



Modeling Reference-Dependent and Labeling Effects in Consumers' Functional Food Choices

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Ning Ning Zou (Helen), Jill Hobbs

University of Saskatchewan
Department of Bioresource Policy, Business & Economics





Research Question

- This paper examines the question of how reference-dependent and labeling effects could be used to model consumer's preference changes in functional food choices.
- Consumers make choices depending on their current health status, prices, and the credibility of health claims.



Presentation Structure

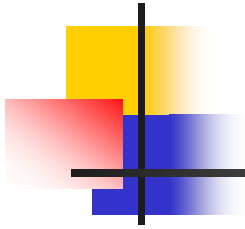
I. Introduction

II. Modeling reference-dependent effects

III. Modeling labeling effects

IV. Conclusion

V. Future research



Part I: Introduction



1.1 What is functional food?

- Health Canada (1999) defines functional foods as a food product that is consumed as part of a usual diet, and has demonstrated physiological benefits and reduces the risk of a chronic disease beyond a basic nutritional function.
- New food category positioned between medicine and conventional foods.
- The central characteristic is its 'health benefits' attribute.
- Reduce risks of cancer, diabetes, cardiovascular disease, and hypertension.



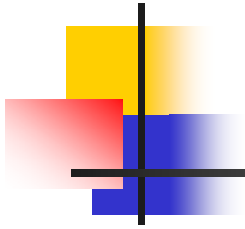
1.2 Functional Food Industry in the Global Market

- Recent in Canada and the United States, popular in Europe and Japan since the 1990s.
- The European market is dominated by digestive health products, a 30-50% price premium is common in their functional dairy products. (Menrad, 2003)
- In the Canadian market, it approximate 20-50% price premium for dairy yogurt products.



1.3 Reference-Dependent Theory Introduction

- Reference-Dependent Theory is a method to measure consumers' preferences, originally from the psychology literature, prospect theory by Tversky and Kahneman in 1981.
- Tversky, A. & D. Kahneman (1991)
The central assumption of Reference-Dependent theory is that losses and disadvantages have a greater impact on preferences than gains and advantages.
- Reference Dependent & Loss Aversion



Part II

Modeling Reference-Dependent Effects



2.1 Reference-Dependent Effects

- There are two kinds of reference point effects:
 - One is that individuals with different reference points have different preferences;
 - The other more interesting one is that a single individual's preference might change if his reference point changes.
- Let's take regular yogurt and probiotic yogurt (functional food) as an example to show an individual's preference change when his reference point changes.
- As shown in figure 1, x & y denoting options, and r & s denoting reference points.
- Each option x & y represents one unit of regular yogurt and one unit of probiotic yogurt with two attributes: health benefit and price at different levels.

