When Is HILO Low? Price Image Formation Based on Frequency versus Depth Pricing Strategies

DANIEL SHEEHAN
RYAN HAMILTON
RAMNATH K. CHELLAPPA

One of the prominent pricing decisions a retailer can make is its choice of pricing strategy. Previous research investigating consumers' responses to stores with frequent, shallow price advantages relative to competitors (a frequency strategy) versus stores with infrequent, deep price advantages (a depth strategy) was all conducted by allowing people to simultaneously view prices from multiple stores, a setting that emphasized across-store comparisons. The present research finds that when a store's prices are evaluated separately, as opposed to simultaneously across stores, many of the prominent findings of previous research are reversed. The authors demonstrate that without simultaneous comparisons across stores, consumers shift from using across-store prices as reference points to using within-category reference prices. As a result of this shift, deep price advantages are easier to evaluate than frequent price advantages, and therefore more influential on consumers' formation of price image. When stores are evaluated separately, the result is most often a depth advantage, where stores with a HILO pricing strategy are evaluated as having a lower price image than EDLP stores, even when the average prices are the same. These results cannot be explained by prior work related to frequency and depth pricing strategies that relied on across-store comparisons.

Keywords: frequency, depth, price image, pricing strategies, retail price impression, EDLP, HILO

Daniel Sheehan (dan.sheehan@uky.edu) is associate professor of marketing and supply chain at the Gatton College of Business and Economics, University of Kentucky, 550 South Limestone, Lexington, KY 40506, USA. Ryan Hamilton (rphamil@emory.edu) is associate professor of marketing at the Goizueta Business School, Emory University, 1300 Clifton Road NE, Atlanta, GA 30322, USA. Ramnath K. Chellappa (ramnath.chellappa@emory.edu) is associate dean and Goizueta term professor of information systems and operations management at the Goizueta Business School, Emory University, 1300 Clifton Road NE, Atlanta, GA 30322, USA. Please address correspondence to Daniel Sheehan. The authors would like to thank David Hardesty and Haipeng (Allan) Chen for their comments in earlier versions of this article. Supplementary materials are included in the web appendix accompanying the online version of this article.

Editors: J. Jeffrey Inman and Andrew T. Stephen

Associate Editor: Rajesh Bagchi

Advance Access publication 28 January 2022

When managing prices, retailers must not only concern themselves with how their prices affect customers' individual purchase decisions, but also with how those prices, in aggregate, affect the retailer's price image (Brown 1969; Hamilton and Chernev 2010; van Heerde, Gijsbrechts, and Pauwels 2008). One factor that affects price image, or a store's overall reputation for pricing, is the distribution of a store's low prices relative to other retailers with similar overall price levels. Specifically, whether a store has small price advantages over other stores on many items—a frequency strategy—or large price advantages on just a few items—a depth strategy—has been found to affect a retailer's price image. When evaluating two retailers with objectively equivalent average prices, previous research has found that consumers tend to form a lower price image of retailers with many small relative price advantages than they do of retailers

 • Vol. 00 • 2022
https://doi.org/10.1093/jcr/ucac005

with fewer, but larger, price advantages. This "frequency advantage" has proven to be a notably robust finding (Alba et al. 1994, 1999; Danziger, Hadar, and Morwitz 2014; Lalwani and Monroe 2005).

However, there are two notable limitations of previous research settings that make them different from the contexts consumers typically encounter when evaluating a retailer's prices. First, all previous research allowed participants to simultaneously compare the prices of the same item across stores. While it is not hard to think of settings where consumers might directly compare prices across stores (e.g., comparing weekly circulars and using price comparison apps), this is likely to be a relatively uncommon way for consumers to encounter a retailer's prices, compared with observing prices one store at a time. Second, past research has presented participants with only a single product per category (e.g., one brand of peanut butter, one brand of clam sauce, and one brand of shampoo; Alba et al. 1994; Danziger et al. 2014; Lalwani and Monroe 2005), instead of the multiple offerings per category that consumers would typically encounter in a retail environment.

We argue that the context in which prices are encountered—defined in part by the limitations of previous research—has important implications for how consumers translate frequency and depth pricing strategies into a price image. In particular, we suggest that the frequency advantage typically identified by previous research may be limited to scenarios where consumers simultaneously compare prices across multiple stores in a joint evaluation. In contrast, we argue that a depth advantage will tend to be more likely in separate evaluations of stores' prices. We propose that when stores' prices are evaluated one at a time, or in isolation, consumers will rely on the most salient contextual cues available—within-category price information—when forming a price image (i.e., that consumers will evaluate the price of one brand of peanut butter by comparing it to the prices of the other brands of peanut butter on the store shelf). Although within-category price information has been absent from past research on frequency and depth effects in pricing, we show this commonly occurring factor can play a major role in how consumers form price impressions.

Understanding how frequency and depth pricing strategies impact price image is of great managerial relevance. The two best-studied pricing policies, every-day low pricing (EDLP) and high/low (HILO) pricing, are predominantly defined by whether the store is pursuing a frequency or a depth strategy (Danziger et al. 2014; Hoch, Dreze, and Purk 1994). EDLP is a low-variance pricing strategy, in which price discounts relative to competitors are spread broadly, across a large number of offerings, and are relatively stable over time. The result is frequent, small price advantages over competing stores. In contrast, HILO stores tend to have somewhat higher prices than competing stores on many items, but also have less frequent, large price advantages on discounted items—the "low" in the high-low strategy (Bell and Lattin 1998; Chellappa, Sin, and Siddarth 2011; Fassnacht and El Husseini, 2013). One of the implications of research into depth and frequency effects has been to offer guidance as to whether EDLP or HILO strategies are more effective in communicating a low-price image to consumers. The general consensus of previous research is that an EDLP strategy, based on frequent, shallow price advantages relative to competitors, will tend to be more successful in creating a low-price image than a HILO strategy based on infrequent, deep price advantages (Alba et al. 1994, 1999; Danziger et al. 2014).

In practice, however, the effectiveness of EDLP strategies is less clear. Anecdotally, the recent experience of retailers such as JC Penney, Target, and Lowes, who have switched from HILO to EDLP strategies in an effort at lowering their price images (Loeb 2017), all experienced significant revenue and market share losses after switching from HILO to EDLP pricing strategies (D'Innocenzio and Chapman 2012; Weinstein 2012). The present research suggests that in many common settings, HILO pricing may communicate low overall pricing better than EDLP pricing.

THEORETICAL DEVELOPMENT

In this research, we examine how the frequency and depth of a retailer's price advantages influence consumer perceptions of its price image. Consistent with previous research, we define price image as the overall impression consumers form of the price level of a retailer or a brand (Hamilton and Chernev 2013). An important finding from the price image literature is that consumers' price image perceptions do not always accurately reflect the real price differences across retailers (Brown 1969; Hamilton and Chernev 2010). Among the ways consumers' price image evaluations can be biased is the "frequency advantage," wherein stores with frequent, shallow price advantages tend to have lower price images than stores with less frequent, deep price advantages (Alba et al. 1994).

To understand frequency and depth strategies, imagine a retailer with a $100 promotional budget that it can apply to items within the store. This retailer could apportion the discounts using a "depth" strategy, reducing the price of a small number of items by a large amount (e.g., discounting 20 items by $5 each). Alternatively, the retailer could choose a "frequency" strategy instead, applying the same total discount to a larger number of items, resulting in smaller discounts on each item (e.g., discounting 100 items by $1 each; Alba et al. 1994). Alternatively, frequency and depth strategies may be applied over time. For example, a given item might be discounted by a small amount frequently (e.g., by $1 every week) or by a large amount

infrequently (e.g., by $5 every 5th week; Alba et al. 1999). In both cases, the frequency strategy would result in a greater number of small price advantages relative to competitors with equivalent overall price levels. In contrast, a depth strategy would result in fewer—but larger—price advantages relative to comparable stores.

The frequency advantage in price image formation has been explained as resulting from consumers "tallying the number of items on which each store enjoys a price advantage over its competitors (a frequency heuristic)" (Alba et al. 1994, 220). This simplifying heuristic allows consumers to incorporate a large number of prices into a price image judgment and is considerably easier than the effortful process of calculating, remembering, and summing the individual price differences across stores. Subsequent research found that it is the salience of frequent price advantages that drives the effect. Frequency information tends to "engulf people's attention," because it is so easy to evaluate (Lalwani and Monroe 2005, 481). The ease of evaluation and consequent salience during evaluations cause small, frequent price advantages to have a greater influence on price image formation than large, infrequent price advantages of the same total size.

When prices are compared simultaneously across stores, the frequency of price advantages has proven to be a highly robust predictor of participants' price image evaluations in previous research. In fact, a depth advantage has only been previously documented in two conditions. The first boundary condition that found a depth advantage occurred when the distribution of prices used as stimuli was dichotomized, including only a single "regular" and a single "discounted" price over time (Alba et al. 1994; Danziger et al. 2014; Lalwani and Monroe 2005). When dichotomous price distributions were used, keeping track of the deep discount totals was easy enough that participants could use that information. However, when price differences were more complex than just switching between two prices over time, the depth information was obscured, and the frequency advantage reemerged. The second boundary condition was based on the magnitude of the pricing advantages. In one study, Lalwani and Monroe (2005) found a marginally significant depth advantage when the size of the price discount exceeded $200. These researchers argued that when price discounts are large enough, in absolute terms, they will be more salient, and hence more likely to be incorporated into price image impressions. (We address large magnitude price discounts in experiment 5.)

