PACKAGING: ARE CONSUMERS PAYING FOR PRICE DISCRIMINATION, SERVICE PROVISION OR BOTH?

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In retail stores, consumers are frequently offered choices between large and small product packages. While the economics literature has viewed package size variations primarily as a form of price discrimination, the marketing literature has viewed them as a mechanism for providing services to consumers. In this paper, we demonstrate an experimental method for measuring consumers' willingness to pay more for packaging services (e.g., small packages better preserve freshness), holding constant the volume purchased and controlling for the marginal costs of packaging and the consumer's consumption rate. Our results show that consumers vary in their willingness to pay a premium for packaging forms that preserve freshness, and that differences vary predictably across product categories, brands, and time horizons. Our approach illustrates the extent to which packaging variations can serve as mechanisms for price discrimination and service provision. Our methodology can be easily extended to other dimensions of quality in packaging.

Keywords: Packaging, Price discrimination, Service provision, Bundling, Experimental design and analysis

JEL Classification: M31, D12

1 Introduction

In retail stores, consumers are frequently offered choices between large and small packages of products such as soft drinks and cereals. Typically, the price per unit differs between large and small packages: consumers are commonly offered a quantity discount but occasionally incur a quantity surcharge for a large package relative to a small one (Agrawal, Grimm and Srinivasan 1993; Gerstner and Hess 1987; Sprott, Manning and Miyazaki 2003). Casual observation alone reveals a wide selection of packaging options available in a single grocery store for a variety of consumer packaged goods (CPG). For example, in the case of soft drinks, there is a wide selection of package choices for any one brand such as Coca-Cola. When buying roughly the same volume, consumers have the option to spend slightly more for an 8-pack of 12 oz. bottles ($3.99) than for a 6-pack of half liter bottles ($3.00).

Different explanations have been offered for these variations in price per unit across package sizes observed in stores. In the economics literature, packaging was characterized early on as a form of commodity bundling leading to third degree price discrimination (Adams and Yellen 1976). More recently, and more relevant for our purposes, it has been characterized as a form of non-linear pricing that serves as a mechanism for second degree price discrimination (Tirole 1988). That is, packaging allows manufacturers and retailers to segment consumers based on unobserved factors. By choosing a particular size of package, for example, a consumer self-selects into a price schedule, so that the same consumer may pay a different unit price depending on whether a small or large package is purchased. According to this view, consumers who pay a higher unit price do not receive more value, but experience a loss in consumer surplus relative to those who pay a lower unit price for the same product. Nevertheless, it is difficult to identify cases of price discrimination in practice because it is widely recognized in the economics

literature that to establish price discrimination, one must account for all possible relevant cost differences (e.g., Carroll and Coates 1999).

In a contrasting stream of research in the marketing literature, variations in packaging have been characterized as a mechanism for providing services to consumers that are not explicitly priced. Packaging is viewed as a mechanism for adding value to a product by increasing the functionality or 'workability' of the product (Twedt 1968). Smaller packages may increase functionality by, for example, reducing consumers' time and effort in purchasing, storing and using the product (Berry, Seiders and Grewal 2002; Granger and Billson 1972). Thus, in the marketing literature, variations in packaging are characterized not as mechanisms for price discrimination, but as a means for providing attributes valued by consumers.

While selling packages of different sizes is often conceptualized as price discrimination, this is true only if the product packaging provides no additional services to consumers (Betancourt 2004). Packaging can be viewed as a form of bundling because packaging involves grouping smaller or larger quantities of product together (e.g., eight hot dog buns in a small package, twelve in a large package). On the demand side, the distinction between packaging as price discrimination and packaging as service provision corresponds to a recent distinction made in the marketing literature between price bundling and product bundling (Stremersch and Tellis 2002). Price bundling is defined as the sale of two or more products together without any integration of the products. On the other hand, product bundling is the integration and sale of two or more different products or services, which adds value to the bundle for at least some consumers.

If the packaging of the product provides services such as keeping food fresher, selling different package sizes is more accurately characterized as product bundling. For example, if

small bottles keep cola fresher than large bottles, some consumers might be happy to pay a premium for smaller bottles, even if their purchase quantity would justify larger bottles. Thus, whether quantity discounts represent price bundling or product bundling depends on consumers' beliefs about whether additional packaging services are being provided by the package with the higher unit price. Price bundling through packaging is equivalent to pure price discrimination only if one assumes the marginal costs of packaging are constant and equal to zero. On the other hand, product bundling through packaging is equivalent to pure service provision if one assumes that the full price premium for the package can be attributed to an increase in the marginal costs of providing a service that consumers value. These distinctions are important because price bundling implies a loss of consumer surplus, but product bundling may not.

In this research, we attempt to integrate these two views of packaging by proposing a mechanism for separating the price discrimination view from the service provision view, or the extent of price bundling from the extent of product bundling. Specifically, we demonstrate an experimental method for determining the degree to which consumers are willing to pay more for packaging services. We focus on one service provided by packaging, that of preserving freshness. We illustrate that willingness to pay for smaller packages and other types of packaging devices preserving freshness depends on both the individual consumer and product characteristics.

We focus on preserving freshness, but this is not the only benefit that consumers may derive from packaging, and our approach can be extended to other benefits as well. Thus, our analysis is relevant for a wide variety of product categories beyond those in which product perishability is an important issue. Indeed, the separation of services provision from price discrimination through packaging is in principle relevant for all products in the consumer

packaged goods industry. Whether a significant part of the profits from this industry are derived from a mechanism that leads to a decrease in the welfare of consumers is an important issue. Even using a narrow definition of the industry, it contributed 1.35% to US GDP in 2003 (Grocery Manufacturers Association Report 2006).

