EXISTENCE OF CONSUMER SEGMENTS BASED ON THE USE OF REFERENCE PRICE

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ABSTRACT

The effect of different forms of reference price-internal and external-has been well documented in the literature. In this study, I hypothesize and confirm the existence of two groups of customers, who differ in their use of reference price scheme. In the detergent category, it was shown that a fixed percentage of the consumer households use internal reference price for evaluating their brand choice, while the rest use external reference price. It can also be inferred that in categories such as detergents, majority of the customers use external reference prices. It was also confirmed that income levels positively moderate the influence of external reference price on probability of a brand choice.

Keywords: Reference price, Brand Choice, Income, Retail.

INTRODUCTION

Reference price is an extensively researched subject in explaining consumer choice (Lisa, Hean & Joseph, 2010; Bruno, Hai & Dutta, 2012; Erdem, Katz & Sun, 2010; Kumar, 1998; Lo, Chou & Teng, 2013; Lowe & Alpert, 2010; Mayhew & Winer, 1992; Mazumdar, Raj & Sinha, 2005; Weaver & Frederick, 2012). There has been a consensus already that in evaluating the purchase price of a product consumers use a standard (Emery, 1969; Monroe, 1973; Winer, 1986). Reference price is the standard price against which a consumer would compare the actual price of the product (Bruno, Hai & Dutta, 2012; Kopalle, Kannan, Boldt & Arora, 2012; Kumar, 1998; Rajendran & Tellis, 1994). It uses the assumption that consumers do not rely on the absolute prices, but only relatively to a reference price (Kopalle, Kannan, Boldt & Arora, 2012; Thaler, 1985). Reference prices have been examined across two streams of research, namely, external and internal reference prices (Mayhew & Winer, 1992). However, extant research offered competing explanations to reference price.

Consumers use internal reference price in assimilating the prices facing them on their prior purchase occasions and stored in long-term memory. This implies that the expectation for the future prices is informed by the past purchase of the brand (Erdem, Katz & Sun, 2010; Lattin and Bucklin, 1989). Consumers evaluate the expected price with the price presented to them on the purchase occasion and their response depends on the difference between the two. Research on reference price is built on several theories of consumer psychology and behaviour; assimilation contrast theory (Sherif, 1963) and adaptation level theory (Helson, 1964). According to adaptation level theory people adapt to the level of past prices they are already exposed to and evaluate new price in association with the adaptation level. Sherif (1963) proposed the assimilation-contrast theory which suggests that a person's current position act his reference point to which further comparisons are made. Depending on this reference point the person may assimilate or reject positions similar to or different from his own. Internal reference price can thus change due to firm's actions; for example a price promotion can reduce the reference price (Bambauer-Sachse and Massera, 2015)

The other stream of literature on external reference price posits that reference price is formed at the point of purchase situation (Hardie, Johnson & Fader, 1993). Such a model does not include consumer's memory of the past information. It has been shown by few studies (Briesch, Krishnamurthi, Mazumdar & Raj, 1997; Mayhew & Winer, 1992; Rajendran & Tellis, 1994) that brand choices are influenced by external reference price. External reference prices are influenced by the observed prices in the choice environment. Shelf-tags at the point of purchase provide such information when consumers observe them; they contain information on the actual price as well as the price of the competing brands (Kumar, 1998). It has been suggested that the price of all the brands in the category influences the formation of external reference price.

While making a product choice, a consumer compares the actual price of the brand with the internal and external reference prices. However, it can be argued that different segments of consumers rely on either internal or external reference price at the time of purchasing the brand. This use of internal or external reference price by consumers is not observable. We model this unobserved heterogeneity in the consumers' use of external and internal reference prices in brand choice situation, with the approaches used by a few studies (Kamakura & Russell, 1989) using latent choice probabilities (Dillon & Mulani, 1989; Knott & Bartholomew, 1999).

Contribution

This research makes three important contributions. First, it confirms the effects of external and internal reference prices on brand choice formation. Second, it is the first conceptualization of the heterogeneity involved in the use of internal and external reference prices by consumers. It is the first article to contribute to the debate on use of external and internal reference prices, by calculating the relative size of the segment that uses each of the reference pricing schemes. The study confirms the size of the segment by splitting the sample on the basis of income: Income levels are expected to affect the way the reference impacts brand choice. Third, the study tested for the moderation effect of income in determining how the effect of reference prices changes with income levels.

