg).

There was no significant WTP for pork with both of the Canadian pork and CQA® labels from this group of respondents.

The WTP for the physical quality attributes show that the value of pork from a hog with a higher hog grade was lower to respondents who thought people can be trusted while the value of pork with higher shear force value was lower to respondents who did not think people can be trusted, these results suggest that consumer general trust play an important role in consumer preferences for physical quality attributes, such as hog grade and shear force. The negative and significant WTP for colour L* indicates that lighter colour pork chops is not preferred by this group of respondents.

Table 5.10 WTP ($/kg) for Pork Chops with Different Quality Attributes as Compared to Conventional Pork from Respondents Who Did Not Agree that Traditionally Raised Pork is Safer than Conventional Pork -Edmonton

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
No labels	Uncertified traditionally raised			5.37	5.37		
	Industry certified traditionally raised						
	Government certified traditionally raised	9.25	6.81	9.25	6.81	9.25	6.81
With Canadian pork label	Conventional	4.63	8.11	4.63	8.11	4.63	8.11
	Uncertified traditionally raised						
	Industry certified traditionally raised						
	Government certified traditionally raised						
With CQA® label	Conventional			9.51	11.40		
	Uncertified traditionally raised						
	Industry certified traditionally raised	5.58	5.58	5.58	5.58	5.58	5.58
	Government certified traditionally raised						
With Canadian pork and CQA® labels	Conventional						
	Uncertified traditionally raised						
	Industry certified traditionally raised						
	Government certified traditionally raised						
Physical attributes	Grade	-0.10	-0.10			-0.10	-0.10
	Color L*			-0.46	-0.46	-0.27	-0.27
	Color a*						
	Shear force			-0.08	-0.08		

5.5.4 COMPARISON OF WTP BETWEEN RESPONDENT GROUPS

For pork with neither the Canadian pork label nor the CQA® label (Table 5.11), certified traditionally raised pork is preferred to uncertified traditionally raised pork. Regarding the differences between the two groups of respondents who agreed and did not agree with the statement that traditionally raised pork is healthier to eat than conventional pork, the value of uncertified traditionally raised pork was lower than conventional pork in the eyes of respondents who did not think people can be trusted in the group that agreed with the statement while it was not different in the eyes of any respondents who did not agree with the statement. Industry certified traditionally raised pork received higher WTP from respondents who agreed with the statement than from respondents who did not agree with the statement. Men who thought people can be trusted and had no children in their households in the group that agree with the statement were willing to pay a lower price for industry certified traditionally raised pork than conventional pork while men who did not think people can be trusted and had children in their households in the group that did not agree with the statement were willing to pay a higher price for industry certified traditionally raised pork than conventional pork. Government certified traditionally raised pork only received WTP from female respondents who thought traditionally raised pork is healthier to eat than conventional pork while it received WTP from all respondents who did not think traditionally raised pork is healthier to eat than conventional pork. Industry certified traditionally raised pork without a label generated higher price premiums from respondents who thought traditionally raised pork is healthier to eat than conventional pork while government certified traditionally raised pork without a label generated higher price premiums from respondents who did not think traditionally raised pork is healthier to eat than conventional pork.

Regarding the differences between the two groups of respondents who agreed and did not agree with the statement that traditionally raised pork is safer to eat than conventional pork, uncertified traditionally raised pork did not generate any WTP from respondents who agreed with the statement while it received a WTP of $5.37/kg from respondents who did not think that people can be trusted in the group that did not agree with the statement; industry certified traditionally raised pork received WTP from both of the groups but the higher values were from the group that agreed with the statement; government certified traditionally raised pork also received WTP from both of the groups but the WTP from men in the group that agreed with the statement is $1.30/kg higher than from men in the other group while the WTP from women in the group that agreed with the statement is $0.75/kg lower than from women in the other group.

Table 5.11 Differences for Different Types of Pork Chops with No Labels as Compared to Conventional Pork between Respondent Groups with Different Beliefs about Traditionally Raised Pork - Edmonton

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
Healthier	Uncertified traditionally raised	-6.85	-6.85			-6.85	-6.85
	Industry certified traditionally raised			6.95	10.88	-5.43	
	Government certified traditionally raised		6.81		6.81		6.81
Not healthier	Uncertified traditionally raised						
	Industry certified traditionally raised			6.05		5.31	3.73
	Government certified traditionally raised	9.16	5.75	9.16	5.75	9.16	5.75
Safer	Uncertified traditionally raised						
	Industry certified traditionally raised	5.52	7.98	10.65	13.11		
	Government certified traditionally raised	7.95	7.57	7.95	7.57	7.95	7.57
Not safer	Uncertified traditionally raised			5.37	5.37		
	Industry certified traditionally raised						
	Government certified traditionally raised	9.25	6.81	9.25	6.81	9.25	6.81

Table 5.12 Differences of WTP ($/kg) for Different Types of Pork Chops with the Canadian Pork Label as Compared to Conventional Pork between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Edmonton

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
Healthier	Conventional	6.23		6.23		6.23	
	Uncertified traditionally raised	10.29	10.29	10.29	10.29	7.66	7.66
	Industry certified traditionally raised						
	Government certified traditionally raised	11.80	9.99	11.80	9.99		
Not healthier	Conventional	6.22	8.62	6.22	8.62	6.22	8.62
	Uncertified traditionally raised						
	Industry certified traditionally raised						
	Government certified traditionally raised						
Safer	Conventional	9.02		9.02		9.02	
	Uncertified traditionally raised	7.95	7.95	7.95	7.95	5.57	5.57
	Industry certified traditionally raised						
	Government certified traditionally raised	11.66	6.80	11.66	6.80		
Not safer	Conventional	4.63	8.11	4.63	8.11	4.63	8.11
	Uncertified traditionally raised						
	Industry certified traditionally raised						
	Government certified traditionally raised						

For pork with the Canadian pork label (Table 5.12), respondents who did not agree with the statement that traditionally raised pork is healthier to eat than conventional pork preferred conventional pork to traditionally raised pork that they were only willing to pay more for conventional pork with the additional Canadian pork label while respondents who agreed with the statement preferred traditionally raised pork to conventional pork that the price premiums were higher for traditionally raised pork than conventional pork. The differences between the two groups of respondents who agreed and did not agree with the statement that traditionally raised pork is safer to eat than conventional pork are similar to the differences between the two groups regarding the statement of health. Only conventional pork received WTP from the sample that did not agree with the statement while all types of pork except industry certified traditionally raised received WTP from the other sample.

Table 5.13 Differences of WTP ($/kg) for Different Types of Pork Chops with the CQA® Label as Compared to Conventional Pork between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Edmonton

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
Healthier	Conventional						
	Uncertified traditionally raised	7.78	7.78			7.78	7.78
	Industry certified traditionally raised						
	Government certified traditionally raised						
Not healthier	Conventional	6.97	6.74	12.47	12.24	6.97	6.74
	Uncertified traditionally raised						
	Industry certified traditionally raised	5.22	5.22	5.22	5.22	5.22	5.22
	Government certified traditionally raised						
Safer	Conventional	7.13				7.13	
	Uncertified traditionally raised	6.25	6.25			6.25	6.25
	Industry certified traditionally raised						
	Government certified traditionally raised						
Not safer	Conventional			9.51	11.40		
	Uncertified traditionally raised						
	Industry certified traditionally raised	5.58	5.58	5.58	5.58	5.58	5.58
	Government certified traditionally raised						

For pork with the CQA® label (Table 5.13), respondents in the group that agreed with the statement that traditionally raised pork is healthier to eat than conventional pork preferred traditionally raised pork to conventional pork that only uncertified traditionally raised pork received WTP from respondents who thought that people can be trusted in this group while respondents in the group that did not agreed with the statement placed higher values on conventional pork with this additional label than on traditionally raised pork (industry certified). Conventional pork with this label received higher WTP from the group of respondents who agreed with the statement that traditionally raised pork is safer to eat than conventional pork than from the group of respondents who agreed with the statement while traditionally raised pork received higher WTP from respondents who agreed with the statement (uncertified traditionally raised pork) than from respondents who did not agree with the statement (industry certified traditionally raised pork).

For pork with both of the Canadian pork label and CQA® labels (Table 5.14), the value of conventional pork increased in the eyes of respondents who agreed with the statement that traditionally raised pork is healthier to eat than conventional pork while it decreased in the eyes of respondents who did not agree with the statement. Traditionally raised pork had no differences in value as compared conventional pork without a label in the eyes of respondents who did not agree with the statements while uncertified traditionally raised pork had a lower value than conventional pork without a label in the eyes of respondents in the other group. All types of pork with the two labels received no price premiums from respondents who did not think traditionally raised pork is safer to eat than conventional pork while traditionally raised pork (uncertified and government certified) had lower values than conventional pork without a label in the eyes of respondents who thought that traditionally raised pork is safer to eat than conventional pork.

Table 5.14 Differences of WTP ($/kg) for Different Types of Pork Chops with both the Canadian Pork Label and CQA® Label as Compared to Conventional Pork between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Edmonton

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
Healthier	Conventional	15.17	15.17	15.17	15.17	15.17	15.17
	Uncertified traditionally raised	-12.50	-12.50	-12.50	-12.50	-12.50	-12.50
	Industry certified traditionally raised						
	Government certified traditionally raised						
Not healthier	Conventional	-9.75	-9.75	-9.75	-9.75	-9.75	-9.75
	Uncertified traditionally raised						
	Industry certified traditionally raised						
	Government certified traditionally raised						
Safer	Conventional						
	Uncertified traditionally raised	-10.80	-10.80	-10.80	-10.80	-10.80	-10.80
	Industry certified traditionally raised						
	Government certified traditionally raised	-10.58		-10.58		-10.58	
Not safer	Conventional						
	Uncertified traditionally raised						
	Industry certified traditionally raised						
	Government certified traditionally raised						

Table 5.15 Differences of WTP ($/kg) for Physical Quality Indicators of Pork Chops between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Edmonton

		Male, trust=1, child=1	Female, trust=1, child=1	Male, trust=0, child=1	Female, trust=0, child=1	Male, trust=1, child=0	Female, trust=1, child=0
Healthier	Grade						
	Color L*			-0.36	-0.36		
	Color a*						
	Shear force			-0.11	-0.11		
Not healthier	Grade	-0.09	-0.09			-0.09	-0.09
	Color L*			-0.33	-0.33	-0.29	-0.29
	Color a*						
	Shear force						
Safer	Grade						
	Color L*						
	Color a*	0.90	0.90	0.90	0.90	0.90	0.90
	Shear force						
Not safer	Grade	-0.10	-0.10			-0.10	-0.10
	Color L*			-0.46	-0.46	-0.27	-0.27
	Color a*						
	Shear force			-0.08	-0.08		

With respect to physical quality attributes (Table 5.15), respondents who did not think that people can be trusted in the group that agreed with the statement that traditionally raised pork is healthier to eat than conventional pork placed lower values on pork chops with higher colour L* (lighter) and shear force value while in the group that did not agree with the statement, all of the respondents placed lower value on pork chops with higher colour L* (lighter) and respondents who thought that people can be trusted placed lower value on pork chops from hogs with higher grades. Regarding differences between the two respondent groups that agreed and did not agree with the statement that traditionally raised pork is safer to eat than conventional pork, respondents who agreed with the statement preferred pork with redder colour while respondents who did not agree with the statement preferred pork with lower colour L* and shear force values, from hogs with lower grades (respondents who thought people can be trusted placed a lower value on pork from hog with higher grade and pork with higher shear force and all had a lower value on pork with higher colour L*).

Hog grade is decided based on the estimated lean yield percentage and carcass weight. Most people have been found to prefer leaner pork both in Canada and other countries in the world (Ngapo et al., 2010; Ngapo et al., 2007a; Verbeke et al., 2005; Dransfield et al., 2005; Brewer et al., 2001), therefore, lean yield has been considered to be an important criterion for carcass evaluation and in determining producer payments for carcasses in order to provide leaner pork to meet consumer demand (Marcoux et al., 2007). In this study, significant correlation coefficients were found between hog grade and estimated carcass lean yield for both hogs from traditionally raised and conventional systems. Pork chops from hog carcasses with higher grades, therefore, were assumed to have higher values. The negative value of hog grade observed in the choices is contrary to the assumption, but it is not very surprising as Pomar et al. (2009) and Marcoux et al. (2007) have suggested that a higher hog grading index can be associated with meat quality problems, such as a problem of PSE (pale, soft and exsudative) pork, etc.. Fjelkner-Modig and Persson (1986) reported that “the highest percent lean in carcass, the highest PSE-frequency (p.102)" and a hog carcass of Hampshire or Landrace with lower lean percentage will give more tender pork than a very lean hog carcass. Although hog grade in this study was found to have no significant effect on the predictions of the meat and sensory quality traits, its negative correlations with colour a* (which has a positive WTP), juiciness, flavour, and overall acceptability of cooked pork need to be paid attention to. As expected, two of the colour measurements had significant values to consumers. Negative WTP for pork chop with higher colour L* suggests that all respondents except those who believed traditionally raised pork is safer to eat than conventional pork preferred darker meat in Edmonton, corresponding to the results observed by Ngapo et al. (2010) that 36% of the consumers from Alberta in their study had a consistent preference for dark red pork while 31% of them had a consistent preference for light red pork. The negative value for shear force is in accordance with our hypothesis as shear force is an indicator of tenderness for cooked pork, though shear force was found to have no significant effect on the prediction of tenderness, a significantly negative correlation was observed between them, indicating that pork with higher shear force value could imply less tender cooked meat.

5.6 MULTINOMIAL LOGIT MODEL FOR THE NATIONAL SAMPLE

5.6.1 VARIABLES

The stated choice experiment in the national online survey was similar to the one in Edmonton, the differences between the two experiments are that real pork chops were used in the Edmonton exercise while pork chops were presented to participants as photos in the national survey and marbling was the only variable physical quality indicator in the national exercise. Therefore, independent variable and the credence attribute variables in the model for the national sample are the same as in the model for Edmonton sample. Marbling which was designed to have two levels (more and less) is the only physical quality variable to be tested in this model. In addition to the demographic variables included in the model for the Edmonton sample, consumer food preferences (eating pork or not, eating meat and fish, non-meat eaters), living area (rural or urban) and provinces are also included in the model as interaction terms with the product attributes. The descriptions of variables in the model are provided in Table 5.16.

Table 5.16 Variable Descriptions in Model, National Sample

Variable	Description
PRICE	Dollar price of product.
N	The “none” option.
TR	Dummy variable =1 if the package of pork chops is traditionally raised, 0 otherwise.
CTR	Dummy variable =1 if package of pork chops is traditionally raised and certified by the Canadian pork industry, 0 otherwise.
GTR	Dummy variable =1 if package of pork chops is traditionally raised and certified by government, 0 otherwise.
CP	Dummy variable =1 if package of pork chops is labeled as Canadian pork, 0 otherwise.
CQA	Dummy variable =1 if package of pork chops is labeled with the Canadian Quality Assurance (CQA®), 0 otherwise.
TRCP	Attribute interaction term =1 if package of pork chops is traditionally raised and is labeled as Canadian pork, 0 otherwise.
TRCQA	Attribute interaction term =1 if package of pork chops is traditionally raised and is labeled with the Canadian Quality Assurance (CQA®), 0 otherwise.
TRCPCQA	Attribute interaction term =1 if package of pork chops is traditionally raised and has the Canadian Pork label and the CQA® label.

CTRCP	Attribute interaction term =1 if package of pork chops is labeled as the pork industry certified traditionally raised and has the Canadian pork label on it, 0 otherwise.
CTRCQA	Attribute interaction term =1 if package of pork chops is labeled as the pork industry certified traditionally raised and has the CQA® label on it, 0 otherwise.
CTRCPCQA	Attribute interaction term =1 if package of pork chops is labeled as the pork industry certified traditionally raised and has the Canadian pork and CQA® labels on it, 0 otherwise.
GTRCP	Attribute interaction term =1 if package of pork chops is labeled as government certified traditionally raised and has the Canadian Pork label on it, 0 otherwise.
GTRCQA	Attribute interaction term =1 if package of pork chops is labeled as government certified traditionally raised and has the CQA® label on it, 0 otherwise.
GTRCPCQA	Attribute interaction term =1 if package of pork chops is labeled as government certified traditionally raised and has the Canadian pork and CQA® labels on it, 0 otherwise.
CONCP	Interaction term between conventional production system (CON) and the Canadian Pork label, equal to 1 if package of pork chops is conventional and has the Canadian PAork label on it, 0 otherwise.
CONCQA	Interaction term between conventional production system (CON) and the Canadian Quality Assurance (CQA®), equal to 1 if package of pork chops is conventional and has the CQA® label on it, 0 otherwise.
CONCPCQA	Attribute interaction term equal to 1 if package of pork chops is conventional and has the Canadian Pork and CQA® labels on it, 0 otherwise.
MARB1	Dummy variable =1 if the pork chops were presented as less

	marbling, 0 otherwise.
GENDER (pork attribute/attribute interaction)	Interaction term between GENDER which took the value of 1 if the respondent is a male and 0 otherwise and pork attribute or attribute interaction.
AGE (pork attribute/attribute interaction)	Interaction term between age and pork attribute or attribute interaction.
CHILD (pork attribute/attribute interaction)	Interaction term between CHILD which took the value of 1 if the respondent had a child or children younger than 18 years in household and 0 otherwise and pork attribute or attribute interaction.
EDUC (pork attribute/attribute interaction)	Interaction term between education and pork attribute or attribute interaction.
EATF (pork attribute/attribute interaction)	Interaction term between pork eating frequency levels and pork attribute or attribute interaction.
TRUS (pork attribute/attribute interaction)	Interaction term between TRUS which took the value of 1 if the respondent believed people can be trusted and 0 otherwise and pork attribute or attribute interaction.
QUE (pork attribute/attribute interaction)	Interaction term between QUE which took the value of 1 if the respondent was from Quebec and 0 otherwise and pork attribute or attribute interaction.
ONT (pork attribute/attribute interaction)	Interaction term between ONT which took the value of 1 if the respondent was from Ontario and 0 otherwise and pork attribute or attribute interaction.
MAN (pork attribute/attribute interaction)	Interaction term between MAN which took the value of 1 if the respondent was from Manitoba and 0 otherwise and pork attribute or attribute interaction.
SASK (pork	Interaction term between SASK which took the value of 1 if

attribute/attribute interaction)	the respondent was from Saskatchewan and 0 otherwise and pork attribute or attribute interaction.
ALB (pork attribute/attribute interaction)	Interaction term between ALB which took the value of 1 if the respondent was from Alberta and 0 otherwise and pork attribute or attribute interaction.
BC (pork attribute/attribute interaction)	Interaction term between BC which took the value of 1 if the respondent was from British Columbia and 0 otherwise and pork attribute or attribute interaction.
RUL (pork attribute/attribute interaction)	Interaction term between RUL which took the value of 1 if the respondent was from rural area and 0 otherwise and pork attribute or attribute interaction.
NTP (pork attribute/attribute interaction)	Interaction term between NTP which took the value of 1 if the respondent did not eat pork and 0 otherwise and pork attribute or attribute interaction.
MF (pork attribute/attribute interaction)	Interaction term between MF which took the value of 1 if the respondent ate meat and fish and 0 otherwise and pork attribute or attribute interaction.
M (pork attribute/attribute interaction)	Interaction term between M which took the value of 1 if the respondent ate meat and 0 otherwise and pork attribute or attribute interaction.

5.6.2 MODEL SPECIFICATION AND GOODNESS-OF-FIT MEASURE

Likelihood ratio test was used for model specification for the national sample similar to the Edmonton sample analyses.

Maritimes which is one of the region categories and the category of non-meat eaters were left out as the base categories.

The variable of marbling (MARB1) and its interaction terms with socio-demographics (GENDERMARB1, AGEMARB1, CHILDMARB1,

EDUCMARB1, EATFMARB1, TRUSMARB1, QUEMARB1, ONTMARB1, MANMARB1, SASKMARB1, ALBMARB1, BCMARB1, RULMARB1, NTPMARB1, MFMARB1, and MMARB1) were added to the base regressions and significance of this set of variables was tested by using likelihood ratio tests. Test results in Table 5.17 show that marbling and its interaction terms with socio-demographics significantly improved the explanatory power of the regression for the groups of respondents who did not agree that traditionally raised pork is healthier or safer to eat than conventional pork. In order to compare results between groups, this set of variables will be added to regressions for the four respondent groups.

Table 5.17 Results of Likelihood Ratio Test by Respondent Group, National Sample

	Healthier	Not healthier	Safer	Not safer
CHISQ Test Statistic	16.01	38.78 ***	16.57	42.79 ***
Degree of Freedom	17	17	17	17
Accept or Reject	Accept	Reject	Accept	Reject
*** significant at 1%; ** significant at 5%; * significant at 10%				

Healthier: the group of respondents who agreed that traditionally raised pork was healthier than conventional pork; Not healthier: the group of respondents who did not agree that traditionally raised pork is healthier than conventional pork; Safer: the group of respondents who agreed that traditionally raised pork was safer than conventional pork; Not safer: the group of respondents who did not agree that traditionally raised pork is safer than conventional pork.

As in the models for the Edmonton sample, the demographic interactions which were not significant in any of the four regressions were dropped because results of likelihood ratio test (Appendix J) suggest that those demographic interaction variables are jointly zero and do not improve the explanatory power of the models as compared to the models without them. Goodness of fit was measured using the McFadden R^2 (equation 5-5) in the models for the national sample.

5.6.3 REGRESSION RESULTS AND WTP

Parameter estimates in the final multinomial logit regression for each respondent group are provided in Table 5.18. The marginal effects were calculated in the same manner as with the models for the Edmonton sample and are presented in Appendix L. The values of willingness to pay were also calculated using equation (5-10). The demographic dummies in the national final models are provinces (Ontario, Quebec, Manitoba, Alberta, Saskatchewan and British Columbia), rural or urban, gender, having a child or children younger than 18 years old in household, pork eater or not pork eater, food preferences (eating meat and fish and eating meat). Calculating WTP with those demographic dummy variables equal to one and zero can result in many WTP responding to many types of consumers, in this study, WTP by consumers in Ontario with different demographics will be calculated and analysed because Ontario is the biggest province with the highest percentage of residents in the country based on the 2006 census. There are eight types of respondents in total in the reported WTP results which are as follows:

1. Respondents in Ontario who were male, living in a rural area, having a child or children younger than 18 years old in household, thinking that people can be trusted, not pork eater, eating meat and fish or eating meat but not fish (Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1).
2. Respondents in Ontario who were **female**, living in a rural area, having a child or children younger than 18 years old in household, thinking that people can be trusted, not pork eater, eating meat and fish or eating meat but not fish (Ontario =1, **gender =0**, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1).
3. Respondents in Ontario who were male, living in an urban area, having a child or children younger than 18 years old in household, thinking that people can be trusted, not pork eater, eating meat and fish or eating meat

but not fish (Ontario =1, gender =1, **rural =0**, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1).

4. Respondents in Ontario who were male, living in a rural area, having **no** a child or children younger than 18 years old in household, thinking that people can be trusted, not pork eater, eating meat and fish or eating meat but not fish (Ontario =1, gender =1, rural =1, **child =0**, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1).
5. Respondents in Ontario who were male, living in a rural area, having a child or children younger than 18 years old in household, **not** thinking that people can be trusted, not pork eater, eating meat and fish or eating meat but not fish (Ontario =1, gender =1, rural =1, child =1, **trust =0**, not eat pork =1, eat meat and fish =1, eat meat but not fish =1).
6. Respondents in Ontario who were male, living in a rural area, having a child or children younger than 18 years old in household, thinking that people can be trusted, **pork eater**, eating meat and fish or eating meat but not fish (Ontario =1, gender =1, rural =1, child =1, trust =1, **not eat pork =0**, eat meat and fish =1, eat meat but not fish =1).
7. Respondents in Ontario who were male, living in a rural area, having a child or children younger than 18 years old in household, thinking that people can be trusted, not pork eater, eating meat but not fish (Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, **eat meat and fish =0**, eat meat but not fish =1).
8. Respondents in Ontario who were male, living in a rural area, having a child or children younger than 18 years old in household, thinking that people can be trusted, not pork eater, eating meat and fish (Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, **eat meat but not fish =0**).

The results of WTP for the national sample were presented as Appendix N.

Table 5.18 Results of Multinomial Logit Regressions for the Four Respondent Groups from Canada

	Healthier		Not Healthier		Safer		Not Safer	
	Dependent variable: CHOICE		Dependent variable: CHOICE		Dependent variable: CHOICE		Dependent variable: CHOICE	
	Number of observations = 4952		Number of observations = 7872		Number of observations =4464		Number of observations = 8360	
	Log likelihood = -4214.50		Log likelihood = -6810.64		Log likelihood = -3787.44		Log likelihood = -7264.31	
	Schwarz B.I.C. = 4661.15		Schwarz B.I.C. = 7281.62		Schwarz B.I.C. = 4228.64		Schwarz B.I.C. = 7738.44	
	Number of Choices = 14856		Number of Choices = 23616		Number of Choices = 13392		Number of Choices = 25080	
	McFadden R^2 = 0.15		McFadden R^2 = 0.20		McFadden R^2 = 0.15		McFadden R^2 = 0.19	
Parameter	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
PRICE	-0.15***	0.01	-0.16***	0.01	-0.14***	0.01	-0.16***	0.01
N	-1.78***	0.16	-1.38***	0.13	-1.56***	0.18	-1.50***	0.12
CONCP	-0.21	0.51	-0.86**	0.42	0.10	0.54	-1.05***	0.40
CONCQA	0.27	0.49	0.16	0.40	0.08	0.54	0.19	0.38
CONCPCQA	0.35	0.30	-0.26	0.24	0.29	0.33	-0.19	0.23
TR	-0.62*	0.33	-0.71***	0.27	-0.66*	0.34	-0.76***	0.26
TRCP	0.94***	0.16	0.60***	0.13	1.02***	0.17	0.56***	0.13
TRCQA	0.72***	0.15	0.51***	0.12	0.88***	0.16	0.42***	0.12
TRCPCQA	-0.74	0.73	0.09	0.60	-1.52**	0.76	0.46	0.58
CTR	-0.81	0.51	-2.36***	0.49	-1.62***	0.58	-1.71***	0.42
CTRCP	0.73	0.57	2.34***	0.54	1.61**	0.65	1.68***	0.47
CTRCQA	1.64***	0.46	1.09***	0.37	1.59***	0.49	1.17***	0.36
CTRCPCQA	-1.28**	0.61	-1.56***	0.53	-1.61**	0.64	-1.48***	0.51
GTR	-0.02	0.44	-0.16	0.36	-0.58	0.48	-0.02	0.34
GTRCP	1.12***	0.20	0.62***	0.16	0.95***	0.20	0.75***	0.15
GTRCQA	-0.51	0.68	-0.16	0.55	0.02	0.72	-0.48	0.53

GTRCPCQA	0.13	0.28	0.56***	0.22	0.06	0.29	0.55***	0.21
GENDERCONCP CQA	-0.02	0.19	0.00	0.16	-0.03	0.21	0.03	0.15
GENDERTR	-0.08	0.11	-0.19**	0.09	-0.06	0.12	-0.19**	0.09
GENDERCTRCP CQA	0.36*	0.19	0.56***	0.15	0.31	0.19	0.58***	0.15
AGECONCP	0.00	0.01	0.00	0.00	-0.01	0.01	0.00	0.00
AGECONCQA	-0.01	0.01	-0.01	0.00	0.00	0.01	-0.01	0.00
AGECTRCP	-0.02***	0.01	-0.01	0.01	-0.03***	0.01	-0.01	0.01
AGECTRCQA	-0.01**	0.01	0.00	0.01	-0.01	0.01	-0.01*	0.01
AGECTRCPCQA	0.02	0.01	0.02**	0.01	0.02**	0.01	0.02*	0.01
AGEGTR	-0.01***	0.004	-0.01**	0.00	-0.01***	0.00	-0.01***	0.00
CHILDCONCP	-0.52***	0.18	0.09	0.15	-0.55***	0.19	0.08	0.14
CHILDTRCP	-0.31*	0.16	0.06	0.13	-0.31*	0.17	0.04	0.13
CHILDCTR	-0.21	0.13	0.10	0.11	-0.26*	0.14	0.08	0.11
CHILDGTRCP	-0.52***	0.16	0.16	0.13	-0.40**	0.16	0.06	0.12
EDUCTRCPCQA	0.06	0.05	0.00	0.04	0.10*	0.05	-0.02	0.04
EDUCGTRCQA	0.08*	0.04	-0.03	0.03	0.06	0.05	-0.01	0.03
EATFCONCP	0.36***	0.11	0.46***	0.09	0.34***	0.11	0.47***	0.08
EATFCONCQA	0.18*	0.10	0.27***	0.09	0.22**	0.11	0.26***	0.08
EATFTR	0.36***	0.08	0.50***	0.06	0.39***	0.08	0.50***	0.06
EATFCTR	0.41***	0.09	0.45***	0.08	0.49***	0.10	0.40***	0.07
EATFCTRCQA	-0.14	0.09	0.03	0.07	-0.20**	0.10	0.06	0.07
EATFGTR	0.26***	0.07	0.44***	0.06	0.30***	0.08	0.42***	0.06
TRUSCTR	-0.43***	0.16	0.19	0.13	-0.49***	0.17	0.22*	0.13
TRUSCTRCQA	0.36*	0.19	-0.04	0.16	0.40**	0.20	-0.04	0.15
TRUSGTR	0.45***	0.18	0.36**	0.15	0.51***	0.19	0.35**	0.14
TRUSGTRCP	-0.49*	0.25	-0.01	0.21	-0.45*	0.27	-0.08	0.20

TRUSGTRCQA	-0.57**	0.27	-0.11	0.22	-0.66**	0.29	-0.08	0.21
TRUSGTRCPCQA	0.72*	0.38	0.10	0.29	0.98**	0.40	0.02	0.29
QUECONCQA	1.01***	0.35	0.66**	0.26	0.95***	0.37	0.69***	0.26
QUECONCPCQA	-0.86*	0.45	-0.25	0.35	-0.80*	0.47	-0.30	0.34
QUETRCQA	0.51**	0.21	0.56***	0.16	0.52**	0.21	0.55***	0.16
QUEGTR	0.99***	0.26	0.17	0.21	1.18***	0.27	0.12	0.20
QUEGTRCQA	-0.72**	0.37	0.41	0.30	-0.94**	0.40	0.42	0.29
ONTCONCQA	0.46	0.30	-0.03	0.27	0.67**	0.32	-0.14	0.27
ONTCONCPCQA	-1.02***	0.40	0.13	0.36	-1.15***	0.42	0.15	0.35
ONTGTR	0.05	0.23	0.13	0.21	0.47**	0.24	-0.12	0.20
ONTGTRCQA	-0.05	0.34	0.17	0.31	-0.44	0.36	0.39	0.29
MANCTR	-0.26*	0.15	0.00	0.12	-0.18	0.16	-0.08	0.11
MANGTR	0.34	0.23	-0.27	0.19	0.45*	0.24	-0.28	0.18
MANGTRCQA	-0.82**	0.40	0.47	0.32	-0.85**	0.43	0.42	0.31
MANGTRCPCQA	0.90**	0.39	-0.10	0.27	0.80*	0.43	-0.01	0.26
SASKCONCPCQA	-0.25	0.34	-0.57**	0.26	-0.52	0.38	-0.44*	0.25
SASKTR	0.41*	0.25	-0.04	0.18	0.52*	0.27	-0.07	0.18
SASKTRCQA	-0.63**	0.29	-0.11	0.23	-0.81**	0.32	-0.07	0.22
SASKCTRCPCQA	0.13	0.32	-0.49**	0.22	0.17	0.36	-0.44**	0.21
SASKGTR	0.31	0.26	-0.43**	0.21	0.46	0.29	-0.45**	0.20
SASKGTRCQA	-0.58	0.45	0.52	0.34	-1.06**	0.49	0.65*	0.33
SASKGTRCPCQA	0.07	0.44	0.16	0.30	0.15	0.45	0.14	0.29
ALBCONCQA	0.50	0.34	0.13	0.26	0.38	0.37	0.20	0.25
ALBCONCPCQA	-0.64	0.44	-0.18	0.35	-0.43	0.48	-0.33	0.33
ALBCTRCPCQA	0.28	0.30	-0.21	0.20	0.46	0.31	-0.25	0.20
ALBGTR	0.40	0.24	-0.23	0.20	0.66**	0.26	-0.33*	0.20
ALBGTRCQA	-0.57	0.35	0.42	0.30	-0.85	0.38	0.57**	0.29

BCCONCP	0.23	0.27	0.36*	0.22	0.35	0.28	0.28	0.21
BCCONCQA	0.67**	0.31	0.52**	0.25	0.74**	0.33	0.48**	0.24
BCCONCPCQA	-1.00**	0.49	-0.40	0.39	-1.10**	0.51	-0.35	0.38
BCTR	-0.22	0.16	0.59***	0.13	-0.23	0.17	0.55***	0.13
BCCTR	0.07	0.20	0.65***	0.17	0.07	0.21	0.59***	0.17
BCCTRCP	-0.29	0.27	-0.18	0.23	-0.28	0.29	-0.16	0.22
BCCTRCPCQA	0.97***	0.38	-0.39	0.28	0.80**	0.38	-0.26	0.27
BCGTR	0.00	0.24	0.29	0.20	0.17	0.25	0.22	0.20
BCGTRCQA	-0.77*	0.42	0.34	0.34	-0.93**	0.44	0.34	0.33
BCGTRCPCQA	0.59	0.38	0.08	0.29	0.48	0.40	0.15	0.28
RULCTR	-0.20	0.13	0.20*	0.11	-0.29**	0.13	0.20	0.11
RULGTRCP	0.13	0.19	0.26*	0.15	0.29	0.20	0.15	0.15
RULGTRCQA	0.10	0.22	0.10	0.18	-0.10	0.24	0.23	0.17
NTPCONCP	-1.06***	0.39	-1.38***	0.29	-1.02**	0.41	-1.35***	0.29
NTPCONCQA	-0.71*	0.38	-1.13***	0.29	-1.09***	0.41	-0.94***	0.28
NTPCONCPCQA	1.00*	0.54	1.25***	0.40	1.52***	0.58	0.98**	0.38
NTPTR	-1.01***	0.23	-1.56***	0.18	-1.05***	0.24	-1.49***	0.17
NTPCTR	-0.80***	0.22	-1.11***	0.16	-0.56**	0.23	-1.19***	0.16
NTPGTR	-0.86***	0.26	-1.33***	0.20	-0.92***	0.27	-1.24***	0.19
NTPGTRCP	-0.61**	0.27	-0.22	0.19	-0.43	0.29	-0.33*	0.18
MFCONCP	0.03	0.19	0.52***	0.15	0.24	0.21	0.39***	0.15
MFCTR	0.70*	0.38	1.39***	0.40	1.45***	0.45	0.83**	0.33
MFCTRCP	0.91*	0.48	-0.89**	0.45	0.42	0.56	-0.43	0.39
MFGTR	0.74***	0.28	0.55***	0.21	1.10***	0.30	0.47**	0.20
MTRCQA	0.24	0.30	-0.15	0.24	0.32	0.33	-0.15	0.22
MTRCPCQA	0.16	0.39	-0.46	0.32	-0.11	0.42	-0.30	0.30
MCTR	1.24***	0.42	1.10***	0.43	1.74***	0.50	0.68*	0.36

MCTRCP	0.60	0.53	-0.94*	0.49	0.00	0.60	-0.46	0.42
MGTR	0.74**	0.31	0.42*	0.23	1.07***	0.33	0.35	0.22
MARB1	-0.37**	0.17	0.38***	0.15	-0.28	0.18	0.30**	0.14
GENDERMARB1	0.05	0.09	0.09	0.07	0.01	0.09	0.10	0.07
AGEMARB1	0.01*	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MANMARB1	0.16	0.12	-0.22**	0.09	0.14	0.12	-0.19**	0.09
SASKMARB1	0.25*	0.15	-0.22**	0.10	0.30*	0.16	-0.21**	0.10
ALBMARB1	0.07	0.13	-0.30***	0.10	0.03	0.13	-0.25***	0.10
NTPMARB1	-0.01	0.14	-0.37***	0.10	0.09	0.15	-0.41***	0.10

*** 1% significant level; ** 5% significant level; * 10% significant level.

5.6.3.1 Results for the Group of Respondents Who Agreed that Traditionally Raised Pork was Healthier to Eat than Conventional Pork

Regression Results

The McFadden R^2 is 0.15. It can be mapped onto a linear R^2 as approximately 0.40.

