Food Quality Verifications and Consumer Trust

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Abstract

Food markets are increasingly characterized by an array of quality assurances with respect to credence attributes, reflecting a growing interest in where food comes from and how it is produced. The provision and signalling of these credence quality attributes includes both public and private sector initiatives. How effective are quality signals in addressing the information asymmetry inherent in credence attributes? To what extent do consumers trust quality assurances from different sources, and does this trust differs across food products or across credence attributes? The paper presents a simple economic welfare analysis of the market for a credence attribute under different assumptions with respect to the strength of consumer preferences, the existence of voluntary versus mandatory standards, and the credibility of third party certification. This is followed by an empirical analysis drawing from two consumer surveys in Canada using discrete choice experiments. Food quality claims related to farm animal welfare in a meat product and to environmental sustainability in a bread product are examined. Latent Class models reveal significant heterogeneity in consumer preferences, both in terms of the value consumers place on farm animal welfare and environmentally sustainable quality assurances, and the extent to which it matters *who* is verifying these assurances.

Keywords credence attribute, animal welfare, environmental sustainability, quality verification, discrete choice experiment

JEL code **Q13; Q18**

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Introduction

A fascinating trend in food markets has been the increasingly diverse array of quality claims based on credence attributes: natural, carbon-neutral, sustainable, local, traditional, eco-friendly, animal friendly, fair trade, etc. The list is long, and growing. In a few cases, organic being the most obvious, there exist nationally recognized public standards codifying production methods and enshrining accreditation and certification processes. For the most part, however, quality claims emanate from a range of private and third party organisations: food manufacturers, supermarkets, farmers' organisations, environmental groups, animal welfare groups, development NGOs, and so on. A range of motivations characterise this diverse group: from product differentiation and the creation of barriers to entry through innovation, to the creation or redressing of market power, to the achievement of a specific social goal.

Standards have evolved over time: quality attributes that were once primarily differentiated in a niche market (with a commensurate price premium) have metamorphosed into the mainstream commodity market as a result of mandatory public standards or even widely adopted private standards that 'raise the bar' in terms of required production practices. Animal welfare provides a good example. Take the market for eggs, which has long featured product differentiation in the form of free range, free-run, cage-free, barn eggs, organic, etc. versus mainstream battery cage egg production systems. Following a prolonged phase-out period, a ban on battery cage production systems came into effect in the European Union in January 2012. The ban followed widespread public pressure from animal welfare organisations, among others. Eggs from free-range and other cage-free production systems now dominate supermarket shelves.

Lobbying efforts extend beyond attempts to change public policy and have also begun to operate through food markets, such as efforts to influence the procurement policies of private sector food retailers, processors and the HRI (hotel, restaurant and institutional) trade. For example, the 'Good Egg' Award from the organisation 'Compassion in World Farming' encouraged UK companies to source cage-free eggs prior to the 2012 outright ban. The growth of private food quality standards has been well documented and includes both consensus standards established by coalitions of firms, GLOBALGAP and the UK's Assured Food Standards (red tractor) scheme being examples, as well as proprietary standards put in place by

individual firms (Henson and Reardon, 2005; Fulponi, 2005; Hobbs, 2010). A number of UK retailers promote their use of proprietary animal welfare standards that include independent auditing of farms, such as the 'Tesco Livestock Codes of Practice' (Tesco, 2012). In the US, Safeway assures its customers that buying decisions give preference to poultry manufacturers using more humane slaughter systems and to pig farmers who are phasing out sow gestation stalls, while a number of large North American meat processors (including Smithfield Foods Inc. and Maple Leaf Foods Inc.) announced they would eventually require their suppliers to phase out the use of sow gestation crates (HSUS, 2011; Smithfield Foods, 2012; Maple Leaf, 2007).

It is clear that private food quality standards are growing in scope and complexity alongside public sector initiatives to address perceived information asymmetries in the provision of credence attributes and/or the public good element potentially embedded in environmental and animal welfare attributes. How effective are public and private standards in signalling quality to consumers? In part this depends on the credibility of the information source: of interest therefore is the extent to which consumers trust quality assurances from different sources, and whether this differs across food products, across credence attributes and across consumers.

The preceding discussion yields four observations. First, governments intervene to different degrees in the regulation of credence attributes such as farm animal welfare, and in particular the extent to which they are willing to legislate mandatory production practices. Second, mainstream food retailers and food processors have begun to provide production method assurances (including animal welfare) to their consumers, often using supply chain audits of their suppliers to ensure compliance. Third, public pressure from third parties (animal welfare groups, environmental groups, etc.) has probably played a role in generating both outcomes: lobbying for changes to public policy and changes to private procurement practices. Finally, labelling and certification are necessary signalling mechanisms for a credence attribute, and the credibility of this quality signal will determine its effectiveness in ameliorating potential market failure from information asymmetry.

Drawing upon these observations the next section presents a simple economic welfare analysis of the market for a credence attribute (animal welfare) under different assumptions with respect to the strength of consumer preferences, the existence of voluntary versus mandatory standards, and the credibility of quality verification. The core model assumptions regarding the strength of consumer preferences and the credibility of private, third party and public verification

are subsequently explored empirically. Discrete choice models are applied to data from two Canadian consumer surveys examining consumer attitudes to animal welfare and environmentally sustainability claims in food products.

Welfare Analysis

A rich literature has emerged dealing with quality assurances and labelling of credence attributes in food markets (see for example, Anania and Nistico, 2004; Giannakas and Fulton, 2002; Roe and Sheldon, 2007). Common themes include the importance of reputation as an incentive for firms to invest in higher quality goods and quality assurance; incentives to cheat (mislabel) in the presence of information asymmetry; credibility of the label or quality assurance; and heterogeneity in consumer preferences. We present a simple economic welfare model examining the role of credible quality signals in the market for a credence attribute: in this case we use the example of animal welfare-friendly food but the case could be extended to other credence attributes, such as food with an eco-friendly claim. Key outcomes from this model are explored in the subsequent empirical analysis. The welfare analysis draws upon Anania and Nistico (2004).