Conceptual Development

Several articles model the use of internal and external reference prices in brand choice situation. One can refer to earlier articles (Kalyanaram & Winer, 1995; Mazumdar et al., 2005) for a review on the conceptualization of the reference price. They present arguments in favour of use and empirical generalizations of reference prices along with the competing models. We build on them by incorporating the heterogeneity framework to the use of internal/external reference prices.

Briesch, Krishnamurthi, Mazumdar & Raj, (1997) argue that divergent views of different reference price constructs assume different price judgement strategies used by the consumers. When past prices from the memory are used to model reference price, assumption is that price judgement is based on the internal reference price. In contrast, when the current prices of the brands are used to model reference price, the price judgement is based on external reference price. So, there are two competing price judgements schemes used by the consumer in evaluating brand choice.

Consumer information processing literature can offer insights on whether a judgement is based on internal or external reference price (Briesch, Krishnamurthi, Mazumdar & Raj, 1997; Hastie & Park, 1986; Lynch & Srull, 1982). The probability of use of internal reference price, a

key contribution from our study, is dependent on the ability and willingness to recall the past prices by respective consumers indulging in consumption. For a specific consumption situation, only a percentage of consumers will be able/willing to remember the past prices. This can also be argued based on other factors such as involvement in the product category or income of the consumer.

Rajendran & Tellis (1994) argue that it is a better strategy from the consumer side to use the competitive prices at the purchase context. Consumers will use external reference prices in the absence of the effect of past memory based internal reference price information. Variations in consumer's memory for past prices can also be due to the time elapsed since previous exposure or may be a function of price volatility and price spread across the brands (Briesch, Krishnamurthi, Mazumdar & Raj, 1997). There are also studies such as Urbany and Dickson (1991) that confirm that only certain consumers are knowledgeable or can recall the past prices they experienced. Thus, it is important to consider that a large percentage of the consumers have little or no recollection of the past prices paid, mainly because for them the price is not an important attribute while making a consumption decision (Dickson & Sawyer, 1990) or due to other reasons cited above.

Thus, we can safely argue that within any group of consumers, there is a sizeable percentage using external reference prices. However, the information about consumers and their usage of reference price strategy across occasions is not observable. Therefore, the use of reference price strategy is random or unknown to the researcher. We are trying to model this unobserved heterogeneity in the use of reference prices to access the impact of each of the reference prices on brand choice formation. We will be thus able to get the approximate size of the segments based on their use of reference pricing strategies.

Past research has demonstrated (Kumar, 1998; Rajendran & Tellis, 1994) that coefficients of both internal and external reference price differences (difference with the actual price) are positive. This is because the choice share of the particular brand is expected to be higher when the actual price of the brand is less than the reference price. So, we expect the coefficients for both the internal and external price differences to be positive.

According to Dickson and Sawyer (1990), a large percentage of the consumers have little or no recollection of the past prices paid because price is not an important attribute to them while making a consumption decision. Whether price is an important attribute of purchase decision making is expected to correlate with income levels. We expect that those consumers with high income will find price a less important attribute. Consumers with high income may not try to remember the past prices and rely more on present prices for comparison. Such consumers will tend to use external reference price for making brand choice decisions. So, we hypothesize income to positively moderate the effect of external reference price (H1) and negatively moderate the effect of internal reference price (H2).

Model Specification

Variable Descriptions

By using household in our model specification, we imply the consumer making purchases for the household. The data used is the household panel from ERIM database on detergent category. The number of brands considered in the brand choice formulation is four.
Variable notations used in this study are

α: A household to be of segment 1 (using internal reference price) is assumed to be of probability α

P_{hjt}: Price paid by household h for on purchase occasion t for brand j

D_{hjt} and F_{hjt}: These variables takes values of 0 or 1; they suggest whether display and feature was present or not, for a brand j on purchase incident t.

