Pricing Prototypical Products

Wilfred Amaldoss*  Chuan He†

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*Professor of Marketing, Fuqua School of Business, Duke University, Durham, NC 27708; email: wilfred.amaldoss@duke.edu.
†Associate Professor of Marketing, Leeds School of Business, University of Colorado, Boulder, CO 80309; email: chuan.he@colorado.edu.
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Abstract

When we think of colas, Coca-Cola first comes to mind. Products such as Cola-Cola, Tide laundry detergent and Chapstick lip balm are the prototypical products in their respective categories. Over three decades, research in consumer psychology has accumulated evidence on how prototypicality structures memory, shapes the composition of consideration set and influences purchase decision. Yet there is no research on how it affects the competitive behavior of firms in a horizontally differentiated market. For example, some prototypical products are lower priced than other products in their category, whereas in certain other categories the prototypical product is higher priced. Using a novel model, we make an initial effort to examine theoretically the impact of prototypicality on the pricing decisions of firms competing in a horizontally differentiated market. Our analysis shows that when consumer valuations are low, the prototypical product charges a lower price and yet earns more profits compared to other products in the category. However, when consumer valuations are high, the rank order of the prices of the prototypical product and a nonprototypical product is reversed, but not the order of profits. We subject these predictions to an empirical test. The experimental results lend support for the qualitative predictions of the model.

Keywords: Prototypical Product, Pricing, Competition, Experimental Economics, Game Theory.
INTRODUCTION

A well-established finding in consumer psychology is that people organize information about products in categories to facilitate decision making (See Loken, Barsalou and Joiner 2008 for a recent review). Further, an individual product in a category may be regarded as the prototypical exemplar of the category (Medlin and Shaffer 1978, Alba and Hutchinson 1987). For example, Time magazine and Coca-Cola are the prototypical exemplars of their categories (Nedungadi and Hutchinson 1985). Moreover, the prototypical product of the category is likely to feature in a consumer’s consideration set and influence her purchase decision (Nedungadi and Hutchinson 1985). While the extensive research on categorization helps us to gain a nuanced understanding of how a prototypical product influences consumer choice, there is no research on how it may affect the competitive behavior of firms in a horizontally differentiated market. For example, should a firm charge a higher or a lower price for a prototypical product? We see some prototypical products, such as Pillsbury cake mix and Charmin bath tissue, being sold at a higher price compared to the nonprototypical products in their category. On the other hand, some prototypical products, such as Chapstick lip balm and Gillette shaving cream are priced lower compared to other products in their category. In this paper we take an initial step toward understanding how the notion of prototypicality can shape the pricing behavior of firms in a horizontally differentiated market.

Consider a product category where consumers tastes are very diverse and they seek $N$ different varieties. There are $n$ ($2 \leq n \leq N$) horizontally differentiated firms with each firm offering a single product, and thus all the different varieties sought by consumers may not be available. One of the products is viewed as the prototypical exemplar of the category, and this prototypical product is more likely to be included in consumers’ consideration sets. Consistent with Rosch (1973) and Nedungadi and Hutchinson (1985), prototypicality does not affect attitude toward a product or its valuation. To facilitate analysis, we incorporate this notion of prototypicality into the spokes model (Chen and Riordan 2007). On studying the equilibrium behavior of competing firms, we obtain two key results. First, some of us may expect the prototypical product to be higher priced. Perhaps, one might think that the prototypical product could take advantage of its higher salience by charging a higher price. Counter to this view, our analysis shows that the prototypical product will be lower priced when consumer valuations are low. To appreciate the intuition for this result, note
that consumers’ tastes are diverse and that all the varieties sought by consumers may not be available. Therefore, some consumers, whose first-preferred product is not available, need to make do with the second-preferred product in their consideration set. Further, because of diversity in consumers’ tastes, the proportion of consumers who consider a given product as their first-preferred product is smaller compared to those who regard it as their second-preferred product. This motivates each firm to cater not only to consumers who view its product as their first choice, but also to those who consider its product as their second choice. As the prototypical product is more salient in consumers’ minds, it is more likely to be included in the consideration set of most consumers. As such, the prototypical product derives a larger fraction of its demand from consumers who view it as the second-preferred product. In this context, when consumer valuations are low, the prototypical product needs to be sufficiently low priced so that it can attract consumers whose first choice is not available and for whom the prototypical product is their second choice. The same argument applies to a lesser extent to the nonprototypical products as they are unlikely to be the second-preferred product of as many consumers. Therefore, it is profitable for the prototypical product to be the lower priced product in a category.

