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This paper examines the reference-dependent and labelling effects when consumers make choices about functional foods, and explores how changes in reference points could alter individuals' preferences. Functional food (probiotic yogurt) and regular food (regular yogurt) are used as examples to explore the potential reference-dependent effects and labelling effects. A consumer utility model with reference point effects is developed. The paper also explores how to model the effects of different labelling (health claim) policies, which could influence consumer preferences by changing consumers' reference points.

Keywords: consumer utility, functional food, labelling policy

JEL Classification: D11, D12

Introduction

Even a casual perusal of food products on offer in a supermarket in Canada, the US, Europe or Japan would reveal a growing array of new food products which claim to provide health benefits, so-called functional foods. Usually the prices for these products are higher than for an equivalent conventional (regular) food. For example, fruit juice with calcium which is claimed to be good for the bones, breakfast cereals with soluble fibre, claimed to be good for the heart, and omega-3 milk which is believed to be good for heart health and perhaps may reduce the risks of cardiovascular diseases and cancer.

The functional food sector is one of the fastest-growing sectors in the food industry. The global market for functional foods was estimated to be worth about US$33 billion in 2000 (Hilliam, 2000), and had grown to an estimated US$85 billion by 2006 (Nutrition Business Journal, 2007). Functional dairy products, such as omega-3 milk, probiotic and prebiotic yogurts, are one of the earliest and most widely adopted forms of functional foods. Relatively little socio-economic research has examined the functional food sector in Canada. When making food choices, an individual consumer might over-consume unhealthy foods or under-consume healthy foods. Understanding how consumers make choices with respect to functional foods is an important new research area.[1]

Standard consumer utility theory assumes that when making decisions, preferences do not depend on current assets. Thus, in the case of a decision to consume a healthier food product, standard consumer utility theory would not take into account the consumer's current health situation. This assumption greatly simplifies the analysis of consumers' choice decisions, but according to a psychological analysis of value, reference levels play a large role in determining preferences (Tversky & Kahneman, 1991). Thus, a consumer's current health situation provides a reference point which affects his/her decision to consume a healthier food product.

The Reference-Dependent model was originally developed from the psychology literature (Prospect Theory) as an approach to modelling consumers' preferences, and:

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[1] See Zou and Hobbs (2006) for a more detailed overview of the functional food sector and a discussion of potential models for evaluating consumer preferences.

“The central assumption of the theory is that losses and disadvantages have greater impact on preferences than gains and advantages” (Tversky & Kahneman, 1991, p.1039). In Prospect Theory, outcomes are expressed as changes (gains or losses) from a neutral reference point. There are two important properties of this theory: reference dependent and loss aversion. Reference dependence means individuals’ preferences depend on a reference point; a change in a reference point often leads to reversals of preference. Loss aversion means losses dominate gains, and people will work harder to avoid losses than to obtain gains.

Using an example of a functional dairy product, this paper examines how reference-dependent and labelling effects could be used to model consumer preference changes in functional food choices. In particular, this approach recognizes that consumers make choices depending on their current health status, the credibility of health claims, and the extent to which they believe that the introduction of a functional ingredient will lead to an improvement in their health status.

Applying the Reference-Dependent Model to Functional Food

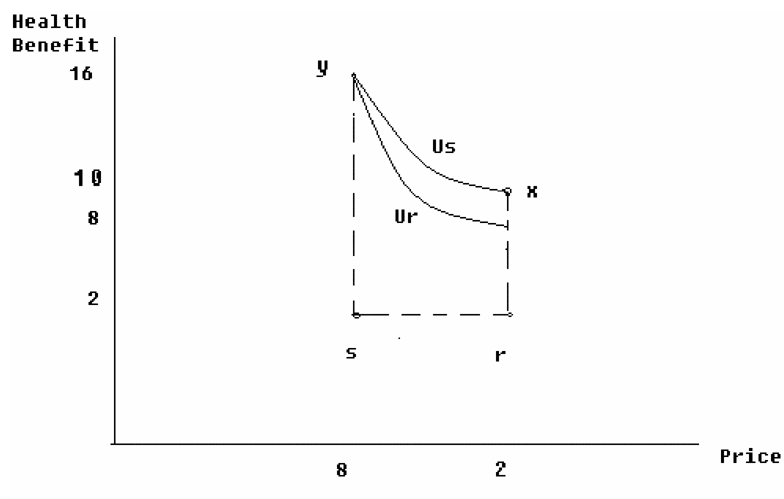
We can use the reference dependent approach to model how consumers make choices about healthier food, and to conceptualize how changes in reference points affect individuals’ preferences. Reference point effects reflect the fact that individuals with different reference points could make heterogeneous choice decisions. Thus, a utility function must be constructed that depends on the reference condition.

