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Signalling Origin: Consumer Willingness to Pay for Dairy Products with the "100% Canadian Milk" Label

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Abstract

In Canada, all fluid milk and cream products must be sourced from Canadian producers under the supply management policy governing the Canadian dairy sector, while other processed dairy products, such as cheese, yogurt, and ice cream can be made using imported milk components. Recently, the Dairy Farmers of Canada launched a 100% Canadian Milk label for products that contain only milk and milk ingredients produced in Canada. This paper uses a Discrete Choice Experiment from a Canada-wide survey of dairy consumers to elicit their willingness-to-pay for ice cream carrying the 100% Canadian Milk label. The results show that Canadian consumers are willing to pay more for ice cream products that carry the label. Consumer knowledge of the dairy sector affects their willingness to pay for this labelling information. Implications for the use of the Canadian origin label and suggestions for further research are discussed.

Keywords: *Willingness to Pay, Ice cream, Stated Preference, Country of Origin, Random Parameters Logit (RPL) model*

JEL Codes: Q13, Q17

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1. Introduction

Consumers in many countries are becoming increasingly interested in the origin of foods and production methods used to process foods, and Canadian consumers are no exception (Hobbs et al 2005; Hu et al 2012; Kuperis et al 1999). In response, firms are placing more emphasis on the provision of information regarding these attributes (Bialkova et al 2013). In this vein, the Dairy Farmers of Canada (DFC) in 2009 launched a 'branding' programme promoting the labelling and consumption in Canada of dairy products with a '*100% Canadian Milk'* symbol. With this initiative, the industry organization hopes to inform Canadian consumers that products displaying the symbol contain milk from Canada that is "high-quality, fresh, safe and containing no antibiotic residues and hormones" (Dairy Farmers of Canada)[1]. The federal government, through the Canadian Food Inspection Agency (CFIA) regulates the use of the 100% Canadian Milk label to ensure that its usage is truthful for consumers and meets legislative requirements (CFIA 2014).

The labelling initiative by the Dairy Farmers of Canada represents a marketing approach for Canadian milk and dairy products based on an explicit representation of country of origin information, along with an implicit suggestion of improved quality arising from production methods that may differ from other countries. While the former is an explicit labelling claim, the latter is implied from the additional marketing messages supplied by DFC. Use of the label on dairy products is voluntary, such that not all products made from Canadian milk display the symbol. Figure 1 depicts the 100% Canadian milk symbol.

(Figure 1 here)

Using a survey of Canadian consumers, the study employs a Discrete Choice Experiment (DCE) to elicit Canadian consumers' preferences for ice cream with the 100% Canadian Milk symbol. The choice experiment allows respondents to choose between products that differ across a number of attributes, including brand, production type, and the presence of the Canadian origin indicator. Multinomial Logit (MNL) and Random Parameters Logit (RPL) models are used to

[1] Unlike in the US dairy sector, the use of recombinant bovine somatotropin (rBST) is prohibited in Canada, hence the use of a "no hormones" claim.

estimate respondents' willingness to pay (WTP) for the ice cream attributes. By examining how the 100% Canadian Milk symbol influences preferences for ice cream, this study also contributes to the growing literature on WTP for country of origin information[2].

An important regulatory context to this discussion is the policy of supply management that regulates the Canada dairy sector. To generate higher returns to Canadian dairy farmers, the supply management system restricts the supply of dairy products through domestic (farm) production quotas on milk production and import restrictions (tariff rate quotas) on dairy products. For more information on the mechanics of supply management and the marketing board system in Canada, see Barichello (1999), Gifford (2005), and Veeman (1987). For the purposes of this analysis, one important outcome of this regulated market is that all fluid milk sold in Canada is produced domestically, while Canada imports a limited quantity of milk components (i.e. proteins, fats, solids) to satisfy its World Trade Organization (WTO) obligations. Milk components are used in the processing of cheese, ice cream, butter, sour cream, and yogurt. Under current Canadian legislation, firms cannot add imported milk or components to fluid milk or table cream sold in Canada.

Given that, by definition, all fluid milk sold in Canada is of Canadian origin, whereas ice cream may contain imported milk components, how does the DFC signal of origin for dairy products resonate with Canadian consumers? Does brand and other quality signals, or consumer knowledge of dairy regulations, influence consumer responses to the 100% Canadian milk signal? Arguably, the origin information contained in the 100% Canadian Milk label may contain valuable quality information for some consumers, as has been shown for other short supply chains where value is added through additional processing methods (Deselnicu et al 2013)[3]. The extent to which the 100% Canadian Milk label influences preferences for dairy products is therefore of relevance to industry stakeholders. Should the future competitive environment for the Canadian dairy sector shift due to changes in the supply management regulatory

[2] In an extended analysis, and updated version of this paper, Forbes-Brown et al (2015) compare Canadian consumer responses to the use of the "100% Canadian Milk" symbol in both fluid milk and ice cream products, and explore how industry knowledge affects WTP for origin information in these different product categories. Interested readers are referred to Forbes-Brown et al (2015) for a more in depth discussion.

[3] In a meta-analysis of price premiums for agricultural products differentiated by geographical indication, Deselnicu et al (2013) found that price premiums were greater for products that are not heavily processed and those with shorter supply chains. In longer supply chains, the authors suggest that brands, and the reputations behind them, can be used to capture these premiums, leading to a substitution effect between brands and geographical indication.

environment, understanding how consumers respond to a signal of Canadian origin on dairy products becomes particularly pertinent.