Second, some may argue that the prototypical product should be higher priced than a nonprototypical product because a prototypical product is of higher perceived quality. Can we observe a higher priced prototypical product even in the absence of any quality difference? Our analysis suggests that in product categories where consumer valuation is high, the prototypical product may be priced higher than a nonprototypical product. As discussed earlier, the prototypical product is included in the consideration set of most consumers and a larger fraction of its demand comes from consumers who view it as the second-preferred product. It is indeed quite an appealing choice, especially for consumers whose first-preferred product is not available. However, there is no need to aggressively cut its price to attract these consumers, because the base valuation of the product is high. As such, the prototypical product is motivated to charge a higher price. A much smaller fraction of the demand for a nonprototypical product comes from such captive consumers, and hence it charges a lower price. Thus, when consumer valuation is high, it is profitable to sell the prototypical product at a higher price compared to other products in its category.

**Related Literature.** The seminal work of Rosch (1973, 1975) on prototypicality has stimulated a large body of work in psychology and marketing (See Loken et al. 2008 for
a review). Rosch’s early work shows that categories have an internal structure, with some members being more representative of the category than others. Medin and Shaffer (1978) argue that the prototype stored in memory is a specific example of category rather than an abstract average of the features of the members in the category. On extending this stream of research to consumer products, Nedungadi and Hutchinson (1985) show that some products are prototypical of their respective categories. Moreover, the probability of the prototypical product being included in consumers’ consideration set is higher. This view of prototypicality does not involve any affective evaluation of the product (see Cohen 1982). Carpenter and Nakamoto (1989) argue that if consumers’ preference are weak, a pioneering brand can draw consumers’ ideal point toward it, raise the valuation of the pioneer and come to be viewed as the prototypical product of the category. Thus, consumer learning can help explain pioneering advantage in mature markets. This advantage can protect the pioneering brand from low-priced me-too products. In keeping with Nedungadi and Hutchinson (1985) but unlike Carpenter and Nakamoto (1989), in our formulation the prototypicality of a product influences the likelihood of being included in the consideration set, but does not change product valuation.

To the best of our knowledge, prior research has not examined the strategic implications of prototypicality in a horizontally differentiated market. In the context of e-commerce, He and Chen (2006) study how being a featured store can affect the store’s price. They show that the featured store charges a higher price than any non-featured store, if consumers simultaneously search for homogeneous products. In contrast to this finding, Armstrong, Vickers and Zhou (2009) show that the prominent firm will charge a lower price than its non-prominent rivals if consumers search sequentially in a horizontally differentiated market. In our model, consumers do not search. We show how the relative price of the prototypical product of a category is moderated by consumer valuation.

Our work is related to the literature on horizontal product differentiation. The standard linear city model, although parsimonious, is not suitable for studying a product category with \( n > 2 \) firms. On the other hand, the circular city model allows for multiple products, but competition is local in that a small change in a firm’s price only affects its neighboring firms, not the other firms in the market (Salop 1979). Another drawback of the circle model is that symmetry necessitates incumbent firms to relocate in the product space upon the entry of a new firm. As our model builds on the spokes framework, there is no need to change the
location of the incumbents when a new firm enters the market (Chen and Riordan 2007). Moreover, each firm is in direct competition with all other firms in the market.

