Does Loss Aversion Exists In Retail Brand Choice Settings? – Empirically Tested by MCMC

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Prospect Theory & Loss Aversion

Toy Example

You go out and plan to run 5km(reference point) like you always did, if you feel so tired and you only runs 4.8km, you wouldn't feel happy because you feel a 'loss' of 0.2km (contradicts the EUT because you still runs 4.8km, much more than 0), and you wouldn't feel much happier if you run 5.2km, because loss of 0.2 km hurts more than gain of 0.2 km – loss aversion.

Prospect Theory & Loss Aversion

- Expected Utility Theorem: People's utility is based on the overall gain or loss.
- Prospect Theory: People make decisions based on gain or loss regarding a reference point, and loss always cause a stronger effect on the utility than gain(loss aversion).
- A main stream of literature are focusing on empirically finding the reference point(Homonoff, 2018; Pope & Schweitzer, 2011; Allen, Dechow, Pope, & Wu, 2017).
- However, considering heterogeneity(individual differences) may lead to a totally different result, loss aversion may not exist at all, as shown in (Bell & Lattin, 2000).

Research Question

Does Loss Aversion exists in brand choice settings?

Figure: Cracker Brand

Potential Contribution

- Contribution: This paper shows 1)the existence of reference point and loss aversion effect in the Yogurt and Cracker Market. 2)the degree of loss aversion effect is small and it even disappears after considering the heterogeneity and possible correlations.

- Advanced computational method: This paper takes heterogeneity into consideration by using hybrid Markov Chain Monte Carlo sampler with a mixture normal prior.

Multinomial Logit Model

$$V_{ijt} = \alpha_{ij} + \beta_{1i}\,\text{Feat}_{jt} + \beta_{2i}\,\text{Disp}_{jt} + \beta_{3i}\text{GAIN}_{ijt} + \beta_{4i}\text{LOSS}_{ijt}$$

$$P_{it}(j) = \frac{\exp\left(V_{ijt}\right)}{\sum_k \exp\left(V_{ikt}\right)}$$

- i: individual
- j: brand/option
- t: time/occasion
- P: Probability
- V: Utility

Multinomial Logit Model

$$V_{ijt} = \alpha_{ij} + \beta_{1i}\,\text{Feat}_{jt} + \beta_{2i}\,\text{Disp}_{jt} + \beta_{3i}\text{GAIN}_{ijt} + \beta_{4i}\text{LOSS}_{ijt}$$

where

$$\text{GAIN}_{ijt} = \begin{cases} \text{RP}_{it} - P_{jt} & \text{if } \text{RP}_{it} - P_{jt} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\text{LOSS}_{ijt} = \begin{cases} P_{jt} - \text{RP}_{it} & \text{if } \text{RP}_{it} - P_{jt} < 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Disp}_{jt} = \begin{cases} 1 & \text{if the brand has a display in store} \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Feat}_{jt} = \begin{cases} 1 & \text{if the brand has a feature advertisement} \\ 0 & \text{otherwise} \end{cases}$$

Data

- Two datasets of consumer panel data: optical scanner panel data for saltine cracker purchase in Rome, GA and scanner panel data for yogurt purchase in Springfield, MO for over 2 years.
- Contains information including purchase records, prices of all the brand, the feature advertising and promotion of the brand over time for hundreds of people over 2 years.

id	disp.sunshine	disp.keebler	disp.nabisco	disp.private	feat.sunshine	feat.keebler	feat.nabisco	feat.private	price.sunshine	price.keebler	price.nabisco	price.private	choice
1	0	0	0	0	0	0	0	0	98	88	120	71	nabisco
1	0	0	0	0	0	0	0	0	99	109	99	71	nabisco
1	1	0	0	0	0	0	0	0	49	109	109	78	sunshine
1	0	0	0	0	0	0	0	0	103	109	89	78	nabisco
1	0	0	0	0	0	0	0	0	109	109	119	64	nabisco
1	0	0	0	0	0	0	0	0	89	109	119	84	nabisco
1	0	0	1	0	0	0	0	0	109	109	129	78	sunshine
1	0	0	1	0	0	0	0	0	109	119	129	78	nabisco

Figure: Cracker Market Data

Heterogeneity concerns: Mixture of Normal Priors

I specify my heterogeneity model across consumers by assuming that $\theta_i = (\alpha_{ij}, \beta_{1i}, \beta_{2i}, \beta_{3i}, \beta_{4i})$ follows a multivariate normal distribution with the mean of $\bar{\theta}$ and the variance of V_θ:

$$\theta_i \sim N\left(\bar{\theta}, V_\theta\right)$$

To let the MCMC Sampler run, I need a prior. I choose to use a natural conjugate prior where the prior on $\bar{\theta}$ is normal and the prior on V_θ is inverted Wishart:

$$V_\theta \sim IW(v, V)$$

Expected Results

Reference point and loss aversion would be shown empirically true using the multinomial logit choice model assuming all the people are the same. However, taking heterogeneity concerns using MCMC Sampler with mixture normal setting would lead to a reduction or even disappear of the Loss Aversion.