The paper is organized as follows: section 2 provides insights from the literature on consumer preferences and willingness to pay for credence attributes such as origin. Section 3 discusses the design and application of the stated preference survey choice experiment, while section 4 explains the empirical methods used to derive the results. Section 5 presents the results of the RPL estimations, including exploring interaction effects between key variables, and the influence of socio-demographics as well as industry knowledge, on respondents' choices. Section 6 concludes the paper with a discussion of implications and suggestions for further research.

2. Consumer willingness to pay for signals of origin: insights from the literature

The link between product attributes and consumer preferences is well established in the literature (e.g. Adams & Salois 2010; Hu et al 2012; McCann-Hiltz et al 2004). The seminal work by Lancaster (1966) posited that consumers derive utility from a product's attributes rather than directly from the product itself. In this vein, dairy consumers are expected to purchase ice cream whose attributes (such as texture, taste, price, brand, origin) more closely match their preferences. Therefore, the expected utility from the product is the total utility derived from each attribute. Stated preference survey methodologies are frequently used to elicit the demand (or WTP) for product attributes, particularly as this allows the researcher to examine hypothetical attribute combinations.

Since Lancaster (1966) established the relationship between product attributes and consumer demand, numerous authors have contributed to this literature by evaluating the impact of a whole host of product characteristics on consumer WTP, including traceability, production methods, and origin. For example, Hobbs et al (2005) use an experimental auction to evaluate Canadian consumer WTP for food safety, traceability and production method assurances in beef and pork products. Their results indicate that consumers were inclined to pay more for a bundling of traceability, food safety and humane animal treatment, as opposed to a traceability assurance alone, none of which is verifiable at the point of purchase in the absence of credible labelling.

Consumers' WTP for origin information in food labels has been the subject of numerous studies. For example, Chryssochoidis et al (2007) find that older consumers in Greece place a higher value on locally produced products relative to younger Greeks. Product origin may also be important to other actors in the value chain. Kim et al (1997) examine the importance to executive chefs and purchasing managers in the Korean hotel industry of the country of origin of the beef products that they purchase. The authors suggest that due to lower awareness and concerns about quality, countries without a dominant position in the market may struggle in capturing market share in valuable export markets. Loureiro and Umberger (2005) assess consumers' WTP for mandatory country of origin labelling in beef, chicken and pork products displaying the label "certified U.S." They also examine how socio-demographic and psychographic factors affect WTP for origin information, finding that consumers who are more concerned with food safety are willing to pay a premium for information on country of origin for poultry products, while those with higher levels of education exhibit a lower willingness to pay for this information in beef products. Volinskiy et al (2009) find that Canadian consumers are willing to pay a premium for canola oil produced in Canada, as well as canola oil produced using canola that is not non-genetically modified.

The majority of these studies use stated preference survey methods to elicit consumer preferences and WTP estimates. The particular strength of this approach is the ability to derive an implicit value for individual product attributes, as well as explore the influence of both socio-demographic factors and consumer knowledge, awareness and attitudes (e.g. towards risk, health, foods safety, etc.) on consumers' WTP for product attributes. In a similar vein, the present study uses a Discrete Choice Experiment (DCE) to examine Canadian consumer preferences for origin labelling in dairy products.

3. Experimental Design and Descriptive Statistics

3.1 Experimental Design

A consumer survey was used to collect data for the analysis, with two versions of the survey developed: one for milk and one for ice cream. This paper focuses on the results from the ice cream survey. For a comparison of the ice cream and milk survey results, see Forbes-Brown et al (2015). The survey featured questions about respondents' ice cream consumption habits, attitudes towards dairy products - including dairy products featuring the 100% Canadian Milk

label, and other psychographic factors such as risk preferences, ethnocentrism and knowledge of the dairy industry. In addition, the survey featured a DCE that assessed respondents' preferences for ice cream endowed with different levels of four attributes: presence of the 100% Canadian Milk label; organic or conventional production methods; national or store brand; and price. Table 1 describes the attributes and levels used in the DCE. The attribute descriptions were provided to respondents in the survey prior to the completion of the choice experiment.

(Table 1 here)

Drawing upon So and Kuhfeld (1995) and Kuhfeld (2001), the choice experiment was designed using Statistical Analysis System (SAS). Thirty-two choice sets were included in the final experimental design[4], divided into four blocks with each respondent assigned to a block. Therefore each respondent was presented with eight choice sets. Hensher et al (2001) and Hess et al (2012) show that respondents are often able to handle large choice sets, however, the final design presented only eight sets to each respondent in order to limit respondent fatigue which can lead to respondents modifying (simplifying) their decision rules when choosing among alternatives (Carson et al 2001). In the survey each choice set comprised three profiles, accompanied by a no-choice option, The no choice option "*I would not choose any*" is defined as an alternative specific constant (ASC) and is typically included in discrete choice experiments. Table 2 presents an example of a choice set.

(Table 2 here)

To place the DCE within a purchasing setting, each choice question was preceded by the behavioural scenario: "imagine that you are shopping for cream and the alternatives below are the only ones available, select the one that you would choose". In addition, a cheap talk script was presented prior to the choice sets to attempt to mitigate hypothetical bias that can inflate WTP values[5] (Carlsson et al 2005).