Taken together, the previously identified boundary conditions on the frequency advantage suggest that depth advantages are likely to be exceedingly rare, occurring only when price distributions are dichotomous over time or when the magnitudes of price discounts are large in absolute terms. Further, the findings documenting the frequency advantage and these boundary conditions were all produced in a joint-evaluation setting, in which experimental participants simultaneously compared the prices of identical items at multiple stores. Thus, previous research in this area was based on the implicit assumption that consumers form retailer price images only by directly comparing one store's prices to a competing store's prices.

In contrast to previous research, we suggest that in separate evaluation contexts, where stores' prices are observed either one at a time or in isolation, the assumption that consumers will use competitors' prices for the same goods as external reference prices (ERPs) becomes difficult to justify. When not presented with lists of prices from multiple stores, consumers may seek out other points of comparison to evaluate prices. Previous research has found that consumers often use the prices of other brands in the same category as ERPs (Briesch et al., 1997; Jacobson and Obermiller, 1990). We propose that when evaluating the prices of multiple stores, one-at-a-time, the price advantages of a store with infrequent, deep price advantages (a depth strategy) would be easy to evaluate: deeply discounted prices would be clear when compared to the prices of other brands in the category. In contrast, frequent, shallow price advantages (a frequency strategy), would be difficult to evaluate, requiring consumers to remember the precise prices of many items to compare across stores. The result is that the frequent, shallow price advantages, that were highly evaluable in previous research settings, would become difficult to evaluate. Instead, when stores' prices are presented separately—or when the prices of one store are presented in isolation—the price advantages of the depth store that would tend to be easy for consumers to evaluate and therefore highly salient when they form a price image impression.

Consider the following illustration: Suppose a customer were to evaluate the prices of peanut butter brands at both a frequency store and a depth store (table 1). Further suppose that this customer was exposed to the prices separately, in the course of shopping: first at one store, then the other. Such a setting would make it is easy to compare prices within a category but difficult to compare prices across stores. At the frequency store, the small price advantages that four of the five brands have over the rival store can only be assessed by remembering the prices of all five brands from one shopping trip to the next. As these assessments would be relatively difficult, the price advantages of the frequency store would be less salient when the consumer forms a price image. In contrast, at the depth store, one of the national brands is priced substantially lower than the others. Such a deep price advantage is easy to evaluate relative to the other prices in the category, and therefore likely to draw consumers' attention and remain salient when an impression is formed. The result would be a lower price image for the depth store than the frequency store.

The argument that information that is easier to evaluate will have a larger influence on judgments is consistent

TABLE 1

HYPOTHETICAL PEANUT BUTTER PRICES AT TWO STORES.

	Frequency store	Depth store
Smuckers, 28 oz.	$3.49	$3.69
Peter Pan, 28 oz.	$3.19	$3.39
Jif, 28 oz.	$3.09	$2.19
Skippy, 28 oz.	$3.39	$3.59
Justin's, 28 oz.	$3.69	$3.99

NOTE.—A frequency store has frequent, shallow price advantages relative to comparable stores, where a depth store has infrequent, deep relative price advantages. When customers evaluate prices at each store separately, they will find it difficult to evaluate the across-store price advantages of the frequency store but easy to evaluate the within-category price advantage of the depth store.

with the evaluability hypothesis (Hsee 1996). Evaluability, or value sensitivity, "refers to the extent to which a person has relevant reference information to gauge the desirability of target values and map them onto evaluation" (Hsee and Zhang 2010, 344–5). One of the factors that can influence the evaluability of information is whether it is presented in isolation or alongside comparable information (Bazerman et al., 1992). Information that is easy to evaluate under joint evaluation, where external reference points are immediately available, can become difficult to evaluate under separate evaluation, where consumers need to recall or construct internal reference points to make comparisons. Research testing the evaluability hypothesis has found that when consumers make judgments, the most relevant or diagnostic attributes are often displaced by attributes that are easier to evaluate (Hsee and Zhang 2010).

In the present context, we argue that the influence of price advantages under frequency and depth strategies will likewise be a function of the evaluability of that information. When consumers want to make a relative price image judgment about two stores, the most diagnostic comparison is to contrast each price with the price of the same item at the competing store. Previous research made these comparisons highly evaluable by presenting the prices of multiple stores jointly, at the same time, to research participants (Alba et al. 1994, 1999; Danziger et al. 2014; Lalwani and Monroe 2005). However, we argue that when prices at different stores are presented separately, customers are likely to substitute the less diagnostic but easy-to-evaluate category reference prices (i.e., the prices of other items in the category at the same store) in place of the highly diagnostic but now difficult-to-evaluate competitive reference prices (i.e., the prices of the same items at competing stores). We expand on this discussion of the diagnosticity and evaluability of internal and ERPs in the general discussion.

Our proposed theoretical account allows for several additional predictions that distinguish it from previous research. First, as previously mentioned, prior research was all based on the assumption that consumers were able to compare prices directly and easily across stores (Alba et al. 1994, 1999; Danziger et al. 2014; Lalwani and Monroe 2005). As such, those theories make no predictions about how consumers would react to a single frequency or depth store presented in the absence of price information from another store. In fact, because it would be impossible to tally the number and size of price advantages relative to another store when one has seen the prices of only one store, the mechanism proposed by previous research simply does not apply to a single-store context. In contrast, because our theoretical account is based on within-category ERPs, our account predicts that a depth store is likely to be evaluated as having a lower price image than a frequency store even when consumers are exposed to the prices of just one store. We tested our proposed theoretical account in both within-subjects settings, where participants see the prices of both stores, presented separately (experiments 1 and 5), and between-subjects settings, where participants see the prices of only one store (experiments 2, 3, 4, and 6).

Second, if our theoretical account is accurate, we should expect to find differences in the pattern of attention that consumers pay to prices at depth and frequency stores. In particular, we expect disproportionate attention to be paid to deeply discounted prices (i.e., they will be more likely to "engulf attention" per Lalwani and Monroe 2005), and that these deeply discounted prices would disproportionately serve as points of comparison for other prices in the same category. We further predict this salience to mediate the relationship between a retailer's pricing strategy (frequency vs. depth) and the price image formed by consumers. We tested this information processing prediction in experiment 3.

Third, our proposed account assumes that the price comparisons within a category are highly evaluable. As such, any factors that make the prices within a category difficult to evaluate would reduce the depth advantage we predicted. We hypothesized that one of these moderators would be consumers' familiarity with the brands they are evaluating. This prediction is based on the argument that the prices of familiar brands will be easy to evaluate in the context of other familiar brands. If the brands were unfamiliar, however, consumers would not have an understanding of each product's relative quality and would be left to wonder whether a low price is a very attractive price for a high-quality offering or simply an appropriate price for a low-quality brand. If true, this account leads to the prediction that the depth advantage will be stronger in stores selling well-known brands than in stores selling unfamiliar brands. We test this prediction in experiment 4.

Our final two experiments provide further support for our theory, while also providing evidence of the downstream consequences of this effect. Experiment 5 examines this depth effect in an intertemporal setting where participants encounter the prices of television brands that fluctuate over many weeks. This experiment also examined store choice as a consequence of participants' price image

impressions. Experiment 6 investigates another downstream consequence of the relationship between pricing strategy and price image: purchase deferral within a store.

EXPERIMENT 1

The purpose of this experiment was to replicate research that demonstrated the frequency advantage in a joint-evaluation setting (Alba et al. 1994), and to test the predicted reversal in a separate-evaluation setting. As such, experiment 1 tests our main prediction: a frequency store will have a lower price image only when the prices of multiple stores are presented jointly. However, when prices were presented separately, one store at a time, the depth store will have a lower price image.

Method

Four-hundred and sixty-two participants (M_{age} = 35.4; 54% women) from Amazon's Mechanical Turk were randomly assigned to the conditions of a 2 (price presentation: joint vs. separate) × 2 (pricing strategy: frequency vs. depth) mixed-design experiment. Price presentation was a between-subjects factor and pricing strategy was a within-subjects factor.

Participants were told that they would be examining the prices of a selection of products that were available at two different stores. Both stores carried the same 40 items, grouped into 10 product categories of four brands each. The categories were presented in a randomized order, one category at a time. For each item, participants were shown a picture alongside the brand name, package size, and price information. The prices were set to be $.20 higher at the depth store than those at the frequency store for 36 of the 40 items, with the remaining four items priced approximately $1.80 lower at the depth store. The total price of all products was the same at both stores. The web appendix contains a full list of the 40 items and their prices at each store.

In the joint presentation condition, participants saw the prices for each item simultaneously, with the prices of both stores listed side-by-side. In the separate presentation condition, participants viewed all the offerings at one store before being shown the prices of the same 40 items at the other store. The order of the retailers in the separate presentation condition was randomized for each participant. An example of the manipulation used in this experiment can be found in the web appendix as well.

After participants viewed all the prices at both stores, they assessed each retailer's price image in several different ways. (Previous research has not settled on a single universal metric for measuring retailer price image; Hamilton and Chernev 2013.) Participants responded to four different measures, which consisted of both numerical price estimates and evaluative responses, presented in a randomized order. We order these measures in this discussion simply to facilitate exposition. The first dependent variable asked participants to estimate the average price of each product category (i.e., the average of the four options in each category) at each store on sliders ranging from $0.01 to $10.00. The order of the stores, and the category estimates within each store, was randomized for each participant. This category-based average measure is consistent with previous research on the frequency advantage (Alba et al. 1999; Danziger et al. 2014) and serves as our primary dependent variable across the remaining studies. As a second measure of price image, participants were also asked to estimate the total price of all 40 items they had seen. This measure is consistent with other frequency advantage research (Alba et al. 1994).

