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EMPIRICAL GENERALIZATIONS FROM REFERENCE PRICE RESEARCH

GURUMURTHY KALYANARAM AND RUSSELL S. WINER
The University of Texas at Dallas
University of California at Berkeley

Considerable theoretical justification for consumers' use of psychological reference points exists from the research literature. From a managerial perspective, one of the most important applications of this concept is reference price, an internal standard against which observed prices are compared. In this paper, we propose three empirical generalizations that are well-supported in the marketing literature. First, there is ample evidence that consumers use reference prices in making brand choices. Second, the empirical results on reference pricing also support the generalization that consumers rely on past prices as part of the reference price formation process. Third, consistent with other research on loss aversion, consumers have been found to be more sensitive to "losses," i.e. observed prices higher than reference prices, than "gains." We also propose topics for further research on reference prices.
(Reference Price; Brand Choice; Decision Making)

Rationale for the Reference Price Construct

The concept of a reference price is that it is an internal standard against which observed prices are compared. While there is some doubt about the accuracy of reference prices due to the fact that consumers have consistently demonstrated a limited ability to recall prices paid (see Dickson and Sawyer 1990, for example), and there are very likely multiple definitions of what constitutes a reference price (Winer 1988), there is a significant body of theory to support the notion that individuals make judgments and choices based on the comparison of observed phenomena to an internal reference point. The purpose of this paper is to argue that there is now sufficient empirical evidence from the marketing literature to strongly support the reference price concept.

Reference price is an important construct from a managerial perspective. For example, the timing of sales promotions can be greatly affected by whether or not it is assumed consumers form reference prices. Consistent price promotions lower reference prices and have two subsequent impacts: (1) the later promotions are not perceived to be as such a good deal as the earlier ones, and (2) a return to the "normal" price may look to the consumer like a price increase. Expectations of future prices compared to a current reference or observed price may also impact consumer reaction to promotions or the purchase timing of durable goods. For example, it is well-documented that households who are later in the adoption cycle of technologically based durable goods often wait for anticipated future price decreases. Reference price is therefore an example of a

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psychological construct which, when incorporated into normative models, can change the way marketing managers make decisions about price and promotion.

Reference price is also a uniquely marketing "spin" on the traditional economics view of price. The classical microeconomic agent makes purchase decisions based on actual prices and income. The concept of a reference price asserts that consumers make decisions based on both actual and perceived prices. Incorporating both concepts into the classical microeconomic model changes the results in some interesting ways, such as producing kinked demand curves (Putler 1990).

Interestingly, the behavioral foundations for the reference price concept come from several different areas of psychology. The most commonly used rationale for reference prices is Helson's Adaptation-Level Theory (1964). Adaptation-level theory is based on the assumption that stimuli are judged with respect to internal norms representing the pooled effects of present and past stimulation. Therefore, all judgments are relative to the prevailing adaptation level. For any individual, the adaptation level for a specific category is a function of the frequency of different values for that category, i.e., the distribution of values. Further, the adaptation level is a function of the magnitude of the series of stimuli, the range of stimuli, and the dispersion of stimuli from the mean.

According to adaptation level theory, the past and present context of experience defines an adaptation level, or reference point, relative to which new stimuli are perceived and compared. A simple illustration of this would be as follows. If a person repeatedly lifts a weight of 100 grams, he or she then becomes accustomed to this weight, i.e., adapts to it, and the adaptation level becomes 100 grams.

Besides psychophysics, other psychological theories strongly support the reference price concept as well. A rationale from the study of attitudes is Assimilation-Contrast Theory, most closely identified with Sherif and Hovland (1958). They hypothesized a price range internal to consumers called a latitude of acceptance that is a range of acceptable prices. According to the theory, if a consumer sees a brand's price that is within the latitude of acceptance, the price is assimilated into the range and becomes acceptable. A price that is outside the range is contrasted to the acceptable range and becomes noticeable. More recently, models developed by choice theorists, such as Kahneman and Tversky's Prospect Theory (1979), have been used to justify reference price effects (see also Johnson and Meyer 1994). They define a value function that is defined over gains and losses, not absolute amounts. Therefore, some reference point is assumed. An important characteristic of the value function is that it is concave for gains and convex for losses, the well-known loss aversion hypothesis. This is an important theory not for the significance of reference price alone but for the general finding discussed below of asymmetrical demand effects for gains (observed prices below the reference price) and losses (observed prices above the reference price). Thus, the concept of a psychological reference point has firm grounding in psychology from a number of perspectives.