[4] This is known as an unlabelled design, where the number of profiles is represented by L^A, where L represents the number of levels and A the number of attributes. Therefore in this design 2x2x2x4 = 32 choice sets in total.

[5] The cheap talk script was as follows: "Before you complete the next section, I want to talk to you about a problem that happens in studies like this one. The questions presented in this section are hypothetical ones, although they try to mimic the choices available for purchase on a regular shopping trip. The product in question may have other attributes that are not included and the available prices may be different from the ones you now see at the supermarket you shop at. However, we want you to imagine that the prices and attributes available below are the ones that you see on a shopping trip, and make your choice based on what you actually believe you would choose. Because you may see different attributes features when you go shopping for this product, the situation creates what is called a "hypothetical bias". This generally occurs when people respond to questions differently in a hypothetical

3.2 Survey Implementation and Descriptive Statistics

The survey instrument was pre-tested and revised before being administered online in March 2012 by a Canadian market research company. Respondents were recruited from the respondent database managed by the market research company and had the option of completing the survey in either English or French (the two official languages of Canada). A screener question was used to ensure that only people who purchased ice cream completed the online survey. A total of 502 respondents completed the ice cream survey. After cleaning the data set for "straight liners" (respondents who selected the same answer for all 8 choice sets), and other responses which were cognitively inconsistent, the final usable sample size was 453 respondents. The sample was closely representative of the Canadian population by province, with a balance of male and female respondents[6]. Respondents had higher levels of incomes and education compared to the Canadian population, which is somewhat to be expected with Internet-based surveys[7].

Nineteen percent of respondents purchased a 1 litre container of ice cream once per three month period, with a further 13% purchasing 1 litre of ice cream twice per month. Most of the respondents (90 percent) claimed to be aware of the 100% Canadian Milk symbol, although it is possible that this result is influenced by agreement bias. It also appears that there is a general belief among Canadian consumers that the presence of the 100% Canadian Milk symbol on ice cream acts as a cue for higher quality, as shown in Figure 2.

(Figure 2 here)

Having outlined the data collection procedures and basic sample characteristics, the next section explains the empirical models and estimation procedures used to examine the discrete choice data.

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situation, such as this, versus a real situation involving real products and real money. So it is important that you answer the questions exactly as you would answer if you were really going to face these choices at your grocery store and buy the item with real money"

[6] Fifty six percent of the ice cream respondents were female, which is representative of the Canadian population (51%) according to Statistics Canada (2011).

[7] For example, just over 30 percent of respondents had a university (bachelors) degree, compared with 17 percent of the Canadian population (Statistics Canada 2011). Respondents earning less than $25,000 per annum were under-represented relative to the Canadian population, while respondents earning more than $70,000 per annum were over-represented compared with the Canadian population (based on Statistics Canada 2011).

4. Empirical Models

Louviere et al (2000) assert that valid measurements should have a consistent theoretical underpinning. Random Utility Theory (RUT) is used to analyze how consumers make choices in discrete choice experiments by accounting for both observed and unobserved factors affecting individuals' choices. A random utility model is comprised of a systematic component (V_n) and a random error component (ε_n), where the systematic component is observable by the analyst (for example, product attributes, socio-demographic and psychographic characteristics) while the random component remains unobserved (preferences, perceptions and taste).

Following Hensher et al (2005), in a choice modelling context where individuals choose between different alternatives, the model representing the choice of alternative *i* being chosen from a set of *j* alternatives can be represented as:

$$P_{ni} = Prob\ (U_{ni} > U_{nj}) = Prob\ (V_{ni} + \varepsilon_{ni}) > Prob\ (V_{nj} + \varepsilon_{nj}) \quad \text{.....(1)}$$

The probability that an individual *n* chooses alternative *i* can be estimated by the Multinomial Logit (MNL) model:

$$P_i = \frac{e^{V_i(\beta)}}{\sum_j e^{V_j(\beta)}} \quad \text{.....(2)}$$

Train (2009) highlights three drawbacks to the MNL model: 1) it can represent systematic taste variations but not those that cannot be linked to observed characteristics of the respondents, and hence assumes preference homogeneity; (2) it assumes independence of irrelevant alternatives (IIA), which may not always exist; and (3) it can handle situations where unobserved factors are independent but it cannot be used when alternatives are correlated. Models such as the Random Parameter Logit (RPL) that relax the IIA assumption and account for heterogeneity are thought to more accurately measure preferences. The RPL can be expressed as (Train, 2009):

$$U_{ni} = (\beta + \theta_n)x_{ni} + \varepsilon_{ni} \text{.....(3)}$$

In equation (3) β represents the mean, and θ_n represents the random term capturing the unobservable individual effects. Based on the RPL model the probability of individual *n* choosing alternative *i* can be represented as (Train, 2009):

$$P_{ni} = \frac{e^{\beta n x_{ni}}}{\sum_j e^{\beta n x_{nj}}}$$

Assuming that $\beta + \theta_n = \beta_n$, if θ_n is zero, this would imply that β_n is fully known and the model would collapse into the general logit model depicted in equation (2). However, since β_n is unknown to the analyst, the RPL (conditional choice probability) is therefore the integral of the standard logit over all possible variables of β_n (Train, 2009). This can be expressed as:

$$P_{ni} = \int L_{ni}(\beta)\, f(\beta)\, d\beta$$

Where: $L_{ni}(\beta) = \frac{e^{V_{ni}(\beta)}}{\sum_{j=1}^{J} e^{V_{nj}(\beta)}}$