A third measure consisted of a price-value scale adapted from past behavioral pricing research (Dodds, Monroe, and Grewal 1991). Participants were asked whether the store's products were "expensive" (reverse-coded), "a good deal," and "affordable," as measured on seven-point scales (1 = not at all to 7 = very much). These items were combined to form an aggregate measure (α = .72) for each store. The fourth measure consisted of a three-item index that measured the relative attractiveness of the two stores' prices on a seven-point scale ranging from disagree to agree: "The majority of Taylor's [the depth store] prices appeared cheaper than Clark's [the frequency store] prices;" "I think Clark's has the more inexpensive products" [reverse-coded]; and "Taylor's Grocery typically had the least expensive item in a category." Thus, the higher the index score, the more participants thought the depth store had lower prices relative to the frequency store. The items were averaged to form a single relative price image index score (α = .82).

Results

We hypothesized that a consumer's price impressions would be predicted by a retailer's pricing strategy and the setting in which prices were encountered. In particular, we expected to find the previously identified frequency advantage—a lower price image for frequency stores than depth stores—when there was joint presentation of price information from multiple stores. In contrast, when there was separate presentation of price information from each store, we predicted the opposite: a depth advantage, such that the depth store would have a lower price image than the frequency store. To facilitate comparisons across dependent variables and across studies, the results of all the dependent variables discussed below are presented together with the results of all other experiments in a single table in the web appendix.

Based on a rule established before the data were collected, we eliminated 31 participants (14 separate condition, 17 joint condition) from the data set for providing one

or more category price estimates more than 3 SD from the mean. Many of these cases were responses from the extreme ends of the scale (e.g., $0.01 or $10.00). The remaining 431 participants were included in all analyses. The same inclusion criteria were used in all experiments. As a robustness check, we report all results from all studies using a 4 SD outlier cutoff in the web appendix.

Category Price Estimate. We tested the significance of the category estimates using a repeated measures analysis with both pricing strategy (depth vs. frequency) and product category as within-subjects factors and price presentation (joint vs. separate) as a between-subjects factor. To control for the absolute price differences between categories (i.e., some categories were more expensive than others), we standardized the average category estimates before the analyses. We report here the unstandardized price means for interpretability.

The results revealed the predicted interaction between pricing strategy and presentation condition ($F(1, 429) = 51.01$; $p < .001$; $\eta^2 = .11$). There was no main effect of presentation context ($F(1, 429) = .453$; $p > .50$) or pricing strategy ($F(1, 429) = .15$; $p > .90$). As predicted, category prices were perceived as being lower for the frequency store when the prices of both stores were presented jointly ($M_{Frequency} = \$3.70$ vs. $M_{Depth} = \$3.96$; $F(1, 429) = 11.64$; $p = .001$; $\eta^2 = .026$), replicating previous research. In contrast, the depth store was considered less expensive when prices were viewed sequentially ($M_{Frequency} = \$3.96$ vs. $M_{Depth} = \$3.81$; $F(1, 429) = 4.81$; $p = .029$; $\eta^2 = .011$). The magnitude of these differences may be more clearly understood by summing across the categories. In the joint evaluation condition, participants anticipated the total average price difference across all 10 categories was $2.68 lower at the frequency store than the depth store. This flipped to an estimate of $1.50 lower at the depth store than the frequency store in the separate evaluation condition.

To get a better understanding of these results, we also tested the significance by creating a difference score (Alba et al. 1994) for each category: [estimate at the depth store]-[estimate at the frequency store]. A positive score indicated that the frequency store was estimated to have lower prices, where a negative score indicated that the depth store was estimated to have lower prices overall. A repeated-measures ANOVA, with product category as a within-subject factor and price presentation (joint vs. separate) as a between-subject factor, revealed a significant main effect of price presentation ($M_{Joint} = \$0.27$ vs. $M_{Separate} = -\$0.15$; $F(1, 429) = 50.29$; $p < .001$; $\eta^2 = .11$). There was no main effect of product category, and the product category by price presentation interaction was not significant ($p > .20$), suggesting that the strength of the effect did not vary significantly by product category. A graph of the difference scores by category and price presentation can be seen in figure 1, and each category mean is reported in the web appendix. It is worth noting that in the joint evaluation condition, all 10 categories were estimated to be lower priced at the frequency store. In contrast, in the separate evaluation condition, all 10 categories were estimated to be lower at the depth store. In reality, the frequency/depth manipulation meant that the four categories with the deeply discounted offerings (bread, cheese, peanut butter, and pizza) had lower average category prices at the depth store. In the other six categories, the average category prices were lower at the frequency store (see web appendix for stimuli prices). This lends credence to the assumption that the average category price estimates do, in fact, reflect participants' store price image impressions.

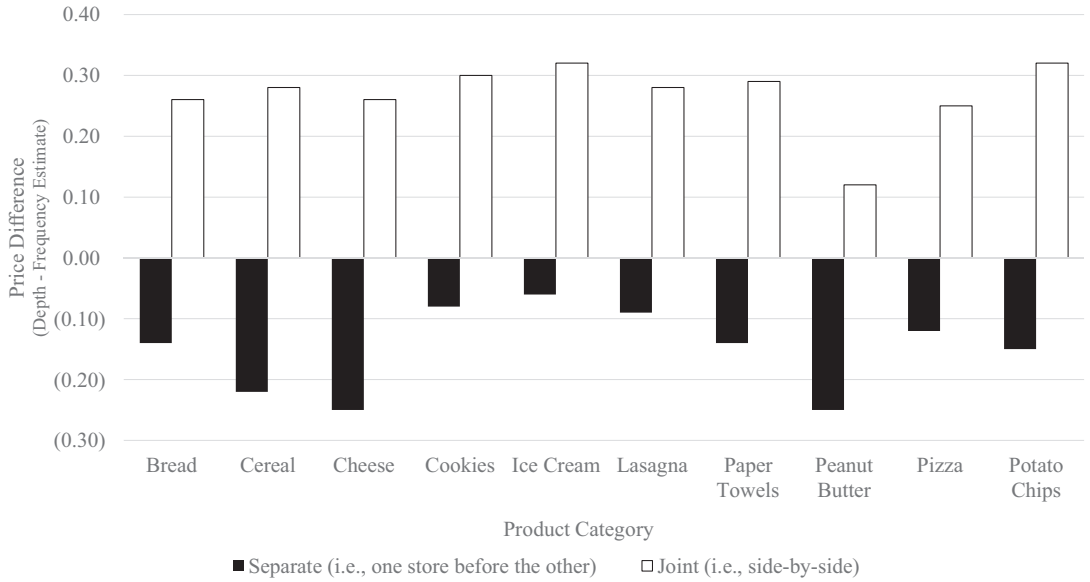
Total Store Price Estimate. Participants' aggregate estimates of the total price of all 40 items at each store was analyzed using a repeated measures ANOVA, with pricing strategy (depth vs. frequency) as a within-subjects factor and price presentation (joint vs. separate) as a between-subjects factor. The results revealed a main effect of pricing strategy ($F(1, 429) = 7.44$; $p = .007$; $\eta^2 = .017$) and no effect of presentation context ($F(1, 429) = 1.15$; $p > .28$). The predicted interaction was significant ($F(1, 429) = 29.64$; $p < .001$; $\eta^2 = .065$). Follow-up analyses supported our core proposition and showed that there was a lower price estimate for the frequency store than the depth store in the joint condition, when the prices of both stores were presented side-by-side ($M_{Depth} = \$127.11$ vs. $M_{Frequency} = \$114.59$; $F(1, 429) = 33.16$; $p < .001$; $\eta^2 = .072$). In contrast, there was a marginally significant decrease in the price estimate for the depth store compared to the frequency store in the separate condition, when the prices are presented separately ($M_{Depth} = \$112.82$ vs. $M_{Frequency} = \$116.98$; $F(1, 429) = 3.71$; $p = .055$; $\eta^2 = .009$).

Price-Value Scale. Consistent evidence was also found using the price value scale. The results of a repeated measures ANOVA with pricing strategy (depth vs. frequency) as a within-subjects factor and price presentation (joint vs. separate) as a between-subjects factor yielded a significant interaction ($F(1, 429) = 51.85$; $p < .001$; $\eta^2 = .108$). Follow-up analyses showed that the depth store was thought to provide less value than the frequency store in the joint condition ($M_{Depth} = 3.74$ vs. $M_{Frequency} = 4.59$; $F(1, 429) = 47.86$; $p < .001$; $\eta^2 = .100$), but the reverse was true in the separate condition ($M_{Depth} = 4.34$ vs. $M_{Frequency} = 3.95$; $F(1, 429) = 10.58$; $p = .001$; $\eta^2 = .024$).

Relative Price Image Scale. We found convergent evidence of the perceived price image differences by examining the three-question relative price image index measure. Recall that larger numbers on this scale indicated that the depth store had a lower price image than the frequency store. As predicted, a one-way ANOVA with price presentation (joint vs. separate) as the independent variable found

FIGURE 1

THE FREQUENCY ADVANTAGE ONLY HOLDS WHEN PRICES ARE PRESENTED JOINTLY ACROSS STORES



NOTE.—Price difference is the difference between the category price estimate at the depth store and the category price estimate at the frequency store. A positive score indicates a lower price image for the frequency store, where a negative score indicates a lower price image for the depth store.

that the depth store had a lower price image when the prices for each store were presented separately than when they were presented jointly ($M_{\text{Separate}} = 4.00$ vs. $M_{\text{Joint}} = 3.63$; $F(1, 429) = 5.11$; $p = .024$; $\eta^2 = .012$).

Discussion

Experiment 1 tested our core hypothesis using a variety of dependent variables that yielded converging results: the experiment replicated the frequency advantage identified by previous research when participants saw both stores' prices simultaneously (Alba et al. 1994, 1999; Danziger et al. 2014; Lalwani and Monroe 2005). However, when participants did not have simultaneous price information across stores, the previous findings were reversed. Participants formed a lower price image of the depth store than of the frequency store when the stores' prices were presented separately.