As results for the Edmonton sample, price and the "none" option variable still have significantly negative coefficients, marginal effects calculated for price show that one unit increase in own price will decrease the probability of choosing the product (either A or B) by approximately 0.03.

TRCP and TRCQA are positive and significant at the 1% significance level which indicates that uncertified traditionally raised pork with a Canadian pork label or a CQA® label are more likely to be chosen by consumers who think traditionally raised pork is healthier to eat than conventional pork while TR is negative and significant at the 10% significance level which indicates that uncertified traditionally raised pork is less likely to be chosen by this group of consumers. These results suggest that uncertified traditionally raised pork should be marketed with either the Canadian pork label or CQA® label to attract purchases by the Canadians who believe that traditionally raised pork is healthier to eat than conventional pork.

CTRCQA is positive and significant at the 1% significance level while CTRCPCQA is negative and significant at the 5% significance level which indicates that consumers belonging to this group are more likely to choose industry certified traditionally raised pork while they were less likely to choose industry certified traditionally raised pork with both the Canadian pork and the CQA® labels suggesting that the CQA® label is an important addition for this group of consumers to choose industry certified traditionally raised pork.

GTRCP is positive and significant at the 1% significance level, the probability of a respondent in this group choosing government traditionally raised pork with the Canadian pork label is 0.08 higher than the probability of choosing the other types of pork.

GENDERCONCPCQA is positive and significant at the 10% significance level, indicating that the probability of a man choosing conventional pork with the Canadian Pork and the CQA® labels was approximately 0.05 higher than the probability of a woman choosing this type of pork.

AGECTRCP, AGECTRCQA and AGEGTR are significantly negative at the 1 and 5% significance levels showing that younger respondents were more likely to choose industry certified traditionally raised pork with the Canadian Pork label or with the CQA® label and government certified traditionally raised pork while AGEMARB1 is significantly positive at the 10% significance level showing that older respondents were more likely to choose pork chops with less marbling.

CHILDCONCP, CHILDTRCP and CHILDGTRCP were negative and significant at the 1 and 10% significance levels. The probability of a respondent who had a child or children younger than 18 years old in household choosing conventional pork with the Canadian Pork label, uncertified traditionally raised pork with the Canadian Pork label, and government certified traditionally raised pork with the Canadian Pork label are approximately 0.06, 0.03, and 0.06, respectively, lower than the probability of a respondent who had no children in their households choosing those types of pork.

EDUCGTRCQA is positively significant at the10% significance level. One additional year of education increases the probability of choosing government certified traditionally raised pork with a CQA® label by approximately 0.01.

EATFCONCP, EATFCONCQA, EATFTR, EATFCTR and EATFGTR are positively significant at the 1% and 10% significance levels indicating that respondents who ate pork more often in this group were more likely to choose conventional pork with either the Canadian Pork label or the CQA® label, uncertified, industry certified and government certified traditionally raised pork. Marginal effect suggests that the Canadian pork label has a stronger positive effect than the CQA® label on the choices of conventional pork (0.08 vs. 0.05) made by consumers with higher pork eating frequency.

NTPCONCP, NTPCONCQA are significantly negative at the 10 and 1% significance levels, respectively, indicating that a consumer who does not eat pork is less likely to choose conventional pork with the Canadian pork label or with the CQA® label while NTPCONCPCQA is significantly positive at the 10% significance level indicating that they were more likely to choose conventional pork with both the Canadian Pork label and CQA® labels. Consumers who do not eat pork are also less likely to choose uncertified, industry certified and government certified traditionally raised pork and government certified traditionally raised pork with the Canadian pork label as compared to pork eating consumers with NTPTR, NTPCTR, NTPGTR and NTPGTRCP being significantly negative at the 1 and 5% significance levels.

MFCTR, MFCTRCP and MFGTR are positively significant at the 10 and 1% significance levels showing that respondents who ate meat and fish in this group were more likely to choose industry and government certified traditionally raised pork and industry certified traditionally raised pork with the Canadian pork label as compared to respondents who were vegetarians. MCTR and MGTR are significantly positive at the 1 and 5% significance levels, respectively, indicating that as compared to the vegetarian respondents, respondents who ate meat but not fish in this group were more likely to choose industry and government certified traditionally raised pork, this suggests that, regarding traditionally raised pork, this type of consumers prefer certified products to uncertified products.

TRUSCTR is significantly negative at the 1% significance level while TRUSCTRCQA is significantly positive at the 10% significance level indicating that respondents who thought that people can be trusted were less likely to choose industry certified traditionally raised pork but were more likely to choose industry certified traditionally raised pork with the CQA® label. TRUSGTR and TRUSGTRCPCQA are significantly positive at the 1 and 10% significance levels, respectively, while TRUSGTRCP and TRUSGTRCQA are significantly negative at the 10 and 5% significance levels, respectively, showing for the government certified traditionally raised pork, respondents who thought people can be trusted were more likely to choose this type of pork with neither the Canadian Pork label nor the CQA® label or with both of the labels while they were less likely to choose government certified traditionally raised pork with only the Canadian pork label or the CQA® label. Regarding preferences for certifier, these results suggest that, to consumers with general trust in people, government is the preferred certifier for traditionally raised pork without labels while the pork industry is the preferred certifier for traditionally raised pork with the CQA® label, and for traditionally raised pork with both the Canadian Pork and the CQA® labels, government as a certify agent is preferred.

The coefficients of province interaction variables show that as compared to respondents in the Maritimes, respondents in Quebec were more likely to choose conventional, uncertified and government certified traditionally raised pork with the CQA® label and government certified traditionally raised pork without labels while they were less likely to choose conventional pork with both of the labels and government certified traditionally raised pork with the CQA® label; respondents in Ontario were also less likely to choose conventional pork with both of the labels; respondents in Manitoba were less likely to choose industry certified traditionally raised pork and government certified traditionally raised pork with the CQA® label while they were more likely to choose government certified traditionally raised pork with both the Canadian pork and CQA® labels; Saskatchewan respondents were more likely to choose uncertified traditionally raised pork without labels while they were less likely to choose this type of pork with the CQA® label; as respondents in Quebec and Ontario, respondents in British Columbia were also less likely to choose conventional pork with both the Canadian pork and CQA® labels while they were more likely to choose conventional pork with only the CQA® label. Whether people are living in rural or urban area does not have any effect on the choices of pork in this group.

With respect to the only physical quality indicator, marbling, the regression results show that people who believe that traditionally raised pork is healthier to eat than conventional pork are less likely to choose lower marbled pork (marginal effect of -0.002) while the coefficients of AGEMARB1 and SASKMARB1 show that older people and people in Saskatchewan with this belief are more likely to choose lower marbled pork than younger people and people in Maritimes with marginal effects of 0.001 and 0.03, respectively.

Willingness to Pay

For pork with no Canadian Pork label or CQA® label, respondents preferred certified traditionally raised pork to uncertified traditionally raised pork such that the highest WTP ($13.81/kg) was for government certified traditionally raised pork from respondents of type six who stated that they were pork eaters. Table 5.19 shows that respondents who eat pork were more willing to pay more for traditionally raised pork without labels than conventional pork as compared to the other types of respondents.

For pork with the Canadian pork label, the highest WTP ($8.78/kg) was for industry certified traditionally raised pork from respondents of type one to type six, respondents of type eight who stated that they ate meat but not fish were willing to pay at a lower price premium which was $4.75/kg. Uncertified traditionally raised pork also generated significant and positive WTP from all types of respondents in Ontario with the highest value, $6.31/kg, from the respondents of type four who had a child or children younger than 18 years old in their households. The Canadian pork label is therefore important in combination with uncertified and industry certified traditionally raised pork for consumers who believe that traditionally raised pork is healthier to eat than conventional pork.

For pork with the CQA® label, all types of respondents were willing to pay more for uncertified and industry certified traditionally raised pork than conventional pork without labels. For the uncertified traditionally raised pork, except for the respondents of type eight who stated that they ate meat but not fish were willing to pay a lower price premium at $4.83/kg, all the other types of respondents were willing to pay $6.42 more for this type of pork than the regular conventional pork. For industry certified traditionally raised pork, except for the respondents of type five who did not think people can be trusted were willing to pay a lower premium at $2.74/kg, all the other types of respondents were willing to pay $5.17/kg for this type of pork than the regular conventional pork. However, the respondents of type five were the only type of respondents who were willing to pay more ($3.92/kg) for government certified traditionally raised pork with the CQA® label than the regular conventional pork. Conventional pork with the CQA® label only received a significant WTP of ($6.78/kg) from the respondents of type six who were pork eaters.

For pork with both the Canadian pork and CQA® labels, only government certified traditionally raised pork generated significant and positive WTP ($5.68/kg) from respondents who agreed that traditionally raised pork is healthier to eat than conventional pork.

Marbling which is a physical quality attribute did not have any effect on consumers' WTP for pork chops in this group.

Table 5.19 WTP ($/kg.) for Pork Chops by Attributes as Compared to Conventional Pork from Respondents Who Agreed that Traditionally Raised Pork was Healthier than Conventional Pork – Canada

		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
No labels	Uncertified traditionally raised	-3.53		-3.53	-3.53	-3.53	3.26	-3.53	-3.53
	Industry certified traditionally raised			7.02	7.10	8.56	11.02		
	Government certified traditionally raised	8.07	8.07	8.07	8.07	5.06	13.81		
With Canadian pork label	Conventional	-4.90	-4.90	-4.90		-4.90		-5.09	-4.90
	Uncertified traditionally raised	4.22	4.22	4.22	6.31	4.22	4.22	4.22	4.22
	Industry certified traditionally raised	8.78	8.78	8.78	8.78	8.78	8.78	2.67	4.75
	Government certified traditionally raised								
With CQA® label	Conventional						6.78		
	Uncertified traditionally raised	6.42	6.42	6.42	6.42	6.42	6.42	6.42	4.83
	Industry certified traditionally raised	5.17	5.17	5.17	5.17	2.74	5.17	5.17	5.17
	Government certified traditionally raised					3.92			
With Canadian pork and CQA® labels	Conventional						-4.61		
	Uncertified traditionally raised								
	Industry certified traditionally raised	-0.21	-2.64	-0.21	-0.21				
	Government certified traditionally raised	5.68	5.68	5.68	5.68		5.68	5.68	5.68
	Marbling								

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

5.6.3.2 Results for the Group of Consumers Who Did Not Agree that Traditionally Raised Pork is Healthier to Eat than Conventional Pork

Regression Results

The McFadden R^2 was calculated to be 0.20, which can be approximately equivalent to an R^2 of 0.50 in a linear regression.

The coefficients for price and the "none" option are significantly negative, marginal effects of price show that one unit increase in own price decreases the probability of choosing the product by approximately 0.03.

CONCP is significantly negative at the 5% significance level while TRCP, CTRCP and GTRCP are significantly positive at the 1% significance level, showing that respondents who did not agree that traditionally raised pork is healthier to eat than conventional pork were less likely to choose conventional pork chops labeled as Canadian pork while they were more likely to choose traditionally raised pork (uncertified, industry certified and government certified) labeled as Canadian pork. For pork without labels, this group of respondents were less likely to choose uncertified and industry certified traditionally raised pork while government certified traditionally raised pork had no significant effect on the choices. TRCQA and CTRCQA are significant and positive at the 1% significance level showing that for pork with the CQA® label, respondents in this group were more likely to choose uncertified and industry certified traditionally raised pork. CTRCPCQA is significant and negative at the 1% significance level while GTRCPCQA is significant and positive at the 1% significance level, indicating that respondents in this group were less likely to choose industry certified traditionally raised pork with both of the labels while they were more likely to choose government certified traditionally raised pork with both of the labels, this suggests that for traditionally raised pork labeled as Canadian pork and CQA®, government is the preferred certifier for consumers who do not think traditionally raised pork is healthier to eat than conventional pork.

Gender is negative and significant at the 5% significance level when interacted with traditionally raised while it is positive and significant at the 1% significance level when interacted with industry certified traditionally raised with both the Canadian pork and CQA® labels, indicating that men who did not think that traditionally raised pork is healthier to eat than conventional pork were less likely to choose uncertified traditionally raised pork while they were more likely to choose industry certified traditionally raised pork with both the Canadian pork and CQA® labels. The probability differences of choosing those two types of pork between a man and a woman are approximately -0.02 and 0.06, respectively.

Age is also positive and significant when interacted with industry certified traditionally raised with both the Canadian pork and CQA® labels, one additional year of age increases the probability of choosing this type of pork by approximately 0.003; whereas it is negative and significant when interacted with government certified traditionally raised pork that one additional year of age decreases the probability of choosing government certified traditionally raised pork by 0.002.

Pork eating frequency is significantly positive when interacted with conventional with the Canadian pork label or the CQA® label, uncertified traditionally raised, industry certified and government certified traditionally raised at the 1% significance level, suggesting that people who eat pork more often are more likely to choose those types of pork. The variable representing not eating pork (NTP) is significantly negative at the 1% significance level when interacted with conventional pork with the Canadian pork label or the CQA® label, uncertified traditionally raised, industry certified traditionally raised, government certified traditionally raised, suggesting that people who do not eat pork are less likely to choose those types of pork. These results suggest that people who eat pork more often care about the quality and information about pork more than those who never eat pork and are more willing to choose pork with additional quality or more information.

MFCONCP is positive and significant at the 1% significance level while MFCTRCP is negative and significant at the 5% significance level, indicating that as compared to the vegetarian respondents, respondents who eat meat and fish in this group were more likely to choose conventional pork with the Canadian pork label while they were less likely to choose industry certified traditionally raised pork with the Canadian pork label. For pork without labels, results suggest that people who eat meat and fish prefer both industry and government certified traditionally raised pork with MFCTR and MFGTR are positive and significant at the 1% significance level. The marginal effects of the two variables (0.16 and 0.07, respectively) show that industry certified traditionally raised pork has a stronger effect than government certified traditionally raised pork. MCTR and MGTR are significantly positive at the 1 and 10% significance levels, respectively, while MCTRCP is significantly negative at the 10% significance level, indicating that as compared to respondents who do not eat meat or fish, respondents who stated that they ate meat but not fish were more likely to choose industry and government certified traditionally raised pork with no labels while they were less likely to choose industry certified traditionally raised pork with the Canadian pork label. These results suggest that consumers who eat meat but not fish and do not believe that traditionally raised pork is healthier to eat than conventional pork prefer certified (both industry and government as certifiers) traditionally raised pork with no labels.

The variable representing consumer general trust is significant and positive at the 5% significance level when interacted with government certified traditionally raised, indicating that respondents who thought people can be trusted in general were more likely to choose government certified traditionally raised pork. The probability of a respondent who thought people can be trusted in general choosing government certified traditionally raised pork chops is 0.04 higher than the probability of a respondent who did not think people can be trusted choosing this type of pork.

The coefficients of the interaction terms regarding province show that, as compared to respondents in Maritimes, respondents in Quebec were more likely to choose conventional and uncertified traditionally raised pork with the CQA® label with QUECONCQA and QUETRCQA being significantly positive at the 5 and 10% significance levels, respectively; respondents in Saskatchewan were less likely to choose conventional and industry certified traditionally raised pork with both the Canadian pork and CQA® labels and government certified traditionally raised pork as SASKCONCPCQA, SASKCTRCPCQA and SASKGTR are negative and significant at the 1% significance level; respondents in British Columbia were more likely to choose conventional pork with the CQA® label and with both the Canadian pork and CQA® labels, they were also more likely to choose uncertified and industry certified traditionally raised pork with no labels.

RULCTR and RULGTRCP are positive and significant at the 10% significance level, showing that respondents who were living in rural areas were more likely to choose industry certified traditionally raised pork and government certified traditionally raised pork. The marginal effects show that the probability differences in choosing these two types of pork between rural and urban residents are 0.03.

This group of respondents were predicted to significantly prefer lower marbled pork such that the probability of choosing pork with lower marbling was approximately 0.01 higher than the probability of choosing pork with more marbling. The coefficients of the province interaction terms show that as compared to respondents in Maritimes, respondents in Manitoba, Saskatchewan and Alberta were less likely to choose lower marbled pork. NTPMARB1 is negative and significant at the 1% significance level which indicates that respondents who stated that they did not eat pork in this group were less likely to choose lower marbled pork.

Willingness to Pay

For pork with no Canadian pork label or CQA® label, uncertified traditionally raised pork had lower values than the regular conventional pork in the eyes of all types of respondents except for the respondents of type six who were pork eaters and were willing to pay $3.76/kg more for traditionally raised pork as compared to conventional pork. These respondents were also the type of respondents who were willing to pay the highest premiums for industry certified and government certified traditionally raised pork with no labels ($12.18/kg and $13.75/kg). Generally speaking, for pork with no other labels, respondents in Ontario who did not think traditionally raised pork is healthier to eat than conventional pork preferred certified traditionally raised pork to uncertified traditionally raised pork.

For pork with the Canadian pork label, all types of respondents in Ontario were willing to pay more for uncertified and government certified traditionally raised pork than the regular conventional pork. The respondents of type four that did not have a child in their household were willing to pay a premium which was $0.40/kg less than the other types of respondents for uncertified traditionally raised pork. The WTP for government certified traditionally raised pork varied by different types of respondents between $3.39/kg and $6.30/kg. Industry certified traditionally raised pork received price premiums from the respondents of type seven and type eight who eat meat but not fish and who eat meat and fish, which were $5.84/kg and $6.16/kg, respectively. Conventional pork with the Canadian pork label only received significant and positive WTP from respondents of type six who are pork eaters which was $6.79/kg, the highest WTP of all types of pork with the Canadian pork label.

For pork with the CQA® label, industry certified traditionally raised was the type of pork that generated the highest price premiums as the values of WTP from all types of respondents in Ontario for it were significant with the highest value ($5.76/kg) from the respondents of type five who did not think people can be trusted. The value of government certified traditionally raised pork with the CQA® label was lower than the regular conventional pork in the eyes of respondents of type three who were living in urban areas. Uncertified traditionally raised pork only received significant WTP from the respondents of type eight who eat meat and fish while conventional pork with the CQA® label only received significant WTP from the respondents of type 6 who are pork eaters.

For pork with both the Canadian pork and CQA® labels, conventional pork was the type that generated the highest price premiums ($6.84/kg) from all types of respondents in Ontario except for the respondents of type 6 who are pork eaters. Government certified traditionally raised pork with the CQA® label received significant WTP from all types of respondents with a lower WTP received from the respondents of type five who did not think people can be trusted. Industry certified traditionally raised pork with the CQA® label had a lower value than the conventional pork in the eyes of female respondents (type two) while uncertified traditionally raised pork did not receive any significant WTP.

For the physical quality attribute, marbling, the respondents of types six who are pork eaters were willing to pay $1.92/kg more for pork with lower marbling as compared to the pork with more marbling.

Table 5.20 WTP ($/kg.) for Pork Chops by Attributes as Compared to Conventional Pork from Respondents Who did not Agree that Traditionally Raised Pork is Healthier than Conventional Pork – Canada

		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
No labels	Uncertified traditionally raised	-5.80	-4.63	-5.80	-5.80	-5.80	3.76	-5.80	-5.80
	Industry certified traditionally raised	5.39	5.39				12.18	-3.12	
	Government certified traditionally raised	5.59	5.59	5.59	5.59		13.75		3.02
With Canadian pork label	Conventional						6.79	-4.90	
	Uncertified traditionally raised	4.06	4.06	4.06	3.66	4.06	4.06	4.06	4.06
	Industry certified traditionally raised							5.84	6.16
	Government certified traditionally raised	4.96	4.96	3.39	3.94	5.02	6.30	4.96	4.96
With CQA® label	Conventional						4.06		
	Uncertified traditionally raised								3.12
	Industry certified traditionally raised	5.50	5.50	5.50	5.50	5.76	5.50	5.50	5.50
	Government certified traditionally raised			-3.23					
With Canadian pork and CQA® labels	Conventional	6.84	6.86	6.84	6.84	6.84		6.84	6.84
	Uncertified traditionally raised								
	Industry certified traditionally raised		-3.82						
	Government certified traditionally raised	4.06	4.06	4.06	4.06	3.47	4.06	4.06	4.06
	Marbling						1.92		

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

5.6.3.3 Results for the Group of Consumers Who Agreed that Traditionally Raised Pork was Safer to Eat than Conventional Pork

Regression Results

The McFadden R^2 measuring the goodness of fit of the regression is 0.15, which is the same as the one for the group of respondents who believed that traditionally raised pork is healthier to eat than conventional pork. It is approximately equivalent to an R^2 of 0.4 in a linear regression.

PRICE and N are negative and significant at the 1% significance level. Marginal effects show that one unit increase in own price of the product will decrease the probability of choosing the product by 0.03 approximately.

TR and CTR are negative and significant at the 10 and 1% significance levels, respectively, while GTR is not significant. Uncertified, industry certified and government certified traditionally raised pork with the Canadian pork label all have significant and positive effects on consumers' choices with TRCP, CTRCP and GTRCP being significant at the 1 and 5% significance levels. TRCQA and CTRCQA are positive and significant at the 1% significance level while TRCPCQA and CTRCPCQA are negative and significant at the 5% significance level, showing that uncertified and industry certified traditionally raised pork with the CQA® label are more likely to be chosen while uncertified and industry certified traditionally raised pork with both of the labels (the Canadian pork label and the CQA® label) are less likely to be chosen. These results suggest that traditionally raised pork with either the Canadian pork label or the CQA® label will be credence attribute combinations preferred by consumers who believe that traditionally raised pork is safer to eat than conventional pork.

Age is negative and significant at the 1% significance level when interacted with industry certified traditionally raised pork with the Canadian pork label and government certified traditionally raised pork with no labels while it is positive and significant at the 5% significance level which suggests that more information for industry certified traditionally raised pork will be preferred by older consumers who think traditionally raised pork is safer to eat than conventional pork.

With CHILDCONCP, CHILDTRCP, CHILDCTR and CHILDGTRCP being negative and significant at the 1, 5 and 10% significance levels, people who have a child or children in their household are predicted to be less likely to choose conventional pork with the Canadian pork label, uncertified and government certified traditionally raised pork with the Canadian pork label and industry certified traditionally raised pork with no labels.

Education is positive and significant at the 10% significance level when interacted with the variable of uncertified traditionally raised pork with the Canadian pork and CQA® labels. The marginal effects indicate that one additional year of education increases the probability of choosing uncertified traditionally raised pork with both the Canadian pork and CQA® labels by 0.02.

Pork eating frequency is positive and significant at the 1 and 5% significance levels when interacted with conventional pork with the Canadian pork label or the CQA® label, uncertified traditionally raised, industry certified and government certified traditionally raised pork while it is negative and significant at the 5% significance level when interacted with industry certified traditionally raised pork with the CQA® label, suggesting that consumers who eat pork more often prefer conventional pork with either the Canadian pork label or the CQA® label and traditionally raised pork (uncertified, industry certified and government certified) with no labels.

The variable of not eating pork is negative and significant at the 5 and 1% significance levels when interacted with conventional pork with the Canadian pork label, conventional pork with the CQA® label, uncertified, industry certified and government certified traditionally raised pork while it is significantly positive at the 1% significance level when interacted with conventional with both the

Canadian pork and CQA® labels, suggesting that people who do not eat pork and believe that traditionally raised pork is safer to eat than conventional pork prefer conventional pork to be labelled as Canadian pork and CQA®.

MFCTR, MFGTR, MCTR, and MGTR are positive and significant at the 1% significance level, indicating that people who stated that they eat meat and fish or they eat meat but not fish were more likely to choose industry and government certified traditionally raised pork as compared to the vegetarian people. These results suggest that consumers who eat meat and believe that traditionally raised pork is safer to eat than conventional pork will prefer certified traditionally raised pork to uncertified traditionally raised pork.

The variable of general trust is significantly negative at the 1% significance level when interacted with industry certified traditionally raised while it is significantly positive at the 1% significance level when interacted with government certified traditionally raised, suggesting that consumers who believe that traditionally raised pork is safer to eat than conventional pork and think people can be trusted prefer government as the certifier for traditionally raised pork. For pork with the CQA® label, these consumers prefer the pork industry as a certifier for traditionally raised pork with TRUSCTRCQA being positive and significant at the 5% significance level while TRUSGTRCQA being negative and significant at the 5% significance level. TRUSGTRCP is negative and significant at the 10% significance level while TRUSGTRCPCQA is positive and significant at the 5% significance level, indicating that respondents who thought people can be trusted in this group were less likely to choose government certified traditionally raised pork while they were more likely to choose industry government certified traditionally raised pork with both the Canadian pork and CQA® labels.

With respect to interactions with provinces, results show that as compared to respondents in Maritimes, respondents in Quebec were more likely to choose conventional and uncertified traditionally raised pork with the CQA® label and government certified traditionally raised pork with no labels while they were less likely to choose conventional pork with both the Canadian pork and CQA® labels and government certified traditionally raised pork with the CQA® label; respondents in Ontario were more likely to choose conventional pork with THE CQA® label and government certified traditionally raised pork while they were less likely to choose conventional pork with both of the labels as the respondents in Quebec; respondents in Manitoba preferred government certified traditionally raised pork that they were more likely to choose government certified traditionally raised pork with either no labels or with both of the labels but they were less likely to choose government certified traditionally raised pork with the CQA® label; respondents in Saskatchewan were more likely to choose uncertified traditionally raised pork with no labels while they were less likely to choose uncertified traditionally raised pork with the CQA® label, they were also more likely to choose lower marbled pork; respondents in Alberta were more likely to choose government certified traditionally raised pork; respondents in British Columbia were more likely to choose conventional pork with the CQA® label while they were less likely to choose conventional pork with both the Canadian pork and CQA® labels.

RULCTR is negative and positive at the 5% significance level indicating that respondents living in a rural area were less likely to choose industry certified traditionally raised pork with no labels. Marginal effects show that the probability difference of choosing this type of pork between rural and urban residents is 0.03.

Willingness to Pay

For pork with no Canadian pork label or CQA® label, respondents who thought traditionally raised pork is safer to eat than conventional pork preferred certified traditionally raised pork to uncertified traditionally raised pork because the values of WTP for industry certified traditionally raised pork were between $11.18/kg and $15.04/kg and were between $6.16/kg and $20.18/kg while uncertified traditionally raised pork only received a low price premium of $3.99/kg from the respondents of type six who were pork eaters.

For pork with the Canadian pork label, uncertified traditionally raised pork received significant WTP from all types of respondents with the highest price premium ($7.14/kg) from the respondents of type four who had no children in their households. Industry certified traditionally raised pork only received a price premium of $5.11/kg from the respondents of type eight who eat meat and fish while government certified traditionally raised pork had no significant WTP and conventional pork received a lower price than the conventional pork with no label from the respondents of type seven who eat meat but not fish.

For pork with the CQA® label, the highest WTP ($9.12/kg) was for conventional pork from the respondents of type six who are pork eaters. Conventional pork with the CQA® label received the highest WTP but only one type of respondents were willing to pay more for it while all types of respondents were willing to pay $2.74/kg to $8.35/kg more for uncertified and industry certified traditionally raised pork as compared to the regular conventional pork with no labels. The results show that uncertified traditionally raised pork is the most profitable type to be labeled as CQA® to consumers who believe that traditionally raised pork is safer to eat than conventional pork.

For pork with both the Canadian pork and CQA® labels, only government certified traditionally raised pork generated price premiums ($7.27/kg) from different types of respondents in Ontario. The two labels lowered the value of conventional pork in the eyes of respondents of type six who ate pork.