In the next section, we review relevant research, propose hypotheses, and describe our experimental method. In Section 3, we present a pilot study and the implications of its results for designing our main experiment. Our main experiment is presented in Section 4, where we discuss our procedures and the experimental results in detail. Subsequently, in Section 5, we evaluate the economic and managerial implications of our results. We conclude in Section 6 with a brief perspective on the contributions and limitations of our analysis.

2 Distinguishing Between Price Discrimination and Service Provision

Using standard empirical methods, it is extremely difficult to distinguish between price discrimination and the value of services provided by packaging as explanations for the correlation between price and package size. Indeed, Betancourt (2004) surveys previous literature implicating price discrimination and shows that all empirical stylized facts consistent with price discrimination through packaging are also consistent with the assumption that small packages provide services such as facilitating storage of the product.

As noted in the introduction, one must account for all possible relevant cost differences to establish price discrimination in a particular situation. For instance, when selling the same quantity, using two small packages rather than one large one usually adds costs, such as additional costs of shelving, labor or refrigeration for retailers and additional costs of materials or labor for manufacturers. These additional costs could justify charging a higher unit price for

small packages, ruling out price discrimination. Because it is very difficult to measure marginal costs precisely, the empirical literature often proceeds by assuming them to be the same for different packaging alternatives (e.g., Khan and Jain 2005), finding special cases in which marginal costs approximate zero (e.g., Borzekowski, Thomadsen and Taragin 2008), or developing and estimating complex structural models that require a variety of assumptions for their implementation (e.g., Cohen 2008). One benefit of experimental research is that it allows us to control explicitly for the marginal costs of packaging.

Following previous research, we assume that consumer's willingness to pay for packaging options is based on three parameters: the consumer's rate of consumption (Khan and Jain 2005), transaction costs (e.g., going to the store to restock; Gerstner and Hess 1987) and storage costs (e.g., space to store product; Gerstner and Hess 1987). The consumer's rate of consumption may change the value of packaging services because heavy users may be less concerned about packages that maintain freshness. In our studies, we control for consumption rate by keeping the purchase volume constant, measuring the number of servings of the product participants typically consume per time period, and then testing the correlation between the number of servings consumed per period and self-reported concern for freshness. We also control for differences in willingness to pay for packaging services based on transaction and storage costs, which typically vary across consumers. In our studies, participants are asked to imagine that the grocery store is conveniently located and storage space is not a constraint, allowing us to concentrate on freshness as the main aspect of storage costs to be considered.

We use scenario-based conjoint analysis to measure the degree to which consumers are willing to pay for smaller or higher quality packages. Both advantages and disadvantages of conjoint analysis have been discussed in previous research (e.g., Green and Srinivasan 1978,

1990; Ding, Grewal and Liechty 2005). For our purposes, the most important advantage of conjoint analysis is that although consumers are not very good at estimating the relative importance of attributes like price and variations in packaging, they can easily rank product alternatives, and conjoint analysis uses product rankings to uncover the relative importance of the underlying attributes to consumers. While it is a more abstract procedure, describing products on conjoint analysis cards instead of showing consumers real products (as in Granger and Billson 1972) offers several advantages: unit prices are explicitly provided, different package sizes are viewed as bundles of the same product rather than as altogether different products, it allows us to avoid aesthetic considerations such as more or less attractive packaging for small vs. large packages, and it allows us to vary sizes and package types without the constraint of real products' availability.

Because there may be many reasons why consumers are willing to pay more for smaller packages, we manipulate two aspects of packaging in our main experiment: package size and package quality. Smaller packages may preserve freshness or enhance the ease with which consumers can store the product, use the product, or dispose of the packaging, for example. In contrast, our manipulation of package quality is narrowly focused on preserving freshness (e.g., a resealable package instead of a non-resealable package), but should have less impact on factors such as ease of storage, use, or disposal. Manipulating both package size and package quality helps us to evaluate the extent to which differences in package size and differences in package quality have similar effects on preferences. Due to our focus on the packaging service of preserving freshness, we compare willingness to pay for packaging services for product categories that vary in their perishability. We propose the following hypotheses:

H1: Holding constant the volume of product purchased, consumers differ in the degree to which they are willing to pay for packaging services that preserve freshness.

H2: Product category moderates willingness to pay for packaging services. Consumers should be more willing to pay for packaging services that preserve freshness in product categories that are highly perishable (vs. less perishable).

H3: Time horizon moderates willingness to pay for packaging services. Consumers should be more willing to pay for packaging services that preserve freshness in highly (less) perishable product categories when the time horizon is short (long) vs. when the time horizon is long (short).

In addition to testing our formal hypotheses, we also designed our main experiment to examine the relationship between willingness to pay for name brands and willingness to pay for packaging services, and the relationship between willingness to pay for smaller packages and willingness to pay for higher quality packages. If consumers who are more willing to pay for name brands are also more willing to pay for packaging services, this increases the potential for price discrimination by name brands. If consumers who prefer small packages also prefer high quality packages, these attributes are complements rather than substitutes.

3 Pilot Study: Choosing Package Size for Soft Drinks

Prior research suggests that in at least some product categories, package size matters only because consumers care about the volume of product purchased (e.g., Khan and Jain 2005). The goal of this pilot study was to test Hypothesis 1, which proposes that holding the volume of

product purchased constant, at least some consumers will be willing to pay a higher unit price for a smaller package size. Moreover, we wanted to link willingness to pay for smaller package size with concern about freshness in the soft drinks product category.

