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Price as an Indicator of Quality: Implications for Utility and Demand Functions

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Abstract

Consumers often infer quality information from prices and rely on their reference prices. This paper incorporates both behavioral regularities into the classic utility function. The analytical investigation reveals five qualitatively different types of consumers, three of which are relatively new to modeling literature. The authors test the model's theoretical insights using a new experimental method, random allocation of scarce inventories (RASI), which is designed to align people's incentives, such that they state their true rank order preferences. The results support the existence of five different types of consumers; the authors discuss the managerial implications for pricing strategies.

Keywords: Price and quality; Utility functions; Incentive alignment; Analysis

Introduction

Contrary to classic economic theory, consumers do not always buy the lowest priced product in a category, even when the products are otherwise similar.[3] One behavioral explanation, supported by empirical evidence (Leavett 1954; Lichtenstein and Burton 1989; Monroe and Krishnan 1985; Rao 1984, 1993; Rao and Monroe 1988; Schindler 1991; Stiving 2000), suggests that consumers infer information (e.g., quality) from price. As a result, price appears to play two opposite roles—allocative and informational—in consumers' purchasing decisions (Rao and Sattler 2000; also see Gabor and Granger 1966). On the one hand, higher price decreases consumer utility, because they must pay more for the product. On the other hand, higher price may induce higher quality perceptions, which increase utility (Monroe and Krishnan 1985). Intuitively, this complex relationship may lead to a nonmonotonous (individual) utility function over price, which then should create an (aggregate) demand function that is not necessarily downward sloped, as assumed ubiquitously in literature and practice.[4]

Understanding the shape of the demand function is fundamental to managerial decisions, because an incorrect assumption about its shape leads to suboptimal decisions. In addition, a firm may suffer if it assumes a single type of demand function when several types actually mark different consumers. Ignoring such consumer demand heterogeneity will deprive the firm of opportunities to optimize its marketing mix and compete effectively with other firms in the market. Despite anecdotal evidence of more complicated demand functions, the classic

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[3] This complex relationship should be evident to anyone who has looked for a book from an online bookstore. Consider a recent search for *Ender's Game* by Orson Scott Card as an example: Amazon.com carried the book new for $6.99 but also offered used copies from 47 affiliated sites, varying in price from $2.98 to $6.99; new copies from 19 affiliated sites, varying in price from $3.91 to $6.99; and collectible copies, including a first edition, from three sites, varying in price from $5.15 to $6.95. There seems to be little or no difference among the options except for price, and Amazon guarantees the reliability of all sites. The mere existence of such a variety of prices implies that at least some people have more complicated utility functions.

[4] Following convention, we define a utility function as one person's preferences for a given product according to some of its characteristics (e.g., price); the demand function is the number of units of a product that a market will demand (purchase) at a given price level.

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downward-sloping assumption predominates in both research and practice (cf. Stiving 2000, who assumes a kinked demand curve). This predominance may persist because no alternative shapes have been proposed for demand functions or tested in rigorous research. We attempt to fill this important research gap by making four key contributions.

First, we develop a parsimonious, analytically tractable, behavior-based analytical model to serve as a descriptive theory of consumers' utility functions. Instead of studying demand directly, we focus on the consumer's utility functions and make inferences about demand, based on the aggregation of the utility functions. The proposed model builds on classic utility theory, augmented with two well-documented behavioral regularities (BRs): (1) consumers infer quality information from a product's price and (2) consumers have a reference price for a given product. This new formulation captures two opposing effects of price, product heterogeneity in terms of both value and the information content of price, and consumer heterogeneity in terms of the degree to which they attend to the information content of price and their reference price for the product category. By developing a model based on behavioral regularities, we offer an alternative formulation of consumers' responses to prices, which analytical modelers may use to specify a model that is more realistic than the standard downward-sloping demand curve.

Second, our model is more realistic in that it is more useful; it explicitly identifies five types (four main types and one subtype) of consumers for a given product, each with a qualitatively different utility function. Two types are well known in prior literature, namely, those who follow a classic downward-sloping curve and those who prefer a medium price overall. Both utility function types previously have been identified empirically (Ofir 2004; Rao and Sieben 1992; see also, for a much different context, Suri and Monroe 2003), and models exist to represent each, though perhaps not at the same time. However, three additional types remain relatively novel, if not completely unknown, particularly in modeling literature. The third type refers to a strictly upward-sloping utility function; these consumers prefer a medium price when the inflection point for the utility function is not within the range of extant price points. The fourth and fifth types begin with a downward-sloping segment, shift to an upward-sloping segment, and end with another downward segment (graphically, they look like inverted Ns). The two utility functions differ only with regard to whether the consumers' most preferred price is 0 or not. For modeling purposes, once empirically verified, our model offers a technique that captures various different types of utility functions.

Third, we propose a new experimental procedure that enables researchers and practitioners to obtain an incentive-compatible preference rank order of alternatives, which in turn provides a means to test various shapes of functions empirically. The use of an incentive-compatible experimental procedure is important; existing literature demonstrates that subjects' stated preferences differ systematically from their revealed preferences and are poor predictors of their actual behavior (Ding 2007; Ding, Grewal, and Liechty 2005; Ding, Park, and Bradlow 2009). The proposed procedure, which we designate the random allocation of scarce inventories (RASI), allocates a limited number of alternatives to a large set of consumers on the basis of their stated preference rank order, such that each consumer has some probability of receiving any product in the category. As a result, it fully motivates consumers to provide a truthful ranking of their preference structure. This new experimental procedure also may be valuable in contexts other than measuring utility functions; for example, a researcher could use it to elicit a consumer's ranked consideration set.

Fourth, we provide strong empirical evidence that the vast majority of consumers can be captured by the five types of utility functions identified in our model. Using our proposed experimental procedure, we conduct an experiment with six different types of food in the context of purchasing a lunch combination. Respondents receive money, which they may use to buy (or not buy) real foods and then consume them. The results from the experiment demonstrate: (1) the existence of all five shapes of utility functions; (2) the relative infrequency of the downward-sloping utility function; (3) the relative preponderance of the utility function that prefers a medium price; (4) individuals exhibiting different utility function have statistically significantly different levels of product involvement for the product categories such that the less uncertain the customer is, the more concerned with price as a sacrifice he or she also is; and (5) utility functions that behave substantially differently from the simple downward slope assumption common in literature and practice. Together, these results provide strong support for the usefulness of our model and for the empirical validity of its theoretical insights.

The rest of this article is organized as follows: In the next section, we discuss the theoretical model and illustrate some key insights. Then, we describe an experiment designed to test our key theoretical insight, namely, the existence of four different types of consumers and the complexity of the demand function. We conclude and point to several research directions in the last section.

Theoretical model

We develop a parsimonious model that mathematically incorporates price-oriented behavioral regularities (BRs) into a classic utility theory model. Our purpose is not to study the scenario in which price serves as credible signal (Bagwell and Riordan 1991; Shoemaker et al. 2003; Stiving 2000) but rather to investigate the scenario in which price could be considered "cheap talk" (i.e., sellers may choose a price without incurring other costs). Our research also differs from existing literature that makes the firm the target of analysis and assumes consumers' demand function (e.g., Stiving 2000); instead, we investigate how consumers react to different prices and identify different utility functions. Our objective therefore is to investigate the impact of BRs on the characteristics of the utility function, as well as its ramifications for demand functions. We first develop our proposed model by augmenting classic utility theory with two relevant and well-documented BRs; afterward, we investigate the theoretical properties of the new utility func-