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Dual effect-based market segmentation and price optimization ☆

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ABSTRACT

Price has two distinct effects on consumers' evaluations of products, namely sacrifice and informational effects. No pricing models exist that explicitly account for this dual effect of price. This article combines insights from behavioral research on the dual effect of price with a model of market segmentation and price discrimination among segments. The authors propose a method for market segmentation that is based on the degree to which consumers attend to the informational and sacrifice effects of price and combine the segment-level parameter estimates with a model of price optimization. An empirical study using seven different product categories provides evidence in support of the robustness and relevance of the proposed approach. The results show that the dual effect-based approach captures consumers' price preference structures more precisely than a segmentation on the basis of the commonly measured total effect of price and thereby enables sellers to increase their profits.

1. Introduction

Setting prices for products represents one of the most critical decisions for both manufacturers and retailers (Gijsbrechts, 1993). In order to set prices optimally, marketers must account for consumers' (heterogeneous) price reactions on the basis of economic and behavioral considerations, product costs, and—if applicable—competition (Estelami & Maxwell, 2003; Levy, Grewal, Kopalle, & Hess, 2004). Therefore, developing an appropriate pricing strategy is both crucial and highly complex and has prompted an extensive stream of research on pricing principles, strategies, and tactics. To increase profitability, marketers typically engage in some form of price discrimination, that is, they attempt to exploit consumer heterogeneity through differential pricing strategies (Gijsbrechts, 1993).

Most pricing models take as an essential input consumer response to changes in price. Two distinct effects, discussed as the "dual role of price" by previous research (e.g., Erickson & Johansson, 1985; Lichtenstein, Ridgway, & Netemeyer, 1993; Voelckner, 2008), drive this price response, namely, sacrifice and informational effects of price. The sacrifice effect, which stems from classic economic theory, refers to a consumer's evaluation of the amount of money that he or she must sacrifice to satisfy his or her consumption needs. In this respect, price generates disutility, and higher prices decrease consumer surplus because consumers must pay more for the product. Previous research suggests two potential sources of the sacrifice component of price: allocative effects and transaction utility. The former indicates the basic way of viewing price as a monetary constraint and varies, among others, with consumers' price consciousness and price mavenism (e.g., Erickson & Johansson, 1985; Lichtenstein et al., 1993). The latter represents the incremental utility associated with a "good deal" which varies, among others, with consumers' value consciousness as well as sales and coupon proneness (Lichtenstein et al., 1993). Contrary to classic economic theory, however, consumers do not always buy the lowest priced product in a category, even when the products are otherwise similar. One behavioral explanation, supported by empirical evidence, is that consumers perceive prices as quality cues and assume a positive association between price and quality. Thus, higher prices may indicate higher quality and thereby increase consumers' perceived utility, which in turn results in a positive price elasticity of demand (Rao & Monroe, 1989). Other potential, but usually less significant sources of the informational effect of price relate to feelings of prestige and status higher prices signal to other people and egocentric desires to make oneself a present (e.g., Lichtenstein et al., 1993; Voelckner, 2008).

Despite strong empirical evidence that both sacrifice and informational effects drive consumer response to changes in price, pricing literature has not discussed the implications of this dual effect of price for price discrimination and optimization decisions (Dixit, Whipple, Zinkhan, & Gailey, 2008; Monroe, 2003; Nagle & Hogan, 2006; Phlips, 1989). This gap in the literature may be because no (empirical) price optimization models exist that explicitly account for the dual effect of price (i.e., the

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sacrifice and informational effects of price). This paper attempts to fill this important research gap by combining insights from behavioral research on the dual effect of price with a model of price optimization among consumer segments. The focus of this article, thus, is not on developing a new method for measuring the different effects of price; rather this paper uses the dual role of price to identify market segments and optimizes prices on the basis of these segments.

Specifically, this paper makes two key contributions. First, the paper introduces a new method for market segmentation that is based on the degree to which consumers attend to the informational and sacrifice effects of price (i.e., dual effect-based segmentation) and provides empirical evidence that the dual effect-based segmentation approach captures consumers' price preference structures more precisely than a segmentation on the basis of the commonly measured total effect of price. Second, the paper explores whether and how companies can exploit the informational effect of price to increase their profits by combining the proposed dual effect-based segmentation approach with a model of price optimization among consumer segments in which the seller offers a menu of product versions and consumers self-select from this menu. Because the relationship between price and perceived quality largely depends on disaggregated behavior and beliefs, it seems plausible that price discrimination policies that consider consumer heterogeneity in terms of the informational effect of price could lead to different profit implications than commonly applied procedures that do not account for this aspect. Profitability simulations illustrate the profit implications of the dual effect-based segmentation and price optimization approach. In addition, the paper identifies market segments on the basis of the commonly measured total effect of price (i.e., total effect-based segmentation), determines the menu of product alternatives that maximizes the seller's profit, and compares the results. The study's findings show that the dual effect-based approach yields more clearly separated, robust segments than a segmentation approach on the basis of the total effect of price and thereby enables sellers to increase their profits.