2.2 Reference Point Change for One Consumer

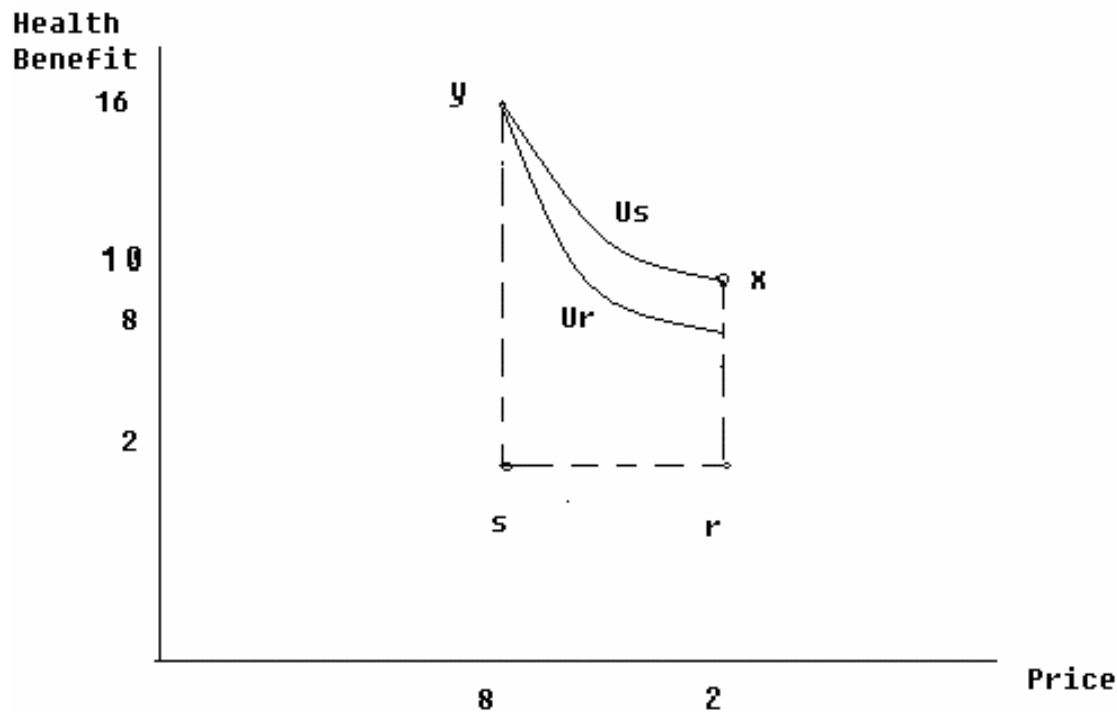


Figure 1: Reference point changes for one person
(Modified of a graph of loss aversion by Tversky and Kahneman, QJE, 1991)

2.3 Reference Points Change for Two Consumers

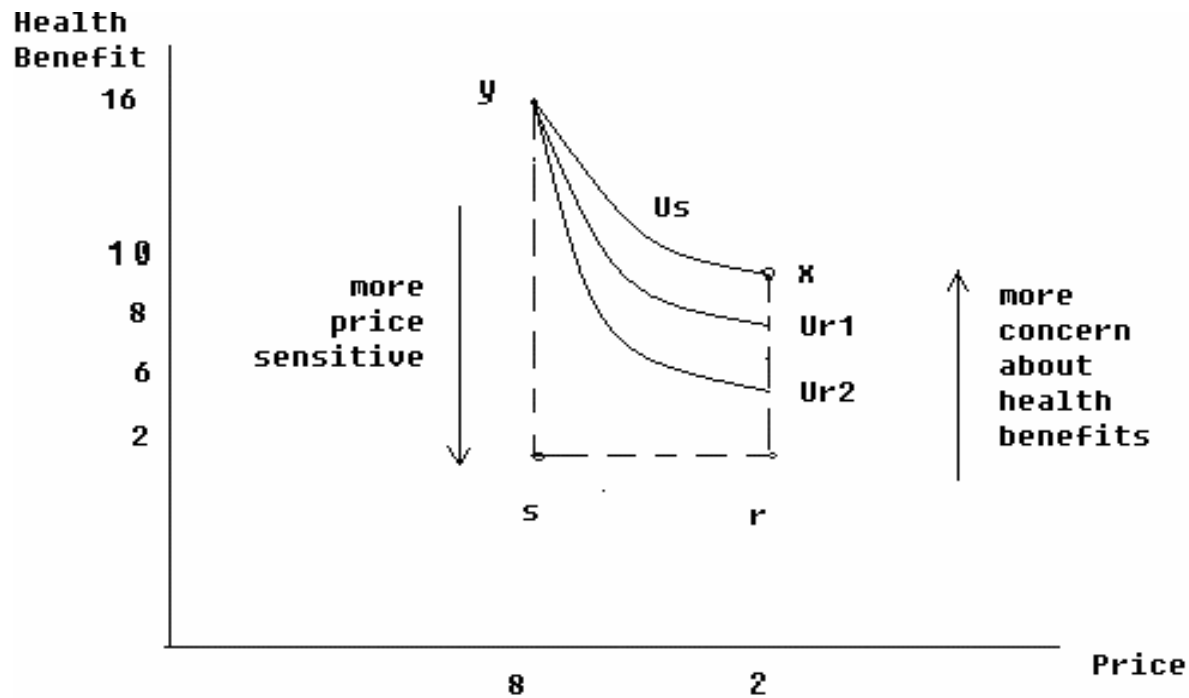


Figure 2: Reference points change for two person

2.4 Reference-dependent Effects on Health Benefits Attribute

- Take health benefits (HB) attribute as an example, the consumer random utility function with reference-dependent effects could be:

$$u_{FFi} = u_{0i} - P_{FFi} + HB_{FFi} + HBgain_i - \lambda * HBloss_i + \varepsilon_i$$

$$u_{RFj} = u_{0j} - P_{RFj} + HB_{RFj} + \varepsilon_j \quad \varepsilon_{i,j} \rightarrow N(0, \delta^2)$$