RPI_{hjt}: Internal reference price used by the household h for purchase incident t for brand j

RPE_{hjt}: External reference price used by the household h for purchase incident t for brand j

We operationalized internal reference price RPI as the geometric mean of the last three period's prices of the respective brands (Rajendran & Tellis, 1994). We operationalized external reference price RPE as the average of the highest, lowest and mean of the current prices (Rajendran & Tellis, 1994).

Brand choice model

We specify the choice problem as a multinomial logit, adhering to vast literature on brand choice models. The conditional probability that brand j will be selected by the hth household on purchase incident t is given by the logit link function:

$$p(j_{ht}) = \frac{\exp(u_{jht})}{\sum_i {}^n \exp(u_{hit})}$$

where u_{jht} is the utility of brand j for h[th] household on incident t and $i = 1, 2, 3\ldots, n$, represents the number of brands.

Past research indicates that product feature and display influence consumer's current brand choice (Gupta, 1988; Tellis, 1988). Following our conceptual discussion, we consider reference price also entering our utility specification for explaining brand choice. (Rajendran & Tellis (1994) argue that it may not be theoretically meaningful to include brand's price along with the difference term involving reference price (i.e., the difference between reference price and current price). Hence, our utility specification has only the difference term.

The specification of the utility function for the consumer using internal reference prices is different from the utility specification for a consumer using external reference prices. For both the consumer segments, the coefficients of display and feature are modelled to be the same. This implies the utility differences in the two sets of consumers are only due to the difference in the type of reference price used, for a given set of exogenous variables. The difference between the brand specific reference price and the actual price enters the utility specification, for the consumer using internal reference price as shown below.

For segment 1 (using internal reference price)

$$u^1_{hjt} = \beta_{1,j} + \beta_1\big(RPI_{hjt} - P_{hjt}\big) + \beta_d D_{hjt} + \beta_f F_{hjt} + \varepsilon_{hjt}$$

There will not be any temporal effect of reference price, when external reference price is used. For the consumers using external reference price, the reference price for h[th] household on a purchase incident is common across all brands. Therefore, the difference between this common

reference price and the actual price enters the utility specification for the consumer using external reference price as shown below

For segment 2 (using external reference price)

$$u^2_{hjt} = \beta_{2,j} + \beta_2\left(RPE_{hjt} - P_{hjt}\right) + \beta_d D_{hjt} + \beta_f F_{hjt} + \varepsilon_{hjt}$$

Note that the coefficients of Display and Feature are the same for the two segments. This is because we assume that the difference between the two segments is only based on the use of reference price in consumption.

The probability of the purchase case made by household h for purchases of brand j on occasion t for both the segments is given by

$$p^1(j_{ht}) = \exp\left(u^1_{jht}\right) / \sum_i{}^n \exp(u^1_{hit}) \quad \text{Using internal reference price}$$

$$p^2(j_{ht}) = \exp\left(u^2_{jht}\right) / \sum_i{}^n \exp(u^2_{hit}) \quad \text{Using internal reference price}$$

Probability of the purchase case made by household h (likelihood of the single observation by the household) on occasion t is given by

$$p^1_{ht} = \sum_j \Delta_j p^1(j_{ht}) \quad \text{Using internal reference price}$$

$$p^2_{ht} = \sum_j \Delta_j p^2(j_{ht}) \quad \text{Using external reference price}$$

where Δ_j (1 or 0) indicates whether a particular brand was chosen on the mentioned purchase occasion.

Likelihood of the set of observations by the household h is given by

$$p^1_h = \prod_t p^1_{ht} \quad \text{Using internal reference price}$$

$$p^2_h = \prod_t p^2_{ht} \quad \text{Using external reference price}$$

We have formed this conceptualization based on the following assumptions. We assume that a consumer make two types of price comparisons, households of segment 1 compares the brand's current price to the internal reference (uses internal reference price). Households of segment 2 compare the brand's current price to its external reference (uses external reference price). A household of segment 1 is assumed to be of probability α and a household of segment 2 is of probability $(1 - \alpha)$. The researcher does not observe which household is segment 1 or segment 2. Thus, α and $(1 - \alpha)$ represent the likelihood of finding a consumer in segment 1 and segment 2, respectively. We can interpret this decomposition as a representation of the market's unobserved segmentation in using internal or external reference price. Therefore, following (Kamakura & Russell, 1989), we can interpret α as the relative size of the segment in the population of consumers. Extant understanding on latent variable models (Dillon & Mulani, 1989; Knott & Bartholomew, 1999) suggests that the unconditional choice probabilities can be decomposed into a weighted average of underlying (or latent) choice probabilities.