Marbling did not have significant effects on the value of pork chops for respondents who believe that traditionally raised pork is safer to eat than conventional pork.

Table 5.21 WTP ($/kg.) for Pork Chops by Attributes as Compared to Conventional Pork from Respondents Who Agreed that Traditionally Raised Pork was Safer than Conventional Pork – Canada

		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
No labels	Uncertified traditionally raised	-3.33		-3.33	-3.33	-3.33	3.99	-3.33	-3.33
	Industry certified traditionally raised	11.18	11.18	13.18	12.98	14.56	15.04		
	Government certified traditionally raised	13.79	13.79	13.79	13.79	10.24	20.18	6.16	6.35
With Canadian pork label	Conventional							-5.61	
	Uncertified traditionally raised	5.00	5.00	5.00	7.14	5.00	5.00	5.00	5.00
	Industry certified traditionally raised								5.11
	Government certified traditionally raised								
With CQA® label	Conventional						9.12		
	Uncertified traditionally raised	8.35	8.35	8.35	8.35	8.35	8.35	8.35	6.14
	Industry certified traditionally raised	5.52	5.52	5.52	5.52	2.74	5.52	5.52	5.52
	Government certified traditionally raised								
With Canadian pork and CQA® labels	Conventional						-6.20		
	Uncertified traditionally raised								
	Industry certified traditionally raised								
	Government certified traditionally raised	7.27	7.27	7.27	7.27		7.27	7.27	7.27
	Marbling								

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

5.6.3.4 Results for the Group of Consumers Who Did Not Agreed that Traditionally Raised Pork is Safer to Eat than Conventional Pork

Regression Results

The McFadden R^2 measuring the goodness of fit of the regression is 0.19, which is close to the one for the group of respondents who did not believe that traditionally raised pork is healthier to eat than conventional pork. It is approximately equivalent to an R^2 of between 0.48 and 0.50 in a linear regression.

The coefficients of price and the "none" option are negative and significant at the 1% significance level. Marginal effects of price suggest that one unit increases in own price will decrease the probability of choice by 0.03.

CONCP is negative and significant at the 1% significance level while TRCP, CTRCP and GTRCP are positive and significant at the same significance level, suggesting that for pork with the Canadian pork label, Canadian consumers who do not think traditionally raised pork is safer to eat than conventional pork are more likely to choose traditionally raised pork (uncertified, industry certified and government certified). TR and CTR are significantly negative at the 1% significance level, indicating that respondents who did not agree that traditionally raised pork is safer to eat than conventional pork were less likely to choose uncertified and industry certified traditionally raised pork with no labels while TRCQA and CTRCQA are significantly positive at the 1% significance level, indicating that these respondents were more likely to choose uncertified and industry certified traditionally raised pork with the CQA® label. CTRCPCQA is negative and significant at the 1% significance level while GTRCPCQA is positive and significant at the same significance level, showing that respondents in this group were less likely to choose industry certified traditionally raised pork with both the Canadian pork and CQA® labels but were more likely to choose government certified traditionally raised pork. These results suggest that people in Canada who do not believe that traditionally raised pork is safer to eat than conventional pork prefer traditionally raised pork (both uncertified and certified) with more information except for industry certified traditionally raised pork.

Gender is negative and significant at the 5% significance level when interacted with uncertified traditionally raised while it is positive and significant at the 1% significance level when interacted with industry certified traditionally raised pork with the Canadian pork label and the CQA® label and when interacted with a lower marbling level. The probability of a man choosing traditionally raised pork is approximately 0.02 lower than the probability of a woman choosing this type of pork while the probability of a man choosing industry certified traditionally raised pork with both the Canadian pork and CQA® labels is approximately 0.06 higher than the probability of a woman choosing this type of pork. Men in this group were also more likely to choose pork with lower marbling.

Age is significantly negative when interacted with industry certified traditionally raised with the CQA® label and with government certified traditionally raised at the 10 and 1% significance levels, respectively, while it is significantly positive at the 10% significance level when interacted with industry certified traditionally raised with both the Canadian pork and CQA® labels. One year of additional age decreases the probability of choosing industry certified traditionally raised pork with the CQA® label and government certified traditionally raised pork by 0.002 while it increases the probability of choosing industry certified traditionally raised pork with both the Canadian pork and CQA® labels by 0.002, this suggests that more information on traditionally raised pork will increase the probability of older consumers in Canada, who do not think that traditionally raised pork is safer to eat than conventional pork, choosing the products.

The variable of pork eating frequency is positive and significant at the 1% significance level when interacted with conventional pork with the Canadian pork label or the CQA® label, uncertified traditionally raised, industry certified traditionally raised, and government certified traditionally raised pork. This suggests that people who eat pork more often are more likely to choose conventional pork with the Canadian pork label or the CQA® label, uncertified, industry certified and government certified traditionally raised pork.

The results of interactions with food preference variables show that as compared to respondents who are vegetarians, respondents who stated that they eat meat and fish were shown to be more likely to choose conventional pork with the Canadian pork label, industry certified and government certified traditionally raised pork; respondents who eat meat but not eat fish were more likely to choose industry certified traditionally raised pork as well.

TRUSCTR and TRUSGTR are positive and significant at the 5% significance level, their marginal effects indicate that the probabilities of people who thought people can be trusted choosing industry certified and government certified traditionally raised pork are 0.03 and 0.04, respectively, higher than the probability of people who did not think people can be trusted choosing these two types of pork, this suggests that consumers in Canada who think people can be trusted and do not believe that traditionally raised pork is safer to eat than conventional pork prefer certified traditionally raised pork.

The results of the interaction terms with province variables show that as compared to respondents in Maritimes, respondents in Quebec were more likely to choose conventional pork with the CQA® label and with both the Canadian pork and CQA® labels which suggests that more information on conventional pork will increase the probability of a consumer in Quebec who do not think traditionally raised pork is safer to eat than conventional choosing the products; respondents in Saskatchewan were less likely to choose conventional pork and industry certified traditionally raised pork with both the Canadian pork and CQA® labels and government certified traditionally raised pork without labels while they were more likely to choose government certified traditionally raised pork with the CQA® label; respondents in Alberta were less likely to choose government certified traditionally raised pork without labels while they were more likely to choose government certified traditionally raised pork with the CQA® label as respondents in Saskatchewan; respondents in British Columbia were more likely to choose conventional pork with the CQA® label, uncertified and industry certified traditionally raised pork.

As the results for the sample who believed that traditionally raised pork is healthier to eat than conventional pork, whether living in rural or urban area does no significantly affect the choices made by respondents in this group.

With respect to the physical quality attribute, MARB1 is positive and significant at the 5% significance level which indicates that respondents who did not agree that traditionally raised pork is safer to eat than conventional pork were more likely to choose lower marbled pork. MANMARB1, SASKMARB1, ALBMARB1 are negative and significant at the 5 and 1% significance levels, indicating that as compared to respondents in Maritimes, respondents in Manitoba, Saskatchewan and Alberta were less likely to choose lower marbled pork. These results are similar to the results for the group of respondents who did not think that traditionally raised pork is healthier to eat than conventional pork.

Willingness to Pay

For pork with no Canadian pork label or CQA® label, government certified traditionally raised pork was preferred by most of the respondents in this group with the highest WTP ($11.22/kg) received from the respondents of type six who are pork eaters. The type of respondents in this group preferred traditionally raised pork with no labels to conventional pork and they were the only respondents who were willing to pay more for uncertified and industry certified traditionally raised pork as compared to the conventional pork ($3.53/kg and $9.28/kg, respectively).

For pork with the Canadian pork label, uncertified and government certified traditionally raised pork received positive WTP from all types of respondents. The WTP for uncertified traditionally raised pork was $3.66 for most of the respondents with a lower value of $3.43/kg by the respondents of type four who did not have a child in their household. The highest WTP ($5.37/kg) for government certified traditionally raised pork was from the respondents of type sixe who are pork eaters while the lowest one ($2.49/kg) was from the respondents of type three who lived in urban areas. Industry certified traditionally raised pork only received price premiums ($5.66/kg and $5.89/kg) from respondents of type seven and type eight who eat meat in general. The Canadian pork label increased the value of conventional pork by $6.09/kg in the eyes of respondents of type six who are pork eaters while it lowered the value of conventional pork by $4.51/kg in the eyes of respondents of type seven who eat meat but do not eat fish.

For pork with the CQA® label, industry certified traditionally raised pork would be the most profitable type of pork which received price premiums ($5.33/kg) from all types of respondents who did not think traditionally raised pork is safer to eat than conventional pork while uncertified traditionally raised pork only received WTP ($2.58/kg) from respondents of type eight who eat meat and fish in this group, conventional pork only received WTP of $3.03/kg from the respondents of type six who are pork eaters and government certified traditionally raised pork did not generate any WTP from this group of respondents.

For pork with both the Canadian pork and the CQA® labels, as compared to conventional pork with no label, respondents in this group were willing to pay $3.50 and $3.37 more for government certified traditionally raised pork while they were not willing to pay more for uncertified traditionally raised pork or industry certified traditionally raised pork. Both of the labels increased the value of conventional pork by $5.72/kg and $5.90/kg in most respondents' eyes in this group except for the respondents of type six who are pork eaters. The results suggest that conventional pork with both labels have a higher value in the eyes of consumers who do not think that traditionally raised pork is safer to eat than conventional pork.

The results of WTP for the physical quality attribute, marbling, show that the respondents of type two preferred higher marbled pork while the respondents of type six preferred lower marbled pork.

Table 5.22 WTP ($/kg.) for Pork Chops by Attributes as Compared to Conventional Pork from Respondents Who did not Agree that Traditionally Raised Pork is Safer than Conventional Pork – Canada

		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
No labels	Uncertified traditionally raised	-5.55	-4.41	-5.55	-5.55	-5.55	3.53	-5.55	-5.55
	Industry certified traditionally raised						9.28	-3.02	
	Government certified traditionally raised	3.66	3.66	3.66	3.66		11.22		
With Canadian pork label	Conventional						6.09	-4.51	
	Uncertified traditionally raised	3.66	3.66	3.66	3.43	3.66	3.66	3.66	3.66
	Industry certified traditionally raised							5.66	5.89
	Government certified traditionally raised	3.39	3.39	2.49	3.02	3.85	5.37	3.39	3.39
With CQA® label	Conventional						3.03		
	Uncertified traditionally raised								2.58
	Industry certified traditionally raised	5.33	5.33	5.33	5.33	5.55	5.33	5.33	5.33
	Government certified traditionally raised								
With Canadian pork and CQA® labels	Conventional	5.90	5.72	5.90	5.90	5.90		5.90	5.90
	Uncertified traditionally raised								
	Industry certified traditionally raised		-3.83						
	Government certified traditionally raised	3.50	3.50	3.50	3.50	3.37	3.50	3.50	3.50
	Marbling		-1.15				1.96		

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

5.6.4 COMPARISON OF WTP BETWEEN RESPONDENT GROUPS

For pork with no labels (Table 5.23), respondents in all groups preferred certified traditionally raised pork to uncertified traditionally raised pork but higher profits could be generated from respondents who agreed with the statements that traditionally raised pork is healthier or safer to eat than conventional pork than from respondents who did not agree with the statements. The respondents of type six who stated that they are pork eaters in all of the groups viewed traditionally raised pork as higher value than conventional pork but those in the groups that agreed with the statements that traditionally raised pork is healthier/ safer to eat than conventional pork were willing to pay higher price premiums than those in the groups that did not agree with the statements.

For pork with the Canadian pork label (Table 5.24), the additional label decreased the value of conventional pork to respondents who agreed that traditionally raised pork is healthier than conventional pork while it increased the value of conventional pork to the respondents of type six who are pork eaters in the group that did not agree with the statement. Industry certified traditionally raised pork received more and higher price premiums from the group that agreed with the statement while government certified traditionally raised pork only received WTP from the group that did not agree with the statement. With regard to the differences between the two groups of respondents who agreed and did not agree with the statement that traditionally raised pork is safer to eat than conventional pork, conventional pork with the Canadian pork label only received WTP from the respondents of type six who are pork eaters in the group that did not agree with the statement. Similar to the differences between the two groups regarding the statement on health, government certified traditionally raised pork also only received WTP from respondents who did not agree with the statement that traditionally raised pork is safer to eat than conventional pork.

Table 5.23 Differences of WTP ($/kg.) for Different Types of Pork Chops with No Labels as Compared to Conventional Pork between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Canada

		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
Healthier	Uncertified traditionally raised	-3.53		-3.53	-3.53	-3.53	3.26	-3.53	-3.53
	Industry certified traditionally raised			7.02	7.10	8.56	11.02		
	Government certified traditionally raised	8.07	8.07	8.07	8.07	5.06	13.81		
Not healthier	Uncertified traditionally raised	-5.80	-4.63	-5.80	-5.80	-5.80	3.76	-5.80	-5.80
	Industry certified traditionally raised	5.39	5.39				12.18	-3.12	
	Government certified traditionally raised	5.59	5.59	5.59	5.59		13.75		3.02
Safer	Uncertified traditionally raised	-3.33		-3.33	-3.33	-3.33	3.99	-3.33	-3.33
	Industry certified traditionally raised	11.18	11.18	13.18	12.98	14.56	15.04		
	Government certified traditionally raised	13.79	13.79	13.79	13.79	10.24	20.18	6.16	6.35
Not safer	Uncertified traditionally raised	-5.55	-4.41	-5.55	-5.55	-5.55	3.53	-5.55	-5.55
	Industry certified traditionally raised						9.28	-3.02	
	Government certified traditionally raised	3.66	3.66	3.66	3.66		11.22		

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

Table 5.24 Differences of WTP ($/kg) for Different Types of Pork Chops with the Canadian Pork Label as Compared to Conventional Pork between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Canada

		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
Healthier	Conventional	-4.90	-4.90	-4.90		-4.90		-5.09	-4.90
	Uncertified traditionally raised	4.22	4.22	4.22	6.31	4.22	4.22	4.22	4.22
	Industry certified traditionally raised	8.78	8.78	8.78	8.78	8.78	8.78	2.67	4.75
	Government certified traditionally raised								
Not healthier	Conventional						6.79	-4.90	
	Uncertified traditionally raised	4.06	4.06	4.06	3.66	4.06	4.06	4.06	4.06
	Industry certified traditionally raised							5.84	6.16
	Government certified traditionally raised	4.96	4.96	3.39	3.94	5.02	6.30	4.96	4.96
Safer	Conventional							-5.61	
	Uncertified traditionally raised	5.00	5.00	5.00	7.14	5.00	5.00	5.00	5.00
	Industry certified traditionally raised								5.11
	Government certified traditionally raised								
Not safer	Conventional						6.09	-4.51	
	Uncertified traditionally raised	3.66	3.66	3.66	3.43	3.66	3.66	3.66	3.66
	Industry certified traditionally raised							5.66	5.89
	Government certified traditionally raised	3.39	3.39	2.49	3.02	3.85	5.37	3.39	3.39

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

Table 5.25 Differences of WTP ($/kg.) for Different Types of Pork Chops with the CQA® Label as Compared to Conventional Pork between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Canada

		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
Healthier	Conventional						6.78		
	Uncertified traditionally raised	6.42	6.42	6.42	6.42	6.42	6.42	6.42	4.83
	Industry certified traditionally raised	5.17	5.17	5.17	5.17	2.74	5.17	5.17	5.17
	Government certified traditionally raised					3.92			
Not healthier	Conventional						4.06		
	Uncertified traditionally raised								3.12
	Industry certified traditionally raised	5.50	5.50	5.50	5.50	5.76	5.50	5.50	5.50
	Government certified traditionally raised			-3.23					
Safer	Conventional						9.12		
	Uncertified traditionally raised	8.35	8.35	8.35	8.35	8.35	8.35	8.35	6.14
	Industry certified traditionally raised	5.52	5.52	5.52	5.52	2.74	5.52	5.52	5.52
	Government certified traditionally raised								
Not safer	Conventional						3.03		
	Uncertified traditionally raised								2.58
	Industry certified traditionally raised	5.33	5.33	5.33	5.33	5.55	5.33	5.33	5.33
	Government certified traditionally raised								

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

For pork with the CQA® label (Table 5.25), conventional pork and uncertified traditionally raised pork generated higher price premiums from the groups of respondents that agreed with the statements that traditionally raised pork is healthier or safer to eat than conventional pork than from the groups of respondents that did not agree with the statements. Government certified traditionally raised pork with the CQA® label had a value of $3.03/kg higher than conventional pork with no label in the eyes of respondent of type five who did not think people can be trusted in the group that agreed with the statement while it had a lower value than conventional pork with no label in the eyes of respondents of type three who lived in urban areas in the group that did not agree with the statement that traditionally raised pork is healthier to eat than conventional pork.

For pork with both of the Canadian pork and CQA® labels (Table 5.26), the two labels increased the value of conventional pork in the eyes of respondents in the groups that did not agree with the statements that traditionally raised pork is healthier or safer to eat than conventional pork while they decreased the value of conventional pork in the eyes of respondents of type sixe who are pork eaters in the groups that agreed that traditionally raised pork is healthier or safer to eat than conventional pork. Government certified traditionally raised pork generated higher price premiums from the groups that agreed with the statements than from the groups that did not agree with the statements.

Marbling which was the only physical quality indicator in the national experiment had no effect on the value of pork chops in the eyes of respondents who agreed with the statements that traditionally raised pork is healthier or safer to eat than conventional pork while respondents of type six who are pork eaters in the other two groups with different beliefs about traditionally raised pork preferred lower marbled pork to higher marbled pork. Research results observed by Ngapo et al. (2007a) showed that Canadian respondents had varying preferences for marbling of pork with 63% of them having inconsistent choices, but 22% of them preferring no marbling which was 6% more than those preferring marbled pork. This implies that marbling can be preferred to be more marbling for some Canadian pork consumers which is consistent with our results.

Table 5.26 Differences of WTP ($/kg.) for Different Types of Pork Chops with the Canadian pork and the CQA® Labels as Compared to Conventional Pork between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Canada

		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
Healthier	Conventional						-4.61		
	Uncertified traditionally raised								
	Industry certified traditionally raised	-0.21	-2.64	-0.21	-0.21				
	Government certified traditionally raised	5.68	5.68	5.68	5.68		5.68	5.68	5.68
Not healthier	Conventional	6.84	6.86	6.84	6.84	6.84		6.84	6.84
	Uncertified traditionally raised								
	Industry certified traditionally raised		-3.82						
	Government certified traditionally raised	4.06	4.06	4.06	4.06	3.47	4.06	4.06	4.06
Safer	Conventional						-6.20		
	Uncertified traditionally raised								
	Industry certified traditionally raised								
	Government certified traditionally raised	7.27	7.27	7.27	7.27		7.27	7.27	7.27
Not safer	Conventional	5.90	5.72	5.90	5.90	5.90		5.90	5.90
	Uncertified traditionally raised								
	Industry certified traditionally raised		-3.83						
	Government certified traditionally raised	3.50	3.50	3.50	3.50	3.37	3.50	3.50	3.50

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

Table 5.27 Differences of WTP ($/kg.) for Marbling of Pork Chops between Respondent Groups with Different Beliefs about Traditionally Raised Pork, Canada

	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
Healthier								
Not healthier						1.92		
Safer								
Not safer		-1.15				1.96		

Type 1: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 2: Ontario =1, gender =0, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 3: Ontario =1, gender =1, rural =0, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 4: Ontario =1, gender =1, rural =1, child =0, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 5: Ontario =1, gender =1, rural =1, child =1, trust =0, not eat pork =1, eat meat and fish =1, eat meat but not fish =1;
Type 6: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =0, eat meat and fish =1, eat meat but not fish =1;
Type 7: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =0, eat meat but not fish =1;
Type 8: Ontario =1, gender =1, rural =1, child =1, trust =1, not eat pork =1, eat meat and fish =1, eat meat but not fish =0.

5.7 SUMMARY

Consumer choices and WTP for pork chops with different quality/ labelling attributes were estimated for respondent groups from Edmonton and Canada using multinomial logit models. Respondent groups were clustered based on their beliefs about traditionally raised pork – believing traditionally raised pork is safer or healthier to eat than conventional pork. Results showed that consumers' prior beliefs did affect consumers' choices and WTP for pork chops with different quality attributes. The comparison of WTP between different groups in the two samples show that people who believe that traditionally raised pork is healthier or safer to eat than conventional pork place higher value on different types of traditionally raised pork than conventional pork while conventional pork with additional information has higher value than traditionally raised pork in the eyes of people who do not think that traditionally raised pork is healthier or safer to eat than conventional pork. This is similar to previous findings (Yen, 2009; Verhoef, 2005; Baker and Burnham, 2001) and meets our assumption that people who think the attributes of traditionally raised pork are better than conventional pork are more likely to choose traditionally raised pork and willing to pay more for it as compared to conventional pork. Demographic characteristics are also observed to play an important role in determining consumer choices and WTP for different types of pork chops but there were more demographics found to significantly affect choices and therefore WTP in the national sample than in the Edmonton sample. This implies a broader potential market national-wide for pork with different combinations of quality attributes.

Certification for traditionally raised pork, the Canadian pork label and the CQA® label can generate price premiums from consumers but preferences vary depending on consumers' beliefs about traditionally raised pork and the combination of the information. A product with more information was expected to be preferred to one with less information, however, the results show that that is not necessary or in some cases extra information decreases the probability of choice or the value of the pork chops. Eden et al. (2008) suggested that "consumer behaviour was not as simple as research and policy imagine, expecting consumers to give positive responses immediately to the provision of more or better information might be unrealistic; information provision could be problematic but not necessarily a 'knowledge-fix' for consumer distrust" (p.625), providing more information might increase the degree of consumer scepticism about food information and assurance claims. Therefore, further understanding of consumer perceptions about the quantity and quality of food information is necessary.

Hog grade and meat quality indicators (colour L*, colour a* and shear force) investigated in the Edmonton study and marbling in the national study were found to help predict consumer preferences. The results of the national sample suggest that people who don't believe that traditionally raised pork is healthier or safer to eat than conventional pork pay more attention to marbling while differences regarding physical quality indicators between groups in the Edmonton sample are very small. Although estimated values for those physical quality indicators were shown to be relatively small as compared to values for credence attributes, consumer preferred physical attributes still add value to the pork; only the pork with the best combination of attributes that yields the highest consumer utility can maximize returns.

CHAPTER 6 CONCLUSION AND IMPLICATIONS

6.1 SUMMARY

In 2008 and 2009, the Canadian pork industry suffered serious economic downturn through a combination of negative factors (e.g. a strong Canadian dollar, a worldwide economic recession, the implementation of Country-of-Origin Labelling program in the United States, the outbreak of swine flu virus, low market prices and high feed prices etc.,). In order to maintain and improve profitability and competitiveness, the pork industry needs to develop and implement effective production and marketing strategies. The decreasing proportion of domestic consumption of Canadian pork due to increasing pork imports and changes in consumer dietary patterns makes promoting domestic demand and increasing the value of domestic pork in the eyes of Canadian consumers indispensable to future success.

Quality becomes an important element in food markets because of increasing consumer interest. However, quality is a concept that has different meanings for different people. Quality as defined by consumers is the key to success in quality improvement/differentiation strategies conducted by the pork industry. Increasing consumer interest in credence attributes in terms of production practices, quality assurance and country of origin have motivated some producers to introduce traditionally raised pork as an alternative production system to conventional system, the industry to develop the Canadian Quality Assurance (CQA®) program and to highlight Canada as the country of origin in attempts to add value to their products. These credence attributes can be verified by consumers only when they are presented in the form of labels and/or certification and consumers have been found to have different preferences for certifying agent and value attributes certified by different agents differently (Romanowska, 2009).

In addition to credence attributes, other quality attributes such as appearance quality indicators (Brewer et al., 2001; Chen et al., 2010; Fortomaris et al., 2006; Ngapo et al., 2004, 2010, 2007a, 2007b; Verbeke et al., 2005) and sensory quality of cooked pork (Brewer et al., 2001; Bryhni, 2002) have been found to affect consumers' purchase decisions and hog grade has been used as a method for linking hog carcass value between producers and processors to provide pork that meet consumers' demands (Marcoux et al., 2003; Pomar et al., 2009). Those quality parameters could be affected by the production practice on the basis of previous studies (Enfält et al., 1997; Gentry et al., 2002; Nilzén et al., 2001; Olsson et al., 2003; Pugliese et al., 2005; van der Wal et al., 1993). Therefore, hog grades, meat quality and consumer sensory assessments of pork from two different production systems (traditionally raised vs. conventional) were investigated with 200 hogs slaughtered from each production system in order to identify whether knowing grade, meat and sensory quality was a good predictor of the pork chops consumers buy in the grocery stores.

To assess the consumer actual purchase decision 197 participants were brought into the Alberta Agriculture Product Testing Centre and subsequent to completing pork sensory analysis each made stated preference choices between pairs of pork chops (each participant did 8 pairs) or neither and completed a survey. Thus the consumer choice experiments were conducted to assess consumers' willingness to pay for packaged pork chops labelled as traditionally raised, certified by the Canadian pork industry or by government or uncertified, without a production practice label (conventional pork), and as Canadian pork (or not) or as CQA® (or not) in Edmonton and Canada. Consumer purchase decisions and preferences are likely affected not only by credence attributes, but also by meat quality attributes and sensory quality attributes (which could play an important role in consumer repeat purchase in long-term). Real packaged pork chops were provided to respondents in the choice experiments in Edmonton in order to identify the optimal combinations of quality attributes valued by consumers. Hog carcass quality, meat quality and consumer acceptability of the sensory quality of the pork chops used in the experiments were also investigated in order to compare the quality between the two production systems (conventional vs. traditionally raised), identify the linkages between different quality traits and link consumer value of individual pork chops to those important quality traits. Results and findings corresponding to the research objectives stated in the first chapter are discussed in the following sections.

Research objective 1: To evaluate pork quality across the supply chain for traditionally raised and conventional pork.

Hog carcass (hog grade, settlement weight and predicted lean yield), meat (pH, colour L*, colour a*, colour b*, drip loss percentage, cooking loss percentage and shear force) and sensory (appearance of outside grilled surface, appearance of inside meat surface, tenderness, juiciness, flavour and overall acceptability) quality traits were evaluated through descriptive statistics including the minimum, maximum and mean values, standard deviations and coefficients of variation by slaughter day for the two production systems. For all the quality parameters, the largest degree of variability was observed in the average drip loss percentage while the smallest degree of variability was observed in the average pH within each production system and across the overall sample. Significant differences were found between the two production systems such that, as compared to conventional hogs, traditionally raised hogs had lower predicted lean yield percentage and hog grade, had meat with lower pH and higher measurements for colour L* (lighter), colour a* (redder), colour b* (more yellow), cooking loss percentage and shear force. Consumer acceptability of sensory quality in terms of appearance, tenderness, juiciness, flavour and overall acceptability was not practically different between the two production systems because the absolute differences observed were very small. Quality traits across the five slaughter days were significantly different within each production system but more significant differences were observed in the traditionally raised sample.

With respect to the differences between production systems, some results in this study have found to be similar to previous studies, for example, higher lean meat percentage was found in conventionally or regularly raised hogs as compared to organically or free range hogs (Olsson et al., 2003; van der Wal et al., 1993), outdoor raised meat had higher value of colour a* (redder) than indoor raised meat (Pugliese et al., 2005), free range or outdoor raised pork had higher shear force than regularly or indoor raised pork (van der Wal et al. 1993; Enfält et al. 1997; Pugliese et al. 2005) and there was no difference in drip loss between free range and regularly raised pork (van der Wal et al., 1993). On the other hand, our results are also found to differ from the previous findings, such as no differences were found between conventional/ regular/ indoor and organic/free range/outdoor production systems regarding pH, measurements of colour and cooking loss (Enfält et al., 1997; Gentry et al., 2002; Olsson et al., 2003; Pugliese et al., 2005; van der Wal et al., 1993) and opposite results are found in terms of colour L* between outdoor and indoor reared pork by Pugliese et al. (2005) and cooking loss percentage between organically and conventional raised pork by Olsson et al. (2003). Drip loss was found to be not different between traditionally raised and conventional pork in this study while Enfält et al. (1997), Nilzén et al. (2001) and Gentry et al. (2002) found it higher in outdoor/free range pork than in indoor-reared pork. Regarding consumer acceptability for sensory quality attributes, some of the attributes such as tenderness, juiciness and overall acceptability were observed to have lower scores in outdoor reared pork in some previous studies such as Enfält et al. (1997) and Jonsäll et al. (2001) which are different from the results in this study. The differences found across slaughter days generally agree with Casteels et al. (1995) and van der Wal et al. (1997) that the day of slaughter affects some of the product-oriented quality parameters. The differences in findings between this study and the previous studies are expectable because the investigated production systems are not exactly the same and there are also differences in the research designs.

Research objective 2: To establish consistency of value as measured across hog grading, meat quality, consumer sensory evaluation, and consumer purchase decisions.

The relationships between hog grade, meat quality and sensory quality attributes were identified by using the Pearson correlation coefficients (calculated to identify correlations between two quality traits) and the multivariate regressions. The multivariate regressions were applied to estimate the determinants for hog grade, meat quality indicators and consumer evaluation on sensory quality attributes and to examine if hog grade is a predictor or a good predictor of meat and sensory quality traits and if meat quality traits are good predictors of consumer assessments on sensory quality attributes. The results show that hog grade has no significant effect on predicting meat or sensory quality traits while pH and cooking loss were found to play an important role in predicting consumer evaluation on sensory quality attributes.

The stated preference data completed by each respondent was examined using multinomial logit regressions explaining the probability that the consumers would choose a package of pork chops with particular attributes. Hog grade, meat quality attributes and the overall consumer acceptability of sensory quality were tested to see if they help predict consumer preferences (improve the fit of the regressions), by using likelihood ratio tests in the multinomial logit regressions. Results showed that hog grade, colour L*, colour a* and shear force significantly improved the explanatory power of the multinomial logit regressions explaining the probability that a consumer would choose a particular pork chop. Consumer willingness to pay for individual pork chops with different quality attributes showed that consumers in Edmonton preferred pork chops with lower hog grades, lower colour L* (lighter) and shear force values and higher colour a* (redder). Although the other meat quality indicators did not show direct significant effects on consumer preferences, significant correlation coefficients suggested that a pork chop with higher colour L* and/or shear force is associated with lower pH and lower water-holding capacity in meat (higher drip loss percentage and cooking loss percentage). Lower consumer acceptability of the sensory quality traits for cooked pork is also correlated with the lower pH and with higher drip loss in raw meat. These results indicate that pH, drip loss and cooking loss could indirectly affect consumer preferences and choices of fresh pork chops and the acceptability of cooked pork. The results from the multivariate regression analysis showed that production system and slaughter days are very important contributors to explaining the variations in hog grade, meat quality traits and consumer acceptability of sensory quality traits. The traditionally raised hogs, in this experiment and in this set of data collected produced pork with higher colour L*, cooking loss percentage and shear force than conventional hogs indicating that the higher colour L* and shear force values could be contributing to the difference in the eyes of final consumers. A lower value is placed on a pork chop from a hog with higher grade on the basis of the results of WTP is in contradiction with our expectation. When going back to the results of consumer choice models, the coefficients for hog grade in the four models are actually positive but insignificant; in the models for the sample who believed that traditionally raised pork is healthier and for the sample who did not believe that traditionally raised pork is safer to eat than conventional pork, the coefficient for the interaction term between hog grade and the level of general trust is negative and in the models for the other two samples, the coefficient for the interaction term between hog grade and pork eating frequency in negative. All these results of hog grade in the consumer choice models show that hog grade actually has no significant effect on consumer choices for an overall sample; the preferences for pork from hogs with lower hog grades are mainly contributed by those consumers with higher pork eating frequency and who think that people can be trusted.

Research objective 3: To estimate the impact of consumer demographic characteristics and attitudes on pork purchase decisions for pork chops produced and labelled with different production practices, certification, CQA® and Canadian pork labels (for Edmonton and national population samples).

