Can bottles speak volumes? The effect of package shape on how much to buy

Sha Yang [a,*], Priya Raghubir [b]

[a] *Stern School of Business, New York University, New York, NY, USA*
[b] *Haas School of Business, University of California, Berkeley, CA, USA*

Abstract

Four multi-method studies show that the more elongated a container, the lower its purchase quantity. Study 1, in the lab, shows beer bottles are perceived to contain more than beer cans, particularly for infrequent beer drinkers. Study 2 analyzes scanner data to show that the purchase quantity of cans is 63.66 percent higher than the purchase quantity of bottles. Study 3, a virtual shopping survey, demonstrates these effects are strongest when the context is socializing at home, and Study 4, in the lab, shows results hold only when desired consumption level is constant. Implications for retailers and product managers are offered.
© 2005 New York University. Published by Elsevier Inc. All rights reserved.

Keywords: Package shape effects; Visual perceptual biases; Purchase quantity decisions

Packaging is drawing attention from retailers and product managers alike. In a world of consumer information load, proliferating SKUs in retail stores, and new product and brand extensions every week, one key to sales is getting the consumer to choose the brand at the point of purchase from a range of alternative options. This paper shows that purchase quantity (number of units of a product purchased) is contingent on the elongation of a container, holding constant actual volume and price of the container.

Companies are increasingly focusing on packaging decisions, finding that in an era of over-advertising, over-promotion, and weekly price-cuts, seemingly small changes in package shapes can bring in significant profits at the sales register (Prince 1994). Packaging can also play an important role in product differentiation, particularly in product categories ranging from fragrances to frequently purchased packaged products, such as colas, beer, and shampoo. For example, recognizing the importance of packaging in a consumer's decision, package designers have turned food containers into increasingly important and sophisticated marketing tools to attract consumers and encourage purchase (Kesler 1986). Moreover, companies can differentiate their brand from their competitors' products through changing the shape of their product package (Sherwood 1999).

Academics have studied the effect of packaging on product categorization and evaluation (Schoormans & Robben 1997), but the effect of package shape on decisions of what, when, and how much to buy is a relatively new area of inquiry despite growing evidence of package size and shape affecting volume perceptions and consumption levels (Folkes, Martin and Gupta 1993; Folkes & Matta 2004; Raghubir & Krishna 1999; Wansink 1996; Wansink & van Ittersum 2003).

This paper builds on volume perception research and extends it to the domain of purchase quantity. A conceptual model describes the interplay of perceived volume and desired consumption for consumers with different levels of experience and in different consumption contexts (see Fig. 1). We predict that consumers purchase a smaller quantity of less elongated containers, as they expect each individual container to have a greater volume. Four studies test the model using a range of methodologies and measures. Across studies we find convergent evidence that fewer units of a taller (vs. shorter) container are purchased by a consumer. The primary implication for managers is to attempt to maintain similar product

* Corresponding author.
  E-mail addresses: shayang@stern.nyu.edu (S. Yang),
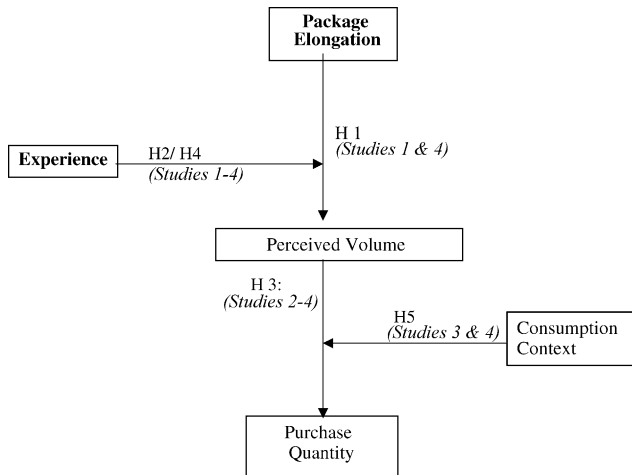raghubir@haas.berkeley.edu (P. Raghubir).

Fig. 1. A conceptual framework of the effect of package shape on purchase quantity.

shapes across two similar offerings of their brand (e.g., a can vs. a bottle).

Overall theoretical model

While actual volume is an important attribute to consider, consumers do not even appear to pay attention to price in a meaningful way (Dickson & Sawyer 1990). Dickson & Sawyer's (1990) study in the context of price and promotion awareness of frequently purchased products showed that under 50 percent of surveyed consumers were aware of having purchased on promotion seconds after they had made their purchase. Of those aware, over 50 percent couldn't recall or were inaccurate in their estimation of price. If consumers do not adequately attend to volume labels on packages, despite labeling rules ensuring that this information is present, then consumer's inferences about product volume are important. We examine whether consumers use package shape to make inferences about product volume.

Elongation effect on volume perception

Consumers who do not use package label information to make judgments about the quantity of an individual product could use the elongation of a package as a source of information (Piaget 1967). Almost half a century ago, Piaget asked elementary school children whether if liquid was poured from a tall cylinder to a shorter and wider cylinder, the volume of liquid had reduced (Piaget 1967, 1968; Piaget, Inhelder, & Szeminska 1960). A strong finding across studies was that young kids use the height of the container while making volume judgments—they believe volume reduces when liquid is poured from taller to shorter and wider glasses (see also Been, Braunstein, & Piazza 1964; Pearson 1964). More recently, Raghubir and Krishna (1999) demonstrated a volume perception bias with an older undergraduate population,

arguing that visual cues (such as elongation of a container) are highly salient and are used to simplify spatial decisions relating to volume. Their stimuli, however, did not explicitly include the package volume on the labels. Packages were either disguised using white paper (Study 1), or the stimuli used were differently shaped glasses without individual volume labels (Studies 2–7). Wansink and van Ittersum (2003) demonstrated such effects were robust and translated to domains when the individuals poured juice themselves (vs. made judgments about how much juice a container contained; but see Folkes & Matta 2004).

It is important to establish whether elongation effects would exist in a context where consumers have access to package label information, as in the case with frequently purchased packaged products where volume information is displayed on the product label. If consumers ignore easily available package information, they must replace this information with other cues which are easy to use, such as perceptually salient visual cues. Among these cues, the elongation of a container is highly salient and likely to be used to make a volume judgment (Piaget 1967; Raghubir & Krishna 1999; Wansink & van Ittersum 2003). To replicate the elongation bias within the domain of packaged goods, we hypothesize:

H1. More elongated containers of packaged products will be perceived to contain a higher volume as compared to less elongated containers of equal volume.

The moderating effect of product category experience

The bias in volume judgments should reduce if consumers use other cues as an input to the judgment. As experienced decision makers can use their prior experience to make a volume judgment, they should rely less on the elongation cue. However, prior research has demonstrated that elongation may also affect consumers' perceptions of how much they have actually consumed: people believe they have consumed less from more elongated containers as their experience disconfirms their prior expectations (Raghubir & Krishna 1999). Even professional pourers (bar-tenders) believe they have poured less into a shallow container, when in fact they have poured more (Wansink & van Ittersum 2003). The implication of these results in our context is that while consumption experience should reduce the volume perception bias, it may not entirely eliminate it. In other words, heavier beer drinkers should be less prone to this bias than lighter-beer drinkers or non-drinkers. Formally:

H2. Product category experience will attenuate H1: more experienced consumers will be less biased than less experienced consumers.