Analyzing Reference-Dependent Effects: Preference Change

Building on Tversky and Kahneman (1991), this paper explores an extension to the reference dependent model. First, it should be noted that there are two kinds of reference point effects: one is well known, that individuals with different reference points will have different preferences; the other more interesting possibility is that an individual’s preferences could change if his reference point changes. Here we explore that possibility as an approach to modelling the effects of different information environments on consumer preferences for functional food.

Let's take regular yogurt and probiotic yogurt as an example to show how an individual's preferences might change when his reference point changes. As shown in figure 1, one consumer bundle of goods is represented by $X = \{x, y, r, s\}$, with x & y denoting options, and r & s denoting reference points. Each option X=(x) represents one unit of regular yogurt with two product attributes: health benefit and price. Bundle Y=(y) represents one unit of probiotic yogurt (functional food), also with the same two attributes but at different levels.

Figure 1: Reference Points change for one person

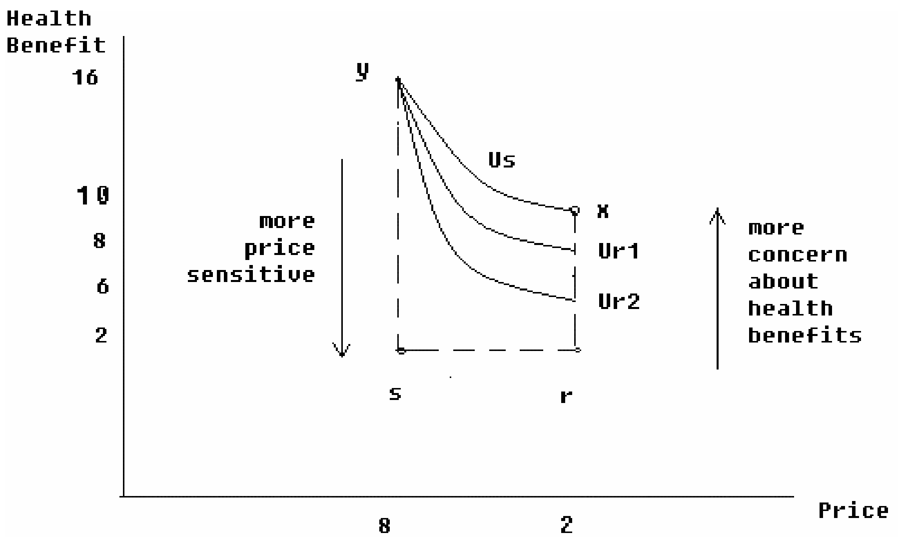


This figure shows us how changes in an individual's reference point could change that consumer's preferences. Suppose a consumer visits a store and notices one type of yogurt with 2 'units' of health benefits selling at \$8 (point s). The consumer takes this information as his reference point, and this individual would be indifferent between spending \$8 to receive a probiotic yogurt (y) with 16 units of health benefits or spending \$2 to receive a regular yogurt (x) with 10 units of health benefits. So his indifference curve is Us in figure 1.

Suppose on another day, the same consumer visits another store and discovers that there is another type of yogurt also with 2 units of health benefits, but that this yogurt is priced at \$2 (point r). The consumer's reference point has changed from s to r, and in this new information environment he will be indifferent between spending \$8 to get the probiotic yogurt with 16 units of health benefits or spending \$2 and receiving 8 units of health benefits. So the consumer's indifference curve shifts to Ur, which lies beneath his original indifference curve Us. Now, the consumer prefers the regular yogurt (x) over the probiotic yogurt (y).

Developing the case further in figure 2, we can show how the preferences of two consumers change to different levels when their reference points change. We assume that two consumers initially have the same indifference curve Us and assume that point s ($8, 2 units) is their reference point. If conditions change in the market such that another reference point r ($2, 2 units) is available, they change their reference point from s to r.