The analysis assumes that farmers use either conventional production methods, resulting in a conventional food product (CNV), or less intensive methods that result in a food product with enhanced animal-welfare characteristics, denoted by AW. The enhanced production methods might include, for example, lower animal densities, refraining from the use of gestation stalls in pork production or battery cages in egg production, providing access to the outdoors, and avoiding the use of sub-therapeutic antibiotics or growth promotants. We assume that enhanced AW production methods result in higher average production costs per unit. Both conventional and animal welfare producers are assumed to be price takers. Finally, it is assumed that AW producers never find it profitable to sell into the conventional market.

Consumers are divided into two groups: Group A consumers are assumed to be indifferent between CNV methods and AW methods, while Group B consumers prefer food produced to higher standards of animal welfare (preferring AW over CNV), obtaining increased utility from the knowledge that animals were raised in what they perceive to be more humane conditions[1]. Group B consumers are willing to pay a higher price for food with an animal welfare

[1] A number of studies show that some consumers perceive products with animal-friendly attributes to be of higher quality than conventional products for a variety of reasons, from ethical beliefs or because of a perception that these

assurance. Finally, consumers from both groups are assumed to be aware (implicitly or otherwise) of the relative cost structure of conventional and animal welfare-friendly production systems, in other words, they anticipate paying a higher price for food with an animal welfare-friendly claim[2].

Based upon the above assumptions, three scenarios are examined: voluntary standards with labelling that is fully credible, voluntary labelling with in the absence of trust, and mandatory standards.

Scenario 1: Voluntary Labelling that is Fully Credible

Initially we assume that only conventional production systems exist, yielding a single market (pooled) equilibrium. However, with the recognition that a group of consumers would prefer meat produced to higher animal welfare standards, some farmers voluntarily switch their production methods from CNV to AW. We assume that AW is produced according to voluntary standards, such as the RSPCA's Freedom Food scheme[3]. Two separate markets for CNV and AW emerge, as depicted in Figure 1, with the higher production costs associated with AW reflected in S_W. Assuming that AW production is not significant enough to cause an increase in the price of inputs for conventional production, the supply of CNV remains at S. AW producers voluntarily label their products to allow identification by Group B consumers. In this scenario it is assumed that monitoring and enforcement is perfect and costless and reputations are important, such that no CNV producer cheats by falsely mislabelling his products as AW. As a result, Group B consumers fully trust the AW label and reveal their maximum willingness to pay for food with these attributes. The demand for the animal welfare-assured food product (AW) is given by D_w. The demand for the equivalent conventional food product, CNV, rotates inwards from D to D_c as a result of some consumers switching to the AW market. The conventional market, CNV, clears at P_C0, Q_C0, while the AW market clears at P_W0, Q_W0, with total welfare as

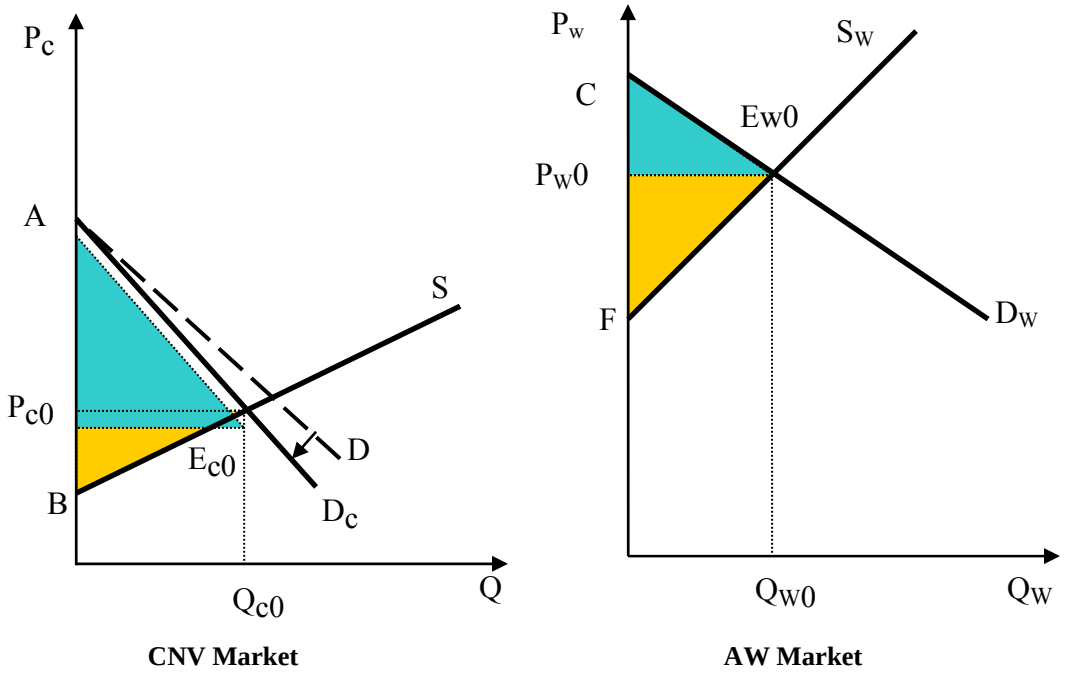
products have taste, food safety or health benefits (e.g., Rolfe, 1999; Harper and Makatouni, 2002;Ophuis, 1994; Lusk *et al.*, 2007). Furthermore, Bennett (1995) points out that some consumers may receive disutility not only from their own consumption but also from other people's consumption of products that are perceived to contribute to poor farm animal welfare, therefore arguing that farm animal welfare has public good (public bad) aspects.

[2] This assumption is consistent with Lusk *et al.* (2007) and Hoogland *et al*., (2007) who found that consumers associated improvements in animal welfare with an expectation of higher meat prices.