Given that the Edmonton sample were selected to be pork 'likers' for the sensory analysis it is possible that their attitudes and stated preference behaviours are different than the general population where there will be a wider range of pork consumption practices and some will be very infrequent pork consumers. Thus examining the preferences of a broader representative sample of Canadians was important to contextualize the results obtained in the Edmonton experiments.

Consumers in both the Edmonton and national samples were studied as groups based on their beliefs about traditionally raised pork regarding health and safety as compared to conventional pork, in order to identify whether consumer priors' beliefs or perceptions affect purchase decisions. For the Edmonton sample, gender, age, years of education, if there is a child or children younger than 18 years old in the household and general trust affected the probability that consumers would choose pork chops with different quality attributes. For the national sample, in addition to those demographics, province of residence, whether respondent is living in a rural or urban area, whether the respondent is a meat eater or not also affected the choice probabilities. From the regression results, the calculation of WTP for pork chops with different quality attributes from the two samples was shown to differ between groups with different beliefs about traditionally raised pork. One obvious difference is that for the packaged pork with no labels, different types of traditionally raised pork received higher prices from respondents who believed that traditionally raised pork is healthier or safer to eat than conventional pork while for the packaged pork with label or labels, respondents who did not believe that traditionally raised pork is healthier or safer to eat than conventional pork are more likely to be willing to pay a higher price premium for conventional pork than traditionally raised pork. These results suggest that consumer priors' beliefs and consumer demographics contribute to consumer purchase decisions for pork chops with different quality attributes.

Regarding consumer preferences for certification, Romanowska (2009) found that certified products were preferred over uncertified products and government was preferred to industry as a certifier for egg production practices in her study. The fact that consumers have more trust and confidence in government is a consistent finding in previous studies (Romanowska, 2009; Hobbs, 2003; Miller and Unnevehr, 2001). In this study, consumer preferences for certification for traditionally raised pork is shown to depend on consumer beliefs about traditionally raised pork and whether the pork is labeled as Canadian pork or CQA® or both or with no label. For pork with no label, respondents in Edmonton and across Canada preferred certified traditionally raised pork to uncertified traditionally raised pork and government certified traditionally raised pork had higher values than industry certified traditionally raised pork for respondents who did not agree that traditionally raised pork is healthier or safer to eat than conventional pork. For pork labeled as Canadian pork, the results from the Edmonton sample show that uncertified and government certified traditionally raised pork were preferred to industry certified traditionally raised (preferences were only observed in respondents who believed that traditionally raised pork is healthier or safer to eat than conventional pork, traditionally raised pork with the Canadian pork label had no significant WTP as compared to conventional pork for respondents who did not believe that traditionally raised pork is safer or healthier to eat than conventional pork); the results from the national sample show that respondents who believed that traditionally raised pork is healthier or safer to eat than conventional pork preferred uncertified and industry certified traditionally raised pork over government certified traditionally raised pork. For pork with the CQA® label, the results from the Edmonton sample indicate that respondents who believed that traditionally raised pork is healthier or safer to eat than conventional pork preferred uncertified traditionally raised pork while the others preferred industry certified traditionally raised pork; the results from the national sample suggest that Canadian consumers preferred uncertified and industry certified traditionally raised pork to government certified traditionally raised pork. For pork with both the Canadian pork and CQA® labels, uncertified traditionally raised pork was shown to have lower value than the conventional pork without a label for respondents in Edmonton who agreed that traditionally raised pork is safer or healthier to eat than conventional pork; government certified is the preferred certifier for traditionally raised pork across Canada.

Regarding the two labels examined in this study, the Canadian pork label, in Edmonton, significantly increases the value of conventional pork. For consumers who believe traditionally raised pork is healthier or safer to eat than conventional pork, both uncertified and government certified traditionally raised pork can generate relatively higher price premiums than conventional pork without a label. In Canada, this label is more effective on uncertified traditionally raised pork. For the CQA® label, for the consumers in Edmonton, conventional pork with this label has a higher value as compared to traditionally raised pork while this label becomes more effective on traditionally raised pork especially on industry certified traditionally raised pork in the national market. When applying the Canadian pork and CQA® labels, in Edmonton, the value of conventional pork increases by $15.17/kg for the consumers who believe that traditionally raised pork is healthier to eat than conventional pork; in Canada, it is only effective on government certified traditionally raised pork for consumers who have a positive belief about traditionally raised pork in terms of health and safety as compared to conventional pork. It is more effective on conventional pork than on government certified traditionally raised pork for consumers who do not believe that traditionally raised pork is healthier or safer to eat than conventional pork because they are willing to pay higher premiums for conventional pork with both of the labels than government certified traditionally raised pork with these labels.

6.2 IMPLICATIONS

This research can help the Canadian pork industry develop strategies and make decisions regarding optimal combinations of fresh pork quality attributes to maximize returns from pork sales. By identifying the value of individual pork chops with different quality attributes in the eyes of final consumers in the market place and linking hog grade, meat quality, consumer sensory quality and consumer purchase probability together the value of production decision is illustrated (Figure 6.1). The results of consumer choices and WTP show that either in Edmonton or across Canada, different types of traditionally raised pork, the Canadian pork label and CQA® label can generate price premiums from consumers. Although labelling has been taken as an efficient mechanism and widely used in order to fix the problems of information asymmetry in marketing, more labels does not necessarily mean higher value will be placed on the products by consumers, for example, in Edmonton, the WTP for different types of pork (conventional, uncertified, industry certified and government certified traditionally raised) with both the Canadian pork and CQA® labels were either negative or not statistically significant except for conventional pork to consumers who believe traditionally raised pork is healthier to eat and government certified traditionally raised pork to male consumers who believe that traditionally raised pork is safer to eat than conventional pork. This suggests that the quantity of information on product labels has to be decided carefully.

In many cases the value of the production attribute (traditionally raised) was associated with certification by an industry or government body. Currently the CFIA regulates the use of terms in labels but may not check on term usage in the marketplace. With the abundance of product claims faced by the public it is clear that there continues to be an oversight role for third party or government regulators in verifying credence production attributes. People either in Edmonton or across Canada seemed to find verification important, especially the people who believe that traditionally raised pork is better than conventional pork.

Physical quality indicators were also found to affect consumer choices, generally speaking, consumers in Edmonton prefer darker (lower colour L*), redder (higher colour a*) and tender (lower shear force) pork chops from hogs with lower hog grade and consumers across Canada who eat pork prefer less marbling in their pork. The values of the WTP for those physical quality attributes are relatively small as compared to the values for the studied credence attributes (informed through labels) suggesting that credence attributes are more significant in affecting consumer purchase decisions. It is possible that the physical quality and sensory characteristics have a bigger influence on repeat purchases which was not examined in this study. However, even those small effects and values can make the profits different. Only the pork with the best combination of quality attributes maximizing consumer satisfaction can maximize industry returns. These physical quality indicators are found to be influenced by factors directly or indirectly in the supply chain including production system, slaughter day, pH, drip loss and cooking loss. The traditionally raised production system is found to produce products with attributes that in general are not consistent with consumer preferences, such as higher colour L* and shear force. Although the sample of people participating in the Edmonton analysis were all pork consumers (conventional) with much higher than average levels of pork consumption, their somewhat lower interest in traditionally raised pork (which may have influenced the role of physical indicators as well) might stem from the fact that they currently eat a lot of pork, they enjoy it and they aren't particularly concerned about the need for different production systems. At the national level the value associated with non-traditional production system was higher. The identified linkages between technical indicators and other quality attributes and the identified determinants of them in this study could help hog producers increase returns. For example, maximizing the value of producing traditionally raised hogs might be achieved through labelling, certifying and ensuring the product has lower colour L* colour and shear force. Understanding the linkages between different hog and meat quality indicators, particularly correlations among them, can also help processors and producers develop more efficient contracts, clearly enhancing product quality throughout the supply chain.

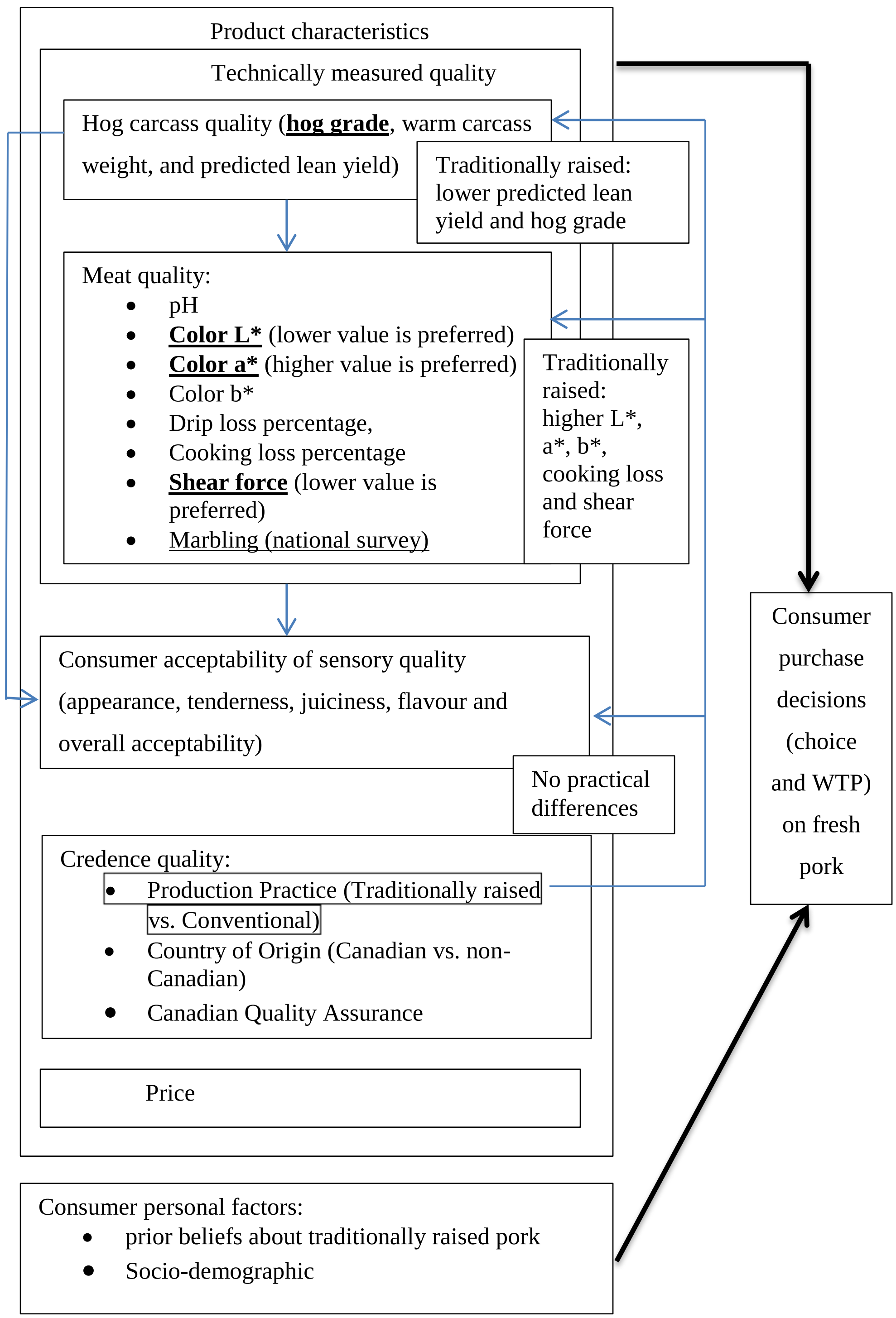
In addition to attributes of the products, consumer demographics and beliefs are also found to play a very important role in consumer preferences and decision making. Profit maximization cannot be made with only one unique optimal combination. It should be specific to different consumer groups so that the highest price premiums can be captured, making consumer segmentation necessary. There were more demographic factors found to affect consumers' choices across Canada than in Edmonton, an implication of that for this study was higher values associated with the labelling of credence attributes around production system in the national sample, in certain demographic segments.

6.3 LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Limitations exist in this study. There are many factors relating to animal and handling pre-slaughter and post-mortem which have been identified to contribute to explaining the variability in product-oriented quality (Casteels et al., 1995; Channon et al., 2004; D'Souza and Mullan, 2002; Fjelkner-Modig and Persson, 1986; Jonsäll et al., 2001; Olsson et al., 2003; Purslow et al., 2008), the limited number of variables measured in this study is a possible reason for the lower goodness of fit for the regressions of the studied quality indicators (hog grade, meat and sensory quality). However since the focus in this research was not on explaining these indicators thoroughly but linking them along the marketing chain, the variables we found to be of interest were the ones included. Future research should also include the variables like breed, genotype, sex, feed, age and slaughter handling such as stunning, etc. in the analysis. The effects of consumer characteristics on consumer acceptability for sensory quality attributes should also have been estimated in addition to production system, slaughter day, hog grade and meat quality indicators because demographics have been found to influence consumer acceptability of sensory quality attributes (Aaslyng et al., 2007).

The explanatory variables including demographic variables and physical quality indicator variables were different in the models for the Edmonton sample and the national sample making the WTP estimates not directly comparable. The results of the Edmonton sample show that higher hog grade, colour L* and shear force lower the value of the fresh pork chops, thresholds for these indicators should be estimated in the further research providing more precise standards. In addition, hog grade is an indicator used to evaluate the quality of hog carcass and as a bridge of communication between producers and processors; it is perhaps the most important signal to producers about which type of pork to produce. In current hog market in Canada, hog carcass grading specification for an individual slaughter plant/facility is an important component of the contracts with or without a price guarantee between hog producers and buyers (Government of Alberta, 2011). The final prices for dressed hogs are made based on the grading specifications (grading grid) defining the bonuses and discounts relative to the cash hog price at the time of sale (supply contracts without a price guarantee) or the base hog price which guaranteed in the forwarding pricing contracts (Government of Alberta, 2011). Financial messages is sent to hog producers by grading grids within contracts about what hog characteristics that processing plants prefer and result in premium prices received by hog producers (Government of Alberta, 2011). Findings in this study suggest that there may be an inconsistency between the grading grids and the physical attributes of pork chops which consumers like in the marketplace. The efficient design of contracts between processors and producers should be able to send clear signals to hog producers that reflect consistent preferences between processors and consumers. Therefore, future study on how to incorporate the consumer preferences into the grading grid could help producers to get a better understanding about the value of their hogs. The other problem is that not every processor uses the same grading grids so grades may have somewhat different weights associated with different characteristics and these may all be inconsistent with the physical attributes desired by consumers. Only hog grades from one processor were used in this study, using the hogs and grades from other processors could provide information on how well the hogs in this study in the eyes of consumers as compared to hogs from other slaughter facilities. In the future study, the comparison of the hogs from specialised marketing systems to conventional hogs from a range of hog operations is necessary to see if the results in this study are robust. In this study only one conventional hog operation and one traditionally raised operation were identified, whether either of these are representative of the rest of the farmers in either system is unknown at this point.

Figure 6.1 Summary of Findings



REFERENCES

Aaslyng, M. D., C. Bejerholm, P. Ertbjerg, H. C. Bertram, and H. J. Andersen. 2003. "Cooking loss and juiciness of pork in relation to raw meat quality and cooking procedure." *Food Quality and Preference*, *14*(4): 277–288.

Aaslyng, M.D., M. Oksama, E.V. Olsen, C. Bejerholm, M. Baltzer, G. Andersen, W. Bredie, D. Byrne, and G. Gabrielsen. 2007. "The impact of sensory quality of pork on consumer preference." *Meat Science*, *76*(1): 61–73.

Abrams, K. M., C. A. Meyers, and T. A. Irani. 2009. "Naturally confused: consumers' perceptions of all-natural and organic pork products." *Agriculture and Human Values*, *27*(3): 365–374.

Adamowicz, W., J. Louviere, and J. Swait. 1998. "Introduction to attribute-based stated choice methods." Final Report to Resource Valuation Branch, Damage Assessment Center, NOAA, US.

Adamowicz, W., P. Boxall, M. Williams, and J. Louviere. 1998. "Stated preference approaches for measuring passive use values: choice experiments and contingent valuation." *American Journal of Agricultural Economics*, *80*(1): 64–75.

Anderson, S., A. de Palma and J. Thisse. 1992. "Discrete choice theory of product differentiation". Cambridge: MIT Press.

Iacobucci, V., D. Surprenant, and R. Gaumond. 2012. "Profile of the Canadian Chicken Industry 2006." *Agriculture and Agri-Food Canada*. Accessed April 23, 2012, from http://www.agr.gc.ca/poultry-volaille/prindc6_eng.htm#sec611-Domestic%20Chicken%20Consumption%20in%20Canada

Agriculture and Agri-Food Canada. 2010. “The Canadian consumer - behaviour, attitudes and perceptions toward food products.” Accessed March 10, 2012, from http://www.ats-sea.agr.gc.ca/info/5505-eng.pdf

Agricultural Marketing Service, Department of Agriculture. 2009. “United States standards for livestock and meat marketing claims, naturally raised claim for livestock and the meat and meat products derived from such livestock.” *Federal Register,* 74(12): 3541–3545. Accessed March 10, 2012, from http://www.gpo.gov/fdsys/granule/FR-2009-01-21/E9-1007/content-detail.html

Alfnes, F. and G. Steine. 2005. “None-of-These Bias in Stated Choice Experiments”. 2005 International Congress, August 23-27, 2005, Copenhagen, Denmark. Accessed June 10, 2011, from http://ideas.repec.org/p/ags/eaae05/24761.html

Apple, J. K., L. K. Rakes, and H. B. Watson. 1999. “Cooking and shearing methodology effects on Warner‐Bratzler shear force values of pork.” *Journal of Muscle Foods, 10*(3): 269–277.

Aubeeluck, A. D. 2010. “A comparative analysis of consumer attitudes towards food safety, animal testing and traceability in the meat industry: japan and Canada.” Unpublished MSc. thesis, Department of Rural Economy, University of Alberta. Accessed April 5, 2010, from https://era.library.ualberta.ca/public/view/item/uuid:a4dac3e1-8354-4a8a-bbcf-25ec103deb5b

Baker, G. A., and T. A. Burnham. 2001. “Consumer response to genetically modified foods: market segment analysis and implications for producers and policy makers." *Journal of Agricultural and Resource Economics*, *26*(02): 387-403.

Beattie, V. E., R. N. Weatherup, B. W. Moss, and N. Walker. 1999. "The effect of increasing carcass weight of finishing boars and gilts on joint composition and meat quality." *Meat Science*, *52*(2): 205–211.

Beaulieu, A. D., J. L. Aalhus, N. H.Williams, and J. F. Patience. 2010. "Impact of piglet birth weight, birth order, and litter size on subsequent growth performance, carcass quality, muscle composition, and eating quality of pork." *Journal of Animal Science*, *88*(8), 2767–2778.

Becker, T.. 2002. Defining Meat Quality. In J. Kerry, J. Kerry, and D. Ledward (Eds.), *Meat processing: improving quality* (pp. 3–24). Woodhead Publishing.

Becker, T.. 2000. "Consumer perception of fresh meat quality: a framework for analysis." *British Food Journal*, *102*(3): 158–176.

Bee, G., G. Guex, and W. Herzog. 2004. "Free-range rearing of pigs during the winter: Adaptations in muscle fiber characteristics and effects on adipose tissue composition and meat quality traits." *Journal of Animal Science*, *82*(4): 1206 –1218.

BEEF CONNECTIONS. 2012. Accessed March 10, 2012, from http://www.beefconnections.ca/

Bejerholm, C., and M. D. Aaslyng. 2004. "The influence of cooking technique and core temperature on results of a sensory analysis of pork—depending on the raw meat quality." *Food Quality and Preference*, *15*(1): 19–30.

Berg, L. 2004. "Trust in food in the age of mad cow disease: a comparative study of consumers' evaluation of food safety in Belgium, Britain and Norway." *Appetite*, *42*(1): 21–32.

Bernues A., A. Olaizola, and K.Corcoran. 2003. "Extrinsic attributes of red meat as indicators of quality in Europe: an application for market segmentation." *Food Quality and Preference*, *14*(4): 265–276.

Bertram, H. C., H. J. Andersen, A. H. Karlsson, P. Horn, J. Hedegaard, L. Nørgaard, and S. B. Engelsen. 2003. "Prediction of technological quality (cooking loss and napole yield) of pork based on fresh meat characteristics." *Meat Science*, *65*(2): 707–712.

Blanchard, P. J., M. B.Willis, C. C. Warkup, and Ellis, M. 2000. "The influence of carcass backfat and intramuscular fat level on pork eating quality." *Journal of the Science of Food and Agriculture*, *80*(1): 145–151.

Botonaki, A., K. Polymeros, E. Tsakiridou, and K. Mattas. 2006. "The role of food quality certification on consumers' food choices." *British Food Journal*, *108*(2): 77–90.

Brewer, M.S., L. G. Zhu, and F. K. McKeith. 2001. "Marbling effects on quality characteristics of pork loin chops: consumer purchase intent, visual and sensory characteristics." *Meat Science*, *59*(2): 153–163.

Brewer, M. S., and F. K. McKeith. 1999. "Consumer-rated quality characteristics as related to purchase intent of fresh pork." *Journal of Food Science*, *64*(1):171–174.

Brunsø, K., L. Bredahl, K. G. Grunert, and J. Scholderer. 2005. "Consumer perception of the quality of beef resulting from various fatteneding regimes." *Livestock Production Science*, *94*(1–2): 83–93.

Bryhni, E. A. 2002. "Consumer perceptions of pork in Denmark, Norway and Sweden." *Food Quality and Preference*, *13*(5): 257–266.

Bryhni, E. A., D. V. Byrne, M. Rødbotten, S. Møller, C. Claudi-Magnussen, A. Karlsson, H. Agerhem, M. Johansson, and M. Martens. 2003. "Consumer and sensory investigations in relation to physical/chemical aspects of cooked pork in Scandinavia." *Meat Science*, *65*(2): 737–748.

Bukenya, J. O., and N. R. Wright. 2007. "Determinants of consumer attitudes and purchase intentions with regard to genetically modified tomatoes." *Agribusiness*, *23*(1): 117–130.

Canadian Pork Council. 2009. "The Canadian Hog Industry's Plan for Success." Accessed March 09, 2012, from http://www.cpc-ccp.com/documents/featured/CHI_TransitionPlan_Eng_4.pdf

Canadian Pork Council. 2012. Accessed March 06, 2012, from http://www.the cqa-aqc.ca/about-e.php

Canada Pork International. 2012. "The Canadian pork exports." Accessed April 23, 2012, from http://www.canadapork.com/en/industry-information/canadian-pork-exports

Canadian Food Inspection Agency. 2011. "Guidelines on Natural, Naturally Raised, Feed, Antibiotic and Hormone Claims." Accessed March 09, 2012, from http://www.inspection.gc.ca/english/fssa/labeti/natall/instmpanie.shtml

Casteels, M., M. J. Van Oeckel , L. Boschaerts, G. Spincemaille, and C. V. Boucqué. 1995. “The relationship between carcass, meat and eating quality of three pig genotypes.” *Meat Science*, *40*(2): 253–269.

Channon, H. A., M. G. Kerr, and P. J. Walker. 2004. “Effect of Duroc content, sex and ageing period on meat and eating quality attributes of pork loin.” *Meat Science*, *66*(4): 881–888.

Chen, M. T., H. L. Guo, T. F. Tseng, S. W. Roan, and T. M. Ngapo. 2010. “Consumer choice of pork chops in Taiwan.” *Meat Science*, *85*(3): 555–559.

D’Souza, D. N., and B. P. Mullan. 2002. “The effect of genotype, sex and management strategy on the eating quality of pork.” *Meat Science*, *60*(1): 95–101.

Darby, M. R., and E. Karni. 1973. “Free competition and the optimal amount of fraud.” *Journal of Law and Economics*, *16*(1): 67–88.

O’Diam, D. M. 2009. “Comparison of Slice Shear Force with Warner Bratzler Shear Force as Predictors of Consumer Panel Palatability Measures in Non-Enhanced and Enhanced Pork Loin Chops.” Ohio State University. Accessed May 20, 2011, from http://etd.ohiolink.edu/send-pdf.cgi/Odiam%20David%20Michael.pdf?osu1236602515

Davies, A., A. J. Titterington, and C. Cochrane. 1995. “Who buys organic food?: A profile of the purchasers of organic food in Northern Ireland.” *British Food Journal*, *97*(10): 17–23.

Davis, G. W., G. C. Smith, Z. L. Carpenter, and H. R. Cross. 1975. "Relationships of quality indicators to palatability attributes of pork loins." *Journal of Animal Science*, *41*(5): 1305–1313.

de Jonge, J. 2008. "A monitor for consumer confidence in the safety of food." Wageningen University, Netherlands. Accessed May 15, 2010, from edepot.wur.nl/122060

de Jonge, J., L. Frewer, H. Van Trijp, R. J. Renes, W. De Wit, , and J. Timmers. 2004. "Monitoring consumer confidence in food safety: An exploratory study." *British Food Journal*, *106*(10/11): 837–849.

de Jonge, J., H. van Trijp, E. Goddard, and L. Frewer. 2008. "Consumer confidence in the safety of food in Canada and the Netherlands: The validation of a generic framework." *Food Quality and Preference*, *19*(5): 439–451.

de Vries, A. G., P. G. van der Wal, T. Long, G. Eikelenboom, and J. W. M. Merks. 1994. "Genetic parameters of pork quality and production traits in Yorkshire populations." *Livestock Production Science*, *40*(3): 277–289.

DeVol, D. L., F. K. McKeith, P. J. Bechtel, J. Novakofski, R. D. Shanks, and T. R. Carr. 1988. "Variation in composition and palatability traits and relationships between muscle characteristics and palatability in a random sample of pork carcasses." *Journal of Animal Science*, *66*(2): 385 –395.

Dransfield, E., T. M. Ngapo, N. A. Nielsen, L. Bredahl, P. O. Sjödén, M. Magnusson, M. M. Campo, and G. R. Nute. 2005. "Consumer choice and suggested price for pork as influenced by its appearance, taste and information concerning country of origin and organic pig production." *Meat Science*, *69*(1): 61–70.

Eden, S., C. Bear, and G. Walker. 2008. "The sceptical consumer? Exploring views about food assurance." *Food Policy*, *33*(6): 624–630.

Ehmke, M. D.. 2006. "International differences in consumer preferences for food Country-of-Origin: A meta-analysis." Selected paper at the Annual Meeting of the American Agricultural Economics Association, Long Beach, California, July 23-26, 2006. Accessed May 10, 2010, from http://ideas.repec.org/p/ags/aaea06/21193.html

Enfält, A. C., K. Lundström, I.Hansson, N. Lundeheim, and P. E. Nyström. 1997. "Effects of outdoor rearing and sire breed (Duroc or Yorkshire) on carcass composition and sensory and technological meat quality." *Meat Science*, *45*(1): 1–15.

Fairbairn, J., and L. J. Gustafson. 2004. "Value-added Agriculture in Canada." Report of the Standing Senate Committee on Agriculture and Forestry, Ottawa: Senate.

Fernandez, X., G. Monin, A. Talmant, J. Mourot, and B. Lebret. 1999a. "Influence of intramuscular fat content on the quality of pig meat - 1. Composition of the lipid fraction and sensory characteristics of m. longissimus lumborum." *Meat Science*, *53*(1): 59–65.

Fernandez, X., G. Monin, A. Talmant, J. Mourot, and B. Lebret. 1999b. "Influence of intramuscular fat content on the quality of pig meat — 2. Consumer acceptability of m. longissimus lumborum." *Meat Science*, *53*(1): 67–72.

Fernandez, X., and E. Tornberg. 1992. “Effect du pH ultimate sur la tendreté de la viande de proc.” *Journées Rech Porcine France*, 24: 65–70.

Feuz, D. M., W. J. Umberger, C. R. Calkins, and B. M. Sitz. 2004. “U.S. consumers’ willingness to pay for flavour and tenderness in steaks as determined with an experimental auction.” *Journal of Agricultural and Resource Economics*. *29*(03): 501-516.

Fjelkner-Modig, S., and J. Persson. 1986. “Carcass properties as related to sensory properties of pork.” *Journal of Animal Science*, *63*(1): 102–113.

Fortin, A., S. D. M. Jones, and C. R. Haworth. 1984. “Pork carcass grading: A comparison of the new Zealand Hennessey grading probe and the Danish Fat-O-Meater.” *Meat Science*, *10*(2): 131–144.

Fortin, A., W. M. Robertson, and A. K. W. Tong. 2005. “The eating quality of the Canadian pork and its relationship with intramuscular fat.” *Meat Science*, *69*(2): 297–305.

Fortomaris, P., G. Arsenos, M. Georgiadis, G. Banos, C. Stamataris, and D. Zygoyiannis. 2006. “Effect of meat appearance on consumer preferences for pork chops in Greece and Cyprus.” *Meat Science*, *72*(4): 688–696.

Fukumoto, K.. 2004. “Taking bounded variables seriously: Extended beta binomial, asymmetric logit, and time series.” Paper prepared for the Research Workshop in Political Economy (Gov. 3007), Harvard University, December 13, 2004.

Gentry, J. G., J. J. McGlone, J. R. Blanton, and M. F. Miller. 2002. “Alternative housing systems for pigs: influences on growth, composition, and pork quality." *Journal of Animal Science*, *80*(7): 1781 –1790.

Gentry, J. G., J. J. McGlone, M. F. Miller, and J. R. Blanton. 2004. "Environmental effects on pig performance, meat quality, and muscle characteristics." *Journal of Animal Science*, *82*(1): 209 –217.

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

Goddard, E. W., B. Shank, C. Panter, T. K. H. Nilsson, and S. B. Cash. 2007. "Canadian chicken industry: consumer preferences, industry structure and producer benefits from investment in research and advertising." Project Report #07-04, University of Alberta, Department of Rural Economy. Accessed February 16, 2010, from http://www.consumerdemand.rees.ualberta.ca/Publications/Network_Working_Papers/PR%2007-04.pdf

Goddard, E., J. Janz, H. Bruce, G. Plastow, S. Moore, L. Ma, V. Muringai, and S. Anders. 2011. "Canadian consumers' willingness to pay for pork with different attributes." In Proceedings 57th International Congress of Meat Science and Technology, 7-12 August 2011, Ghent-Belgium.

Gondret, F., L. Lefaucheur, H. Juin, I. Louveau, and B. Lebret. 2006. "Low birth weight is associated with enlarged muscle fibre area and impaired meat tenderness of the longissimus muscle in pigs." *Journal of Animal Science, 84*(1): 93–103.

Goos, P., B. Vermeulen, and M. Vandebroek. 2010. "D-optimal conjoint choice designs with no-choice options for a nested logit model." *Journal of Statistical Planning and Inference*, *140*(4): 851–861.

Government of Alberta, Alberta Agriculture and Rural Development. 2011. "Hog Market Contracting in Western Canada." Fact sheet. Accessed May 31, 2012, from http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sis10957

Grafton, Q., W. Adamowicz, D. Dupont, H. Nelson, R. J. Hill, and S. Renzetti. 2004. "The Economics of the Environment and Natural Resources" (annotated ed.). Wiley-Blackwell.

Grannis, J., and D. D. Thilmany. 2002. "Marketing natural pork: An empirical analysis of consumers in the mountain region." *Agribusiness, 18*(4): 475–489.

Grebitus, C.. 2008. "Food quality from the consumer's perspective: An empirical analysis of perceived pork quality." Dissertation, Cuvillier Verlag, Goettingen, Germany.

Green, J., A. Draper, and E. Dowler. 2003. "Short cuts to safety: Risk and "rules of thumb" in accounts of food choice." *Health, Risk and Society*, *5*(1): 33–52.

Greene, W. H.. 2007. "Econometric analysis" (6th ed.). Prentice Hall.

Grunert, K. G.. 1995. "Food quality: A Means-End Perspective." *Food Quality and Preference*, *6*(3): 171–176.

Grunert, K. G.. 2005. "Food quality and safety: Consumer perception and demand. *European Review of Agricultural Economics*, *32*(3): 369–391.