Figure 2: Reference Points Change for two person

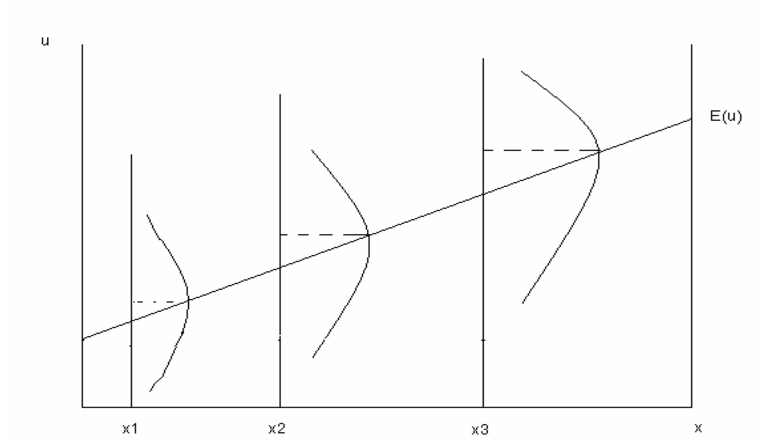


Consumer 1's new indifference curve shifts to Ur1, which means that the probiotic yogurt ($8, 16 units) delivers the same utility as the regular yogurt ($2, 8 units). However, consumer 2's new indifference curve shifts to Ur2, implying that the probiotic yogurt ($8, 16 units) delivers the same utility as a different regular yogurt ($2, 6 units). Thus, the two consumers react differently. From figure 2 we can see that Ur2 lies beneath Ur1, indicating that consumer 1 is more concerned about health benefits than consumer 2, or alternatively, consumer 2 is more price sensitive than consumer 1.

<u>Modelling Consumer Utility with Reference-dependent Effects</u>

To develop a modified reference-dependent theory, first it is necessary to specify the utility function of individual consumers with heterogeneous choices, as in figure 3.

Figure 3: A Utility Model with Heterogeneous Consumers' Choices



Based on ordinary random utility theory, here, E(u) captures the average expected utilities for all consumers; while x1 and x2, etc. represent individual consumers. Consumers will have different expected utilities from a given product. For an individual consumer i, his utility function could be expressed as:

$$u_i = E(u_i) + \varepsilon_i \qquad \varepsilon \to N(0, \delta^2)$$

Let's take a look at the reference point effects for the price attribute first. Assume all the variables are constant in the utility function except the price attribute. Now the utility function changes to:

$$u_i = u_0 - p_i - \lambda ploss_i + pgain_i + \varepsilon_i \qquad \varepsilon \to N(0, \delta^2)$$

Where $ploss_i$ captures the difference between the reference price and the observed price when the observed price is above the reference point; $pgain_i$ captures the difference between the reference price and the observed price when the observed price is below the reference point; p_i is the observed price for an individual i; u_0 captures the basic utility from consuming the product. With a restriction that $\lambda > 1$, this restriction captures the asymmetric response above and below the reference point, which means the decision maker exhibits loss aversion. For empirical applications, the test of the presence of loss aversion is that the estimated value of λ is significantly greater than one (Bell and Lattin, 2000).

Take the health benefits (HB) attribute as an example to show the reference dependent effects. Also assume all the variables are constant in the utility function except the HB attribute, thus the utility function could be expressed as:

$$u_{FF} = u_0 - P_{FF} + HB_{FF} + HBgain_i - \lambda * HBloss_i + \varepsilon_i$$

$$u_{RF} = u_0 - P_{RF} + HB_{RF} + \varepsilon_j \qquad \varepsilon \rightarrow N(0, \delta^2)$$

Where u_{FF} and u_{RF} are the per unit utilities from consuming one unit of the functional food (FF) and one unit of the traditional food (RF); the corresponding prices are P_{FF} and P_{RF}. The parameter u_0 is a per unit base level of utility to consume one unit of yogurt. HB_{FF} and HB_{RF} are the health benefit attributes for the functional food and the regular food. Taking HB_{RF} as the reference point and HB_{FF} as the observed attribute, $HBgain_i$ captures the difference between the reference point and the observed attribute when the observed attribute is more than the reference point, which means $HB_{FF} - HB_{RF} > 0$; $HBloss_i$ captures the difference between the reference point and the observed attribute when the observed attribute is less than the reference point, which means $HB_{FF} - HB_{RF} < 0$. Also with $\lambda > 1$, the utility function is consistent with the evidence for loss aversion.