[3] Freedom food is a farm assurance scheme run by the Royal Society for the Prevention of Cruelty to Animals (RSPCA). The scheme is based on RSPCA standards, and monitored by the RSPCA. See http://www.rspca.org.uk/freedomfood/

indicated by the shaded areas. This outcome hinges on the strong assumptions that labelling is fully credible and cheating is absent.

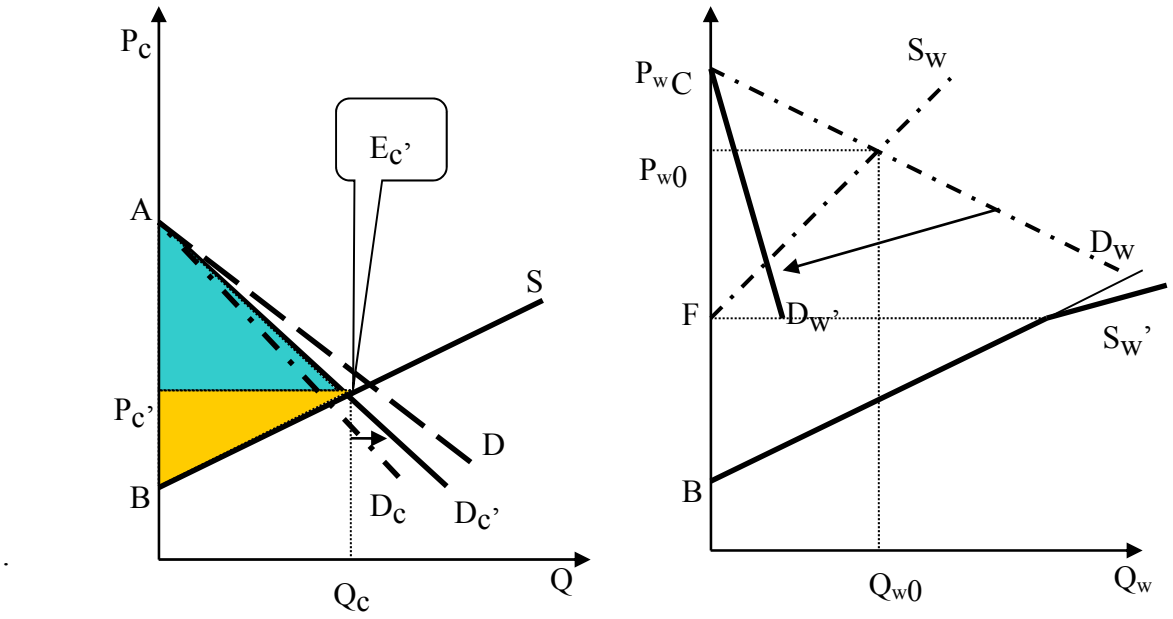
Figure 1: Market Equilibria under Fully Credible Voluntary Labelling



Scenario 2: Voluntary Labelling in the Absence of Trust

Alternatively, we examine the outcome when consumers have little or no trust in the voluntary AW label; this case is equivalent to no labelling of AW. All conventional producers can, without legally abrogating a regulation, sell their CNV products on the AW market; monitoring and enforcement of voluntary labels is imperfect and the adverse selection problem is pervasive. Following Anania and Nistico (2004), the supply in the AW market for prices below F coincides with that in the CNV market when the voluntary label is fully credible, as no AW producer finds it profitable to produce, and the AW market is supplied by conventional producers only (Figure 2). When the price exceeds F, both the AW and the CNV producers are offering their products on the AW market. As a result, the supply of AW is given by the horizontal summation of S and S_w and is denoted by S_w' in Figure 2.

Figure 2: Market equilibria when consumers have little or no trust in the voluntary label



CNV Market **AW Market**

It is assumed that Group B consumers are still willing to pay a premium for food offered on the AW market as long as the price that is charged is greater than F, as they face a positive probability of buying animal welfare-friendly products. However, their willingness to pay is much lower than in the case when they fully trust the label. This is captured by the clockwise inward rotation in the demand for AW-labelled food from D_W to D_W'. Moreover, consumers are not willing to buy any product offered on the AW market at prices below F, as they know that F is the minimum price that AW producers require to start producing animal welfare-friendly food; therefore, a product offered at a price below F can only be conventional food.

Figure 2 shows that competition between the AW and the CNV producers (all are price takers) on the AW market will result in CNV producers offering their product at a price just below F, which is the minimum entry price for the AW producers. At this price consumers will not buy any product they are offered as AW since they know that at that price it can only be conventional product, CNV. As a result, the AW market collapses and the CNV producers have to sell their products on the conventional market. In this case, the supply of CNV is equal to the supply of CNV under voluntary labelling that is fully credible – i.e., S in Figure 2. It is assumed that at least some of the B consumers (those who only weakly prefer AW and are now unable to

buy AW at a higher price) join the A consumers, causing the demand for CNV to expand with respect to that in the previous scenario – i.e., $D_{C'}$ in Figure 2.

The CNV price and the quantity of CNV that is marketed exceed those that emerge on the market when labelling of animal welfare-friendly food is fully credible because now no AW production can take place and CNV is substituted for AW by some of the group B consumers. The surplus that is earned by the A consumers, and the B consumers who switch, is given by area $A\text{-}E_{C'}\text{-}P_{C'}$ in Figure 2. The remaining B consumers, with stronger preferences, unable to buy the animal welfare-friendly food product at a higher price, exit the AW market and do not receive any surplus. They are worse off as the AW market collapses. The total consumer surplus in scenario 2 is lower than that enjoyed by the consumers (both A and B) in scenario 1. The CNV producers earn surplus equal to area $P_{C'}\text{-}E_{C'}\text{-B}$ and are better off compared to the case of fully credible AW labelling. Conversely, the AW producers are worse off, as they have to exit the AW market. The total welfare that is generated in the remaining CNV market is given by area $A\text{-}E_{C'}\text{-B}$. The credibility of AW labelling again drives this outcome.