EXPERIMENT 2

The goal of experiment 2 was to provide a convergent test of our central hypothesis: that a depth store will have a lower price image than an otherwise equivalent frequency store when prices are *not* presented jointly across stores. Experiment 2 provides two advances over experiment 1. First, experiment 2 used an incentive-compatible design, such that participants were told that those who were most accurate in their price estimates (the main dependent variable) would receive a gift card as a reward, providing a consequence for their judgments.

Second, where experiment 1 employed a within-subjects design that allowed participants to see the prices of two competing stores before evaluating the price image of each, experiment 2 used a between-subjects design, revealing the prices of only one store to participants before they made a price image judgment. This allows us to see if the results of experiment 1 were somehow driven by the competitive external reference points that were available in experiment 1. A between-subjects test will allow us to distinguish between the types of ERPs participants are using, since competitive reference prices will no longer be available for participants if they only see the prices at a single store. It is important to emphasize that none of the previous work on the frequency advantage used a between-subjects design, because all previous work was based on the assumption of direct comparison of prices across stores (Alba et al. 1994, 1999; Danziger et al. 2014; Lalwani and Monroe 2005). As such, those theories can make no predictions about the evaluations of a single store in isolation.

Method

Two-hundred and fifty-five undergraduate students at an American university ($M_{\text{age}} = 20.49$; 60% male)

participated in a between-subjects (frequency vs. depth) experiment in exchange for course credit and a chance to win a $25 gift card. Participants were randomly assigned to one of two price strategy conditions (depth vs. frequency). As in experiment 1, the sum of the prices for each store was identical, but the distribution of prices varied such that, although the depth store was significantly cheaper than the frequency store on four items, it was modestly more expensive on the other 36 products. The products and prices that were used can be found in the web appendix.

After seeing the prices of either the depth store or the frequency store, participants completed two price image measures, presented in random order. One of the dependent variables was the same category price estimates measure used in the first experiment. For this measure, participants were asked to estimate the average price of the four items in each of the 10 categories (presented in random order). To incentivize participants to put forth their best effort, they were told that the three participants whose estimates were closest to the actual category averages would each receive a $25 gift card. As a second measure of price image, participants also completed the three-item price value measure adapted from Dodds et al. (1991) used in experiment 1. The items were combined to form an aggregate measure for each participant ($\alpha = .78$).

Results

Because participants in this study were not exposed to prices across stores simultaneously, we predicted that the results would mirror the findings from the separate evaluation condition in experiment 1, in that participants would form a lower price image of the depth store than of the frequency store. The results across both dependent measures were consistent with that prediction. We applied the same exclusion rule used in experiment 1 and eliminated 11 participants (nine from the frequency condition, two from the depth condition) from the analyses for supplying one or more category estimates that were more than 3 SD away from the category mean. After removing outliers, the responses from 244 participants were left for analysis.

Category Price Estimates. The category estimates were standardized to control for absolute price differences across categories. A repeated-measures ANOVA, with pricing strategy as a between-subjects factor and product category as the within-subjects factor, found a significant difference, in that the average category estimate at the depth store was lower than the estimate at the frequency store ($M_{\text{Depth}} = \$3.81$ vs. $M_{\text{Frequency}} = \$4.11$; $F(1, 242) = 8.88$; $p = .003$; $\eta^2 = .035$).

Price-Value Scale. Next, we examined participants' responses to the price-value scale (i.e., The store's products are expensive (reverse-coded), affordable, a good deal). An ANOVA with price strategy as the independent variable and price value as the dependent variable revealed that participants thought that the depth store price provided more value than the frequency store ($M_{\text{Depth}} = 4.56$ vs. $M_{\text{Frequency}} = 4.18$; $F(1, 242) = 6.76$; $p = .01$; $\eta^2 = .027$).

Discussion

Experiment 2 provides support for our conceptual framework by replicating the depth advantage found in the first experiment in a between-subjects paradigm (i.e., where participants were exposed to prices at only one store). It is worth noting that in this experiment, participants provided their estimates and evaluations after seeing the prices of only one store, without any competitive reference points. This contrasts with all previous research on frequency and depth effects. This demonstrates that depth effects can still occur without the competitive reference information that was required under previous theories of frequency and depth pricing strategies.

We also conducted an additional experiment testing our hypotheses in a between-subjects setting using a more naturalistic setting. As consumers make a series of purchase decisions within a store, there is an increased opportunity for distraction due to the variety of products on the shelf. It is also possible that any pricing effects could be diluted with the increased incidental exposure to prices of items not purchased or in categories not evaluated. Experiments 1 and 2, in line with previous research, presented participants with a relatively sterile environment: lists of items and prices presented on a computer screen. However, it is possible that more information-rich environments, such as those consumers encounter when shopping, could alter the effect. As such, we designed an experiment where price evaluations were made in a physical grocery store mock-up containing more than 400 items to better approximate an actual shopping environment. The results (reported in the web appendix) confirm that participants formed lower price images of depth stores than frequency stores, even when they were in this natural store environment.

EXPERIMENT 3

Experiment 3 was designed to provide a closer examination of our proposed process. We have argued that the depth advantage is driven by consumers using within-category ERPs when evaluating a store's prices. This differs from the across-store ERP account proposed in previous research (Alba et al. 1994, 1999; Danziger et al. 2014; Lalwani and Monroe 2005). The goal of experiment 3 was to provide more direct evidence of this mechanism by tracking how participants accessed price information and made comparisons across prices in frequency and depth stores. To this end, this experiment used a Mouselab process tracing protocol to track participants' information processing patterns (Payne, Bettman, and Johnson 1988).

Past research found that the number of price advantages at each store was generally more salient than the size of those price advantages (Alba et al. 1994). It was argued that the number of price advantages across stores is more likely to "engulf people's attention" (Lalwani and Monroe 2005) than the magnitude of the advantages. As such, these theories predicted no particular privilege, in terms of attention or salience, for the deeply discounted prices at the depth store relative to any other prices (Alba et al. 1994, 1999; Danziger et al. 2014).

In contrast, if our theoretical account is accurate, then we would expect participants to pay more attention to prices that are deeply discounted than to other prices. Our account further predicts that it is the within-category price comparisons that drive price image, as it is these prices that allow consumers to properly evaluate the deep discounts. Experiment 3 tested (1) whether deeply discounted prices were accessed for a longer period of time than the same items when they were not deeply discounted (i.e., the prices of the same items at the frequency store), and (2) whether participants made more within-category price comparisons in categories that contained deeply discounted items than when the same categories did not have a deeply discounted price.

Method

Two hundred and ninety-seven adults from Amazon's Mechanical Turk (M_{age} = 38.8; 57.7% women) completed a between-subjects experiment for monetary compensation. As in the previous experiment, participants were randomly assigned to a pricing strategy condition (frequency vs. depth) and then shown a picture, brand name, unit size, and (covered) price of 40 products. The products consisted of 10 different categories, each with four brands, which were presented one category at a time. The price information of all the products was covered and only revealed when participants placed a cursor on an opaque rectangle labeled "price." The prices of 36 products were $.20 less expensive at the frequency store, while the remaining four products were between $1.00 and $2.00 less expensive at the depth store. The web appendix contains a list of the products and prices used in both conditions. After seeing all 10 categories, participants completed two price image-dependent measures, presented in random order.

Measures

Price Image. Consistent with the previous studies, we collected participants' impressions of the retailer's price image two different ways. First, participants provided average category price estimates for each of the 10 categories. Second, participants completed the price value scale (expensive [reverse-coded], affordable, and a good value; α=.74).

Accessing Price Information. Four of the 40 total items had large price advantages in the depth condition relative to the frequency condition (Kraft Singles Cheese Slices [$0.99 vs. $2.79]; Nature's Own Whole Wheat Bread [$1.69 vs. $2.69]; DiGiorno Cheese Pizza [$4.95 vs. $6.95]; and Jif Creamy Peanut Butter [$1.39 vs. $2.79]). For ease of exposition, we will refer to these four key items as the "deep discounts," understanding that they were only deeply discounted in the depth condition, not the frequency condition. MouselabWEB software, designed by Martijen C. Willemsen and Eric J. Johnson (www.mouselabweb.org), allowed us to track and log both the length of time and the number of times participants examined each of the covered prices. We report only the time analysis here. We validated our results by also examining the number of times participants viewed the prices, and report those results in the web appendix. The findings are consistent using either measure.

Results

Price Image: Category Price Estimates. Following the same rule from previous studies, we eliminated 23 participants (11 from the frequency store, 12 from the depth condition) for providing one or more price estimates more than 3 SD from the mean. The remaining 274 participants were included in the analyses. Price estimates were analyzed using a repeated measure ANOVA with pricing strategy (frequency vs. depth) as a between-subjects factor, product category as a within-subjects factor, and average category price estimate as the dependent variable. The analyses were conducted with standardized category estimates to control for absolute price differences across categories, but we report means in raw form for interpretability. As predicted, the results revealed a depth advantage, such that the average category estimates were lower for the depth store than the frequency store ($M_{Frequency}$ = $4.08 vs. M_{Depth} = $3.76; $F(1, 272) = 23.66$; $p < .001$; $\eta^2 = .08$).

Price Image: Price-Value Scale. We found similar results when examining participants' responses to the price-value scale. A one-way ANOVA found a marginally significant increase in value in the prices of the depth store relative to the frequency store ($M_{Frequency}$ = 4.07 vs. M_{Depth} = 4.29; $F(1, 272) = 3.26$; $p = .072$; $\eta^2 = .012$). These results are consistent with the findings of the previous studies.