We feel that it is crucial to the general empirical findings on reference price effects on demand that there is such considerable theoretical support for the phenomenon. In order for a large number of consistent empirical findings to better our understanding of behavior, there must be a theoretical rationale for the results. One definition of an empirical generalization is that it is "a pattern or regularity that repeats over different circumstances and that can be described simply by mathematical, graphic, or symbolic methods" (Bass 1993). We would like to add to that definition that an empirical "generalization" must be firmly grounded in theory, whether an ex ante theory or an ex post modification to an existing theory, to distinguish it from an empirical "consistency."

Empirical Generalizations

Our survey of the research literature suggests that there are three established empirical generalizations in the reference price area. The first generalization refers to overall effects of reference price.

GENERALIZATION 1. *Reference prices have a consistent and significant impact on consumer demand.* This is a strong finding across different operationalizations of reference price and in different demand applications, whether using aggregate or household data or whether the dependent variable is brand choice or some other manifestation of demand.

Empirical Support for Perceived Price

The most common conception of reference price is that it is the "perceived" price or the price that the consumer expects to pay for a brand or product category when entering a store. Empirical studies of reference price effects typically form a reference price discrepancy variable which is either (observed price–reference price) or the reverse.

There are several studies that support this generalization. The studies differ in the methodologies and data sets. Each one of these studies finds the reference price effect to be significant. Rinne (1981) compares three approaches: (1) setting reference price equal to previous price, (2) taking reference price as the weighted mean of the logarithms of past observations as suggested by Helson (1964), and (3) using an exponential smoothing model motivated by adaptive expectations. He embeds each reference price model in a share-price response equation whose parameters are estimated from a dataset. Winer (1986) tested two different reference price formulations in a brand choice model estimated using coffee scanner panel data, one based on the extrapolative expectations hypothesis and the other a rational expectations hypothesis. He found the reference price effects to be significant and improved holdout predictions but did not find a marked difference between the alternative formulations of reference price formation.

Raman and Bass (1988) started from an adaptive expectations view of reference price but attempted to incorporate the additional phenomenon of price thresholds (Monroe 1973). Working with aggregate data, they determined the reference price using a Box-Jenkins autoregressive model on historical prices. The reference price expression was then embedded in a model of market share response to price and a switching regression methodology was used to identify thresholds. Kalyanaram and Little (1989) incorporated reference price effects in a multinomial logit brand choice model and found significant reference price effect in two scanner panel databases for ground coffee (IRI and SAMI). Reference price was modeled as an exponential smoothing process where a customer modifies his/her view of price as new information is encountered. Kalyanaram and Little (1994) use the same reference price formulation and estimate the effect in two drink (sweetened and unsweetened) scanner panel data bases to be significant. Using laundry detergent scanner data, Winer (1989) developed a multi-stage choice model of brand preference and household brand choice shares. He found that levels of reference prices moved households away from ideal points and that differences between reference and observed prices had a significant negative impact on choice shares.

Variations of the basic reference price models have also consistently shown reference price effects. Lattin and Bucklin (1989), employing the IRI coffee data set, modeled and estimated the reference points for both price and promotional activity and found both reference points to be significant (although the reference price variable was incorrectly signed). They included a promotion variable that was found to be insignificant, but differences from the promotional reference point and a price-promotion interaction term were significant, i.e., unanticipated promotions had a significant and positive impact on brand choice probabilities. Kalwani et al. (1990) built a richer model of reference price including not only variables of past prices but also promotional frequency and the proneness of the household to buy on promotion. They estimated this reference price effect model using a coffee data base and found it to be significant. Do consumers have multiple reference points? This was addressed by Mayhew and Winer (1992) in their analysis of scanner data for the yogurt product category by providing for internal and external reference prices. Internal reference prices are defined to be based on actual or other price concepts, and external reference prices are defined to be observed regular prices printed

on shelf labels. Calibration of discrete choice models incorporating both types of reference prices suggest that both the internal and external reference prices have significant effects on purchase probabilities. Multiple reference prices were also tested by Rajendran and Tellis (1994), who refer to the internal reference price as the temporal reference price (formed based on past prices paid or observed) and the external reference price as the contextual price (formed based on the lowest observed price at point-of-purchase). They find both reference prices to be significant predictors of saltine cracker brand choice. Krishnamurthi et al. (1992) model the reference price effect as the last price paid and find significant reference price effects not only on consumer brand choice decisions but also on purchase quantity decisions in a consumer goods category provided by BURKE and coffee data base provided by IRI.