- u_{FF} & u_{RF}** --- the utilities with consuming one unit of functional food (FF) and one unit of regular food (RF).
- u_0** --- a base level utility.
- P_{FF} & P_{RF}** --- corresponding prices.
- HB_{FF} & HB_{RF}** --- health benefits attributes for functional food and regular food.
- HB_{RF}** --- the reference point & **HB_{FF}** --- the observed point.
- $HBgain$** --- when $HB_{FF} - HB_{RF} > 0$; **$HBloss$** --- when $HB_{FF} - HB_{RF} < 0$.
- $\lambda > 1$** , consistent with the evidence for loss aversion.



2.5 Consumer Utility Theory with Reference-dependent Effects

- We use a vertical market model to apply reference-dependent effects in consumer utility theory. (Fulton & Giannakas, 2004)

- **Consumer's problem:**

The consumer with characteristic \mathbf{C} ($c \in [0,1)$) having a utility function:

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

$$u_{RF} = u_0 - P_{RF} + HB_{RF}$$

- \mathbf{C} --- consumers' willingness-to-pay (WTP) determined by heterogeneous consumer's choice decisions based on the 'health benefits' attribute.

2.6 Consumer Utility Curves with Reference-dependent Effects

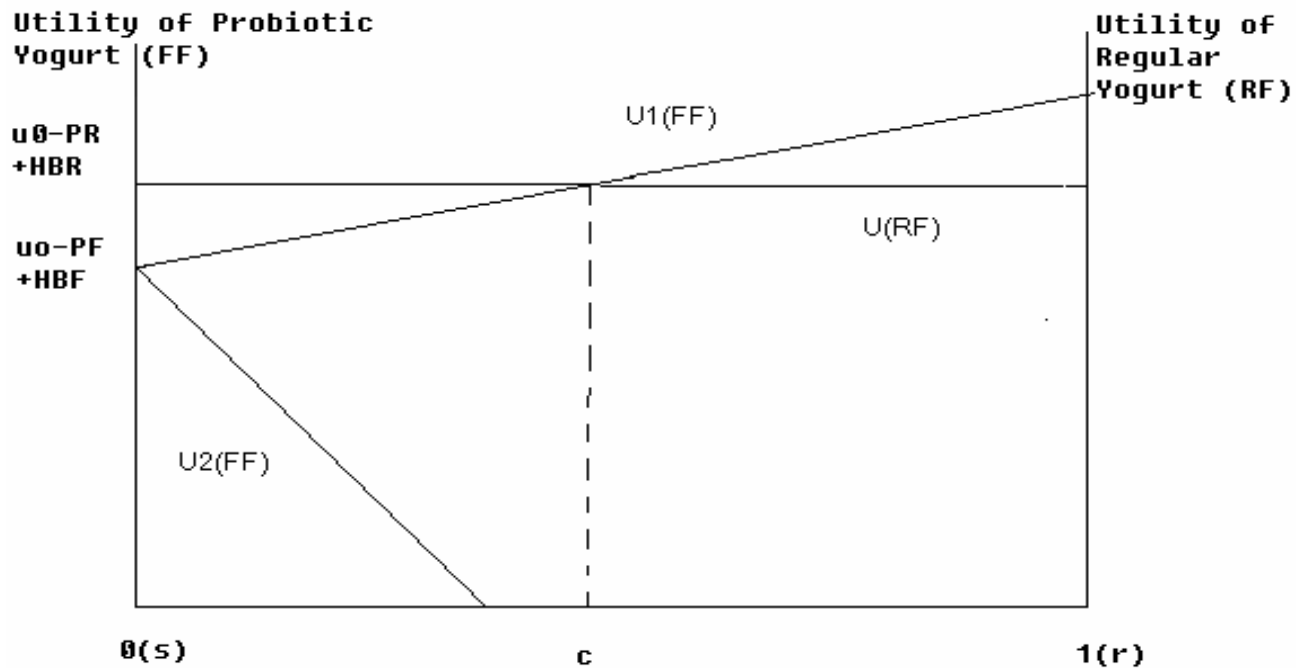


Figure 3: Utility Curves with Reference-Dependent Effects



2.7 Consumer Demand Functions with Reference-Dependent Effects

- 1) When some consumers believe that there is a gain from consuming functional food products, the demand curve for the functional product and regular food are:

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

- 2) When all the consumers believe that there is a loss from consuming functional food products, the demand curve for the functional product and regular food are:

$$x_{FF}^D = 0 \qquad x_{RF}^D = 1$$



2.8 Consumer Demand Functions with Reference-Dependent Effects (con't)

- In this model, consumers' attitudes about health benefits and prices determine the market shares.
- How does a consumer perceive whether there is a health gain or loss to choose functional food rather than regular food?
- Labelling information plays a key role in allowing consumers to make informed choices.



Part III Modeling Labeling Effects



3.1 Labeling Regulation Introduction

- In function food choices, 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 very restrictive.
- Health Canada (2003) only allows five kinds of specific science-based health claims to be used on food labels or in advertisements. While, the United States allows seventeen.

3.2 Labelling Effects and Policy Change



- Constrained by the health claims of labelling regulation in Canada, partial labelled functional food products have been introduced into the market.
- What is partial labelling and full labelling?
- Now it is time to build the partial labelling and full labelling effects into the previous consumer utility theory with reference-dependent effects.



3.3 Modeling Labelling Effects

- **Consumer's problem:**

$$u_{RF} = u_0 - P_{RF} + HB_{RF}$$

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

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

- **Take a group of consumers, and each one makes a choice to consume one unit of a regular food, a partial labelled functional food, or a fully labelled functional food.**
- **Taking partial labelling (PL) as the reference point, and comparing full labelling (FL) with it, there is a labelling reference-dependent effects, captured by the item (FL-PL)*C, when a consumer chooses to consume the full 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.**

3.4 Consumer Demand Functions with Reference-Dependent and Labelling Effects

- **Full Labeling Case:** demand equations for the regular food and full labelled functional food are:

$$x_{RF}^D = \frac{p_{FLFF} - p_{RF} + (HB_{RF} - HB_{FLFF})}{(HB_{FLFF} - HB_{RF}) + (FL - PL)} \quad x_{FLFF}^D = 1 - \frac{p_{FLFF} - p_{RF} + (HB_{RF} - HB_{FLFF})}{(HB_{FLFF} - HB_{RF}) + (FL - PL)}$$

- **Partial Labeling Case:** demand equations for the regular product and partial labelled functional product are:

$$x_{RF}^D = \frac{p_{PLFF} - p_{RF} + (HB_{RF} - HB_{PLFF})}{HB_{PLFF} - HB_{RF}} \quad x_{PLFF}^D = 1 - \frac{p_{PLFF} - p_{RF} + (HB_{RF} - HB_{PLFF})}{HB_{PLFF} - HB_{RF}}$$



3.5 Consumer Utility Theory with Reference-dependent and Labelling Effects Summary

- Compare those two cases; the major difference comes from the health claims reference-dependent effects.
- If those effects do exist, the demand for full labelled functional food will be greater than the demand for partial labelled functional food.
- Labelling effects might change health benefits effects.
- Use reference point effects to capture heterogeneities in consumer preferences based on product attributes, such as health benefits and price, and to examine consumers' responses to different labelling strategies.



IV. Conclusion

- This paper incorporates reference-dependent theory from the psychology literature into consumers' decision making models, and focuses on how the changes in reference points could change individuals' preferences.
- There are three major variables.
- When adding in the labeling effects, the reference points of health benefits attribute might change, which could change consumers' preferences for functional food.
- There are at least three possible aspects that could change consumers' reference points: health status, the credibility of labeling claims, and how much efforts consumers put into reading labels.



V. Future Research

- In the future, I will work on some specific empirical applications to test this model, and try to answer the following questions:
 - Whether there are reference-dependent and labelling effects for both health benefits and health claims attributes?
 - Whether the full labelling information could reduce consumer's heterogeneity?
 - What facts could change consumers' reference points?
- This theoretical paper is still a working on paper. Any comments and suggestions are really appreciated.



Thank you!

Contact information:

Helen Zou

Email: niz206@mail.usask.ca

Phone: (306) 880-1568

Address: 3D34, 51 Campus Drive, Saskatoon, SK, S7N 5A8