In this study, participants rank ordered their preferences for soft drinks packaged in small, medium and large bottles. Although the package size, price, and price per ounce varied across alternatives, the total number of servings (total volume) was constant across alternatives (e.g., participants compared four 0.5 liter bottles to two 1 liter bottles and to a 2 liter bottle).

3.1 Participants and Procedure

Ninety-two undergraduate students were asked to imagine that they were spending their own money at the grocery store. They were given a set of six conjoint analysis cards printed with information about each alternative's brand, price and package size. Participants stacked the cards so that their most preferred alternative was on the top of the pile and their least preferred alternative was on the bottom of the pile. In so doing, they made tradeoffs between package size and brand (Coke or Pepsi) and between package size and unit price. Reflecting real market conditions, smaller bottles had a higher price per ounce than larger bottles and Coke and Pepsi were priced the same.

After rank ordering the alternatives, participants estimated their typical consumption rate ("How many servings of soft drinks do you usually have per week? (1 serving = 1 cup = 8 ounces)"). They also rated their degree of concern about freshness ("I often have a problem with soft drinks going flat after the bottles are opened" and their view of package size as a means of addressing this concern "Using small bottles helps to keep soft drinks from going flat") using a seven-point scale. Finally, they answered demographic items.

3.2 Results and Discussion

Using the six rankings provided by each participant as the dependent variables, we ran a regression for each participant in which brand (Coke vs. Pepsi) and package size (2 liter bottle, two 1 liter bottles or four .5 liter bottles) were the independent variables. The coefficients of these regressions allowed us to classify participants based on their willingness to make tradeoffs between brand and package size.

Looking at the individual level data, package size was clearly important to many consumers: 57% of the participants rank ordered their cards based on package size before brand, while only 43% ordered on brand before package size. Averaging the standardized beta coefficients across participants shows that in general, participants considered package size more important (average $\beta = -.36$) than brand (average $\beta = -.20$).

Overall, 68% of the participants preferred Coke over Pepsi (table 1). Supporting Hypothesis 1, 29% (almost one third of the participants) preferred to pay a higher price per ounce for smaller bottles rather than a lower price per ounce for larger bottles. There was also an interesting difference across brands in preferences for small packages. A Chi square test ($X^2(91) = 4.94$, $p < .05$), shows that significantly more Coke drinkers were willing to pay a higher unit price for small bottles (37%) than Pepsi drinkers (14%).

Insert tables 1 and 2 here

One issue to address is whether these results suggest that some participants were more concerned with freshness than others, or whether they simply reflect differences in consumption rate. To provide insight into this issue, we analyzed the correlations between the conjoint

analysis coefficients and our self-report measures (table 2). Notably, coefficients for package size are positively and significantly correlated with both of the measures "I have a problem with soft drinks going flat" and "Using small bottles prevents soft drinks from going flat". This suggests that greater concern with freshness and a belief that smaller packages keep products fresher motivated participants to prefer smaller bottles.

In contrast, coefficients for package size were not positively correlated with self-reported consumption rates, allowing us to rule out the alternative explanation that the heaviest users prefer the largest packages. Furthermore, the correlation between self-reported consumption rate and self-reported concern for freshness was not significant, suggesting that there was no systematic relationship between consumption rate and concern for freshness.

In summary, holding volume purchased constant, participants clearly made tradeoffs between package size and price, highlighting the importance of package size to many consumers. Furthermore, the trade-offs elicited by the experiment were consistent with participants' self reported concerns about freshness. Those participants who reported a high degree of concern about soft drinks going flat systematically chose smaller bottles. In contrast to earlier literature assuming that consumers' package size preferences are linked only to consumption rate, these results suggest that consumers also care about package size as a means to preserve freshness.

One limitation of this study is that we use package size as a proxy for package quality. While small packages are the primary means for maintaining freshness for soft drinks, it is possible that participants are choosing small packages for reasons other than the greater freshness they provide. To address this concern, we vary package size and one dimension of package quality (package types that preserve freshness) separately in our main experiment. Another limitation of this study is that price serves as a proxy for package size and quality with

no reference to the marginal costs of packaging options. To address this concern, we introduce a low-priced store brand in our main experiment. Participants are told that although the store brand charges more for smaller packages or for higher quality packages, these price differences only defray the increase in marginal costs associated with the packaging.

4 Experiment: Comparing Choices of Package Size and Type Across Product Categories When Marginal Costs Differ

In our main experiment, we focus on the role of freshness as a motivating factor in package selection. We use two different manipulations of packaging services: package size and package types that preserve freshness. To further assess whether willingness to pay more for smaller packages and higher quality packages is related to concerns about freshness, we compare two different product categories that differ in perishability, and we manipulate consumers' time horizons as they consider the packaging options. Because the literature on packaging has traditionally focused on issues of price discrimination, we also test whether name brands can charge more for packaging services than low price store brands.

4.1 Participants and Design

Participants were 170 undergraduate students, who were randomly assigned to cells of a 2 product category (cold cuts, cereals) x 2 time horizon (short, indefinite) x 2 order (cold cuts first, cereals first) mixed design. Product category was manipulated within-subjects and time horizon and order were manipulated between subjects.

Cold cuts and ready-to-eat cereals were chosen as the product categories because cold cuts require refrigeration but cereals do not, and the shelf life of cold cuts is perceived to be shorter than that of cereals. Thus, we expected participants to be more concerned about freshness for cold cuts than for cereals. A pretest with graduate students ($N = 33$) confirmed a belief among consumers that both unopened ($M_{\text{cold cuts}} = 30.12$ days vs. $M_{\text{cereal}} = 327.21$ days, $t(32) = 7.63$, $p < .001$) and opened ($M_{\text{cold cuts}} = 7.76$ days vs. $M_{\text{cereal}} = 62.33$ days, $t(32) = 3.52$, $p = .001$) cereals have a longer shelf-life than cold cuts.