$f(\beta)$ is a density function and called a mixing distribution – it can be either discrete or continuous. Similarly to the standard logit $V_{ni}(\beta)$ represents the systematic component of utility. Assuming linearity in parameters $V_{ni}(\beta) = \beta' x_{ni}$ results in the mixed logit being represented as:

$$P_{ni} = \int \left(\frac{e^{\beta' x_{ni}}}{\sum_{j=1}^{1} e^{\beta' x_{nj}}} \right) f(\beta) d\beta$$

As is standard practice, the MNL was first estimated, followed by RPL. While both sets of results are presented in the next section, the focus is on the results of the RPL models which better capture the effects of heterogeneity within the sample population. Coefficients from RPL models are used to quantify preferences through WTP estimates. Since the attributes used in the choice experiment were effects coded (to avoid correlation with the intercept) as opposed to dummy coded, WTP can be represented by either:

$$WTP = {-2(\beta_x)}/{\beta_p} \quad \text{.....(4) or}$$

$$WTP = {-2(\beta_x + \beta_D * D)}/{\beta_p} \quad \text{.....(5)}$$

where β_x and β_p represent the attribute and price coefficient respectively, D represents a vector of demographic or other variables being interacted with product attributes and β_D is the vector of coefficients resulting from the interactions. Equation (4) is used to estimate WTP for a variable without interactions, while equation (5) is used when the model has interaction effects.

The attributes used in the choice experiment (type: organic or conventional, brand: store or national and 100% Canadian label: present or absent) were effects coded while price was a continuous variable. Effects coding was used in contrast to dummy coding because there is an

inherent problem with dummy coding attribute levels, as discussed by Hensher et al (2005) and Bech and Gyrd-Hansen (2005). Given that the effect of the base level cannot be separated from that of the regression constant, dummy coding can potentially result in perfect confoundment with the grand mean of the regression. Tables 3a and 3b provide descriptions of the variables used in the estimation process and indicate how each variable was coded for use in the estimations.

(Tables 3a and 3b here)

5. Results

5.1 MNL Results

The analysis that follows begins with the MNL model results before proceeding to a more detailed discussion of the RPL models. Table 4 presents the MNL main effects model results. The model exhibits a reasonable fit, with a pseudo R^2 of 0.25. The signs of the attribute coefficients suggest that respondents derive positive utility from choosing ice cream labelled as containing 100% Canadian milk, as well as from national (versus store) brands, but negative utility from choosing organic ice cream. The negative and significant coefficient for price indicates that higher prices cause disutility, while the ASC1 for not 'purchasing' an ice cream product in a choice set is also negative and significant. The WTP estimates suggest that respondents place a premium of $1.50 for ice cream with the *100% Canadian Milk* symbol, and discount organic ice cream relative to conventional by 46 cents per 2 litre carton. The latter finding is surprising since in reality a market does exist for organic ice cream, however, it should be noted that the MNL model does not account for heterogeneity in preferences, which may be clouding this result. To explore the influence of heterogeneity in consumer preferences, RPL models are required.

Table 4 here

5.2 RPL Results with interactions

Recall that the RPL approach relaxes the IIA assumption and provides an opportunity to account for heterogeneity in consumer preferences. In estimating the RPL using the ice cream data, the organic and national brand attributes were specified as random parameters following a normal distribution. The 100% Canadian Milk attribute was also initially included as a random parameter, however, the lack of statistical significance for the derived standard deviation of the

attribute indicated that it should be estimated as non-random. All other variables were also estimated as non-random parameters. These fixed coefficients, namely price, the no-purchase option and the 100% Canadian Milk attribute, represent non-random utility values which suggest that respondents' preferences for these attributes are homogeneous and can be determined from the mean preferences for these attributes. This conclusion was drawn from observing that allowing these variables to vary randomly resulted in standard deviations that were not significant. When a standard deviation is not significant it suggests that there is no significant dispersion around the mean as it relates to preferences. The significance of the standard deviation of the random parameters indicate sources of heterogeneity in respondents` choices regarding ice cream labelled as organic and national brand. These results suggest that preferences for these attributes, and particularly the organic ice cream attribute, (discussed below) are heterogeneous. Table 5 reports the RPL results and WTP estimates, and exhibits a better fit (as indicated by the Pseudo R^2) compared to the MNL model[8].

The estimated models also include two interaction variables which capture any interaction effects between the 100% Canadian Milk symbol and type (organic or conventional) as well as brand (national or store brand). The inclusion of interactions between attributes captures how both attributes jointly impact preferences and can indicate whether the attributes are complements (a positive coefficient) or substitutes (a negative coefficient) (Louviere et al 2000). The interaction between the organic attribute and the 100% Canadian Milk attribute (*CanOrg*) is not significant for the ice cream data[9]. Similarly, the results indicate that ice cream choices were unaffected when national brand ice cream also displayed the 100% Canadian Milk symbol (*CanNat*).

When interaction terms are included in a model the WTP calculation differs from a model without interactions since all interaction effects must be captured (equation 5). Therefore, in estimating the WTP for the national brand attribute and the organic attribute, both the main effect and interaction effects with the 100% Canadian Milk attribute are taken into consideration. The results in Table 5 reveal that respondents prefer ice cream with the 100% Canadian Milk symbol, with an estimated WTP premium of $1.56 for a 2 litre carton of ice cream containing this label.