The Kalyanaram and Little (1994) paper is a good example of how a merging of psychological theory into empirical brand choice models has the potential to better understand the theory. In that paper, the authors estimate a "latitude of acceptance" around the reference price, i.e., a potential zone of indifference to small deviations between the observed and reference price. Not only is this psychological construct validated using the revealed preference scanner panel data, but the authors also estimate its width and variability by different market segments, new contributions to the theory.

Empirical Support for Expected Future Price

The first generalization assumed a comparison of current reference price to the current observed price. An alternative reference price that has received some empirical validation is expected future price. This expectation could be compared to either the current observed or reference price and is particularly important for consumer durables where the timing of purchases might be heavily influenced by whether the consumer felt the price was going to rise or fall. There is a straightforward economic interpretation of this behavior in terms of the tradeoff between, for example, paying a higher price now and having the utility of the product versus paying a lower price in a future period and foregoing the use of the product.

The few studies that have utilized the expected future price as a reference price construct have found that it can affect purchase timing. Estimation of these expected future prices have assumed a linear extrapolative approach based on past prices. Using two years of data from the Survey of Consumer Credit, Winer (1985) found that expected future prices affected the probability of purchasing color TVs. Yoo et al. (1987) found in the context of a diffusion model that future price expectations significantly affected the adoption patterns of three out of five durable goods.

GENERALIZATION 2. "*Internal*" *reference prices utilize past prices as part of the consumer's information set*. In every empirical study utilizing the reference price concept as an internal, psychological construct, the authors make assumptions about how the reference prices are formed. While there is variability in this research in terms of the functional forms (e.g., linearly lagged prices versus exponentially smoothed past prices), the unit of analysis (item or brand-specific reference prices versus a category reference price), and the complexity of the model (past prices only versus a more comprehensive model of how reference prices are formed), all empirical studies of references prices have assumed that past prices are important components of the reference price formation process. Depending upon how the choice models are estimated, these studies have found either explicitly that past prices are significant predictors of reference price (e.g., Kalwani et al., 1990) or, based on the overwhelming evidence produced in Generalization 1 that reference prices have been found to significantly influence choice, have inferred that past prices form the basis of reference price.

These empirical results have been brought into question by the price recall data presented by Dickson and Sawyer (1990) and by intuition. They reported that even asking

consumers in the store after they put an item in their baskets produced 21.1% who could not offer a price and less than half (47.1%) that could state the price. Intuition also suggests that consumers are not very likely to remember past prices paid or observed in stores since there are many products purchased in supermarkets and individual brand or product category prices constitute a small proportion of prices stored in memory and an even smaller proportion of all data stored in memory. Thus, the empirical results obtained could be the result of specification error of the formation process or measurement error, particularly of "observed" prices.

Several recent studies have attempted to directly compare models of the formation process. Rajendran and Tellis (1994) compare a choice model with both contextual (based on current prices) and temporal (based on past prices) reference prices against a choice model with each alone and conclude that the model with both kinds of reference prices explains choice better in four markets of cracker data. Briesch et al. (1994) empirically compare choice models where the reference price is formed on current prices only (no price memory) with several where reference price is assumed to be formed based on past prices only. The best-fitting choice model utilized a reference price formation process based upon brand-specific prices of brands available on the previous choice occasion.

In sum, there is convincing empirical evidence that past prices are considered when consumers form reference prices. At the same time, these results are not necessarily in conflict with the Dickson-Sawyer results and intuition for several reasons. A substantial number of respondents to price recall surveys do recall past prices reasonably accurately (55.6% were within 5% of the correct price). In addition, relative reference prices may still be accurate even if the individual estimates are not if accuracy varies randomly over the population. While not related to accuracy, Dickson and Sawyer reported that 93.1% of the shoppers queried responded to the question about the relative price of the brand chosen, which was significantly higher than the 78.9% who offered absolute prices.

An open research question is *which* past prices are appropriate for the reference price formulation model. Should the prices of brands in a category be used only when the category is purchased or when any shopping trip occurred? How many past prices should be used? With respect to this latter question, Hardie et al. use only one past price while Kalwani et al. use observed prices from the most recent five purchase occasions.

GENERALIZATION 3. *Consumers react differently to price increases and price decreases relative to the reference price. Consumers react more strongly to price increases than to price decreases.* More specifically, the general finding is that when the (observed price-reference price) term is split into two variables, one for positive deviations and the other for negative deviations, both coefficients are negative but the positively signed variable's coefficient is larger in absolute value. We briefly describe the support for this generalization as the asymmetry of gains and losses is more fully summarized by Johnson and Meyer (1994).