Now we formally introduce the consumer utility model with reference-dependent effects. A potential framework within which to apply reference-dependent effects in consumer utility theory is a model allowing for vertical product differentiation. In what follows, we draw upon Fulton & Giannakas (2004) who used a utility model to explore the effects on consumer utility of labelling genetically modified foods.

<u>Consumer's problem</u>

Taking a group of consumers, each one makes a choice to consume one unit of a traditional product (regular yogurt, RF) or a functional food product (Probiotic yogurt, FF). The consumers are differentiated with respect to a characteristic c, which represents consumers' willing-to-pay (WTP) determined by heterogeneous consumers' choice decisions based on the 'health benefits' attribute. The consumer with characteristic c ($c \in [0,1)$) has a utility function defined by:

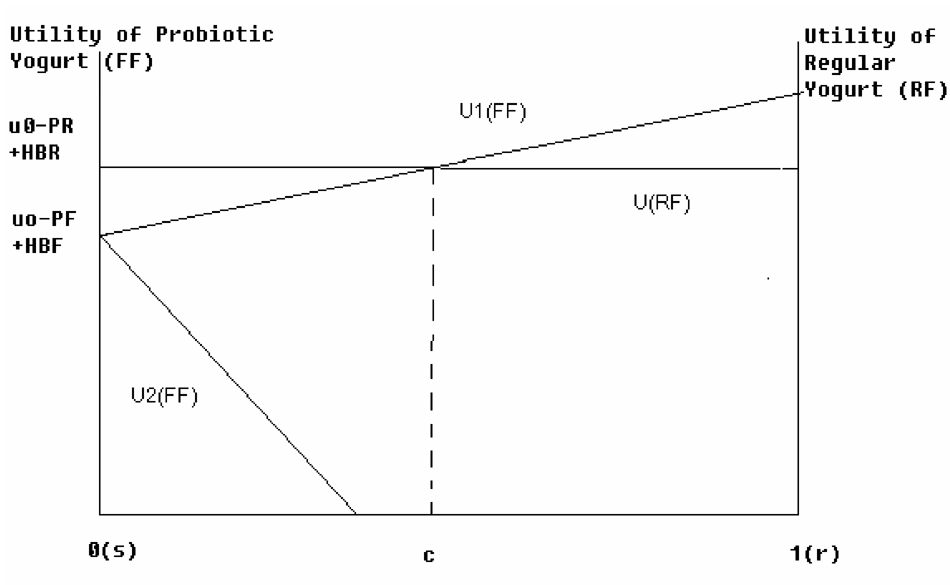
$$u_{FF} = u_0 - P_{FF} + HB_{FF} + (HB_{FF} - HB_{RF})*C - \lambda*(HB_{FF} - HB_{RF})*C$$
$$u_{RF} = u_0 - P_{RF} + HB_{RF}$$

The first equation, u_{FF}, measures the utility if one unit of functional food has been consumed. The second equation, u_{RF}, measures the utility if one unit of regular food has been consumed.

The notation explanations (e.g. u_0, P_{FF}, P_{RF}, HB_{RF} and HB_{FF}) are the same as above except for the last two items in the first equation. Taking HB_{RF} as the reference point and HB_{FF} as the observed attribute, the item $(HB_{FF}–HB_{RF})*C$ represents the reference-dependent effects for the health benefit gain; and the item $\lambda*(HB_{FF}–HB_{RF})*C$ represents the reference-dependent effects for the health benefit loss. Note that these two items can not co-exist for any individual consumer's utility function, because the consumer's will perceive either a gain or a loss from consuming functional food.

Using figure 4, we illustrate the consumer's problem graphically. The consumers with different reference points allocated from point's' to point 'r' in figure 2 correspond to consumers with different characteristics (c) allocated from point 0 (s) to point 1(r) in figure 4. Assume individual consumers are equally allocated on the horizontal axis.

