ESSAYS IN MODELING INDIVIDUAL PREFERENCES

By

ARMENAK MARKOSYAN

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

DOCTOR OF PHILOSOPHY

WASHINGTON STATE UNIVERSITY
School of Economic Sciences

AUGUST 2009

To the Faculty of Washington State University:

The members of the Committee appointed to examine the dissertation of ARMENAK MARKOSYAN find it satisfactory and recommend that it be accepted.

_____
Dr. Jill J. McCluskey, Chair

_____
Dr. Thomas L. Marsh

_____
Dr. Hayley H. Chouinard

ACKNOWLEDGMENT

First and foremost, my deepest gratitude goes to my advisor Professor Jill McCluskey for guiding me in this dissertation and for her enormous support and patience in all aspects of my studies and career. Dr. McCluskey is truly the best advisor I could have ever wished for. I am also very grateful to my committee members Dr. Tom Marsh and Dr. Hayley Chouinard for their support, patience, guidance, and significantly improving my critical thinking in research. Special thanks to Dr. Ron Mittelhammer for having his door open, for all the advices, and for serving on my Masters' in Statistics committee. I also gratefully acknowledge the financial support from the IMPACT center and Dr. Tom Wahl for providing me opportunities to apply theory to real world problems. Thanks to Charlie Hochsprung for her kind support all these years. Special thanks to Dr. Richard Shumway for offering me to join the graduate program at WSU.

I would like to thank people who made my presence at WSU possible. My deepest gratitude goes to Dr. Verne House, who recommended me for WSU, and Dr. Daniel Dunn, who, along with Dr. House, provided me with tremendous support in my journey from Yerevan to Pullman. I would also like to expresses my deepest gratitude to Dr. James Barron and Karen Barron who had an immense contribution to my graduate student experience.

I would like to thank the entire faculty of the School of Economic Sciences particularly all my instructors that are too many too list, for maintaining a wonderful academic environment and keeping their doors open for graduate students like me. Also, thanks to all my graduate school peers and friends.

This dissertation is dedicated to my parents, Svetlana Karapetyan and Harutyoun Markosyan, who supported me throughout my life.

Go Cougs!!!

ESSAYS IN MODELING INDIVIDUAL PREFERENCES

Abstract

by Armenak Markosyan, Ph.D.
Washington State University
August 2009

Chair: Jill J. McCluskey

This dissertation includes three essays modeling the effect of information on individual preferences. The first article develops a theoretical model to consider the tradeoff between enhanced quality and perceived risk associated with consumption of new technology foods. Although consumers in general have positive feelings towards functional foods, many are still not willing to purchase them even with a significant discount. In this paper, I model the choice of functional foods in a utility theoretic framework to study the effect of different types of information on demand for such foods by consumers with heterogeneous perceived risk and quality preferences.

The second study is an empirical analysis of consumers' response to new technology with a product-enhancing attribute. This article measures consumers' responses to apples enriched with an antioxidant coating. Antioxidant-enriched apples are believed to provide additional health benefits reducing the risk of cancer and heart diseases. Consumer surveys with contingent valuation questions were conducted in Seattle and Spokane, Washington in 2006. A key result is that organic consumers are less likely to buy apples with this new technology than consumers in Seattle. Information regarding the potential health benefits of antioxidants has a positive significant effect on consumers' willingness to pay. The estimated mean willingness to pay suggests that there is a small premium associated with this product in the mind of an average consumer.

The third article is a political economy study which analyzes determinants of individual preferences for trade policies. This article analyzes individual preferences for trade policy instruments by constituents of special interest groups and provides new determinants of those preferences. The results suggest that individuals with high levels of human and physical capital are more likely to support free-trade policies and oppose trade-restricting ones. The choice of specific free-trade of trade-restricting policies depends on sector of production. In addition, we suggest that individuals with close ties with government are likely to supporting government in choosing the policy instruments regardless of the other factors. Finally, individuals who rely on mass media for trade-related information tend to shift their preferences towards protectionist policies.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES AND FIGURES

CHAPTER ONE

INTRODUCTION

Preferences for New Technology Foods

Technological advances in the food industry resulted in a large variety of foods made with the use of new technology being sold in the marketplace. These products sometimes referred to as novel or functional foods, are designed with enhanced nutritional value and health benefits. Interest in functional foods has been growing due to higher health care costs; new legislation expanding the category of dietary supplements; and recent scientific discoveries linking dietary habits with the development of many diseases, including coronary heart disease and some cancers (Milner, 2000). Functional food is broadly defined as any food or food components that provide health benefit beyond basic nutrition (Institute of Food Technologies, 2005). Products such as high-fiber breakfast cereals, orange juice with added calcium, vitamin-fortified milk, and vitamin-enriched diet coke and water are now widely available in grocery stores.

The functional food category has been growing rapidly over the last decade. U.S. sales of functional foods grew from $11.3 billion in 1995 to $18.5 billion in 2001. This accounts for 3.7% of the total food sales. The sales are projected to reach $49 billion by 2010 (U.S. General Accounting Office, 2000). Despite the rapid growth, functional foods are not specifically defined under American law. The U.S. Food and Drug Administration (FDA) regulates functional foods under the same framework as conventional foods. The FDA has neither a definition nor a specific regulatory framework for foods marketed as functional foods. Apart from the FDA, the Federal Trade Commission regulates health claims made in advertising of food products. The regulation of functional foods provides policy challenges arising from

information asymmetry. Issues considered in developing policies include factors influencing consumer preferences for these products and uncertainties in the markets for them (Veeman, 2002). Hobbs (2002) points out regulatory uncertainty and credibility as important challenges that nutraceuticals and functional food industry faced in using labels as quality signals.

The impact of functional foods may be quite positive. As an example, Malla et al (2007) estimate the value of potential health benefits of a functional food product, Trans fat-free canola oil. They conclude that there is a significant impact of trans-fatty acids on coronary heart disease costs. Under different scenarios, they estimate the potential reduction in coronary heart disease cost to be between roughly CAD$54 million to CAD$440 million.

Although one might expect for consumers to embrace the positive health benefits, some may reject functional food products because they utilize new technology, which they feel is risky. Other consumers prefer to consume "natural" foods whenever possible. Although most consumers have positive feelings towards the health benefits associated with functional foods, many may still not be willing to purchase them, even with a significant discount. These consumers describe functional foods as "unnatural" and "potentially unsafe."

Two essays in this dissertation investigate the consumer preferences and markets for foods made with new technology both in a theoretic and empirical framework.

Preference for Trade Policies

What drives policy-makers to choose one trade policy direction over another? Why do policy-makers often choose to implement protectionist policies in times when economists widely agree on the benefits of free-trade? These are some of the questions that political scientists, trade theorists, and economists have continuously been asking. The need to study trade policies is

apparent. Trade policies affect nearly every area of the economy and are believed to have major long-term effects on growth and development. Understanding the entire trade policy development process is a challenging task. Trade policies are formed under the influence of numerous forces and factors including pressure from interest groups, foreign policy developments, domestic economic conditions, and the political environment.

Individual trade policy preferences are believed to be an integral part of the trade policy making process where policies emerge as an equilibrium outcome of individuals' demand and government institutions' supply of trade policies. Therefore, to fully understand trade policy developments, we must first enhance our knowledge of the determinants of trade policy preferences among the individuals comprising major interest groups and identify the factors that drive those preferences. For example, what factors are likely to form a support base towards trade-restricting policies like use of tariffs, anti-dumping laws, and export subsidies; or what factors are likely to form a support base toward free-trade policies such as reduction of non-tariff and tariff barriers and/or elimination of subsidies? The third article in this dissertation contributes to the overall knowledge base of trade policy formation by answering these questions and providing new determinants of trade policy preferences.

Dissertation Format

This dissertation includes three essays modeling the effect of information on individual preferences. Chapter 2 develops a theoretical model to consider the tradeoff between enhanced quality and perceived risk associated with consumption of new technology foods. In this paper, I model the choice of functional foods in a utility theoretic framework to study the effect of different types of information on demand for such foods by consumers with heterogeneous perceived risk and quality preferences. Chapter 3 is an empirical analysis of consumers' response to new technology with a product-enhancing attribute. The

product in question is antioxidant-enriched apple, which is believed to provide additional health benefits reducing the risk of cancer and heart diseases. This article measures consumers' responses to apples enriched with an antioxidant coating using an original survey dataset with contingent valuation. Chapter 4 is a political economy study which analyzes determinants of individual preferences for trade policies. This article analyzes individual preferences for trade policy instruments by constituents of special interest groups and provides new determinants of those preferences.

Summary of Findings

In Chapter 2, results suggest that novel foods cannot drive traditional foods out of the market. However, under certain conditions, as firms increase their promotion efforts and the government increases its' monitoring effort, the quantity of traditional food in the market will decrease and the quantity of novel food in the market will increase. On the other hand, the demand for novel foods can become zero if the difference in the perceived nutritional value between novel and traditional foods is less than or equal to the sum of the average perceived risk and the price premium for the novel foods. Novel foods can disappear from the market if the negative information drives the perceived nutritional value of novel foods below the level of average perceived risk plus the price premium.

In chapter 3, a key result is that organic consumers are less likely to buy apples with this new technology. Information regarding the potential health benefits of antioxidants has a positive significant effect on consumers' willingness to pay. The estimated mean willingness to pay suggests that there is a small premium associated with this product in the mind of an average consumer.

In chapter 4, we find evidence to suggest that individual preferences for trade policies depend on their human capital and physical capital endowments, sector of production, as well as ties to the government and main information sources. The results suggest that individuals with high levels of human and physical capital are more likely to support free-trade policies and oppose trade-restricting ones. The choice of specific free-trade of trade-restricting policies depends on sector of production. In addition, we suggest that individuals with close ties with government are likely to supporting government in choosing the policy instruments regardless of the other factors. Finally, individuals who rely on mass media for trade-related information tend to shift their preferences towards protectionist policies.

REFERENCE:

Hobbs, J. E. 2002. Evolving Supply Chains in the Nutraceuticals and Functional Foods Industry. *Canadian Journal of Agricultural Economics* 50(4): 559-568.

Institute of Food Technologists. 2005. *Functional Foods: Opportunities and Challenges.* *http://members.ift.org/IFT/Research/IFTExpertReports/functionalfoods_report.htm*. (Accessed 11/21/07).

Malla, S., J.E. Hobbs, and O. Perger. 2007. Valuing the Health Benefits of a Novel Functional Food. *Canadian Journal of Agricultural Economics* 55 (1): 115–136.

Veeman, M. 2002. Policy Development for novel Foods: Issues and Challenges for Functional Food. *Canadian Journal of Agricultural Economics* 50 (4): 527–539.

CHAPTER TWO

ENHANCED QUALITY VERSUS PERCIEVED RISK OF NEW TECHNOLOGY: THE ROLE OF INFORMATION

Summary:

This article investigates the impact of the introduction of food products that use new technology. We model consumer choice of these food products in a vertical product differentiation framework with heterogeneous consumers. We incorporate enhanced nutritional value and consumers' perceived risk of the new technology. The perceived risk is a function of the firm's public relations efforts reflected in the mass media, the government's monitoring efforts, and negative news shocks. Firms are heterogeneous in the effectiveness of their public relations efforts with the media. Our results suggest that emergence of new technology foods will likely to decrease the quantity of traditional foods in the market, however, does not have the ability to drive the traditional foods out of the market. We find that increase in government spending to monitor and certify the new technology foods will increase the quantity of new technology food products in the market with diminishing returns.

INTRODUCTION

Developments in food technology have brought new generations of food products into the market. These new products, referred to as "functional foods" or "novel foods," are heavily marketed with claims of significant health benefits via additional nutrition and prevention of diseases. The category of functional food is broadly defined as any food or food components that provide health benefit beyond basic nutrition (Institute of Food Technologies, 2005). Products such as high-fiber breakfast cereals, orange juice with added calcium, vitamin-fortified milk, and vitamin-enriched diet coke and water are now widely available in grocery stores. Interest in functional foods has been growing due to higher health care costs; new legislation expanding the category of dietary supplements; and scientific discoveries linking dietary habits with the development of many diseases, including coronary heart disease and some cancers (Milner, 2000).

Although one might expect for consumers to embrace the positive health benefits from functional foods, some may reject these products because they utilize new technology, which they feel is risky. Although most consumers have positive feelings towards the health benefits associated with functional foods, many may still not be willing to purchase them, even with a significant discount. Lack of public acceptance of genetically modified (GM) food products is well documented and has resulted in reduced or curbed demand for GM food products (McCluskey et al 2006). Consumer skepticism is usually attributed to the unknown environmental and health consequences of genetically modified crops. It has also been shown that information affects the attitudes towards GM foods.

Many researchers have investigated the effects of risk (e.g. Flynn et al 1998; Smith and Johnson, 1988; Rogers, 1997; Gegax et al, 1991). A series of studies is dedicated to analyzing consumer preferences for new technology perceived as risky and the effects of information on their preferences (e.g. Johnson, 1988; Nayga et al 2004; Bord and O'Connor, 1990). In the industrial organization literature, Farrell and Saloner (1985) analyze a two-stage game of technology adoption by consumers with varying appreciation of technology in the presence of network externalities.

The introduction of foods produced with use of new technology creates a demand by economic agents for information as they make decisions on their adoption and use (Huffman et. al., 2004). Empirical studies have found that information can affect consumer preferences for new technology. Markosyan et. al. (2009) find that offering a statement regarding the potential health benefits of a functional food product has a positive and significant effect on consumers' willingness to pay for that product. For GM foods, the empirical literature finds evidence that both positive and negative information affects preferences for GM foods (e.g. Hu, Zhou, and Ding, 2005; Anand et. al., 2007; Lusk et. al., 2004). Rousu *et al*. (2004) conducted an experimental auction to elicit consumers' willingness to pay for GM foods under different information regimes. They find information from interested parties and third-party sources has a strong impact on willingness to pay and that show individuals place a greater weight on negative information than on positive information.

Industry leaders in agricultural biotechnology, like Monsanto, Syngenta, and the Council on Biotechnology Information (CBI) have been continuously spreading positive information through media and other outlets regarding claiming significant beneficial effects of the GM

crops, from lowering food costs to improving the environment (Hoban, 2001). On the other hand, consumer groups have been actively disseminating information regarding potential negative impact of such products, such as uncertain health effects and environmental impact (Huffman et. al., 2004). In fact, Huffman et. al. (2004) identify most reliable sources of information in the public opinion as university research, government, and media. To this extent, we model both consumers' risk perceptions as well as their valuation of enhanced nutrition from new technology as functions positive industry information through media outlets, government information, and negative information shock.

This article models consumer choice of these food products in a vertical differentiation framework in which consumers choose between functional foods and traditional foods. In addition, we incorporate outside information effect into the model as factors that influence perceived risk of new technology and benefits from nutritional value. We investigate market effects of the introduction of food products that are *enhanced* through the use of new technology. The novel foods are differentiated by enhanced nutritional value. We allow for consumers to be heterogeneous in their risk attitudes toward new technology.

This article builds on several previous studies which have analyzed markets for food products made with new technology. Fulton and Giannakas (2004) examine the market and welfare effects of different labeling and regulatory regimes for genetically modified (GM) food products. Their results suggest that the introduction of GM technologies is likely to result in a conflict between consumers, producers, and life science companies. Consumer welfare decreases when the aversion to GM products and the costs of segregating the GM and the non-GM product are high. Producer welfare may also decrease as a result of introduction of GM

food partly due to consumer aversion and partly due to life science companies who price the GM seed so that the GM technology is not fully adopted. Similarly, Lapan and Moschini (2005) investigate grading, minimum quality standards, and labeling of GM foods in a vertical product differentiation framework with a purity level for non-GM products. They find that a purity level that is too high leads to the disappearance of non-GM products, and that some quality standards benefits farmers.

Giannakas and Yiannaka (2008) examine a similar problem with second-generation, consumer-oriented GM products. They introduce a value that consumers place on these new technology foods. Their results suggest that the introduction of consumer-oriented new technology foods will affect the markets for regular GM, conventional, and organic products based on consumers' valuation of the new technology attributes. As this valuation increases, the new GM foods attract more consumers who switch from other products. The authors suggest that there is a threshold in consumers' valuation level at which the new GM foods dominate the market and drive first-generation GM's, conventional products, and organic products out of the market.

This article contributes to the economic literature on markets for food products made with new technology in two ways. Although many studies point out the generally high level of consumer aversion to new technology foods (Lusk and Coble, 2005; Fulton and Giannakas, 2004), ours is the first analysis to combine risk aversion associated with consumption of new technology food products and vertical product differentiation from nutritional enhancement. Next, we include the effect of information on consumers' valuation and risk perception towards new technology foods.

The article proceeds as follows. In the next section, we present a model of vertical product differentiation with a perceived risk parameter. Then, we analyze the effect of information on the market for novel and traditional foods and welfare. The article ends with conclusions and discussion.

THE MODEL

We consider a homogenous food product, *x*. New technology makes it possible to nutritionally augment the product to an amount $v_F > v_T \geq 0$, where v_T is the nutritional benefit from the traditional food product. Let c_T and c_F denote the costs of firm costs of traditional and functional food production, respectively. Following Mussa and Rosen (1978), we assume the costs associated with nutritional augmentation are fixed, and $c_T < c_F$.

We derive the relevant customer utility function for the nutritionally augmented foods. We consider both the good itself *x*, and consumer wealth *w*, product prices, consumer willingness to pay for the product, which is based on the degree to which they value nutritional augmentation and the perceived risk of new technology. Consumers prefer products with higher levels of nutrition and derive utility from knowing that consuming a nutritious diet will result in health benefits. However, this benefit may be diminished by the consumers' perceived risk of this new technology, functional foods. Following Mussa and Rosen (1978), consumers vary in their abilities to purchase such products because their personal wealth endowments differ. Accordingly, the utility function for traditional food is characterized as follows:

(1) $$U_T = w - \frac{1}{\theta(w)} p_T + v_T$$

where *w* is wealth, the price of traditional food is denoted as p_T. We assume that wealth is uniformly distributed on the interval $[\underline{w}, \overline{w}]$, which implies that θ is uniformly distributed over $[\underline{\theta}, \overline{\theta}]$ where $\underline{\theta} = \theta(\underline{w})$ and $\overline{\theta} = \theta(\overline{w})$. One can interpret $\frac{1}{\theta(w)}$ as the marginal utility of wealth. The utility function for the functional food product is characterized as:

(2) $$U_F = w - \frac{1}{\theta(w)} p_F - \overline{R}(m|g,n,\psi) + v_F$$

Where as p_F is the price of the functional food product, v_F is the nutritional benefit from the functional food product and by definition $v_F > v_T$. The function $\overline{R}(m|g,n,\psi)$ is the average perceived risk from consuming the functional foods, and we assume that $\frac{\partial \overline{R}}{\partial m} < 0 \; and \; \frac{\partial^2 \overline{R}}{\partial m^2} > 0$, $\frac{\partial \overline{R}}{\partial n} > 0 \; and \; \frac{\partial^2 \overline{R}}{\partial n^2} > 0$ and $\frac{\partial \overline{R}}{\partial g} < 0 \; and \; \frac{\partial^2 \overline{R}}{\partial g^2} > 0$. The average perceived risk is a function of positive information based on the firm's public relations efforts reflected in the mass media, *m*, and the government's monitoring efforts, *g*, and negative news shocks, *n*. These latter two

variables are exogenous to the firm for the purposes of the current analysis.[1] The parameter ψ_i is the exogenous firm type and is uniformly distributed on the unit interval. This parameter represents that producers are heterogeneous in the effectiveness of their public relations efforts with the media. Without loss of generality, we assume that $\psi_1 > \psi_2$, which means that firm 1's information dissemination to the media is more effective in changing the public's opinion. We denote $\bar{R}_1(m_1 \mid g, n, \psi_1)$ as the average risk when only firm 1 produces functional food and invests in promotion, $\bar{R}_2(m_2 \mid g, n, \psi_2)$ as the average risk when only firm 2 produces functional food.