Empirical Support

We cite eight studies (Bell and Lattin 1993, Kalyanaram and Little 1989, Kalwani et al. 1990, Putler 1992, Mayhew and Winer 1992, Krishnamurthi et al. 1992, Hardie et al. 1993, Kalyanaram and Little 1994) that provide support for this generalization. The general approach of framing this problem is that consumers perceive prices above the reference price as losses, and prices below the reference price as gains. Employing such a definition, Kalyanaram and Little (1989) obtain empirical results from the ground coffee data bases of IRI and SAMI suggesting asymmetric price response by the consumers. Similarly, asymmetric price response effects were found by Kalyanaram and Little (1994) in sweetened and unsweetened drink scanner panel data bases. Kalwani et al. (1990) use a richer reference price representation but define losses and gains as Kalyanaram and

Little and find general support for asymmetric consumer price response in brand choice decisions. The study of yogurt product category by Mayhew and Winer (1992) adds further empirical evidence of differential effects of losses and gains and, again, losses have a greater effect on brand choice probabilities than gains. Analyzing the egg demand in Southern California, Putler (1992) finds that the marginal loss variable for eggs is significant at the five percent level, and the marginal gain variable has the correct sign but is not statistically significant. This paper is particularly noteworthy as Putler derives the asymmetric reference price demand model by formally integrating Prospect Theory into the classic microeconomic theory of the consumer, thus providing a stronger theoretical base for the empirical results.

Hardie et al. (1993) offer another approach to studying the asymmetric price response effects. They set a reference brand, r, for each consumer based on his or her purchase history. The price "gain" provided by any brand, j, is now defined as the amount by which the price of brand j is below that of the reference brand, and the price "loss" is the amount by which the price of brand j is above that of the reference brand. Using this definition and a multinomial logit framework, they find that losses relative to a reference brand show more impact upon choices than gains for both price and quality in orange juice product category.

There is some accumulated evidence that this asymmetry is attenuated by heterogeneity. In the analysis of a packaged good and the coffee data from IRI by Krishnamurthi et al. (1992), the authors divide consumers into loyals and switchers and decisions into brand choice and quantity choice. In brand choice decisions, there is no evidence of asymmetric price response among loyal consumers, but switchers exhibit such an asymmetry. In quantity decisions, loyals exhibit an asymmetric price response, and the evidence on switchers is mixed. Bell and Lattin (1993) find the basic loss aversion result with orange juice data, but find that accounting for household heterogeneity in loss aversion diminishes the effect. Clearly, more research is needed into this finding that the asymmetric results may be contingent on the definition of various market segments. It is also possible that what looks like loss aversion at the household level could be cross sectional variance in pure price sensitivity in that more price sensitive households choose lower-priced brands and, therefore, observe more higher-priced brands on a particular choice occasion. The empirical evidence that suggests a need for different price coefficients for different households in the choice models further indicates that the loss aversion finding may be because of cross-sectional heterogeneity (Gonul and Srinivasan 1994, Kamakura and Russell 1989) or asymmetric switching based on perceived quality (Allenby and Rossi 1991).

Two studies find the possibility that gains can be valued higher than losses. One such finding is in Greenleaf's (1995) aggregate analysis of the peanut butter category. A second is the study by Han et al. (1993) analyzing probabilistic regions of price insensitivity around reference price using ground coffee data. A possible explanation for these findings relates to the patterns of promotions to which consumers are exposed. A brand with either infrequent promotions or an irregular pattern of promotions, making it difficult to forecast when the next might occur, could cause stockpiling in the "gain" condition thus showing greater impact of gains over losses.

Normative and Managerial Implications

We noted in the introduction that one of the key managerial implications of reference prices (perceived price) is in the area of price promotions. Promotions may erode probability of purchase because the consumers may lower their reference prices, thus increasing their price sensitivity and perhaps harming brand equity. In addition, if a brand is frequently on promotion, consumers may become confused about what the "normal" price is and may view a return to the usual price as a price increase. Obviously, there is an optimal frequency of promotions that does not lower the reference price significantly nor confuses customers about the normal price.

An implication of reference prices is that retailers should plan their frequency, duration, and level of price promotions so that they may indirectly manage the reference prices that consumers form. Greenleaf (1995) has studied analytically and empirically how reference price effects influence promotion profits. There are several interesting insights from this study. For example, irregular promotions often maximize profit from reference price effects. As the demand impact of negative reference gaps increases compared to that of positive gaps, promotions become more profitable. Kopalle and Winer (1995) embed reference price effects into a model that also permits "reference" quality to be affected by observed and reference price. Their theoretical results show that if the gain from the reference value being higher than the observed value is higher for quality than price, then a cyclical pricing policy will result. Rajendran and Tellis's (1994) simulated results show that ignoring both contextual and temporal reference prices leads to a manufacturer setting a suboptimal everyday low price.