Accessing Price Information. We have argued that the depth advantage is driven by deep price advantages being more salient (i.e., more likely to "engulf people's attention"; Lalwani and Monroe 2005) than frequent, shallow price advantages. If this account is accurate, we should expect to find that the large price advantages at the depth store will draw a disproportionate share of attention, and

lead to more price comparisons within those categories. We assessed the attention paid to the four "deep discount" products by comparing the total length of time that participants spent accessing these prices in the depth condition, relative to the frequency condition.

We conducted a repeated-measures ANOVA with the pricing strategy condition as a between-subjects variable, product category as the within-subjects variable, and the time spent accessing the deep discounts as the dependent variable. We log-transformed the dependent measure (i.e., Ln[time + 1]) to control for the skewness of a timing variable, but report untransformed means for interpretability. As expected, participants spent more time viewing the deeply discounted prices in the depth condition ($M_{\text{Depth}} = 1.70$ seconds) than did participants viewing the same products in the frequency condition when they were not deeply discounted ($M_{\text{Frequency}} = 1.28$ seconds; $F(1, 272) = 7.68$; $p = .006$; $\eta^2 = .027$).

Comparing Price Information. We have argued that the deeply discounted prices are evaluated as attractive because they are evaluated in the context of other offerings in the category that make the deep discount easy to evaluate. If this prediction is accurate, then we should find that in categories with deep discounts, participants not only pay more attention to the deep discounts, but *also* pay more attention to the other, non-discounted prices in the category as they compare prices. We examined the time spent accessing the non-deep discounts using a repeated-measures ANOVA, with the pricing strategy (frequency vs. depth) as a between-subjects factor and category as a within-subjects factor. Results revealed that participants spent more time accessing the within-category reference prices (i.e., the prices of the other [non-discounted] category products in the same category of the deeply discounted product) in the depth condition ($M_{\text{Depth}} = 4.44$ seconds) than in the frequency condition ($M_{\text{Frequency}} = 3.84$ seconds; $F(1, 272) = 4.75$; $p = .030$; $\eta^2 = .017$).

Serial Mediation. Next, we investigated whether the salience of deep discounts, as measured by attention and price comparisons, mediated the effect of pricing strategy (depth vs. frequency) on participants' price estimates. A bootstrapping serial mediation procedure (Preacher and Hayes 2004; Model = 6; IV = Price strategy; DV = Price estimates; M1 = Time spent accessing the deep discounts [log-transformed]; M2 = Time spent accessing non-deep discounts in the same categories [log-transformed]) found evidence for an indirect effect. The results showed that pricing strategy influenced the amount of time participants accessed the deep discounts ($b = .68$, SE = .18, $t = 3.84$, $p = .0002$), which influenced the amount of time participants spent accessing the non-deep discounts in the same categories ($b = .41$, SE = .04, $t = 11.24$, $p < .0001$). Not only did the results reveal a significant indirect effect of deep discount time alone (Price strategy → Deep discount time → Price estimates; 95% CI (5,000 draws) = [−1.53, −.12]), there was also the predicted serial mediation effect. The time spent accessing the deep discounts predicted the time spent accessing the non-deep discounts in the same category, which predicted the price image estimate (Price strategy → Deep discount time → Non-deep discount time → Price estimates; 95% CI (5,000 draws) = [.14, 1.15]).

Discussion

Experiment 3 provided further support for our conceptual framework by replicating the results from the earlier experiments in an adapted design using MouselabWEB software. Once again, participants considered the store that utilized a depth pricing strategy to have a lower price image than a store utilizing a frequency pricing strategy with the same average price level.

Additionally, experiment 3 also provides evidence supportive of the proposed process. The results suggest that large price advantages offered by the deep discounts drew more attention and led to more price comparisons within those categories. In line with our theorizing, the results suggest that both the deeply discounted prices and the non-discounted prices in the same category appear to jointly "engulf attention" (Lalwani and Monroe 2005), and this increased salience drives price image evaluations. Experiment 3 provided mediation evidence in support of our proposed account. In the next study, we test our account by examining a theory-derived moderator of the depth advantage.

EXPERIMENT 4

Central to our argument that within-category ERP comparisons drive the depth advantage is the assumption that the price advantages at a depth store are highly evaluable. We propose that one factor that is likely to impact the evaluability of prices within a category is the familiarity of the brands in that category. In our previous studies, the familiarity of the brands used made the large price advantages of the depth stores easy to evaluate relative to the other category options: even when consumers do not have a well-defined internal reference price for a particular item, they may have a general expectation of the relative prices in the category. Even an expectation that a set of competing brands should be priced within some proximity of each other will make those prices more evaluable. However, if the brands in the category are unfamiliar, and cannot provide meaningful points of comparison, then their effectiveness as external reference points will be reduced, thereby reducing the evaluability of the depth store's price advantages.

To illustrate, return to the peanut butter example in table 1. With familiar brands, it will be clear to most

consumers that $2.19 is an attractive price for Jif when evaluated in the context of other national brands priced much higher ($3.39–$3.99). Now imagine that all options were replaced with unfamiliar brands. In this case, consumers would not know whether the $2.19 in the depth store was a great deal on a high-quality offering or simply an accurate price for a low-quality brand. If true, this account leads to the prediction that the depth advantage will be stronger in stores selling well-known brands than in stores selling unfamiliar brands.

Method

We randomly assigned 363 undergraduates at a large American university (M_{age} = 20.2; 48.4% women) to the conditions of a 2 (pricing strategy: frequency vs. depth) by 2 (brand familiarity: high vs. low) between-subjects experiment. Participants completed a virtual shopping trip in either a frequency store or a depth store. In the high brand-familiarity condition, the stimuli were the same 40 brands and prices used in experiment 1. Most items were well-known, national brands commonly found in grocery stores. In contrast, in the low brand-familiarity condition, we generated fictitious brand names for all offerings. (All product categories in both stores included a store brand called "Grocery Square." The brand was held constant across familiarity conditions, and participants in all conditions were told that Grocery Square was that store's private label brand.) A complete list of the real product names, their fictitious counterparts, and the associated prices, can be found in the web appendix. This experiment collected only a single measure of price image: the average price of each category, as used in all previous experiments.

Results

We had predicted that in the familiar brands condition, we would find results consistent with our previous experiments: participants would form a lower price image of the depth store than of the frequency store. In contrast, we expected that when participants were confronted with unfamiliar brands, the effect would be moderated, such that the depth advantage would be reduced. The data supported this prediction. Based on a rule established before we collected the data, we eliminated 26 participants (13 from the frequency condition, 13 from depth condition) for providing one or more category price estimates more than 3 SD from the mean estimates, leaving 337 participants for the analyses.

A repeated-measures ANOVA predicting price image perceptions (i.e., standardized average category estimates) based on pricing format (depth vs. frequency) and brand familiarity (high vs. low) revealed the predicted interaction ($F(1, 333) = 5.26$; $p = .022$; $\eta^2 = .016$; figure 2). The main effects of pricing strategy ($F(1, 333) = 2.45$; $p = .12$) and brand familiarity ($F(1, 333) = .11$; $p = .74$) were not significant. Replicating the findings of the previous experiments, when the retailer carried familiar brands, the depth store had lower average category price estimates than the frequency store (M_{Depth} = $3.52 vs. $M_{Frequency}$ = $3.73; $F(1, 333) = 7.42$; $p = .007$; $\eta^2 = .022$). However, the depth advantage disappeared when the retailer carried unfamiliar brands (M_{Depth} = $3.68 vs. $M_{Frequency}$ = $3.62; $F(1, 333) = .27$; $p = .60$).

Discussion

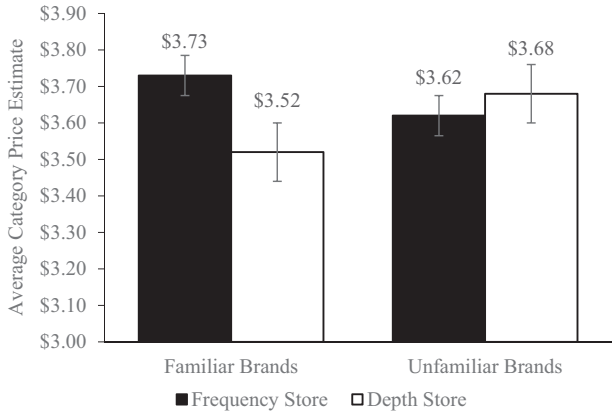
In experiment 4, we examined a theory-derived moderator of the proposed influence of pricing strategy on price image. We have argued that when the context reduces the evaluability of within-category reference prices, the depth advantage documented in previous studies should be mitigated. We found support for this prediction: when participants evaluated prices in the context of unknown brands, the price image advantage for the depth store was mitigated.

This experiment reduced the usefulness of within-category ERPs by providing participants with unfamiliar brands. It is important to note, however, that brand familiarity is not the only factor that could affect the evaluability of a depth store's price advantages. Anything that makes within-category ERPs easier to use will also likely increase the strength of the depth advantage by making the deep discounts easier to evaluate, where factors that reduce the usefulness of within-category ERPs should reduce the strength of this effect. For example, a store's shelf organization could make comparing prices within a category difficult if comparable brands were located apart from each other. (We thank an anonymous reviewer for suggesting this.) We conducted an experiment, reported in the web appendix, that tested this prediction by presenting participants either with items grouped in categories, similar to the stimuli in our other experiments, or items presented individually, in random order. Consistent with our argument, when the items were presented by-category, facilitating the use of within-category ERPs, we found a depth advantage. When items were presented individually, no depth effect was found.