We varied both package size and one dimension of package quality. For cold cuts, packages were either resealable or non-resealable. For cereals, packages either had two small freshness bags or they had one large freshness bag. To test whether high reputation brands can charge more for packaging services, we included two high price name brands (Oscar Mayer and Tyson for cold cuts; General Mills and Kellogg's for cereals) and one store brand for each product category. We also created a price structure such that the high price name brands charged a higher premium for smaller packages and higher quality packages than the low price store brand. The stimuli are presented in Appendix 1.

To manipulate time horizon, participants in the short time horizon condition were told "As you walk through the store, you remember that a week from now, you will be leaving town for several days." This statement was absent for participants in the indefinite time horizon condition. We chose a time horizon of one week because our pretest showed that once opened, cold cuts (cereals) are believed to have a shelf life of about one week (two months).

4.2 Procedure

Participants were asked to imagine they had moved to an apartment in a new city for a

summer job. To control for transaction and storage costs other than freshness, participants were told that they lived close to the store and storage space was not constrained. They were told they would be consuming the products by themselves. To control for assumptions about the marginal cost of packaging, all participants read: "Please assume that when the store brand charges more for a particular kind of packaging, they are covering their additional costs for the packaging, but they are not making any additional profit. However, this may not be the case when General Mills or Kellogg's [Oscar Mayer or Tyson] charge more for a particular kind of packaging."

After completing the conjoint task for the first product category, participants completed the second conjoint analysis task. Next, they responded to questions about their consumption rate and concern about freshness for each product category. Finally, they answered demographic items.

4.3 Results and Discussion

As predicted, participants were more concerned about freshness for cold cuts ($M = 3.87$) than for cereals ($M = 3.51$; $F(1, 169) = 4.46$, $p < .05$). Using the nine and twelve rankings of the alternatives provided by each participant as the dependent variables, we ran a regression for each product category for each participant in which price, package size, package type and brand were the four independent variables. The coefficients of these regressions allowed us to classify participants based on their willingness to make tradeoffs between high price brands, package size and package quality.

Insert tables 3 and 4 here

Overall, for cereals (table 3), participants preferred the high price brands to the store brand (64.71% vs. 35.29%), large packages to small packages (82.35% vs. 17.65%), and low quality packages to high quality packages (65.89% vs. 34.11%). For cold cuts (table 4), the majority of participants preferred the high price brands over the store brand (62.35% vs. 37.65%), and high quality packages to low quality packages (71.77% vs. 28.23%), but they were indifferent between large and small packages (50.59% vs. 49.41%). As in the pilot study, participants varied in the degree to which they valued freshness. Variation in individual preferences within both product categories supports Hypothesis 1.

We also checked for consistency between the results of the conjoint analysis and the self report measures by looking at the correlations between each participant's coefficients for the options providing freshness and their self reported concern with freshness. These measures are reported in Appendix 2. For cold cuts, concern for freshness was correlated with preferences for smaller ($r = .21$, $p < .001$) and higher quality packages ($r = -.20$, $p < .001$). For cereals, concern for freshness was correlated with preferences for higher quality packages ($r = -.28$, $p < .001$).[1] Appendix 2 also allows us to evaluate the relationship between self-reported measures of consumption rate, i.e., the number of weekly servings, and self-reported concerns about freshness. For both cereals and cold cuts, correlations between consumption rate and concerns about freshness are nonsignificant, suggesting that concern for freshness is not serving as a proxy for frequency of consumption.

4.3.1 Moderation by Product Category

First, we compared participants' willingness to pay more for small packages across product categories. Because each participant ranked alternatives for both cold cuts and cereals, we used McNemar's test of correlated proportions to test for differences in the proportion of

[1] Smaller (larger) packages were coded as one (zero), and higher (lower) quality packages were coded as zero (one).

consumers with particular preferences across product categories. Supporting Hypothesis 2, more consumers were willing to pay a premium for small packages for cold cuts (84 of 170, 49%) than for cereals (30 of 170, 18%; McNemar's $p < 0.001$), after accounting for individual differences in participants' concern with package size. This is consistent with participants' self-reported willingness to pay for small packages, which was higher for cold cuts ($M = 5.11$) than cereals ($M = 4.14$, $F(1,169) = 35.85$, $p < .01$).

Next, we tested for differences across product categories in participants' willingness to pay for package types that preserve freshness. Paralleling the results for size and supporting Hypothesis 2, more consumers were willing to pay a premium for high quality packaging for cold cuts (122 out of 170 or 72%) than cereals (58 out of 170 or 34%; McNemar's $p < 0.001$), accounting for individual differences in concern with package quality. This is consistent with participants' self-reported willingness to pay for quality packaging, which was higher for cold cuts ($M = 5.97$) than cereals ($M = 5.25$, $F(1,169) = 32.55$, $p < .01$).

4.3.2 Moderation by Time Horizon

Next, we tested the degree to which time horizon moderated willingness to pay for freshness in highly perishable product categories. Combining the data across brands, a loglinear analysis of the resulting three-way contingency table for cold cuts demonstrates that preferences for large, low quality packages were more prevalent in the indefinite time horizon condition, while preferences for small, high quality packages were more prevalent in the short time horizon condition, $G^2(4) = 31.58$, $p < .001$. Participants choosing small (large) packages were also more likely to choose high (low) quality packages, $G^2(1) = 26.68$, $p < .001$. No other effects were significant (ps > .14).