Scenario 3: Mandatory AW Standard with Autarky

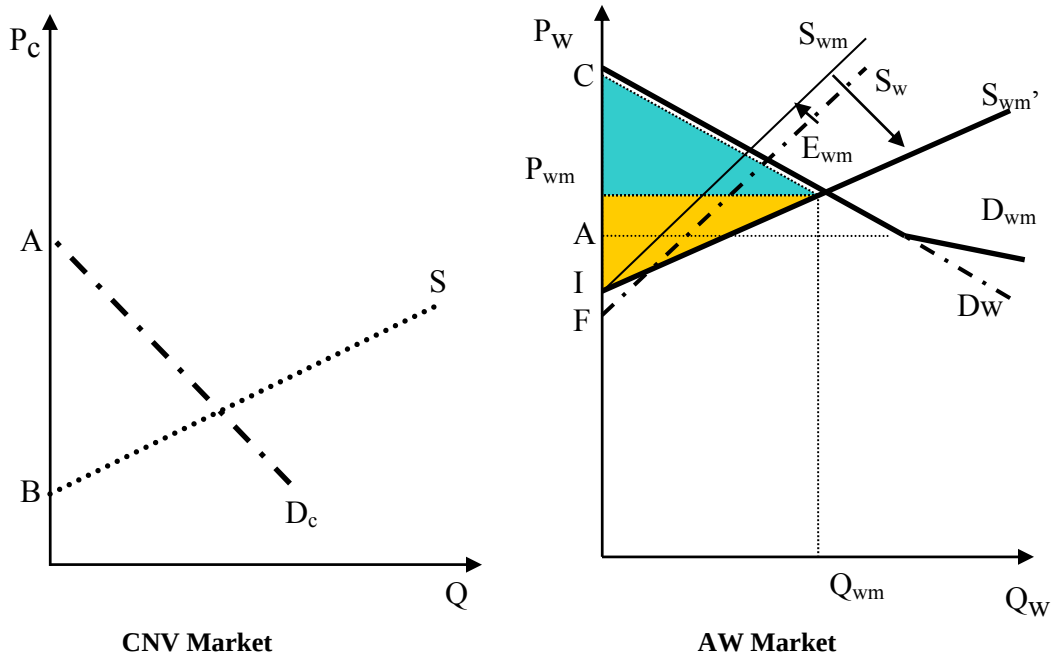
This scenario depicts a situation in which *all* domestic farmers are required to adopt specific "welfare-friendly" production methods; intensive production methods are banned in the domestic market. This is analogous to recent legislation in some jurisdictions as discussed earlier. We assume that the mandatory standard is more stringent than the voluntary standards used by AW producers in the previous scenarios, resulting in higher AW production costs, depicted by the shift in S_W to S_{Wm} in Figure 3. While some of the CNV producers are expected to exit the market, most of them are assumed to adapt to the mandatory animal welfare protocols. As a result, the domestic AW production increases (shown by a rotation in the supply of AW from S_{Wm} to $S_{Wm'}$ in Figure 3).

For simplicity, it is assumed that the mandatory domestic standard is accompanied by a ban on all imports not complying with an equivalent standard, such that imports of CNV are prevented from entering the market. Hobbs *et al*. (2002) note that the European Union proposed border restrictions based on animal welfare production standards; while Kerr and Hobbs (2002)

chart the long-running trade dispute between the EU and the US and Canada based on the EU's ban on imports of beef using growth promotants following a similar domestic ban (a trade barrier subsequently ruled illegal by the WTO disputes panel).

On the demand side, Group A consumers are willing to buy animal welfare-friendly food when its price falls below A. Thus, the aggregate demand for AW, D_{wm}, is the horizontal summation of D_c and D_w.

Figure 3: Market equilibrium under mandatory AW standard and autarky



The equilibrium price of AW under the mandatory standard, P_{wm}, lies below the price of AW under voluntary labelling. However, it is not low enough to allow the A consumers (who are indifferent between the two production systems) to substitute the conventional food, CNV, for animal welfare-friendly food, so that the equilibrium quantity of AW that is marketed, Q_{wm}, goes only to the B consumers. In other words, group A consumers are forced out of the market for this particular product and look for substitutes.

Under this scenario, the B consumers enjoy surplus equal to area C-E_{wm}-$P_{wm,}$ while the economic surplus accruing to the AW producers is given by area P_{wm}-E_{wm}-I. Thus, the total welfare that is generated in the AW market under the mandatory animal welfare standard, and no imports of the conventional equivalent, is given by area C-E_{wm}-I and is smaller than the total welfare under fully credible voluntary labelling. Group A consumers suffer from the absence of choice between AW and the cheaper CNV. Furthermore, CNV producers lose since some of them incur additional costs to comply with the animal welfare standard while others exit the market.

The economic welfare outcomes modelled above suggest that a situation of credible voluntary labelling maximises economic welfare since it allows heterogeneous consumers to choose between different combinations of price and quality according to their preferences. It allows consumers with strong ethical preferences to express those preferences through market transactions. Cleary this outcome hinges on a number of assumptions, including the extent to which voluntary labelling systems are credible. Understanding the factors that enhance or constrain the credibility of a voluntary quality label is the subject of the ensuing empirical analyses. Also key to determining the size of the relative welfare gains and losses is the extent to which consumer preference heterogeneity exists with respect to the credence attribute, together with the relative strength of these preferences. Empirical research can address whether a "Group B" set of consumers exists as well as their relative price sensitivity.