Several studies find that subjective probabilities of risks and benefits associated with biotechnology in foods are functions of the level of consumer trust in government regulators regarding food supply safety, attitudes toward scientific discovery, and, importantly, the influence of media coverage (Caswell, 2000; Curtis et al., 2004; and Nelson, 2001).

The marginal utility associated with each product varies for different consumers due to the marginal utility of consumer wealth. Consumers can always get zero utility from consuming nothing. Consistent with Mussa and Rosen (1978), we cast the maximization of utility as analogous to maximizing surplus that would accrue due to purchasing a unit of *x*, given by $v_i - I_F \bar{R} - \frac{p_i}{\theta(w)}$, where *i* = *F, T,* and I_F indicates whether the product utilizes new technology and I_T is equal to zero.

Each firm's market share can be calculated based on θ. Accordingly, let $S_i(\theta)$ be the surplus that is generated to a consumer who buys product *i* = T, F. Let Θ_i consist of the share of

[1] Although it is beyond the scope of the current analysis, it would be interesting to consider lobbying as a variable that affects government actions.

consumers purchasing products from firm *i*. We model the market share of the firm *i*, μ_i, with the following expression

(3) $$\mu_i \equiv \int_{\Theta i} dF(\theta),$$

where F(θ) represents the distribution function of θ. The interval for Θ_T is [θ_T, θ_F], and the interval for Θ_F is [θ_F, $\bar{\theta}$]. For the consumers that fall in the range of θ_T to θ_F, the net surplus will be greater for traditional foods. Between θ_F and $\bar{\theta}$, the net surplus will be greater for traditional foods. Solving for θ when $S_T = 0$ *and* $S_T = S_F$, we obtain the expressions for θ_T and θ_F:

(4) $$\theta_T = \frac{p_T}{v_T},$$

(5) $$\theta_F = \frac{p_F - p_T}{v_F - v_T - \bar{R}}.$$

The firms in our analysis play a two-stage game. In this model, the firms compete on price and nutritional augmentation and they can invest in public relations efforts that affect consumers' perceived risk of functional foods. A similar model is developed by Aurora and Gangopadhyay (1995).

CHOICE OF PRICES

In the first stage of our game, firms choose the level of nutritional augmentation and public relations efforts, and in the second stage, firms choose prices. To obtain sub-game perfection, we solve the second stage first. Firm *i*'s profits in the second stage given v_F , v_T , and *m*, is then

(6) $$\pi_F = p_F \int_{\theta_F}^{\bar{\theta}} dF(\theta) - m - c_F$$

(7) $$\pi_T = p_T \int_{\theta_T}^{\theta_F} dF(\theta) - c_T .$$

We define the relevant market segment in terms of the range $N \equiv [\bar{\theta} - \underline{\theta}]$. Since, by assumption, θ is uniformly distributed over $[\underline{\theta}, \bar{\theta}]$,

(8) $$\pi_F = \frac{p_F[\bar{\theta}(v_F - v_T - \bar{R}) - p_F + p_T]}{N(v_F - v_T - \bar{R})} - m - c_F$$

(9) $$\pi_T = \frac{p_T\left(p_F v_T - p_T\left(v_F - \bar{R}\right)\right)}{N(v_F - v_T - \bar{R})v_T} - c_T .$$

By differentiating the firm objective functions with respect to price, we consider p_F and p_T respectively and set each equal to zero. By solving for the equilibrium in the second stage of our game, we find that

(10) $$p_F = \frac{2\bar{\theta}(v_F - \overline{R} - v_T)\left(v_F - \overline{R}\right)}{4\left(v_F - \overline{R}\right) - v_T}$$

(11) $$p_T = \frac{\bar{\theta}(v_F - \overline{R} - v_T)v_T}{4\left(v_F - \overline{R}\right) - v_T}.$$

From these equilibrium prices, we obtain our first result. Typically, researchers assume that new products with enhanced attributes will obtain a premium price in the market. Here we show that any premium price depends on relative value to consumers of the attribute weighed against the disutility from perceived risk.

Proposition 1: The price of the functional food will be greater than the traditional food if the average perceived risk is not too large relative to the marginal nutritional benefit from the enhanced attribute.

Proof: Subtracting equation 11 from equation 10, we obtain p_F - p_T, which is positive if $\left(v_F - \overline{R} - v_T\right)\left(2\left(v_F - \overline{R}\right) - v_T\right) > 0$. If $\left(v_F - \overline{R} - v_T\right) > 0$, it sufficient for this expression to be positive. The expression $v_F - v_T - \overline{R}$ is the marginal nutritional benefit less the perceived risk from the enhanced attribute.

CHOICE OF TECHNOLOGY AND INFORMATION DISSEMINATION

Given the prices chosen in the second stage of the game, each firm chooses to produce functional food, traditional food, or nothing in the first stage. If the firm produces functional food, it must also choose *m*, the level of information dissemination in the form of public relations released to the media. Utilizing Equations 11 and 12, the profit equations can be expressed as the following:

$$\pi_F\left(v_F, v_T; \bar{R}\right) = \frac{4\bar{\theta^2}\left(v_F - \bar{R}\right)^2 (v_F - \bar{R} - v_T)}{N\left(4\left(v_F - \bar{R}\right) - v_T\right)^2} - m - c_F \tag{12}$$

$$\pi_T\left(v_F, v_T; \bar{R}\right) = \frac{\bar{\theta^2}\left(v_F - \bar{R}\right) v_T\left(v_F - \bar{R} - v_T\right)}{N\left(4\left(v_F - \bar{R}\right) - v_T\right)^2} - c_T. \tag{13}$$

By differentiating Equation 12 with respect to *m*, one can solve for the optimal level of *m* for each firm:

$$m_i^* = m^*(\psi_i, n, g, v_F, v_T, \bar{\theta}) \tag{14}$$

We can plug m^* into π_F *and* π_T to obtain the profit functions with m_i^*. In order to obtain a Nash equilibrium, each firm must maximize profits, given the other firm's choices. The choice of v_1, v_2 in equilibrium is denoted as v_1^*, v_2^*.

$$\pi_1(v_1^*, v_2^*) \geq \pi_1(v_1, v_2^*) \quad \forall v_1 \in \{v_F, v_T\}, \tag{15}$$

$$\pi_2(v_1^*, v_2^*) \geq \pi_2(v_1^*, v_2) \quad \forall v_2 \in \{v_F, v_T\}.$$

There are four possible cases of pure-strategy Nash Equilibria: 1) $\{v_F, v_T\}$, 2), $\{v_T, v_F\}$ 3) $\{v_T, v_T\}$, and 4) $\{v_F, v_F\}$, where the first element in the set is firm 1's choice and the second is firm 2's choice and one possible family of mixed strategies, which, if exists, mixes between the first two pure-strategy Nash Equilibria: $\{v_F, v_T\}$ and $\{v_T, v_F\}$.

As mentioned above, the Nash equilibrium is obtained when a firm maximizes the profit given the other firms' action. In a Bertrand competition, since firms in price, choosing the same product will result in zero profits. Thus, firms differentiate themselves so that $\{v_F, v_F\}$ and $\{v_T, v_T\}$ will not occur in the equilibrium.

Proposition 2: Both functional food and traditional food will exist in the market so long as the relative perceived risk is low with respect to the nutritional value of the functional food.

Proof: Suppose firm 1 chooses functional food then firm 2's profit will equal zero if it chooses to produce functional food as well. Therefore, so long as its profits are positive from traditional foods, it will produce traditional food instead. Given firm 1 chooses functional food, firm 2's profit function from traditional food is

$$\pi_T^2 = \frac{\bar{\theta}^2 (v_F - \bar{R}_1)(v_F - \bar{R}_1 - v_T) v_T}{N(4(v_F - \bar{R}_1) - v_T)^2} - c_T \tag{16}$$

For π_T^2 will be positive it is necessary that either $v_F - \bar{R}_1 > 0$ and $v_F - \bar{R}_1 > v_T$ or $v_F - \bar{R}_1 < 0$ and $v_F - \bar{R}_1 < v_T$.

Given firm 2 chooses traditional food, firm 1 will choose functional food if it obtains positive profits from it, since producing traditional firm will yield zero profits for both firms.

$$\pi_F^1 = \frac{4\bar{\theta}^2 \left(v_F - \bar{R}_1\right)^2 (v_F - \bar{R}_1 - v_T)}{N\left(4\left(v_F - \bar{R}_1\right) - v_T\right)^2} - m_1 - c_F \tag{17}$$

For π_F^1 will be positive it is necessary that $v_F - \bar{R}_1 > v_T$. Therefore, $v_F - \bar{R}_1 > v_T$ is necessary for the game to achieve a Nash Equilibrium $\{v_F, v_T\}$.

Similarly, suppose firm 1 chooses traditional food, then firm 2 will choose functional food if it gets positive profits.

$$\pi_F^2 = \frac{4\bar{\theta}^2 \left(v_F - \bar{R}_2\right)^2 (v_F - \bar{R}_2 - v_T)}{N\left(4\left(v_F - \bar{R}_2\right) - v_T\right)^2} - m_2 - c_F \tag{18}$$

For π_F^2 will be positive it is necessary that $v_F - \bar{R}_2 > v_T$.

Given firm 2 chooses functional food, firm 1 will produce traditional food if it obtains positive profits.

$$\pi_T^1 = \frac{\bar{\theta}^2 (v_F - \bar{R}_2)(v_F - \bar{R}_2 - v_T) v_T}{N(4(v_F - \bar{R}_2) - v_T)^2} - c_T \tag{16}$$

For π_T^1 will be positive it is necessary that either $v_F - \bar{R}_2 > 0$ and $v_F - \bar{R}_2 > v_T$ or $v_F - \bar{R}_2 < 0$ and $v_F - \bar{R}_2 < v_T$. Consequently, $v_F - \bar{R}_2 > v_T$ is necessary for the game to achieve a Nash Equilibrium $\{v_T, v_F\}$.

Finally, if $v_F - \bar{R}_1 < v_T$ and $v_F - \bar{R}_2 < v_T$ both firms are indifferent between producing traditional food and producing nothing. Thus, both produce traditional food and earn competitive zero profits which is the third Nash Equilibrium.

To summarize the proof above, there are two possible Nash Equilibriums in the market depending on the relative magnitude of perceived risk with respect to the nutritional value of functional and traditional foods.

Nash Equilibrium 1: Firm 1 and firm 2 produce functional and traditional food, respectively, if the value of functional food net of average perceived risk when firm 1 invests in promotion is greater than the value of traditional food.

Nash Equilibrium 2: Firm 1 and firm 2 produce traditional and functional food, respectively, if the value of functional food net of average perceived risk when firm 2 invests in promotion is greater than the value of traditional food.

Nash Equilibrium 3: Firm 1 and firm 2 both produce traditional food if the value of functional net of average perceived risk when either firm invests in promotion is less than the value of traditional food.

There are several interesting implications from this result. First, the proposition 2 suggests that, under certain conditions, both products will always exist in the market, thus, implying that functional foods will never drive traditional foods out of the market. In contrary, other

researchers suggest that one potential danger from fortified foods is that they may jeopardize the market for traditional foods (e.g. Giannakas and Yanaka, 2008). Secondly, which of the equilibriums will exist in the market is a function of producers' effectiveness to disseminate information. If it is the case that perceived risk is decreasing in media expenditure and the magnitude of the effect is a function of producer type, i.e. $\partial \overline{R}_i / \partial m_i \equiv \overline{R}_i^m(\psi_i) < 0$ then in our model $\{v_F, v_T\}$ is a more likely outcome, since $\psi_1 > \psi_2$. Finally, the equilibrium in the market will depend on negative shock and government monitoring effort. These effects are discussed in detail in the next section.

CONCLUSIONS AND DISCUSSIONS

This article investigates the market effects of the introduction of food products that are enhanced through the use of new technology. The perceived risk associated with consumption of new technology food products and vertical product differentiation from nutritional enhancement is included in the model. The effect of information on risk perception towards new technology foods is analyzed.

Our results suggest that novel foods cannot drive traditional foods out of the market. However, under certain conditions, as firms increase their promotion efforts and the government increases its' monitoring effort, the quantity of traditional food in the market will decrease and the quantity of novel food in the market will increase. This shift will never be drastic so that traditional foods disappear from the market. On the other hand, the quantity of novel foods in the

market can become zero if the difference if the perceived risk is so high as to drive its nutritional value below the value of traditional foods.

REFERENCES

Anand, A., R.C. Mittelhammer, and J.J. McCluskey. 2007. Consumer Response to Information and Second-Generation Modified Food in India. *Journal of Agricultural & Food Industrial Organization 5 [Article 8]*.

Aurora. S. and S. Gangopadhyay. 1995. "Toward a Theoretical Model of Voluntary Overcompliance." *Journal of Economic Behavior and Organization,* vol. 28, pp. 289-309.

Bord, R.J. and R.E. O'Connor. 1990. "Risk Communication, Knowledge, and Attitude: Explaining Reactions to a Technology Perceived as Risky." *Risk Analysis* 10(4): 499 – 506.

Caswell, J.A. 2000. "An Evaluation of Risk Analysis as Applied to Agricultural Biotechnology with a Case Study of GMO Labeling." *Agribusiness* 16(1):115-123.

Curtis, K.R., J.J. McCluskey, and T.I. Wahl 2004. "Consumer Acceptance of Genetically Modified Food Products in the Developing World." *AgBioForum*, 7(1&2): 69-74.

Farrell, J. and G. Saloner, 1985, "Standardization, Compatibility, and Innovation," *Rand Journal of Economics*, vol. 16, pp. 70-83.

Flynn, James, Ellen Peters, C.K. Mertz, and Paul Slovic. 1998. "Risk Media and Stigma at Rocky Flats." *Risk Analysis* 18 (6): 715-727.

Fulton, M. and K. Giannakas. 2004. "Inserting GM Products into the Food Chain: The Market and Welfare Effects of Different Labeling and Regulatory Regimes." *American Journal of Agricultural Economics* 86(1): 42 – 61.

Gegax, D., S. Gerking, and W. Schulze. 1991. "Perceived Risk and the Marginal Value of Safety." *Review of Economics and Statistics*

Giannakas, K. and A. Yiannaka. 2008. "Market and Welfare Effects of Second-Generation, Consumer-Oriented GM Products." *American Journal of Agricultural Economics* 90(1): 152 – 171.

Hu, W., F. Zhong and Y. Ding. 2005. Actual Media Reports on GM Foods and Chinese Consumers' Willingness to Pay for GM Soybean Oil. *Journal of Agricultural and Resource Economics* 31(2): 376–390.

Huffman, W.E., M. Rousu, J.F. Shogren, and A. Tegene. 2004. "Who Do Consumers Trust for Information: The Case of Genetically Modified Foods?" *American Journal of Agricultural Economics* 86(5): 1222-1229.

International Food Information Council. 2006. Functional Foods Fact Sheet: Antioxidants. http://www.ific.org/publications/factsheets/antioxidantfs.cfm. (Accessed 11/21/07).

Johnson, F.R. 1988. "Economic Costs of Misinforming About Risk: The EDB Scare and the Media." *Risk Analysis* 8(2): 261 – 269.

Lapan, H. and G. Moschini. 2007. "Grading, Minimum Quality Standards, and the Labeling of Genetically Modified Products." *American Journal of Agricultural Economics* 89(3): 769 – 783:

Lusk, J.L. and K.H. Coble. 2007. "Risk Perceptions, Risk Preference, and Acceptance of Risky Food." *American Journal of Agricultural Economics* 87(2): 393-405.

Lusk, J.L., L.O. House, C. Valli, S.R. Jaeger, M. Moore, B. Morrow, and W.B. Traill. 2004. "Effect of Information about Benefits of Biotechnology on Consumer Acceptance of Genetically Modified Food: Evidence from Experimental Auctions in United States, England, and France." *European Review of Agricultural Economics* 31: 179-204.

Markosyan, A., J.J. McCluskey, and T.I. Wahl. 2009. "Consumer Response to Information about a Functional Food Product: Apples Enriched with Antioxidants," *Canadian Journal of Agricultural Economics* 57, pp. 325-341.

McCluskey, J.J. K.M. Grimsrud, and T.I. Wahl, 2006. "Comparisons of Consumer Responses to Genetically Modified Foods in Asia, North America, and Europe," in *Economics of Regulation of Agricultural Biotechnologies*, Richard E. Just, Julian Alston, and David Zilberman, editors, New York, NY: Springer/Kluwer Academic Publishers, pp. 227-240.

Milner, J.A. 2000. Functional Foods: the U.S. Perspective. *American Journal of Clinical Nutrition* 71(6): 1654-1659.

Mussa, M. and S. Rosen. 1978. "Monopoly and Product Quality," *Journal of Economic Theory* 18, 301-317.

Nayga, R.M. Jr., W. Aiew, and J.P. Nichols. 2004. "Information Effects on Consumers' Willingness to Purchase Irradiated Food Products." *Review of Agricultural Economics* 27(1): 37-48.

Nelson, C/H. 2001. "Risk Perception, Behavior, and Consumer Response to Genetically Modified Organisms." *American Behavioral Scientist* 44(8): 1371-1388.

Rogers, G.O. "The Dynamics of Risk Perception: How Does Perceived Risk Respond to Risk Events?" *Risk Analysis* 17(6): 745 – 757

Rousu, Matthew C., Wallace E. Huffman, Jason F. Shogren, and Abebayehu Tegene. (2004). "Estimating the Public Value of Conflicting Information: The Case of Genetically Modified Foods." *Land Economics* 80(1):125-135.

Smith, V.K. and F.R. Johnson. 1988. “How Do Risk Perceptions Respond to Information? The Case of Radon.” *The Review of Economics and Statistics* 70(1): 1 – 8.