Purchase quantity hypothesis

How does a consumer decide how many units of a product to purchase? There are a number of possible scenarios relating

the amount in the package to the amount a person wishes to consume. If desired consumption level is less than or equal to the perceived volume of a package, then one unit should be purchased (e.g., purchase of a single serving drink with a meal or at a ball game). If desired consumption level is greater than perceived volume of a single unit, then multiple units need to be purchased to make up the total desired consumption amount (e.g., purchase of beer for a party at home). Thus, factors affecting perceived volume should carry through to purchase quantity decisions. If desired consumption is fixed, and elongation is directly related to perceived volume, then elongation should be inversely related to purchase quantity. The more elongated the container, the fewer such containers should be purchased. The lower half of the conceptual model in Fig. 1 presents this figuratively.

Krider, Raghubir, and Krishna (2001, Study 4) tested the effect of rectangular versus round containers in a context characterized by a fixed level of desired consumption over a single consumption episode—the amount of cream cheese required to spread over a bagel. Rectangular containers of cream cheese were perceived to be larger than round ones of the same volume (3/4 oz). This followed through to the purchase quantity decision—the likelihood of buying a second unit of cream cheese was greater when round versus rectangular containers were purchased. Krider et al.'s (2001) results imply that if elongated bottles are perceived to contain more than less elongated cans (H1), purchase quantity should be lower when bottles are purchased as compared to when cans of the same volume are purchased, holding price, and desired consumption level constant.

H3. More elongated containers generate less purchase quantity than less elongated containers, holding constant actual container volume and price.

The moderating role of experience

H2 predicts a lower bias amongst those who have experience with the product category. The same logic implies that those who have product category experience should be less prone to the effect of package shape on purchase quantity hypothesized in H3 above, or:

H4. The effect of package elongation on purchase quantity (H3) is attenuated by experience: experienced consumers are less prone to purchasing fewer units of more (vs. less) elongated containers than inexperienced consumers.

The moderating role of consumption context

The effect of volume perception should translate into purchase quantity only under conditions when the overall consumption level is constant. Therefore, in contexts where consumers desire to purchase an overall fixed quantity, fewer units of a more (vs. less) elongated container should be purchased. We propose:

H5. Consumption context moderates the effect of package shape on purchase quantity, such that the effects are strongest when desired consumption level is constant.

Summary of empirical approach

Across a range of beer brands, within a brand, the bottle is more elongated than the can. Given the elongation bias, a beer bottle should be perceived to contain more than a beer can. When desired consumption is constant, this implies fewer bottles should be purchased as compared to cans, controlling for other variables. As there are many differences between bottles and cans that could also lead to higher purchase quantities of cans as compared to bottles, we use a multi-method approach directly testing the most relevant and likely alternative explanations within and across studies. Study 1, in the lab tests volume perception as a function of elongation of bottles and cans, Study 2 analyzes scanner data purchases of beer, Study 3 is a virtual shopping simulation, and Study 4, again in the lab examines the role of context manipulating desired consumption level. The alternative explanations for the effect of bottles versus cans includes higher availability of larger pack sizes for cans; the fact that cans are more convenient to store, less fragile, and easier to carry. They are discussed below along with a summary of how the studies empirically control for them.

a. *Differential availability of bottles (vs. cans) in larger package sizes*. Bottles are less likely to come in larger packages than cans. Therefore, when higher purchase quantities are needed, people may purchase cans rather than bottles. Further, if larger package sizes for cans cue a larger purchase quantity (e.g., when a consumer sees a case of beer, they unthinkingly buy the case of 24 cans irrespective of whether they need 24 cans or not; and since bottles are less likely to come in 24 unit cases, this leads to fewer bottles being purchased than cans), the differential availability of beer in larger pack sizes could lead to a supply side explanation for H3. This is controlled for in different ways in Studies 2–4. In Study 2 (scanner data analysis), we analyze a concatenated data set of smaller pack sizes which are available in both cans and bottles. In Study 3 (simulated shopping survey), availability of cans is the same as that for bottles, and in Study 4 (lab experiment) no availability cues are provided.

b. *Weight, carrying, and storage convenience*: As bottles are heavier than cans of the same volume, carrying larger number of bottles is more inconvenient than carrying larger number of cans. This could lead to fewer bottles (vs. cans) being purchased on any given purchase occasion. Further, as the top of cans is flat as compared to tapered like bottles, cans are easier to stack, and therefore, more cans may be purchased during a purchase occasion as compared to bottles.

Study 2 (scanner data) controls for this issue using three methods. (1) We use an instrument variable approach to control for the endogeneity of the container choice, choosing lagged container choice as the instrument variable that is correlated with the container choice but not correlated with the error term in the equation of purchase quantity. (2) We split the data set into beer bottle and beer can subsets and identify brands within each that are shorter or taller than the average 12-oz unit. Separate regressions for the two subsets are conducted to examine the effect of elongation on purchase quantity. (3) We examine if results hold for the subset of consumers who purchase both bottles and cans.

In Study 3 (virtual shopping survey), consumers do not have to carry or stock the containers, making alternative explanations such as storage and carrying convenience less compelling. In Study 4 (lab experiment), the context specifies that beer is to be purchased on the day of a special occasion for a specific purpose making storage considerations less relevant.

c. *Consumer perceptions of taste and price*: Consumers may believe that beer tastes better in a bottle than it does in a can, and is priced higher, leading to their being willing to purchase fewer bottles than cans. To control for this, the laboratory experiment (Study 4) specifies the price of the beer (same for bottles and cans), and the analysis of scanner data (Study 2) and virtual shopping simulation (Study 3) control for price and brand of the beers statistically. Further, Study 1 measures these perceptions to examine if they relate to different volume perceptions of beer in bottles versus cans.

To summarize, Studies 1 and 4 test H1 and H2 in a lab setting where product category experience is measured. Studies 2–4 test H3 using different methods. H4 is tested using two different methods in Studies 2 and 3. Study 2 tests H4 with scanner panel data using total purchase quantity as a proxy for experience. Heavier purchasers are likely to have more experience, and, therefore, should show smaller differences in their average purchase quantity of more versus less elongated containers. Study 3 tests H4 with simulated shopping survey data using age as a proxy for experience.

H5 is also tested using two different methods in two different studies. Study 3 tests H5 by manipulating consumption context as "home-social," "outside-social," or "non-social" (cf. Yang, Allenby, & Fennell 2002). Purchase quantities for each context should be differentially based on expected consumption levels. Outside-social contexts would be most likely to be guided by social norms (e.g., a six- or twelve-pack of beer). Non-social contexts would be most likely to reflect an expectation of average consumption over a period of time (e.g., the next planned purchase opportunity). However, home-social contexts would reflect an expectation of overall consumption at a given occasion: a situation closest to a one where there is a fixed desired consumption level. In such a context, the effects of volume perception should be most likely to translate into purchase quantity decisions. Study 4 tests H5 using a different operationalization of desired consumption level in the lab to see if results conceptually replicate.