In the presence of uncertainty about labelling claims, Group B consumers have a strong incentive to lobby for mandatory animal welfare (or environmental) standards. If consumers with strong preferences (Group B) are successful in lobbying for mandatory standards the outcome will be akin to scenario 3, which yields a loss in surplus to those consumers who are indifferent between conventional food and food produced with specific credence attributes, such as higher animal welfare or environmental standards[4]. Therefore, analysis that measures the strength of consumer preferences for credence attributes, while accounting for preference heterogeneity, is needed. Finally, an issue not explicitly captured in the above graphical analysis, which has

[4] The outcomes also depend on the relative price differential between AW and CNV production and the extent to which producers can switch between these production systems. This issue is beyond the scope of the present analysis. Interested readers are referred to Babcock *et al.* 2002.

focused on information asymmetry, is the extent to which the production of food with animal welfare, environmental sustainability, or similar credence attributes has public good properties. If the market underprovides a socially acceptable level of these attributes then the social welfare gains/losses from fully credible voluntary labelling versus the imposition of mandatory standards are not as clear cut. The following section presents an empirical analysis exploring some of the questions outlined above in the context of two credence attributes: farm animal welfare and environmental sustainability.

Empirical Analysis

The empirical analysis is directed at three key questions emerging from the above discussion: 1) to what extent are voluntary labelling systems for credence attributes credible; 2) to what extent does consumer preference heterogeneity exist with respect to credence attributes; and 3) do these effects differ across products and across attributes? To this end, two nationwide Internet-based consumer surveys were undertaken in Canada in June-July 2008[5]. Both surveys included a discrete choice experiment. The discrete choice experiment in the first study (480 respondents) presented respondents with a choice scenario for bread characterized by environmentally sustainable and pesticide-free production methods, together with verification of these quality attributes by various organisations (public sector, private sector, third party), at different price levels. For ease of exposition, study #1 will be referred to as the 'Environmental' or bread study[6]. The second study (540 respondents) focused on animal welfare, with a discrete choice experiment featuring pork chops containing three different animal welfare attributes (housing system, group pens, use of antibiotics), together with verification by various organizations (similar to the environmental study), at various prices. For ease of exposition, study #2 will be referred to as the 'Animal Welfare' or pork study[7].

[5] As the surveys were undertaken in English only, the samples under-represent the French-speaking province of Quebec, but were otherwise reasonably representative of English-speaking Canadians. As with many Internet surveys, the samples tended to slightly over-represent higher education groups and under-represent lower income Canadians. Survey respondents were recruited by Leger Marketing from their online panel of Canadian consumers.

[6] For a detailed discussion of study #1, readers are referred to Innes (2008) and Innes and Hobbs (2011).

[7]. For a detailed discussion of study #2, readers are referred to Uzea (2009) and Uzea et al. (2011). Study #2 included a general population sample (540 respondents) and a targeted sample of animal welfare organization members (52 respondents). For the purposes of this paper, only the general population sample results are used.

In addition to the discrete choice experiments, both surveys collected data on respondents' food purchasing habits, attitudes toward various food production methods, and trust in public and private sector sources for information about farming, together with socio-demographic information[8]. Responses to the general survey questions indicate a higher level of declared trust in public sector and third party organizations, on average, while trust in private sector actors appeared to be weaker. However, this broad overview masks considerable heterogeneity in consumer attitudes toward quality verification, and does not capture the extent to which consumers trade-off different types of quality verification when faced with products priced at different levels. The discrete choice experiments provide a more nuanced picture.

Choice Modelling

In the two choice experiments respondents were asked to imagine that they were planning to purchase a pre-packaged loaf of bread, or a package of boneless pork chops, and were asked to choose one alternative from a choice set where each alternative was described by a set of production method attributes, a verifying organization, and price. Tables 1 and 2 describe the bread and pork product attributes used in the choice experiments, along with the levels for the attributes that varied across the choice sets. Selection of attributes followed a review of relevant literature and discussion with industry experts. Price levels corresponded with prices for basic versus speciality bread and pork products in the Canadian retail market.

Table 1 Study 1: Environmental Study (Bread): Attributes and Levels

ATTRIBUTE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
Verifying Organization	Government	Third Party	Supermarket	Bakery	Farmer
Pesticide-Free Grains	Yes	No			
Environmentally Sustainable Grains	Yes	No			
Price[a]	$1.99/loaf	$2.99/loaf	$3.99/loaf	$4.99/loaf	

[a] All prices are in Canadian dollars. At the time of the survey Cdn$1 = £0.50

[8] Copies of the survey instruments are available from the authors upon request or can be found in Innes (2008), and in Uzea (2009) or Uzea et al. (2011) as an online attachment.

Table 2: Study 2: Animal Welfare Study (Pork): Attributes and Levels

ATTRIBUTE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Verifying Organization	Government	Third Party	Supermarket	Processor	Farmer	None
Pigs' Housing system	Outdoor Housing	Hoop Housing	Conventional Housing			
Gestation Stalls	Use of sow gestation stalls	Use of groups pens for sows				
Sub-Therapeutic Antibiotics	Raised with the use of antibiotics	Raised without the use of antibiotics				
Price[a]	$11.07/Kg	$13.21/Kg	$16.08/Kg	$19.36/Kg		

[a] All prices are in Canadian dollars. At the time of the survey Cdn$1 = £0.50

Both choice experiments used an orthogonal main effect design divided into four blocks of eight questions in each group, such that each respondent completed eight choice tasks. Examples of the choice sets are presented in Figure 2. Each choice set included an opt-out 'no purchase' option (D) to increase the realism of the choice task since in a real shopping situation consumers can decide not to make a purchase.