[8] Models estimating the main effects (results for the four attributes alone) without interaction terms were also estimated. Results for the main effects-only RPL models are not reported here but are available from the authors upon request and show a positive WTP for the *100% Canadian Milk* symbol on ice cream.

[9] This stands in contrast to the results for the milk survey data, as discussed in Forbes-Brown et al, 2015.

The results also indicate that a 2 litre carton of ice cream labelled as organic is generally discounted by 48 cents. Also, respondents derive positive utility from choosing a national brand ice cream as opposed to a store brand ice cream, with an estimated WTP of 44 cents for national brands. The negative and significant coefficient for price is as expected, indicating that respondents derive disutility from higher prices. The ASC1 coefficient is also negative and significant, reflecting the disutility derived from not 'purchasing' ice cream as opposed to 'purchasing' ice cream in the DCE.

Table 5 here

To what extent do different types of consumers exhibit different attitudes towards a signal of Canadian origin on dairy products? Building covariates into the model enables an exploration of the influence of key socio-demographic differences, and is explored in the next section.

5.3 Exploring Socio-Demographic Differences

To determine the extent to which age, income, gender, education, as well as regional differences, affected respondents preferences for ice cream with the 100% Canadian Milk attribute, the RPL model was expanded to include key socio-demographic variables. The results of the RPL with covariates are presented in Table 6. The premium for the assurance of Canadian origin is robust to this expanded model, while the interaction of the Canadian origin symbol with both national brand and organic does not affect ice cream choices, consistent with the earlier RPL model. Controlling for socio-demographic differences among respondents shows that income does not appear to affect choices, while regional differences in preferences were also relatively minimal (respondents in the prairie responses exhibited a slight preference for ice cream with the signal of Canadian origin). Respondents with higher levels of education tended to discount ice cream with the 100% Canadian signal, while older respondents were willing to pay a relatively small premium of 6 cents.

Table 6 here

Taken together, the results indicate that respondents exhibit strong preferences for ice cream with the 100% Canadian Milk attribute but that the value of this symbol when combined with other quality cues (brand type, production method), and accounting for socio-demographic differences, varies. There could be several explanations for this observation, some of which

cannot be formally verified from the data. One possible explanation could be the level of respondents' knowledge regarding the dairy industry. In other words, to what extent do Canadian consumers realize that, unlike retail fluid milk that must be of Canadian origin, ice cream may contain imported milk ingredients? Does this knowledge affect their WTP for the 100% Canadian Milk label on ice cream products? This issue is examined by incorporating respondents' knowledge about the dairy industry into the analysis.

5.4 Does Industry Knowledge Matter?

Accounting for respondents' knowledge of the dairy industry may provide further insights into respondents' choices and their WTP for ice cream with the 100% Canadian Milk symbol. To evaluate whether knowledge of the dairy industry affected respondents' choices, respondents were asked a series of "industry knowledge" questions *after* completing the choice experiment section[10]. In particular, it is expected that respondents to the ice cream survey are expected to behave differently if they are more informed about the dairy sector (and if origin information matters to them), since ice cream sold in Canada can be made from imported milk ingredients.

Respondents to the ice cream survey appeared relatively knowledgeable, with 71% responding correctly to the question "*Ice cream can contain milk ingredients or modified milk ingredients imported from other countries such as the United States, Europe, Australia or New Zealand"*. Respondents who answered the knowledge questions incorrectly (i.e. False) were asked a follow-up question along the lines of "if the previous statement were true would that have affected any of your choices" (in the DCE). In the ice cream survey, this number was just over 60 percent.

To explore the role respondents' industry knowledge played in influencing WTP for the 100% Canadian Milk symbol an interaction term between respondents' "knowledge" and the 100% Canadian Milk attribute (*CanKnwl*) is added to a main effects RPL model. The *CanKnwl* coefficient accounts for respondents who are aware (unaware) that ice cream can be made from

[10] For example: "Ice cream can contain milk ingredients or modified milk ingredients imported from other countries such as the United States, Europe, Australia or New Zealand" (True, False). As reported in Forbes-Brown et al (2015), respondents in the parallel milk survey were asked a variation on the knowledge questions "With the exception of chocolate milk, all milk sold in Canada must be produced in Canada, so even if it does not display the 100% Canadian Milk symbol it is Canadian" (True, False); "Approximately 81% of Canadian dairy farms are located in Ontario and Quebec (True, False); "Milk is **NOT** a good source of calcium" (True, False).

imported milk ingredients and how the presence (absence) of the symbol acts in concert with knowledge to influence preferences. The interpretation of the knowledge variable is such that it represents respondents who are aware that *not all* of the ingredients in the ice cream may be Canadian.