For cereals, the same loglinear analysis shows that participants were more willing to pay for high quality packaging in the indefinite than in the short time horizon condition, $G^2(1) = 4.66$, $p < .05$. No other effects were significant (ps > .05). Thus, supporting Hypothesis 3, time horizon moderates the effect of product category on willingness to pay for packaging that preserves freshness. For cold cuts, a short time horizon led to preferences for smaller, high quality packages, while for cereals, the indefinite time horizon led to greater willingness to pay for high package quality. As expected, while neither package size nor quality is perceived to maintain the freshness of cold cuts for more than about a week, the perishability of cereals matters only in the indefinite time horizon condition.

4.3.3 Correlations Among Attributes

We also tested for correlations in consumers' tendencies to prefer high price brands, high quality packaging and small packages in a highly perishable product category. Combining the data across time horizons, a loglinear analysis of the resulting three-way contingency table for cold cuts shows that those who preferred high quality packages were more likely to prefer small packages ($G^2(1) = 26.68$, $p < .001$). Thus, small packages and high quality packages seem to behave as complements rather than as substitutes in the provision of freshness.

In addition, those who preferred high price brands were more likely to choose high quality packaging ($G^2(1) = 17.30$, $p < .001$) and small packages ($G^2(1) = 13.82$, $p < .001$). These two-way interactions were qualified by a three-way interaction showing that those who preferred high price brands tended to choose both high quality packaging and small packages ($G^2(4) = 49.56$, $p < .001$). This is particularly notable due to the high price brands' higher price premium for packaging services and our explicit statement that this price premium may exceed marginal

costs. In contrast to the results for cold cuts, the same loglinear analysis for less perishable ready-to-eat cereals showed no significant effects (ps > .11).

4.3.4 Disentangling Price Discrimination from the Provision of Services

Our analysis suggests that some participants are willing to pay more for smaller and higher quality packages, and that some participants are willing to pay more for name brands. Our next step is to assess the degree to which these participants are paying for second degree price discrimination and the degree to which they are paying for services provision. The following analysis refers to the data in table 5.

To be conservative, we assume that name brand products may be perceived to be higher in quality than store brand products, justifying the price premium paid for name brand products. Thus, the first row of the table for both cold cuts and ready-to-eat cereals indicates zero price discrimination for name brand products when a large, low quality package is chosen. Similarly, there is no premium paid for service provision when a large, low quality package is chosen. However, recall that the stimuli included price premia for smaller and higher quality packages, and that these premia were higher for name brand products than for store brand products (e.g., the difference in price between a small and large package was greater for name brand products than for store brand products). To control for inferences about the quality of packaging provided by the name brands relative to the store brands, participants were told explicitly that the price increases charged by store brands for smaller or higher quality packages were equivalent to their marginal cost increases, but that this might not be the case for the name brands. This design allows us to explicitly separate price discrimination from price increases due to services provision.

Insert table 5 here

For each package type, table 5 shows the percentage of participants choosing this package type and the store brand (column 1) and the percentage of participants choosing this package type and the name brand (column 3). Those choosing the store brand are paying only marginal costs to receive greater packaging services. For example, those choosing a small, low quality package of store brand cold cuts (row 2 of panel A) are paying $.60 more ($6.09 - $5.49) for the smaller package, and because the price increase is equal to marginal costs, the price increase can be fully attributed to services provision. In contrast, those choosing a small, low quality package of name brand cold cuts are paying $.60 more for services provision as well as an additional $.50 ($6.59 - $6.09) that can be attributed to price discrimination. Because participants were faced with discrete options in the experiment, the prices associated with each option represent an estimate of the lower bound to what a participant is willing to pay for that option. Some participants may be willing to pay more for the option. The experiment simply indicated their willingness to pay at least as much as indicated in table 5.

One limitation is that although we asked participants to assume that package quality was identical for store brands and name brands, participants may have believed that the name brands provided higher quality packaging improvements than the store brand (e.g., that the resealable packages provided by the name brands were more effective for keeping cold cuts fresh than those provided by the store brand). If this is the case, we may be showing an upper bound for price discrimination. However, while this argument may apply to high quality packages, it is less applicable to smaller size packages, because package size is a less ambiguous attribute.

5 Economic and Managerial Implications

5. 1 Economic Implications

Our experimental results provide several useful economic insights. First, they show that in all three product categories we tested, willingness to pay a premium for smaller package sizes and higher quality packages varies across consumers and is related to their concern about freshness. Given that some participants value freshness more than others, this variation provides opportunities for price discrimination. Second, in our main experiment, some participants were willing to pay more than marginal cost for packages that preserve freshness. This opens up the possibility of price discrimination for these consumers. For instance, table 5 shows that 55% of the participants were exposed to the possibility of price discrimination for cold cuts and 28% were for cereals. Third, our data also illustrates that name brands increase consumers' willingness to pay for packaging services that preserve freshness when products are highly perishable. Fourth, and more generally, we show not only that consumers vary in their willingness to pay a premium for smaller package sizes and higher quality packages, but also that these differences vary predictably across product categories, brands, and time horizons.

Both direct and indirect measures from our studies show that consumers believe different sizes and types of packages provide services such as enhancing freshness. For example, using direct measures, 69.4% of the participants in our main experiment responded 5 or higher on a seven-point scale when asked if they agreed smaller packages help keep cold cuts fresh, and 87.6% responded 5 or higher when asked if resealable packages help keep cold cuts fresh. The indirect measures produced by the conjoint analysis and summarized in table 5 show, for example, that 49% of participants were willing to pay a higher unit price for smaller packages of

cold cuts, and 72% were willing to pay more for resealable packages. Thus, our results provide support for the argument that different package sizes and types may provide value to consumers rather than acting solely as an instrument for price discrimination.