Gunenc, A.. 2007. “Evaluation of pork meat quality by using water holding capacity and vis-spectroscopy.” Thesis, McGill University, Montreal, Canada. Accessed February 10, 2010, from http://digitool.Library.McGill.CA:8881/R/?func=dbin-jump-fullandobject_id=18708

Hall, B. H., and C. Cummins. 2009. “TSP 5.1 Reference Manual.” TSP international, Palo Alto, CA. Available at www.tspintl.com/products/TSP51RM.pdf

Hansen, L. L., C. Claudi-Magnussen, , S. K. Jensen, and H. J. Andersen. 2006. “Effect of organic pig production systems on performance and meat quality.” *Meat Science*, (74): 605–615.

Harper, G. C., and A. Makatouni. 2002. “Consumer perception of organic food production and farm animal welfare.” *British Food Journal*, *104*(3/4/5): 287–299.

Hensher, D. A., J. M. Rose, and W. H. Greene. 2005. “Applied choice analysis: A primer.” Cambridge University Press.

Hobbs, J. E.. 2003. “Consumer demand for traceability”. Working Paper No. 14614. International Agricultural Trade Research Consortium. Accessed February 12, 2010, from http://ideas.repec.org/p/ags/iatrwp/14614.html

Hobbs, J. E., D. Bailey, D. L. Dickinson, and M. Haghiri. 2005. “Traceability in the Canadian red meat sector: Do consumers care?” *Canadian Journal of Agricultural Economics*, *53*(1): 47–65.

Hodgson, R. R., G. W. Davis, G. C. Smith, J. W. Savell, and H. R. Cross. 1991.

"Relationships between pork loin palatability traits and physical characteristics of cooked chops." *Journal of Animal Science*, *69*(12): 4858–4865.

Hoffmann, R.. 2000. "Country of origin – A consumer perception perspective of fresh meat." *British Food Journal*, *102*(3): 211–229.

Honikel, K.O.. 1993. Quality of fresh pork-review. In E. Puolanne, D. I. Demeyer, M. Ruusunen, and S. Ellis (Eds.), *Pork Quality: Genetic and Metabolic Factors* (pp. 203–216). CABI Publishing.

Hu, W., T.A. Woods, and S. Bastin, 2009. "Consumer acceptance and willingness to pay for blueberry products with Nonconventional attributes." *Journal of Agricultural and Applied Economics*, *41*(1): 47-60.

Huapaya, G. M.. 1997. "Relationship between swine production traits measured in live animals at probing age and their carcass quality." MSc thesis, University of Guelph, Ontario, Canada. Accessed March 3, 2010, from http://www.collectionscanada.gc.ca/obj/s4/f2/dsk2/ftp03/MQ27512.pdf

Huff-Lonergan, E., T. J. Baas, M. Malek, J. C. M. Dekkers, , K. Prusa, and M. F. Rothschild. 2002. "Correlations among selected pork quality traits." *Journal of Animal Science*, *80*(3): 617–627.

Janz, J.. 2010. "Integrating genomics, meat science, consumer science, and economics to add value to Alberta's livestock sector." A project report on the methodology and results of pork processing and consumer product testing by the Food Processing Division, Alberta Agriculture and Rural Development.

Jonsäll, A., L. Johansson, and K. Lundström. 2001. “Sensory quality and cooking loss of ham muscle (M. biceps femoris) from pigs reared indoors and outdoors.” *Meat Science, 57*(3): 245–250.

Joo, S., R. G. Kauffman, B. Kim, and C. Kim. 1995. “The relationship between colour and water-holding capacity in postrigor porcine longissimus muscle.” *Journal of Muscle Foods*, *6*(3): 211–226.

Killinger, K. M., C. R. Calkins, W. J. Umberger, D. M. Feuz, and K. M. Eskridge. 2004. “Consumer sensory acceptance and value for beef steaks of similar tenderness, but differing in marbling level.” *Journal of Animal Science, 82*(11): 3294 –3301.

Kruse, R.. 2008. “New label encourages consumers to choose Canadian pork.” *Put Pork on Your Fork*. Accessed April 23, 2012, from http://putporkonyourfork.com/media/pdf/News/PMC_NewsRelease_ON_FINAL.pdf

Kuperis, P., M. Vincent, J. R. Unterschultz, and M. M. Veeman. 1997. “Niche markets for fresh the Canadian pork in the Pacific Northwest: A case study.” Staff paper 97-03, Department of Rural Economy, University of Alberta, Canada. Accessed February 11, 2010, from http://www.rees.ualberta.ca/en/Research/~/media/rees/Research/Documents/Staff%20Papers/sp-97-03.pdf

Lagerkvist, C. J., F. Carlsson, , and D.Viske. 2006. “Swedish consumer preferences for animal welfare and biotech: A choice experiment.” Accessed March 20, 2012, from http://www.agbioforum.org/v9n1/v9n1a06-lagerkvist.htm

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

Lebret, B., M. C. Meunier-Salaün, A. Foury, P. Mormède, E. Dransfield, and J. Y. Dourmad. 2006. “Influence of rearing conditions on performance, behavioral, and physiological responses of pigs to preslaughter handling, carcass traits, and meat quality.” *Journal of Animal Science*, *84*(9): 2436 – 2447.

Lee, S., J. Norman, S.Gunasekaran, R. L. J. van Laack, B. Kim, and R. Kauffman. 2000. “Use of electrical conductivity to predict water-holding capacity in post-rigor pork.” *Meat Science*, *55*(4): 385–389.

Liljenstolpe, C.. 2005. “Valuing animal welfare with choice experiments: an application to Swedish pig production”. 2005 International Congress, August 23-27, 2005, Copenhagen, Denmark No. 24503. European Association of Agricultural Economists. Accessed February 10, 2010, from http://ideas.repec.org/p/ags/eaae05/24503.html

Louviere, J. J., D. A. Hensher, and J. D. Swait. 2000. “Stated choice methods: Analysis and applications” (1st ed.). Cambridge University Press.

Louviere, J. J., and G. G. Woodworth. 1983. “Design and analysis of simulated consumer choice or allocation experiments: An approach based on aggregate data”. *Journal of Marketing Research*, 20: 350-367.

Lusk, J. L., F. B. Norwood, and J. R. Pruitt. 2006. “Consumer demand for a ban on antibiotic drug use in pork production.” *American Journal of*

Agricultural Economics, *88*(4): 1015–1033.

Kmenta, J., and R. F. Gilbert. 1970. “Estimation of seemingly unrelated regressions with autoregressive disturbances.” *Journal of the American Statistical Association, 65*(329): 186–197.

Manitoba Pork Council. 2012. Accessed March 06, 2012, from http://manitobapork.com/canadian_quality_assurance.aspx

Marcoux, M., J. F. Bernier, and C. Pomar. 2003. “Estimation of Canadian and European lean yields and composition of pig carcasses by dual-energy X-ray absorptiometry.” *Meat Science*, *63*(3): 359–365.

Marcoux, M., C. Pomar, L. Faucitano, and C. Brodeur. 2007. “The relationship between different pork carcass lean yield definitions and the market carcass value.” *Meat Science*, *75*(1): 94–102.

Martin, A. H., A. P. Sather, H. T. Fredeen, and R. W. Jolly. 1980. “Alternative market weights for swine. II. Carcass composition and meat quality.” *Journal of Animal Science*, *50*(4): 699–705.

Martinez, S. W., R. D. Hanagriff, M. H. Lau, and J. M. Harris. 2007. “Factors affecting demand for branded beef.” 2007 Annual Meeting, February 4-7, 2007, Mobile, Alabama No. 34885. Southern Agricultural Economics Association. Accessed June 6, 2010, from http://ideas.repec.org/p/ags/saeasm/34885.html

McEachern, M. G., and M. J. A. Schröder. 2004. “Integrating the voice of the consumer within the value chain: a focus on value-based labelling communications in the fresh-meat sector.” *Journal of Consumer*

Marketing, *21*(7): 497–509.

McFadden, D.. 1974. "Conditional logit analysis of qualitative choice behaviour." *Frontiers in econometrics* (pp. 105–142). Academic Press.

McFadden, D.. 1986. "The choice theory approach to market research." *Marketing Science*, *5*(4): 275–297.

Miller, G. Y., and L. J. Unnevehr. 2001. "Characteristics of consumers demanding and their willingness to pay for certified safer pork." *Journal of Agribusiness*, *19*(2): 101-119.

Miller, R. K.. 2002. Factors Affecting the Quality of Raw Meat. In J. Kerry, J. Kerry, and D. Ledward (Eds.), *Meat processing: improving quality* (pp. 27 – 63). Woodhead Publishing Ltd.

Millet, S., M. Hesta, M. Seynaeve, E. Ongenae, S. De Smet, J. Debraekeleer, and G. P. J. Janssens. 2004. "Performance, meat and carcass traits of fatteneding pigs with organic versus conventional housing and nutrition." *Livestock Production Science*, *87*(2–3): 109–119.

Meuwissen, M. P. M., A. G. J.Velthuis, H. Hogeveen, and R. B. M. Huirne. 2003. "Traceability and certification in meat supply chains." *Journal of Agribusiness*, *21*(2): 167-181.

Moeller, S. J., R. K. Miller, K. K. Edwards, H. N. Zerby, K. E. Logan, T. L. Aldredge, C. A. Stahl, M. Boggess, and J.M. Box-Steffensmeier. 2010. "Consumer perceptions of pork eating quality as affected by pork quality attributes and end-point cooked temperature." *Meat Science*, *84*(1): 14–22.

Mørkbak, M. R., T. Christensen, and D. Gyrd-Hansen. 2010. "Consumer preferences for safety characteristics in pork.” *British Food Journal, 112*(7): 775–791.

Moskowitz, H. R., A. M. Muñoz, and M. C. Gacula. 2004. “Viewpoints and Controversies in Sensory Science and Consumer Product Testing.” John Wiley and Sons.

Napolitano, F., A. Braghieri, E. Piasentier, S. Favotto, S. Naspetti, and R. Zanoli. 2010. “Cheese liking and consumer willingness to pay as affected by information about organic production.” *The Journal of Dairy Research*, *77*(3): 280–286.

Nelson, P.. 1970. “Information and consumer behavior.” *Journal of Political Economy*, *78*(2): 311–329.

Nelson, P.. 1974. “Advertising as information.” *Journal of Political Economy*, *82*(4): 729–754.

Ngapo, T. M., J.-F.Martin, and E. Dransfield, 2004. “Consumer choices of pork chops: results from three panels in France.” *Food Quality and Preference*, *15*(4): 349–359.

Ngapo, T. M., J. Fortin, J. L. Aalhus, and J.-F. Martin. 2010. “Consumer choices of pork chops: results from two Canadian sites.” *Food Research International*, *43*(6): 1559–1565.

Ngapo, T. M., J.-F. Martin, and E. Dransfield. 2007a. “International preferences for pork appearance: I. Consumer choices.” *Food Quality and Preference*, *18*(1): 26–36.

Ngapo, T. M., J.-F. Martin, and E. Dransfield. 2007b. “International preferences for pork appearance: II. Factors influencing consumer choice." *Food Quality and Preference, 18*(1): 139–151.

Nicholyn Farms. 2011. Accessed March 06, 2012, from http://www.nicholyn.com/

Nilsson, T., K. Foster, and J. L. Lusk. 2006. "Marketing opportunities for certified pork chops." *Canadian Journal of Agricultural Economics*, *54*(4): 567–583.

Nilzén V, J. Babol, P.C. Dutta, N. Lundeheim, A.C. Enfält, and K. Lundström. 2001. "Free range rearing of pigs with access to pasture grazing - effect on fatty acid composition and lipid oxidation products." *Meat Science, 58*(3): 267–275.

Norman, J. L., E. P. Berg, H. Heymann, and C. L. Lorenzen. 2003. "Pork loin colour relative to sensory and instrumental tenderness and consumer acceptance." *Meat Science*, *65*(2): 927–933.

NPPC Pork Quality Solutions Team. 1998. "Pork quality targets." *National Pork Board*. Accessed April 4, 2012, from http://www.pork.org/filelibrary/Factsheets/PIGFactsheets/NEWfactSheets/12-04-02g.pdf

Nute, M. G.. 2002. Sensory analysis of meat. In J. Kerry, D. Ledward, and J. Kerry (Eds.), *Meat processing: improving quality* (pp. 175–190). Woodhead Publishing Ltd.

O'Mahony, R., C. Cowan, and M. Keane. 1991. "Consumer preferences for pork chops with different levels of intramuscular fat." *Food Quality and*

Preference, *3*(4): 229–234.

Ontario Pork Producers Marketing Board. 2009. Ontario Pork Producer Monthly Newsletter. Accessed November 3, 2011, from http://www.thepigsite.com/downloads/download/190/

O'Sullivan, M. G., and J. P. Kerry. 2009. Sensory evaluation of fresh meat. In J. P. Kerry and D. Ledward (Eds.), *Improving the Sensory and Nutritional Quality of Fresh Meat* (pp. 178–196). Woodhead Publishing.

Olesen, I., F. Alfnes, M. B. Røra, and K. Kolstad. 2010. "Eliciting consumers' willingness to pay for organic and welfare-labelled salmon in a non-hypothetical choice experiment." *Livestock Science*, *127*(2–3): 218–226.

Olsson, V., K. Andersson, I. Hansson, and K. Lundström. 2003. "Differences in meat quality between organically and conventionally produced pigs." *Meat Science*, *64*(3): 287–297.

Olynk, N. J., G. T. Tonsor, and C. A. Wolf. 2010. "Consumer willingness to pay for livestock credence attributes claim verification." *Journal of Agricultural and Resource Economics*, *35*(2): 261-280.

Otto, G., R. Roehe, H. Looft, L. Thoelking, and E. Kalm. 2004. "Comparison of different methods for determination of drip loss and their relationships to meat quality and carcass characteristics in pigs." *Meat science*, *68*(3): 401–409.

Palka, K., and H. Daun. 1999. "Changes in texture, cooking losses, and myofibrillar structure of bovine m. semitendinosus during heating." *Meat Science*, *51*(3): 237–243.

PIC. 2003. “Understanding Industry Measurements and Guidelines.” Accessed January 11, 2012, from http://www.kaslobay.ca/downloads/techupdate/meatquality.pdf

Pomar, C., M. Marcoux, M. Gispert, and M. Font i Furnols. 2009. Determining the Lean Content of Pork Carcasses. In Joseph P. Kerry and D. Ledward (Eds.), *Improving the Sensory and Nutritional Quality of Fresh Meat* (pp. 493 – 518). Woodhead Publishing.

Popper, R., W. Rosenstock, M. Schraidt, and B. J. Kroll. 2004. “The effect of attribute questions on overall liking ratings.” *Food Quality and Preference*, *15*(7–8): 853–858.

Pouta, E., J. Heikkilä, S. Forsman-Hugg, M. Isoniemi, and J. Mäkelä. 2010. “Consumer choice of broiler meat: The effects of country of origin and production methods.” *Food Quality and Preference*, *21*(5): 539–546.

Pugliese, C, G. Calagna, V. Chiofalo, V. Moretti, S. Margiotta, O. Franci, and G. Gandini. 2004. “Comparison of the performances of Nero Siciliano pigs reared indoors and outdoors: 2. Joints composition, meat and fat traits.” *Meat Science*, *68*(4): 523–528.

Pugliese, C., R. Bozzi, G. Campodoni, A. Acciaioli, O. Franci, and G. Gandini. 2005. “Performance of Cinta Senese pigs reared outdoors and indoors. 1. Meat and subcutaneous fat characteristics.” *Meat Science, 69*(3): 459–464.

Purslow, P. P., I. B. Mandell, T. M. Widowski, J. Brown, C. F. M. Delange, J. A. B. Robinson, E. J. Squires, M.C. Cha, and G. VanderVoort. 2008. “Modelling quality variations in commercial Ontario pork production.”

Meat Science, *80*(1): 123–131.

Romanowska, P. E.. 2009. “Consumer preferences and willingness to pay for certification of eggs with credence attributes.” Unpublished MSc thesis, Department of Rural Economy, University of Alberta, Canada. Accessed January 14, 2010, from http://login.ezproxy.library.ualberta.ca/login?url=http://proquest.umi.com.login.ezproxy.library.ualberta.ca/pqdweb?did=1921533621andFmt=7andclientId=12301andRQT=309andVName=PQD

Rude, J., J. P. Gervais, and M. -H. Felt. 2010. “Detecting COOL impacts on US-Canada Bilateral Hog and Pork Trade Flows.” Canadian Agricultural Trade Policy Research Network. Accessed September 20, 2011, from http://www.uoguelph.ca/catprn/PDF-TPB/TPB-10-01-Rude-Gervais.pdf

Sanders, D. R., W. Moon, and T. H. Kuethe. 2007. “Consumer willingness-to-pay for fresh pork attributes.” *Journal of Agribusiness*, *25*(2): 163-179.

Sather, A. P., W. M. Robertson, S. D. M. Jones, and S. M. Zawadski. 1998. “An evaluation of a terminal sire line for feedlot performance, carcass composition, and meat quality.” *Canadian journal of animal science*, *78*(4): 561–574.

Siegrist, M. and G. Cvetkovich. 2000. “Perception of hazards: the role of social trust and knowledge.” *Risk Analysis: An Official Publication of the Society for Risk Analysis*, *20*(5): 713–719.

Sitz, B. M., C. R. Calkins, D. M. Feuz, W. J. Umberger, and K. M. Eskridge. 2005. “Consumer sensory acceptance and value of domestic, Canadian, and Australian grass-fed beef steaks." *Journal of Animal Science*, *83*(12): 2863 –2868.

Skelley, G. C., D. L. Handlin, and T. E. Bonnette. 1973. "Pork acceptability and its relationship to carcass quality." *Journal of Animal Science, 36*(3): 488–492.

Statistics Canada. 2011. CANSIM table 002-0001 and Catalogue no. 21-011-X. Accessed December 29, 2011, from http://www40.statcan.gc.ca/l01/cst01/agri03a-eng.htm

Statistics Canada. 2011. CANSIM table 002-0010 - Supply and Disposition of Food in Canada, Annual. Accessed March 09, 2012, from http://www5.statcan.gc.ca/cansim/a26?lang=engandretrLang=engandid=0020010andpaSer=andpattern=andstByVal=2andp1=-1andp2=38andtabMode=dataTableandcsid=

Statistics Canada. 2011. CANSIM table 003-0088 - Hogs Statistics, Supply and Disposition of Hogs, Quarterly. Accessed March 09, 2012 from http://www5.statcan.gc.ca/cansim/a26?lang=engandretrLang=engandid=0030088andpaSer=andpattern=andstByVal=2andp1=-1andp2=38andtabMode=dataTableandcsid=

Statistics Canada. 2011. CANSIM, table 002-0011 - Food Available in Canada, Annual. Accessed March 09, 2012 from http://www5.statcan.gc.ca/cansim/a26?lang=engandretrLang=engandid=0020011andpaSer=andpattern=andstByVal=2andp1=-1andp2=38andtabMode=dataTableandcsid=

Statistics Canada. 2010. Population and dwelling counts, for Canada, provinces and territories, 2006 and 2001 censuses. Accessed March 09, 2012 from http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/hlt/97-550/Index.cfm?TPL=P1CandPage=RETRandLANG=EngandT=101

Statistics Canada. 2009. 2006 Census of Population. Accessed March 09, 2012, from http://www40.statcan.ca/l01/cst01/famil122f-eng.htm

Statistics Canada. 2007. 2006 Census of Population. Accessed March 09, 2012, from http://www40.statcan.ca/l01/cst01/famil53a-eng.htm

Statistics Canada. 2007. 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Accessed March 09, 2012, from http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E

Statistics Canada. 2007. Families and Households, 2006 Census, Catalogue no. 97-553-XCB2006004. Accessed March 09, 2012, from http://www5.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=97-553-XWE2006009andlang=eng

Sundrum, A.. 2007. Quality in Organic, Low-Input and Conventional Pig Production. *Handbook of Organic Food Safety and Quality* (pp. 144–177). Cambridge: Woodhead Publishing Ltd.

Sutton, D. S., M. Ellis, Y. Lan, F. K. McKeith, and E. R. Wilson. 1997. “Influence of slaughter weight and stress gene genotype on the water-holding capacity and protein gel characteristics of three porcine muscles.” *Meat Science*, *46*(2): 173–180.

The Garden Basket. Accessed March 06, 2012, from http://www.thegardenbasket.ca/departments/organic-beef-chicken-markham/

Thurstone, L. L.. 1927. “Psychophysical analysis.” *The American Journal of Psychology*, *38*(3): 368–389.

Tonsor, G. T., N. J. Olynk, and C. A. Wolf. 2009. “Consumer preferences for animal welfare attributes: the case of gestation crates.” *Journal of Agricultural and Applied Economics*, *41*(03): 713-730.

TRADITIONALLY RAISED. Accessed March 06, 2012, from http://www.traditionallyraised.ca/

Trienekens, J. H.. 2010. “Matching diverse (quality of) supply with market differentiation opportunities in the pork chain.” 2010 Internatonal European Forum, February 8-12, 2010, Innsbruck-Igls, Austria No. 100470). International European Forum on Innovation and System Dynamics in Food Networks. Accessed from http://econpapers.repec.org/paper/agsiefi10/100470.htm

Ubilava, D.. 2006. “Consumers’ willingness-to-pay for selected pork attributes in the Republic of Georgia.” Thesis, Purdue University, Indiana.

Ubilava, David, and K. Foster. 2009. “Quality certification vs. product traceability: Consumer preferences for informational attributes of pork in Georgia.” *Food Policy*, *34*(3): 305–310.

Ubilava, David, K. A. Foster, J. L. Lusk, and T. K. Nilsson. 2008. “Differences in U.S. consumer preferences for certified pork chops when facing branded vs. non-branded choices.” 2008 Annual Meeting, July 27-29, 2008, Orlando, Florida No. 6194. American Agricultural Economics Association (New Name 2008: Agricultural and Applied Economics Association).

Unnevehr, L. J., G. Y. Miller, and M. I. Gómez. 1999. “Ensuring food safety and quality in farm-level production: Emerging lessons from the pork industry.” *American Journal of Agricultural Economics*, *81*(5): 1096–1101.

Unterschultz, J. R., K. Quagrainie, and M. M. Veeman. 1996. “Consumer preferences for biopreservatives in beef and pork packaging and testing the importance of product origin.” Project Report # 96-03, Department of Rural Economy, University of Alberta, Canada. Accessed December 5, 2009, from http://www.rees.ualberta.ca/en/Research/~/media/rees/Research/Documents/Project%20Reports/pr-96-03.pdf

Urga, G., and C. Walters. 2003. “Dynamic translog and linear logit models: a factor demand analysis of interfuel substitution in US industrial energy demand.” *Energy Economics*, *25*(1): 1–21.

USDA Rural Development. “Value-added producer grant.” Accessed April 23, 2011, from http://www.rurdev.usda.gov/va/programs/RBS/valueadd.htm

Uzea, A. D.. 2009. “Canadian consumer valuation of farm animal welfare and quality verification: the case of pork.” MSc thesis, Department of Agricultural Economics, University of Saskatchewan, Canada. Accessed February 26, 2012, from http://library.usask.ca/theses/available/etd-06082009-185952/

van der Wal, P. G., B. Engel, and B. Hulsegge. 1997. “Causes for variation in pork quality.” *Meat Science*, *46*(4): 319–327.

van der Wal, P. G., G. Mateman, A. W. de Vries, G. M. A. Vonder, F. J. M. Smulders, G. H. Geesink, and B. Engel. 1993. ““Scharrel” (free range) pigs: Carcass composition, meat quality and taste-panel studies.” *Meat Science*, *34*(1): 27–37.

van Kleef, E., L. J. Frewer, G. M. Chryssochoidis, J. R. Houghton, S. Korzen-Bohr, T. Krystallis, J. Lassen, U. Pfenning, and G. Rowe. 2006. “Perceptions of food risk management among key stakeholders: Results from a cross-European study.” *Appetite*, *47*(1): 46–63.

van Laack, R. L., R. G. Kauffman, W. Sybesma, F. J. Smulders, G. Eikelenboom, and J. C. Pinheiro. 1994. “Is Colour brightness (L-value) a reliable indicator of water-holding capacity in porcine muscle?” *Meat Science*, *38*(2): 193–201.

Van Oeckel, M. ., N. Warnants, and C. Boucqué. 1999. “Pork tenderness estimation by taste panel, Warner–Bratzler shear force and on-line methods.” *Meat Science*, *53*(4): 259–267.

Verbeke, W., S. De Smet, I. Vackier, M. J. Van Oeckel, N. Warnants, and P. Van Kenhove, 2005. “Role of intrinsic search cues in the formation of consumer preferences and choice for pork chops.” *Meat Science*, *69*(2): 343–354.

Verhoef, P. C.. 2005. “Explaining purchases of organic meat by Dutch consumers.” *European Review of Agricultural Economics*, *32*(2): 245 –267.

Vervaet, C. P.. 2004. “The economics of hog carcass grading in Ontario.” Thesis, University of Guelph, Canada.

Vickers, Z. M., C. M. Christensen, S. K. fahrenholtz, and I. M. Gengler. 1993. “Effect of questionnaire design and the number of samples tasted on hedonic ratings1.” *Journal of Sensory Studies*, *8*(3): 189–200.

Walley, K., S. Parsons, and M. Bland. 1999. “Quality assurance and the consumer: A conjoint study.” *British Food Journal*, *101*(2): 148–162.

Western Hog Exchange. Grids and Grading. Accessed March 05, 2011, from https://www.westernhogexchange.com/gradingGrids.aspx?menu=218

Western Hog Exchange. Grids and Grading. Accessed January 10, 2012, from https://www.westernhogexchange.com/gradingGrids.aspx?menu=218

Wood, J. D.. 1990. Consequences for meat quality of reducing carcass fatness. Wood J.D., Fisher A.V. (Eds), *Reducing fat in meat animals* (pp.344-397). Elsevier Applied Science, London (1990).

Wooldridge, J.. 2005. Introductory Econometrics: A Modern Approach. 3rd ed. South-Western College Pub.

Xue, H., D. Mainville, W. You, and Rodolfo M. Nayga, Jr. 2009. “Nutrition knowledge, sensory characteristics and consumers’ willingness to pay for pasture-fed beef.” 2009 Annual Meeting, July 26-28, 2009, Milwaukee, Wisconsin No. 49277. Agricultural and Applied Economics Association. Accessed February 10, 2010, from http://ideas.repec.org/p/ags/aaea09/49277.html

Yen, S. M.. 2009. “Valuing environmental, health and social benefits using choice modeling a comparison of the implicit prices of food attributes for rural and urban consumers." MSc thesis, Department of Agricultural Economics, McGill University, Canada. Accessed February 10, 2010, from http://digitool.Library.McGill.CA:8881/R/?func=dbin-jump-fullandobject_id=32602

Yiridoe, E. K., S. Bonti-Ankomah, and R. C. Martin. 2007. "Comparison of consumer perceptions and preference toward organic versus conventionally produced foods: A review and update of the literature." *Renewable Agriculture and Food Systems*, *20*(04): 193–205.

Zhang, X.. 2010. "Analysis of value added meat product choice behaviour by Canadian households." Unpublished MSc thesis, Department of Rural Economy, University of Alberta, Canada. Accessed April 23, 2010, from https://era.library.ualberta.ca/public/view/item/uuid:953c1dae-0948-4bdf-b737-e31ca67e35d4

Appendix A: Questionnaire for Cooked Product Evaluation

1. <u>Look</u> at this sample and indicate how much you like/dislike the <u>appearance</u> of...

The outside grilled surface

Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
☐	☐	☐	☐	☐	☐	☐	☐	☐

The inside meat surface

Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
☐	☐	☐	☐	☐	☐	☐	☐	☐

2. <u>Eat</u> some of this sample and answer the following questions …

How much do you like/dislike the TENDERNESS of this sample?

Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
☐	☐	☐	☐	☐	☐	☐	☐	☐

How much do you like/dislike the JUICINESS of this sample?

Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
☐	☐	☐	☐	☐	☐	☐	☐	☐

How much do you like/dislike the FLAVOUR of this sample?

Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
☐	☐	☐	☐	☐	☐	☐	☐	☐

3. Considering all its characteristics, how much to you like/dislike this sample?

Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
☐	☐	☐	☐	☐	☐	☐	☐	☐

4. Please record any comments reflecting what you **LIKED** about this sample:

5. Please record any comments reflecting what you **DISLIKED** about this sample:

Now a few questions about you so that we can define our consumer test population…
Please select only one answer for each of the following questions

Are you male or female?
❍ Male
❍ Female

How many children younger than 18 years of age live in your house?
❍ No children living at home
❍ 1
❍ 2
❍ 3 or more

How many people live in your household?
❍ 1
❍ 2
❍ 3 or more

What is your position in the household?
❍ Head of household/main income
❍ Partner of head of household
❍ Other family member

What is your marital status?
❍ Married/living together/common law
❍ Single

What is the highest level of education you have achieved?
❍ Elementary school
❍ Secondary (high) school
❍ Technical/college/university
❍ Graduate studies

Which of the following best describes your employment status?
❍ Employed full-time or self-employed
❍ Employed part-time
❍ Homemaker
❍ Student
❍ Retired
❍ Unemployed
❍ Other

For comparison purposes only, which one of the following best describes your annual <u>household</u> income before taxes?
❍ Under $19,999
❍ $20,000 to $49,999

- ❍ $50,000 to $89,999
- ❍ More than $90,000

When you buy pork, is it usually from… (choose one)

- ❍ a supermarket
- ❍ a butcher’s shop
- ❍ another small shop
- ❍ a farmers’ market
- ❍ another way (e.g. directly from a farm or through acquaintances)

Appendix B: Information Sheet for Survey Participants – Edmonton

TRADITIONALLY RAISED *PRODUIT TRADITIONNELLEMENT*	TRADITIONALLY RAISED - 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 by-products in feed
CERTIFIED TRADITIONALLY RAISED *CERTIFIÉ PRODUIT TRADITIONNELLEMENT*	TRADITIONALLY RAISED - 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 by-products in feed (Certified by the Canadian pork industry)
TRADITIONALLY RAISED *PRODUIT TRADITIONNELLEMENT*	TRADITIONALLY RAISED - 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 by-products in feed (Certified by government)
	CQA® promotes best management practices to reduce or eliminate potential on-farm hazards that could compromise the safety of pork.
	Canadian Pork identifies fresh pork that is produced from hogs raised in Canada

Appendix C: Survey Instrument, Edmonton

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** 1	**disagree** 2	**neither agree, nor disagree** 3	**agree** 4	**strongly agree** 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** **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	❐	❐	❐	❐	❐

9. 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	❐	❐	❐	❐	❐

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**	**Once per month**	**Once per week**	**More than once per week**
	1	**2**	**3**	**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	❐	❐	❐	❐

Appendix D: Descriptive Statistics of Hog Carcass, Meat and Sensory Quality Traits across the Five Slaughter Days for the two Production Systems (Traditionally Raised versus Conventional) – Edmonton

Trait		Slaughter Day	N	Maximum	Minimum	Mean	S.D.	Coefficient Of Variation	Sig. Difference Test Across Slaughter Days (p-value)
Hog Grade Index	Traditional Raised	1	40	116.00	50.00	98.60	15.63	0.16	0.20
		2	40	116.00	50.00	102.18	16.91	0.17	
		3	40	116.00	70.00	103.78	11.73	0.11	
		4	40	116.00	70.00	105.50	10.51	0.10	
		5	40	116.00	50.00	104.05	11.79	0.11	
	Conventional	1	40	116.00	100.00	113.33	4.02	0.04	0.13
		2	40	116.00	100.00	112.68	4.21	0.04	
		3	40	116.00	101.00	113.35	3.56	0.03	
		4	40	116.00	70.00	111.55	7.37	0.07	
		5	40	116.00	80.00	110.38	9.09	0.08	
Settlement Weight	Traditional Raised	1	40	117.00	86.50	98.45	7.33	0.07	< 0.00
		2	40	119.00	84.00	93.96	7.29	0.08	
		3	40	108.00	83.00	94.69	4.61	0.05	
		4	40	105.50	86.00	93.33	4.75	0.05	
		5	40	109.00	83.00	95.38	6.07	0.06	
	Conventional	1	40	114.50	85.50	94.05	5.57	0.06	0.88
		2	40	107.00	85.50	95.01	4.46	0.05	
		3	40	106.50	85.00	94.08	4.43	0.05	

		4	40	107.00	86.50	94.38	4.39	0.05	
		5	40	106.50	81.50	94.74	5.26	0.06	
Probe Yield	Traditional Raised	1	40	61.90	0.00	50.58	19.43	0.38	< 0.00
		2	40	61.40	0.00	51.36	19.72	0.38	
		3	40	63.90	54.60	58.48	1.81	0.03	
		4	40	64.90	55.20	59.14	2.05	0.03	
		5	40	63.10	0.00	57.48	9.47	0.16	
	Conventional	1	40	65.50	0.00	60.21	9.91	0.16	0.53
		2	40	64.80	57.50	60.58	1.38	0.02	
		3	40	65.10	0.00	58.61	13.74	0.23	
		4	40	63.80	0.00	57.63	13.49	0.23	
		5	40	64.90	56.20	60.76	1.91	0.03	
Average pH	Traditional Raised	1	40	5.65	5.22	5.50	0.08	0.02	0.01
		2	40	5.64	5.29	5.47	0.08	0.01	
		3	40	5.72	5.36	5.52	0.08	0.02	
		4	40	5.86	5.35	5.47	0.10	0.02	
		5	40	5.63	5.08	5.46	0.10	0.02	
	Conventional	1	40	6.03	5.40	5.55	0.11	0.02	0.19
		2	40	5.69	5.31	5.52	0.07	0.01	
		3	40	5.63	5.35	5.52	0.07	0.01	
		4	40	5.86	5.27	5.50	0.11	0.02	
		5	40	5.77	5.30	5.50	0.09	0.02	
Average L*	Traditional Raised	1	40	64.24	53.64	57.03	2.38	0.04	< 0.00
		2	40	61.90	50.09	56.03	2.50	0.04	
		3	40	60.29	51.04	55.84	2.36	0.04	

		4	40	61.55	48.15	55.31	2.65	0.05	
		5	40	59.00	50.09	54.23	2.45	0.05	
	Conventional	1	40	62.33	45.40	54.87	3.78	0.07	< 0.00
		2	40	59.12	48.80	54.15	2.36	0.04	
		3	40	57.44	48.59	52.43	2.06	0.04	
		4	40	56.38	47.23	52.06	2.26	0.04	
		5	40	57.73	49.75	53.52	1.97	0.04	
Average a*	Traditional Raised	1	40	9.80	5.33	7.62	1.03	0.13	< 0.00
		2	40	11.88	4.89	6.77	1.36	0.20	
		3	40	9.02	5.17	6.78	1.02	0.15	
		4	40	9.49	4.04	7.03	1.19	0.17	
		5	40	8.83	4.76	6.50	1.16	0.18	
	Conventional	1	40	10.13	5.29	6.94	1.14	0.16	0.17
		2	40	9.40	4.70	6.88	1.29	0.19	
		3	40	9.35	4.89	6.67	1.07	0.16	
		4	40	8.91	3.69	6.34	1.07	0.17	
		5	40	10.03	3.88	6.69	1.29	0.19	
Average b*	Traditional Raised	1	40	9.45	5.42	7.43	0.97	0.13	< 0.00
		2	40	11.78	3.92	7.10	1.40	0.20	
		3	40	9.87	4.69	7.25	1.28	0.18	
		4	40	9.48	2.87	7.15	1.25	0.17	
		5	40	8.34	3.78	6.31	1.04	0.16	
	Conventional	1	40	9.52	4.63	6.40	1.26	0.20	0.10
		2	40	8.21	3.91	6.34	1.15	0.18	
		3	40	8.45	4.13	6.01	0.94	0.16	

		4	40	7.88	3.94	5.80	0.94	0.16	
		5	40	8.26	3.25	5.98	1.35	0.23	
Drip Loss Percentage	Traditional Raised	1	40	6.11	0.49	1.78	1.30	0.73	< 0.00
		2	40	8.55	0.71	3.45	1.85	0.54	
		3	40	12.29	0.89	3.64	2.63	0.72	
		4	40	15.03	0.81	4.15	3.27	0.79	
		5	40	6.87	0.96	2.81	1.34	0.48	
	Conventional	1	40	4.52	0.30	1.58	0.95	0.60	< 0.00
		2	40	6.98	0.97	3.02	1.49	0.50	
		3	40	13.53	0.88	3.19	2.33	0.73	
		4	40	12.13	1.00	4.56	3.05	0.67	
		5	40	7.67	0.70	2.78	1.66	0.60	
Cooking Loss Percentage	Traditional Raised	1	40	30.82	21.83	27.02	1.95	0.07	0.19
		2	40	31.13	23.35	27.95	1.93	0.07	
		3	40	35.63	22.84	28.05	2.48	0.09	
		4	40	31.68	17.90	27.37	2.57	0.09	
		5	40	31.15	23.93	27.38	2.03	0.07	
	Conventional	1	40	30.18	20.04	25.29	2.06	0.08	< 0.00
		2	40	31.09	23.66	27.00	1.66	0.06	
		3	40	29.45	20.34	26.12	1.95	0.07	
		4	40	29.31	19.40	25.96	2.02	0.08	
		5	40	30.48	23.06	27.50	2.09	0.08	
Shear Force	Traditional Raised	1	40	78.25	29.50	49.24	10.39	0.21	< 0.00
		2	40	94.28	40.62	60.83	13.65	0.22	
		3	40	95.97	36.71	59.16	15.11	0.26	

		4	40	86.00	30.77	56.18	10.27	0.18	
		5	40	80.80	32.57	55.56	11.29	0.20	
	Conventional	1	40	73.30	25.16	42.62	11.70	0.27	< 0.00
		2	40	87.33	28.97	54.81	14.48	0.26	
		3	40	83.65	39.55	58.07	9.79	0.17	
		4	40	74.80	28.30	49.90	11.56	0.23	
		5	40	73.20	28.41	50.79	11.60	0.23	
Appearance of Outside Grilled Surface	Traditional Raised	1	24	8.25	5.00	6.86	0.77	0.11	< 0.00
		2	36	8.25	5.00	6.92	0.80	0.12	
		3	40	8.00	3.50	6.26	0.89	0.14	
		4	40	8.25	3.00	6.34	1.06	0.17	
		5	40	7.75	3.50	6.32	0.84	0.13	
	Conventional	1	24	8.00	3.50	6.75	1.05	0.16	0.01
		2	36	8.25	5.50	7.07	0.67	0.10	
		3	40	7.75	4.50	6.58	0.95	0.14	
		4	40	8.50	5.00	6.38	0.74	0.12	
		5	40	8.00	5.00	6.66	0.74	0.11	
Appearance of Inside Meat Surface	Traditional Raised	1	24	7.75	5.50	6.85	0.69	0.10	< 0.00
		2	36	8.25	5.75	6.98	0.61	0.09	
		3	40	7.75	3.00	6.30	0.97	0.15	
		4	40	7.50	3.75	6.26	0.85	0.14	
		5	40	8.00	4.00	6.13	0.93	0.15	
	Conventional	1	24	8.00	4.75	6.64	0.81	0.12	0.01
		2	36	8.00	5.50	6.94	0.64	0.09	
		3	40	7.75	5.00	6.50	0.69	0.11	

		4	40	7.75	5.50	6.48	0.59	0.09	
		5	40	7.75	4.00	6.31	0.97	0.15	
Tenderness	Traditional Raised	1	24	8.50	5.00	6.58	0.97	0.15	< 0.00
		2	36	7.75	3.25	6.28	1.18	0.19	
		3	40	8.00	2.50	5.79	1.14	0.20	
		4	40	7.25	3.00	5.32	1.05	0.20	
		5	40	7.75	2.75	5.41	1.14	0.21	
	Conventional	1	24	8.75	3.00	6.45	1.25	0.19	< 0.00
		2	36	8.25	5.00	6.89	0.90	0.13	
		3	40	7.75	4.75	6.23	0.76	0.12	
		4	40	8.50	3.25	6.08	1.26	0.21	
		5	40	8.00	2.75	6.04	1.04	0.17	
Juiciness	Traditional Raised	1	24	8.50	3.50	6.60	1.06	0.16	< 0.00
		2	36	8.00	4.00	6.40	1.14	0.18	
		3	40	8.00	3.75	6.01	1.03	0.17	
		4	40	7.50	3.00	5.66	1.07	0.19	
		5	40	7.75	2.50	5.56	1.30	0.23	
	Conventional	1	24	8.25	3.50	6.35	1.19	0.19	0.07
		2	36	8.00	4.00	6.65	0.95	0.14	
		3	40	7.50	4.25	6.23	0.88	0.14	
		4	40	8.00	4.00	6.07	1.06	0.18	
		5	40	8.00	3.25	6.04	1.06	0.17	
Flavour	Traditional Raised	1	24	8.50	4.25	6.45	0.97	0.15	0.03
		2	36	8.25	4.25	6.33	1.08	0.17	
		3	40	7.75	4.50	6.07	0.86	0.14	

		4	40	7.25	4.00	5.95	0.95	0.16	
		5	40	7.50	3.25	5.75	0.99	0.17	
	Conventional	1	24	8.25	4.25	6.04	1.11	0.18	0.08
		2	36	8.00	4.00	6.51	0.90	0.14	
		3	40	7.25	4.25	6.06	0.83	0.14	
		4	40	7.75	4.75	6.11	0.76	0.12	
		5	40	7.50	4.00	6.00	0.77	0.13	
Overall Acceptability	Traditional Raised	1	24	8.50	4.25	6.55	1.03	0.16	< 0.00
		2	36	8.00	4.25	6.25	1.01	0.16	
		3	40	8.00	4.00	5.86	1.00	0.17	
		4	40	7.00	3.50	5.56	0.89	0.16	
		5	40	7.75	2.50	5.49	1.19	0.22	
	Conventional	1	24	8.00	3.50	6.08	1.25	0.21	0.10
		2	36	8.00	4.00	6.55	0.94	0.14	
		3	40	7.25	4.50	6.08	0.77	0.13	
		4	40	8.00	3.50	6.06	0.98	0.16	
		5	40	8.00	3.25	6.00	0.90	0.15	

Appendix E: Descriptive Statistics of Hog Carcass, Meat and Sensory Quality Traits for the Two Production Systems (Traditionally Raised versus Conventional) and for an Overall Sample

	Trait	Treatment	N	Minimum	Maximum	Mean		S.D.	Coefficient of Variation	Mean Difference
						Statistic	S.E.			
Hog	Settlement Weight	Traditionally raised	200	83	119.00	95.16	0.45	6.32	0.07	0.7059
		Conventional	200	81.50	114.50	94.45	0.34	4.81	0.05	
		Overall sample	400	81.50	119.00	94.81	0.28	5.62	0.06	
	Probe Yield	Traditionally raised	200	0.00	64.90	55.41	0.96	13.52	0.24	-4.151***
		Conventional	200	0.00	65.50	59.56	0.69	9.72	0.16	
		Overall sample	400	0.00	65.50	57.48	0.60	11.94	0.21	
	Hog Grade Index	Traditionally raised	200	50.00	116.00	102.82	0.96	13.62	0.13	-9.435***
		Conventional	200	70.00	116.00	112.26	0.43	6.11	0.05	
		Overall sample	400	50.00	116.00	107.54	0.58	11.55	0.11	
Meat	Average pH	Traditionally raised	200	5.10	5.90	5.49	0.01	0.09	0.02	-0.0337***
		Conventional	200	5.27	6.03	5.52	0.01	0.09	0.02	
		Overall sample	400	5.10	6.00	5.50	0.00	0.09	0.02	
	Average L*	Traditionally raised	200	48.15	64.24	55.69	0.18	2.61	0.05	2.2838***

		Conventional	200	45.40	62.33	53.41	0.19	2.75	0.05	
		Overall sample	400	45.40	64.24	54.55	0.15	2.91	0.05	
	Average a*	Traditionally raised	200	4.00	11.90	6.94	0.09	1.21	0.17	0.2339*
		Conventional	200	3.69	10.13	6.70	0.08	1.18	0.18	
		Overall sample	400	3.70	11.90	6.82	0.06	1.20	0.18	
	Average b*	Traditionally raised	200	2.87	11.78	7.05	0.09	1.25	0.18	0.9404***
		Conventional	200	3.25	9.52	6.11	0.08	1.15	0.19	
		Overall sample	400	2.87	11.78	6.58	0.06	1.29	0.20	
	Drip Loss Percentage	Traditionally raised	200	0.49	15.03	3.17	0.17	2.34	0.74	0.1393
		Conventional	200	0.30	13.53	3.03	0.16	2.23	0.74	
		Overall sample	400	0.30	15.03	3.10	0.11	2.28	0.74	
	Cooking Loss Percentage	Traditionally raised	200	17.90	35.63	27.55	0.16	2.22	0.08	1.1781***
		Conventional	200	19.40	31.09	26.37	0.15	2.10	0.08	
		Overall sample	400	17.90	35.63	26.96	0.11	2.24	0.08	
	Shear Force	Traditionally raised	200	29.50	95.97	56.19	0.91	12.81	0.23	4.9570***
		Conventional	200	25.16	87.33	51.24	0.91	12.91	0.25	
		Overall sample	400	25.16	95.97	53.72	0.65	13.08	0.24	
Sensory	Appearance of Outside Grilled Surface	Traditionally raised	180	3.00	8.20	6.50	0.07	0.92	0.14	-0.1681*
		Conventional	180	3.50	8.50	6.67	0.06	0.85	0.13	
		Overall sample	360	3.00	8.50	6.59	0.05	0.89	0.14	

	Appearance of Inside Meat Surface	Traditionally raised	180	3.00	8.20	6.46	0.07	0.89	0.14	-0.0968
		Conventional	180	4.00	8.00	6.56	0.06	0.77	0.12	
		Overall sample	360	3.00	8.20	6.51	0.04	0.83	0.13	
	Tenderness	Traditionally raised	180	2.50	8.50	5.81	0.09	1.19	0.21	-0.5088***
		Conventional	180	2.80	8.80	6.31	0.08	1.08	0.17	
		Overall sample	360	2.50	8.80	6.06	0.06	1.16	0.19	
	Juiciness	Traditionally raised	180	2.50	8.50	5.99	0.09	1.18	0.20	-0.2625**
		Conventional	180	3.20	8.20	6.25	0.08	1.03	0.17	
		Overall sample	360	2.50	8.50	6.12	0.06	1.12	0.18	
	Flavour	Traditionally raised	180	3.20	8.50	6.07	0.07	0.99	0.16	-0.0694
		Conventional	180	4.00	8.20	6.14	0.06	0.87	0.14	
		Overall sample	360	3.20	8.50	6.11	0.05	0.93	0.15	
	Overall acceptability	Traditionally raised	180	2.50	8.50	5.88	0.08	1.09	0.18	-0.2694**
		Conventional	180	3.20	8.00	6.15	0.07	0.97	0.16	
		Overall sample	360	2.50	8.50	6.02	0.05	1.04	0.17	

*** 1% significance level; ** 5% significance level; * 10% significance level.

Appendix F: Correlation Coefficients by Slaughter Day: Hog, Meat and Sensory Quality Indicators for Traditionally Raised Sample

		Weight	Yield	Grade	pH	L*	a*	b*	Drip loss	Cook loss	Shear force	Outside	Inside	Tenderness	Juiciness	Flavour	Overall
N1	Weight	1.00	-0.15	-0.31	0.09	0.20	0.03	0.14	-0.23	0.00	0.02	0.04	0.29	0.18	0.29	0.31	0.35
	Yield	-0.15	1.00	-0.22	-0.07	0.15	0.13	0.21	-0.11	0.07	-0.04	0.31	0.22	-0.09	-0.01	0.15	0.16
	Grade	-0.31	-0.22	1.00	-0.03	-0.20	0.05	0.00	-0.02	-0.11	0.08	0.30	-0.25	-0.23	-0.29	-0.30	-0.32
N2	Weight	1.00	0.25	-.56**	.32*	.32*	0.21	.35*	.41**	-.55 **	-.36 *	.33*	0.16	.36*	.345*	0.22	0.33
	Yield	0.25	1.00	-0.17	0.17	-0.28	0.15	-0.04	0.20	-0.19	0.19	0.01	-0.08	0.23	0.12	0.09	0.13
	Grade	-.56**	-0.17	1.00	-0.22	-0.17	-0.24	-0.29	-.37*	.49**	0.23	-0.23	-.35*	-.33*	-0.27	-.42*	-.33*
N3	Weight	1.00	0.25	.33*	-0.02	.33*	0.15	.33*	0.07	-.34*	-0.28	-0.14	-0.13	-0.20	-0.25	-0.16	-0.20
	Yield	0.25	1.00	.84**	-0.27	0.04	-0.18	-0.03	0.08	0.00	.34*	0.04	-0.21	-0.21	-0.19	-0.26	-.31*
	Grade	.33*	.84**	1.00	-0.24	0.13	-0.16	0.02	0.11	-0.05	0.20	0.03	-0.15	-0.27	-0.23	-0.29	-.35*
N4	Weight	1.00	-.32*	-0.24	-0.10	0.03	.33*	0.25	0.29	0.14	0.11	0.06	0.14	0.18	0.21	.34*	0.24
	Yield	-.32*	1.00	.76**	.32*	-0.26	-0.05	-0.26	0.04	-0.16	-0.09	-0.17	-0.13	-0.06	-0.01	-0.10	-0.17

	Grade	-0.24	.76**	1.00	0.19	-0.24	0.22	-0.13	0.08	-0.31	-0.21	-0.17	-0.18	-0.02	-0.10	-0.12	-0.14
N5	Weight	1.00	-0.08	-0.14	-0.10	0.02	-0.10	-0.05	0.00	-0.14	-0.16	0.04	-0.05	-0.15	-0.12	0.01	-0.12
	Yield	-0.08	1.00	.83**	0.08	-0.04	0.08	-0.13	-0.05	-0.25	-0.20	-0.07	-0.16	-0.02	0.04	-0.21	-0.12
	Grade	-0.14	.83**	1.00	0.26	-0.27	0.18	-0.18	0.16	-0.08	0.00	-0.21	-0.30	-0.19	-0.19	-0.27	-0.27
N1	pH	0.09	-0.07	-0.03	1.00	-0.02	-0.21	-0.27	0.08	-.34*	0.00	0.37	0.16	-0.05	0.00	0.06	0.05
	L*	0.20	0.15	-0.20	-0.02	1.00	-0.27	0.31	-0.23	-0.13	-.34*	0.25	0.06	0.10	0.01	0.19	0.17
	a*	0.03	0.13	0.05	-0.21	-0.27	1.00	.71**	0.12	0.03	-0.16	-0.10	-0.03	0.26	0.33	0.22	0.26
	b*	0.14	0.21	0.00	-0.27	0.31	.71**	1.00	-0.04	0.05	-0.24	0.06	0.04	0.33	0.26	0.29	0.30
	Drip loss	-0.23	-0.11	-0.02	0.08	-0.23	0.12	-0.04	1.00	-0.09	-0.18	0.17	0.21	0.04	0.00	0.09	0.10
	Cook loss	0.00	0.07	-0.11	-.34*	-0.13	0.03	0.05	-0.09	1.00	.41**	0.06	0.16	0.21	0.07	0.13	0.10
	Shear force	0.02	-0.04	0.08	0.00	-.34*	-0.16	-0.24	-0.18	.408**	1.00	-0.07	0.02	0.06	-0.16	-0.14	-0.15
N2	pH	.32*	0.17	-0.22	1.00	0.13	.40*	.39*	0.25	-.45**	-0.24	.55**	.41*	0.27	0.10	0.08	0.28
	L*	.32*	-0.28	-0.17	0.13	1.00	0.06	.54**	-0.01	-0.10	-.57**	.35*	.47**	0.16	0.23	0.17	0.22
	a*	0.21	0.15	-0.24	.40*	0.06	1.00	.77**	0.19	-.40*	-0.08	0.29	0.30	.39*	.41*	0.30	.35*
	b*	.35*	-0.04	-0.29	.39*	.54**	.77**	1.00	0.27	-.51**	-.49**	.42*	.53**	.38*	.50**	.45**	.43**

	Drip loss	.41**	0.20	-.37*	0.25	-0.01	0.19	0.27	1.00	-.48**	-0.03	-0.09	0.02	0.00	0.17	0.25	0.14
	Cook loss	-.55**	-0.19	.49**	-.45**	-0.10	-.40*	-.51**	-.48**	1.00	0.21	-0.15	-0.26	-0.23	-.35*	-.50**	-.37*
	Shear force	-.36*	0.19	0.23	-0.24	-.57**	-0.08	-.49**	-0.03	0.21	1.00	-0.25	-.47**	-0.14	-0.06	-0.18	-0.14
N3	pH	-0.02	-0.27	-0.24	1.00	-0.04	-0.23	-0.30	0.24	-0.24	-0.06	0.13	0.20	.44**	0.31	.32*	.35*
	L*	.33*	0.04	0.13	-0.04	1.00	0.30	.74**	-0.02	-0.17	-.35*	0.08	0.15	0.05	0.14	0.02	0.11
	a*	0.15	-0.18	-0.16	-0.23	0.30	1.00	.74**	-.33*	-0.07	-0.14	-.38*	-0.15	-0.12	-0.07	0.01	-0.03
	b*	.33*	-0.03	0.02	-0.30	.74**	.74**	1.00	-0.28	-0.11	-0.31	-0.24	-0.08	-0.13	-0.03	-0.07	-0.02
	Drip loss	0.07	0.08	0.11	0.24	-0.02	-.33*	-0.28	1.00	.42**	0.28	-0.04	-0.07	-0.05	-0.31	-0.10	-0.10
	Cook loss	-.34*	0.00	-0.05	-0.24	-0.17	-0.07	-0.11	.42**	1.00	.47**	0.09	-0.06	-0.04	-0.17	-0.16	-0.02
	Shear force	-0.28	.34*	0.20	-0.06	-.35*	-0.14	-0.31	0.28	.470**	1.00	0.06	-0.21	-0.10	-0.12	-0.10	-0.19
N4	pH	-0.10	.32*	0.19	1.00	-.66**	-0.11	-.58**	-0.22	-0.13	0.12	0.01	0.14	0.02	0.11	0.22	0.06
	L*	0.03	-0.26	-0.24	-.66**	1.00	-0.02	.60**	-0.04	0.05	-0.26	0.18	0.05	0.13	0.06	-0.01	0.13
	a*	.33*	-0.05	0.22	-0.11	-0.02	1.00	.62**	.35*	0.20	-0.16	.34*	0.19	.35*	0.14	0.27	.34*
	b*	0.25	-0.26	-0.13	-.58**	.60**	.622**	1.00	.47**	0.07	-.32*	0.28	0.17	.33*	0.10	0.14	0.28
	Drip loss	0.29	0.04	0.08	-0.22	-0.04	.351*	.469**	1.00	0.07	-0.05	0.08	0.09	0.16	0.13	0.06	0.08

	Cook loss	0.14	-0.16	-0.31	-0.13	0.05	0.20	0.07	0.07	1.00	0.19	.46**	.37*	0.30	.39*	0.30	.31*
	Shear force	0.11	-0.09	-0.21	0.12	-0.26	-0.16	-.318*	-0.05	0.19	1.00	0.00	-0.03	-0.18	0.05	0.11	-0.07
N5	pH	-0.10	0.08	0.26	1.00	-.42**	-0.14	-.33*	0.17	0.28	0.27	0.01	0.06	-0.08	-0.08	-0.08	-0.04
	L*	0.02	-0.04	-0.27	-.42**	1.00	-.371*	0.20	-0.19	-0.16	-.34*	0.08	0.21	0.06	0.08	0.14	0.13
	a*	-0.10	0.08	0.18	-0.14	-.37*	1.00	.67**	0.13	-0.17	-0.02	-0.02	-0.06	0.14	0.09	0.10	0.09
	b*	-0.05	-0.13	-0.18	-.33*	0.20	.672**	1.00	-0.03	-0.19	-0.17	-0.02	0.15	0.12	0.03	0.19	0.15
	Drip loss	0.00	-0.05	0.16	0.17	-0.19	0.13	-0.03	1.00	0.13	0.28	-0.20	-0.16	-0.20	-0.27	-0.14	-0.16
	Cook loss	-0.14	-0.25	-0.08	0.28	-0.16	-0.17	-0.19	0.13	1.00	.72**	0.05	0.22	0.13	0.01	0.08	0.13
	Shear force	-0.16	-0.20	0.00	0.27	-.34*	-0.02	-0.17	0.28	.72**	1.00	0.12	0.16	0.08	0.08	0.07	0.12
N1	Outside	0.04	0.31	0.30	0.37	0.25	-0.10	0.06	0.17	0.06	-0.07	1.00	.43*	-0.17	-0.22	0.00	0.02
	Inside	0.29	0.22	-0.25	0.16	0.06	-0.03	0.04	0.21	0.16	0.02	.43*	1.00	.49*	.45*	.64**	.72**
	Tenderness	0.18	-0.09	-0.23	-0.05	0.10	0.26	0.33	0.04	0.21	0.06	-0.17	.49*	1.00	.59**	.66**	.74**
	Juiciness	0.29	-0.01	-0.29	0.00	0.01	0.33	0.26	0.00	0.07	-0.16	-0.22	.45*	.59**	1.00	.73**	.82**
	Flavour	0.31	0.15	-0.30	0.06	0.19	0.22	0.29	0.09	0.13	-0.14	0.00	.64**	.66**	.73**	1.00	.95**
	Overall	0.35	0.16	-0.32	0.05	0.17	0.26	0.30	0.10	0.10	-0.15	0.02	.72**	.74**	.82**	.95**	1.00

N2	Outside	.33*	0.01	-0.23	.55**	.35*	0.29	.42*	-0.09	-0.15	-0.25	1.00	.69**	.65**	.44**	.42*	.64**
	Inside	0.16	-0.08	-.35*	.41*	.47**	0.30	.53**	0.02	-0.26	-.47**	.69**	1.00	.49**	.37*	.44**	.51**
	Tenderness	.36*	0.23	-.33*	0.27	0.16	.39*	.38*	0.00	-0.23	-0.14	.65**	.49**	1.00	.80**	.75**	.91**
	Juiciness	.35*	0.12	-0.27	0.10	0.23	.409*	.50**	0.17	-.35*	-0.06	.44**	.37*	.80**	1.00	.76**	.84**
	Flavour	0.22	0.09	-.42*	0.08	0.17	0.30	.45**	0.25	-.50**	-0.18	.42*	.44**	.75**	.76**	1.00	.83**
	Overall	0.33	0.13	-.33*	0.28	0.22	.347*	.43**	0.14	-.37*	-0.14	.64**	.51**	.91**	.84**	.83**	1.00
N3	Outside	-0.14	0.04	0.03	0.13	0.08	-.38*	-0.24	-0.04	0.09	0.06	1.00	.66**	.41**	.36*	.50**	.57**
	Inside	-0.13	-0.21	-0.15	0.20	0.15	-0.15	-0.08	-0.07	-0.06	-0.21	.66**	1.00	.48**	.52**	.70**	.73**
	Tenderness	-0.20	-0.21	-0.27	.44**	0.05	-0.12	-0.13	-0.05	-0.04	-0.10	.41**	.48**	1.00	.68**	.59**	.76**
	Juiciness	-0.25	-0.19	-0.23	0.31	0.14	-0.07	-0.03	-0.31	-0.17	-0.12	.36*	.52**	.68**	1.00	.68**	.78**
	Flavour	-0.16	-0.26	-0.29	.32*	0.02	0.01	-0.07	-0.10	-0.16	-0.10	.50**	.70**	.59**	.68**	1.00	.87**
	Overall	-0.20	-.31*	-.35*	.35*	0.11	-0.03	-0.02	-0.10	-0.02	-0.19	.57**	.73**	.76**	.78**	.87**	1.00
N4	Outside	0.06	-0.17	-0.17	0.01	0.18	.34*	0.28	0.08	.46**	0.00	1.00	.75**	0.26	.48**	.42**	.49**
	Inside	0.14	-0.13	-0.18	0.14	0.05	0.19	0.17	0.09	.37*	-0.03	.75**	1.00	.39*	.68**	.48**	.49**
	Tenderness	0.18	-0.06	-0.02	0.02	0.13	.35*	.33*	0.16	0.30	-0.18	0.26	.39*	1.00	.69**	.74**	.86**

	Juiciness	0.21	-0.01	-0.10	0.11	0.06	0.14	0.10	0.13	.39*	0.05	.48**	.68**	.69**	1.00	.73**	.77**
	Flavour	.34*	-0.10	-0.12	0.22	-0.01	0.27	0.14	0.06	0.30	0.11	.42**	.48**	.74**	.73**	1.00	.88**
	Overall	0.24	-0.17	-0.14	0.06	0.13	0.34*	0.28	0.08	.31*	-0.07	.49**	.49**	.86**	.77**	.88**	1.00
N5	Outside	0.04	-0.07	-0.21	0.01	0.08	-0.02	-0.02	-0.20	0.05	0.12	1.00	.70**	.55**	.65**	.42**	.58**
	Inside	-0.05	-0.16	-0.30	0.06	0.21	-0.06	0.15	-0.16	0.22	0.16	.70**	1.00	.70**	.73**	.65**	.77**
	Tenderness	-0.15	-0.02	-0.19	-0.08	0.06	0.14	0.12	-0.20	0.13	0.08	.55**	.70**	1.00	.88**	.77**	.93**
	Juiciness	-0.12	0.04	-0.19	-0.08	0.08	0.09	0.03	-0.27	0.01	0.08	.65**	.73**	.88**	1.00	.75**	.90**
	Flavour	0.01	-0.21	-0.27	-0.08	0.14	0.10	0.19	-0.14	0.08	0.07	.42**	.65**	.77**	.75**	1.00	.89**
	Overall	-0.12	-0.12	-0.27	-0.04	0.13	0.09	0.15	-0.16	0.13	0.12	.58**	.77**	.93**	.90**	.89**	1.00

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed). N1: slaughter day1. N2: slaughter day2. N3: slaughter day4. N5: slaughter day5.