Figure 4: Utility Models with Reference-Dependent Effects



In this figure, 0(s) represents that consumer allocated at value 0 who takes point s as his reference point. 1(r) represents a consumer allocated at value 1 who takes ‘r’ as his own reference point. The horizontal line U (RF) is the utility curve for regular food. U1 (FF) represents the utility function for functional food when there is a gain for some consumers from functional food, which means $HB_{FF} - HB_{RF}$ >0. U2 (FF) represents the situation when there is a loss to all the consumers from consuming the functional food, which means that $HB_{FF} - HB_{RF}$ <0[2].

At the intersection between U (RF) and U1 (FF), the consumer situated at point c will be indifferent between regular yogurt and probiotic yogurt. The consumers located to the right of consumer c prefer probiotic yogurt since their utility from consuming probiotic yogurt is higher than regular yogurt; and the consumers to the left of consumer c prefer regular yogurt.

Consumer Demand Curves

1) When there is a gain to consuming functional food products, item $\lambda * (HB_{FF} - HB_{RF}) * C = 0$ in the above utility curve. Now the utility curve will be:

$$U1(FF): u_{FF} = u_0 - P_{FF} + HB_{FF} + (HB_{FF} - HB_{RF}) * C$$
$$U(RF): u_{RF} = u_0 - P_{RF} + HB_{RF}$$

The consumer with characteristic c $\left(c: \mathrm{U1}_{\mathrm{FF}} = \mathrm{U}_{\mathrm{RF}} \Rightarrow c = \frac{p_{FF} - p_{RF}}{HB_{FF} - HB_{RF}} - 1 \right)$ is indifferent between consuming the functional food and the regular food. The demand curve for the functional product is given by $x_{FF}^D = c$,

$$x_{FF}^D = 1 - \frac{p_{FF} - p_{RF}}{HB_{FF} - HB_{RF}} \qquad (1)$$

And the demand for the regular food is given by.

$$x_{RF}^D = \frac{p_{FF} - p_{RF}}{HB_{FF} - HB_{RF}} \qquad (2)$$

[2] This is an extreme case. Hypothetically it could arise if there is a lack of clinical support for purported health claims, and if consumers have concerns about potential negative long-run side-effects for health, or there are problems with allergies or drug interactions (Brophy and Schardt, 1999).

2) When there is a loss to consuming functional food products, $(HB_{FF} - HB_{RF})$ *C = 0 in the utility curve. Now the utility curve will be:

$$U2(FF): u_{FF} = u_0 - P_{FF} + HB_{FF} - \lambda * (HB_{FF} - HB_{RF}) * C$$
$$U(RF): u_{RF} = u_0 - P_{RF} + HB_{RF}$$

If this is the case, we can see from the figure 4 that the utility curve for regular food lies completely above the utility curve for the functional food product. So the demand curve for the functional product is given by:

$$x_{FF}^{D} = 0 \qquad (3)$$

And the demand for the regular food is given by.

$$x_{RF}^{D} = 1 \qquad (4)$$

Note that situation 2) is simply an extreme case of situation 1) (zero consumption of functional foods). This result is consistent with economic intuition since usually the price of a functional food is higher than its conventional equivalent. If consumers believe that there are no health benefits from consuming functional food, no-one will consume functional food given its price premium, and all consumers will choose regular food. In this model, consumers' attitudes about health benefits and prices determine the market shares of functional food and regular food. Only when consumers believe that there is a gain from consuming functional food will the market be shared between functional food and regular food. In the absence of perceived health benefits, the utility functions above indicate that there will be no market for functional food, which of course is consistent with our intuition.

How do consumers perceive whether there are health gains or losses from choosing functional food rather than regular food? Labelling information plays a key role in allowing consumers to make informed choices.

Modelling Labelling Effects and Policy Change

A change in the information available to consumers through different types of health claims labelling might change consumers' reference points for the health benefits attribute, thereby altering their preferences for functional food.

If the assumption that consumers' preferences depend on their reference points is correct it is interesting to consider what factors determine consumers' reference points. For example, the consumer's current health situation provides a reference points for the health benefits attribute of a functional food. A consumer who has health problems may perceive a higher benefit from consuming a functional food, and therefore have a higher probability of purchasing these foods. In contrast, for a consumer who is very healthy, functional foods may only offer a marginal potential improvement in health status. 'Healthy or unhealthy' is the consumer's perception about his or her personal health status.