Therefore, unconditional likelihood of the set of observations from a household h is given by

$$p_h = \alpha p_h^1 + (1 - \alpha) p_h^2$$

This likelihood of household level purchase can be used for calculating the log likelihood function for the whole set of observations from the households in the panel.

$$LL = \sum_h p_h$$

LL is used for the maximum likelihood procedure for estimating the parameters specified in the utility function and for finding the relative size of the segment using internal reference price (α).

RESULTS

Data was ordered and the initial computations of the reference price were made using R 3.1. The test of the main model and of the interaction hypothesis is conducted using Gauss 12 with the Maxlik procedure. The main model accounts for the heterogeneity in the use of reference price (internal/external). The variable α captures the probability that a household uses internal reference price. The second model tests how income of the household moderates the effects of the reference prices. The third and fourth models determine the individual coefficient for the low income and high income households. Relative size of the segments using each of their reference pricing strategies, are calculated in each case.

We have provided the model estimation results in Table 1, for the detergent data. The coefficients of the different types of reference price, display and feature are evaluated for suitability of the direction/sign and their statistical significance using t-test. In all the models, the reference price coefficients have the expected sign, displaying face validity of the selected model.

In the main model, the coefficients of both display ($b=0.173$, $t=3.36$) and feature ($b=0.381$, $t=7.28$) are both significant and positive. This shows that the promotional variables have an impact on the brand choice process. This was expected and confirms the findings from earlier literature. Coefficients of the internal and external reference price differences are positive and significant as expected ($b=0.652$, $t=7.27$ and $b=1.717$, $t=43.26$).

Results for the moderation only support H1. Though the sign of the interaction term involving internal reference price shows the hypothesized sign, it is not significant ($b= -0.007$, $t= -0.92$). Interaction term involving external reference price confirms the hypothesized relationship in H1 and is significant ($b=0.005$, $t=2.61$). Hence, the effect that the external reference price has on the choice of brand is more for high income consumers than the low income consumers ($b=1.813$, $t=32.02$ vs. $b=1.667$, $t=31.49$). Hence, we conclude that income is an important determinant affecting the influence of reference price in brand choices.

	Full Model		Full Model with Moderation		Low Income		High Income	
	seg1	seg2	seg1	seg2	seg1	seg2	seg1	seg2
Brand 1	-0.761	-0.255	-0.867	-0.246	-1.101	-0.213	-0.047	-0.332
	-4.05	**-5.88**	**-3.44**	**-5.80**	**-4.53**	**-3.63**	**-0.25**	**-5.24**
Brand 2	-0.592	1.113	2.240	0.486	-0.593	0.926	-0.664	1.332
	-3.13	**23.39**	**15.49**	**8.77**	**-2.82**	**14.14**	**-1.95**	**19.72**
Brand 3	2.242	-0.226	-1.578	0.777	1.884	-0.406	2.915	0.066
	18.04	**-3.34**	**-4.67**	**15.82**	**12.96**	**-4.57**	**13.81**	**0.82**
Reference price difference	0.652	1.715	0.601	1.521	0.517	1.667	0.637	1.813
	7.27	**43.26**	**2.26**	**21.64**	**4.88**	**31.49**	**3.87**	**32.02**
Reference price difference × Income			-0.007	0.005				
			-0.92	**2.61**				
Display	0.173		0.244		0.244		0.103	
	3.36		**4.83**		**3.53**		**1.37**	
Feature	0.381		0.395		0.410		0.336	
	7.28		**7.54**		**5.74**		**4.30**	
Size of the segment	0.147	0.853	0.144	0.856	0.140	0.860	0.141	0.859
Number of observations	6849.000		6849.000		3645.000		3204.000	

Table 1
COEFFICIENT ESTIMATES FROM MULTINOMIAL LOGIT MODELS OF BRAND CHOICE
[T-STATISTICS IN BOLD]

*Low income and high income groups are made by splitting the data into two based on income

The relative size of the consumers using internal reference price for making brand choices was consistently shown to be around 14% in all the models tested. This supported our major thesis that, in a brand choice situation, a certain percentage of consumers use internal reference price and others use external reference price. The results hold even among groups of high income and low income segments. Another interesting insight is that majority of the consumers in the category are using external reference price. This supports the thesis that a large percentage of the consumers does not keep track of the prices or does not use past prices as the reference for purchase decision making.