Figure 2: Examples of Choice Sets from Both Studies

Study 1: Bread

Features	**A**	**B**	**C**	**D**
Organization verifying	Supermarket Verified	3rd Party Verified	Bakery Verified	I would not purchase any of these products
Pesticide Free			√	
Environmentally Sustainable	√	√		
Price	$2.99	$4.99	$3.99	
	Option A	Option B	Option C	Option D
I would choose …	⊙	⊙	⊙	⊙

Study 2: Pork Chops

Features	**A**	**B**	**C**	**D**
Pigs' Housing System	Outdoor	Hoop	Conventional	I would not buy any of these products.
Gestation Stalls	Group pens	Gestation stalls	Gestation stalls	
Antibiotics	Not used	Not used	Used	
Organization verifying	Third Party verified	Government verified	None	
Price	$ 19.26/ kg (or $ 8.74/ lb)	$ 13.21/ kg (or $ 5.99/ lb)	$ 11.07/ kg (or $ 5.02/ lb)	
I would choose…	□	□	□	□

The data from each study are analysed separately with choice behaviour modelled in a random utility maximisation framework, assuming that individual *n* receives utility *U* from selecting alternative *i* in choice situation *t*. Utility is a combination of a systematic component which varies with the product attributes, V_{nit}, and a stochastic component, ε_{nit}, as specified in equation (1) (Louviere *et al*., 2000).

(1) $U_{nit} = V_{nit} + \varepsilon_{nit}$

The systematic component of the utility function is given by:

(2) $V_{nit} = \alpha_n BUYNONE_{nit} + \delta_n^{'} Price_{nit} + \beta_n^{'} x_{nit}$

where α_n represents individual *n*'s utility of not purchasing any bread (pork) products in a choice situation *t*, $BUYNONE_{nit}$ is an alternative specific constant that takes the value 1 for the no purchase alternative (Option D) and 0 otherwise, $Price_{nit}$ is price and x_{it} is a vector of non-price quality attributes from the discrete choice experiment. Definitions of the variables used in each study are provided in Tables 3 and 4. Individual *n* chooses the alternative that yields the highest utility from a choice set J= 1,…,*j*.

Following Louviere *et al.* (2000) this can be represented as:

(3) $U_{in} > U_{jn}$ for all $j \neq i$ for all $i \neq j$, in case that alternative i is chosen

Substituting (1) into (3) leads to:

(4) $(V_{in} + \varepsilon_{in}) > (V_{jn} + \varepsilon_{jn})$

The probability P_{in} that an individual n chooses alternative i is:

(5) $P_{in} = \Pr ob(U_{in} > U_{jn}) = \Pr ob(V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}) = \Pr ob(\varepsilon_{jn} - \varepsilon_{in} < V_{in} - V_j)$ for all j≠i

Table 3: Study 1: Environmental (Bread) Study Variables

VARIABLE	DESCRIPTION
Pesticide-Free	Dummy=1 if grains were produced without the use of chemical pesticides
Sustainable	Dummy=1 if grains were produced in an environmentally sustainable way
Government Verified	Effects coded dummy=1 if grains were verified by government to contain at least one of Pesticide-Free or Sustainable
Third Party Verified	Effects coded dummy=1 if grains were verified by a third party to contain at least one of Pesticide-Free or Sustainable
Farmer Verified	Effects coded dummy=1 if grains were verified by the farmer or a farm organisation to contain at least one of Pesticide-Free or Sustainable
Supermarket Verified	Effects coded dummy=1 if grains were verified by the supermarket to contain at least one of Pesticide-Free or Sustainable
Bakery Verified	Included in regressions by effects coding the organization attribute. Can be calculated as (-Government Verified)+ (-Farmer Verified) + (-Third Party Verified) + (-Supermarket Verified)

Table 4: Study 2: Animal Welfare (Pork) Study Variables

VARIABLE	DESCRIPTION
Outdoor Housing	Effects coded dummy=1 if pigs were kept outdoors.
Hoop Housing	Effects coded dummy=1 if pigs were housed in large tent-like shelters with straw bedding.
Conventional Housing	Included in regression by effects coding the housing attribute. Can be calculated as (-Outdoor)+(-Hoop).
Sows in Groups	Effects coded dummy=1 if sows were kept in groups in pens.
Sows in Gestation Stalls	Included in regression by effects coding "Sows in Groups". Can be calculated as (-Sows in Groups).
No Sub-Therapeutic Antibiotics (Therapeutic Antibiotics Only)	Effects coded dummy=1 if the antibiotics were administered only with the approval of a veterinarian and were aimed at treating diseases.
Sub-therapeutic Antibiotics	Included in regression by effects coding "Therapeutic Antibiotics". Can be calculated as (-No S.T. Antibiotics).
Government Verified	Effects coded dummy=1 if pork chops were verified by government to contain at least one of Outdoor Housing, Hoop Housing, Sows in Groups, No Antibiotics
Third Party Verified	Effects coded dummy=1 if pork chops were verified by a third party (certifying company or a non-profit organization) to contain at least one of Outdoor Housing, Hoop Housing, Sows in Groups, No Antibiotics
Farmer Verified	Effects coded dummy=1 if pork chops were verified by an farmer or farm organisation to contain at least one of Outdoor Housing, Hoop Housing, Sows in Groups, No Antibiotics
Processor Verified	Effects coded dummy=1 if pork chops were verified by a meat processor to contain at least one of Outdoor Housing, Hoop Housing, Sows in Groups, No Antibiotics
Supermarket Verified	Effects coded dummy=1 if pork chops were verified by a supermarket to contain at least one of Outdoor Housing, Hoop Housing, Sows in Groups, No Antibiotics
Not Verified	Included in regression by effects coding the organization attribute. Can be calculated as (-Farmer Verified)+ (-Processor Verified)+ (-Supermarket Verified) +(-Government Verified)+ (-Third Party Verified)

A Latent Class Model (LCM) is valuable for this analysis since it allows heterogeneity within the sample to be captured by specifying homogenous groups of consumers with similar latent characteristics (e.g. see Nilsson *et al*., 2006). It constitutes a generalization of the multinomial logit model (MNL) in the sense that homogeneity within groups and heterogeneity between groups is assumed[9]. The LCM model estimates individual class specific β_f for F

[9] Initial estimations using the MNL are reported elsewhere; see Innes, 2008 and Uzea et al., 2011.

different classes within the sample. The indirect utility function V_{nif} of an individual *n* belonging to class *f* choosing alternative *i* is defined as (Uzea et al., 2011):