Another potential determinant of the reference point for health benefits is future perceived health status. If labelling of functional foods offers full information to consumers about the long-term health benefits from the food, consumers who are healthy right now might nevertheless use this information to alter their consumption choices to consume functional food as a proactive health protection strategy. This means the consumers might change their reference points from their current health situation to their future health situation. Clearly, this is just a hypothesis which could be explored through further empirical research. Understanding the determinants of consumers' reference points for the health benefits attributes will provide insights into the extent to which consumers are likely to change their consumption patterns in response to new information. The regulatory environment governing allowable labelling claims affects consumers' reference points by altering the information set available to consumers. In what follows we offer a brief overview of the health claim labelling rules in Canada and the US.

A Comparison of Health Claims Regulation in the U.S. and Canada

In making a decision regarding the consumption of functional food, consumers face two types of uncertainty: uncertainty about the health attributes of a specific food and uncertainty over future health outcomes. Given the information asymmetry inherent in functional foods, labelling information plays a key role in allowing consumers to make informed choices. Canadian current regulations for health claims on functional foods are relatively restrictive relative to a number of other countries where functional foods are a rapidly growing segment of the food market.

The United States permits two types of claims: first, a health claim which links a nutrient to a particular disease, for example, “diets rich in calcium may reduce the risk of osteoporosis”, this type of health claim must be pre-approved by the U.S. Food and Drug Administration (FDA). Second, a product may carry a function claim linking a substance to an effect on the functioning of the body, for example, “calcium builds strong bones”. This type of health claims does not need pre-approval (Heller et al, 1999). Currently through the FDA’s health claims regulation system, 17 kinds of health claims are allowed for functional foods products in the United States.

Under the current food labelling policy in Canada, Health Canada (2003) only allows five specific science-based risk reduction claims to be used on food labels or in advertisements. The allowed health claims in Canada are the following (Health Canada, 2003):

1. a healthy diet low in sodium and high in potassium and reduced risk of high blood pressure;
2. a healthy diet with adequate calcium and vitamin D and reduced risk of osteoporosis;
3. a healthy diet low in saturated and trans fat and reduced risk of heart disease;
4. a healthy diet rich in vegetables and fruit and reduced risk of some types of cancers;
5. the non-cariogenic benefits of non-fermentable carbohydrates in gums and hard candies

These are risk reduction claims. Disease prevention claims, linking consumption of a food to the prevention of a specific disease, are not permitted on food products in Canada. Products claiming to treat, cure, mitigate or prevent a disease or illness are regulated as drugs. The above five health claims are based on ten existing approved health claims by the United States under the Nutrition Labeling and Education Act (NLEA) in the 1990s. Health Canada (2003) reviewed those ten claims and determined that five of them would be allowed in Canada, while the other five claims remain unapproved. The unapproved health claims include: “fat and cancer; folate and neural tube defects; fiber-containing grain products, fruits, and vegetables and cancer; fruits, vegetables, and grain products that contain fiber, particularly soluble fiber, and risk of coronary artery disease; soluble fiber and risk of coronary artery disease". (Fitzpatrick, 2004)

Due to the relatively more restrictive labelling regulatory environment in Canada, many Canadian functional food products cannot be sold domestically as functional foods and tend to be exported to the United States, which has a growing functional food market estimated to be worth about $37 billion in 2001. (Boyd, 2001) This also means that Canadian consumers are prevented from purchasing functional food products that might otherwise have been marketed in Canada. Clearly, the regulatory system needs to balance consumer protection, and the avoidance of spurious or misleading health claims, with the ability for food manufacturers to communicate the health benefits of genuinely beneficial functional foods to consumers. While this is a difficult balance, the fact remains that far fewer health claims are allowed in Canada relative to other countries, and the range of functional food products on the market is therefore more limited.

Given the importance of labelling and information asymmetry in understanding the consumer decision-making process for functional foods, the effect of different labelling strategies will now be examined; in particular, whether different labelling policies could offer sufficient information to change consumers' reference points and thus reduce consumer heterogeneity.