CHAPTER THREE

CONSUMER RESPONSE TO INFORMATION ABOUT A FUNCTIONAL FOOD PRODUCT: APPLES ENRICHED WITH ANTIOXIDANTS

Summary:

Interest in functional foods has been growing as consumers become increasingly concerned with diet and nutrition. This article measures consumers' responses to apples enriched with an antioxidant coating. Antioxidant-enriched apples are believed to provide additional health benefits reducing the risk of cancer and heart diseases. We discuss the benefit-risk tradeoffs, which are that although functional food products provide health benefits beyond basic nutrition, some consumers may reject them because they utilize new technology, which they feel is risky or that they are "un-natural." Consumer surveys with contingent valuation questions were conducted in Seattle and Spokane, Washington in 2006. A key result is that organic consumers are less likely to buy apples with this new technology than consumers in Seattle. Information regarding the potential health benefits of antioxidants has a positive significant effect on consumers' willingness to pay. The estimated mean willingness to pay suggests that there is a small premium associated with this product in the mind of an average consumer.

INTRODUCTION

Technological advances in the food industry resulted in a large variety of functional foods being sold in the marketplace. Interest in functional foods has been growing due to higher health care costs; new legislation expanding the category of dietary supplements; and recent scientific discoveries linking dietary habits with the development of many diseases, including coronary heart disease and some cancers (Milner, 2000). Functional food is broadly defined as any food or food components that provide health benefit beyond basic nutrition (Institute of Food Technologies, 2005). Products such as high-fiber breakfast cereals, orange juice with added calcium, vitamin-fortified milk, and vitamin-enriched diet coke and water are now widely available in grocery stores. These foods promise to contribute to health maintenance through prevention of many illnesses. [2]

The functional food category has been growing rapidly over the last decade. U.S. sales of functional foods grew from $11.3 billion in 1995 to $18.5 billion in 2001. This accounts for 3.7% of the total food sales. The sales are projected to reach $49 billion by 2010 (U.S. General Accounting Office, 2000). Despite the rapid growth, functional foods are not specifically defined under American law. The U.S. Food and Drug Administration (FDA) regulates functional foods under the same framework as conventional foods. The FDA has neither a

[2]The impact of functional foods may be quite positive. As an example, Malla et al (2007) estimate the value of potential health benefits of a functional food product, Trans fat-free canola oil. They conclude that there is a significant impact of trans-fatty acids on coronary heart disease costs. Under different scenarios, they estimate the potential reduction in coronary heart disease cost to be between roughly CAD$54 million to CAD$440 million.

definition nor a specific regulatory framework for foods marketed as functional foods. Apart from the FDA, the Federal Trade Commission regulates health claims made in advertising of food products. The regulation of functional foods provides policy challenges arising from information asymmetry. Issues considered in developing policies include factors influencing consumer preferences for these products and uncertainties in the markets for them (Veeman, 2002). Hobbs (2002) points out regulatory uncertainty and credibility as important challenges that nutraceuticals and functional food industry faced in using labels as quality signals.

Although one might expect for consumers to embrace the positive health benefits, some may reject functional food products because they utilize new technology, which they feel is risky. Other consumers prefer to consume "natural" foods whenever possible. Although most consumers have positive feelings towards the health benefits associated with functional foods, many may still not be willing to purchase them, even with a significant discount. These consumers describe functional foods as "unnatural" and "potentially unsafe." This article examines the consumer response to a functional food product with consumer survey data collected for this purpose. One of the questions asked was, "How would you feel about apples with wax coatings enriched with antioxidants?" The responses ranged from, "Stop playing with natural food!" to "That sounds like a great idea!"

The functional food product that is the subject of this investigation is a protective coating that is applied to apples (and potentially other fruits). The coating is enhanced with specific flavonoids and stilbenes (antioxidants), which are believed to enhance the fruit's health benefits. In recent years, there has been a great increase in research and publicity devoted to the beneficial effects of antioxidants. Antioxidants are substances that may protect cells from the damage

caused by unstable molecules known as free radicals. Free radical damage is believed to lead to cancer. Antioxidants interact with and stabilize free radicals and may prevent some of the damage free radicals otherwise might cause. Examples of antioxidants include beta-carotene, lycopene, vitamins C, E, and A, and other substances (National Cancer Institute, 2004). These compounds, often called phytonutrients, are present in most fruits and vegetables naturally. The consumption of pills providing these compounds has increased in recent years (*Denver Post,* 2007). Indeed, this trend suggests that consumers are much more aware of their health benefits. There is also information indicating that maximum benefits are achieved when these phytonutrients are consumed in natural products (e.g. fruits, wine) rather than in pill form. Significant evidence has been found that fruits and vegetables in combination have synergistic effects on antioxidant activities leading to greater reduction in risk of chronic diseases, specifically for cancer and heart diseases (International Food Information Council, 2006).

The objective of this article is to measure consumers' response to apples with enriched coatings and analyze the factors that affect consumers' choice. Specifically, we estimate confidence intervals for the possible premium consumers will pay for this product and analyze the exogenous variables that affect willingness to pay (WTP). In addition, we test whether the provision of information describing potential benefits of functional foods has a significant effect on consumers' WTP.

PREVIOUS STUDIES ON CONSUMER ACCEPTANCE

There is a large literature on consumer acceptance of new technology. Several studies (e.g. Hu, et al, 2005; Lusk et al, 2004; Tegene et al, 2003; Li et al, 2004) conclude that there is a significant positive shift in consumers' preferences towards new technology food products after being exposed to positive information. Although functional foods are relatively new to the market, there is an emerging literature on how the market is responding. Labrecque et al (2006) find only minor differences among French, American, and French Canadian students' attitudes towards functional foods. Their results suggest that health-related and product-related benefits, credibility of information, and high knowledge have a positive effect on attitudes. Based on interviews with American mothers, Chema et al (2006) find that functional attributes, such as higher protein, increased calcium, and lower cholesterol, were highly valued.

West et al. (2002) assess consumers' valuation of functional foods in Canada. They find that Canadian consumers have generally positive attitudes towards functional foods and may be willing to pay a premium for them. However, they indicate that a large proportion of respondents negatively perceive genetically modified (GM) and organic foods relative to conventional foods, after controlling for price and health properties. Maynard and Franklin (2003) employ a survey with a sensory evaluation to assess the commercial potential of "cancer-fighting" dairy products. Households with children and health-conscious consumers were most willing to pay premiums for "cancer-fighting" dairy products.

Peng et al (2006) examine the acceptance of conjugate linolic acid (CLA) enriched dairy products among Canadian consumers and factors influencing the acceptance. The results suggest that gender and education do not significantly affect consumers' acceptance of CLA-Enriched dairy products. Middle-aged consumers and consumers with teenagers in the household are

more likely to buy this product. The authors argue that the target consumer segment for this product should be health-conscious, middle-aged consumers who believe in healthiness of conventional milk products.

The current article measures consumers' responses to apples enriched with antioxidant coatings, a functional food product, while simultaneously considering the effect of information. To our knowledge, this is the first examination of preferences towards fresh produce marketed as functional food.

DATA

The data utilized in this analysis was collected in face-to-face interviews that were conducted in September and October of 2006 in grocery stores in Seattle and Spokane, Washington. All the stores offer a variety of fresh produce including both conventional and organic items. A total of 730 surveys were completed and used in the analysis. The questionnaire included questions about awareness of antioxidants, attitudes toward nutritionally enriched foods and apples enriched with antioxidants, factors influencing apple purchases, and the choice of where to shop for food. Dichotomous choice contingent valuation questions with follow-up were included to elicit consumers' WTP for apples with enriched coatings. The questionnaire also included questions about the respondents' demographic characteristics, such as age, income, education, and presence of children in the household.

The sample demographics and the U.S. Census 2000 data for Seattle and Spokane are presented in Table 1. The comparison to the Census data is made because, as in all surveys, a

concern whether the sample is representative of the population under study. The average age is 45 years, which is higher than the population average but expected since children were not approached. Sixty-one percent of the respondents were female. The average size of household was 2.75 members, and 35% of the respondents had children under 18 in the household. Most of the respondents reported to have higher education degrees. Thirty-one percent of the respondents had a bachelor's degree, 27% had advanced or graduate degrees, 28% attended some college, 12% had a high school diploma, and only 2% said they have had some school. The most common response to annual household income fell within $40,000 and $79,999. Also, the majority of the respondents were employed at the time of the survey. Sixty-two percent and 16% said they were formally employed and self employed respectively, 11% reported to be retired, 5% were students, 4% were housewives, and 3% disclosed to be unemployed.

Survey responses suggest a general awareness of antioxidants and their health benefits. Twenty percent reported having no knowledge of antioxidants, 65% and 15% claimed to be "somewhat knowledgeable" and "very knowledgeable" of antioxidants, respectively. Twenty-seven percent of the respondents reported that they never take vitamin supplements, 47% take vitamins daily, and 27% take vitamins two to three times a week.

Attitudinal and shopping habit variables are presented in Table 2. Selected questions from the survey are presented in the Appendix. In response to a question about attitudes toward nutritionally enriched food, 25% and 38% of the respondents said they felt "very positive" or "somewhat positive," respectively. Only 2% of the consumers surveyed felt "very negative" about nutritionally enriched food. If respondents provided a "somewhat negative"

or “very negative” response, then they were asked to provide a rationale. The most common explanations included, “It is unnatural,” “It is better to get necessary nutrients naturally,” “Additives are not good for ones health,” and “Organic food is better.”

Subsequently, the respondents were asked to rate their feelings about apples that are “naturally wax coated with antioxidants.” The percentage of positive responses was significantly lower. Fifteen percent and 27% of the overall customers surveyed said they had “very positive” and “somewhat positive” feelings, respectively. Nineteen percent felt “somewhat negative,” and only 6% felt “very negative” about apples enriched with antioxidants. Finally, 28% were neutral, and 5% said they “didn’t know”.

Again, customers who felt negatively about apples enriched with antioxidants were asked to explain why. The most common responses were, “I don’t want to eat wax,” “It is unnatural,” “Additives to fruit are not necessary,” “Washing apples removes the wax,” “I prefer food with no additives,” “I don’t have enough information,” “It is better to get nutrients naturally,” “I prefer organic,” and “It changes the taste.”

In terms of shopping behavior, 85% of the respondents were the primary shoppers in their household. The majority, 58%, of the respondents shop 2-to-5 times a week. Twenty-eight percent shops once a week, 8% shop daily, and 5% and 1% shop once every 2 weeks and once a month respectively. The respondents were also asked about the most important factor in their choice of where to shop for food. “Quality” was the most common response with 65%. Price, variety, and location appeared to be roughly equally important to the consumers with 16%, 12%, 12% and 17%, respectively. Four percent of the respondents listed “other” factors, out of which

all but one said availability of organic food was the most important factor influencing their choice of grocery stores.

There were two different versions of the survey, with half of the respondents receiving each one. One version contained the following statement about potential health benefits of antioxidants, "Fruit enhanced with natural antioxidants will improve its health benefits by helping to prevent cancer, cardiovascular and other diseases." The other version of the survey contained no additional information. Including this positive information in half the surveys allows us to test for how positive information on consumers' affects attitudes toward naturally enriched apples and WTP.

THEORY AND METHODS

Contingent-valuation (CV) method is a technique that is used to estimate willingness to pay (WTP). [3] CV is based on a dichotomous choice model in which individual WTP can be estimated based on responses to market-type questions (Kanninen, 1993). The survey for this study contained contingent valuation questions regarding the respondents' willingness to pay a premium or accept a discount in order to buy enriched apples. We use the double-bounded model (Hanemann et al., 1991) to analyze the outcomes of the survey.[4] In one set of questions,

[3]For further information, including recent reviews and comparison across models estimable from CV data with reiteration see, for example, Flachaire and Hollard, (2006).

[4]There is a literature on the appropriate number of iterations to include in the bidding procedures used in the CV method. Cameron and Quiggin (1994) evidenced the problem of anchoring/starting point bias with iterations of

the respondents were first asked if they were willing to pay an initial bid price for naturally enriched apples. If the answer to this question was "yes," a follow-up question was asked in which the respondents were asked if they were willing to pay the naturally enriched apples at a higher price. If the respondent's answer to the first question was "no," a follow-up question was asked in which the respondent was offered a discount on the naturally enriched apples. The randomly assigned premium or discount levels had the following values: $\pm 5\%$, $\pm 10\%$, $\pm 20\%$, and $\pm 30\%$. Each level of premium or discount was used for one fourth of the surveys. The distribution of responses to the premium and discount bids for apples enriched with antioxidants is presented in Table 3.

Random Utility Model

Let U_0 and U_1 be the utility functions when an individual buys regular food (indicated by 0) and functional food (indicated by 1) respectively[5]

(1) $U_0(0,Y;X) = V_0(0,Y;X) + \varepsilon_0 = \alpha_0 + \rho Y + Z_0'X + \varepsilon_0$ and

bids. There is some bias with the double-bounded model, primarily due to inconsistencies which may be present between the consumers' first and subsequent bids (Hanemann and Kanninen, 1999). Recent studies suggest that the loss from bias outweighs by the gain in efficiency relative to a single dichotomous choice question (Aadland and Caplan, 2004; Scarpa and Bateman, 2000; Bateman et al., 2001; Whitehead 2002, 2004; and Cooper et al., 2002).

[5] We assume homogeneity of consumers, which is a shortcoming of the study, however not a concern to the validity of the model and results. Extensive empirical literature studies preferences and willingness to pay assuming consumer homogeneity (e.g. Loureiro, Gracia, Nayga, 2006; Hobbs et. al., 2005; Peng, West, Wang, 2006; Labreque et. al., 2006).

(2) $U_1(1,Y\text{-}P;X) = V_1(1,Y\text{-}P;X) + \varepsilon_1 = \alpha_1 + \rho(Y - P) + Z_1'X + \varepsilon_1.$

Y represents income, X represents individuals' characteristics that affect the decision process, P is the extra price of the functional food, ρ is the marginal utility of income, ε_0 and ε_1 are i.i.d. random errors with mean 0. An individual will prefer the functional food over the conventional food if the utility from the functional food is greater than the utility received from the conventional food, i.e. $U_1(1,Y\text{-}P;X) \geq U_0(0,Y;X)$ or

(3) $\alpha_1 + \rho(Y - P) + Z_1'X + \varepsilon_1 \geq \alpha_0 + \rho Y + Z_0'X + \varepsilon_0.$

After some simple operations expression (3) can be written as

(4) $\Delta U \equiv \alpha - \rho P + Z'X \geq \varepsilon$

where $\alpha = (\alpha_1 - \alpha_0)$, $Z = (Z_1 - Z_0)$, and $\varepsilon = (\varepsilon_1 - \varepsilon_0)$ that is assumed to have a logistic distribution with mean 0 and variance $\sigma^2 = \left(\pi/\sqrt{3}\right)^2$. Thus, the probability that an individual will choose the functional food over the conventional food can be characterized as

(5) $P(\text{Buy Functional Food}) = P(\alpha - \rho P + Z'X \geq \varepsilon) = F(\alpha - \rho P + Z'X)$

where $F(\bullet)$ is a logistic cumulative distribution function.

Four outcomes are possible in the double-bounded dichotomous choice model. They are: (1) the respondent is neither willing to buy the enriched apples at *BI,* the initial bid price, nor is he or she willing to buy it at *BL*, the discounted price (i.e., "no" followed by "no"); (2) the respondent is not willing to buy the enriched apples at the initial bid price, but given the random discount, the respondent exhibits a willingness to buy it at that price (i.e., "no" followed by "yes"); (3) the respondent is willing to buy the enriched apples at the initial bid price but not at *BH*, the higher price (i.e., "yes" followed by "no"); (4) the consumer is willing to buy the enriched apples at the initial price and he or she is also willing to pay the random premium (i.e., "yes" followed by "yes"). The probabilities of being in each category are

(6) $P(\text{Yes, Yes}) = P(\Delta U^{U} \geq \varepsilon) = F(\alpha - \rho P^{U} + Z'X)$[6]

$P(\text{No, No}) = P(\Delta U^{L} \leq \varepsilon) = 1 - F(\alpha - \rho P^{L} + Z'X)$

$P(\text{Yes, No}) = P(\Delta U^{0} \geq \varepsilon \cap \Delta U^{U} \leq \varepsilon) = F(\alpha - \rho P^{U} + Z'X) - F(\alpha - \rho P^{0} + Z'X)$

$P(\text{No, Yes}) = P(\Delta U^{0} \leq \varepsilon \cap \Delta U^{L} \geq \varepsilon) = F(\alpha - \rho P^{0} + Z'X) - F(\alpha - \rho P^{L} + Z'X),$

where P^0, P^L, and P^U are initial, lower, and upper prices respectively. The log-likelihood function is

(7) $$\ln L = \sum_{i=1}^{n} \{ d_i^{yy} \ln F(\alpha - \rho P_i^U - Z' X_i) + d_i^{yn} \ln(F(\alpha - \rho P_i^U + Z' X_i) - F(\alpha - \rho P_i^0 + Z' X_i)) + d_i^{yn} \ln(F(\alpha - \rho P_i^0 + Z' X_i) - F(\alpha - \rho P_i^L + Z' X_i)) + d_i^{nn} \ln(1 - F(\alpha - \rho P_i^L + Z' X_i)) \}$$

where $d_i^{yy}, d_i^{yn}, d_i^{ny},$ and d_i^{nn} are indicators for each group. The solution to the first order conditions gives us maximum likelihood estimates for our parameters. The empirical version of the expression (4) is characterized as

(8) $$\Delta U \equiv \alpha - \rho P + \sum_{i=1}^{2} z_i * Treatments_i + \sum_{i=3}^{6} z_i * Demographics_i + \sum_{i=7}^{8} z_i * Vit.\ consumption_i + \sum_{i=9}^{10} z_i * Shopping\ preferences_i.$$

The information variable is included in the treatment group. The basis for the WTP analysis is the well-known Random Utility Model, in which respondents choose to purchase the good in question if the utility derived from the good is higher then the alternative. The information acts as a factor that affects consumers' utility. We hypothesize that the positive information makes the

[6] Utility is non-increasing in prices and $P^L < P^0 < P^U$, therefore $\Delta^U < \Delta^0 < \Delta^L$. Consequently, in Equation (5) $P(\Delta^0 \geq \varepsilon \mid \Delta^U \geq \varepsilon) = P(\Delta^0 \leq \varepsilon \mid \Delta^L \leq \varepsilon) = 1$.

product attribute (i.e. additional antioxidants) more attractive to consumers, which increases the utility and subsequently increases the likelihood of switching to the functional food. Table 4 presents a brief description and explanation of the coding for the explanatory variables used in the model. The B variable in (2) represents the random bid offered to each consumer. Equation (2) was estimated via maximum likelihood.