SUMMARY AND CONCLUSION

The model proposed in the article uses estimated reference as well as observed prices in finding the underlying use of reference price mechanisms in consumer brand purchase decisions. Constructs are measured using observed panel data for the detergent category. The results can be treated as the estimates of the underlying consumer behaviour. Similar to Kamakura and Russell (1989), we started with the choice process at the household level and made assumptions about the use of similar underlying choice processes across two segments that varied only in their reference price strategies.

The most significant contribution of this research is the confirmation that different segments of consumers use the two reference price strategies in facing a brand choice environment. The reasons for the use of a particular reference price strategy can be many, as

discussed in the conceptual development session-lack of recollection of past prices, involvement in the product category, income of the consumer, the time elapsed since previous exposure or may be a function of price volatility and price spread across the brands. In all our models, even within the high income and low income groups, we found that the relative size of the group using internal reference price when making the brand choice is 14%. Also, external reference price has been found to be used by majority (86%) of the consumers in a brand choice scenario.

The percentage of people using particular reference price strategy may not be generalizable across different situations. In different purchasing situations, this percentage can vary. However, our research makes a contribution in establishing the existence of different groups of people using different reference price strategy. The modelling approach using unobserved heterogeneity is quite popular and has been widely used in prior studies (Kamakura & Russell, 1989).

As income increases, consumer will find that price is not an important attribute affecting brand choices for them. Hence, they do not have much motivation for remembering past prices. This causes them to rely more on the current prices at the time of consumption. These current prices are captured by the conceptualization of external reference price. Hence, the effect of external reference price on brand choice is more for high income people because they have more motivation to use them.

Though we hypothesized that income will negatively moderate the influence of internal reference price, the results are not significant. Hence, we do not have support to tell that as income increases, the effect of internal reference prices on brand choice declines. Although interaction term returns valence as predicted, statistical support is not there.

Both the internal reference price difference and external reference price difference coefficients in the main model were showing positive significant coefficients as expected (Kumar, 1998; Rajendran & Tellis, 1994). This is because the choice share of the brand would expectedly be higher when the reference price is less than the actual price of the brand. The coefficients of both display and feature are also positive and significant as established in previous literature (Briesch, Krishnamurthi, Mazumdar & Raj, 1997).

Many of our findings have an implication in the retail industry. The fact that internal reference prices are used by a minority of consumers can be used by marketers to launch different pricing strategies. Price discrimination schemes based on quantity discounts and promotional discounts can be launched without worrying about their impact on consumers through internal reference price. Generally, these strategies are expected to influence internal reference price when the consumer remembers and uses his past purchase prices in future purchases. Since internal reference price is used by a small segment of consumers, this effect is lower on an aggregate scale. This can be one of the reasons why promotional dip is not observed in aggregate level data (Hendel & Nevo, 2003).

Since majority of the users are using external reference prices, influencing external reference price formation is important. Companies can use strategies such as including more product lines that influence the formation of external reference price. For example, inclusion of higher price brands in the shelf will cause the formation of a higher external reference price, which can be a strategy for selling lower priced brands. Such strategies will be more influential on high income segments in the market because our findings suggest that the impact of external reference price is higher for high income consumers.

Future research is tasked with retesting our findings in another product category in order to enhance the generalizability of our results. Other ways of operationalizing internal and

external reference prices can also be checked in the current model and compared for the best fit. Variables driving the segment formation of internal and external reference price use can be investigated using hierarchical models. We have already indicated such potential variables in the present study such as information processing capacity, time from past purchase, price volatility, category involvement and price spread across the brand.

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