It is important to note that the boundary condition identified in this experiment (brand familiarity) would not be predicted by the previous research on frequency and depth effects. In fact, the frequency advantage has previously been demonstrated using unbranded items (Danziger et al. 2014) and hypothetical brands (Alba et al. 1999) in joint-evaluation settings. When consumers evaluate prices by directly comparing them at competing stores, it does not matter whether they are familiar with the item in question. When the same item is less expensive at one store than the other, that is enough to make a relative judgment.

FIGURE 2

PERCEIVED PRICE IMAGE, MEASURED BY AVERAGE CATEGORY PRICE ESTIMATES



NOTE.—When brands are familiar, the depth advantage documented in the previous experiments is replicated, such that the store with infrequent, deep price advantages is thought to have lower prices than the store with frequent, shallow price advantages. When the brands are unfamiliar, the depth advantage goes away.

EXPERIMENT 5

The goals of experiment 5 were to (1) provide a parallel test of our central hypothesis, using an intertemporal implementation of depth and frequency pricing strategies, (2) demonstrate the effect for a different product type and at a higher price level, and (3) determine the downstream consequence of this effect on subsequent consumer evaluations and behaviors.

Some of the research on depth and frequency pricing strategies has been conducted using a "single-shot" research paradigm that presents participants the prices of many items from different categories at a single point in time (Alba et al. 1994). The previous experiments in this article followed this template by providing participants with price information from many items at a single point in time. Other research on depth vs. frequency pricing has used an intertemporal paradigm, where participants were given the prices of competing stores over time, typically weekly or monthly (Alba et al. 1999; Danziger et al. 2014; Lalwani and Monroe 2005). In this context, consumers shopping at a frequency store should expect to see a relatively low price for a product that is consistent over time. In contrast, the prices at the depth store will be somewhat higher most of the time, but much lower occasionally. Given the historical role of the intertemporal context in testing the frequency advantage, we felt it was important to ensure that our proposed outcomes could still be found in an intertemporal setting, as well as the single-shot setting used in our other experiments.

The second goal of this experiment was to extend the findings beyond the grocery store products used in previous experiments. Although most of the research on the frequency advantage used grocery store items as stimuli (Alba et al. 1994, 1999; Danziger et al. 2014), Lalwani and Monroe (2005) identified a potential moderator on previous findings for more expensive offerings. They found that when price discounts were large in absolute terms (i.e., not simply as a proportion of the price), deep discounts were more salient. Because price magnitude had previously been found to moderate the frequency advantage, we felt it was important to test whether large prices might similarly moderate the depth advantage we identified, even if our proposed theory predicts no such moderation.

Finally, we wanted to examine the downstream consequences of the price image formation identified in our previous experiments. Danziger et al. (2014) identified some divergence between price estimates and store choice when consumers are confronted with both depth and frequency stores. We therefore sought to test whether our results would be robust to measures of store choice and subsequent purchase intentions.

Method

Four-hundred and seventy-seven undergraduate students (M_{age} = 20.6.4; 40.8% women) completed a within-subjects study for partial course credit. In the study, participants saw the same five television brands at two different stores over the course of eight "weeks." The prices were presented by alternating stores on separate pages, and counterbalanced so that some participants saw the prices of the frequency store first, while other participants saw the depth store first. It is important to note that the separate presentation of prices (one store at a time) represents a departure from previous research, where intertemporal price information was for both stores was presented jointly (Alba et al. 1999).

In constructing the stimuli, most of the television brands were $20 lower at the frequency store than at the depth store, but there were seven cases where one of the brands in the depth store was $50–$160 cheaper. (The brand that was discounted varied over time.) Additionally, the exact prices of each brand varied slightly from week to week in order to ensure the results could not be explained by a simple dichotomous distribution of prices (Alba et al. 1999; Danziger et al. 2014; Lalwani and Monroe 2005). The web appendix contains the complete price list of both stores.

Participants first responded to two different future intention measures, presented in random order, to examine possible downstream consequences. In one measure, participants were asked their likelihood of returning to each store to purchase additional electronics in the future

on a seven-point scale (1 = "Not at All Likely;" 7 = "Very Likely"). The other measure asked them to make a binary choice of which store they would be more likely to visit to find the lowest prices for electronics. Afterwards, participants (1) estimated the average price for each of the five television brands at each store, (2) responded to the price-value scale from previous studies (i.e., expensive [reverse-coded], affordable, and good value; $\alpha = .73$), and (3) completed the same three-item relative price image scale used in experiment 1 ($\alpha = .86$). These three measures of price image were presented in random order.

Results

Price Image: Category Price Estimates. We predicted that participants would form a lower price image of a depth store than of a frequency store, even when pricing information is presented over time, instead of at a single point in time. The data supported our prediction. As in the previous experiments, we removed 29 participants from the analyses for providing one or more brand estimates that were more than 3 SD from the brand means. The data from the remaining 448 participants were analyzed with a repeated-measures ANOVA, with store pricing strategy (frequency vs. depth) and television brand (Vizio, Panasonic, etc.) as within-subjects variables. Consistent with the previous studies, the results show a significant effect of pricing strategy, such that the average prices were thought to be lower at the depth store ($438.01) than at the frequency store ($443.04; $F(1, 447) = 6.36$; $p = .012$; $\eta^2 = .014$).

Price Image: Price-Value Scale. The responses to the price-value scale for each store yielded similar results. A paired *t*-test of the price-value index revealed that participants found more value in the prices at the depth store than the frequency store ($M_{Depth} = 4.27$ vs. $M_{Frequency} = 4.05$; $t(447) = -3.12$; $p = .002$).

Price Image: Relative Price Image Scale. We averaged participants' responses to the same three-question relative price image index measure used in experiment 1 and compared it to the midpoint of 4 (above four on the seven-point scale indicated a belief that the depth store had lower prices than the frequency store). The results of a one-sample *t*-test showed that participants' responses (4.30) were significantly above the midpoint of the scale ($t(447) = 4.58$; $p < .001$).

Downstream Consequences: Store Choice. A paired *t*-test of the future purchase intentions found that participants revealed a greater willingness to return to the depth store (4.98) than the frequency store (4.69; $t(447) = -3.15$; $p = .002$). Furthermore, when given a binary choice of which store they would return to, more participants preferred to go to the depth store (61.4%) than the frequency store (38.6%) for their next electronics purchase. This is significantly different from chance (i.e., 50%; $t(447) = 4.95$; $p < .001$).

To determine how price image perceptions led to these consequential intentions, we utilized a within-subjects bootstrapping mediational procedure (MEMORE macro; Montoya and Hayes, 2017). The results show that participants' price image impressions mediated their future purchase intentions. That is, the confidence intervals for the indirect effect of the differences in participants' aggregated brand price estimates did not include zero (95% CI (5,000 draws): [−.2132; −.0260]).

Discussion

Experiment 5 tested our central hypothesis using an intertemporal research paradigm, in which consumers were presented with the prices of a single product category over time (Alba et al. 1999). We had predicted that a depth advantage would hold in an intertemporal setting, just as it did in the single-shot setting used in our previous studies. Furthermore, the television brands used in this study were all substantially more expensive than the grocery products used in earlier studies, a factor that previous research found moderated the frequency advantage (Lalwani and Monroe 2005)—but which our proposed account predicted would not moderate. The consistent results show the robustness of our effect and support our proposed theoretical account. In addition, the results of experiment 5 also demonstrated one of the downstream consequences of the effect (Danziger et al. 2014). Not only can deep discounts lead consumers to form lower prices image, but mediational evidence suggests that they can also shift consumer preferences for where to go when looking for another home entertainment product.

EXPERIMENT 6

The results of our previous studies have supported the notion that a depth effect is likely to occur when consumers evaluate a store's prices in isolation, or separately, one at a time. These experiments found that the results were robust to several different measures of price image, and to store choice. Experiment 6 was designed to test another downstream consequence of price image assessments: purchase deferral decisions. Consumers can use price image assessments to determine the likelihood of being able to find a lower price for a given item if they were to continue shopping (Larson, Hamilton, and Parker 2021). A consumer who observes an item at a low-price image store might reasonably conclude they are unlikely to find a lower price elsewhere, and so they choose to buy. In contrast, a consumer who observes the same item at a high price image store might conclude they could find a better price if they keep shopping, and so they defer purchase.

Method

We randomly assigned 500 Mechanical Turk participants (M_{age} = 20.4; 51.2% women) to one of two conditions (frequency vs. depth) in a between-subjects experiment. The study began by asking participants to imagine that they were shopping in a new grocery store. They were presented with 40 products (and their prices) from 10 different categories (see web appendix for complete list). After observing these items and their prices, participants were presented with a purchase opportunity. Participants were informed that they encountered some coolers and "although not on your shopping list," they were considering purchasing one. Participants were offered four different coolers to choose from, but were also give the option to defer purchase because, "I think I can find a better price at another store." Following the purchase deferral choice, participants were given two of the same price image measures used in previous experiments: average category price estimates and evaluation of the store's value (affordable, expensive [*r*], good deal). These measures were presented in random order.

Results

Price Image: Category Price Estimates. The same data inclusion rule was applied to this experiment as all our other experiments. Twenty-eight participants were eliminated for producing responses more than 3 SD away from the category means, resulting in 472 participants in the analysis. Consistent with the findings of our other experiments, the depth store was estimated to have lower prices than the frequency store (M_{Depth} = \$3.87 vs. $M_{Frequency}$ = \$4.06). A repeated-measures ANOVA predicting price image perceptions (i.e., standardized average category estimates) based on pricing strategy (depth vs. frequency) revealed that this difference was significant ($F(1, 470) = 8.02$; $p = .005$; $\eta^2 = .017$).