Regarding price discrimination, table 5 shows that 38% (11%) of the participants were (not) willing to expose themselves to price discrimination due to their valuation of small size packages for cold cuts. Similarly, 52% (20%) were (not) willing to expose themselves to price discrimination due to their high valuation of high quality packages for cold cuts. For cereals, on the other hand, only 11% (7%) were (not) willing to expose themselves to price discrimination due to their valuation of small size and 22% (12%) were (not) willing to expose themselves to price discrimination due to their valuation of high quality packages. More generally, while 23% of participants did not indicate a preference for a packaging option to preserve freshness for cold cuts, 56% of participants did not indicate a preference for a packaging option to preserve freshness for cereals.

It is interesting to compare our results with two recent analyses of consumer purchase data for small and large package sizes. Cohen (2008) showed that consumers tend to choose small packages of paper towels with a higher unit price more frequently than large packages. Similarly, Khan and Jain (2005) show that consumers tend to choose small packages of analgesics with a higher unit price more frequently than large packages. In contrast, the majority of our participants preferred large packages, whether the category was soft drinks, ready-to-eat cereals or cold cuts. Because we control for the volume purchased, our study design removes one of the key advantages offered by smaller packages, a lower total price (Khan and Jain 2005).

5.2 Managerial Implications

Of special interest to managers may be that our results imply opportunities to profit from providing packaging services for consumer packaged goods due to predictable variations across product categories and brands as well as across consumers. For at least some product categories, consumers seem to care a lot about the freshness provided by packaging services, and are willing to pay higher unit prices for it. For name brands, in particular, it appears that higher profits could be made by offering packaging options that preserve freshness.

For instance, table 5 shows that 9% of participants are willing to pay at least 16.4% of the base price of the cheapest packaging option for small size and high quality through the store brand in the case of cold cuts. Moreover 35% of participants are willing to pay at least 27.3% of the base price of the cheapest packaging option for small size and high quality through name brands in the case of cold cuts. Because these numbers are lower bounds for willingness to pay, they suggest abundant profit opportunities to be exploited by name brands and store brands in pricing packaging options for cold cuts. In the case of cereals, however, these profit opportunities are scarce. For example, table 5 shows that only 5% (3%) of participants are willing to pay at least 62.6% (37.6%) of the base price of the cheapest packaging option for small size and high quality through the name brands (store brand).

More generally, similar experiments using packaging dimensions other than freshness, such as ease of storage, ease of package disposal, and ease of product removal, could be undertaken. Our conjoint analysis methodology can be used by managers and easily extended to measure consumers' willingness to pay for packaging functions specific to their own product categories. Conjoint analysis is widely used in industry, and available software packages make it relatively easy to analyze the results (Green and Srinivasan 1990).

6 Concluding Remarks

Our main contributions in this paper fall into several different categories. First, we have integrated two different streams of literature on packaging: namely, the one emphasizing packaging as a mechanism for price discrimination and the one emphasizing packaging as a mechanism for providing services valued by consumers. Second, we have demonstrated that preserving freshness is a valued attribute in several product categories and that it can be provided in different fashions. While this may be obvious to practitioners, we are not aware of any investigations of this issue in the academic literature on packaging. Third, we have provided a method for separating the provision of services through packaging from its use as a price discrimination device. This method can be extended to a wide variety of applications in the CPG industry. Finally, from a normative perspective, we have shown that store brands which offer packaging services desired by consumers may increase consumer welfare by reducing opportunities for price discrimination. A similar conclusion applies to other low price brands.

These results do have several potential limitations worth noting. First, our studies were conducted with undergraduate students, and we used only three product categories. Nonetheless, the product categories we chose were familiar to our participants, and we chose them to represent different levels of concern about freshness. The fact that our participants made consistent tradeoffs in the conjoint analysis and differentiated between product categories in the predicted manner suggests they took the experimental task seriously. That said, it would be helpful to replicate these findings for consumers making real rather than hypothetical choices (Ding et al. 2005). Second, we controlled for consumption rate by measuring the number of servings consumed per week, but we did not measure frequency of consumption; both factors may influence willingness to pay for packaging services. Because the number of servings did not

differ across time horizon conditions, and because the correlation between number of servings and concern for freshness was nonsignificant in both time horizon conditions, however, we do not believe differences in frequency of consumption can explain our results. Third, although we explicitly stated that store brands charged their marginal costs for packaging services in the experiment, and that high price brands may have been charging more than marginal costs, participants may have believed that high price brands incurred higher costs (or delivered higher freshness) for the same packaging services. Finally, although we based our price premia for smaller packages and for higher quality packages on market prices, it would be helpful to examine the sensitivity of our results to larger or smaller price increases.

Appendix 1: Stimuli Used for Experiment

Conjoint analysis cards for cold cuts:

Cold Cuts L Oscar Mayer One 16oz. non-resealable package Price: $5.79 Price per oz.: $.36 Number of servings: 16	**Cold Cuts V** Tyson One 16oz. non-resealable package Price: $5.79 Price per oz.: $.36 Number of servings: 16	**Cold Cuts O** Store brand One 16oz. non-resealable package Price: $5.49 Price per oz.: $.34 Number of servings: 16
Cold Cuts Q Oscar Mayer Two 8oz. non-resealable packages (total 16oz.) Price: $6.59 Price per oz.: $.41 Number of servings: 16	**Cold Cuts K** Tyson Two 8oz. non-resealable packages (total 16oz.) Price: $6.59 Price per oz.: $.41 Number of servings: 16	**Cold Cuts U** Store brand Two 8oz. non-resealable packages (total 16oz.) Price: $6.09 Price per oz.: $.38 Number of servings: 16
Cold Cuts N Oscar Mayer One 16oz. resealable package for freshness Price: $6.29 Price per oz.: $.39 Number of servings: 16	**Cold Cuts R** Tyson One 16oz. resealable package for freshness Price: $6.29 Price per oz.: $.39 Number of servings: 16	**Cold Cuts M** Store brand One 16oz. resealable package for freshness Price: $5.79 Price per oz.: $.36 Number of servings: 16
Cold Cuts P Oscar Mayer Two 8oz. resealable packages for freshness (total 16oz.) Price: $6.99 Price per oz.: $.44 Number of servings: 16	**Cold Cuts T** Tyson Two 8oz. resealable packages for freshness (total 16oz.) Price: $6.99 Price per oz.: $.44 Number of servings: 16	**Cold Cuts S** Store brand Two 8oz. resealable packages for freshness (total 16oz.) Price: $6.39 Price per oz.: $.40 Number of servings: 16