(6) $V_{nif} = \alpha_{nif} + \delta_f^{'} P_{ni} + \beta_f^{'} x_{nit}$

The choice probability of an individual *n* choosing alternative *i* conditional on membership in class *f* is:

(7) $P_{ni/f} = \sum_{f=1}^{F} s_f \frac{\exp(v_{n,i,f})}{\sum_{j=1}^{C} \exp(v_{n,j,f})}$ Where s_f is the class probability 0<s<1 so that $s'1 = \sum_{m=1}^{M} s_m = 1$

where $P_{ni|f}$ is a joint product of the probability of individual *n* falling into a latent group *f* and the probability of alternative *i* will be chosen from a choice set given the individual is in group *f*. The number of classes, *F,* was specified using the Bayesian Information Criterion (BIC) following the procedure outlined in Boxall and Adamowicz (2002). Finally, willingness-to-pay (WTP) estimates reveal consumer preferences for the attributes. The willingness-to-pay estimates are the ratios of the marginal utility of attributes over the marginal utility of money: $-\beta_m / \beta_p$ – where m=1….,6 (bread) [m=1,..,9 (pork)] are conditional marginal utilities estimated at the mean of the population for the attribute of interest and β_p is the parameter for price (Louviere *et al*,. 2000). Of particular interest for the purpose of this study is the *relative* size of the WTP estimate for quality verifications from different sources.

Results

The willingness to pay estimates for the bread (environmental) and pork (animal welfare) studies are reported in Tables 5 and 6 respectively[10]. In both cases, five classes of respondents emerged and have been named for ease of exposition. Average class probabilities indicate the probability of respondents falling into a particular class. Of interest for the purpose of this paper is the *relative* difference in WTP estimates across the classes within each sample which provide useful indicators both of the strength of consumer preferences and of the extent to which trust in alternative quality verification sources (public, private, third party) differs among consumers. In terms of the conceptual model outlined earlier sets of 'Group A' and 'Group B' consumers do exist, and also differ with respect to which source of verification is regarded as credible.

[10] A more detailed discussion of the underlying model coefficients is available in Innes and Hobbs (2011) and Uzea et al. (2011). In the interests of space, the discussion in this paper is limited to the WTP estimates.

Table 5: Environmental (Bread) Study: Latent Class Model WTP estimates ($ per loaf) (n=480)[a]

Variable	**Class 1** *Concerned Shopper*	**Class 2** *Independent Verification Seeker*	**Class 3** *Label Believer*	**Class 4** *Defer to Farmer*	**Class 5** *Not Interested*
Pesticide-Free	**10.26**[**b]	**3.13**[*]	**2.27**[**]	**0.40**[**]	**-0.18**[**]
Environmentally Sustainable	**6.34**[**]	**2.42**[***]	**1.45**[**]	**0.28**[**]	0.07
Government	**5.13**[**]	**4.30**[*]	**0.06**[**]	**-0.39**[**]	0.08
Farmer Verified	0.85	**-1.05**[**]	**-0.34****	**1.22**[**]	**0.40****
Third Party Verified	**-3.80**[**]	**3.34**[**]	**0.18**[**]	**-0.48**[**]	**-0.12**[**]
Supermarket Verified	**-3.55**[**]	**-4.27**[***]	**0.22**[**]	**-0.68**[**]	0.04
Bakery Verified	1.37	-2.32	-0.12	0.34	-0.40
Average Class Probabilities	0.220	0.120	0.352	0.123	0.186

Notes:

a. Model fit: Log-Likelihood -3415 Adjusted Pseudo-R^2 0.358. For details of the underlying parameter estimates see Innes and Hobbs (2011)

b. ** indicates significance at the 5 per cent level

Table 6: Animal Welfare (Pork) Study: Latent Class Model WTP estimates ($/kg) (n=541)[a]

Variable	**Class 1** *Conventional Pork Consumers*	**Class 2** *Avoid Purchasing*	**Class 3** *Verification Matters*	**Class 4** *Trust Farmers*	**Class 5** *Activists*
Outdoor Housing	0.13	-0.03	**3.40****	-0.67	**4.77****
Hoop Housing	0.17	-15.55	**2.05****	0.18	**1.92****
Conventional Housing	-0.30	15.58	**-5.46****	0.49	**-6.68****
Sows in Groups	**0.27**** [b]	-2.92	**3.48****	**2.60****	**4.40****
Sows in Gestation Stalls	**-0.27****	2.92	**-3.48****	**-2.60****	**-4.40****
No Sub-Therapeutic Antibiotics	0.18	0.62	**-10.89****	**4.04****	**7.65****
Use of Sub-Therapeutic Antibiotics	-0.18	-0.62	**10.89****	**-4.04****	**-7.65****
Farmer Verified	0.03	16.70	**-13.57****	**3.86****	-0.02
Processor Verified	**0.59****	9.93	**8.35****	**-1.24***	-0.19
Supermarket Verified	0.03	28.06	-1.91	**-4.21****	**4.83****
Government Verified	**0.97****	-81.22	**22.87****	**8.75****	**3.27****
Third Party Verified	-0.40	-23.88	**8.13****	**1.61****	0.56
No Verification	**-1.23****	50.40	**-23.88****	**-8.76****	**-8.46****
Average Class Probabilities	0.222	0.029	0.256	0.206	0.287

Notes:
a. Model fit: Log-Likelihood -3559.564; Adjusted Pseudo-R^2 0.219. For details of the underlying parameter estimates see Uzea et al (2011)
b. **, * indicates significance at the 5 per cent and 10 per cent levels respectively