Appendix G: Correlation Coefficients by Slaughter Day: Hog, Meat and Sensory Quality Indicators for Conventional Sample

		Weight	Yield	Grade	pH	L*	a*	b*	Drip loss	Cook loss	Shear force	Outside	Inside	Tenderness	Juiciness	Flavour	Overall
C1	Weight	1.00	0.12	-0.19	0.14	-0.04	-0.18	-0.14	0.23	0.17	$.36^{*}$	0.11	0.18	0.02	0.13	0.11	0.15
	Yield	0.12	1.00	0.11	0.08	$-.38^{*}$	-0.06	$-.36^{*}$	0.17	0.02	0.05	-0.10	-0.18	-0.05	-0.08	-0.22	-0.15
	Grade	-0.19	0.11	1.00	0.23	-0.16	0.00	-0.10	0.05	-0.13	-0.12	-0.06	-0.20	0.03	0.14	0.07	0.01
C2	Weight	1.00	-0.06	-0.05	-0.03	0.25	-0.13	-0.03	-0.10	-0.23	0.06	0.19	-0.01	-0.06	-0.04	0.07	0.06
	Yield	-0.06	1.00	$.70^{**}$	$-.35^{*}$	0.24	0.14	0.26	0.04	-0.02	-0.16	-0.03	-0.29	-0.04	0.05	-0.09	0.02
	Grade	-0.05	$.70^{**}$	1.00	-0.29	-0.02	0.20	0.20	0.23	0.04	0.05	-0.07	-0.13	-0.12	-0.12	0.01	-0.03
C3	Weight	1.00	0.02	$-.32^{*}$	-0.16	-0.12	0.10	0.07	-0.01	0.16	0.18	0.21	0.28	0.06	0.04	-0.06	0.06
	Yield	0.02	1.00	0.17	-0.05	0.27	0.06	0.23	-0.07	-0.16	-0.25	-0.06	-0.08	0.13	0.04	0.06	0.14
	Grade	$-.32^{*}$	0.17	1.00	-0.04	-0.03	0.08	0.01	-0.04	-0.15	$-.48^{**}$	-0.07	-0.16	-0.17	-0.14	-0.01	-0.09
C4	Weight	1.00	0.21	-0.16	0.05	-0.05	0.04	0.07	-0.14	0.19	0.13	0.09	-0.19	0.18	0.25	0.08	0.11
	Yield	0.21	1.00	0.06	-0.07	-0.05	0.23	0.23	-0.03	0.15	-0.14	-0.15	-0.07	-0.03	-0.05	0.12	-0.01

	Grade	-0.16	0.06	1.00	0.19	-0.09	0.01	-0.04	-0.03	-0.31	-0.07	-0.02	-0.02	-0.12	-0.23	-0.26	-0.24
C5	Weight	1.00	-.43**	-0.16	-0.01	0.12	-0.24	-0.08	-0.08	-0.14	0.16	0.22	0.22	0.12	0.02	-0.02	0.01
	Yield	-.43**	1.00	.60**	0.09	-0.20	-0.14	-0.11	.32*	-0.14	-0.13	0.04	-0.28	-0.07	-0.16	-0.12	-0.05
	Grade	-0.16	.60**	1.00	-0.04	-0.06	-.33*	-0.20	0.19	-0.27	0.09	0.01	-0.16	0.00	-0.12	-0.01	0.00
C1	pH	0.14	0.08	0.23	1.00	-.42**	0.07	-0.25	-0.04	-.453**	-0.21	0.04	0.07	0.13	0.21	0.18	0.14
	L*	-0.04	-.38*	-0.16	-.42**	1.00	0.09	.784**	-.41**	0.06	-0.28	0.19	0.28	0.19	0.23	.45*	0.26
	a*	-0.18	-0.06	0.00	0.07	0.09	1.00	.55**	-0.04	-0.22	-0.29	0.09	0.07	0.08	-0.06	0.14	0.08
	b*	-0.14	-.36*	-0.10	-0.25	.78**	.55**	1.00	-.368*	-0.10	-.423**	0.21	0.23	0.24	0.25	.521**	0.30
	Drip loss	0.23	0.17	0.05	-0.04	-.41**	-0.04	-.37*	1.00	0.28	.40*	0.25	0.27	0.17	0.25	0.19	0.20
	Cook loss	0.17	0.02	-0.13	-.45**	0.06	-0.22	-0.10	0.28	1.00	.44**	0.20	0.06	0.07	0.02	-0.31	-0.07
	Shear force	.36*	0.05	-0.12	-0.21	-0.28	-0.29	-.42**	.40*	.44**	1.00	0.00	-0.09	-0.30	-0.17	-0.12	-0.17
C2	pH	-0.03	-.35*	-0.29	1.00	-0.12	0.07	-0.02	-0.09	-.38*	-0.25	-0.04	0.30	0.20	0.10	-0.05	-0.03
	L*	0.25	0.24	-0.02	-0.12	1.00	0.08	.51**	-0.30	-0.14	-.40*	.34*	0.07	0.19	0.27	0.15	0.32
	a*	-0.13	0.14	0.20	0.07	0.08	1.00	.83**	-0.16	-0.04	-0.16	0.31	.42*	0.10	0.25	0.23	0.21
	b*	-0.03	0.26	0.20	-0.02	.51**	.83**	1.00	-0.14	-0.12	-.37*	.41*	.34*	0.16	0.32	0.24	0.32

	Drip loss	-0.10	0.04	0.23	-0.09	-0.30	-0.16	-0.14	1.00	-0.05	0.01	-0.12	-0.05	-0.02	-0.09	-0.08	-0.11
	Cook loss	-0.23	-0.02	0.04	-.38*	-0.14	-0.04	-0.12	-0.05	1.00	.56**	-0.07	-0.23	-0.29	-0.30	-0.21	-0.24
	Shear force	0.06	-0.16	0.05	-0.25	-.40*	-0.16	-.37*	0.01	.56**	1.00	-0.21	-0.24	-.504**	-.47**	-0.17	-.44**
C3	pH	-0.16	-0.05	-0.04	1.00	-0.05	-.36*	-.39*	-0.05	0.15	0.15	0.00	0.02	0.05	0.15	0.19	0.25
	L*	-0.12	0.27	-0.03	-0.05	1.00	-0.28	0.27	-.38*	-.33*	-0.23	0.07	-0.01	0.13	-0.13	0.03	-0.02
	a*	0.10	0.06	0.08	-.36*	-0.28	1.00	.74**	0.04	-0.08	-0.30	0.06	-0.03	-0.14	-0.12	-0.04	-0.05
	b*	0.07	0.23	0.01	-.39*	0.27	.74**	1.00	-0.20	-0.24	-.38*	0.15	0.00	-0.09	-0.22	-0.07	-0.16
	Drip loss	-0.01	-0.07	-0.04	-0.05	-.38*	0.04	-0.20	1.00	0.12	0.15	-0.06	-0.08	-0.11	-0.13	-0.28	-0.21
	Cook loss	0.16	-0.16	-0.15	0.15	-.33*	-0.08	-0.24	0.12	1.00	.33*	-0.13	-0.02	0.00	0.04	-0.05	-0.04
	Shear force	0.18	-0.25	-.48**	0.15	-0.23	-0.30	-.38*	0.15	.33*	1.00	-0.23	0.05	-0.02	-0.01	-0.07	-0.04
C4	pH	0.05	-0.07	0.19	1.00	-0.29	-0.11	-.325*	-0.26	-.325*	-0.21	-0.06	0.07	0.24	0.06	0.22	0.20
	L*	-0.05	-0.05	-0.09	-0.29	1.00	-.36*	-0.06	-.32*	-0.09	0.02	-0.11	-0.02	0.26	.31*	0.24	0.31
	a*	0.04	0.23	0.01	-0.11	-.36*	1.00	.80**	0.03	0.23	-0.27	.33*	0.18	-0.17	-0.26	0.01	-0.12
	b*	0.07	0.23	-0.04	-.33*	-0.06	.80**	1.00	0.03	0.14	-0.03	0.30	0.06	-0.19	-0.20	-0.02	-0.11
	Drip loss	-0.14	-0.03	-0.03	-0.26	-.32*	0.03	0.03	1.00	0.13	-0.07	0.00	-0.11	-.39*	-.36*	-.33*	-.38*

	Cook loss	0.19	0.15	-0.31	-.33*	-0.09	0.23	0.14	0.13	1.00	0.28	0.08	-0.01	-0.12	-0.08	0.08	-0.07
	Shear force	0.13	-0.14	-0.07	-0.21	0.02	-0.27	-0.03	-0.07	0.28	1.00	-0.25	-0.24	-0.26	-0.10	-0.23	-0.27
C5	pH	-0.01	0.09	-0.04	1.00	-.54**	-0.27	-.40**	0.02	-0.14	0.10	-0.09	-0.25	-0.04	-0.10	-.34*	-0.06
	L*	0.12	-0.20	-0.06	-.54**	1.00	0.17	.52**	-0.28	0.16	-0.15	0.19	0.13	0.09	-0.11	0.11	-0.01
	a*	-0.24	-0.14	-.33*	-0.27	0.17	1.00	.79**	0.18	0.02	-0.19	-0.28	0.03	-0.03	0.09	0.29	0.04
	b*	-0.08	-0.11	-0.20	-.40**	.52**	.79**	1.00	0.16	0.08	-0.21	-0.06	0.17	0.11	0.03	0.27	0.08
	Drip loss	-0.08	.32*	0.19	0.02	-0.28	0.18	0.16	1.00	-0.24	.34*	-0.09	-0.09	-0.20	-0.11	-0.08	-0.06
	Cook loss	-0.14	-0.14	-0.27	-0.14	0.16	0.02	0.08	-0.24	1.00	0.27	.42**	.37*	0.01	0.22	0.17	0.14
	Shear force	0.16	-0.13	0.09	0.10	-0.15	-0.19	-0.21	.34*	0.27	1.00	0.05	-0.06	-.39*	-0.15	-0.14	-0.29
C1	Outside	0.11	-0.10	-0.06	0.04	0.19	0.09	0.21	0.25	0.20	0.00	1.00	.79**	.61**	.62**	0.35	.54**
	Inside	0.18	-0.18	-0.20	0.07	0.28	0.07	0.23	0.27	0.06	-0.09	.79**	1.00	.65**	.60**	.50*	.65**
	Tenderness	0.02	-0.05	0.03	0.13	0.19	0.08	0.24	0.17	0.07	-0.30	.61**	.65**	1.00	.82**	.65**	.90**
	Juiciness	0.13	-0.08	0.14	0.21	0.23	-0.06	0.25	0.25	0.02	-0.17	.62**	.60**	.82**	1.00	.734**	.832**
	Flavour	0.11	-0.22	0.07	0.18	.45*	0.14	.52**	0.19	-0.31	-0.12	0.35	.50*	.65**	.73**	1.00	.846**
	Overall	0.15	-0.15	0.01	0.17	0.26	0.08	0.30	0.20	-0.07	-0.17	.54**	.65**	.90**	.83**	.846**	1.00

C2	Outside	0.19	-0.03	-0.07	-0.04	.34*	0.31	.41*	-0.12	-0.07	-0.21	1.00	.55**	.56**	.64**	.56**	.70**
	Inside	-0.01	-0.29	-0.13	0.30	0.07	.42*	.34*	-0.05	-0.23	-0.24	.55**	1.00	.49**	.53**	.41*	.45**
	Tenderness	-0.06	-0.04	-0.12	0.20	0.19	0.10	0.16	-0.02	-0.29	-.50**	.56**	.49**	1.00	.75**	.65**	.80**
	Juiciness	-0.04	0.05	-0.12	0.10	0.27	0.25	0.32	-0.09	-0.30	-.47**	.64**	.53**	.75**	1.00	.58**	.85**
	Flavour	0.07	-0.09	0.01	-0.05	0.15	0.23	0.24	-0.08	-0.21	-0.17	.56**	.41*	.65**	.58**	1.00	.81**
	Overall	0.06	0.02	-0.03	-0.03	0.32	0.21	0.32	-0.11	-0.24	-.44**	.70**	.45**	.80**	.85**	.81**	1.00
C3	Outside	0.21	-0.06	-0.07	0.00	0.07	0.06	0.15	-0.06	-0.13	-0.23	1.00	.70**	0.26	0.31	.36*	.54**
	Inside	0.28	-0.08	-0.16	0.02	-0.01	-0.03	0.00	-0.08	-0.02	0.05	.70**	1.00	.36*	0.28	0.21	.52**
	Tenderness	0.06	0.13	-0.17	0.05	0.13	-0.14	-0.09	-0.11	0.00	-0.02	0.26	.36*	1.00	.77**	.56**	.65**
	Juiciness	0.04	0.04	-0.14	0.15	-0.13	-0.12	-0.22	-0.13	0.04	-0.01	0.31	0.28	.77**	1.00	.60**	.75**
	Flavour	-0.06	0.06	-0.01	0.19	0.03	-0.04	-0.07	-0.28	-0.05	-0.07	.36*	0.21	.56**	.60**	1.00	.77**
	Overall	0.06	0.14	-0.09	0.25	-0.02	-0.05	-0.16	-0.21	-0.04	-0.04	.54**	.52**	.65**	.75**	.77**	1.00
C4	Outside	0.09	-0.15	-0.02	-0.06	-0.11	.33*	0.30	0.00	0.08	-0.25	1.00	.50**	-0.23	0.00	0.02	0.03
	Inside	-0.19	-0.07	-0.02	0.07	-0.02	0.18	0.06	-0.11	-0.01	-0.24	.50**	1.00	-0.09	0.03	0.06	0.08
	Tenderness	0.18	-0.03	-0.12	0.24	0.26	-0.17	-0.19	-.39*	-0.12	-0.26	-0.23	-0.09	1.00	.76**	.64**	.83**

	Juiciness	0.25	-0.05	-0.23	0.06	.31*	-0.26	-0.20	-.36*	-0.08	-0.10	0.00	0.03	.76**	1.00	.58**	.82**
	Flavour	0.08	0.12	-0.26	0.22	0.24	0.01	-0.02	-.33*	0.08	-0.23	0.02	0.06	.64**	.58**	1.00	.80**
	Overall	0.11	-0.01	-0.24	0.20	0.31	-0.12	-0.11	-.38*	-0.07	-0.27	0.03	0.08	.83**	.82**	.80**	1.00
C5	Outside	0.22	0.04	0.01	-0.09	0.19	-0.28	-0.06	-0.09	.42**	0.05	1.00	.52**	.40*	0.27	0.22	.44**
	Inside	0.22	-0.28	-0.16	-0.25	0.13	0.03	0.17	-0.09	.37*	-0.06	.52**	1.00	.62**	.70**	.59**	.67**
	Tenderness	0.12	-0.07	0.00	-0.04	0.09	-0.03	0.11	-0.20	0.01	-.39*	.40*	.62**	1.00	.80**	.66**	.87**
	Juiciness	0.02	-0.16	-0.12	-0.10	-0.11	0.09	0.03	-0.11	0.22	-0.15	0.27	.70**	.80**	1.00	.70**	.88**
	Flavour	-0.02	-0.12	-0.01	-.34*	0.11	0.29	0.27	-0.08	0.17	-0.14	0.22	.59**	.66**	.70**	1.00	.74**
	Overall	0.01	-0.05	0.00	-0.06	-0.01	0.04	0.08	-0.06	0.14	-0.29	.44**	.67**	.87**	.88**	.74**	1.00

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed). C1: slaughter day1. C2: slaughter day2. C3: slaughter day4. C5: slaughter day5.

Appendix H: Socio-economic and Demographic Characteristics by Group with Different Beliefs about Traditionally Raised, Edmonton Sample

		Non Healthier (N=120)	Healthier (N=77)	Non Safer (N=130)	Safer (N=67)
Gender	Male	51.7%	45.5%	51.5%	44.8%
	Female	48.3%	54.5%	48.5%	55.2%
Age	18-24	13.3%	10.4%	13.1%	10.4%
	25-29	10.8%	18.2%	12.3%	16.4%
	30-39	13.2%	23.4%	16.9%	17.9%
	40-49	21.6%	23.4%	22.3%	22.4%
	50-64	33.3%	24.7%	30.0%	29.9%
	over 64	7.5%	0.0%	5.4%	3.0%
Education	Elementary	0.0%	0.0%	0.0%	0.0%
	Secondary/High School	13.3%	18.2%	15.4%	14.9%
	Technical/college/university	70.0%	64.9%	68.5%	67.2%
	Graduate	16.7%	16.9%	16.2%	17.9%
Employment status	Employed full-time or self-employed	73.3%	84.4%	75.4%	82.1%
	Employed part-time	10.0%	2.6%	10.0%	1.5%
	Homemaker	0.8%	0.0%	0.8%	0.0%
	Student	5.8%	10.4%	6.2%	10.4%
	Retired	8.3%	2.6%	6.2%	6.0%
	Unemployed	0.8%	0.0%	0.8%	0.0%
	Other	0.8%	0.0%	0.8%	0.0%
Income	Under $19,999	5.0%	1.3%	5.4%	0.0%
	$20,000 to $49,999	15.0%	20.8%	15.4%	20.9%
	$50,000 to $89,999	33.3%	24.7%	33.8%	22.4%
	More than $90,000	40.0%	40.3%	40.0%	40.3%

	I'd rather not answer this question	6.7%	13.0%	5.4%	16.4%
Number of Children < 18 years	0	77.5%	67.5%	75.4%	70.1%
	1	5.8%	15.6%	6.2%	16.4%
	2	14.2%	13.0%	16.2%	9.0%
	3 or more	2.5%	3.9%	2.3%	4.5%
General Trust	People can be trusted	65.8%	50.6%	60.8%	58.2%
	Otherwise	34.2%	49.4%	39.2%	41.8%
Pork Eating Frequency	Fewer than two times per year	0.8%	0.0%	0.8%	0.0%
	Once per month	28.3%	33.8%	30.0%	31.3%
	Once per week	50.8%	55.8%	53.1%	52.2%
	More than once per week	20.0%	10.4%	16.2%	16.4%
When you buy pork, is it usually in…?	a supermarket	96.7%	90.9%	95.4%	92.5%
	a butcher's shop	1.7%	2.6%	1.5%	3.0%
	another small shop	0.8%	2.6%	1.5%	1.5%
	a farmers' market	0.8%	3.9%	1.5%	3.0%
	another way (e.g. directly from a farm or through acquaintances	0.0%	0.0%	0.0%	0.0%

Appendix I: Socio-economic and Demographic Characteristics by Group with Different Beliefs about Traditionally Raised, National Sample

		Non Healthier (N=984)	Healthier (N=619)	Non Safer (N=1045)	Safer (N=558)
Gender	Male	40.7%	37.8%	40.3%	38.2%
	Female	59.3%	62.2%	59.7%	61.8%
Age	18-24	4.4%	5.5%	4.6%	5.2%
	25-29	4.5%	7.1%	4.6%	7.2%
	30-39	14.2%	14.4%	13.7%	15.4%
	40-49	16.3%	17.8%	16.6%	17.4%
	50-64	38.0%	36.8%	38.0%	36.7%
	65+	22.7%	18.4%	22.6%	18.1%
Education	Elementary or junior high school	2.5%	2.7%	2.3%	3.2%
	High school	29.2%	29.9%	29.7%	29.0%
	Technical training / Business School / Community college	36.4%	37.0%	36.0%	37.8%
	University	23.8%	23.3%	24.4%	22.0%
	Post Graduate studies (Masters or PhD)	8.1%	7.1%	7.7%	7.9%
Employment	Employed full-time or self-employed	40.2%	41.2%	40.4%	41.0%
	Employed part-time	9.7%	12.0%	9.7%	12.2%
	Homemaker	8.7%	8.1%	8.8%	7.9%
	Student and full-time employed	0.9%	1.3%	1.0%	1.3%
	Student and part-time employed	1.5%	2.6%	1.4%	2.9%
	Student only	1.2%	1.3%	1.2%	1.3%
	Retired	30.6%	26.5%	30.7%	25.8%
	Unemployed	5.1%	3.9%	4.6%	4.7%
	Other	2.0%	3.2%	2.2%	3.0%
Income	$24,999 or under	14.9%	13.7%	14.7%	14.0%

	$25,000 to $39,999	18.1%	20.0%	17.2%	21.9%
	$40,000 to $64,999	26.1%	27.0%	27.2%	25.1%
	$65,000 to $79,999	14.3%	13.7%	13.9%	14.5%
	$80,000 to $99,999	11.3%	11.0%	10.8%	11.8%
	$100,000 to $119,999	8.2%	6.9%	8.6%	6.1%
	$120,000 or more	7.0%	7.6%	7.6%	6.6%
Number of Children < 18 years	0	75.0%	72.4%	75.2%	71.7%
	1	11.7%	13.2%	11.5%	13.8%
	2	8.5%	10.2%	8.6%	10.2%
	3	3.4%	2.6%	3.3%	2.7%
	4	0.8%	1.3%	0.9%	1.3%
	More than 4	0.6%	0.3%	0.6%	0.4%
Region	Maritimes	11.9%	13.9%	12.2%	13.4%
	Quebec	13.5%	12.6%	13.3%	12.9%
	Ontario	13.0%	17.0%	12.7%	17.9%
	Manitoba	18.0%	16.6%	18.2%	16.1%
	Saskatchewan	13.2%	10.3%	13.3%	9.9%
	Alberta	13.7%	13.4%	13.9%	13.1%
	British Columbia	16.7%	16.2%	16.4%	16.7%
	Urban	82.7%	79.2%	82.8%	78.7%
	Rural	17.3%	20.8%	17.2%	21.3%
Do you eat pork?	Yes	78.0%	87.6%	78.6%	87.6%
	No	22.0%	12.4%	21.4%	12.4%
Food Preferences	Eat meat and fish	80.2%	83.5%	79.9%	84.4%
	Eat fish but don't eat meat	3.7%	2.4%	3.5%	2.5%
	eat meat but don't eat fish	13.5%	12.6%	14.0%	11.6%
	A vegetarian	2.6%	1.5%	2.6%	1.4%
When you buy pork, is it usually in…?	A supermarket	82.3%	79.6%	82.4%	79.2%

	A butcher shop	6.8%	8.9%	7.0%	8.8%
	Another small shop	1.6%	2.4%	1.6%	2.5%
	A farmers' market	1.1%	1.5%	1.1%	1.4%
	Other (e.g. directly from a farm or from acquaintances	8.1%	7.6%	7.8%	8.1%
Pork eating Frequency	Never	14.8%	6.6%	14.4%	6.5%
	Fewer than two times per year	12.5%	10.8%	12.0%	11.6%
	Once a month	32.4%	37.0%	32.8%	36.7%
	Once a week	33.2%	35.9%	33.8%	35.1%
	More than once a week	7.0%	9.7%	7.0%	10.0%
General Trust	People can be trusted	45.0%	47.2%	46.0%	45.5%
	Otherwise	55.0%	52.8%	54.0%	54.5%

Appendix J: Results of Likelihood Ratio Test of Including the Insignificant Demographic Interactions in the Four Regressions

Results of likelihood ratio test of including the insignificant demographic interactions in the four regressions, Edmonton sample

SAFER			NOT SAFER			HEALTHIER			NOT HEALTHIER		
Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject
83.28 (.13)	70	Accept	69.60 (.68)	76	Accept	59.12 (.82)	70	Accept	73.01 (.54)	75	Accept

Healthier: the group of respondents who agreed that traditionally raised pork was healthier than conventional pork; Not healthier: the group of respondents who did not agree that traditionally raised pork is healthier than conventional pork; Safer: the group of respondents who agreed that traditionally raised pork was safer than conventional pork; Not safer: the group of respondents who did not agree that traditionally raised pork is safer than conventional pork.

Results of likelihood ratio test of including the insignificant demographic interactions in the four regressions, national sample

SAFER			NOT SAFER			HEALTHIER			NOT HEALTHIER		
Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject	Chi-squared Test Statistic (p-value)	DF	Accept or Reject
175.61 (.35)	169	Accept	69.60 (.68)	76	Accept	59.12 (.82)	70	Accept	73.01 (.54)	75	Accept

Healthier: the group of respondents who agreed that traditionally raised pork was healthier than conventional pork; Not healthier: the group of respondents who did not agree that traditionally raised pork is healthier than conventional pork; Safer: the group of respondents who agreed that traditionally raised pork was safer than conventional pork; Not safer: the group of respondents who did not agree that traditionally raised pork is safer than conventional pork.

Appendix K: Marginal Effects for Variables in the Multinomial Logit Regressions for the Four Respondent Groups, Edmonton Sample

	Healthier			Not Healthier			Safer			Not Safer		
	Marginal Effect											
Parameter	Choice1	Choice2	Choice3	Choice1	Choice2	Choice3	Choice1	Choice2	Choice3	Choice1	Choice2	Choice3
PRICE1	-0.01	0.003	0.003	-0.001	0.001	0.001	-0.02	0.01	0.01	-0.001	0.0003	0.0004
PRICE2	0.003	-0.003	0.0001	0.001	-0.001		0.01	-0.01	0.001	0.0003	-0.0003	
PRICE3	0.003	0.0001	-0.003	0.001		-0.001	0.01	0.001	-0.01	0.0004		-0.0004
N	0.04	-0.02	-0.02	0.01	-0.004	-0.005	0.11	-0.06	-0.06	0.004	-0.002	-0.002
CONCQA				-0.05	0.02	0.02				-0.02	0.01	0.01
CONCPCQA	-0.35	0.18	0.17	0.01	-0.01	-0.01						
TR										-0.002	0.001	0.001
TRCP				-0.001	0.001	0.001				-0.001	0.001	0.001
TRCPCQA	0.04	-0.02	-0.02				0.11	-0.05	-0.06			
CTR							-0.09	0.05	0.04			
CTRCQA				-0.01	0.005	0.005				-0.01	0.003	0.003
CTRCPCQA	0.01	-0.01	-0.01	0.004	-0.002	-0.002	0.02	-0.01	-0.01	0.002	-0.001	-0.001
GENDERCONCP							-0.22	0.11	0.11			
GENDERCTR	0.03	-0.01	-0.01									
AGECONCQA1										0.001	-0.001	-0.001
AGECONCQA2										-0.001	0.001	-0.00001
AGECONCQA3										-0.001	-0.00001	0.001
AGETRCQA1				0.0002	-0.0001	-0.0001						

AGETRCQA2				-0.0001	0.0001							
AGETRCQA3				-0.0001		0.0001						
CHILDCTR	-0.05	0.03	0.03				-0.21	0.11	0.10			
CHILDGTRCP	-0.13	0.07	0.06				-0.18	0.09	0.09			
EDUCCONCQA1				-0.02	0.01	0.01				-0.01	0.003	0.003
EDUCCONCQA2				0.01	-0.01	0.0003				0.003	-0.003	0.00003
EDUCCONCQA3				0.01	0.0003	-0.01				0.003	0.00003	-0.003
EDUCTRCP1				-0.001	0.001	0.001						
EDUCTRCP2				0.001	-0.001							
EDUCTRCP3				0.001		-0.001						
EATFCONCP1							0.18	-0.09	-0.09			
EATFCONCP2							-0.09	0.11	-0.01			
EATFCONCP3							-0.09	-0.01	0.10			
EATFCTR1										0.003	-0.002	-0.002
EATFCTR2										-0.002	0.002	-0.00001
EATFCTR3										-0.002	-0.00001	0.002
EATFCTRCP1	0.06	-0.03	-0.03									
EATFCTRCP2	-0.03	0.03	-0.001									
EATFCTRCP3	-0.03	-0.001	0.03									
EATFCTRCQA1				-0.02	0.01	0.01						
EATFCTRCQA2				0.01	-0.01	0.0001						
EATFCTRCQA3				0.01	0.0001	-0.01						
EATFCTRCPCQA1	-0.06	0.03	0.03	0.01	-0.004	-0.004	-0.20	0.10	0.10	0.004	-0.002	-0.002
EATFCTRCPCQA2	0.03	-0.03	0.0004	-0.004	0.004	-0.00001	0.10	-0.11	0.01	-0.002	0.002	
EATFCTRCPCQA3	0.03	0.0004	-0.03	-0.004	-0.00001	0.004	0.10	0.01	-0.10	-0.002		0.002

EATFGTR1	0.04	-0.02	-0.02				0.13	-0.07	-0.06			
EATFGTR2	-0.02	0.02	-0.0005				-0.07	0.08	-0.01			
EATFGTR3	-0.02	-0.0005	0.02				-0.06	-0.01	0.08			
EATFGTRCPCQA1				0.01	-0.003	-0.004						
EATFGTRCPCQA2				-0.003	0.003	-0.00001						
EATFGTRCPCQA3				-0.004	-0.00001	0.004						
TRUSTR	0.07	-0.03	-0.03				0.16	-0.08	-0.08			
TRUSCTR	0.05	-0.03	-0.03				0.15	-0.08	-0.07	0.004	-0.002	-0.002
TRUSGTR							0.20	-0.10	-0.10	0.01	-0.004	-0.004
EATFGRAD1				-0.0001	0.00004	0.00005	-0.002	0.001	0.001			
EATFGRAD2				0.00004	-0.00004		0.001	-0.001	0.0001			
EATFGRAD3				0.00005		-0.00005	0.001	0.0001	-0.001			
TRUSGRAD	0.09	-0.04	-0.04							0.01	-0.01	-0.01
MQCL1				-0.001	0.0004	0.0004	-0.01	0.01	0.01	-0.0004	0.0002	0.0002
MQCL2				0.0004	-0.0004		0.01	-0.01	0.0004	0.0002	-0.0002	
MQCL3				0.0004		-0.0004	0.01	0.00	-0.01	0.0002		-0.0002
EATFL1							0.005	-0.002	-0.002			
EATFL2							-0.002	0.003	-0.0002			
EATFL3							-0.002	-0.0002	0.002			
TRUSL										-0.01	0.005	0.005
MQSF1	-0.003	0.002	0.001	-0.0004	0.0002	0.0002	-0.005	0.002	0.002	-0.0002	0.0001	0.0001
MQSF2	0.002	-0.002	0.00003	0.0002	-0.0002		0.002	-0.003	0.0002		-0.0001	
MQSF3	0.001	0.000	-0.002	0.0002		-0.0002	0.002	0.0002	-0.003			-0.0001
EATFSF1	0.001	-0.0004	-0.0004	0.0001	-0.00004	-0.00005				0.0001	-0.00003	-0.00003
EATFSF2	-0.0004	0.0004	-0.00001	-0.00004	0.00004					-0.00003	0.00003	

EATFSF3	-0.0004	-0.00001	0.0004	0.0000		0.00005				-0.00003		0.00003
TRUSSF	-0.04	0.02	0.02				-0.13	0.07	0.06			

Choice A is recorded as choice2, choice B is recorded as choice3, and choice C is recorded as choice1 which was an option of choosing neither A nor B.