Conjoint analysis cards for ready-to-eat cereals:

Cold Cereal L General Mills One 30oz. box with one 30 oz. freshness bag inside Price: $5.39 Price per oz.: $.18 Number of servings: 27	**Cold Cereal P** Kellogg's One 30oz. box with one 30 oz. freshness bag inside Price: $5.39 Price per oz.: $.18 Number of servings: 27	**Cold Cereal O** Store brand One 30oz. box with one 30 oz. freshness bag inside Price: $4.79 Price per oz.: $.16 Number of servings: 27
Cold Cereal Q General Mills Two 15oz. boxes, each with 15 oz. freshness bag inside (total 30oz.) Price: $7.79 Price per oz.: $.26 Number of servings: 27	**Cold Cereal K** Kellogg's Two 15oz. boxes, each with 15 oz. freshness bag inside (total 30oz.) Price: $7.79 Price per oz.: $.26 Number of servings: 27	**Cold Cereal S** Store brand Two 15oz. boxes, each with 15 oz. freshness bag inside (total 30oz.) Price: $6.59 Price per oz.: $.22 Number of servings: 27
Cold Cereal N General Mills One 30oz. box with two 15 oz. freshness bags inside (total 30oz.) Price: $6.59 Price per oz.: $.22 Number of servings: 27	**Cold Cereal R** Kellogg's One 30oz. box with two 15 oz. freshness bags inside (total 30oz.) Price: $6.59 Price per oz.: $.22 Number of servings: 27	**Cold Cereal M** Store brand One 30oz. box with two 15 oz. freshness bags inside (total 30oz.) Price: $5.69 Price per oz.: $.19 Number of servings: 27

Appendix 2: Correlations among Coefficients and Self-Report Measures in Main Experiment

Ready-to-Eat Cereals	Coefficient for Brand Reputation	Coefficient for Size	Coefficient for Brand	Coefficient for Quality	Servings Per Week	"Problem with stale"	"Using small boxes"	"Using freshness bags"
Coefficient for Brand Reputation[a]	1.0							
Coefficient for Size[b]	-.15 (p = .05)	1.0						
Coefficient for Brand[c]	-.48 (p < .01)	-.02 (p = .85)	1.0					
Coefficient for Quality of Package[d]	.06 (p = .44)	.24 (p < .01)	-.02 (p = .77)	1.0				
Number of Servings Per Week	-.05 (p = .51)	.12 (p = .14)	-.01 (p = .97)	.13 (p = .08)	1.0			
"Have problem with cereals getting stale"[e]	-.18 (p < .05)	-.04 (p = .57)	.12 (p = .12)	-.28 (p < .01)	-.08 (p = .31)	1.0		
"Using small boxes…"[e]	-.11 (p = .15)	.07 (p = .39)	.02 (p = .79)	-.16 (p < .05)	-.16 (p < .05)	.36 (p < .01)	1.0	
Using freshness bags…"[e]	-.16 (p < .05)	-.06 (p = .43)	.11 (p = .14)	-.15 (p = .06)	-.15 (p = .06)	.24 (p < .01)	.42 (p < .01)	1.0

[a] Higher coefficients indicate preference for store brand; coding of variables: General Mills or Kellogg's = 1, store brand = 0
[b] Higher coefficients indicate preference for small packages; coding of variables: 30 oz. box with one bag or 30 oz. box with two bags = 1, two 15 oz. boxes = 0
[c] Higher coefficients indicate preference for Kellogg's or store brand; coding of variables: General Mills = 1, Kellogg's and store brand = 0
[d] Higher coefficients indicate preference for lower quality packages; coding of variables: 30 oz. box with 2 bags or two 15 oz. boxes = 1, one 30 oz. box = 0
[e] Responses were reported using a 1-7 scale where 1 = disagree, 7 = agree

Cold Cuts	Coefficient for Brand Reputation	Coefficient for Size	Coefficient for Brand	Coefficient for Quality	Servings per Week	"Problem with freshness"	"Using small packages"	"Using resealable packages"
Coefficient for Brand Reputation[a]	1.0							
Coefficient for Size[b]	-.35 ($p < .01$)	1.0						
Coefficient for Brand[c]	-.29 ($p < .01$)	.11 ($p = .15$)	1.0					
Coefficient for Quality[d]	.21 ($p < .01$)	-.44 ($p < .01$)	.06 ($p = .44$)	1.0				
Servings Per Week	.13 ($p = .10$)	-.09 ($p = .27$)	-.05 ($p = .49$)	.12 ($p = .12$)	1.0			
"Have a freshness problem with cold cuts"[e]	-.06 ($p = .43$)	.21 ($p < .01$)	-.07 ($p = .35$)	-.20 ($p < .01$)	.08 ($p = .33$)	1.0		
"Using small packages…"[e]	-.06 ($p = .43$)	.20 ($p = .01$)	-.03 ($p = .70$)	-.06 ($p = .41$)	.07 ($p = .34$)	.30 ($p < .01$)	1.0	
"Using resealable packages…"[e]	-.11 ($p = .15$)	.06 ($p = .44$)	.04 ($p = .61$)	-.18 ($p = .02$)	.01 ($p = .91$)	.20 ($p = .01$)	.38 ($p < .01$)	1.0