Both studies reveal a subset of consumers with strong preferences for quality verifications related to credence attributes, together with similar patterns of attitudes toward the source of these verifications. Of particular note is that in both studies public sector (government)

quality verification is valued highly by distinct segments (classes 1 and 2 in the bread/environmental study, classes 3, 4, and to some extent 5, in the pork/animal welfare study). With the exception of the *defer to farmer* group in the bread study, who exhibited a small negative WTP for government verification, in general consumers in both studies appeared to be either supportive of or indifferent towards government as a verifier of these production attributes. In contrast, attitudes toward the other verification sources were distinctly mixed. Third party verification was viewed positively by the *independent verification seeker* class in the bread/environmental study, with a marginally positive valuation by the *label believer* class (as indicated by very small positive WTP). Similarly, in the pork/animal welfare study, the *verification matters* and *trust farmers* groups had positive views of third party verification, while the other three classes were indifferent. However, it is clear from the environmental study in particular that third party verification did not resonate with all consumers: the *concerned shoppers* viewed this source of quality verification negatively, as did (very marginally), the *not interested* class. In both studies, the description of 'third party' was kept carefully neutral (described as a certifying company or non-profit organization), however, *third party* is a very broad category and it is likely that attitudes toward specific third parties will differ.

Reactions to the various private sector verification sources were also mixed, while some respondents (e.g. the *defer to farmer* class) in the environmental study evidently preferred farmer-based verification, this was not true of the *independent verification seeker* class, who discounted verification by farmers. Similarly in the animal welfare study, a distinct segment of respondents (class 4) trusted farmers (as well as government), while the *verification matters* class reacted negatively to farmer-based verification. Turning to the opposite end of the supply chain, both the *concerned shopper* and *independent verification seeker* classes in the environmental study reacted negatively to supermarket verification, while the *trust farmers* class in the animal welfare study had a similar negative reaction. Nevertheless, some respondents evidently did trust supermarkets, as revealed by the positive valuation from class 5 (*activists)* in the animal welfare study, and marginally so by the *label believer* class in the environmental study. A potential limitation of both studies is that 'supermarkets' were defined as a category whereas it is entirely plausible that consumers may have higher levels of trust in a specific supermarket retailer. The role of brand/company identity in establishing credible quality verifications is a topic for further research.

As with attitudes toward the source of verification, considerable heterogeneity is evident in the relative importance of the production method attributes. The environmental study features a class of highly motivated consumers, the *concerned shopper* class, with extremely high WTP estimates which are indicative of strongly held preferences, while the *independent verification* seeker and *label believer* classes also viewed these attributes positively but are likely not as motivated as class 1 consumers. Again, of interest here as an indicator of the strength of preferences is the relative size of the WTP estimates, rather than their absolute values. The remaining two classes in the environmental study, representing about 30 per cent of respondents, were not particularly interested in these quality attributes, as indicated by WTP estimates that are either very small or not statistically significant. Similarly, in the animal welfare study, the *activists* and the *verification matter*s classes responded positively to the welfare-enhanced production attributes (outdoor housing, hoop housing, sows in groups), while the *trust farmer*s group valued only some of these attributes, and the *conventional pork consumers* and *avoid purchasing* classes (together representing approximately 25% of respondents) evidently did not place a great deal of value in these attributes.

Conclusions

Examining consumer trust in credence attribute assurances through two Canadian studies conducted at approximately the same time but focused on different food products, we expect some differences to exist given the focus on different production attributes - animal welfare versus environmental sustainability; as well as different products - pork chops versus bread. Added to this there were slight differences in the design of the choice experiments. The commonalities across the studies, however, provide interesting points of comparison. The key message from both studies, as well as the earlier welfare analysis, is the need to consider heterogeneity in consumer preferences when examining sources of quality verification.

Of course, the stated choice experiment is a hypothetical choice situation and there always remains the question of whether consumers would make the same choices in a 'real' purchase situation. In this regard it is the *relative* size of these WTP estimates across the latent classes that is of most interest. It is evident that some respondents have very strong preferences for the credence attributes examined in these two studies (as indicated by the relative size of the WTP estimates), and it is these consumers who also tend to value a public sector role in verification relatively highly. Both studies reveal a highly motivated group of consumers likely

to be both very interested in products with these attributes, and possibly therefore also in lobbying for policies to encourage these types of production systems (e.g., through stricter animal welfare or environmental regulations)[11]. We can liken these respondents to the 'Group B' consumers in the earlier welfare analysis.

Both sets of empirical results also reveal a sub-set of consumers who tend to trust farmers. However, both studies also reveal a sizeable segment of respondents who might be considered 'conventional food' consumers (akin to the 'Group A' consumers from the welfare analysis): they exhibit relatively low WTP for these quality attributes and, consistent with this response, a concomitant low WTP for quality verification. These consumers do not share the Group B-type consumer views about on-farm production methods, tend to be more price sensitive, and would be less likely to benefit from policies mandating environmental and animal welfare aspects of agricultural production systems; the public good aspects of animal welfare and environmental protection notwithstanding.

This paper began with the observation that food markets are characterized by an increasingly diverse array of credence attribute quality claims. While some public standards exist, and governments differ in the extent to which they are willing to legislate mandatory production practices or engage in the monitoring and verification of quality claims, the real growth in quality assurances is coming from private sector and third party entities: supermarkets, food processors, farm organisations, interest groups. Theory suggests that credible signals in the form of labelling and verification are necessary to ameliorate the information asymmetry inherent in the provision of a credence attribute. Empirical results indicate that consumers do not speak with one voice when it comes to their valuation of food attributes and in whom they trust for quality assurances. The diversity of food quality claims in the marketplace currently available attests to this fact. Nevertheless, in these Canadian studies, a relatively high degree of trust in public sector (government) quality verification appeared to map onto stronger preferences for the environmental and animal welfare attributes. This suggests a role for the public sector in facilitating the establishment and verification of credible industry-led quality assurances. An exploration of the relative roles of different organisations in standard setting, accreditation, certification and monitoring is a topic for further research.

[11] Indeed, in the animal welfare study, an analysis of several latent factors explaining class membership found that the degree of involvement in nine 'activism' related activities was significant in explaining class membership (Uzea et al., 2011)

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