ESTIMATION RESULTS

The parameter estimation results are reported in Table 5, and the marginal effects of the estimated model with confidence intervals are reported in Table 6. To assess the significance of the model and the goodness of fit, we performed a Likelihood Ratio (LR) test to estimate an R^2 equivalent measure designed specifically for double-bounded logit models. From the LR test, we reject the null hypothesis that all the parameters in the model jointly equal to zero and conclude that our model has a significant explanatory power. Further, we employ the sequential classification procedure (SCP) to estimate a model fit measure. Kanninen and Khawaja (1995) show that the conventional R^2 measures, such as the McFadden Pseudo R^2 and Pearson Chi-Square are not appropriate for double-bounded logit models.

As expected, the bid negative, which means that as the hypothetical price increases, the probability that the respondent choose to purchase the product goes down. The negative and significant coefficient for the SEATTLE variable suggests that respondents from Seattle are less likely to pay premium for apples enriched with antioxidants than those from Spokane. We suggest two explanations for this result. First, Spokane, located in the Eastern part of the

Washington, which is surrounded by large acreage of wheat crop land. Previous studies have found that consumers living in a close proximity to conventional agriculture are more accepting of "innovative" value-added agricultural production (McCluskey et al 2003), and this effect may contribute to their willingness to pay for antioxidant apples. This is related to Slovic's (1987) theories about the factors that contribute to risk perceptions: dread risk and unknown risk. Unknown risk is the primary factor associated with consumption of functional foods because many consumers are unfamiliar with these products. Since, residents of agricultural areas are more familiar with agricultural processes we would expect their levels of unknown risk be lower.

The positive and significant coefficient on the health benefit variable suggests that the statement regarding potential health benefits of antioxidant apples has a positive and significant effect on consumers' WTP for this product. On one hand, this suggests that most consumers need information in order to choose functional foods. On the other hand, this suggests that consumers are easily influenced by information. Note, that we have provided only one strong health claim without referencing any source for reliability. The fact that consumers responded positively to this signal suggests significant vulnerability of consumers to potentially misleading (or false) health claims. In addition, empirical literature finds evidence that both positive and negative information affects preferences for Genetically Modified food (e.g. Hu, Zhong, and Ding, 2005; Anand, Mittelhammer, and McCluskey, 2007). It seems reasonable that negative information is likely to significantly reduce consumers' willingness to pay for functional foods. However, having not tested this proposition explicitly, we do not make any conclusions in this regard.

None of the demographic variables are statistically significant in explaining consumers' WTP for apples enriched for antioxidants. Vitamin consumption is not significant either. Consumers' shopping preferences are significant. The nutrition-versus-price tradeoff variable is

significant and has a negative coefficient. This suggests that consumers who are more price conscious relative to nutrition conscious are less likely to pay a premium for apples enriched with antioxidants. The ORGANIC variable has a negative and significant effect, which suggests that respondents for whom the availability of organic produce is important in choosing where to shop are willing to pay less for antioxidant apples.

Mean WTP

Mean willingness to pay can be estimating is calculated following Hanemann (1984) as $WTP^{+} = \frac{1}{\hat{\rho}}(\hat{\alpha} + \hat{Z}'\overline{X})$. A 95% confidence interval can be calculated for mean WTP using the delta method.[7] Mean WTP results are presented in Table 7. We use the initial bid of \$0.99 as a benchmark for estimating the mean WTP. The mean premium for apples enriched with antioxidants is estimated to fall between 6.4% to 9.4% in a 95% confidence interval.[8] This

[7]A 95% confidence interval around estimated mean WTP for each case was calculated using the delta method, which approximates the asymptotic variance of a function of random variables as:

$asymptotic\,var\left[f(b)\right] \cong \frac{\partial f(b)}{\partial b'}\left[Var(b)\right]\left[\frac{\partial f(b)}{\partial b'}\right]'$, where $f(b) = \frac{\alpha + Z'X}{\rho}$ (Green, 2003).

[8] Previous literature suggests that the estimates of WTP for hypothetical private goods may be biased and inflated (e.g. List, 2003), so we emphasize that these estimates suggest that the average consumer will be a small premium. Further, the upward bias may exist in the magnitude of the estimates, but it should not affect the ordinal ranking. Consequently, the WTP estimates are useful for comparing across categories, such as those respondents who received positive information with those who did not.

suggests that average respondent is willing to pay a small premium for the enriched apples.

The estimated mean WTP for the consumers in Seattle is a 7% premium with a 95% confidence interval of [5.1%, 8.9%]. The mean WTP in the Spokane grocery store was estimated to be approximately a 10% premium with a 95% confidence interval of [7.7%, 12.6%]. Since the confidence intervals overlap, we test this difference for statistical significance. The null and alternative hypotheses for a lower-tailed test are

$$H_0 : WTP^+_{Seattle} = WTP^+_{Spokane}$$
$$H_a : WTP^+_{Seattle} < WTP^+_{Spokane}$$

We reject the null hypothesis and conclude that the mean WTP for Seattle sub-sample is less than the mean WTP for Spokane sub-sample.

In addition, the mean WTP is estimated separately for the respondents who received the positive information statements and those who received no information. On average, respondents who received no information were willing to pay 6% premium for the antioxidant-enriched apples with 95% confidence interval of [4.1%, 7.9%]. In contrast, respondents who received information were willing to pay 10% premium with 95% confidence interval of [7.7%, 12.6%]. Again, we test the difference between the two estimated means for statistical significance. The null and alternative hypotheses for an upper-tailed test are

$$H_0 : WTP^+_{Positive\ Information} = WTP^+_{No\ Information}$$
$$H_a : WTP^+_{Positive\ Information} > WTP^+_{No\ Information}$$

The null hypothesis can be rejected at 1% significance level, providing support for the conclusion that the mean WTP with positive information is greater than mean WTP with no information.

The respondents from Seattle are, on average, willing to pay approximately 3.8% more than the respondents from Spokane. The respondents who received the positive information are willing to pay roughly 3.3% more than consumers who received no such information. Consumers who seek organic produce in choosing where to shop are, on average, willing to pay 14.8% less for antioxidant apples. Figure 1 shows the change in probability of saying "yes" to apples enriched with antioxidants given different bids. The probability drops from 0.98 for 30% discount to 0.71 for the initial offer down to 0.11 for 30% premium.

CONCLUSIONS

The purpose of the article was to examine consumers' attitudes towards functional foods, in general, and for apples enriched with antioxidant specifically. Face-to-face surveys were conducted in the State of Washington with a total of 730 responses. Although consumers generally have positive attitudes towards the health benefits associated with functional foods, some will reject functional food products because they utilize new technology, which they feel is risky. Other consumers prefer to consume "natural" foods whenever possible. When considering the specific functional food product, apples that are enriched with antioxidants, fewer of the respondents expressed positive feelings compared with functional foods in general. We argue that this is in some part due to the product being a fresh produce item as opposed to processed food products such as orange juice or cereal. Attitudes, nevertheless, were positive in general, and the market does not reject the idea of this new product. The major reasons some consumers reject the idea of apples enriched with antioxidants are their perceptions that wax in

general is not pleasant for consumption, additives in food are unnecessary and sometime unhealthy, there is not enough information about the product and its safety, organic food is better and is more healthy, and additives in fruit specifically are unnatural.

The results of the willingness-to-pay estimation are that, on average, our respondents are willing to pay a small premium for apples enriched with antioxidants. Considering factors affecting willingness to pay, consumers who choose where to shop based on organic availability and consumers who are more price conscious relative to nutrition conscious are less likely to pay a premium for apples enriched with antioxidants. Also, there is evidence that consumers in Spokane are more likely to pay a premium for the product then consumers in supermarkets in Seattle. The estimated confidence interval for the mean WTP in the Spokane area was approximately between 8% and 13%, while the estimated confidence interval for the mean WTP the in Seattle area was approximately between 5% and 9%. We argue that the main reason for this can be that since Seattle is a large growing market for organic produce. In contrast, Spokane is more closely aligned with traditional agriculture with large surrounding wheat acreage.

The statement providing positive information about antioxidants included in half the questionnaires had a significant and positive effect on consumers' WTP. The average premium with the positive information is estimated to be between about 4% more than without the statement. Therefore, there is evidence that similar statements on labels of functional foods may have positive effects on consumers' propensity for buying them.

This study contributes to the overall understanding of functional food markets with a specific emphasis on fresh-produce functional foods. Labrecque et al (2006) suggest little differences among Canadian and American consumers' attitudes towards functional foods.

Therefore, Canadian agribusiness firms and policy makers can learn important lessons from this study as well. The study guides agribusiness firms and retailers trying to enter fresh produce functional food markets in developing suitable marketing strategies. It appears that these products are most likely to be successful in areas with strong agricultural land and stores not catering to organic consumers. Perhaps the most important lesson is that information is the key to success. Dissemination of positive information educating consumers about the benefits and safety of these products is vital for the growth of this industry. On the other hand, this study provides evidence of significant consumer sensitivity towards health claims, thus showing the importance of carefully developing/maintaining regulatory framework around such claims in order to protect consumers both in Canada and the United States. Finally, based on the response to the health benefit information, one can extrapolate that as more consumers recognize the potential health benefits, the market for functional foods is likely grow.

Table 3.1 Summary statistics for demographic variables

	Total Sample	Seattle Sample	Seattle Census 2000	Spokane Sample	Spokane Census 2000
Number of Respondents	730	550	N/A	180	N/A
Median age (years)	45	44	35	46	35
Mean number of persons per household	2.75	2.55	2.1	3.35	2.0
Male	39%	32.27%	49.1%	40.56%	48.2%
Female	61%	62.73%	50.9%	59.44%	51.8%
Children under 18 present in the household	35%	33.10%	19.6%	41.67%	31.7%
Education (highest level)					
Some school	2%	1.64%	10.5%	4.44%	11.9%
High School diploma	12%	6.55%	15.3%	26.67%	26.3%
Some college	28%	24.55%	27.0%	34.44%	36.4%
Bachelor's degree	31%	34.36%	29.9%	21.11%	16.2%
Advanced degree or graduate degree	27%	31.82%	17.0%	11.11%	9.2%
Household Income (in 2005)					
Less than $39,999	25%	19.27%	38.0%	40.00%	53.5%
$40,000 - $79,999	37%	35.45%	34.8%	38.33%	33.3%
$80,000 - $109,000	20%	20.36%	11.4%	13.89%	6.6%
$110,000 - $149,000	11%	12.55%	9.4%	3.89%	4.3%
$150,000 - $199,999	6%	6.73%	2.9%	1.67%	0.9%
Greater than $200,000	2%	2.36%	3.5%	0.00%	1.2%
Employment status					
Formally employed	62%	61.45%	66.3%	59.44%	58%
Self employed	16%	16.36%	7%	13.33%	6.2%
Unemployed	3%	2.55%	3.6%	4.44%	5.7%
Retired	11%	9.82%	N/A	12.22%	N/A
Student	5%	4.36%	N/A	3.33%	N/A
Housewife	4%	3.45%	0.2%	5.56%	0.2%

Table 3.2 Response summary to selected questions*

Variable	*Percentage of respondents*
How do you feel about …	
Nutritionally enriched food	
Very positive	25%
Somewhat positive	38%
Neutral	25%
Somewhat negative	8%
Very negative	2%
Don't know	2%
Apples with wax coatings which are enriched with antioxidants	
Very positive	15%
Somewhat positive	27%
Neutral	28%
Somewhat negative	19%
Very negative	6%
Don't know	5%
Primary shopper in the household	85%
How often do you take vitamin or nutrient supplements?	
Never	27%
2-3 times a week	27%
Daily	47%
Most important factor in choosing where to shop for food	
Price	16%
Quality	65%
Variety	12%
Location	17%
Organic	4%
Most important factor in choosing apples	
Appearance	29%
Variety	32%
Nutrients	12%
Price	11%
Size	2%
Other: Taste	13%
Other: Organic	6%
Importance of higher nutrient content in food compared to buying food at the lowest price (1 = higher nutrient foods most important … 10 = lower price most important)	5.4

*Note: See survey questions in the Appendix

Table 3.3 Distribution of bid responses

	Premium				
	5%	10%	20%	30%	Total
Yes	66	76	60	56	258
No	35	43	66	69	213
Total	101	119	126	125	471
	Discount				
	5%	10%	20%	30%	Total
Yes	10	17	21	28	76
No	38	42	45	31	156
Total	48	59	66	59	232

Table 3.4 Description of explanatory variables

Variable	Description
Treatments	
SEATTLE	1 = Seattle, 0 = Spokane
INFO	1 = Presence of positive statement, 0 = no information
Demographics	
GENDER	1 = Male, 0= Female
EDUCATION	1 = Bachelor's degree or above, 0 = otherwise
INCOME	Mid-points of the income categories
AGE	Reported age
Vitamin Consumption	
MEDIUM	1 = 2-3 times a week, 0 = otherwise
HIGH	1 = Daily, 0 = otherwise
Shopping Preferences	
NUTRITION - PRICE	Tradeoff between higher nutrition and low price food, continuous scale of 1=highest nutrition to 10=highest value (See question 5 in the Appendix)
ORGANIC	1= Organic most important factor in where to shop

Table 3.5 Maximum likelihood parameter estimates

Variable	Coefficient	Standard Error	Z-statistic
CONSTANT	-10.057***	0.536	-18.756
BID	11.530***	0.700	16.461
Treatments			
SEATTLE	-0.385**	0.190	-2.027
INFO	0.336**	0.154	2.179
Demographics			
GENDER	0.134	0.161	0.838
EDUCATION	-0.101	0.169	-0.599
INCOME	0.002	0.002	0.715
AGE	-0.007	0.006	-1.165
Vitamin Consumption			
MEDIUM	-0.055	0.185	-0.298
HIGH	0.176	0.195	0.899
Shopping Preferences			
NUTRITION - PRICE	-0.053*	0.028	-1.876
ORGANIC	-1.494***	0.344	-4.343
Observations	640		
LR-stat	40.41		
R^2 equivalent	0.736		

Note: *10% significance level, **5% significance level, ***1% significance level

Table 3.6 Marginal effects of the explanatory variables on mean WTP

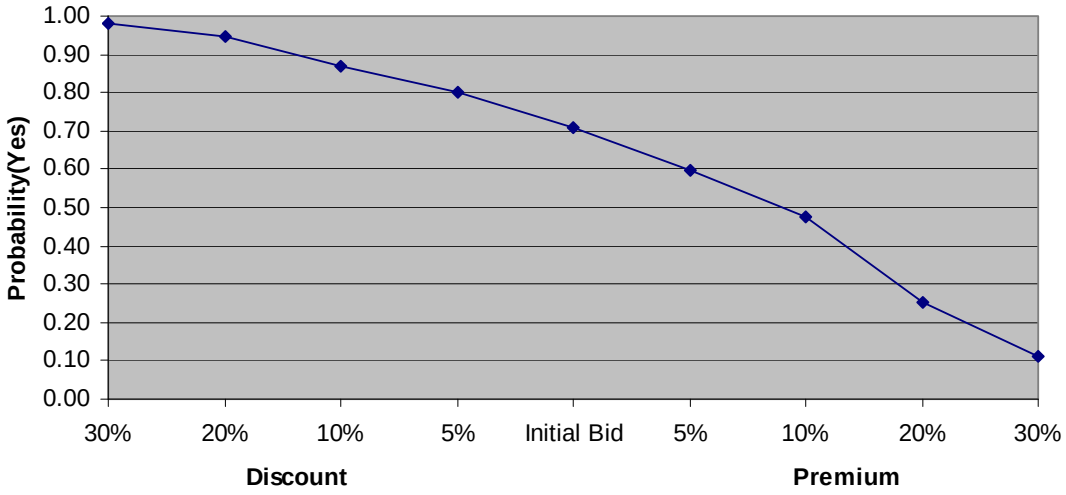
Variable	Marginal Effect	Standard Error	Z-statistic	90% Confidence Interval Lower Bound	90% Confidence Interval Upper Bound
CONSTANT	--	--	--	--	--
BID	--	--	--	--	--
Treatments					
SEATTLE	-0.038**	0.019	-2.023	-0.069	-0.007
INFO	0.033**	0.015	2.186	0.008	0.059
Demographics					
GENDER	0.013	0.016	0.837	-0.013	0.040
EDUCATION	-0.010	0.017	-0.599	-0.038	0.018
INCOME	0.000	0.0002	0.715	-0.000	0.001
AGE	-0.001	0.0006	-1.165	-0.002	0.0003
Vitamin Consumption					
MEDIUM	-0.006	0.018	-0.298	-0.036	0.025
HIGH	0.017	0.019	0.900	-0.014	0.049
Shopping Preferences					
NUTRITION - PRICE	-0.005*	0.003	-1.876	-0.010	-0.001
ORGANIC	-0.149***	0.034	-4.334	-0.205	-0.092

Note: *10% significance level, **5% significance level, ***1% significance level

Table 3.7 Estimates of mean WTP

Sample	Mean WTP	95% Confidence interval
Full Sample	$1.08 (8% premium)	$1.06 - $1.094 (6.4% - 9.4% premium)
Seattle	$1.07 (7% premium)	$1.051 - $1.089 (5.1% - 8.9% premium)
Spokane	$1.10 (10% premium)	$1.077 - $1.126 (7.7% - 12.6% premium)
No Information	$1.06 (6% premium)	$1.041 - $1.079 (4.1% - 7.9% premium)
Positive Information	$1.10 (10% premium)	$1.074 - $1.121 (7.4% - 12.1% premium)

Figure 3.1 Probability of choosing functional food as bid varies



REFERENCE:

Aadland, D. and A. Caplan. 2004. Incentive incompatibility and Starting-Point Bias in Iterative Valuation Questions: Comment. *Land Economics* 80: 312-315.

Anand, A., R.C. Mittelhammer, and J.J. McCluskey. 2007. Consumer Response to Information and Second-Generation Modified Food in India. *Journal of Agricultural & Food Industrial Organization 5 [Article 8]*, pp. 145-172.

Bateman, I.J., I.H. Landford, A.P. Jones and G.N. Kerr. 2001. Bound and Path Effects in Double Bounded and Triple Bounded Dichotomous Choice Contingent Valuation. *Resource and Energy Economics* 23: 191-213.

Cameron, T. and J. Quiggin. 1994. Estimation Using Contingent Valuation Data from a 'Dichotomous Choice with Follow Up' Questionnaire. *Journal of Environmental Economics and Management* 27: 218-234.

Chema, S.K., L.A. Marks, J.L. Parcell, and M. Bredahl. 2006. Marketing Biotech Soybeans with Functional Health Attributes. *Canadian Journal of Agricultural Economics* 54 (4): 685-703.

Cooper, J., W.M. Hanemann, and G. Signorello. 2002. One and One-Half Bound Dichotomous Choice Continent Valuation. *The Review of Economics and Statistics* 84: 742-750.

Flachaire, E. and G. Hollard. 2006. Controlling Starting-Point Bias in Double-Bounded Contingent Valuation Surveys. *Land Economics* 82:103-11.

Green, W. H. 2003. *Econometric Analysis* (Fifth Edition). Pearson Education, Inc., Upple Saddle River, N.J.

Hanemann, M. W. 1984. Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses. *American Journal of Agricultural Economics* 66 (3): 332-341.