[a] Higher coefficients indicate preference for store brand; coding of variables in regression: Oscar Mayer or Tyson = 1, store brand = 0
[b] Higher coefficients indicate preference for small packages; coding of variables: one 16 oz. package = 1, two 8 oz. packages = 0
[c] Higher coefficients indicate preference for Tyson or store brand; coding of variables: Oscar Mayer = 1, Tyson and store brand = 0
[d] Higher coefficients indicate preference for nonresealable packages; coding of variables: resealable packages = 1, nonresealable packages = 0
[e] Responses were reported using a 1-7 scale where 1 = disagree, 7 = agree

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Table 1: Classification of Participants Based on Preferences for Brand and Package Size (Pilot Study)

	Coke	Pepsi	Total
Small Package	23	4	27
Large Package	40	25	65
Total	63	29	92

Table 2: Correlations Among Coefficients and Self-Report Measures (Pilot Study)

	Coefficient for Size	Coefficient for Brand	Servings Per Week	"Problem with flatness"	"Using small bottles"
Coefficient for Package Size[a]	1.0				
Coefficient for Brand[b]	-.18 (p = .09)	1.0			
Servings Per Week	-.01 (p = .89)	.03 (p = .75)	1.0		
"Have a problem with flatness"[c]	.21 (p < .05)	-.03 (p = .76)	.19 (p = .07)	1.0	
"Using small bottles prevents flatness"[c]	.30 (p < .01)	-.06 (p = .58)	-.06 (p = .58)	.04 (p = .68)	1.0

[a] Higher beta coefficients indicate preference for small packages; coding of variables: 2 liter bottle = 2, two 1 liter bottles = 1, four .5 liter bottles = 0

[b] Higher beta coefficients indicate preference for Pepsi; coding of variables: Coke = 1, Pepsi = 0

[c] Responses were reported using a 1-7 scale where 1 = disagree, 7 = agree

Table 3: Classification of Participants Based on Preferences for Brand Reputation, Package Size and Package Type for Ready-To-Eat Cereals

		Low Quality Package		High Quality Package		Low Quality[a]	High Quality[a]	Large Package[b]	Small Package[b]
	Brand Reputation (Price)	Large Package	Small Package	Large Package	Small Package				
Short Horizon	High	36	6	10	5	42	15	46	11
	Low	13	5	6	0	18	6	19	5
Long Horizon	High	27	4	18	4	31	22	45	8
	Low	20	1	10	5	21	15	30	6

N = 170 participants.

[a] Totals in the Low (High) Quality Package column are summed across Small Package and Large Package columns.

[b] Totals in the Large (Small) Package column are summed across Low Quality Package and High Quality Package columns.

Table 4: Classification of Participants Based on Preferences for Brand Reputation, Package Size and Package Type for Cold Cuts

		Low Quality Package		High Quality Package		Low Quality[a]	High Quality[a]	Large Package[b]	Small Package[b]
	Brand Reputation (Price)	Large Package	Small Package	Large Package	Small Package				
Short Horizon	High	6	3	15	31	9	46	21	34
	Low	10	4	5	7	14	12	15	11
Long Horizon	High	7	2	14	28	9	42	21	30
	Low	16	0	13	9	16	22	29	9

$N = 170$ participants.

[a] Totals in the Low (High) Quality Package column are summed across Small Package and Large Package columns.

[b] Totals in the Large (Small) Package column are summed across Low Quality Package and High Quality Package columns.

Table 5: Disentangling Price Discrimination and Provision of Services

A. Premia for Price Discrimination and Provision of Services for Cold Cuts

Package type	Percent choosing store brand and this package type	Premium attributed to service provision[a]	Percent choosing name brand and this package type	Premium attributed to price discrimination[b]
Large and low quality	15%	0 (0/5.49)	8%	0 (0/5.79)
Small and low quality	2%	9.9% (.60/6.09)	3%	7.6% (.50/6.59)
Large and high quality	11%	5.2% (.30/5.79)	17%	7.9% (.50/6.29)
Small and high quality	9%	14.1% (.90/6.39)	35%	8.6% (.60/6.99)

B. Premia for Price Discrimination and Provision of Services for Ready-to-Eat Cereals

Package type	Percent choosing store brand and this package type	Premium attributed to service provision[a]	Percent choosing name brand and this package type	Premium attributed to price discrimination[b]
Large and low quality	19%	0 (0/4.79)	37%	0 (0/5.49)
Small and low quality	4%	NA[c]	6%	NA[c]
Large and high quality	9%	15.8% (0.90/5.69)	17%	13.7% (0.90/6.59)
Small and high quality	3%	27.3% (1.80/ 6.59)	5%	15.4% (1.20/7.79)

N = 170 participants.

[a] Measured as the increase in price for improved packaging relative to the large standard package for the store brand, keeping purchase volume constant.

[b] Measured as the increase in the price charged for improved packaging for the name brand relative to the store brand, keeping purchase volume constant (e.g., the increase in price for a small package relative to a large package of the name brand less the increase in the price for a small package relative to a large package of the store brand product).

[c] This package type did not exist among the alternatives in the stimuli. For ready-to-eat cereals, small packages were always high quality packages.