In addition to controlling for differences between bottles and cans in different ways, we also conducted a pretest where material was held constant to assess the pure effect of elongation on volume perceptions of beer bottles. This is described and is followed by a description of the four studies.

Pretest

The pretest examined if consumers expect more elongated (taller) containers of a frequently purchased packaged good (beer), to contain more than less elongated (shorter) containers of the equivalent volume. We chose beer as the product category as the major manufacturers have at least two product shapes of equivalent volume in their offerings: taller bottles and shorter cans, and there is some variation in package shapes of beer across brands. As the volume of beer is displayed on all containers, testing the elongation effect in this domain would provide strong support for the hypothesis as consumers have easy access to the volume of a beer container, and this volume does not vary much across brands (mode = 12 oz).

Study participants

Participants were 31 undergraduate students enrolled in an introductory marketing course. They completed the task for partial course credit.

Procedure

The cover story used was "Design Aesthetics." Participants were told:

"As you are probably aware, the design of a package is an important marketing decision. The shape, color, material, and labeling decisions are all important considerations in designing an attractive package. In this task, we would like you to evaluate your preferences for different container shapes. There are no right or wrong answers. Please start now."

All participants were shown two 12 oz bottles of beer that differed in their elongation. The Pilsner-Urquell is more elongated than the Sierra-Nevada. It is taller (24 cm vs. 20 cm), has a longer neck, and a smaller circumference around its widest part (19 cm vs. 20.5 cm).

Participants were first asked whether they had a preference for the packaging of the two beer bottles to increase the believability of the cover story, and were then asked to estimate the volumes of the two containers using an open-ended question format.

Results

As predicted, the more elongated container was perceived to contain a higher volume of beer (means = 13.10 oz vs.

12.71 oz; $F(1,30) = 3.37, p < .05$), successfully replicating the elongation effect within the context of beer bottles.

Discussion

The pretest showed that taller bottles are perceived to contain more than shorter bottles. Given this, we now investigate whether, holding brand constant, a taller container will be perceived to contain more than a shorter container of the same volume. This is a relevant question for product managers whose product ranges include containers of different shapes but the same volume: for example, beer bottles versus beer cans. If the taller item in their product line is estimated to be bigger than the shorter one, with fewer units of it purchased as a consequence, managers should be aware of this so that they can control it (through increasing the salience of product volume information on the package label, or changing the shapes of their cans to make them closer to the height of their bottles) or leverage it (through producing more cans than bottles).

Study 1: Effect of package type on volume perception: the moderating role of experience

Study 1 tests the effect of elongation on volume perceptions of packaged goods (H1), and the moderating effect of product category experience (H2).

Study participants

Participants were 60 undergraduate students enrolled in an introductory marketing course who completed the task for partial course credit.

Procedure

The study was described as one investigating attitudes and behaviors of students as they reached the age of 21 (the legal drinking age in the United States where the data was collected). They were asked to assume that they were 21, and were planning a beer and snacks party to celebrate a friend's 21st birthday. Four common brands of beer were placed in front of them: Bud, Bud Light, Miller Light, and Heineken. For each of these brands, both a bottle and a can were placed next to each other. (Except for Heineken, which has a shorter bottle: 19.5 cm, the bottles of the other 3 brands are nearly identical; height: 23 cms. All cans are 12 cms high, and both bottles and cans contain 12 oz each). Study participants were told: "Beer is on special at the store you go to. The price for a 6 pack is $4.95."

Participants were then asked to estimate the volume of the containers: using the following question wording: "Look at the beers in front of you, and answer the following question: To the best of your ability, estimate the volume of beer in: the can of beer: _____ ounces and the bottle of beer: _____ ounces." The containers were arranged as in a display at a

market, but study participants could not actually pick them up and read off the volume information on the label. Participants were seated in a "U" shape, and the beer containers were displayed on a table in the middle of the two arms of the "U" (approximately six to twelve feets from the respondents).

Participants then rated their level of agreement (7 = agree strongly, midpoint = 4) with five statements regarding differences between bottles and cans. These were: "People prefer beer in bottles to beer in cans" ($M = 5.27$), "Beer in bottles tastes better than beer in cans" ($M = 4.63$), "Beer bottles are more expensive than beer cans" ($M = 5.36$), "People drink more beer when they are drinking cans" ($M = 4.07$), "People drink more slowly from a bottle than they do from a can" ($M = 4.29$). These attitudes show that people in general believe that beer in bottles is preferred to beer in cans and implies that if the price of the two is kept the same, then they should be willing to buy more bottles than cans – the opposite direction of our prediction.

To check whether results were invariant to method of elicitation (i.e., people may not be used to thinking in ounces, but rather just in terms of glasses, or servings, and therefore they may be more likely to make an error when asked to estimate amount using this unfamiliar unit), we directly asked for the extent of agreement with the statement: "A bottle of beer contains more than a can of beer."

Finally, to measure usage experience, participants were asked: "In an average week, how many beers do you consume?" using an open-ended response format. There were 18 non-drinkers who reported an average consumption of 0. A median split was used to categorize the remaining participants into "lighter drinkers," or those who reported consumption of 1–3 bottles in an average week ($n = 22$), and "heavier drinkers," or those who reported consumption of 4 or more bottles in an average week ($n = 18$). They then gave their age and gender and were thanked for their participation.

Results

Two participants did not complete the measures and were removed from the analysis, leaving a usable sample of 58. The sample was approximately equally split by gender (males = 27, females = 31), and reported an average age of 21.42 years (<21 years = 15, 21 years = 31, and >21 years = 13; non-report = 1). Mean reported consumption was 3.10 beers per week.

Hypothesis 1 was supported. The more elongated beer bottle was perceived to contain almost 20 percent more than the beer can (means = 12.86 oz vs. 15.38 oz; $F(1,57) = 58.11$, $p < .001$). Thus, we replicated the elongation hypothesis to the domain of differences between bottles and cans. Post-hoc analyses revealed no moderating effects of age or gender (F's < 1). At an individual level, 38 participants (65.5 percent) displayed the bias, while 19 (33 percent) did not, and 1 displayed the reverse bias. Amongst those who displayed the elongation bias, the modal difference between the bottle and the can was 4 oz ($n = 21$), followed by 2 oz ($n = 8$).

Hypothesis 2 argued that experienced users would be less biased. A 2 (package: bottle/can) × 3 (drinking behavior: non, lighter and heavier) ANOVA on volume perception, where the first factor was within-subjects and the second factor a between-subjects measured variable showed a main effect of package ($F(1,55) = 63.08$, $p < .001$). The interaction was not significant at $p < .05$ ($F(2,55) = 2.95$, $p < .06$). The elongation bias (H1) was significant for all groups. Non-drinkers estimated the beer bottle to contain over 25 percent more than the beer can ($Ms = 14.06$ vs. 17.72, $F(1,17) = 36.09$, $p < .001$), lighter drinkers estimated it as over 16 percent larger ($Ms = 12.59$ vs. 14.68, $F(1,21) = 16.86$, $p < .001$), and heavier drinkers estimated it over 15 percent larger ($Ms = 12.00$ vs. 13.89, $F(1,17) = 11.90$, $p < .005$). Age and gender did not moderate the effects. Perceived differences in bottles and cans (other than volume) did not explain the volume perception bias.[1] The effect is robust to measurement method (similar results were obtained with the responses to the agree–disagree statement regarding perceived volume of bottles vs. cans).