Hanemann, M.W., J. Loomis and B.J. Kanninen. 1991. Statistical Efficiency of Double-Bounded Dichotomous Choice Contingent Valuation. *American Journal of Agricultural Economics* 73: 1255-1263.

Hanemann, W.M. and B. Kanninen. 1999. The Statistical Analysis of Discrete-Response CV Data. In *Bateman, I.J. and Willis, K.G. (Eds.) Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries*. Oxford University Press: 302-442.

Hobbs, J. E. 2002. Evolving Supply Chains in the Nutraceuticals and Functional Foods Industry. *Canadian Journal of Agricultural Economics* 50(4): 559-568.

Hobbs, J. E., D. Bailey, D. L. Dickinson, and M. 2005. "Traceability in the Canadian Red Meat Sector: Do Consumers Care?" *Canadian Journal of Agricultural Economics* 53(1): 47-65.

Hu, W., F. Zhong and Y. Ding. 2005. Actual Media Reports on GM Foods and Chinese Consumers' Willingness to Pay for GM Soybean Oil. *Journal of Agricultural and Resource Economics* 31(2): 376–390.

International Food Information Council. 2006. Functional Foods Fact Sheet: Antioxidants. http://www.ific.org/publications/factsheets/antioxidantfs.cfm. (Accessed 11/21/07).

Institute of Food Technologists. 2005. *Functional Foods: Opportunities and Challenges.* *http://members.ift.org/IFT/Research/IFTExpertReports/functionalfoods_report.htm*. (Accessed 11/21/07).

Kanninen, B.J. 1993. Optimal Experimental Design for Double-Bounded Dichotomous Choice Contingent Valuation. *Land Economics* 69 (2): 138-46.

Kanninen, B.J. and M. S. Khawaja. 1995. Measuring Goodness of Fit for the Double-Bounded Logit Model. *American Journal of Agricultural Economics* 77: 885–890.

Labrecque, J., M. Doyon, F. Bellavance, and J. Kolodinsky. 2006. Acceptance of Functional Foods: A Comparison of French, American, and French Canadian Consumers. *Canadian Journal of Agricultural Economics* 54: 647-661.

Loureiro, M.L., A. Gracia, and R.M. Nayga, Jr. 2006. Do Consumers Value Nutrition Labels? *European Review of Agricultural Economics* 33(2): 249-268.

Li, Q., J.J. McCluskey and T.I. Wahl. 2004. Effects of Information on Consumers' Willingness to pay for GM-corn-fed Beef. *Journal of Agricultural and Food Industrial Organization* 2: Article 2. Available at http://www.bepress.com/jafio/vol2/iss2/art9.

List, J. A. 2003. "Does Market Experience Eliminate Market Anomalies?" *Quarterly Journal of Economics*, 118(1), 41-71.

Lusk, J.L., L.O. House, C. Valli, S.R. Jaeger, M. Moore, J.L. Morrow and W.B. Traill. 2004. Effect of Information about Benefits of Biotechnology on Consumer Acceptance of Genetically Modified food: Evidence from Experimental Auctions in the United States, England, and France." *European Review of Agricultural Economics* 31:179-204.

Malla, S., J.E. Hobbs, and O. Perger. 2007. Valuing the Health Benefits of a Novel Functional Food. *Canadian Journal of Agricultural Economics* 55 (1): 115–136.

Maynard, L.J. and S.T. Franklin. 2003. Functional Foods as a Value-added Strategy: the Commercial Potential of "Cancer-fighting" Dairy Products. *Review of Agricultural Economics* 25(2): 316–331.

Milner, J.A. 2000. Functional Foods: the U.S. Perspective. *American Journal of Clinical Nutrition* 71(6): 1654-1659.

National Cancer Institute. 2004. Antioxidants and Cancer Prevention: Fact Sheet. http://www.cancer.gov/cancertopics/factsheet/antioxidantsprevention.

McCluskey, J.J., K.M. Grimsrud, H. Ouchi, and T.I. Wahl. 2003. Consumer Response to Genetically Modified Food Products in Japan. *Agricultural and Resource Economics Review* 32/2: 222-231.

Peng, Y., G.E. West, and C. Wang. 2006. Consumer Attitudes and Acceptance of CLA-enriched dairy Products. *Canadian Journal of Agricultural Economics* 54(4): 663-684.

Scarpa, R. and I. Bateman. 2000. Efficiency Gains Afforded by Improved Bid Design versus Follow-Up Valuation Questions in Discrete Choice CV Studies. *Land Economics* 76: 299-311.

Slovic, P. 1987. "Perception of Risk." *Science 236*: 280-285.

Supplement Industry Growing. The Denver Post June 03, 2007. Available at http://www.denverpost.com/portlet/article/html/imageDisplay.jsp?contentItemRelationshipId=1454237

U.S. Census Bureau. 2000. Quick Tables. http://factfinder.census.gov. (Accessed 11/21/07).

U.S. General Accounting Office, 2000. *Dietary Supplements and Functional Foods*. U.S. GAO/RCED-00-156.

Tegene, A., W.E. Huffman, M. Rousu, M. and J.F. Shogren. 2003. *The Effects of Information on Consumer Demand for Biotech Foods, Evidence from Experimental Auctions.* U.S. Department of Agriculture, Economic Research Service, Technical Bulletin 1903.

Veeman, M. 2002. Policy Development for novel Foods: Issues and Challenges for Functional Food. *Canadian Journal of Agricultural Economics* 50 (4): 527–539.

West, G.E., C. Gendron, B. Larue, and R. Lambert. 2002. Consumers' Valuation of Functional Properties of Foods: Results from a Canada-Wide Survey. *Canadian Journal of Agricultural Economics* 50(4): 541–558.

Whitehead, J. 2002. Incentive Incompatibility and Starting-Point Bias in Iterative Valuation Questions. *Land Economics* 78: 285-97.

Whitehead, J. 2004. Incentive incompatibility and Starting-Point Bias in Iterative Valuation Questions: Reply. *Land Economics* 80: 316-319.

APPENDIX A

AN EXAMPLE OF A QUESTIONNAIRE FOR ATTITUDES TOWARDS FUNCTIONAL FOODS

M/F:	City: Seattle	Site: Greenwood

Section I

Q.1How knowledgeable do you consider yourself on **antioxidants** and their effects on human health?

- ☐ Very knowledgeable
- ☐ Somewhat knowledgeable
- ☐ Not knowledgeable

Q.2How often do you take vitamin or nutrient supplements?

- ☐ Never
- ☐ 2-3 times a week
- ☐ Daily

Q.3 When purchasing food, how important is **higher nutrient content** in food, compared to buying food at the **lowest price**? Please rate your feeling of importance on a scale of 1 to 10, where 1 means higher nutrient foods are the most important and 10 means buying food at the lowest price is the most important.

1 2 3 4 5 6 7 8 9 10

Q.4 How do you feel about **nutritionally enriched food**, e.g. orange juice with added calcium, high fiber cereal, etc.?

- ☐ Very positive → **SKIP to Q.6**
- ☐ Somewhat positive → **SKIP to Q.6**
- ☐ Neutral → **SKIP to Q.6**
- ☐ Somewhat negative
- ☐ Very negative
- ☐ Don't know → **SKIP to Q.6**

Q.5 If you feel negative about function food, please explain why?

Q.6 How often do you eat **an apple**?

- ☐ Daily
- ☐ At least once a week
- ☐ At least once a month, but less than once a week
- ☐ Less than once a month

Q.7 What is **the most important factor** when you buy apples?

- ☐ Appearance
- ☐ Variety
- ☐ Nutrients
- ☐ Price
- ☐ Size
- ☐ Others, please fill in_____

Q.8 Since in washing apples they loose their natural coating, natural wax is used as a coating to protect them. ***Fruit enhanced with natural antioxidants will improve its' health benefits by helping to prevent cancer, cardiovascular and other diseases.*** How would you feel about apples with **wax coatings which are naturally enriched with antioxidants**?

- ☐ Very positive → **SKIP to Q.10**
- ☐ Somewhat positive → **SKIP to Q.10**
- ☐ Neutral → **SKIP to Q.10**
- ☐ Somewhat negative
- ☐ Very negative
- ☐ Don't know → **SKIP to Q.10**

Q.9 If you think it is negative to use naturally enriched wax coatings on apples, please explain why?

Q.10 The average price of apples is $0.99/lb. If you were going to purchase apples today, and if apples with **wax coatings which are naturally enriched with antioxidants** were **offered at the same price** than typical wax coated apples, would you purchase them?

- ☐ Yes
- ☐ No → **SKIP to Q.12**

Q.11 Now, if the price of the apples with **wax coatings which are naturally enriched with antioxidants was 10% higher** than typical wax coated apples, would you be willing to purchase them?

- ☐ Yes → **SKIP to Q.13**
- ☐ No → **SKIP to Q.13**

Q.12 Now, if the price of apples with **wax coatings which are naturally enriched with antioxidants** was **10% lower** than typical wax coated apples, would you be willing to purchase them?

- ☐ Yes
- ☐ No

Q.13 What is the most important factor to you in your choice of where to shop for **FOOD**?

- ☐ Price
- ☐ Quality
- ☐ Variety
- ☐ Location
- ☐ Other, please fill in _____

Q.14 How often do you shop at the following types of food venues for **FOOD**?

	Never	Once a month	2-3 times a month	Once a week	2-3 times a week	More than 3 times a week
Farmers' Market	☐	☐	☐	☐	☐	☐
Independent specialized food store (e.g. Food Co-op)	☐	☐	☐	☐	☐	☐
Specialized supermarket (e.g. Wholefoods, Trader Joes')	☐	☐	☐	☐	☐	☐
Supermarket (e.g. Safeway)	☐	☐	☐	☐	☐	☐
Supercenter (e.g. Wal-Mart Supercenter)	☐	☐	☐	☐	☐	☐

Q.15 If you were going to purchase any **FRUIT** today, which type would you most likely purchase given they were offered **at the same price**?

- ☐ Regular
- ☐ Labeled as "Naturally Enriched with Antioxidants"
- ☐ Labeled as "Organic"
- ☐ Eco-labeled

Section II

Q.16 Are you the person who shops for most of the groceries for your household?

- ☐Yes
- ☐ No

Q.17 How often do you shop for food?

- ☐ Daily
- ☐ Between 2-5 times per week
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month

Q.18 How many members do you have in your household? ☐

Q.19 Do any children under 18 live in your household?

- ☐ Yes
- ☐ No

Q.20 What is the highest level of education that you have completed?

- ☐Some school
- ☐High School diploma
- ☐Some College
- ☐Bachelors' degree
- ☐Advanced degree or graduate degree

Q.21 In which income bracket would your household fall into in the year of 2005?

- ☐ Less than $39,999
- ☐ $40,000 - $79,999
- ☐ $80,000 - $109,999
- ☐ $110,000 - $149,000
- ☐ $150,000 - $199,999
- ☐ Greater than $200,000

Q.22 Which one of the following categories best describes your employment status:

- ☐ Formally employed
- ☐ Self employed
- ☐ Unemployed
- ☐ Retired
- ☐ Student
- ☐ Housewife

Q.23 Please indicate your age ☐

Thank you very much for your participation!

CHAPTER FOUR

INDIVIDUAL PREFERENCES FOR TRADE POLICIES

Summary:

This article analyzes individual preferences for trade policy instruments by constituents of special interest groups and provides new determinants of those preferences. Evidence have been found to suggest that individual preferences for trade policies depend on human capital and physical capital endowments, sector of production, as well as ties to the government and main information sources. The results suggest that individuals with high levels of human and physical capital are more likely to support free-trade policies and to oppose trade-restricting policies. The choice of specific free-trade or trade-restricting policies depends on the sector of production. In addition, we suggest that individuals with close ties to government are likely to support government in choosing policy instruments regardless of other factors. Finally, individuals who rely on mass media for trade-related information tend to shift their preferences towards protectionist policies.

INTRODUCTION

What drives policy-makers to choose one trade policy direction over another? Why do policy-makers often choose to implement protectionist policies in times when economists widely agree on the benefits of free-trade? These are some of the questions that political scientists, trade theorists, and economists have continuously been asking. The need to study trade policies is apparent. Trade policies affect nearly every area of the economy and are believed to have major long-term effects on growth and development. Understanding the entire trade policy development process is a challenging task. Trade policies are formed under the influence of numerous forces and factors including pressure from interest groups, foreign policy developments, domestic economic conditions, and the political environment.

Individual trade policy preferences are believed to be an integral part of the trade policy making process where policies emerge as an equilibrium outcome of individuals' demand and government institutions' supply of trade policies. Therefore, to fully understand trade policy developments, we must first enhance our knowledge of the determinants of trade policy preferences among the individuals comprising major interest groups and identify the factors that drive those preferences. For example, what factors are likely to form a support base towards trade-restricting policies like use of tariffs, anti-dumping laws, and export subsidies; or what factors are likely to form a support base toward free-trade policies such as reduction of non-tariff and tariff barriers and/or elimination of subsidies?

This article contributes to the overall knowledge of trade policy formation by answering these questions and considering new determinants of trade policy preferences. We delineate trade policies into several major categories of import and export policies. Then we empirically analyze

factors that drive individual preferences for those policies using state-preference data for a specific group of constituents playing a major role in the international trade arena – fruit and vegetable producers. This analysis improves the understanding of different policy developments by the government. From the policy-maker's perspective, understanding these preferences will help to identify the segments of constituents likely to provide support for or opposition to different policies.

Previous empirical studies make inferences on individual trade policy preferences based on the general publics' preference for trade-restriction versus trade-liberalization. Balisteri (1997) analyzed forces of support and opposition to trade by Canadian citizens using the case of Central America Free Trade Agreement (CAFTA). Scheve and Slaughter (2001) examined pro-trade versus trade-protectionist attitudes and found that factor-endowment and asset ownership are the dominating factors in explaining support for trade barriers. Mayda and Rodrik (2005) analyzed individuals' protectionist versus free-trade attitudes in different countries. They found evidence that support for free-trade is based on higher factor-endowment, industry of employment, and non-economic determinants such as neighborhood attachments and patriotism.

In this paper, we take a different direction when examining individual's preferences for trade policies and improve on previous literature in several ways. First, we analyze individuals' preferences for specific trade policy instruments, rather than free-trade versus protectionist attitudes. In doing so, we take into account the underlying correlation among preferences for these policies. Then, we incorporate the role of government involvement and information into the model, which has not previously been considered. Finally, we do not concentrate our study on general individual preferences, which may or may not be influential in the policy-making process. Instead we focus on the preferences of individuals comprising a major agricultural

interest group – specialty crops producers – who are major players in the international trade arena and arguably play an important role in the developments of trade policies.

The rest of the paper proceeds as follows. The next section lays out the theoretical framework. Then, we give an overview of the specialty crops industry followed by the survey and data. We then present the econometric model and the results of the analysis. The paper ends with a discussion of findings and implications.

THEORETICAL FRAMEWORK

Political economy literature commonly analyzes individual preferences for trade with the self-interest approach, where preferences are described as a consequence of trade policies on an individual's real wealth. An individual supports or opposes the trade policy based on whether the policy increases or decreases the individual's wealth (see Baldwin, 1989; Scheve and Slaughter, 2001; Rodrik, 2005). We present a model of individual preferences for trade policies as a combination of direct economic effects translated through prices and costs and indirect effect of policies on individuals' wealth.

Consider a small economy with *n* number of individuals who use two factors, human capital and physical capital, to produce goods. They have identical utility functions, but differ in their factor endowments. The economy has an abundant amount of both human capital and physical capital which are fully employed. Let W be the wealth of an individual. The wealth of an individual *i*, where *i*=1,2,…,n, equals the reward from the factor of production, or factor income, minus additional cost of production, i.e.

(1) $$W_i = f_i(p_i; l, k, Y) - c_i(l, k, Y)$$

The factor income, f, is a function of the domestic price of good i, p_i, given the producers' endowment of human capital, l, endowment of physical capital, k, and the sector of production, Y (or the good they produce).

Suppose the government has a fixed set of j trade policy instruments. Let $R=\{r_{1,}...,r_j\}$ be all policy instruments available to the government. The governments choice of policies will affect the domestic price and/or cost of production of the good produced by the individual i. We can extend the expression (1) to

(2) $$W_i = f_i(p_i(r_1,...,r_j);l,k,Y) - c_i(r_1,...,r_j;l,k,Y)$$

We can, therefore, express the effect of policy r_k on the wealth of an individual producer as follows:

(3) $$\frac{\Delta W_i}{\Delta r_k} = \frac{\Delta f_i}{\Delta p_i}\frac{\Delta p_i}{\Delta r_k} - \frac{\Delta c_i}{\Delta r_k}$$ [9]

Expression (4) below shows that, assuming a linear functional form on p_i and c_i, the effect of policy k on wealth will be a function of all other policy instruments, the endowment of human and physical capital of the individual as well as the sector of production.

(4) $$\frac{\Delta W_i}{\Delta r_k} \equiv W_k'(R_{-k},l,k,Y),$$

[9] This change is applicable for both continuous and discrete r. An example of the continuous case would be subsidies, here $\Delta W_i / \Delta r_k \equiv \partial W_i / \partial r_k$. An example of the discrete case would be a trade ban due to invasive species problem, here $\Delta W_i / \Delta r_k \equiv W_i^1 - W_i^0$ with W_i^0 being the wealth before the ban and W_i^1 being the wealth after the ban.

where R_{-k} are all the policies excluding policy *k*. The indirect utility of individual *i* is $U_i(W(R,l,k,Y))$. Consequently, the utility of the individual *i* from policy *k* is a function of the change in wealth due to change in the policy shown in expression (5)

(5) $\quad U_{ik}^{*} \equiv U_{ik}^{*}(W'(R_{-k},l,k,Y))$.

Therefore, individual utility derived from a particular policy is a function of all other available policies, individuals' human and physical capital endowments, and the sector of production, where U^{*} is differentiable and increasing in W'. Individuals will base their support for the available policy instruments on the order of their utilities derived from those policies as in the Random Utility Model (RUM). For example, if there are 3 policy instruments available (*j=3)*, say q_1, q_2, and q_3, individual *i* will prefer q_1 to q_2 and q_2 to q_3 if $U_{iq_1}^{*} > U_{iq_2}^{*} > U_{iq_3}^{*}$.

In addition to the direct effect on wealth through prices and costs, the agents' support will depend on some indirect policy effects on his/her wellbeing, which we call indirect wealth effect. We hypothesize, that this individuals' support for policies can be significantly altered by outside information and government ties of the agent. In other words, the indirect wealth effect, $\tilde{W}$, is a function of the amount of information an individual acquires from different mediums, *I*, and the degree to which an individual is tied to government, *G*. Some examples of the information sources that individuals use to acquire trade-related information include mass media, government publications, extension publications, international trade organizations, and trade journals. Some ways government gets involved in individuals' businesses are by providing subsidies, tax benefits, and getting the individuals involved in various governmental programs. The full policy support function, as shown in expression (6), is a sum of the direct economic effect and the indirect effect, $\tilde{W}'$.