Price Image: Price-Value Scale. The results of an ANOVA found a main effect of pricing strategy (M_{Depth} = 3.97 vs. $M_{Frequency}$ = 3.70; $F(1, 470) = 8.40$; $p = .004$; $\eta^2 = .018$). Participants found more value in the prices of the depth store than the frequency store.

Downstream Consequences: Purchase Deferral. To examine whether participants' price image impressions would influence a subsequent deferral decision, we gave participants the option of choosing one of several coolers—or to decline to purchase from that store. As predicted, a logistic regression revealed that participants who visited the depth store were less likely to defer the additional purchase than those who visited the frequency store (M_{Depth} = 46.15% vs. $M_{Frequency}$ = 56.72%; Wald = 5.26, $p = .022$).

We next wanted to examine if this deferral decision was driven by participants' price image impressions. In separate models, a bootstrapping procedure (PROCESS macro; Model 4; Preacher and Hayes 2004) tested both price image measures as potential mediators of the deferral decision. There was a significant indirect effect of the price-value scale. That is, the confidence interval for the indirect effect of the differences in participants' responses to the price-value scale (95% CI (5,000 draws): [−.1379; −.0101]) does not include zero. The second mediator tested, aggregated category price estimates, was not significant. As a post hoc test, we found a moderately significant mediation when excluded outliers were included (90% CI (5,000 draws): [.0033; .0869]). Taken together, these results suggest the participants' downstream decision to purchase or not from a store was driven by their price image impressions of that store.

Discussion

Experiment 6 replicated the depth advantage found in our previous studies when participants evaluated store prices in isolation. This experiment also extended our findings by demonstrating another downstream consequence of price image evaluations: purchase deferral. As suggested by previous research (Larson et al. 2021), price image impressions come with assumptions about the likelihood of finding more attractive prices on comparable items elsewhere. In accordance with the notion that consumers would be more likely to "showroom" at high price image stores, we predicted and found that participants shopping in the in a frequency store, relative to those in a depth store, were more likely to defer a potential purchase from a category (with identical prices at both stores). We further found that this choice was mediated by participants' price image impressions.

GENERAL DISCUSSION

Effectively managing price image is of key strategic importance to retailers. Retailer price image not only affects where consumers choose to shop (van Heerde et al. 2008), but also, once inside the store, what they expect to pay (Thaler 1985), and whether to buy or defer purchase (Larson et al. 2021). One of the most prominent actions retailers can take in communicating a price image is their choice of pricing strategy. The extant work in this area has found that, with a few narrow exceptions, consumers tend to form a lower price image of frequency stores than of depth stores (Alba et al. 1994, 1999; Danziger et al. 2014; Lalwani and Monroe 2005). Translated into strategic terms, previous research would support pursuing an EDLP strategy over a HILO strategy, if the retailer's goal is to communicate a low-price image.

Our research contributes to the literatures on pricing strategies (frequency vs. depth) and price image formation by identifying an important boundary condition on previous work: the findings of previous research apply only to joint evaluation, where the prices of multiple stores are compared simultaneously. In contrast, our research finds that when stores' prices are evaluated separately, and there are multiple brands per category, consumers switch to a different set of ERPs. As a result, we find that a depth advantage is the more common outcome. That is, in settings where consumers encounter information from one store at a time, HILO pricing may be more effective in communicating a low-price image than EDLP pricing.

Although this research examined price image formation, we expect that our theoretical account could also be applied to the formation of other types of consumer impressions. For example, consider how consumers might evaluate the "health halo" of a restaurant chain (Chandon and Wansink, 2007). An objective assessment of healthfulness might involve direct comparisons of nutrition information across restaurants—a joint comparison—as might be done using a website like menustat.org (Alexander et al., 2020). If, on the other hand, consumers evaluate restaurants' nutrition information separately, our research suggests that comparisons within the menu are likely to drive consumers' perceptions of the chain's healthfulness. A restaurant that chose to include a few relatively healthy options in the context of traditionally unhealthy categories (e.g., a low-calorie dessert, low-carb cauliflower tots among the French fry options) might obtain a healthier "halo" than could be achieved by modestly reducing the calories of all the items on the menu.

Our theoretical account's boundary conditions provide some guidance as to what kinds of retailers might see the greatest effect from employing a depth strategy. Experiment 4 found that deep discounts are only recognized as deep discounts when they are applied to familiar brands and in the context of other familiar brands that can serve as points of comparison. This suggests that depth strategies will be most effective for stores selling mostly familiar brands (e.g., grocery stores), but will likely be less effective for stores selling mostly unfamiliar brands (e.g., hardware stores). Similarly, within a given store, depth strategies will tend to be most effective in communicating a low-price image in categories with familiar brands (e.g., peanut butter in grocery stores and power tools in hardware stores) and less effective in categories with unfamiliar brands (e.g., white wine vinegar in grocery stores and sandpaper in hardware stores).

It is worth noting that the role of brand familiarity, as outlined above, is somewhat unusual in behavioral research, in that it strengthens, rather than weakens, the central effect. Often, behavioral studies are designed using unfamiliar or novel stimuli to better reduce noise and identify the influence of the experimental treatment. Context effects, in particular, rest on the assumption that consumers do not have strong *a priori* opinions about the items being evaluated. If they did, they would have less need to rely on the context to aid their judgments and choices. In contrast, our theoretical process requires that price differences within a category be highly evaluable, which is more likely when brands are familiar. Product offerings that are unfamiliar will actually make the context effect we identified less likely.

One of the contributions of this research was to document the shift in the reference prices that consumers use in different contexts. We predicted and found a shift from ERPs at competing stores (competitive ERPs) under joint evaluation to ERPs within each category (category ERPs) under separate evaluation. But these are, of course, not the only reference prices available to consumers. Consumers may also bring with them some internal reference prices (IRPs) of specific goods based on their previous experience. To the best of our knowledge, there is no framework for understanding how and when consumers might use various reference prices to assess a store's price image. We propose predicting reference price usage based on two dimensions: (1) how diagnostic each comparison would be in assessing a store's price image and (2) how easy each comparison would be based on the availability of the reference price (table 2).

The most diagnostic points of comparison for assessing the relative price image of a store are competitive ERPs. Whether a direct comparison of prices across stores is easy or difficult depends on the nature of the evaluation. In a joint comparison setting, those comparisons are highly evaluable. In contrast, in a separate comparison setting, these comparisons are extremely difficult, requiring the recall of a large number of specific prices across shopping experiences. Thus, when previous research on depth and frequency effects used a joint-evaluation setting, it facilitated reference price comparisons that were both the most diagnostic and highly evaluable (Alba et al. 1994).

IRPs are the next most diagnostic. These are price expectations based on previous shopping experiences, or extensive research, and may be used by consumers to assess the price image of a store. Anecdotally, a friend of one of the authors keeps careful track of the prices of a four-pack of AA batteries at the stores he shops. Because this item is sold at a wide variety of stores, this allows him to compare the observed prices to his IRP and quickly form an opinion of pricing at the store. While these well-defined IRPs will be highly evaluable when they are available, prior research on price knowledge (Dickson and Sawyer 1990) suggests that these well-defined IRPs are also likely to be rare. If well-articulated IRPs were prevalent among participants into our experiments, it would have introduced noise to our analyses, reducing the influence of our manipulations and, therefore, the likelihood of finding differences across conditions.

TABLE 2

POINTS OF COMPARISON FOR EVALUATING PRICES TO DETERMINE A STORE'S PRICE IMAGE

	Diagnosticity of comparison	Evaluability of comparison	
		Joint evaluation	Separate evaluation
Competitive ERPs	Highest	Highest	Low
IRPs	High	High for frequently purchased or well researched items; Low for all others	
Category ERPs	Low	High	High

Although not as diagnostic as the other reference points, the prices within a given category can also serve as a point of comparison in evaluating a store's price image. These evaluations reveal nothing about the objective price differences between one store and another, but they are immediately available. While likely not as easy to evaluate as a single competitive ERP, if only because comparisons will often involve relative evaluations of several prices within the category, category ERPs will still typically be highly evaluable. The experiments in this article attest to consumers' willingness to rely on category ERPs in assessing price images.

Although the present research provides some support for this proposed framework, additional research is needed to test this hierarchy specifically. The results of experiment 1 confirm that when both competitive ERPs and category ERPs are available (joint evaluation condition), participants' judgments were based on the competitive ERPs. According to our framework, competitive ERPs are both more diagnostic of assessing price image and more evaluable under joint evaluation, and so more likely to be preferred by consumers. In contrast, when competitive ERPs are less accessible (separate evaluation condition), participants' judgments were consistent with their having used category ERPs—less diagnostic, but more evaluable. The findings of all of our experiments are consistent with the evaluability hypothesis (Hsee and Zhang 2010): Consumers will tend to be influenced by the most evaluable information, not necessarily the most diagnostic.

Future research is also needed to examine the additional factors that could influence price image formation based on the retailer's pricing strategy. For example, both HILO and EDLP pricing strategies are often paired with in-store communications that draw attention to low prices (e.g., "sale" or "compare at" tags). Consistent with the design of previous research on the frequency advantage (Alba et al. 1994), none of the price advantages in our experiments were accompanied by any such cues, leaving the potential impact of these attentional cues unexamined. Although there has been research into how promotional messages influence the perceptions of individual prices (Mulhern and Padgett 1995), how these communication tools affect store price image has yet to be studied. By making low prices more salient, do these low-price flags help lower the price image of a store? Or do these messages draw attention to the higher regular prices, by emphasizing all the prices that are *not* flagged, resulting in a higher overall price image? How retailers' pricing and communication strategies affect price image formation remain fruitful areas for future research.