Table 7 reports the RPL results with the industry knowledge interaction term, revealing that respondents who are aware that ice cream can be made from imported milk ingredients discounted ice cream with the 100% Canadian Milk symbol by 32 cents relative to respondents who are unaware of this information. This result is rather unexpected given that the 100% Canadian Milk symbol would in this case represent tangible differentiation between ice cream made from imported milk ingredients and ice cream made from domestic milk. This finding may stem from whether or not respondents with more industry knowledge are concerned about the origin of their foods. The survey also included a question asking respondents the extent to which they were concerned about the origin of the food they purchase. Taking a look at this data for the ice cream respondents, it is clear that of the 323 (or 72%) of respondents who stated they were aware that ice cream sold in Canada may contain imported ingredients, around 25% agreed or strongly agreed that they were not concerned with the origin of their food, while 34% were indifferent, leaving 41% who disagreed or strongly disagreed (in other words, who declared themselves to be concerned about the origin of their food). This suggests that among the respondents who were "aware", a majority may not be willing to pay a premium for an assurance that an ice cream product contained 100% Canadian milk. This partially explains why these respondents were not willing to pay a premium for ice cream with the symbol, although it remains unclear why more knowledgeable respondents discounted ice cream with the symbol, and this remains a relevant topic for further research.

Table 7 here

6. Discussion and Conclusions

This paper has examined how Canadian consumers' preferences for ice cream are influenced by the 100% Canadian Milk symbol. The choice experiment used to elicit preferences included four alternatives and four attributes: 1) national brand ice cream versus store brand; 2) organic versus conventional; 3) 100% Canadian Milk symbol versus no symbol; and 4) price. Over 90% of respondents indicated that they were aware of the 100% Canadian Milk symbol, although it is possible that this high rate of agreement might be influenced by agreement bias.

There were mixed perceptions towards products with the 100% Canadian Milk symbol versus products without, although the RPL estimations show that consumers in general were willing to pay a premium for products with the symbol.

Interestingly, the ice cream results suggest that respondents on average derive negative utility from choosing organic ice cream. National brands are preferred over store brands, while interactions between the 100% Canadian Milk symbol and brand are not significant for ice cream[11]. By design, the DCE treats brands (national Vs store) as generic in the sense that the study does not examine attitudes towards a specific brand per se, rather the intent was to capture attitudes towards types of brands as quality signals. The treatment of brands, and the extent to which origin labels complement or substitute for brand signals as a quality cue, is an interesting area for research.

As a secondary interest, the paper also assessed the role of industry knowledge in accounting for differences in willingness to pay for ice cream with the symbol. Results show that respondents who are aware that ice cream can be made from imported milk ingredients tended to discount ice cream with the symbol, as opposed to those who are not aware. In a parallel analysis of the influence of industry knowledge on consumer willingness to pay for the 100% Canadian milk symbol on fluid milk products, as reported in Forbes-Brown et al (2015), it was found that respondents who are aware that all milk sold in Canada is Canadian discounted milk displaying the Canadian origin symbol, perhaps reflecting some scepticism towards the label, although this is hard to verify. Turning these results around, in both cases it implies that *lack* of knowledge results in increased willingness to pay.

While this paper provides some interesting findings on consumer WTP for origin information in a domestic market, some limitations are present. As is the case for any stated preference survey, the DCE questions were based on hypothetical scenarios and therefore respondents' choices may not reflect how they would actually behave in real market settings as their choices were non-binding. To mitigate this hypothetical bias, a "cheap talk script" was included in the survey. Research has shown that cheap talk scripts can be an effective way of reducing hypothetical bias (Lusk, 2003). Nevertheless, as with any stated preference experiment, the expressed preferences and WTP estimations may still suffer from a degree of hypothetical

[11] This differs from the results for the parallel milk sample, as reported in Forbes-Brown et al (2015), which suggest that the 100% Canadian Milk symbol acts a substitute for national brand milk but may be a complement for store brand milk.

bias. The survey focused on ice cream, in part because it is a product that is relatively straightforward to define compared to a product such as cheese that exhibits a far broader range of qualities and varieties. Nevertheless, applying this type of analysis to a broader range of dairy products, along with further exploration of the source of heterogeneity across segments of consumers, are possible extensions to this analysis.

Consumers' perceptions of the 100% Canadian Milk symbol have implications for the Canadian dairy sector. Given that consumers on average received increased utility from choosing ice cream with the symbol, there is a potential for the dairy supply chain, and particularly processors, to extend the Canadian "branding" initiative to other products made from milk by-products such as frozen pizzas and other "ready to eat foods". Such an initiative could further promote awareness and strengthen loyalty toward domestic dairy products. This initiative is potentially important to the dairy industry as a pre-emptive measure should the regulatory environment for the supply management system change in the future, subjecting the Canadian dairy sector to stronger international competitive pressure.

Canada recently made rather tentative steps towards liberalizing some aspects of its dairy industry. Under the Canada and European Union (EU) Comprehensive Economic and Trade Agreement (CETA), among other changes, Canada has agreed to the importation of more cheese from Europe[12]. In turn Canada expects to benefit from this agreement by gaining preferential market access to European markets through the elimination or reduction of tariffs for some Canadian goods entering the EU market. Canada is also currently engaged in regional free trade negotiations with other nations bordering the Asia-Pacific region under the Trans-Pacific Partnership (TPP). The extent to which loosening import restrictions in the Canadian dairy sector will be a component of the TPP negotiations remains unclear at this point in time but is the subject of negotiating pressure from trading partners in the region. It is therefore plausible that the Canadian dairy sector may face increased competition from imports in the future, and as such, understanding how consumers respond to a signal of Canadian origin on dairy products remains relevant for the sector.