(6) $\quad U_{ik} \equiv U_{ik}^{*}(W'(R_{-k},l,k,Y),\tilde{W}'(G,I))$.

To summarize, here we have presented a general framework for analyzing some of the factors that can potentially influence individual preferences for trade policies. Next, we are going to analyze which policy instruments individuals are likely to favor or reject based on the effects of those policies on their wealth. Under this framework, the way individual wealth is going to be affected by different policies will primarily depend on human and physical capital endowments of the individual, the sector of production the individual is involved in, as well as information sources and government ties, which we believe affect the subjective individual interpretation of the wealth effect of different policies have.

PREFERENCE FOR TRADE POLICY INSTRUMENTS

Here we examine individual preferences towards certain policy instruments. We delineate trade policies into nine major import and export policy instruments. Import policy instruments include: prevention of invasive species, r_{IS}, use of tariffs to protect import sensitive crops, r_{TB}, and maintaining anti-dumping laws to prevent dumping of foreign products on the U.S. market, r_{AD}. Export policies have six components[10]: reduction of non-tariff trade barriers (NTB) in world

[10] We consider export policies that are linked (directly or indirectly) to governmental programs already included in the Trade Title of 2002 Farm Bill, which relate to both specialty crops and commodity crops. Reduction of non-tariff trade barriers is captured under Technical Barriers to Trade (TBT) programs established in 2002 to remove, resolve, or mitigate sanitary and phytosanitary (SPS) and other technical barriers to trade. One of the provisions, Technical Assistance for Specialty Crops (TASC), specifically addresses unique barriers that prohibit or threaten the export of US specialty crops. Market Development Programs (MDP), which include Market Access Program (MAP), Foreign Market Development Program (FMD), and Emerging Markets Program (EMP), deal with promotion of US products abroad. Export Credit Guarantee Programs (ECGP) aim to enhance competitiveness of US products in foreign markets through credit assistance to exporting producers. Finally, Export Enhancement Program (EEP) provides

markets, r_{NTB}, reduction of tariff trade (TB) barriers in world markets, r_{TB}, promotion of US products abroad, r_{PR}, elimination of domestic or export subsidies by foreign competitors, r_{FS}, enhancing competitiveness of U.S. products in foreign markets, r_{EC}, and U.S. export subsidies, r_{ES}.

We can investigate how factor endowment changes preferences by examining the effect of factor endowment on the wealth of the individual as a result of these policies. For this, we turn to the standard trade theory of Hecksher-Ohlin (HO). In the HO economy, factors can costlessly move across the sectors and factor income varies by factor-type, which is the theoretically the case in the long-run. Countries export services of their abundant factors and import services of their scarce factors. Under this scenario, free-trade raises the relative price of the good that intensively uses the abundant factor, i.e. $\Delta p_i / \Delta r_{TB} > 0, \Delta p_i / \Delta r_{NTB} > 0, \Delta p_i / \Delta r_{FS} > 0$. The increase in the relative price of the good increases the return to the factor intensively used in the production, i.e. $\Delta f_i / \Delta p_i > 0$. Thus, free-trade benefits individuals who own the factors with which the economy is relatively well endowed, and hurts those who own the factors which are scarce (Stolper Samuelson Theorem, p.60, Kennen, 1998), i.e. $W'_{TB} > 0, W'_{NTB} > 0, W'_{FS} > 0$. Trade-restricting policies, such as use of tariffs, maintaining anti-dumping laws, and export subsidies, will have the opposite effect on individuals who are highly endowed with human capital and physical capital, i.e. $W'_{TB} < 0, W'_{NTB} < 0, W'_{FS} < 0$. Overall, if we assume that individuals form their

---

funding (subsidies) to US exporters to help compete against subsidized prices in specific export markets (ERS/USDA – The 2002 Farm Bill). The 2002 Farm Bill does not include any programs addressing tariff trade barriers in foreign markets and elimination of domestic or export subsidies by foreign competitors.

trade preferences based on the long-run consequences, then the HO model gives us grounds to hypothesize that individuals with a relatively high factor-endowment are more likely to support policies promoting free-trade, and to oppose the trade-restricting ones.

Further, we hypothesize that individuals' choice of trade preferences depends on their sector of production, and more specifically, by the trade environment of the sector. For example, an agricultural commodity producer is having difficulties competing with much cheaper imports of good *i*. The government sets tariffs, which drives the price of the good up, i.e. $\Delta p_i / \Delta r_{TB} > 0$, which in turn increases the factor income, i.e. $\Delta f_i / \Delta p_i > 0$. Consequently, these producers will support the use of tariffs in the U.S. Now, suppose the producer is facing significant NTBs in his sector. If the government is successful in eliminating or relaxing some of those barriers that will bring producers' cost of inspection and monitoring down, i.e. $\Delta c_i / \Delta r_{NTB} < 0$, this in turn will increase the producers' wealth (assuming it doesn't negatively affect prices), i.e. $W'_{NTB} > 0$. Similarly, when the government allocates more effort towards prevention of invasive species, this drives the cost of inspection and monitoring down and, consequently, increases the welfare of producers whose sector is most vulnerable to invasive species.

The second part of the political support function in (6) consists of the effect of information and government intervention. Here, the wealth effect of economic parameters is indirect in that they don't directly affect prices and factor incomes. We hypothesize that outside information changes individuals' perceptions of wealth effects resulting from trade policies. Mass media presents a good example. Mass media is sometimes believed to cover predominantly "bad news" in response to viewers' demand who seek to be aware of and protect themselves from adverse events (McCluskey and Swinnen, 2005). In the trade arena, covering "bad news" entails emphasizing presumptive negative effects of free trade such as loss of U.S. industry

competitiveness due to cheap imported products and/or loss of U.S. jobs. Individuals following these news broadcasts are likely to form a perception that free-trade policies will negatively affect their wealth. In other words, as the amount of trade-related information being acquired from mass media sources increases, the perceived wealth effect of free-trade policies goes down, i.e. $\Delta\tilde{W}'_{TB}/\Delta I_{media} < 0, \Delta\tilde{W}'_{NTB}/\Delta I_{media} < 0, \Delta\tilde{W}'_{FS}/\Delta I_{media} < 0$, and the perceived wealth effect of protectionist policies goes up, i.e. $\Delta\tilde{W}'_{TR}/\Delta I_{media} > 0$, $\Delta\tilde{W}'_{AD}/\Delta I_{media} > 0, \Delta\tilde{W}'_{ES}/\Delta I_{media} > 0$. We, therefore, can hypothesize that individuals who rely on mass media for trade, such as information will be more likely to support use of tariffs, anti-dumping laws, and export subsidies.

Finally, we incorporate government involvement into individuals' operations as a factor that can potentially influence preferences for trade policies. The idea behind this is to test whether government can shift producers' preferences by involving individuals in various programs. Generally, individuals will participate in governmental programs if they believe such participation will increase their wealth. These individuals develop a strong perception of positive effects of governmental involvement. Consequently, they are more inclined to trust the government and to support trade policies regardless of other factors.

TRADE AND SPECIALTY CROPS INDUSTRY

The "specialty crops" industry, defined as fruits, vegetables, tree nuts, dried fruits, and nursery crops (Specialty Crops Competitiveness Act, 2004) present an interesting case study of trade policy preferences. This sector is a very important part of U.S. agriculture. In 2005, the total farmgate value for specialty crops in the U.S. topped $60 billion, accounting for almost half of the total agricultural farmgate value (USDA, 2007). However, this sector has not been a beneficiary of the U.S. government support system. Most of the support programs in the Farm

Bill flow towards so-called "program crops" such as wheat, corn, and soybeans[11]. The industry benefits to some degree from USDA programs related to trade, conservation, credit, protection from pests and diseases, and other programs. (CRS Report for Congress, 2005)

Specialty crops have drawn attention under the Specialty Crops Competitiveness Act signed in 2004. The Act proposes "to ensure an abundant and affordable supply of highly nutritious fruits, vegetables, and other specialty crops for American consumers and international markets by enhancing the competitiveness of United States-grown specialty crops, and for other purposes." In the Farm Bill 2007 debate, producers of specialty crops criticized huge government subsidies and called for more support for marketing, research, protection from invasive species, and elimination of unfair trade practices by foreign countries (Alston and Sumner, 2007).

Trade policies are among the most important issues facing the specialty crop industry. Many controversial tariff and non-tariff trade barriers prevent U.S. specialty crops from expanding exports into large foreign markets. For example, after India imposed new fumigation requirements for dried fruit imports in 2004, the U.S. specialty crop industry (mostly almonds) suffered a loss of over $92 million. This is just an isolated case of a much greater impact of controversial trade practices on U.S. specialty crops. In this article, we focus on U.S. trade policies that are (or may possibly be) developed to facilitate access of U.S. agricultural commodities to foreign markets and protect them against possible adverse impacts from imports.

[11] It is noteworthy that specialty crops have a number of distinguishing features that sets them apart from program crops, such as no direct subsidies and low support from the government in general, high labor intensity, market (demand) driven production, smaller scale of production, and higher profit margins (SCPOC PNW, Progress Report I, WSU 2006).

SURVEY AND DATA

We performed the data collection in two stages. First, we conducted a series of focus groups with specialty crop producers in the Pacific-Northwest (PNW), and then we conducted a mail survey with specialty crop producers in the state of Washington. The focus group's objective was to provide a more in-depth understanding of producers' perspective on trade policies, and served as a base for designing a more effective survey instrument. Five focus groups were conducted, with a total of thirty participants from Washington, Oregon, and Idaho. Several main points were noted from the focus groups. Primarily, Northwest specialty crop producers called for creating an even playing field in the international trade arena. In particular, they were concerned with being at a competitive disadvantage in some domestic markets due to high differences in pesticide regulations, environmental laws, and labor costs. Also, they believed that high subsidies in some countries, along with significant tariff and non-tariff barriers, are keeping them out of those markets. Therefore, the majority of these producers wanted to see that SPS barriers will have sound scientific justification. More extensive description of the focus groups is presented in Appendix A.

Following the focus groups, a mail survey was conducted with Washington State fruit growers[12]. The survey was pre-tested with a focus group of participants, after which it was distributed through the mail among 4,145 fruit growers in the State of Washington. A total of

[12] Washington State constitutes one of the top specialty crop producers in the US. In 2004 the state produced roughly $4 billion worth of specialty crops. Washington leads the nation in apple production, producing more than a half of its apples in the US. This state also produced 47% of US cherries 2004, 42% of pears, 75% of hops, and 90% of raspberries (USDA NASS, 2004). The potato, grape, asparagus, and nursery industries also represent very important markets in the state of Washington.

401 responses (9.67% response rate) have been received, from which 363 responses are useable. Most of the respondent's farms are located in Central Washington, and had an annual gross receipt of less than $500,000.

This comprehensive survey consisted of four sections: domestic policies, trade and foreign policies, labeling and traceability, and demographics. Domestic policies included specialty crop producers' attitude towards governmental involvement, income support programs, research and environmental programs, and labor issues. The majority of the respondents agreed that an active government role in the specialty crop sector is necessary. If an active government involvement was present, the majority would support market promotion to stimulate demand and safeguards against import surges, and oppose input subsidies for production. Among income support programs, disaster assistance received the most support, followed by subsidized insurance. Research programs found strong support among very many specialty crop producers. Preservation/conservation of farmland and water quality appeared to be the most important environmental programs.

Preservation/conservation of farmland and water quality appeared to be the most important environmental programs in the respondents' opinion.

We designed the trade section to assess preferences towards import and export policies, opinions about competitiveness of specialty crops, governmental trade institutions, free trade agreements, and main information sources for trade issues. We delineated governmental policies concerning international trade into two major categories: import policies and export policies. The respondents were asked to rank different trade policies on a Likert scale of "-3" to "+3" with -3 being the least important and +3 being the most important policy. The percentages of responses in each category are presented in Tables 1 and 2.

The sample consisted of 15 percent of producers under 45 years of age, sixty one percent being between 45 and 60 years old, and 24 percent over 60 years old, with a median age of 54. Sixty one percent of the respondents claimed they had received a college degree, and 13 percent claimed they held graduate degrees. Eighty percent of the respondents had annual farm gross receipt of less than $750,000, 13 percent had annual gross receipt of $750,000 to $2,000,000, and seven percent had gross receipt of over $2,000,000 annually. Seventy four percent of the respondents claimed they produced apples, 27 percent indicated they produced pears, and 25 percent claimed they had cherry production. In addition, a minor portion of respondents were growing grapes, potatoes, hops, or wheat. Fifty eight percent of the producers indicated they were involved in some governmental program such as CRP or EQUIP. Finally, thirteen percent stated that their main source of trade-related information was government publications, and 29 percent indicated that their main information source was mass media. The means of the variables used in the model are presented in Table 3.

ECONOMETRIC ESTIMATION

In this section, we first provide the empirical model derived from the support function (6), which uses individuals' human and physical capital, sector of production, as well as government involvement and information sources to analyze preferences for import and export policies. We describe the two-step estimation procedure with factor analysis as the first step, and multivariate ordinal probit estimation as the second step.

Empirical Model

The empirical model is a linear approximation of expression (6). Individual j's preference for k^{th} import policy and z^{th} export policy can be expressed as

(8)

$$\text{IMPORT}_{ik} = \sum_{g=1}^{h} \beta_{kg}\text{FACTOR}_{ig} + \sum_{m=h+1}^{n} \beta_{km}\text{SECTOR}_{im} + \sum_{p=n+1}^{l} \beta_{kp}\text{GOV}_{ip} + \sum_{q=l+1}^{r} \beta_{kq}\text{INFO}_{iq} + \varepsilon_{ik}$$

(9)

$$\text{EXPORT}_{iz} = \sum_{g=1}^{h} \beta_{zg}\text{FACTOR}_{ig} + \sum_{m=h+1}^{n} \beta_{zm}\text{SECTOR}_{im} + \sum_{p=n+1}^{l} \beta_{zp}\text{GOV}_{ip} + \sum_{q=l+1}^{r} \beta_{zq}\text{INFO}_{iq} + \varepsilon_{iz}$$

where IMPORT is a latent variable indicating individuals' preference for a particular import policy and EXPORT is a latent variable indicating individuals' preference for a particular export policy alternative. The vector of exogenous variables contains four groups of variables. One group (FACTOR) consists of variables measuring producers' factor endowment. We approximate human capital by education level, and physical capital using the annual gross receipt of the operation. The second group (SECTOR) includes variables representing sectors in the specialty crop industry. Three major commodities are considered: apples, pears, and cherries. Next, we measure the influence of the government using a variable that shows whether the producer is involved in any governmental programs (e.g. CRP, EQUIP). INFO contains two variables which show the main information sources the individual uses for trade related issues, namely, government publications and mass media. We capture the effect of the alternative policies, R_k, by allowing for cross-equation correlation among the error terms.

IMPORT and EXPORT are both unobservable variables, and the researcher observes only the ranking that the respondents give to a particular policy. The respondent has a choice

from a Likert-scale of 0 to 4, which is presumed to be connected to the unobservable variable in the following way[13]:

$$
\begin{aligned}
&\text{Choice} = 0 \quad \textit{if} \quad \text{IMPORT or EXPORT} \le 0 \\
&\text{Choice} = 1 \quad \textit{if} \quad 0 < \text{IMPORT or EXPORT} \le \mu_1 \\
&\text{Choice} = 2 \quad \textit{if} \quad \mu_1 < \text{IMPORT or EXPORT} \le \mu_2 \\
&\text{Choice} = 3 \quad \textit{if} \quad \mu_2 < \text{IMPORT or EXPORT} \le \mu_3 \\
&\text{Choice} = 4 \quad \textit{if} \quad \text{IMPORT or EXPORT} > \mu_3
\end{aligned} \tag{10}
$$

where μ's are unknown thresholds to be estimated. Also, ε_{ij} and ε_{zj} are assumed to be normally distributed with mean 0 and variances σ_i^2 and σ_z^2 respectively.

The resulting model is characterized as a system of univariate ordinal probit models. Preferences among the policy alternatives are expected to be highly correlated with each other. Therefore, the efficiency of the estimation will improve if the equations are estimated jointly as a system. In this model, known as a multivariate ordinal probit model, the errors are assumed to be multivariate normally distributed with a mean of 0 and a covariance matrix with off-diagonal elements being the covariances between equations.

The estimation procedure consists of two steps. First, we perform a factor analysis on export policies to avoid estimating six simultaneous equations. Then, sets of import and export policy equations are estimated using a multivariate ordered probit regression. Similar models have been used in different applications by Zhao and Harris (2004) and Gracia, Loureiro, Nayga (2007).

Factor Analysis

[13] For the dependent variable the original scale of -3 and +3 is grouped into 5 categories to ensure sufficient observation in each category. Without loss of generality the grouping of categories was performed as follows: -3, -2, and -1 = 0, 0 = 1, 1 = 2, 2 = 3, 3 = 4.

We performed a factor analysis for export policies to gain more insight about individual preferences and possibly reduce the number of equations in a single system to facilitate the computation. The reason for the factor analysis is to describe the covariance relationships among variables in terms of a few underlying, but unobservable, factors. We are essentially trying to group the export policies that are highly correlated among them, but which have relatively small correlations with variables in a different group. Interpretation of the factors is subjective and relies upon the researchers' knowledge and intuition.

Factor analysis is performed using a maximum likelihood approach (Johnson and Wichern, 2003). First, we conducted a chi-square test to determine the number of sufficient factors. The null hypothesis of "no common factors" was rejected with chi-square value equal to 296.07 and 15 degrees of freedom. However, we failed to reject the hypothesis that 2 factors are sufficient with chi-square value equal to 3.527 and 4 degrees of freedom. Consequently, we proceeded with the factor analysis with two factors. Extensive description of the factor analysis with the factor loading is presented in Appendix B.

Table 5 shows the policies retained in two factors with their interpretations. Factor 1 includes *reduced non-tariff trade barriers in world markets, reduced tariff barriers in world markets, and elimination of domestic or export subsidies by foreign competitors*. The variables in this factor are policies directed towards leveling the playing field in the international trade arena. We will call this factor "Fair Trade." Factor 2 includes *promotion of U.S. products abroad, enhancing competitiveness of U.S. products in foreign markets, and U.S. export policies*. This factor can be interpreted as policies directed towards promoting and enhancing competitiveness of U.S. products abroad. For simplicity, we will call this factor "Promotion of U.S. products."

Multivariate Ordinal Probit

We estimate one set of equations for import policies. Further, we combine the export policies into two groups according to the factor analysis results and estimate two sets of equations (3 equations in each) for these policies. According to factor analysis export policies within Factor 1 are not highly correlated with the policies in Factor 2. Therefore, we do not lose efficiency by estimating the two groups of export policies separately.