2. Related previous research

The relationship between price and quality has received great attention in pricing research. Empirical research on the link between price and product quality consists of two streams: (1) studies investigating the "objective" relationship between price and quality levels and (2) those analyzing their perceived association. Studies of objective quality, such as analyses of consumer report data, show only weak correlations between price and objective quality levels (Gerstner, 1985). Even though some empirical evidence indicates that price–objective quality correlations increase with the level of consumer information (Tellis and Wernerfelt 1987) and weaken over time (Curry & Riesz, 1988), researchers consistently agree that this relationship lacks practical significance (Lichtenstein, 2005).

Studies on the relationship between price and perceived quality have produced mixed results due to differences in study design, definitions of the core constructs, and methodological difficulties (Gijsbrechts, 1993; Rao & Monroe, 1989). However, the vast majority of studies document the existence of an informational effect of price and identify individual and product category-related factors that influence the perception and use of price as a quality indicator (Dodds, Monroe, & Grewal, 1991; Kardes, Cronley, Kellaris, & Posavac, 2004; Mitra, 1995). Individual factors refer, for example, to the relevance of search time and the level of product knowledge on the part of the consumer, whereas examples of product category factors include the levels of product complexity and category prices.

Recently, a few studies have developed an approach to measure the informational and total effects of price in a conjoint analysis setting (Rao & Sattler, 2003). The method requires collecting data from two scenarios. One scenario is subject to a budget constraint (total effect of price) and the other is not (informational effect of price). The difference between the total and the informational effects of price then identifies the sacrifice effect of price. Empirical tests provide evidence that the methodology is able to separately estimate the two distinct effects of price. Recent research has extended the basic methodology to a choice-based conjoint setting, which reveals preferences by examining discrete choice behavior (Voelckner, 2008).

Surprisingly, although previous research provides strong evidence that consumers use price as an indicator of product quality, the question of how marketers might use the informational effect of price to develop market segments and optimize prices remains unaddressed. Rather, price optimization and discrimination models are based on microeconomic assumptions and only account for the sacrifice effect of price (Nagle & Hogan, 2006; Simon, 1989). Price optimization models that rely on price response functions usually do not include behavioral detail (Leeflang & Wittink, 2000). Some studies account for reference price effects in price optimization (e.g., Natter, Reutterer, Mild, & Taudes, 2007), but reference price effects also fall into the sacrifice effect of price. Erdem, Keane, and Sun (2008) measure the impact of quality signaling effects of prices in their structural model, but do not study and recommend a price optimization and discrimination approach accounting for this effect. Further, price optimization and discrimination based on disaggregate choice or conjoint models have accounted for behavioral detail, but not for the dual effect of price either (Gilbride & Allenby, 2004; Zhang & Jedidi, 2002).

3. Method

3.1. Measuring the sacrifice and informational effects of price

The separation of the two distinct effects of price builds on the methodology proposed by Rao and Sattler (2003), but simultaneously measures the informational and sacrifice effects of price.[4] This paper's approach therefore requires the collection of discrete choice data from three different scenarios to capture the (1) total, (2) informational, and (3) sacrifice effects of price. That is, each respondent is exposed to the following three scenarios:

First scenario (total effect of price). Respondents accomplish choice tasks with the assumption that they must pay the quoted price ("Assume you have to pay the full price shown"). This scenario is commonly used for conjoint measurement settings. Because this setting does not distinguish between the sacrifice and the informational effects of price, it measures the total effect of price.

Second scenario (informational effect of price). Respondents view the same choice sets as in the first scenario but assume that a third party will pay the shown price ("Assume you don't have to pay for the product. Your supermarket has its anniversary and therefore gives away the product for free"), which eliminates the sacrifice effect of price. The informational effect of price, however, remains constant in this scenario as previous studies show that free gift frames maintained quality perceptions (Darke & Chung, 2005). If the price still exhibits an effect, that effect likely constitutes informational effects.

Third scenario (sacrifice effect of price). Respondents receive additional information from an established and highly regarded consumer report company. These consumer report cards state that the products presented in a choice set are identical in terms of quality. Thus, the price can no longer serve as an indicator of quality, so it measures the pure sacrifice effect of price.

The rationale for this approach is that the magnitude of the sacrifice effect should relate inversely to the amount of budget the consumer retains after purchasing the product and disappear if the product is free

[4] Rao and Sattler (2003) model the total and informational effects of price and identify the sacrifice effect of price as the difference between these two effects. In contrast, this paper explicitly measures both the informational and the sacrifice effects of price using a gift scenario (informational effect of price).