The results for ice cream provide a starting point for considering how consumer responses to the 100% Canadian Milk symbol may play out for other processed dairy products. If

[12] CETA is a comprehensive agreement, extending well beyond the agricultural sector; for the purposes of this paper only the provisions affecting the cheese sector are discussed.

pressure from international trading partners is successful in opening up the Canadian dairy market to more competition from imports, the Canadian origin symbol may become a more relevant assurance of domestic origin to those consumers for whom this type of assurance matters. Understanding the role of origin labels on food products, and the extent to which they represent valuable branding and product differentiation strategies for domestic agricultural sectors, remains a worthy topic of investigation.

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Table 1: Description of Attributes and Attribute Levels

Attributes	**Explanation**
	The symbol is a seal of origin that guarantees the dairy products you are buying are made entirely from 100% Canadian milk or milk ingredients.
Type: Organic, Conventional	Ice cream labelled organic suggests that the ingredients used in the production process have not been treated with hormones and that the product contains no antibiotics. No such claims/suggestions are made with regards to conventional ice cream
Brand: National, Store	A National brand such as Chapman's and Breyers can be found throughout the country in all stores while store brands are only found in the affiliated store. For example, Safeway brands (only found in Safeway and affiliated stores) and President Choice brands only found in Canadian Super Store and affiliated stores.
Price ($CDN/2 litres) **Ice Cream:** $4.56, $5.50, $6.40 and $7.50	National average price range for a 2-litre of ice cream.

Table 2: An Example of an Ice cream Choice Set

	Option A	**Option B**	**Option C**	
Labelled: 				**I would not purchase any**
Type	ORGANIC	CONVENTIONAL	CONVENTIONAL	
Brand	STORE	NATIONAL	NATIONAL	
Price ($)	5.50	7.50	4.56	
I would choose...	☐	☑	☐	☐

Table 3a: Variable Names and Descriptions

Attribute (Label)	**Description**
100% Canadian milk label *(Can)*	1 if product is labelled 100% Canadian Milk, -1 otherwise
Organic *(Org)*	1 if product is organic , -1 otherwise
National brand *(Nat)*	1 if product is a national brand, -1 otherwise
Price *(Price)*	Continuous
Alternative Specific Constant *(ASC1)*	1 if alternative 4 (no choice alternative) is chosen, 0 otherwise
Gender (*Gen*)	1 if respondent is female 0 otherwise
Education (*Edu*)	*Linear Coding* 0 some high school and High School 1 Some technical, Business College, and Completed Tech. / business College 2 Some University and Bachelor's Degree 3 Graduate degree
Income (*Inc*)	*The midpoint is used to code the different categories into a linear variable* 12,500 - Less than $25,000 35,000 - $25, 000 to $44,999 55,000 - $45,000 to $64,999 75,000 - $65,000 to $84,999 95,000 - $85,000 to $104,999 , 127,500 - $105,000 to $150,000 187,500 - More than $150,000
Prairies (*Prai*)[a]	1 if respondents reside in either Saskatchewan, Alberta or Manitoba, 0 otherwise
Atlantic (*Atl*)	1 if respondents reside in Newfoundland, Prince Edward Island, Nova Scotia, or New Brunswick, 0 otherwise
British Columbia (*BC*)	1 if respondents reside in British Columbia 0 otherwise
Quebec (*Que*)	1 if respondents reside in Quebec, 0 otherwise

a. Base (omitted) category for region is Ontario

Table 3b: Interaction Terms

Variable	Description
CanOrg	Interaction between 100% Canadian milk and organic
CanNat	Interaction between 100% Canadian and national brand
CanAge	Interaction between 100% Canadian and respondents' age
CanGen	Interaction between 100% Canadian and female
CanInc	Interaction between 100% Canadian and household income
CanEdu	Interaction between 100% Canadian and respondents level of education
CandKnw	Interaction between the 100% Canadian attribute and respondents who answered the ice cream industry knowledge question correctly[a]
CanPrai	Interaction between respondents residing in the Prairies and the *100% Canadian milk* attribute
CanAlt	Interaction between respondents living in the Atlantic region and the *100% Canadian milk* attribute
CanBC	Interaction between respondents residing in British Columbia and the *100% Canadian milk* attribute
CanQue	Interaction between respondents residing in Quebec and the *100% Canadian milk* attribute

a. The industry knowledge questions are explained in section 5.4.

Table 4: Ice cream – Base MNL model (Main Effects)

Variable	Coefficient	T-ratio	WTP	T-ratio
Can	.728***	29.066	1.504***	27.648
Org	-.221***	-10.153	-.458***	-10.039
Nat	.223***	8.555	.46***	8.725
Price	-.969***	-34.335	-	-
ASC1	-6.73**	-38.406	-	-
Psuedo R^2		0.254		
Log likelihood Function		-3544.35		
***,** and * represent significance at the 1%, 5% and 10% level respectively				

Table 5: Ice Cream - RPL with Interactions

Variable	Coefficient	T-Ratio	WTP	T-Ratio
Random Parameters in Utility Function				
Org	-.285***	-7.877	-.470***	-8.221
Nat	.266***	7.361	.438***	7.508
Non-random Parameters in Utility Function				
Can	.946***	19.745	1.558***	26.122
CanOrg	-.016	-.478	-.026	-0.479
CanNat	-.032	-.994	-.054	-0.99
Price	-1.215***	-22.145	-	-
ASC1	-8.06***	-25.089	-	-
Derived Standard Deviations of Parameter Distributions				
NsOrg	.929***	8.684	-	-
NsNat	.727***	6.774	-	-
Pseudo r -squared		0.301		
Log likelihood Function		-3513.929		
***,** and * represent significance at 1%, 5% and 10% respectively				