Derivation of the log-likelihood function for a multivariate ordered probit model is presented in Appendix C. Estimation of this model requires computation of multivariate normal integrals, which is a difficult task. Simulation methods have been developed that accurately and efficiently handle these kinds of computations. We are going to estimate our model using the method of simulated scores developed by Hajivassiliou and McFadden (1998).

Marginal Effects

The magnitude of coefficients for ordinal probit models is not directly interpretable. Therefore, we estimated the marginal effects for each equation. The marginal effects for continuous variables are estimated as a partial derivative of the probability of being in each category with respect to a unit increase in the explanatory variable. For example, the marginal effect of a continuous variable X_k on the probability of Choice = j is

$$ME_{jk}^{Continuous} = \frac{\partial \Pr(Choice = j \mid X_k)}{\partial X_k} = [f(\mu_{j-1} - X'\beta) - f(\mu - X'\beta)]\beta_k \quad (11)$$

where f(●) is the probability density function. For the dummy variables it is more appropriate to compute the marginal effects as a discrete change in the predicted probability of being in each category when the dummy variable changes from 0 to 1 holding everything else constant. For example, the marginal effect of a dummy variable X_l on the probability of Choice = j is

(12) $$ME_{jl}^{Dummy} = \Pr(Choice = j \mid X_l = 1) - \Pr(Choice = j \mid X_l = 0).$$

In the multivariate estimations, different marginal effects can be computed. For instance, one type of marginal effect can be evaluated with respect to the joint probability of Pr(Choice$_1$ = 1, Choice$_2$ = 1, Choice$_3$ = 1). Also, marginal effects can be evaluated with respect to the conditional probability, say, Pr(Choice$_1$ = 1 | Choice$_2$ = 1, Choice$_3$ = 1) or with respect to the marginal probability, say, Pr(Choice$_1$ = 1), Pr(Choice$_2$ = 1), and Pr(Choice$_3$ = 1). Marginal effects with respect to marginal probabilities will now be reported, since they are the primary focus of this article. These marginal effects show the change in probability of being in each category given a unit increase in the given variable.

RESULTS: DETERMINANTS OF TRADE POLICY PREFERENCES

This section describes the results of the estimations describing the determinants of trade policy preferences. Tables 6 – 8 show the results of the multivariate ordered probit estimations by groups of policies. To conserve space, marginal effects are reported for the probability of Choice=4, i.e. the effect of producer characteristics on the probability of allocating highest effort to a particular policy. To assess the model fit we performed a likelihood ratio test for each system. The LR-Statistic is sufficiently large in all cases to conclude that the models have high explanatory power (χ^2 with 33 degrees of freedom equals 43.77).

Factor Endowment

The results of estimation suggest that producers with college degrees are more likely to support policies directed towards prevention of invasive species and free-trade policies. The negative sign of such policies as use of tariffs, anti-dumping laws, and export subsidies, suggests that

college graduates are less likely to support trade-restricting policies. However, only the factor of maintaining anti-dumping laws policy has a significant coefficient. The results also suggest that physical capital matters in determining trade preferences. Large farm owners are more inclined to support free trade policies, while mid-size farm owners are more inclined to support invasive species policies compared to smaller specialty crop farmers. Although the rest of the variables are not significant in the income category, the signs turned out as expected in accordance with the factor-endowment perspective.

Sector

The results clearly support the proposition that trade preferences are specific to the sector of production. Specifically, we found evidence to suggest that individuals in sectors more vulnerable to certain trade issues are likely to support policies addressing those issues. The results for pear and cherry sectors from the estimations more vividly show the evidence in support of this idea. For example, the results show that pear producers are more likely to support high government effort towards prevention of invasive species. This support is more likely to be driven by an incident with Chinese pear fungus found in stores of Wenatchee, WA in 2003. As a consequence of this incident, the USDA prohibited Ya Li pear imports from China and ordered a national recall of this fruit. There is also evidence that this group of producers is concerned with high tariff trade barriers in the world markets. Pear producers have difficulty entering large potential markets such as the European Union, Turkey, Egypt, China, India, and Korea, due to high tariffs on pear imports (USDA FAS, 2005). Our estimation results show that pear producers are likely to be highly in favor of reducing tariff barriers in the world markets.

In the cherry sector producers are more likely to support policies directed towards prevention of invasive species and use of tariffs. Similar to the pear industry, the entry to large markets like Argentina, Brazil, European Union, Turkey, China, India, and Japan is difficult due to high tariff barriers, which further supports hypothesis 2.

Government

Government involvement is another significant determinant of trade policy preferences. According to the estimation results, individuals who have ties with the government are more likely to support use of tariffs, anti-dumping laws, reduction of tariff barriers in world markets, reduction of foreign subsidies by foreign competitors, and policies directed towards improving competitiveness of U.S. crops abroad including export subsidies. This is quite an interesting result. In one way, it suggests that individual preferences are strongly intertwined with government actions and individuals allowing government intervention, who are keen to support all kinds of policies regardless of their factor-endowment or sector of production. In another way, it suggests that government can indirectly influence individual preferences over trade policy, and potentially other policies, by being involved in individuals' business, for example by offering subsidies, special tax privileges, and/or various governmental programs.

Information Sources

Finally, we found evidence to support our hypothesis regarding the influence of information sources. The results show that producers who get their trade related information primarily from mass media are more likely to support trade-restricted policies such as use of tariffs, anti-dumping laws, and export subsidies. In the estimations government publication effect is

significant only for reduction of tariff barriers. Therefore, we can suggest that mass media has a much stronger effect on individual trade policy preferences than government publications.

CONCLUSIONS

Our paper provides a unique perspective into trade policy preferences. Unlike other studies, we analyze the determinants of individual preferences towards specific trade policy instruments. In addition, this paper provides a unique insight into individual preferences within a major agricultural interest group – specialty crop producers. The results suggest that individuals with a high level of human capital and physical capital are more likely to support policies directed towards promoting free-trade. The results also suggest that individual trade preferences are sector-specific in that individuals more sensitive to certain trade issues are more likely to support policies addressing those issues. In addition, we found evidence that trade policy preferences are affected by ties to governmental programs and outside information sources. Specifically, individuals with ties to governmental programs are likely to support any policies regardless of their factor-endowment or sector of production. In addition, individuals who get their trade information primarily through mass media are more likely to support trade-restrictive policies.

From a policy standpoint, it is imperative to understand the forces driving individual policy preferences in order to identify the support and opposition bases for different policies. For example, our study suggests that the support base for fair trade policies in the specialty crop sector are educated large farmers. On the other hand, evidence shows that mass media is likely to form a support base for the trade-restricting policies. In addition, trade policies should be developed considering the sensitivity of particular sector in the international trade arena.

Overall, this paper provides a discussion of new determinants of trade policy preferences. The core question, however, remains how these preferences translate into trade policies. For example, looking back at our case of specialty crops, if the individual preferences indeed have as strong an influence on trade policy formation as political economy literature suggests, we should expect tighter control on invasive species and increased efforts on reducing tariff and non-tariff barriers for certain specialty crops in the near future.

Table 4.1 Summary of responses for import policy preferences

Policy Option (Dep. Variable)	Least Important			Neutral			Most Important
	-3	**-2**	**-1**	**0**	**1**	**2**	**3**
Prevention of invasive species ($IMPORT_1$)	1%	1%	2%	8%	12%	21%	55%
Use of tariffs to protect import sensitive crops ($IMPORT_2$)	5%	3%	4%	12%	19%	18%	38%
Maintaining anti-dumping laws to prevent dumping of foreign products on the US market ($IMPORT_3$)	2%	1%	1%	3%	5%	14%	75%

Table 4.2 Summary of responses for export policy preferences

Policy Options (Dep. Variable)	Least Important			Neutral			Most Important
	-3	**-2**	**-1**	**0**	**1**	**2**	**3**
Reduce *non-tariff* trade barriers in world markets ($EXPORT_1$)	4%	1%	2%	15%	13%	23%	42%
Reduce *tariff* trade barriers in world markets ($EXPORT_2$)	2%	0%	1%	7%	13%	26%	51%
Promotion of US products abroad ($EXPORT_3$)	2%	1%	1%	9%	16%	18%	52%
Elimination of domestic or export subsidies by foreign competitors ($EXPORT_4$)	3%	0%	2%	16%	13%	19%	46%
Enhance competitiveness of US products in foreign markets ($EXPORT_5$)	3%	1%	2%	10%	17%	21%	47%
US Export Subsidies ($EXPORT_6$)	14%	7%	8%	35%	14%	9%	12%

Table 4.3 Explanatory variable descriptions and means in the survey

Dummy Variable	Description	Mean
MIDDLE-AGE	1 if age is between 45 and 60 years old	0.61
OLDER-AGE	1 if age is over 60 years old	0.24
GRADUATE	1 if college graduate or post-graduate degree	0.61
MID-SIZE FARM	1 if gross receipt between $750,000 and $2,000,000	0.13
LARGE FARM	1 if gross receipt over $2,000,000	0.07
APPLE	1 if apple producer	0.74
PEAR	1 if pear producer	0.27
CHERRY	1 if cherry producer	0.25
PROGRAM	1 if involved in governmental programs	0.58
GOV PUBLICATION	1 if main information source is government publications	0.13
MEDIA	1 if main information source is media	0.29

Table 4.4 Explanation of the Common Factors for Export Policies

Factor	Policy Option	Factor Explanation
Factor 1	Reduce *non-tariff* trade barriers in world markets Reduce tariff barriers in world markets Elimination of domestic or export subsidies by foreign competitors	Leveling the playing field in the international trade (R.O.W. actions)
Factor 2	Promotion of US product abroad Enhance competitiveness of US products in foreign markets US export subsidies	Competitiveness of US products in foreign markets (U.S. actions)

Table 4.5 Marginal Effects: Import Policies

	Prevention of invasive species ($IMPORT_1$)	Use of tariffs to protect import sensitive crops ($IMPORT_2$)	Maintaining anti-dumping laws to prevent dumping of foreign products on the US market ($IMPORT_3$)
Variable	Choice=4	Choice=4	Choice=4
MIDDLE-AGE	0.3551***	0.1870***	0.2284***
OLDER-AGE	0.5059***	0.2653***	0.3741***
GRADUATE	0.1472***	-0.0230	-0.0675*
MIDDLE INCOME	0.1860***	-0.0736	-0.0074
HIGH INCOME	0.0306	-0.0525	-0.0350
APPLE	0.0844*	0.1021**	0.1623***
PEAR	0.0876*	-0.0006	0.1089**
CHERRY	0.0926*	0.1165**	0.0742
PROGRAM	0.0358	0.1614***	0.1631***
GOV PUBLICATION	0.0950	0.0789	0.0111
MEDIA	0.0487	0.0796*	0.1236***
Observations	328		
LR-Statistic	628		

*, **, and *** shows significance at 10%, 5%, and 1% level, respectively.

Table 4.6 Marginal Effects: Export Policies for Fair Trade Factor

	Reduce *non-tariff* trade barriers in world markets ($EXPORT_1$)	Reduce tariff trade barriers in world markets ($EXPORT_2$)	Elimination of domestic or export subsidies by foreign competitors ($EXPORT_4$)
Variable	Choice=4	Choice=4	Choice=4
MIDDLE-AGE	0.2326***	0.1198**	0.1450***
OLDER-AGE	0.3139***	0.2460***	0.3326***
GRADUATE	0.1636***	0.0995**	0.1684***
MIDDLE INCOME	0.0474	0.0864	0.0341
HIGH INCOME	0.1471*	0.3748***	0.2964***
APPLE	0.1388**	0.2046***	0.1702***
PEAR	0.0457	0.1195**	-0.0017
CHERRY	0.0551	0.0875	0.0602
PROGRAM	0.0694	0.1306***	0.1334***
GOV PUBLICATION	-0.0076	0.1539**	0.0225
MEDIA	0.0306	0.0499	0.0209
Observations	295		
LR-Statistic	512		

*, **, and *** shows significance at 10%, 5%, and 1% level, respectively

Table 4.7 Marginal Effects: Export Policies for Competitiveness Factor

	Promotion of US products abroad ($EXPORT_3$)	Enhance competitiveness of US products in foreign markets ($EXPORT_5$)	US export subsidies ($EXPORT_6$)
Variable	Choice=4	Choice=4	Choice=4
MIDDLE-AGE	0.2568***	0.2649***	0.0446*
OLDER-AGE	0.3722***	0.3995***	0.0836***
GRADUATE	0.0151	0.0184	-0.0107
MIDDLE INCOME	0.0426	0.0296	0.0133
HIGH INCOME	-0.0186	-0.0874	-0.0413
APPLE	0.2041***	0.1502***	0.0295
PEAR	0.0065	0.0487	-0.0254
CHERRY	0.0235	0.0731	0.0271
PROGRAM	0.2305***	0.1574***	0.0988***
GOV PUBLICATION	0.0946	0.1110	0.0037
MEDIA	0.1068**	0.0493	0.0641**
Observations	295		
LR-Statistic	474		

*, **, and *** shows significance at 10%, 5%, and 1% level, respectively

Table 4.8 Error correlations among equations

	IMP_1	IMP_2	IMP_3	EXP_1	EXP_2	EXP_4	EXP_3	EXP_5	EXP_6
IMP_1	1	0.282***	0.289***						
IMP_2	0.282***	1	0.776***						
IMP_3	0.289***	0.776***	1						
EXP_1				1	0.705***	0.442***			
EXP_2				0.705***	1	0.580***			
EXP_4				0.442***	0.580***	1			
EXP_3							1	0.748***	0.391***
EXP_5							0.748***	1	0.395***
EXP_6							0.391***	0.395***	1

*, **, and *** shows significance at 10%, 5%, and 1% level respectively

REFERENCE:

Alston, J.M., and D.A. Sumner. 2007. Perspectives on Farm Policy Reform. *Journal of Agricultural and Resource Economics* 32(1): 1 – 19

Baldwin, R.E. 1989. "The political economy of trade policy." *The Journal of Economic Perspectives* 3(4): 119 – 135

Balistreri, E.J. 1997. "The performance of the Heckscher-Ohlin-Vanek model in predicting endogenous policy forces at the individual level." *Canadian Journal of Economics* 97: 1- 17

Gracia, A., M. Loureiro, and R.N. Nayga. 2007. "Do Consumers Perceive Benefits from the Implementation of a EU Mandatory Nutrition Labeling Program?" *Food Policy* 32: 160 – 174.

Greene, W.H. 2003. *Econometric Analysis*. Prentice Hall, New Jersey.

Grossman, G. and E. Helpman. 1994. "Protection for sale." *The American Economic Review* 84(4): 833 – 50

Grossman, G.M. and E. Helpman. 2002. Interest Groups and Trade Policy. Princeton University Press, Princeton, New Jersey.

Hajivassiliou, V.A., D.L. McFaddan. 1998. The Method of Simulated Scores for the Estimation of LDV Models. *Econometrica* 66(4): 863 - 896.

Johnson, R.A., and D.W. Wichern. 2002. *Applied Multivariate Statistical Analysis*. Prentice Hall, New Jersey.

Kenen, P. 1989. *The International Economy*. Prentice Hall, Englewood Hills, NJ.

Maddala, G.S. 1983. Limited-Dependent and Qualitative Variables in Econometrics. Cambridge University Press

Mayda, A.M., and D. Rodrik. 2005. Why are some people (and countries) more protectionist than others? *European Economic Review* 49: 1393 – 1430.

McCluskey, J.J. and J. Swinnen. 2005. Political Economy of Media and Demand for Genetically-Modified Products. *American Journal of Agricultural Economics* 45(3): 676 – 987.

Rodrik, D. 1995. Political economy of trade policy. In: Grossman, G., Rogoff, K. (Eds.). Handbook of International Economics, Vol. 3. Elsevier, Amsterdam, pp. 1457 – 1494.

Scheve, K.F, M.J. Slaughter. 2001. What determines individual trade policy preferences? *Journal of International Economics* 54: 267 – 292.

Specialty Crops Competitiveness Act of 2004. Public Law108-465, December, 2004

Specialty Crops Policy Options and Consequences: Pacific Northwest Region. Progress Report I: Summary of Focus Groups. WSU IMPACT Center, January 2006.

The 2002 Farm Bill: Title III – Trade. USDA ERS. http://www.ers.usda.gov/Features/farmbill/titles/titleIIItrade.htm

US Department of Commerce, International Trade Administration, Import Administration http://www.trade.gov/ia/index.asp

Zhao, X., and M.N. Harris. 2004. Demand for Marijuana, Alcohol and Tobacco: Participation, Levels of Consumption and Cross-equation Correlations. *Economic Record* 80(251): 394 – 41

APPENDIX B

FOCUS GROUPS WITH SPECIALTY CROP PRODUCERS,

ESTIMATED FACTOR LOADINGS FROM FACTOR ANALYSIS,

LOG-LIKELIHOOD FUNCTION OF MULTIVARIATE ORDERED PROBIT, and

AN EXAMPLE OF A QUESTIONNAIRE FOR SPECIALTY CROP PRODUCERS

Specialty Crop Producer Focus Groups

As an initial step towards understanding specialty crop producers' perspective on governmental policies, we conducted a series of focus groups in the Pacific Northwest (PNW)[14]. To capture many crop varieties, we chose specific locations in different regions of Washington, Oregon and Idaho. We conducted focus groups in Moses Lake, WA; Yakima, WA; Mt. Vernon, WA; Salem, OR; and Ontario, OR. Ontario, OR was chosen to represent farmers in Treasure Valley, which covers part of Oregon and Idaho. A total of 30 specialty crop producers participated in the focus groups. The participants were growers of various specialty crops including apples, pears, cherries, potatoes, berries, and vegetables.

The focus groups were administered with the help of a moderator (communication specialist). The moderator asked all of the questions and actively engaged the participants into the conversation. We created several topics for the discussions: income support programs and crop insurance, trade programs, impact of WTO rulings on specialty crops, U.S. import and export policies, price developments and safeguards, trade agreements, invasive species and bio-security, bio-fuels, organic and environmental issues, research, rural development, and block grants.

We have concluded several main points from these discussions. Specialty crop producers in the Northwest in general are strongly opposed to direct government subsidies. The producers considered these subsidies as distorting factors that keep inefficient producers in the business, thus hurting the whole industry. Crop insurance was considered to be more viable option for correcting high farm income fluctuations. However, some farmers strongly felt they needed to be adjusted to better suit specialty crop production, taking into account specific features of the industry such as high costs and small scale operation.

[14] For full discussion of the focus groups, see SCPOC PNW, Final Report, WSU, 2006

In regard to international trade, Northwest specialty crop producers called for creating an even playing field. In particular, they were concerned with being at a competitive disadvantage in some domestic markets due to high differences in pesticide regulations, environmental laws, and labor costs. Also, high subsidies in some countries, along with significant tariff and non-tariff barriers, keep them out of those markets. The producers wanted to see that non-tariff SPS barriers have sound scientific justification. They were also highly concerned with biosecurity issues, i.e. invasive species. Diseases imported from other countries greatly affect the local specialty crop industry, and the producers called for much tougher control on imported agricultural products as well as enforcement of traceability.