Asymmetric price response effect suggests that retailers and manufacturers have to devise careful strategies while raising the price of a brand. One approach may be to raise prices in small increments so that consumers can be forced to adapt to higher reference prices. Another rationale for small incremental price increases is that consumers appear to have a region of price insensitivity around the reference price, and a price change may not be noticed by the consumers (Kalyanaram and Little 1994).

The managerial implications of consumers forming future price expectations are fairly intuitive. In durable goods product categories characterized by rapid technological improvements and continuous cost reductions such as video cassette recorders and personal computers, consumers have certainly learned that prices start out at a high level and drop over time. Clearly, this can be a price discrimination mechanism to maximize profits from pioneers and early adopters. However, after the high margin consumers have been "cherry picked," more discretionary buyers enter the market. If prices drop during a short period of time, these consumers can wait for further price declines before purchasing and thus disrupt normal patterns of demand. This has, in fact, occurred during the various periods of airline fare wars.

Very little normative research has been done in the marketing literature using expected future prices. Coase's (1972) seminal work shows that if consumers form expectations about future prices and they have perfect foresight, a monopolist would be immediately forced to price at marginal cost as the consumers would expect the price to be reduced the instant after they would purchase and would therefore wait. Narasimhan (1989) shows that in a monopoly, when consumer expectations are present and consumers enter the market following an S-shaped diffusion process, restrictions are placed on how quickly the firm can reduce its price.

Future Research and Emerging Generalizations

We have identified the following fruitful areas for research in the area of reference price:

1. The concept of a reference still needs to be fully validated. Despite the compelling evidence presented above, we cannot be certain that consumers actually form reference prices, only that they act as if they did.

2. Consumers may use multiple reference prices. Winer (1988) argued that there may be as many as eight concepts of reference price. Few papers other than Mayhew and Winer (1992) and Rajendran and Tellis (1994) have examined this issue. The contextual or external reference price issue in particular needs further study.

3. Is there a reference point or a reference gap? Some researchers (Han et al. 1993, Kalyanaram and Little 1994, Lattin and Bucklin 1989, Raman and Bass 1988) have found empirically that there is a region of price insensitivity around the reference price, i.e., a latitude of acceptance. This needs to be explored further.

4. Which past prices do consumers use in forming a reference price, and how many are used? Like many questions in marketing, the answer to this one may be product category specific depending on, among other things, product category price variability from price promotions and/or retail price changes.

5. Do reference prices vary over market segments? If so, does this heterogeneity affect some of the generalizations described in this paper? As noted above, there is still some uncertainty about the impact of reference prices when cross-sectional variation in households is taken into account.

6. It can easily be seen from the research referenced in this paper that almost all the empirical work using actual behavior data (rather than controlled experiments, for example) in the reference pricing area has been done using scanner panel data from frequently purchased packaged goods. Industrial products have not been studied; industrial buyers may be influenced by mental comparisons of observed or communicated prices from salespeople to a reference price. Thus, there is a need to study the reference price phenomenon in contexts other than frequently purchased packaged goods, which dominate the studies so far.

It should be noted that this paper covers only reference price effects and not other situations involving similar comparisons or "framing" such as industrial buying decisions (Puto 1987). We have also only reviewed literature analyzing revealed preference data; other studies in laboratory contexts have found significant reference effects (Kahneman et al. 1990, and Tversky and Simonson 1993, for example).

A nice feature of this stream of research is that it "bridges" the usual gap between consumer behavior researchers and marketing scientists, since the estimated choice models are motivated by theory from consumer behavior and social psychology and not from a more methodological perspective like other issues in choice modeling such as unobserved heterogeneity. The scanner panel data thus become a "natural" experimental design that complements more controlled laboratory research. This is a useful way of looking at scanner data since, after all, they do represent the actual behavior of real people, a fact which seems to be often forgotten.

In sum, we feel that the previously cited results concerning the effects of reference price on consumer demand satisfy the conditions for empirical generalizations. In addition, the descriptive and normative research described in this paper has been shown to be important to managers as well as academics. Further work in this area should continue to build upon the research cited in this paper and, hopefully, new generalizations will ultimately emerge. Not only will these generalizations impact academic research on reference price, but they should further demonstrate the importance of the reference price construct to managerial decision-making.

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