Discussion

Results show that bottles are perceived to contain more than cans of the same volume even when the package label provides volume information. The bias appears to be robust, holding for those with higher experience with the product category. However, a limitation of this study is that there is low variance in the measure of product category experience in the sample (primarily non-drinkers or light-drinkers). As the moderation hypothesis, H2, is an ordinal one (predicting lower effects for the more experienced group), then the "higher" experience group may be less experienced in a general sense. This implies that the results of the laboratory study with a college aged sample of students may not generalize to the overall beer drinking population. Further, Study 1 stopped at examining volume perceptions and did not test for purchase quantity. To examine the generalizability and external validity of the effect of elongation, Study 2 uses an adult sample and measures actual purchase behavior. It examines whether the effect of package shape on volume perception translates to the amount people will buy: purchase quantity of beer when purchased in bottles versus cans (H3 and H4).

Study 2: Does package shape affect purchase quantity? Scanner panel data analysis

Study 2 examines whether the volume perception bias has carryover consequences for purchase quantity in the real

---

world using an adult sample and with measures of actual sales.

Data description

We analyze scanner panel data collected by A.C. Nielsen on light beer purchases. The data covers 22,639 purchase occasions of the three major light beers (Bud Light, Miller Lite and Coors Light) from January 1997 to September 1998. Together, these three brands account for 80 percent of the total light beer market.

The data set includes brand choice, package choice, quantity purchased, whether a promotion was offered (feature or display), and price paid (incorporating whether the price was discounted or not). The major variable of interest in this paper is whether controlling for other variables (such as price and promotion), and aggregating across the three brands, consumers' purchase quantities of a 12 oz beer package differ when they purchase beer cans or bottles.

Model and results

Hypothesis 3—effect of elongation of a container on purchase quantity

We test the relationship between purchase quantity and container type while controlling for the price effect and promotion effect. We use a standard formulation (Deaton & Muellbauer 1980; Bemmaor & Mouchoux 1991) and fit the log demand model below (Model 1):

$$\log(\text{quantity}) = \beta_0 + \beta_1 \text{ bottle} + \beta_2 \text{ log(price)}$$
$$+ \beta_3 \text{ promotion} + \varepsilon \qquad (1)$$

where the dependent variable is the purchase quantity in number of cans/bottles, *bottle* is a dummy variable which takes a value of 1 if bottles are selected and 0 if cans are selected, *price* is the actual price per can/bottle, and *promotion* is a dummy variable which takes a value of 1 if there is a promotion (and 0 if there is no promotion).

We use Ordinary Least Square regression to estimate the model. The results are significant ($R^2 = .482$; $F = 6969.5$, $p < .0001$). The coefficient of price is significant and negative implying higher quantities are purchased when prices are lower ($\beta_2 = -1.835$, $t = -105.18$, $p < .0001$). The presence of a promotion has a significant and positive influence on beer purchase quantity ($\beta_3 = .017$, $t = 2.96$, $p = .003$). The intercept value is positive and significant ($\beta_0 = 1.658$, $t = 181.71$, $p < .0001$). These results are presented in Table 1 as Model 1a.

Hypothesis 3 predicts $\beta_1 < 0$, that is, a lower purchase quantity when bottles (vs. cans) are selected. As expected the coefficient of the container variable is significant and negative ($\beta_1 = -.247$, $t = -44.42$, $p < .0001$). This suggests people purchase more when they buy cans as compared to when they buy bottles. The average number of bottles purchased (9.77) is smaller than the average number of cans purchased (15.99). Thus, H3 is supported.

---

[1] A regression analysis using the difference between estimates of volume of bottles versus cans as the dependent measure, and the 6 belief statements regarding differences between bottles and cans as independent measures was significant ($F(6,51) = 4.02$, $p < .005$, $R^2 = .24$), with the only belief statement exerting a significant effect being the belief that bottles contain more than cans ($t = 4.17$, $p < .001$).

Table 1
Regression results from Study 2

Dependent variable = log (quantity)	Model 1: $\beta_0 + \beta_1$ bottle $+ \beta_2$ price $+ \beta_3$ promotion $+ \varepsilon$			Model 2 = $\beta_0 + \beta_1$ bottle $+ \beta_2$ price $+ \beta_3$ promotion $+ \beta_4$ usage*bottle $+ \varepsilon$		
	Model 1a: all observations	Model 1b: concatenated data set	Model 1c: instrument variable	Model 2a: all observations	Model 2b: concatenated data set	Model 2c instrument variable
Intercept	1.658**	1.723**	1.599**	1.670**	1.742**	1.667**
Bottle (bottle = 1)	−.247**	−.095**	−.271**	−.293**	−.141**	−.439**
log (price)	−1.835**	−1.298**	−1.959**	−1.813**	−1.258**	−1.784**
Promotion (present = 1)	.017*	.054**	.023**	.015*	.053**	.020**
Bottle × usage				.181**	.190**	.637**

Note: (a) OLS including all observations. (b) OLS including observations with equal or less than 12 cans/bottles of purchase. (c) Instrument variable approach including all observations (taking into account the endogeneity of container choice).

  * Indicates a significance level of .003.
 ** Indicates a significance level of .0001.

To summarize, using scanner data for light beer purchases, we found that when bottles were purchased, the purchase quantity was lower than when cans of the same size were purchased, holding price and promotional events constant.

H4—moderating effect of experience on the elongation effect

We ran a separate regression to include the interaction effect between usage experience and type of package indexed by β_4 (Model 2).

$$\log(\text{quantity}) = \beta_0 + \beta_1 \text{ bottle} + \beta_2 \text{ log(price)}$$
$$+ \beta_3 \text{ promotion} + \beta_4 \text{ usage} * \text{bottle} + \varepsilon \tag{2}$$

Based on people's beer purchasing history, we created a usage variable which takes the value of 1 if the individual's average purchase quantity exceeds or equals the median (12 bottles or cans) and 0 otherwise. The variable "usage*bottle" measures the interaction between usage and container (bottle/cans).[2] Hypothesis 4 predicts $\beta_4 > 0$. A positive interaction coefficient indicates that for heavy users the effect will be smaller. This is because the negative coefficient for the bottle variable (β_1) will be offset by the positive interaction coefficient for a heavy user. This would lead to an overall smaller effect of package elongation on purchase quantity for the heavier drinker of beer as compared to the lighter drinker of beer.

As shown on the right hand column of Table 1 (Model 2a), the coefficient for the usage-container interaction is significant and positive ($\beta_4 = .181$, $t = 17.12$, $p < .0001$). The *bottle* coefficient remains negative in this analysis ($\beta_1 = −.293$, $t = −47.67$, $p < .0001$). The bottle coefficient is also larger in absolute terms than the coefficient of the interaction term. This implies that there is a smaller difference in the average purchase quantity of bottles versus cans for heavy purchasers than for light purchasers. This supports Hypothesis 4.