Additional research is also needed to examine how other product- or market-related factors influence price image. Our research shows that the influence of pricing strategy on price image is largely determined by the context or manner in which consumers encounter retailers' prices. Yet, as our theory is predicated on consumers' abilities to evaluate and attend to large discounts, is possible that other factors may also indicate whether this strategy would be successful in this context. Specifically, as past literature has characterized products according to how easy they are to compare and evaluate, the success of a depth strategy in signaling low-price image could also vary according to this product distinction. For example, experience goods are thought to be less evaluable than search goods (Nelson 1970). This suggests that the ability of within-category reference prices to influence a retailer's price image may be mitigated if they primarily sell experience goods.

Future research is also needed to examine additional factors that could influence price image formation based on the retailer's pricing strategy. For example, both HILO and EDLP pricing strategies are often paired with in-store communications that draw attention to low prices (e.g., "sale" or "compare at" tags). None of the price advantages in our experiments were accompanied by any such cues, leaving the potential impact of these attentional cues unexamined. Although there has been research into how promotional messages influence the perceptions of individual prices (Mulhern and Padgett 1995), how these communication tools affect store price image has yet to be studied. By making low prices more salient, do these low price flags help lower the price image of a store? Or do these messages draw attention to the higher regular prices, by emphasizing all the prices that are *not* flagged, resulting in a higher overall price image? How retailers' pricing and communication strategies affect price image formation remain fruitful areas for future research.

One major boundary condition on the current findings is that we studied price image formation, not changes in existing price image. Although this has been the typical way this topic has been studied experimentally (Alba et al. 1999; Danziger et al. 2014; Lalwani and Monroe 2005), there is research suggesting that price images, once formed, can influence subsequent evaluations of prices encountered at those stores (Alba et al. 1994; Hamilton and Chernev 2013; Thaler 1985), often making price images "sticky." Further, this previous research suggests that the interaction between an existing price image and new price information is complex, with prices sometimes evaluated as consistent with the price image, other times evaluated in contrast to the price image, and still other times not biasing the judgment either way. As such, our results are most conservatively evaluated through the lens of price image formation, and not price image change, though this would be an important avenue for future research.

Finally, before managers implement strategies based on the findings of this article, important questions concerning calibration would need to be answered. The experiments reported in this article used depth strategy manipulations that varied in terms of the percentage of prices that were discounted, and the size of the discounted prices. Clearly, there will be limits as to the minimum frequency and minimum depth of discounts before consumers fail to attend to the lower prices, and they lose their power to influence price image formation. We expect that the calibration of the depth strategy will vary based on several factors, including the size of the assortment a store carries and the number and size of the product categories within the overall assortment.

DATA COLLECTION INFORMATION

The first author collected the data for experiments 1, 3, and 6 through Amazon's Mechanical Turk in the fall of 2018 (experiment 1), the spring of 2019 (experiment 3) and the fall of 2020 (experiment 6). The data for experiments 2, 4, and 5 were collected by research assistants, under the supervision of the first author, at the University of Kentucky Behavioral Research Lab in the fall of 2016 (experiment 4) and the spring of 2021 (experiments 2 and 5). The data for all of the experiments were analyzed by the first author with the consultation of the second author. All data are currently stored in a Dropbox folder under the management of the first author.

REFERENCES

Alba, Joseph W., Susan M. Broniarczyk, Terence A. Shimp, and Joel E. Urbany (1994), "The Influence of Prior Beliefs, Frequency Cues, and Magnitude Cues on Consumers' Perceptions of Comparative Price Data," *Journal of Consumer Research*, 21 (2), 219–35.

Alba, Joseph W., Carl F. Mela, Terence A. Shimp, and Joel E. Urbany (1999), "The Effect of Discount Frequency and Depth on Consumer Price Judgments," *Journal of Consumer Research*, 26 (2), 99–114.

Alexander, Eleanore, Rutkow, Lainie, Gudzune, Kimberly A., Cohen, Joanna E., and McGinty, Emma E.(2020), "Healthiness of US Chain Restaurant Meals in 2017," *Journal of the Academy of Nutrition and Dietetics*, 120 (8), 1359–67.

Bazerman, Max H., Loewenstein, George F., and White, Sally Blount, (1992), "Reversals of Preference in Allocation Decisions: Judging an Alternative versus Choosing among Alternatives," Administrative Science Quarterly, 37 (2), 220–40.

Bell, David R. and James M. Lattin (1998), "Shopping Behavior and Consumer Preference for Store Price Format: Why 'Large Basket' Shoppers Prefer EDLP," *Marketing Science*, 17 (1), 66–88.

Briesch, Richard A., Lakshman Krishnamurthi, Tridib Mazumdar, and S. P. Raj (1997), "A Comparative Analysis of Reference Price Models," *Journal of Consumer Research*, 24 (2), 202–14.

Brown, Francis E. (1969), "Price Image versus Price Reality," *Journal of Marketing Research*, 6 (2), 185–91.

Chandon, Pierre, and Wansink, Brian (2007), "The Biasing Health Halos of Fast-Food Restaurant Health Claims: Lower Calorie Estimates and Higher Side-Dish Consumption Intentions," *Journal of Consumer Research*, 34 (3), 301–14.

Chellappa, R. K., R. Sin, and S. Siddarth (2011), "Price-Formats as a Source of Price Dispersion: A Study of Online and Offline Prices in the Domestic US Airline Markets," *Information Systems Research*, 22 (1), 83–98.

Danziger, Shai, Liat Hadar, and Vicki G. Morwitz (2014), "Retailer Pricing Strategy and Consumer Choice under Price Uncertainty," *Journal of Consumer Research*, 41 (3), 761–74.

Dickson, Peter R., and Sawyer Alan G. (1990), "The price knowledge and search of supermarket shoppers." *Journal of marketing*, 54 (3), 42–53.

Dodds, William B., Kent B. Monroe, and Dhruv Grewal (1991), "Effects of Price, Brand, and Store Information on Buyers' Product Evaluations," *Journal of Marketing Research*, 28 (3), 307–19.

Fassnacht, Martin, and Sabine El Husseini (2013), "EDLP VERSUS Hi–lo Pricing Strategies in Retailing—a State of the Art Article," *Journal of Business Economics*, 83 (3), 259–89.

D'Innocenzio, Anne and Michelle Chapman. (2012), "Lowe's 2Q Results Miss Expectations, Cuts Outlook," *Boston Globe*, http://archive.boston.com/business/articles/2012/08/20/lowes_2q_results__miss_expectations_cuts_outlook/ (Accessed May 2020).

Hamilton, Ryan and Alexander Chernev (2013), "Low Prices Are Just the Beginning: Price Image in Retail Management," *Journal of Marketing*, 77 (6), 1–20.

—— (2010), "The Impact of Product Line Extensions and Consumer Goals on the Formation of Price Image," *Journal of Marketing Research*, 47 (1), 51–62.

Hoch, Steven, Xavier Dreze, and Mary Purk (1994), "EDLP, Hi-Lo. and Margin Arithmetic," *Journal of Marketing*, 58 (4), 16–27.

Hsee, Christopher K. (1996), "The Evaluability Hypothesis: An Explanation for Preference Reversals between Joint and

Separate Evaluations of Alternatives," *Organizational Behavior and Human Decision Processes*, 67 (3), 247–57.

Hsee, Christopher K, and Jiao Zhang (2010), "General Evaluability Theory," *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, 5 (4), 343–55.

Jacobson, Robert, and CarlObermiller, (1990), "The Formation of Expected Future Price: A Reference Price for Forward-Looking Consumers," *Journal of Consumer Research*, 16 (4), 420–32.

Lalwani, Ashok K. and Kent B. Monroe (2005), "A Reexamination of Frequency-Depth Effects in Consumer Price Judgments," *Journal of Consumer Research*, 32 (3), 480–5.

Larson, Jeffrey S., Ryan Hamilton, and Jeffrey R. Parker (2021), "Where You Shop Affects How You Choose: Retailer Price Image and the Importance of Enriched versus Comparable Attributes," *Journal of the Association for Consumer Research*, 6 (1), 130–41.

Loeb, Walter (2017), "Walmart, Target and the Future," *Forbes*, January 2, https://www.forbes.com/sites/walterloeb/2017/01/02/walmart-target-and-the-future/#3810ec0b6712 (Accessed February 2022).

Montoya, Amanda K., and Hayes, Andrew F. (2017), "Two-Condition within-Participant Statistical Mediation Analysis: A Path-Analytic Framework," Psychological Methods, 22 (1), 6.

Mulhern, Francis J. and Daniel T. Padgett (1995), "The Relationship between Retail Price Promotions and Regular Price Purchases," *Journal of Marketing*, 59 (4), 83–90.

Nelson, P. (1970), "Information and Consumer Behavior," *Journal of Political Economy*, 78 (2), 311–29.

Payne, John W., James R. Bettman, and Eric J. Johnson (1988), "Adaptive Strategy Selection in Decision Making," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 14 (3), 534–52.

Preacher, Kristopher J. and Andrew F. Hayes (2004), "SPSS and SAS Procedures for Estimating Indirect Effects in Simple Mediation Models," *Behavior Research Methods, Instruments, & Computers: A Journal of the Psychonomic Society*, 36 (4), 717–31.

Thaler, Richard (1985), "Mental Accounting and Consumer Choice," *Marketing Science*, 4 (3), 199–214.

van Heerde, Harald J., Els Gijsbrechts, and Koen Pauwels (2008), "Winners and Losers in a Major Price War," *Journal of Marketing Research*, 45 (5), 499–518.

Weinstein, Justin (2012), "An Investment in Lowe's is an Investment in Everyday Low Pricing," *Seeking Alpha*, https://seekingalpha.com/article/819791-an-investment-in-lowes-is-an-investment-in-everyday-low-pricing.