Appendix L: Marginal Effects for Variables in the Multinomial Logit Regressions for the Four Respondent Groups, National Sample

	Healthier			Not Healthier			Safer			Not Safer		
	Marginal Effect											
Parameter	Choice1	Choice2	Choice3	Choice1	Choice2	Choice3	Choice1	Choice2	Choice3	Choice1	Choice2	Choice3
PRICE1	-0.04	0.02	0.02	-0.04	0.02	0.02	-0.04	0.02	0.02	-0.04	0.02	0.02
PRICE2	0.02	-0.03	0.01	0.02	-0.03	0.01	0.02	-0.03	0.01	0.02	-0.03	0.01
PRICE3	0.02	0.01	-0.03	0.02	0.01	-0.03	0.02	0.01	-0.03	0.02	0.01	-0.03
N	0.37	-0.18	-0.19	0.28	-0.14	-0.14	0.35	-0.18	-0.18	0.29	-0.14	-0.15
CONCP				-0.17	0.09	0.09				-0.15	0.08	0.08
TR	-0.10	0.05	0.05				-0.11	0.06	0.06	-0.10	0.05	0.05
TRCP	-0.20	0.10	0.10				-0.21	0.10	0.10	-0.14	0.07	0.07
TRCQA	-0.18	0.09	0.09				-0.20	0.10	0.10	-0.12	0.06	0.06
TRCPCQA							0.04	-0.02	-0.02			
CTR				-0.07	0.03	0.03	-0.23	0.11	0.11	-0.06	0.03	0.03
CTRCP				-0.25	0.12	0.12	-0.14	0.07	0.07	-0.24	0.12	0.12
CTRCQA	-0.14	0.07	0.07	-0.22	0.11	0.11	-0.13	0.07	0.07	-0.22	0.11	0.11
CTRCPCQA	-0.01	0.005	0.005	0.11	-0.05	-0.05	-0.004	0.002	0.002	0.10	-0.05	-0.05
GTRCP	-0.17	0.08	0.08	-0.16	0.08	0.08	-0.15	0.07	0.07	-0.17	0.08	0.09
GTRCPCQA				-0.15	0.08	0.08				-0.15	0.07	0.08
GENDERTR				0.05	-0.02	-0.02				0.05	-0.02	-0.02
GENDERCTRCPCQA	-0.09	0.04	0.05	-0.13	0.06	0.06				-0.13	0.06	0.06
AGECTRCP1	-0.004	0.002	0.002				-0.01	0.003	0.003			

AGECTRCP2	0.002	-0.004	0.002				0.003	-0.01	0.003			
AGECTRCP3	0.002	0.002	-0.004				0.003	0.003	-0.01			
AGECTRCQA1	-0.003	0.002	0.002							-0.002	0.001	0.001
AGECTRCQA2	0.002	-0.003	0.002							0.001	-0.002	0.001
AGECTRCQA3	0.002	0.002	-0.003							0.001	0.001	-0.002
AGECTRCPCQA1				0.004	-0.002	-0.002	0.01	-0.003	-0.003	0.004	-0.002	-0.002
AGECTRCPCQA2				-0.002	0.003	-0.001	-0.003	0.005	-0.002	-0.002	0.002	0.000
AGECTRCPCQA3				-0.002	-0.001	0.003	-0.003	-0.002	0.005	-0.002	0.000	0.002
AGEGTR1	-0.003	0.001	0.001	-0.002	0.001	0.001	-0.002	0.001	0.001	-0.002	0.001	0.001
AGEGTR2	0.001	-0.003	0.002	0.001	-0.002	0.001	0.001	-0.003	0.002	0.001	-0.002	0.001
AGEGTR3	0.001	0.002	-0.003	0.001	0.001	-0.002	0.001	0.002	-0.003	0.001	0.001	-0.002
CHILDCONCP	0.12	-0.06	-0.06				0.12	-0.06	-0.06			
CHILDTRCP	0.07	-0.03	-0.03				0.06	-0.03	-0.03			
CHILDCTR							0.05	-0.03	-0.03			
CHILDGTRCP	0.12	-0.06	-0.06				0.09	-0.04	-0.04			
EDUCTRCPCQA1							0.02	-0.01	-0.01			
EDUCTRCPCQA2							-0.01	0.02	-0.01			
EDUCTRCPCQA3							-0.01	-0.01	0.02			
EDUCGTRCQA1	0.02	-0.01	-0.01									
EDUCGTRCQA2	-0.01	0.01	-0.004									
EDUCGTRCQA3	-0.01	-0.004	0.01									
EATFCONCP1	0.08	-0.04	-0.04	0.11	-0.05	-0.06	0.07	-0.03	-0.03	0.11	-0.06	-0.06
EATFCONCP2	-0.04	0.08	-0.04	-0.05	0.10	-0.04	-0.03	0.08	-0.05	-0.06	0.10	-0.04
EATFCONCP3	-0.04	-0.04	0.08	-0.06	-0.04	0.10	-0.03	-0.05	0.08	-0.06	-0.04	0.10
EATFCONCQA1	0.04	-0.02	-0.02	0.07	-0.03	-0.03	0.04	-0.02	-0.02	0.06	-0.03	-0.03

EATFCONCQA2	-0.02	0.04	-0.02	-0.03	0.06	-0.02	-0.02	0.05	-0.03	-0.03	0.05	-0.02
EATFCON CQA3	-0.02	-0.02	0.04	-0.03	-0.02	0.06	-0.02	-0.03	0.05	-0.03	-0.02	0.05
EATFTR1	0.09	-0.04	-0.04	0.12	-0.06	-0.06	0.09	-0.04	-0.04	0.12	-0.06	-0.06
EATFTR2	-0.04	0.08	-0.03	-0.06	0.10	-0.04	-0.04	0.09	-0.04	-0.06	0.09	-0.03
EATFTR3	-0.04	-0.03	0.08	-0.06	-0.04	0.10	-0.04	-0.04	0.09	-0.06	-0.03	0.10
EATFCTR1	0.09	-0.04	-0.04	0.11	-0.06	-0.06	0.09	-0.05	-0.05	0.10	-0.05	-0.05
EATFCTR2	-0.04	0.09	-0.05	-0.06	0.08	-0.03	-0.05	0.11	-0.07	-0.05	0.07	-0.02
EATFCTR3	-0.04	-0.05	0.09	-0.06	-0.03	0.08	-0.05	-0.07	0.11	-0.05	-0.02	0.07
EATFCTRCQA1							-0.04	0.02	0.02			
EATFCTRCQA2							0.02	-0.05	0.02			
EATFCTRCQA3							0.02	0.02	-0.05			
EATFGTR1	0.05	-0.02	-0.03	0.10	-0.05	-0.05	0.05	-0.02	-0.02	0.10	-0.05	-0.05
EATFGTR2	-0.02	0.06	-0.03	-0.05	0.10	-0.05	-0.02	0.07	-0.05	-0.05	0.09	-0.04
EATFGTR3	-0.03	-0.03	0.06	-0.05	-0.05	0.10	-0.02	-0.05	0.07	-0.05	-0.04	0.09
TRUSCTR	0.09	-0.05	-0.05				0.09	-0.05	-0.05	-0.05	0.03	0.03
TRUSCTRCQA	-0.08	0.04	0.04				-0.08	0.04	0.04			
TRUSGTR	-0.09	0.04	0.04	-0.08	0.04	0.04	-0.08	0.04	0.04	-0.08	0.04	0.04
TRUSGTRCP	0.11	-0.05	-0.05				0.09	-0.05	-0.05			
TRUSGTRCQA	0.14	-0.07	-0.07				0.16	-0.08	-0.08			
TRUSGTRCPCQA	-0.15	0.08	0.08				-0.19	0.09	0.09			
QUECONCQA	-0.18	0.09	0.09	-0.15	0.07	0.08	-0.15	0.07	0.07	-0.16	0.08	0.08
QUECONCPCQA	0.21	-0.10	-0.10				0.20	-0.10	-0.10			
QUETRCQA	-0.10	0.05	0.05	-0.13	0.07	0.07	-0.09	0.04	0.04	-0.13	0.07	0.07
QUEGTR	-0.16	0.08	0.08				-0.15	0.07	0.07			
QUEGTRCQA	0.17	-0.09	-0.09				0.23	-0.11	-0.11			

ONTCONCQA							-0.11	0.06	0.06			
ONTCONCPCQA	0.25	-0.12	-0.12				0.28	-0.14	-0.14			
ONTGTR							-0.07	0.03	0.04			
MANCTR	0.06	-0.03	-0.03									
MANGTR							-0.07	0.03	0.03			
MANGTRCQA	0.20	-0.10	-0.10				0.21	-0.10	-0.10			
MANGTRCPCQA	-0.17	0.08	0.08				-0.14	0.07	0.07			
SASKCONCPCQA				0.13	-0.07	-0.07				0.10	-0.05	-0.05
SASKTR	-0.09	0.05	0.05				-0.11	0.05	0.05			
SASKTRCQA	0.15	-0.07	-0.07				0.17	-0.09	-0.09			
SASKCTRCPCQA				0.11	-0.05	-0.05				0.09	-0.05	-0.05
SASKGTR				0.10	-0.05	-0.05				0.11	-0.05	-0.06
SASKGTRCQA							0.25	-0.13	-0.13	-0.16	0.08	0.08
ALBGTR							-0.09	0.04	0.05	0.08	-0.04	-0.04
ALBGTRCQA										-0.14	0.07	0.07
BCCONCP				-0.08	0.04	0.04						
BCCONCQA	-0.13	0.06	0.06	-0.12	0.06	0.06	-0.12	0.06	0.06	-0.11	0.06	0.06
BCCONCPCQA	0.24	-0.12	-0.12				0.27	-0.13	-0.13			
BCTR				-0.14	0.07	0.07				-0.13	0.07	0.07
BCCTR				-0.16	0.08	0.08				-0.15	0.07	0.07
BCCTRCP CQA	-0.22	0.11	0.11				-0.18	0.09	0.09			
BCGTR CQA	0.19	-0.09	-0.09				0.23	-0.11	-0.11			
RULCTR				-0.05	0.03	0.03	0.06	-0.03	-0.03			
RULGTRCP				-0.06	0.03	0.03						
NTPCONCP	0.25	-0.13	-0.13	0.33	-0.17	-0.17	0.23	-0.11	-0.12	0.32	-0.16	-0.16

NTPCON CQA	0.16	-0.08	-0.08	0.28	-0.14	-0.14	0.24	-0.12	-0.12	0.23	-0.11	-0.12
NTPCONCP CQA	-0.24	0.12	0.12	-0.30	0.15	0.15	-0.32	0.16	0.16	-0.24	0.12	0.12
NTPTR	0.25	-0.12	-0.12	0.36	-0.18	-0.18	0.25	-0.13	-0.13	0.35	-0.17	-0.17
NTPCTR	0.19	-0.09	-0.09	0.26	-0.13	-0.13	0.12	-0.06	-0.06	0.28	-0.14	-0.14
NTPGTR	0.19	-0.09	-0.10	0.32	-0.16	-0.16	0.18	-0.09	-0.09	0.30	-0.15	-0.15
NTPGTRCP	0.14	-0.07	-0.07							0.08	-0.04	-0.04
MFCONCP				-0.13	0.06	0.06				-0.10	0.05	0.05
MFCTR	-0.16	0.08	0.08	-0.32	0.16	0.16	-0.33	0.16	0.16	-0.20	0.10	0.10
MFCTRCP	-0.22	0.11	0.11	0.18	-0.09	-0.09						
MFGTR	-0.16	0.08	0.08	-0.13	0.06	0.07	-0.21	0.10	0.11	-0.11	0.06	0.06
MCTR	-0.22	0.11	0.11	-0.26	0.13	0.13	-0.23	0.11	0.12	-0.17	0.08	0.08
MCTRCP				0.22	-0.11	-0.11						
MGTR	-0.13	0.06	0.06	-0.09	0.04	0.05	-0.13	0.07	0.07			
MARB1	0.003	-0.002	-0.002	-0.02	0.01	0.01				-0.02	0.01	0.01
AGEMARB11	0.001	-0.001	-0.001									
AGEMARB12	-0.001	0.001	-0.0004									
AGEMARB13	-0.001	-0.0004	0.001									
MANMARB1				0.06	-0.03	-0.03				0.05	-0.02	-0.02
SASKMARB1	-0.06	0.03	0.03	0.05	-0.03	-0.03	-0.07	0.04	0.04	0.05	-0.03	-0.03
ALBMARB1				0.07	-0.04	-0.04				0.06	-0.03	-0.03
NTPMARB1				0.09	-0.05	-0.05				0.10	-0.05	-0.05

Choice A is recorded as choice2, choice B is recorded as choice3, and choice C is recorded as choice1 which was an option of choosing neither A nor B.

Appendix M: Consumer Willingness to Pay for Pork Chops with Different Quality Attributes As Compared To Conventional Pork – Edmonton Sample

GROUP OF RESPONDENTS WHO AGREED THAT TRADITIONALLY RAISED PORK WAS SAFER THAN CONVENTIONAL PORK												
	Gender=1, trust=1, child=1		Gender=0, trust=1, child=1		Gender=1, trust=0, child=1		Gender=0, trust=0, child=1		Gender=1, trust=1, child=0		Gender=0, trust=1, child=0	
Parameter	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
CONCP	9.02	[.013]	2.85	[.370]	9.02	[.013]	2.85	[.370]	9.02	[.013]	2.85	[.370]
CON CQA	7.13	[.090]	4.40	[.286]	3.57	[.456]	0.84	[.869]	7.13	[.090]	4.40	[.286]
CONCP CQA	7.58	[.355]	7.58	[.355]	7.58	[.355]	7.58	[.355]	7.58	[.355]	7.58	[.355]
TR	-3.08	[.279]	-3.08	[.279]	4.54	[.218]	4.54	[.218]	-3.08	[.279]	-3.08	[.279]
TRCP	7.95	[.039]	7.95	[.039]	7.95	[.039]	7.95	[.039]	5.57	[.072]	5.57	[.072]
TR CQA	6.25	[.035]	6.25	[.035]	4.73	[.162]	4.73	[.162]	6.25	[.035]	6.25	[.035]
TRCP CQA	-10.80	[.021]	-10.80	[.021]	-10.80	[.021]	-10.80	[.021]	-10.80	[.021]	-10.80	[.021]
CTR	5.52	[.071]	7.98	[.018]	10.65	[.006]	13.11	[.001]	-1.01	[.715]	1.45	[.588]
CTRCP	0.46	[.875]	0.46	[.875]	0.46	[.875]	0.46	[.875]	0.46	[.875]	0.46	[.875]
CTR CQA	0.31	[.913]	0.31	[.913]	0.31	[.913]	0.31	[.913]	0.31	[.913]	0.31	[.913]
CTRCP CQA	-0.85	[.858]	-0.85	[.858]	-0.85	[.858]	-0.85	[.858]	-0.85	[.858]	-0.85	[.858]
GTR	7.95	[.037]	7.57	[.032]	7.95	[.037]	7.57	[.032]	7.95	[.037]	7.57	[.032]
GTRCP	11.66	[.021]	6.80	[.099]	11.66	[.021]	6.80	[.099]	6.61	[.109]	1.74	[.599]
GTR CQA	4.50	[.185]	4.50	[.185]	4.50	[.185]	4.50	[.185]	4.50	[.185]	4.50	[.185]
GTRCP CQA	-10.58	[.083]	-2.59	[.627]	-10.58	[.083]	-2.59	[.627]	-10.58	[.083]	-2.59	[.627]
GRADE	-0.04	[.374]	-0.04	[.374]	-0.04	[.487]	-0.04	[.487]	-0.04	[.374]	-0.04	[.374]
CL	-0.22	[.243]	-0.22	[.243]	-0.19	[.322]	-0.19	[.322]	-0.16	[.385]	-0.16	[.385]
CA	0.90	[.035]	0.90	[.035]	0.90	[.035]	0.90	[.035]	0.90	[.035]	0.90	[.035]

SF	0.05	[.245]	0.05	[.245]	-0.08	[.182]	-0.08	[.182]	0.05	[.245]	0.05	[.245]
GROUP OF RESPONDENTS WHO DID NOT AGREE THAT TRADITIONALLY RAISED PORK IS SAFER THAN CONVENTIONAL PORK												
	Gender=1, trust=1, child=1		Gender=0, trust=1, child=1		Gender=1, trust=0, child=1		Gender=0, trust=0, child=1		Gender=1, trust=1, child=0		Gender= 0, trust=1, child=0	
Parameter	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
CONCP	4.63	[.069]	8.11	[.003]	4.63	[.069]	8.11	[.003]	4.63	[.069]	8.11	[.003]
CON CQA	1.43	[.673]	3.32	[.301]	9.51	[.015]	11.40	[.007]	1.43	[.673]	3.32	[.301]
CONCP CQA	-4.35	[.355]	-4.35	[.355]	-4.35	[.355]	-4.35	[.355]	-4.35	[.355]	-4.35	[.355]
TR	0.11	[.963]	0.11	[.963]	5.37	[.077]	5.37	[.077]	0.11	[.963]	0.11	[.963]
TRCP	1.27	[.694]	1.27	[.694]	1.27	[.694]	1.27	[.694]	1.60	[.527]	1.60	[.527]
TR CQA	1.57	[.528]	1.57	[.528]	0.23	[.936]	0.23	[.936]	1.57	[.528]	1.57	[.528]
TRCP CQA	-0.42	[.912]	-0.42	[.912]	-0.42	[.912]	-0.42	[.912]	-0.42	[.912]	-0.42	[.912]
CTR	0.10	[.969]	-1.28	[.638]	4.18	[.124]	2.80	[.323]	2.59	[.215]	1.21	[.546]
CTRCP	0.66	[.777]	0.66	[.777]	0.66	[.777]	0.66	[.777]	0.66	[.777]	0.66	[.777]
CTR CQA	5.58	[.026]	5.58	[.026]	5.58	[.026]	5.58	[.026]	5.58	[.026]	5.58	[.026]
CTRCP CQA	-4.61	[.229]	-4.61	[.229]	-4.61	[.229]	-4.61	[.229]	-4.61	[.229]	-4.61	[.229]
GTR	9.25	[.002]	6.81	[.036]	9.25	[.002]	6.81	[.036]	9.25	[.002]	6.81	[.036]
GTRCP	-1.16	[.712]	2.00	[.543]	-1.16	[.712]	2.00	[.543]	0.18	[.947]	3.34	[.253]
GTR CQA	3.61	[.206]	3.61	[.206]	3.61	[.206]	3.61	[.206]	3.61	[.206]	3.61	[.206]
GTRCP CQA	-1.54	[.718]	-2.51	[.561]	-1.54	[.718]	-2.51	[.561]	-1.54	[.718]	-2.51	[.561]
GRADE	-0.10	[.010]	-0.10	[.010]	0.03	[.503]	0.03	[.503]	-0.10	[.010]	-0.10	[.010]
CL	-0.18	[.256]	-0.18	[.256]	-0.46	[.010]	-0.46	[.010]	-0.27	[.078]	-0.27	[.078]
CA	-0.30	[.328]	-0.30	[.328]	-0.30	[.328]	-0.30	[.328]	-0.30	[.328]	-0.30	[.328]
SF	-0.02	[.503]	-0.02	[.503]	-0.08	[.087]	-0.08	[.087]	-0.02	[.503]	-0.02	[.503]

GROUP OF RESPONDENTS WHO AGREED THAT TRADITIONALLY RAISED PORK WAS HEALTHIER THAN CONVENTIONAL PORK												
	Gender=1, trust=1, child=1		Gender=0, trust=1, child=1		Gender=1, trust=0, child=1		Gender=0, trust=0, child=1		Gender=1, trust=1, child=0		Gender= 0, trust=1, child=0	
Parameter	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
CONCP	6.23	[.064]	1.64	[.601]	6.23	[.064]	1.64	[.601]	6.23	[.064]	1.64	[.601]
CON CQA	0.83	[.857]	-1.11	[.772]	1.24	[.789]	-0.69	[.895]	0.83	[.857]	-1.11	[.772]
CONCP CQA	15.17	[.084]	15.17	[.084]	15.17	[.084]	15.17	[.084]	15.17	[.084]	15.17	[.084]
TR	-6.85	[.020]	-6.85	[.020]	4.07	[.242]	4.07	[.242]	-6.85	[.020]	-6.85	[.020]
TRCP	10.29	[.006]	10.29	[.006]	10.29	[.006]	10.29	[.006]	7.66	[.014]	7.66	[.014]
TR CQA	7.78	[.009]	7.78	[.009]	2.85	[.379]	2.85	[.379]	7.78	[.009]	7.78	[.009]
TRCP CQA	-12.50	[.008]	-12.50	[.008]	-12.50	[.008]	-12.50	[.008]	-12.50	[.008]	-12.50	[.008]
CTR	0.28	[.923]	4.21	[.176]	6.95	[.030]	10.88	[.003]	-5.43	[.076]	-1.50	[.545]
CTRCP	2.55	[.394]	2.55	[.394]	2.55	[.394]	2.55	[.394]	2.55	[.394]	2.55	[.394]
CTR CQA	1.39	[.623]	1.39	[.623]	1.39	[.623]	1.39	[.623]	1.39	[.623]	1.39	[.623]
CTRCP CQA	-1.82	[.701]	-1.82	[.701]	-1.82	[.701]	-1.82	[.701]	-1.82	[.701]	-1.82	[.701]
GTR	5.87	[.101]	6.81	[.047]	5.87	[.101]	6.81	[.047]	5.87	[.101]	6.81	[.047]
GTRCP	11.80	[.011]	9.99	[.024]	11.80	[.011]	9.99	[.024]	4.49	[.239]	2.68	[.426]
GTR CQA	4.07	[.224]	4.07	[.224]	4.07	[.224]	4.07	[.224]	4.07	[.224]	4.07	[.224]
GTRCP CQA	-7.29	[.205]	-3.33	[.531]	-7.29	[.205]	-3.33	[.531]	-7.29	[.205]	-3.33	[.531]
GRADE	-0.06	[.225]	-0.06	[.225]	0.05	[.349]	0.05	[.349]	-0.06	[.225]	-0.06	[.225]
CL	-0.15	[.400]	-0.15	[.400]	-0.36	[.078]	-0.36	[.078]	-0.14	[.427]	-0.14	[.427]
CA	0.57	[.142]	0.57	[.142]	0.57	[.142]	0.57	[.142]	0.57	[.142]	0.57	[.142]
SF	0.01	[.861]	0.01	[.861]	-0.11	[.051]	-0.11	[.051]	0.01	[.861]	0.01	[.861]
GROUP OF RESPONDENTS WHO DID NOT AGREE THAT TRADITIONALLY RAISED PORK IS HEALTHIER THAN CONVENTIONAL PORK												

	Gender=1, trust=1, child=1		Gender=0, trust=1, child=1		Gender=1, trust=0, child=1		Gender=0, trust=0, child=1		Gender=1, trust=1, child=0		Gender= 0, trust=1, child=0	
Parameter	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
CONCP	6.22	[.022]	8.62	[.003]	6.22	[.022]	8.62	[.003]	6.22	[.022]	8.62	[.003]
CON CQA	6.97	[.040]	6.74	[.061]	12.47	[.005]	12.24	[.008]	6.97	[.040]	6.74	[.061]
CONCP CQA	-9.75	[.046]	-9.75	[.046]	-9.75	[.046]	-9.75	[.046]	-9.75	[.046]	-9.75	[.046]
TR	1.94	[.446]	1.94	[.446]	4.11	[.199]	4.11	[.199]	1.94	[.446]	1.94	[.446]
TRCP	0.52	[.883]	0.52	[.883]	0.52	[.883]	0.52	[.883]	0.89	[.735]	0.89	[.735]
TR CQA	1.23	[.629]	1.23	[.629]	1.81	[.539]	1.81	[.539]	1.23	[.629]	1.23	[.629]
TRCP CQA	-0.19	[.961]	-0.19	[.961]	-0.19	[.961]	-0.19	[.961]	-0.19	[.961]	-0.19	[.961]
CTR	3.77	[.169]	2.20	[.435]	6.05	[.062]	4.48	[.159]	5.31	[.016]	3.73	[.091]
CTRCP	-1.10	[.646]	-1.10	[.646]	-1.10	[.646]	-1.10	[.646]	-1.10	[.646]	-1.10	[.646]
CTR CQA	5.22	[.044]	5.22	[.044]	5.22	[.044]	5.22	[.044]	5.22	[.044]	5.22	[.044]
CTRCP CQA	-4.16	[.292]	-4.16	[.292]	-4.16	[.292]	-4.16	[.292]	-4.16	[.292]	-4.16	[.292]
GTR	9.16	[.004]	5.75	[.083]	9.16	[.004]	5.75	[.083]	9.16	[.004]	5.75	[.083]
GTRCP	-2.84	[.399]	0.50	[.880]	-2.84	[.399]	0.50	[.880]	0.24	[.933]	3.58	[.226]
GTR CQA	3.38	[.241]	3.38	[.241]	3.38	[.241]	3.38	[.241]	3.38	[.241]	3.38	[.241]
GTRCP CQA	-1.31	[.765]	-1.04	[.811]	-1.31	[.765]	-1.04	[.811]	-1.31	[.765]	-1.04	[.811]
GRADE	-0.09	[.024]	-0.09	[.024]	-0.03	[.511]	-0.03	[.511]	-0.09	[.024]	-0.09	[.024]
CL	-0.22	[.167]	-0.22	[.167]	-0.33	[.070]	-0.33	[.070]	-0.29	[.074]	-0.29	[.074]
CA	-0.23	[.474]	-0.23	[.474]	-0.23	[.474]	-0.23	[.474]	-0.23	[.474]	-0.23	[.474]
SF	0.01	[.875]	0.01	[.875]	-0.06	[.203]	-0.06	[.203]	0.01	[.875]	0.01	[.875]

Appendix N: Consumer Willingness to Pay for Pork Chops with Different Quality Attributes As Compared To Conventional Pork – National Sample

GROUP OF RESPONDENTS WHO AGREED THAT TRADITIONALLY RAISED PORK IS SAFER THAN CONVENTIONAL PORK								
	Ontario=1, Gender=1, Rural=1,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=0, Rural=1,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=0,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=0, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, Trust=0, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, Trust=1, Not eat pork=0, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=0, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=0
CONCP	-3.90	-3.90	-3.90	-0.07	-3.90	3.19	-5.61*	-3.90
CON CQA	1.56	1.56	1.56	1.56	1.56	9.12***	1.56	1.56
CONCP CQA	4.37	4.55	4.37	4.37	4.37	-6.20**	4.37	4.37
TR	-3.33*	-2.90	-3.33*	-3.33*	-3.33*	3.99***	-3.33*	-3.33*
TRCP	5.00***	5.00***	5.00***	7.14***	5.00***	5.00***	5.00***	5.00***
TR CQA	8.35***	8.35***	8.35***	8.35***	8.35***	8.35***	8.35***	6.14***
TRCP CQA	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.03
CTR	11.18***	11.18***	13.18***	12.98***	14.56***	15.04***	1.06	-0.93
CTRCP	5.14	5.14	5.14	5.14	5.14	5.14	2.20	5.11***
CTR CQA	5.52***	5.52***	5.52***	5.52***	2.74**	5.52***	5.52***	5.52***
CTRCP CQA	-0.53	-2.69	-0.53	-0.53	-0.53	-0.53	-0.53	-0.53

GTR	13.79***	13.79***	13.79***	13.79***	10.24***	20.18***	6.16**	6.35***
GTRCP	-0.25	-0.25	-2.29	2.52	2.90	2.74	-0.25	-0.25
GTR CQA	-2.78	-2.78	-2.08	-2.78	1.81	-2.78	-2.78	-2.78
GTRCP CQA	7.27***	7.27***	7.27***	7.27***	0.43	7.27***	7.27***	7.27***
MARB1	-0.06	-0.16	-0.06	-0.06	-0.06	-0.70	-0.06	-0.06
GROUP OF RESPONDENTS WHO DID NOT AGREE THAT TRADITIONALLY RAISED PORK IS SAFER THAN CONVENTIONAL PORK								
	Ontario=1, Gender=1, Rural=1,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=0, Rural=1,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=0,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=0, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, Trust=0, Not eat pork=1, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, Trust=1, Not eat pork=0, Eat meat and fish=1, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=0, Eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, Trust=1, Not eat pork=1, Eat meat and fish=1, Eat meat=0
CONCP	-2.13	-2.13	-2.13	-2.63	-2.13	6.09***	-4.51**	-2.13
CON CQA	-2.67	-2.67	-2.67	-2.67	-2.67	3.03**	-2.67	-2.67
CONCP CQA	5.90**	5.72**	5.90**	5.90**	5.90**	-0.07	5.90**	5.90**
TR	-5.55***	-4.41***	-5.55***	-5.55***	-5.55***	3.53***	-5.55***	-5.55***
TRCP	3.66***	3.66***	3.66***	3.43***	3.66***	3.66***	3.66***	3.66***
TR CQA	1.64	1.64	1.64	1.64	1.64	1.64	1.64	2.58***
TRCP CQA	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	1.44
CTR	2.02	2.02	0.79	1.53	0.71	9.28***	-3.02*	-2.14
CTRCP	3.07	3.07	3.07	3.07	3.07	3.07	5.66***	5.89***
CTR CQA	5.33***	5.33***	5.33***	5.33***	5.55***	5.33***	5.33***	5.33***

CTRCP CQA	-0.27	-3.83***	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27
GTR	3.66*	3.66*	3.66*	3.66*	1.52	11.22***	0.79	1.52
GTRCP	3.39**	3.39**	2.49*	3.02**	3.85**	5.37***	3.39**	3.39**
GTR CQA	-0.73	-0.73	-2.13	-0.73	-0.24	-0.73	-0.73	-0.73
GTRCP CQA	3.50**	3.50**	3.50**	3.50**	3.37***	3.50**	3.50**	3.50**
MARB1	-0.52	-1.15*	-0.52	-0.52	-0.52	1.96***	-0.52	-0.52
GROUP OF RESPONDENTS WHO AGREED THAT TRADITIONALLY RAISED PORK IS HEALTHIER THAN CONVENTIONAL PORK								
	Ontario=1, Gender=1, Rural=1,Child=1, trust=1, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=0, Rural=1,Child=1, trust=1, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=0,Child=1, trust=1, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=1,Child=0, trust=1, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, trust=0, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, trust=1, not eat pork=0, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, trust=1, not eat pork=1, eat meat and fish=0, eat meat=1	Ontario=1, Gender=1, Rural=1,Child=1, trust=1, not eat pork=1, eat meat and fish=1, eat meat=0
CONCP	-4.90*	-4.90*	-4.90*	-1.41	-4.90*	2.19	-5.09*	-4.90*
CON CQA	2.01	2.01	2.01	2.01	2.01	6.78***	2.01	2.01
CONCP CQA	2.12	2.23	2.12	2.12	2.12	-4.61*	2.12	2.12
TR	-3.53*	-3.01	-3.53*	-3.53*	-3.53*	3.26***	-3.53*	-3.53*
TRCP	4.22***	4.22***	4.22***	6.31***	4.22***	4.22***	4.22***	4.22***
TR CQA	6.42***	6.42***	6.42***	6.42***	6.42***	6.42***	6.42***	4.83***
TRCP CQA	1.68	1.68	1.68	1.68	1.68	1.68	1.68	0.58
CTR	5.68	5.68	7.02**	7.10**	8.56**	11.02***	0.95	-2.66
CTRCP	8.78**	8.78**	8.78**	8.78**	8.78**	8.78**	2.67	4.75***

CTR CQA	5.17***	5.17***	5.17***	5.17***	2.74**	5.17***	5.17***	5.17***
CTRCP CQA	-0.21	-2.64*	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21
GTR	8.07***	8.07***	8.07***	8.07***	5.06*	13.81***	3.10	3.09
GTRCP	-2.53	-2.53	-3.38	0.97	0.74	1.58	-2.53	-2.53
GTR CQA	0.13	0.13	-0.54	0.13	3.92*	0.13	0.13	0.13
GTRCP CQA	5.68***	5.68***	5.68***	5.68***	0.87	5.68***	5.68***	5.68***
MARB1	-0.46	-0.78	-0.46	-0.46	-0.46	-0.37	-0.46	-0.46
GROUP OF RESPONDENTS WHO DID NOT AGREE THAT TRADITIONALLY RAISED PORK IS HEALTHIER THAN CONVENTIONAL PORK								
	Ontario=1, Gender=1, Rural=1,Child= 1, trust=1, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=0, Rural=1,Child= 1, trust=1, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=0,Child= 1, trust=1, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=1,Child= 0, trust=1, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=1,Child= 1, trust=0, not eat pork=1, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=1,Child= 1, trust=1, not eat pork=0, eat meat and fish=1, eat meat=1	Ontario=1, Gender=1, Rural=1,Child= 1, trust=1, not eat pork=1, eat meat and fish=0, eat meat=1	Ontario=1, Gender=1, Rural=1,Child= 1, trust=1, not eat pork=1, eat meat and fish=1, eat meat=0
CONCP	-1.71	-1.71	-1.71	-2.25	-1.71	6.79***	-4.90**	-1.71
CON CQA	-2.88	-2.88	-2.88	-2.88	-2.88	4.06**	-2.88	-2.88
CONCP CQA	6.84**	6.86**	6.84**	6.84**	6.84**	-0.83	6.84**	6.84**
TR	-5.80***	-4.63***	-5.80***	-5.80***	-5.80***	3.76***	-5.80***	-5.80***
TRCP	4.06***	4.06***	4.06***	3.66***	4.06***	4.06***	4.06***	4.06***
TR CQA	2.20	2.20	2.20	2.20	2.20	2.20	2.20	3.12***
TRCP CQA	-2.24	-2.24	-2.24	-2.24	-2.24	-2.24	-2.24	0.60

CTR	5.39*	5.39*	4.14	4.75	4.22	12.18***	-3.12*	-1.34
CTRCP	0.36	0.36	0.36	0.36	0.36	0.36	5.84***	6.16***
CTR CQA	5.50***	5.50***	5.50***	5.50***	5.76***	5.50***	5.50***	5.50***
CTRCP CQA	-0.36	-3.82***	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
GTR	5.59**	5.59**	5.59**	5.59**	3.38	13.75***	2.18	3.02*
GTRCP	4.96***	4.96***	3.39**	3.94**	5.02***	6.30***	4.96***	4.96***
GTR CQA	-2.63	-2.63	-3.23**	-2.63	-1.94	-2.63	-2.63	-2.63
GTRCP CQA	4.06***	4.06***	4.06***	4.06***	3.47***	4.06***	4.06***	4.06***
MARB1	-0.35	-0.88	-0.35	-0.35	-0.35	1.92***	-0.35	-0.35

*** 1% significance level; ** 5% significance level; * 10% significance level.