Testing alternative explanations

As discussed earlier, there are two major supply-related factors which could have led to the same pattern of results: differential availability of large package sizes for bottles versus cans, and other intrinsic differences between bottles and cans, such as differences in materials, weight, fragility, stackability, recycling ability, etc. Both could account for higher purchase quantities for cans versus bottles, even when price and promotion are controlled.

The availability explanation

One route for consumers to get around the limited availability of larger sizes of bottles is to make multiple smaller pack size purchases. In fact, approximately ten percent of the observations in this data set, did make multiple-same-item purchases. However, if larger package sizes for cans simply cue a larger purchase quantity, a supply side explanation may still exist. To counter this explanation, we ran a separate analysis only including observations with a purchase quantity of twelve bottles/cans or less. Results replicate albeit the coefficients are smaller in size (in Model 1, $\beta_1 = −.095$, and in Model 2, $\beta_1 = −.141$; see Models 1b and 2b, Table 1, for complete regression results). An even smaller data set only incorporating a data set concatenated to purchases of six units or fewer shows that the results are robust. The beta coefficients of the container remain negative and significant in both models (in Model 1, $\beta_1 = −.0564$, $t = −7.65$), and in Model 2, $\beta_1 = −.0534$, $t = −7.11$, $p < .0001$ for both). These analyses suggest that our results are not fully explainable by supply-side issues regarding the lower availability of large package quantities for bottles versus cans, albeit supply side issues could certainly exacerbate the effect.

The intrinsic bottle-can differences explanation

Other intrinsic differences between bottles and cans could also increase the likelihood of more cans being purchased. This poses another direction of relationship between bottle/can choice and quantity purchased. Specifically, the bottle/can choice may be related to how much the person buys.

---

  [2] A model using a continuous measure of usage produced consistent results.

Therefore, we propose Eq. (3) as follows,

$$\text{bottle} = \gamma_0 + \gamma_1 \ \text{quantity} + \varsigma \tag{3}$$

Eqs. (1) and (3) form a standard structural equation problem where container choice (*bottle*) is endogenous. The problem of ignoring the endogeneity effect by running an OLS regression on Eq. (1) is that the estimate of β_1 will be biased because of the correlation between x_1 and ε (Green 1997). We used the instrumental variable approach to control for the endogeneity of container choice. Good instruments should be correlated with container choice and independent of the errors in demand Eq. (1). An easily available instrument for container choice will be the lagged container choice. After accounting for the endogeneity in container choice, all the βs remain significant and in the same direction as in the single equation model (see details in Table 1, Models 1c and 2c).

Another way of controlling for bottle vs. can differences is to divide the sample into one for bottles and one for cans. This keeps material constant within each sub-sample. Within each sub-sample, containers are categorized by height: if the height is $\geq$ the average container height within that sub-sample, then "container height" takes the value of 1; otherwise, it takes the value of 0. A negative coefficient for container height implies that lower volumes are purchased for taller than average bottles and cans. Separate regressions on the two sub-samples (bottles and cans; Model 2) using log volume as the dependent variable, container height, and oz per bottle/can as the two independent variables shows a significant negative container coefficient (bottle sample $\beta = -1.324$, $t = -39.51$, $p < .0001$; can sample $\beta = -.162$, $t = -5.87$, $p < .0001$). The other coefficients are in the same direction as before. This indicates that both in the case of bottles, and in the case of cans, fewer units of more elongated containers are purchased.

Another way of examining the robustness of the results to intrinsic differences in bottles and cans is to examine whether the results hold for the group of consumers who purchase both bottles and cans. An analysis of this group of consumers show that the results are robust: in Model 1, $\beta_1 = -.2220$ ($t = -34.54$, $p < .001$), and in Model 2, $\beta_1 = -.2886$ ($t = -36.97$, $p < .001$). Said differently, the same set of consumers purchase fewer bottles than cans per shopping trip when they purchase beer.

Discussion

Hypotheses 3 and 4 were supported. Purchase quantities are higher when cans are purchased compared to when bottles are purchased. Within each of these package shapes, purchase quantities are higher for shorter bottles (cans) than they are for taller bottles and cans. Further, consumers who purchase both, purchase fewer bottles than they do cans. Though supply side issues and intrinsic differences between bottles and cans could exacerbate these effects, they do not completely explain them.

This data was for the light beer category which may have favored our hypothesis. The effect of elongation on volume perception translates in the manner hypothesized in H3 to purchase quantity, when people's desired consumption is fixed. If drinkers of light beer wish to control their overall beer consumption more than drinkers of regular beer, they may be more likely to support our hypotheses. In the next study, we relax this constraint, and examine the effects of elongation on purchase quantity under conditions varying in terms of how much people want to consume. Further, while in this study we controlled for the effect of price and promotion and two potential supply factors, we did not control for other potential differences between cans and bottles (e.g., stackability, etc.). The next two studies attempt to control these variables, and also extend the investigation to assess the moderating role of context and desired consumption (H5).

Study 3: Virtual shopping survey: the moderating role of consumption contexts

Study 3 examines (i) whether controlling for intrinsic differences in bottles and cans, usage contexts and drinking motivation, consumers purchase more cans than they do bottles, (ii) whether consumption context moderates this effect, and (iii) whether effects hold with a sample of adult regular beer drinkers.

Method

Data description

The data comes from a field experiment conducted by Miller Brewing Company. Respondents were 842 adults selected through mall-intercepts in North Carolina ($n = 111$), Illinois ($n = 120$), Ohio ($n = 120$), Texas ($n = 120$), Florida ($n = 120$), and California ($n = 251$). The sample was constructed using the following age quota: 50 percent between age 21 to 34 (21–27 years: 25 percent; 28–34 years: 25 percent) and 50 percent between age 35 and 50. The ratio of males to females was 3 to 1 (males = 631; or 75 percent). To be included in the sample, the respondent should have drunk at least six units (bottles or cans) of 12 oz beer a week. This minimum quantity requirement ensures a sample that has experience with the product category.[3] The median weekly beer consumption was nine bottles (12 oz) and the median weekly beer expenditure was $15.

Procedure

Respondents were asked screening questions on beer consumption prior to inclusion in the sample. They were assigned to a beer-drinking context: social (home or outside), and non-social (e.g., watching TV at home) and asked to complete a simulated virtual shopping survey. Data on brand

---

[3] As experience attenuates the bias, excluding light drinkers is a strong test of the elongation hypothesis.

