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Competitive Package Size Decisions☆

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Abstract

In the consumer packaged goods (CPGs) industry, consumers base their purchase decisions in part on package size because different package sizes offer different levels of convenience. The heterogeneous preference for package size allows manufacturers to use package size as a competitive tool in order to raise margins in the face of higher production costs. By competing in package sizes, manufacturers may be able to soften the degree of price competition in the downstream market, and raise margins accordingly. In order to test this hypothesis, we develop a structural model of consumer demand, and manufacturers' joint decisions regarding package size and price applied to supermarket chain-level scanner data for the ready-to-eat breakfast cereal category. While others have argued that manufacturers reduce package sizes as a means of raising unit prices in a hidden way, we show that package size and price are strategic complements – downsizing intensifies price competition, which does not allow manufacturers to raise unit prices through package downsizing. Therefore, package downsizing does not yield a desirable outcome for manufactures. On the other hand, retailers benefit from package downsizing, as it leads to lower wholesale prices, and higher category profits.
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1. Introduction

Consumer packaged goods (CPGs) face very public scrutiny when they reduce package sizes, yet keep shelf prices constant (Poulter 2013). According to McIntyre (2011), Heinz reduced the size of some of its ketchup products by an average of 11 percent, Kraft reduced the amount of crackers in its Nabisco Premium saltines and Honey Maid graham crackers boxes by 15 percent, and PepsiCo reduced the size of its half-gallon cartons of Tropicana by 8 percent, all while either keeping the package-price the same, or increasing it (in the PepsiCo case by 5–8 percent). Reducing package sizes as a means of raising retail unit-prices may be a rational response by manufacturers to the expectation that consumers tend to respond more sharply to package-prices than unit-prices (Çakır and Balagtas 2014), but ignores the strategic nature of changing package sizes. Rather, it is more likely that oligopolistic manufacturers take into account not only consumer responses to a change in package size, but responses by rivals. In this study, we examine package-size changes from a strategic perspective, and show that the implications can be dramatic.

Other researchers consider demand-side motivations for changing package sizes, but not cost or strategic reasons. Because few consumers have perfect recall of package sizes or unit prices, they tend not to compare unit prices over time or among products (Binkley and Bejnarowicz 2003; Granger and Billson 1972; Raghubir and Krishna 1999; Russo 1977). Accordingly, manufacturers may change package sizes, and hence unit prices, without changing the shelf price as a means of passing along higher costs. Çakır and Balagtas (2014) find that manufacturers change package sizes, rather than price, because consumers tend to ignore changes in unit-prices. However, they do not account for the fact that package size decisions are endogenous, and strategic. Ignoring the endogeneity of package-size changes is not trivial, because, if prices and package

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size are strategic complements, then package-size reductions by one firm are no longer simply price increases that are likely to be ignored. Rather, other firms may reduce prices, leading to sharper price competition, and perhaps even lower prices.

If consumer demand depends at least in part on package size, and products sold by different manufacturers are substitutable, then manufacturers are likely to use package size as a strategic variable. Consumers exhibit heterogeneous preferences for package size depending on their consumption rate, storage cost, transaction cost, and marginal utility from increased consumption (Gerstner and Hess 1987; Subramaniam and Gal-Or 2009). Therefore, manufacturers often differentiate on the basis of package size in order to attract particular market segments. For example, Kelloggs offers Special K in some 11 different package sizes, while General Mills sells Cheerios in 24 others. By offering different package sizes, they attempt to avoid direct price comparison with substitute products (Anderson, De Palma, and Thisse 1992).

Empirical evidence shows that if firms in oligopolistic markets have multiple decision variables – price and non-price variables – they tend to compete in non-price variables, but collude in price. This is true for a range of variables, from investment in R&D and capacity (Brod and Shivakumar 1999; Davidson and Deneckere 1990; Fershtman and Gandal 1994), advertisement (Dixit and Norman 1978; Slade 1995), promotion (Richards 2007), line extension (Kadiyali, Vilcassim, and Chintagunta 1998), product-line length (Draganska and Jain 2005), product assortment (Draganska, Mazzeo, and Seim 2009), location in geographic space (Friedman and Thisse 1993; Thomadsen 2007), and location in attribute space (Jehiel 1992; Seim 2006). In each case, non-price variables can serve as strategic tools that change the nature of price competition. Despite its prominence in product design, and salience to consumers, competitive package sizing has received little attention in the literature.

We frame our hypothesis regarding manufacturers' choices of price and package size in a structural model of consumer demand, production cost, and manufacturers' optimal response to package-preferences. On the demand-side, we explicitly account for package-size preferences. By conditioning manufacturer decisions on consumer preferences for different package sizes, we ensure that manufacturer decisions are optimal responses with respect to their expectations on how consumers will react. On the supply-side, oligopolistic manufacturers jointly set package size and wholesale prices and retailers set retail prices taking into account consumer demand, manufacturer and retailer costs, and competition in package size and price. Retailers are assumed to pass-through manufacturers' package size decisions and set retail prices. Following Slade (1995), Besanko, Gupta, and Jain (1998) and Sudhir (2001), we assume that retailers act as local monopolists once consumers have chosen a particular store. Estimating a structural model is not only necessary to avoid bias and inconsistency in our econometric estimates (Villas-Boas and Zhao 2005), but by doing so we are able to estimate the extent of strategic interaction among manufacturers in the upstream market.

We apply our empirical framework to supermarket chain-level scanner data for the ready-to-eat breakfast cereal category for a major US metropolitan market. We find that package size decisions by manufacturers reflect both consumer preferences, and competition in both price and package size. Manufacturers tend to reduce package sizes in response to higher costs as a means of mitigating the potential negative impact on profits. However, shrinking packages to pass along higher costs is only part of the story. Rather, changing package sizes is costly, and changing in package sizes incites strong price competition. Therefore, the incentive to change packages is much more constrained than previously thought, and often not in manufacturers' interests at all.

We contribute to the empirical marketing literature by endogenizing joint package size and price decisions. We show that strategic considerations are as important to manufacturers as consumers' responses to smaller package sizes. On a substantive level, we show that when manufacturers change package sizes, they respond not only to consumer preferences, but to the structure of packaging costs, and the nature of rivalry in their industry. As a consequence of the destructive price-competition they incite, package changes are infrequent.

Our findings have practical implications for both manufacturers and retailers. For manufacturers, the observation that package size and price are strategic complements means that downsizing can be expected to lead to lower competitor prices, more intense price competition, and lower margins. For retailers, lower wholesale prices, if passed through to consumers, may lead to more aggressive price competition and lower margins downstream as well. On a practical level, retailers that have adopted rigorous pricing algorithms will have to reoptimize pricing and promotion schedules following a downsizing. Further, if more intense rivalry among manufacturers results in lower profits, then they will be less likely to fund trade promotions or other allowances – off-invoice items that traditionally form a substantial part of total retail profits.

The remainder of this paper is organized as follows. In the second section, we provide a brief review of the relevant literature on package size choices, packaging costs, and the strategic nature of package-size decisions. In the third section, we describe a structural econometric model designed to test our hypotheses regarding the strategic role of package sizes in consumer-good pricing, and how the model is estimated. In the fourth section, we describe the data, and present some stylized facts drawn from our sample that motivates this study. In the fifth section, we present the estimation and simulation results and discuss how package size affects consumer demand, production costs, and competition in the market and the equilibrium relationship between package size and price. We draw conclusions, explain some fundamental implications for firms and regulators in the CPGs industry, and describe potential extensions in the final section.

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