Table 6: Ice Cream- RPL Controlling for Socio-Demographic Differences

Variable	Coefficient	T-Ratio	WTP	T-Ratio
Random Parameters in Utility Function				
Org	-.287***	-7.851	-.467***	-8.219
Nat	.266***	7.291	.433***	7.44
Non-random Parameters in Utility Function				
Can	.873***	7.572	1.578***	9.114
CanOrg	-.011	-.314	-.018	-0.314
CanNat	-.032	-.976	-.052	-.972
CanInc	0.000	-.795	0.000	-0.795
CanEdu	-.079**	-2.299	-.130**	-2.31
CanAge	.004***	2.848	.006***	2.88
CanGen	.019	.287	.030	0.287
CanQue	-.108	-1.232	-.176	-1.233
CanPrai	.171**	1.923	.278**	1.924
CanBc	-.039	-.417	-.062	-0.417
CanAtl	.074	.611	.12	0.611
Price	-1.228***	-22.012	-	-
ASC1	-8.132***	-24.913	-	-
Derived Standard Deviations of Parameter Distributions				
NsOrg	.936***	8.673	-	-
NsNat	.742***	6.878	-	-
Pseudo R^2		0.303		
Log likelihood Function		-3500.41		
***,** and * represent significance at the 1%, 5% and 10% level respectively				

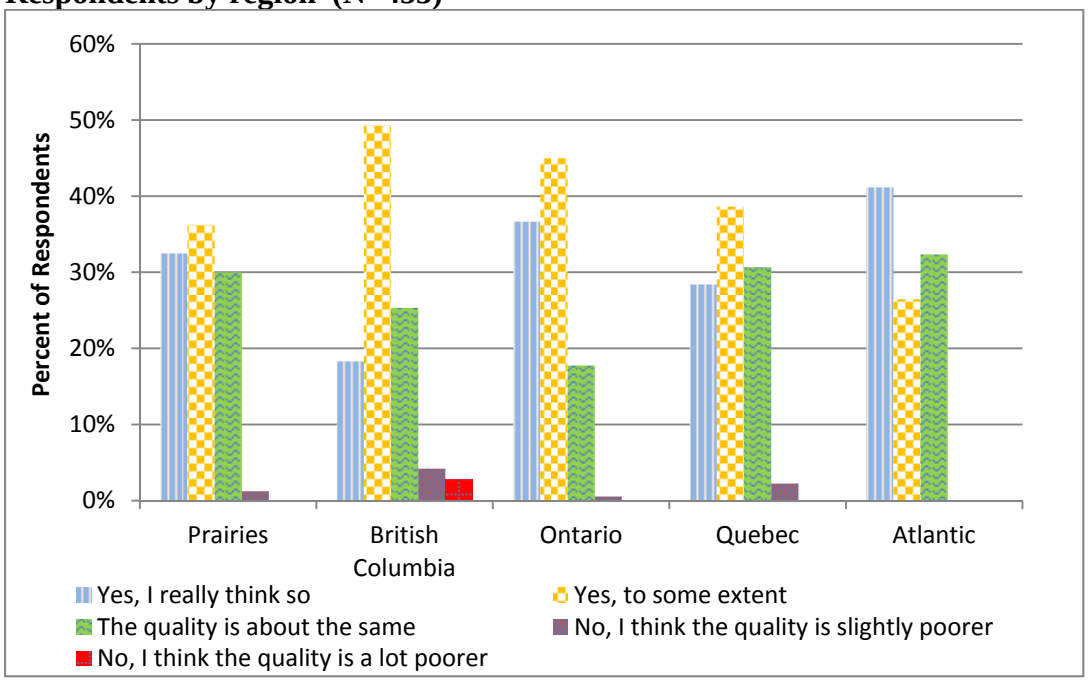
Table 7 Ice Cream - RPL Controlling for Knowledge

Variable	Coefficient	T-Ratio	WTP	T-Ratio
Random Parameters in Utility Function				
Org	-.294***	-8.376	-.48***	-8.89
Nat	.262***	7.266	.428***	7.441
Non-random Parameters in Utility Function				
Can	1.088***	19.736	1.463***	22.297
CanKnwl	-.194***	-2.846	-.318***	-2.864
Price	-1.222***	-22.329	-	-
ASC1	-8.1***	-25.318	-	-
Derived Standard Deviations of Parameter Distributions				
NsOrg	.944***	8.864	-	-
NsNat	.735***	6.776	-	-
Psuedo r-squared		0.301		
Log likelihood Function		-3510.37		
***,** and * represent significance at 1%, 5% and 10% respectively				

Figure 1: The 100% Canadian Milk Symbol

Source: Dairy Farmers of Canada (http://www.dairyfarmers.ca/news-centre/campaigns/100-canadian-milk)

Figure 2: The 100% Canadian Milk Symbol as an Indication of Higher Quality - Ice cream Respondents by region[a] (N=453)



Notes: [a] Responses to the question :"On a scale of 1 to 5, please rate your agreement with the following statements "In comparison to milk products **without** the 100% Canadian milk logo, I consider **milk products with the 100% Canadian milk logo to be of higher quality**" where 1 = Yes I really think so to 5 = I think the quality is a lot poorer