Table 2
Posterior mean estimates (posterior standard deviations in parentheses) from Study 3

Variables	Variable definition	Model 3 (α)	Model 4 (Γ)	
			$\beta_{container}$	β_{price}
Bottle	1 = bottle, 0 = can	**−.262 (.018)**	–	–
log (price)	log (the price per bottle or can in $)	**−.833 (.039)**	–	–
Light	1 = light beer, 0 = regular beer	.001 (.008)	–	–
Import	1 = imported beer, 0 = domestic beer	**.052 (.013)**	–	–
Premium	1 = premium beers, 0 = below-premium beers	**.184 (.011)**	–	–
Male	1 = male, 0 = female	**.105 (.020)**	−.018 (.025)	.076 (.043)
Young	1 = <35 in age, 0 = >35 in age	**.070 (.021)**	**−.062 (.022)**	**.096 (.043)**
Homesocial	1 = home social context, 0 = else	**.227 (.024)**	**−.061 (.025)**	**.181 (.053)**
Outsocial	1 = out-of-home social context, 0 = else	**.159 (.022)**	−.035 (.023)	**.105 (.050)**
Motives to consume beer elicited on a 5-point scale (1 = not at all/5 = Very).	I was thirsty	−.001 (.004)	−.005 (.009)	−.002 (.019)
	I felt stressed and wanted to relax	.005 (.004)	.000 (.009)	.033 (.019)
	I didn't think much about which beer I was drinking	.000 (.004)	−.010 (.008)	.020 (.013)
	I was enjoying the taste, color, and the aroma of beer	**−.008 (.004)**	**.012 (.005)**	−.021 (.017)
	I wanted to read the label to see what was in the beer or where it was brewed	.002 (.004)	−.002 (.008)	.004 (.016)
	I did not want to get too full on beer	.000 (.004)	−.008 (.010)	.006 (.015)
	I was happy that I got a good deal on the beer I bought	**.012 (.006)**	**−.015 (.006)**	.005 (.016)
	I was thinking about myself, my past and my future	−.002 (.004)	−.001 (.008)	−.002 (.018)
	I was having a lot of fun	**.015 (.006)**	−.013 (.011)	.009 (.15)
	I was bored	−.001 (.005)	**.016 (.007)**	**−.049 (.018)**
	I was enjoying the way the beer went with food or snacks	.003 (.005)	.009 (.009)	.019 (.017)

Note: Figures in bold indicate that zero lies outside of the 95 percent highest posterior density interval of the estimate.

choice, package choice, and purchase quantity were collected through a computer-based simulation where beer virtual shops were created to offer a real depiction of a display in the store. Respondents sat in front of the screen and made selections based on their preferences and store promotions. Within each context, respondents took six "trips" to the virtual stores and made purchases. We recorded the number of units of a 12 oz beer purchased, whether it was a bottle or a can, and recorded the price and promotional context of the purchase occasion. Respondents were also asked the reasons they like to drink beer, responding "Not at all = 1" to "Very = 5" to a set of statements including "I was bored," "I was having a lot of fun," etc.

Model description and results

Hypothesis 3 predicted fewer bottles would be purchased as compared to cans. We tested the relationship between purchase quantity and container type while controlling for the price effect by fitting Eq. (1) (which modeled the log of quantity purchased on the container shape, and the log of price) to test H3. The results were significant ($R^2 = .466$, $F = 3764.99$, $p < .0001$). The price coefficient was significant and negative, albeit displaying lower price elasticity than in Study 1, probably due to cost being less materially relevant in a simulated versus real shopping task ($\beta_2 = -.451$; $t = -32.49$, $p < .0001$). The intercept value was positive and significant ($\beta_0 = 2.645$; $t = 249.16$, $p < .0001$). As predicted by H3, β_1, the coefficient of the container variable was significant and negative ($\beta_1 = -.402$; $t = -47.68$, $p < .0001$). This replicates Study 2

results and further supports H3: larger quantities of shorter containers are purchased.

Model 3

Model 3 is based on the log demand structure tested in Model 1 but additionally controls for three product attributes (whether the beer is light or regular, imported or domestic, and premium vs. non-premium), user demographics (gender and age), usage contexts (whether home or out, and social vs. non-social), the underlying motives of beer purchase, and the unobserved heterogeneity among consumers. The model is specified as below:

$$\log (y_{hj}) = \alpha' x + \beta_h' z + \varepsilon_{hj} \qquad (4)$$

$$\beta_h = \Gamma d + v_h \qquad (5)$$

$$\varepsilon_{hj} \sim \text{iidNormal}(0, \sigma^2) \qquad (6)$$

$$v_h \sim \text{MVN}(0, D) \qquad (7)$$

Here, h indexes person and j indexes virtual shopping trip. y stands for quantity in number of cans/bottles, x is a vector of [1, bottle, light, imported, premium, log (price), gender, age, context$_{homesocial}$, context$_{outsocial}$, m1, ..., m11], z is a vector of [bottle, log (price)], and d is a vector of [gender, age, context$_{homesocial}$, context$_{outsocial}$]. Table 2 reports variable definitions. The random effects are built on bottle and log (price): the two terms whose effects are of interest to us[4].

---

[4] A model that included random effects on all variables was less parsimonious and produced worse fit.

Here the β_h is the individual's sensitivity to bottle and log of price. The model allows for the person-context descriptors (such as age, gender, and usage contexts) to moderate β_h: individual's container sensitivity and price sensitivity.

We estimate a Hierarchical Bayes random effects model, due to its flexibility in capturing observed and unobserved consumer heterogeneity. It is especially important here to model the unobserved heterogeneity because the motives under study do not completely capture the situational influence on individuals' tastes (Yang et al. 2002). The model is estimated via MCMC. Draws from the posterior distributions were used to evaluate means and standard deviations of the parameter estimates. The chain ran for 5000 iterations. The last 2000 iterations were used to obtain parameter estimates. The convergence was ensured by starting the chain from multiple points and inspecting time-series plots of model parameters.

Results support H3: purchase quantity is lower when bottles versus cans are purchased. As in the previous Model 1 analysis, the coefficient of the bottle variable was significant and negative ($\alpha_{bottle} = -.262$). Table 2 reports the estimates for the a vector for all main effects. The results are intuitive. For example, holding other variables constant, premium and imported beers generate more purchases ($\alpha_{premium} = .184$; $\alpha_{import} = .052$), males and those under 35 years tend to purchase more beer ($\alpha_{male} = .105$; $\alpha_{young} = .070$), and social situations generate more beer purchases compared with home-nonsocial situations ($\alpha_{homesoc} = .227$; $\alpha_{outsoc} = .159$). The main effect of whether the beer was heavy or light did not exert an effect, increasing the generalizability of Study 2 results (based on light beer purchase) to the population of beer drinkers.

Model 4

Model 4 differs from Model 3 as it includes the interaction between motives and sensitivity to container type and price. Specifically, d is a vector of [gender, age, context$_{homesocial}$, context$_{outsocial}$, motives to drink beer]. The two right hand columns of Table 2 report the estimates for the Gamma matrix.

H5—Interaction with usage contexts

Usage context interacted with the package shape effect as hypothesized in H5. The size of the effect was stronger when the usage context was home-social—the situation that best resembles a context where purchases reflect desired consumption. In home-social situations the effect of package shape on purchase quantity was the largest: people tended to purchase a smaller number of bottles versus cans of beer ($\Gamma_{Homesocial, container} = -.061$). The relationship between bottle and purchase quantity is the same for home-nonsocial and outside-social situations as the interaction between bottle and outside-social is not significantly different from 0.

Interaction with age

Age interacted with the effect of container shape on purchase quantity ($\beta_h = -.062$). Younger consumers (<34) were more prone to purchasing a smaller number of bottles versus cans. Using age as a proxy for experience (older consumers have more beer drinking years behind them), an age interaction can be interpreted in the context of H4, where lighter drinkers were shown to be more prone to the volume perception bias. (See the last two columns of Table 2 for complete results).