More funding was requested for applied research, extension services, pesticide controls and similar programs. Also, more government support was called for in areas of new markets and value-added production. Focus groups give us a good idea of specialty crop producers' perceptions about governmental policies. However, it is still not clear what factors influence those perceptions.

Estimated Factor Loadings and Varimax Rotated Loadings for Export Policies

Table B.1 Estimated Factor Loadings for Export Policies

Policy Option	Estimated Loadings		Rotated Estimated Loadings	
	F_1	F_2	F_1^*	F_2^*
Reduce *non-tariff* trade barriers in world markets	0.364	0.449	0.020	**0.577**
Reduce tariff barriers in world markets	0.546	0.655	0.041	**0.852**
Promotion of US product abroad	0.595	-0.390	**0.710**	0.047
Elimination of domestic or export subsidies by foreign competitors	0.412	0.276	0.162	**0.469**
Enhance competitiveness of US products in foreign markets	0.767	-0.388	**0.846**	0.152
US export subsidies	0.360	-0.211	**0.414**	0.048

Log-likelihood Function for Multivariate Ordered Probit

The probabilities of an individual choosing each category are:

$$\Pr(Choice = 0) = \Phi(-X'\beta)$$
$$\Pr(Choice = 1) = \Phi(\mu_1 - X'\beta) - \Phi(-X'\beta)$$
$$\Pr(Choice = 2) = \Phi(\mu_2 - X'\beta) - \Phi(\mu_1 - X'\beta)$$
$$\Pr(Choice = 3) = \Phi(\mu_3 - X'\beta) - \Phi(\mu_2 - X'\beta)$$
$$\Pr(Choice = 4) = 1 - \Phi(\mu_3 - X'\beta)$$

To construct the total log-likelihood function, the probabilities of all combinations of the outcomes are needed. We have a tri-variate model with five categories, thus there are 125 possible joint events with the following probabilities:

$$\Pr(0,0,0) = \Pr(P_1^* \le 0, P_2^* \le 0, P_3^* \le 0) = \Phi_3(-X'\beta_1, -X'\beta_2, -X'\beta_3; \Sigma)$$
$$\Pr(0,0,1) = \Pr(P_1^* \le 0, P_2^* \le 0, 0 < P_3^* \le \mu_{31}) = \Phi_3(-X'\beta_1, -X'\beta_2, \mu_{31} - X'\beta_3; \Sigma) - \Pr(0,0,0)$$
$$\Pr(0,0,2) = \Pr(P_1^* \le 0, P_2^* \le 0, \mu_{31} < P_3^* \le \mu_{32}) = \Phi_3(-X'\beta_1, -X'\beta_2, \mu_{32} - X'\beta_3; \Sigma) - \Pr(0,0,0) - \Pr(0,0,1)$$
$$\vdots$$
$$\Pr(2,0,1) = \Pr(\mu_{1,1} < P_1^* \le \mu_{1,2}, P_2^* \le 0, 0 < P_3^* \le \mu_{3,1}) = \Phi(\mu_{1,2} - X'\beta_1, -X'\beta_2, \mu_{3,1} - X'\beta_3; \Sigma) - \sum_{k=0}^{2}\sum_{l=0}^{0}\sum_{\substack{m=0 \\ (k,l,m)\neq(2,0,1)}}^{1} \Pr(k,l,m)$$
$$\vdots$$
$$\Pr(1,2,3) = \Pr(0 < P_1^* \le \mu_{1,1}, \mu_{2,1} < P_2^* \le \mu_{2,2}, \mu_{3,3} < P_3^* \le \mu_{3,4}) = \Phi_3(\mu_{1,1} - X'\beta_1, \mu_{2,2} - X'\beta_2, \mu_{3,4} - X'\beta_3; \Sigma) - \sum_{k=0}^{1}\sum_{l=0}^{2}\sum_{\substack{m=0 \\ (k,l,m)\neq(1,2,3)}}^{3} \Pr(k,l,m)$$
$$\Pr(q,r,s) = \Pr(\mu_{1,q-1} < P_1^* \le \mu_{1,q}, \mu_{2,r-1} < P_2^* \le \mu_{2,r}, \mu_{3,s-1} < P_3^* \le \mu_{3,s}) = \Phi_3(\mu_{1,q} - X'\beta_1, \mu_{2,r} - X'\beta_2, \mu_{3,s} - X'\beta_3; \Sigma) - \sum_{k=0}^{q}\sum_{l=0}^{r}\sum_{\substack{m=0 \\ (k,l,m)\neq(q,r,s)}}^{s} \Pr(k,l,m)$$

$$\log L = \sum_{j=1}^{J}\sum_{q=0}^{4}\sum_{r=0}^{4}\sum_{s=0}^{4} Z_j(q,r,s)\log \Pr_j(q,r,s), \text{ where q,r,s = } \{0,1,2,3,4\}$$

APPENDIX C.4 Questionnaire

Section A. Domestic Policies

1. Overall, do you think an **active government role** in the specialty crops sector is necessary?

Strongly agree	Slightly agree	Neutral	Disagree	Strongly disagree
☐	☐	☐	☐	☐

2. If government plays an active role in the specialty crops sector, **what type of programs would you like to see**? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=strongly oppose, (0)=neutral, (+3)=strongly support. Circle the appropriate answer.*

		Strongly oppose			Neutral			Strongly support
A	Input subsidies for production	-3	-2	-1	0	1	2	3
B	Market promotion to stimulate demand	-3	-2	-1	0	1	2	3
C	Safeguard against import surges	-3	-2	-1	0	1	2	3
D	Export enhancement programs/export subsidies	-3	-2	-1	0	1	2	3

3. What **income support programs** should be used for specialty crops? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=strongly oppose, (0)=neutral, (+3)=strongly support. Circle the appropriate answer.*

		Strongly oppose			Neutral			Strongly support
A	Direct payments	-3	-2	-1	0	1	2	3
B	Countercyclical payments	-3	-2	-1	0	1	2	3
C	Marketing loans	-3	-2	-1	0	1	2	3
D	Subsidized insurance	-3	-2	-1	0	1	2	3
E	Disaster assistance	-3	-2	-1	0	1	2	3

4. Should farm **income support programs** be modified to target benefits to **only small specialty crop farms** ($500,000 or less in annual gross revenues)?

☐ Yes ☐ No

5. What **research areas** should the government support? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=strongly oppose, (0)=neutral, (+3)=strongly support. Circle the appropriate answer.*

		Strongly oppose			Neutral			Strongly support
A	Production technology	-3	-2	-1	0	1	2	3
B	Value-added product development	-3	-2	-1	0	1	2	3
C	Invasive pest and general pest prevention	-3	-2	-1	0	1	2	3
D	Market development and promotion	-3	-2	-1	0	1	2	3
E	Economic analysis of market, public policy, and economic issues affecting competitiveness	-3	-2	-1	0	1	2	3

6. Should university **research, extension, and education programs** be targeted **only to small farms** ($500,000 or less in annual gross revenues)?

☐ Yes ☐ No

7. What are the most important **environmental programs** to which the government should provide financial support? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=least important, (0)=neutral, (+3)=most important. Circle the appropriate answer.*

		Least important			Neutral			Most Important
A	Preservation/Conservation of open space	-3	-2	-1	0	1	2	3
B	Preservation/Conservation of farmland	-3	-2	-1	0	1	2	3
C	Preservation/Conservation of water quality	-3	-2	-1	0	1	2	3
D	Preservation/Conservation of wildlife habitat	-3	-2	-1	0	1	2	3

E	Management of animal waste	-3	-2	-1	0	1	2	3
F	Reducing soil erosion	-3	-2	-1	0	1	2	3
G	Increasing carbon in soil	-3	-2	-1	0	1	2	3
H	Producing fuels from crops and other biomass	-3	-2	-1	0	1	2	3

8. What are the most important **labor issues** in agriculture? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=least important, (0)=neutral, (+3)=most important. Circle the appropriate answer.*

		Least Important			Neutral			Most Important
A	Labor and human resource management	-3	-2	-1	0	1	2	3
B	Workforce availability	-3	-2	-1	0	1	2	3
C	Foreign guest worker program	-3	-2	-1	0	1	2	3
D	Availability of seasonal labor	-3	-2	-1	0	1	2	3
E	Community impacts of immigrant works	-3	-2	-1	0	1	2	3
F	Independent contractors versus employees	-3	-2	-1	0	1	2	3
G	Worker unions and collective bargaining	-3	-2	-1	0	1	2	3

Section B. Trade and Foreign Policies

9. Please, indicate whether you are agree with the following statement:
"Specialty crop producers benefit from international trade."

Strongly agree	Slightly agree	Neutral	Disagree	Strongly disagree
☐	☐	☐	☐	☐

10. Indicate where you see the **right balance between free trade and national sovereignty** in order to pursue domestic economic or social policy goals. *Please, check* **one** *answer that matches your opinion the best.*

☐ a. "Free trade without any government intervention should be the policy objective."

☐ b. "Free trade should be the policy objective but least-trade distorting policy intervention should be allowed when necessary."

☐ c. "Government intervention should be possible as long as the policies are targeted only towards domestic producers."

☐ d. "Government should have all rights to intervene/regulate markets in order to pursue their policy goals."

11.1. Should the government design any policies regarding US **imports**?

☐ Yes **(go to 11.2)** ☐ No **(go to 12.1)**

11.2. What should be the most important US **import** policy? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=least important, (0)=neutral, (+3)=most important. Circle the appropriate answer.*

		Least Important			Neutral			Most Important
A	Prevention of invasive species	-3	-2	-1	0	1	2	3
B	Use of tariffs to protect import sensitive crops	-3	-2	-1	0	1	2	3
C	Maintaining anti-dumping laws to prevent dumping of foreign products on the US market	-3	-2	-1	0	1	2	3

12.1. Should the government design any policies regarding US **exports**?

☐ Yes **(go to 12.2)** ☐ No **(go to 13.1)**

12.2. What should be the most important US **export** policy? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=least important, (0)=neutral, (+3)=most important. Circle the appropriate answer.*

		Least Important			Neutral			Most Important
A	Reduce *non*-tariff trade barriers in world markets	-3	-2	-1	0	1	2	3
B	Reduce tariff trade barriers in world markets	-3	-2	-1	0	1	2	3
C	Promotion of US products abroad	-3	-2	-1	0	1	2	3
D	Elimination of domestic or export subsidies by foreign competitors	-3	-2	-1	0	1	2	3
E	Enhance competitiveness of US products in foreign markets	-3	-2	-1	0	1	2	3
F	US Export Subsidies	-3	-2	-1	0	1	2	3

13. What should be the government role in the area of **competitiveness of specialty crops**? *Please, check **one** option.*

☐ a. Increase competitiveness of domestic specialty crops products by providing financial support regardless of import flows.

☐ b. Intervene actively in form of border measures or financial support when imports enter the U.S. under circumstances of "unfair competition."

☐ c. Government should only provide market information and extension service in order to support farmers, but not intervene actively.

☐ d. No role for the government at all.

14. What are the most important determinants for **competitiveness** of the US agricultural products? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=least important, (0)=neutral, (+3)=most important. Circle the appropriate answer.*

		Least Important			Neutral			Most Important
A	Adoption of new technologies	-3	-2	-1	0	1	2	3
B	Input costs	-3	-2	-1	0	1	2	3
C	Transportation costs	-3	-2	-1	0	1	2	3
D	Labor issues	-3	-2	-1	0	1	2	3
E	Environmental Constraints	-3	-2	-1	0	1	2	3
F	Financial support from the US government	-3	-2	-1	0	1	2	3
G	Import flows into domestic markets	-3	-2	-1	0	1	2	3
H	Changes in consumption patterns	-3	-2	-1	0	1	2	3

15. From which programs of the existing **trade title** of the farm bill have you benefited? *Please, check as many options as apply*.

- ☐ a. Export Credit Guarantee Program
- ☐ b. Market Development Program (Market Access Program, Foreign Market Development, Emerging Market Program, Online Exporter Assistance, Global Market Strategy)
- ☐ c. Export Enhancement Program
- ☐ d. Food Aid and Development Programs
- ☐ e. Biotechnology and Technical Barriers to Trade Program
- ☐ f. Technical Assistance for Specialty Crops Program
- ☐ g. Dairy Export Incentive Program
- ☐ h. None

16. What US **government institutions** are the most relevant for foreign trade issues (imports and exports)? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=least relevant,(0)=neutral, (+3)=most relevant. Circle the appropriate answer.*

		Least relevant			Neutral			Most relevant
A	Animal and Plant Health Inspection Service (APHIS)	-3	-2	-1	0	1	2	3
B	Environmental Protection Agency (EPA)	-3	-2	-1	0	1	2	3
C	United States Trade Representative (USTR)	-3	-2	-1	0	1	2	3
D	USDA Foreign Agricultural Service (FAS)	-3	-2	-1	0	1	2	3
E	Customs and Border Protection (CBP)	-3	-2	-1	0	1	2	3
F	Food Safety Inspection Service (FSIS)	-3	-2	-1	0	1	2	3
G	Food and Drug Administration (FDA)	-3	-2	-1	0	1	2	3

17. Please, indicate how the following statements match your opinion.
The term "trade agreement" includes WTO membership and all other type of Foreign Trade Agreements or bilateral agreements.

a. Membership in a trade agreement **enhances trade opportunities** in general.

Strongly agree ☐ Slightly agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

b. Membership in a trade agreement enhanced the **trade possibilities for your product/your members' products**.

Strongly agree ☐ Slightly agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

c. The membership of a trading partner in a trade agreement with the US influences **your potential product markets** or trading partners.

Strongly agree	Slightly agree	Neutral	Disagree	Strongly disagree
☐	☐	☐	☐	☐

18. What is your **perception of the impact** on trade of the different trade agreements? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=very negative, (0)=no effect, (+3)=very positive. Circle the appropriate answer.*

		Very Negative			No Effect			Very Positive
A	WTO	-3	-2	-1	0	1	2	3
B	NAFTA	-3	-2	-1	0	1	2	3
C	Bilateral Agreements	-3	-2	-1	0	1	2	3

19. What are the most important issues in the current **WTO trade negotiations**? *Please, evaluate each option on the scale of (-3) to (+3), (-3)=least important, (0)=neutral, (+3)=most important. Circle the appropriate answer.*

		Least important			Neutral			Most important
A	Labor laws	-3	-2	-1	0	1	2	3
B	Environmental impacts	-3	-2	-1	0	1	2	3
C	Harmonization of food safety standards	-3	-2	-1	0	1	2	3
D	Trade facilitation (Harmonization of all types of import requirements impeding trade)	-3	-2	-1	0	1	2	3

20. Have you **lost** export opportunities due to trade agreements?

☐ Yes: Please, indicate trade agreement/event, commodity, and country

_____

☐ No

21. Have you **gained** export opportunities as a result of trade agreements?

☐ Yes: Please, indicate trade agreement/event, commodity, and country

☐ No

22. What are your **main information sources** for trade related information/export markets?
Please, evaluate each option on the scale of (-3) to (+3), (-3)=least important, (0)=neutral, (+3)=most important. Circle the appropriate answer.

		Least important			Neutral			Most important
A	Professional/academic journals	-3	-2	-1	0	1	2	3
B	Trade journals	-3	-2	-1	0	1	2	3
C	Government publications	-3	-2	-1	0	1	2	3
D	International trade organizations' information	-3	-2	-1	0	1	2	3
E	Foreign trade partners	-3	-2	-1	0	1	2	3
F	Industry organizations' publications	-3	-2	-1	0	1	2	3
G	Mass media (newspaper, TV)	-3	-2	-1	0	1	2	3
H	Colleagues	-3	-2	-1	0	1	2	3
I	University extension publications	-3	-2	-1	0	1	2	3

Section C. Labeling and Traceability

23. **Circle the appropriate word** to complete the sentence.

    Labeling should be used to identify **country of origin** on {domestic / imported / domestic and imported / no} food products.

24. Should product made using **biotechnology** be labeled as such?

    ☐ Yes ☐ No

25. Should the government increase efforts to **improve traceability** from consumer back to producer to improve food safety and tracking if it **increases the average price of food** by

    a. 1% ☐ Yes ☐ No

    b. 2% ☐ Yes ☐ No

    c. 3% ☐ Yes ☐ No

    d. 5% ☐ Yes ☐ No

    e. 10% ☐ Yes ☐ No

26. Are you satisfied with the current policy of the government regarding **agricultural market information and reporting**?

Highly satisfied	Somewhat satisfied	Neutral	Unsatisfied	Highly unsatisfied	Do not use
☐	☐	☐	☐	☐	☐

Section D. Demographics

For producers

27. Where is your farm located? Please, indicate the **county and state**.

28. Are you a member of any grower associations and/or commissions?

☐ Yes: Please, indicate which ones:

_____

_____

_____

☐ No

29. Are you able to **switch to "program crop production"** in your farm area (e.g. wheat, corn, soybeans)?

☐ Yes

☐ No

30. Do you participate in **domestic farm programs** (e.g. direct payments, CRP, crop insurance, EQIP)?

☐ Yes: Please, indicate which ones:

_____

_____

☐ No

31. Please, indicate up to **3 main commodities** that are produced on your farm and fill in the **market destinations** for each crop.

	Crop (ordered by gross revenue)	% to domestic market	% to foreign market	Total, %
1				100
2				100
3				100

32. For the crops that are marketed in foreign countries, please, indicate **3 major destinations and the percentage of the revenues** coming from each country. Also, indicate what countries are the **major competitors** in the markets for each commodity.

	Crop (ordered by gross revenue)	Top Export Destination Countries	% of your total export revenue	Major foreign country competitor
1				
2				
3				

32. What countries are the **most important competitors in the US markets** for each commodity? List up to 3 countries.

	Crop (ordered by gross revenue)	Major competitors in US market
1		
2		
3		

33. Are any of the countries indicated in Question 32 & 33 in a **trade agreement with the US** (e.g. WTO, NAFTA, Bilateral agreements)?

☐ Yes: Please, indicate the countries: _____

☐ No

☐ Don't know

34. Please, indicate your **age**. ☐

35.
☐ Male
☐ Female

36. Please, indicate the **highest education level** you have completed.

☐ a. Less than high school
☐ b. High school
☐ c. Technical school
☐ d. Some college
☐ e. College graduate
☐ f. Post-graduate degree

37. Please, indicate **number of members in your household**. ☐

38. Please, indicate the **size of your farm** by annual gross receipt.

☐ a. < $249,999
☐ b. $250,000 - $499,999
☐ c. $500,000 - $749,999
☐ d. $750,000 – $999,999
☐ e. $1,000,000 - $1,999,999
☐ f. $2,000,000 - $2,999,999
☐ g. > $3,000,000

39. Please, indicate total **off-farm** income of your household.

☐ a. $0
☐ b. $1 - $19,999
☐ c. $20,000 - $39,999
☐ d. $40,000 - $60,000
☐ e. > $60,000