Modelling the Influence of Labelling on Reference-dependent Effects

In the absence of labelling, the health benefits from functional foods are a credence attribute, since the differences between a functional and a regular food cannot be detected by search or experience. The relatively restrictive labelling regulatory environment in Canada (only five allowable risk reduction claims) has resulted in food companies using other means to signal potential health benefits. We refer to this as partial labelling. For example, food firms use a logo or visual cue to imply a health benefit. Figure 5 provides an example - the use of a red heart mark on the milk package - which is clearly meant to imply that consumption of the product is good for heart health. In other cases, food products contain an endorsement or healthy diet recommendation by a third party, such as the Canadian Diabetic Association, or the 'Health Check program of the Heart and Stroke Foundation. In some cases, products contain indirect health claims that imply health benefits (e.g. Claims "low in saturated and trans fat") that require consumers' knowledge of the relationship between consumption and heart disease. In contrast, full labelling would allow direct and specified health claims on product labels (e.g. "Calcium reduces the risk of osteoporosis.").

Figure 5: Partial labelling example

In the second section of this paper, we examined the reference-dependent effects for the price and health benefits attributes. Now we expand on that discussion and apply the reference-dependent effects to the health claims (HC) attribute under different labeling situations. Further, we assume there are two kinds of consumers: group 1 who always read food labels carefully, and group 2 who do not pay much attention to food labels. Under the current health claims policy in Canada, with only five permissible health claims, partial labelling dominates for functional food products. So we take this partial labeling as the reference point, and look at how a change in policy to facilitate full labelling of a greater range of health claims could have a reference-dependent effect.

We begin by expressing the utility curve for functional food as:

$$U_{FFi} = u_0 - P_i + HC_i + HCgain_i - \lambda * HCloss_i + \varepsilon_i \qquad \varepsilon \to N(0, \delta^2)$$

We assume that all the other variables are constant except price and health claims. U_{FFi} represents per unit utilities of consuming one unit of the functional food (FF) and $i \in (1,2)$ represents the consumers from the two different groups mentioned above; HC_i is the health claims attribute of the functional food. Taking partial labelling (PL) as the reference point and full labelling (FL) as the observed health claims attribute,

$HCgain_i$ captures the difference between FL and PL when the observed attribute is greater than the reference point ($FL - PL > 0$); $HCloss_i$ captures the effect if the observed attribute is less than the reference point ($FL - PL \leq 0$), but this effect is unlikely to occur in reality, unless we considered a case whereby full labelling led to information overload for consumers.

If $FL - PL > 0$, this consumer might belong to group 1 who would benefit from the labelling policy change from partial labelling to allowing full labelling since they always read the label carefully, and would benefit from additional information; if $FL - PL \leq 0$, this consumer might belong to group 2 who do not benefit from the labelling policy change since they usually do not pay much attention to food labels.

The following section will focus on how the health claims effects from different labelling policies could influence consumers' preferences through changing their reference points. The different consumer willingness to pay for functional foods and traditional foods could explain why both functional foods and traditional foods co-exist under different labelling policies. Now it is time to build the partial labelling and full labelling effects into the previous consumer utility theory with reference-dependent effects.

<u>The Consumer's Problem</u>

Take a group of consumers, each one chooses whether to consume one unit of a traditional product, a fully labelled functional food product, or a partial labelled functional food product[3]. The consumers are differentiated with respect to a characteristic c, which represents consumers' willing-to-pay (WTP) based on the 'health benefits' attribute and labelling attribute. The consumer with characteristic c ($c \in [0,1)$) has a utility function:

$$u_{RF} = u_0 - P_{RF} + HB_{RF}$$
$$u_{PL-FF} = u_0 - P_{PL-FF} + HB_{PL-FF} + (HB_{PL-FF} - HB_{RF})*C - \lambda*(HB_{PL-FF} - HB_{RF})*C$$
$$u_{FL-FF} = u_0 - P_{FL-FF} + HB_{FL-FF} + (HB_{FL-FF} - HB_{RF})*C - \lambda*(HB_{FL-FF} - HB_{RF})*C + (FL - PL)*C$$

[3] Fulton and Giannakas (2004) used a similar approach to model consumer choices in response to different GM labels.