Discussion

To summarize, Study 3 replicated and extended Study 2 results using a different method and approach, controlling for intrinsic differences in bottles and cans, and contextual differences in supply, price level and promotional activity. As in Study 2, cans are associated with a higher purchase quantity as compared to bottles. Usage context and age moderated the effects. The next study attempts to replicate these effects by testing H5 using a more explicit operationalization of desired consumption level.

Study 4: Manipulating the desire to consume: a beer party experiment

Study 4 tests H5 using a laboratory experiment: manipulating motivation to consume at a high or low level, and measuring purchase quantity as well as perceived volume.

Design and procedure

We conducted a 2×2: consumption motive (heavy vs. light drinking occasion) $\times$ package shape (bottle/can) between subjects experiment. Fifty-seven students drawn from the same pool as Study 1 participated (there was no overlap between the two studies.) The average age was 21.70 years (under $21 = 11$; 21 years $= 32$, over $21 = 14$), and both genders were equally represented in the sample (males $= 28$, females $= 29$). The mean reported average consumption of beer in a week was 4.86 beers (including eighteen nondrinkers).

The cover story used was the same as in Study 1. Motivation to consume at a fixed-low or variable-high level was manipulated in the description that study participants were provided:

"You and your friends are planning a restrained [an extravagant] party to celebrate a friend's birthday. Your friend is turning 21. It is the night before [after] your final exam. The party starts at 8:00, after dinner, and is a beer and chips do. You would like to have a lot of fun, but not drink too much beer [and drink a lot of beer]. The party needs to wrap up by about 11 p.m. [2:00 a.m.]. There should be approximately a dozen people at the party. You need to purchase beer for this party. Everyone will bring some beer, but it is your responsibility to ensure that the beer does not run out before the party ends."

Package shape was manipulated in the question that participants answered: "You have been asked to buy cans [bottles]. How many cans [bottles] of beer will you purchase?"

Dependent measures

The number of units of beer purchased served as the primary dependent measure. Additionally, participants were asked to estimate the volume of beer in a can/bottle (using an open ended measure as in the Pretest and Study 1). They were then asked questions regarding their estimates of the average beer consumption at the party and the percentage of guests who would be drunk at the end of the party to serve as manipulation checks. Manipulation checks to ensure that motivation to consume beer was LOW [HIGH] was also tested by eliciting agreement on a 7-point scale to statements like: "The party will be a heavy drinking occasion," "The party will finish late," and "People will drink a lot at the party." We measured the estimated weekly consumption, age and gender as in Study 1.

Results

Manipulation checks

As expected, participants in the motivation to consume less versus more condition, agreed to a lesser extent that the party was a heavy drinking occasion ($Ms = 4.00$ vs. 5.28, $F(1,55) = 8.19, p < .01$), that it would finish late ($Ms = 4.46$ vs. 5.59, $F(1,55) = 5.36$, $p < .05$), and that people would drink a lot ($Ms = 4.26$ vs. 5.83, $F(1,55) = 13.82$, $p < .001$). The reported average consumption at the party was higher in the heavy versus light drinking scenarios ($Ms = 4.96$ vs. 3.27, $F(1,49) = 13.29$, $p < .001$), as was the estimated minimum consumption level ($Ms = .96$ vs. 1.81, $F(1,49) = 6.83, p < .05$), and the estimated maximum number of beers that would be consumed ($Ms = 5.65$ vs. $8.96, F(1,49) = 13.66, p < .001$). The estimated percentage of guests who would be drunk at the end of the party followed the same trend ($Ms = 36.19$ percent vs. 64.67 percent; $F(1,49) = 12.88, p < .001$). Thus, the manipulation worked as intended.

Beer drinking experience was used to categorize participants into non-drinkers (average = 0), with a median split (<5, 5 and >5) used to categorize the rest into lighter and heavier drinkers.

Effect of package shape on estimated volume: H1 and H2

A 2 (package: estimate of bottle/can) × 3 (drinking behavior: none, light, heavy) MANOVA where the first factor was within-subjects and the second factor a measured between-subjects variable, revealed a significant effect of package shape ($F(1,50) = 45.13, p < .001$), moderated by product category experience ($F(2,50) = 9.67$, $p < .001$). H1 was supported, replicating Study 1 results: cans were estimated to contain less than bottles ($Ms = 13.77$ oz vs. 15.72 oz). Further, the interaction was as hypothesized in H2: as people reported greater amount of beer drinking, they were less

prone to the bias: while non-drinkers ($Ms = 12.75$ vs. 16.25, $F(1,15) = 87.83$, $p < .001$) and lighter drinkers ($Ms = 12.63$ vs. 14.84, $F(1,18) = 19.17$, $p < .001$) were biased, heavier drinkers were not ($Ms = 15.89$ vs. 16.17, ns)[5]. Gender did not affect the bias (main and interaction effect $ps > .30$).

Effect of package shape on purchase quantity: H3 and H5

A 2 × 2 (package shape: bottle/can × motivation to consume: high/low) ANOVA on the number of beers "purchased" for the party, incorporating the perceived volume of a can and a bottle of beer as a covariate, showed a significant effect of motivation to consume ($F(1,47) = 32.91$, $p < .001$). This main effect reflected higher purchase amounts in the high versus low consumption scenarios ($Ms = 60.41$ vs. 38.93). The main effect of package shape was not significant, but as hypothesized in H5, moderated the effect of desire to consume (interaction $F(1,47) = 3.76$, $p < .05$). In the condition where desire to consume was low and fixed, more cans than bottles were purchased ($Ms = 40.15$ vs. 37.87), as seen in Studies 1–3. However, results reversed when the desire to consume beer was high ($Ms = 67.43$ vs. 53.87 for bottles vs. cans).

General discussion

Across four studies using a multi-method approach, our results demonstrate that: (i) elongated containers are perceived to contain more even in the context of frequently purchased products where package labels mention the actual volume of the container, (ii) the more usage experience a consumer has, the lower the effect of package elongation on volume perception and purchase quantity, (iii) in the context of multi-unit purchases, a smaller quantity of units are purchased if the package is more elongated, holding actual volume, price, promotion, and desired consumption level constant, (iv) these effects are strongest when the consumption context is a single occasion without the presence of social norms providing external anchors for purchase quantity, and (v) these effects are strongest when the desired consumption level is constant.

Methodologically, the paper uses a mix of research methods, types of data, and methods of analysis, each with its distinctive advantages and limitations, to address issues of internal and external validity across studies. Combining laboratory experiments (Study 1 and Study 4: rich in antecedent measures and with the advantage of manipulating versus measuring constructs), with field surveys (Study 3: using actual users) and scanner panel data purchase (Study 2: reflecting actual purchase behavior) allows for a simultaneous understanding of both the antecedents of a psychological effect (by identifying moderators), as well as a demonstration of

---

[5] As the median split between lighter and heaver drinkers was at 5 (Lighter = 1–5; Heavier: >5 vs. 4 in Study 1) could account for the significant interaction in Study 4 (but a robust effect in Study 1).

the consequences of the effect to a managerially relevant dependent variable: purchase quantity, in the managerially actionable domain of packaging.

