Heterogeneous Consumer Preferences for Nanotechnology and Genetic-Modification Technology in Food Products

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Abstract

This study investigates heterogeneous consumer preferences for nano-food and genetic-modified (GM) food and the associated benefits using the results of choice experiments with 1117 U.S. consumers. We employ a mixed logit model and a latent class logit model to capture the heterogeneity in consumer preferences. Our results identify four consumer groups and each consumer group has distinctive demographic backgrounds, which generates deeper insights in the diversified public acceptance for nano and GM food.

Introduction

- GM food currently constitutes a large portion of domestic food supply, including an estimated 70% of processed foods (Hallman et al. 2003).
- The growth prospect for the nano-food industry is significant, with a predicted rise in total market value to $20 billion by 2015 (Groves and Titoria 2009).
- Given the strong prevalence and interest in GM and nano-foods, it is important to understand consumer perceptions of acceptance, benefits and risks, and their desires for labeling.

Methods

Choice Experiment:

- Participants were presented with a series of choice scenarios of 32oz (2lb) bag of long grain white rice.
- Technology: nanotechnology, genetically modified, or conventional breeding.
- Associated Benefits: enhanced nutrition, enhanced taste, enhanced food safety, less harmful impact on environment, or no benefit.

Table 1. Choice Scenario Question Example

Option	A	B	C
Technology	Nanotech	GM	Neither A or B
Benefit	No Benefit	Enhanced Nutrition	
Price	$3.75	$5.00	

Econometric Models:

- Mixed Logit Model:
  The conditional probability of individual i choosing alternative j in choice scenario t is given by

$$L_{ijt}(\beta_i) = e^{\beta_i' x_{ijt}} / \sum_{j=1}^{M} e^{\beta_i' x_{ijt}}$$

- Latent Class Logit Model:
  Given that this individual belongs to latent class s ($s = 1,2,\dots,S$), the probability is:

$$Pr(x_{ijt}|s) = \prod_{t=1}^{W} \frac{e^{\beta_s x_{ijt}}}{\sum_j^M e^{\beta_s x_{ijt}}}$$

the weight for latent class s is the population share of that class and specified by

$$\pi_{si}(\theta_s') = \frac{e^{\theta_s' z_t}}{1+\sum_{s=1}^{S-1} e^{\theta_s' z_t}}$$

where z_t is a set of observable characteristics for class membership and θ_s' is a vector for class membership model parameters.

Results

1. Nano or GM application in rice production decreases an individual's overall utility; whereas the presence of any additional benefits enhances the utility.

Table 2. WTP Estimates

Attributes	WTP ($/lb)	95% CI($/lb)
Nanotech	-0.87	(-0.97, -0.76)
GM	-0.96	(-1.08, -0.84)
Nutrition	0.92	(0.81, 1.03)
Safety	0.98	(0.86, 1.10)
Environment	0.57	(0.48, 0.66)
Taste	0.56	(0.46, 0.66)

2. Adaptive bounded kernel density figures show clear preference heterogeneity for Nanotechnology and GM, and latent class analysis further identified four consumer groups based on individual WTP characters.

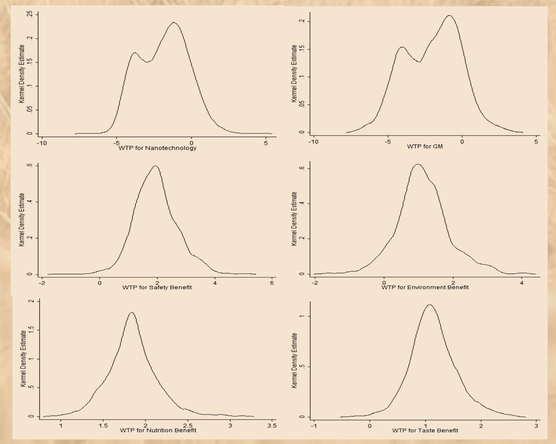

Figure1. Kernel Density Distribution for WTP of each attribute

3. Consumers from the four classes vary significantly in social-demographics.

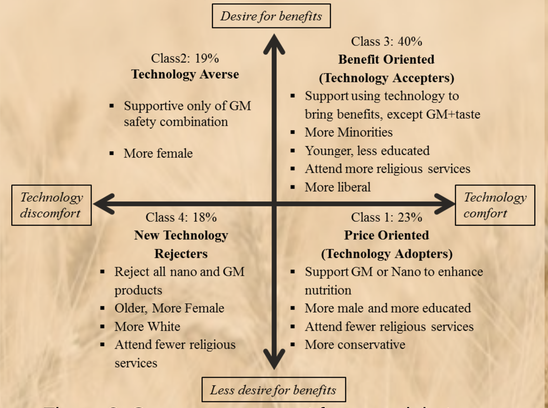

Figure 2. Consumer segment framework between preference and Character

Conclusion

- GM causes more reduction in the utility than nanotechnology across all groups of people and benefits.
- Heterogeneous consumer preferences for nano-food and GM food along with associated benefits clearly exist, and consumers can be segmented into four preference groups: 'Price Oriented', 'Technology Averse', 'Benefit Oriented', and 'New Technology Rejecters'.
- Each preference group has identical social and demographic background.
- The majority of consumers will not reject these technologies outright, but base their decisions on a complicated calculus of benefits, risks, technological comfort, and safety.

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