Where u_{RF}, u_{PL-FF} and u_{FL-FF} are the per unit utilities from consuming one unit of the regular food, one unit of the partial labelled functional food and one unit of the full labelled functional food respectively; the corresponding prices and health benefits are P_{RF}, P_{PL-FF}, P_{FL-FF}, HB_{RF}, HB_{PL-FF} and HB_{FL-FF}; Here, the first equation measures the utility if one unit of regular product is consumed; the second equation measures the utility if one unit of the partial labelled functional food is consumed; and the third equation measures the utility if one unit of a fully labelled functional food product is consumed. Note that there is a reference-dependent effect for the health benefits attribute in the second equation, and there are reference-dependent effects for both the health benefits attribute and the labelling attribute in the third equation. For the third equation, taking partial labelling (PL) as the reference point, we can compare with the situation of full labelling (FL). There is a labelling reference-dependent effect captured by the term (FL-PL)*C, when a consumer chooses to consume the fully labelled functional food. There is no labelling loss effect, since consumers always gain or at least there is no harm from more accurate and specified labelling claims (an exception could be if information overload became a problem with full labelling information).

Full Labelling Case

When the functional food products are fully labelled the products carry full information on the link between consumption of the food and the treatment and prevention of certain diseases. The consumer has a choice whether to purchase fully labelled functional foods or regular foods. In the full labelling case, using equations one and three above the demand curves for regular food and full labelled functional food can be derived. The demand for regular food is:

$$x_{RF}^{D} = \frac{p_{FL-FF} - p_{RF} + \left(HB_{RF} - HB_{FL-FF}\right)}{\left(HB_{FL-FF} - HB_{RF}\right) + (FL - PL)} \qquad (5)$$

And the demand for fully labelled functional food is:

$$x_{FL-FF}^{D} = 1 - \frac{p_{FL-FF} - p_{RF} + \left(HB_{RF} - HB_{FL-FF}\right)}{\left(HB_{FL-FF} - HB_{RF}\right) + (FL - PL)} \qquad (6)$$

Partial Labelling Case

When the functional food products are partially labelled, health claims are not permitted on the product. Instead, food manufacturers use visual cues or indirect claims to imply the health benefits and differentiate the product from traditional food. In this case, the consumer has the choice of either purchasing partially labelled functional foods or purchasing regular foods. Using equations one and two above, we derive the demand curve for regular food and partially labelled functional food. The demand for regular food is:

$$x_{RF}^{D} = \frac{p_{PL-FF} - p_{RF} + \left(HB_{RF} - HB_{PL-FF}\right)}{HB_{PL-FF} - HB_{RF}} \quad (7)$$

And the demand for partial labelled functional product is:

$$x_{PL-FF}^{D} = 1 - \frac{p_{PL-FF} - p_{RF} + \left(HB_{RF} - HB_{PL-FF}\right)}{HB_{PL-FF} - HB_{RF}} \quad (8)$$

Comparing those two cases it is clear that the major difference comes from the health claims reference-dependent effects. If those effects exist, the demand for full labelled functional food will be greater than the demand for partial labelled functional food, and the labelling effects might change the previous health benefits effects. If the health claims reference-dependent effects do exist, the demand for functional food might increase, so the market share for functional food and regular food will also change.

In this section, the model used reference point effects to capture heterogeneities in consumer preferences based on product attributes such as health benefits, and examined consumers' responses to different labelling information environments. Future empirical work is needed to test hypotheses regarding the reference dependent effects for health claim labelling, and the effect of health claims on consumers' functional food choices.

Conclusion and Future Research

This paper incorporated reference-dependent theory from the psychology literature into a model of consumers' decision making for functional dairy products. It focused on the reference-dependent effects when consumers make choices, showing how changes in reference points could change individuals' preferences, and whether labelling could offer sufficient information to change consumers' preferences. The effect of different labelling policies on the health claims attribute is of interest, particularly when we compare a partial labelling scenario with that of full labelling.

This paper provides a basis for future empirical analysis of the demand for functional food under different labelling situations. In particular, empirical analysis could assess whether there are reference-dependent and labelling effects for both health benefits and health claims attributes for Canadian consumers of functional food; how consumers react to full labelling versus partial labelling, and the extent to which this may reduce consumer heterogeneity.

There are three major variables in the model: Health Benefits, Health Claims Labelling Information and Price. A related area for future study is to determine what factors could change consumers' reference points for the Health Benefits and Health Claims Labelling Information variables. An initial assessment suggests that there are at least three possible factors that could change consumers' reference points: consumer's current and anticipated future health status, the credibility of labelling claims, and how much effort consumers put into reading labels. Further research could examine these factors, as well as determine how they could be influenced by public information campaigns, or by an industry association through generic advertising targeting the health benefits of, for example, functional dairy products.

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