Theoretical implications

The primary theoretical contribution of the paper is to demonstrate the elongation bias with frequently purchased packaged goods and demonstrate that this bias has consequences for purchase quantity decisions. Contextual differences (in consumption context) and individual differences (in product category expertise) moderate these effects. This paper adds to the literature on spatial perceptions by showing the external validity of the effects.

Consumer welfare implications

Our results show volume perception biases are strong, and affect decisions of how much to consume. If consumers are unaware of this effect, as is implied by the effect percolating into the purchase quantity decision, companies could exploit this fact. This adds to the public policy implication of Wansink and van Ittersum's work (Study 3), where they showed bartenders pour "larger" alcoholic drinks into short and wide (vs. long and slender) glasses and believe they do the reverse. In fact, there is evidence that industry practitioners know consumers are not very sensitive to small changes in volume and use this to downsize products rather than increase prices (e.g., Charmin toilet paper reduced its roll size from 500 to 380 sheets in early 1987, and later to 350 sheets without changing its price). Adams, di Benedetto, & Chandran (1991) report that less than a quarter of companies who have downsized their products, reported a negative impact of downsizing on sales.

If package labeling laws aimed at improving consumer welfare make manufacturers increase the size and prominence of the actual volume of a container, then consumers are more likely to attend to actual volume information and be less prone to volume perception biases and improve consumer welfare.

Consumers interested in reducing the actual volume of a product that they consume would also be likely to make more informed choices. This would help the public policy concern regarding the increase in obesity in society.

Managerial implications

In many product categories, the same manufacturer offers two different package shapes of the same item. Beer in bottles versus cans is one example. Others include jars versus squeeze-tubes of cosmetics, cartons versus cans of soft drinks, more rectangular versus more square cartons of ten packets of cigarettes, and glasses from a soda fountain versus prepackaged bottles or cans of soda. For such manufacturers, it is important to understand the ramifications of using similar dimensions for the same product in their product line, versus not. The results of this paper show that if the product is one where desired consumption level is fixed and multiple units are purchased at a time, then the more elongated container will have a lower purchase quantity. Managers can use this information to either make product shape changes, highlight the size of the different containers so consumers do not rely on the heuristic of elongation to make their volume decisions, or change their prices or margins across the two package shape varieties of the same product to maximize their profits.

Study limitations and areas for future research

One of the primary limitations of our research is that our operationalizations of the elongation construct used beer bottles and beer cans that do differ on a number of dimensions other than elongation. While the multi-method investigation, and the use of different controls is different studies mitigated the problem of drawing a conclusion on the basis of our results, future research could examine the issue using a more tightly controlled set of differently elongated containers. Further, our investigation was restricted to a single product category. Future research could examine if the effects we found also translate into other food and non-food related product categories such as ketchup containers, or shampoos. The potential moderating role of the ease of storage of containers could also be an issue worth investigating.

While we suggest that the differential purchase quantities for bottles and cans are contingent on the context for which beer is being purchased, we did not examine other psychographic and situational variables that could lead to the preference for one type of container over the other (e.g., would bottles be more likely to be purchased for special occasions?). This is offered as an area for future research. Another area that would be interesting to investigate is whether people's perceptions of the variance in volumes are contingent on package shape. It is possible that people believe that there is greater variance in beer bottle volumes versus beer can volumes, which could affect their volume expectations and feed into their purchase decisions. Finally, we focused on the elongation due to height. It is possible that elongation effects may also exist along a width dimension: for example, a more elongated block of cheese may be perceived to contain more than a squarer block of cheese. The issue is which dimension is more salient to the consumer. While there is some work on this area (Krider et al. 2001), examining the contextual moderators of the salience of the width versus height dimension remains an area for future research.

References

Adams, Anthony, di Benedetto, C. Anthony, & Chandran, Rajan. (1991). Can you reduce your package size without damaging sales? *Long Range Plan Planning*, *24*(4), 86–96.

Been, R. T., Braunstein, M. L., & Piazza, M. H. (1964). Judgment of volume reduction in distorted metal containers. *Journal of Engineering Psychology*, *3*, 23–27.

Bemmaor, Albert C., & Mouchoux, Dominique. (1991). Measuring the short-term effect of in-store promotion and retail advertising on brand sales: A factorial experiment. *Journal of Marketing Research*, *28*(May), 202–214.

Deaton, Angus, & Muellbauer, J. (1980). *Economics and consumer behavior*. Cambridge: Cambridge University Press.

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

Folkes, Valeries S., Martin, Igrid M., & Gupta, Kamal. (1993). When to say when: Effects of supply on usage. *Journal of Consumer Research*, *20*(December), 467–477.

Folkes, Valeries S., & Matta, Shashi. (2004). The effect of package shape on consumers' judgments of product volume: attention as a mental contaminant. *Journal of Consumer Research*, *31*(September), 390–401.

Green, William H. (1997). *Econometric analysis* (3rd ed.). Engle-wood Cliffs, NJ: Prentice-Hall.

Kesler, Lori. (1986). Grocery marketing: Successful packages turn medium into message. *Advertising Age*, *57*(53, October 13), S2–S3.

Krider, Robert E., Raghubir, Priya, & Krishna, Aradhna. (2001). Pizzas: π or square? Psychophysical biases in area estimation. *Marketing Science*, *20*(4), 405–425.

Pearson, R. G. (1964). Judgment of volume from photographs of complex shapes. *Perceptual and Motor Skills*, *18*, 889–900.

Piaget, Jean. (1967). Cognitions and conservations: Two views. *Contemporary Psychology*, *12*, 532–533.

Piaget, Jean. (1968). Quantification, conservation and nativism. *Science*, *162*, 976–979.

Piaget, Jean, Inhelder, B., & Szeminska, A. (1960). *The child's conception of geometry*. New York: Basic Books.

Prince, Greg W. (1994). The contour: A packaging vision seen through Coke-bottle lenses. *Beverage World, 113* (1567, Periscope ed., May 31), 1,6.

Raghubir, Priya, & Krishna, Aradhna. (1999). Vital dimensions in volume perception: Can the eye fool the stomach? *Journal of Marketing Research*, *36*(August), 313–326.

Schoormans, Jan P. L., & Robben, Henry S. J. (1997). The effect of new package design on product attention, categorization and evaluation. *Journal of Economic Psychology*, *18*(2), 271–287.

Sherwood, Mark. (1999). Winning the shelf wars. *Global Cosmetic Industry*, *164*(March), 64–67.

Wansink, Brian. (1996). Can package size accelerate usage volume? *Journal of Marketing*, *60*(July), 1–14.

Wansink, Brian, & van Ittersum, Koert. (2003). Bottoms up! The influence of elongation on pouring and consumption volume. *Journal of Consumer Research*, *30*(December), 455–463.

Yang, Sha, Allenby, Greg M., & Fennell, Geraldin. (2002). Modeling variation in brand preference: The roles of objective environment and motivating conditions. *Marketing Science*, *21*(1), 14–31.