The rest of the paper is organized as follows. Section 2 lays out the model and analyzes the equilibrium prices of the prototypical product and a nonprototypical product under low and high consumer valuations. Section 3 confronts our main theoretical predictions with data from two tightly controlled laboratory studies. Finally, Section 4 concludes by summarizing the findings and outlining some directions for further research.

THE MODEL

**Spokes Model.** Consider a product category where consumers seek \( N \) different varieties. Firms offer only \( 2 \leq n \leq N \) varieties, implying that all the varieties sought by consumers may not be available. We model this product market as a spokes network on a plane (Chen and Riordan 2007, Amaldoss and He 2010). Consumers preferring variety \( i \) (\( i = 1, 2, \ldots, N \)) are represented by a line \( l_i \) of length \( \frac{1}{2} \). Furthermore, consumers are distributed uniformly on the spokes, and we normalize the total mass of consumers to be one. The consumer located on spoke \( i \) at distance \( x \) from its proximal end is denoted by \( (l_i, x) \) where \( x \in [0, \frac{1}{2}] \). Each firm offers a single product indexed \( j \in \{1, \ldots, n\} \), and the firm is located at the origin of the spoke for that variety (namely, at \( x = 0 \)).

As the market is horizontally differentiated, the base value of all the products is the same and is denoted by \( v \). If the consumer located at \((l_j, x)\) were to purchase the local product \( j \), she would derive the following indirect utility:

\[
U(l_j, x, p_j) = v - tx - p_j,
\]

where \( t \) is her sensitivity to product characteristics, and \( p_j \) is the price of the product. But if the consumer were to purchase any other product available in the market, such as product \( k \) where \( k \neq j \), the indirect utility from the nonlocal product will be:

\[
U(l_j, x, p_k) = v - t(1 - x) - p_k.
\]

This consumer will purchase her local product \( j \) if \( U(l_j, x, p_j) > U(l_j, x, p_k) \), suggesting that

\footnote{Because the consumer located at \((l_j, x)\) is \( \frac{1}{2} - x \) units of distance away from the center of the spokes network and product \( k \) is \( \frac{1}{2} \) unit of distance further away, the total distance between the consumer and the nonlocal product \( k \) is \( \frac{1}{2} - x + \frac{1}{2} = 1 - x \).}
the marginal consumer who is indifferent between the two products is located at a distance 
\[ \frac{1}{2} + \frac{p_k - p_j}{2r} \] from product \( j \).

As in Chen and Riordan (2007), consumers consider at most two products. A consumer’s first-preferred product is the local variety corresponding to the spoke in which the consumer resides. The second-preferred product of the consumer is a nonlocal variety in any of the other spokes, and it is exogenously fixed \( \text{à priori} \). The assumption that consumers consider at most two products helps to obtain a pure-strategy equilibrium and it reflects the observation that consumers have a small consideration set (Nedungadi 1990, Hauser and Wernerfelt 1990). Next we incorporate the notion of a prototypical product into the spokes model.

**Prototypical product.** Research in consumer behavior and psychology suggests the prototypical product of a category is more salient in memory (Mervis, Catlin and Rosch 1976, Nedungadi and Hutchinson 1985, Ward and Loken 1986). The increased salience helps consumers to easily access information about the prototype from memory (Winkielman et al. 2006). High salience, however, does not guarantee that a consumer will buy the prototypical product, because the purchase decision depends on its relative price as well as the individual consumer’s relative preference for it.

In keeping with prior literature, we model prototypicality as a cognitive construct that is unaffected by attitude and evaluation. Specifically, in our formulation prototypicality influences the salience of a product and in turn the likelihood of the product being included in a consumer’s consideration set (Nedungadi and Hutchinson 1985). Recall that in the spokes model, the first-preferred product of a consumer is the local product of the spoke on which the consumer resides (Chen and Riordan 2007, Amaldoss and He 2010). The consideration set of a consumer includes a second-preferred product, which could in principle be any of the nonlocal products. We allow the prototypicality of a product to influence the probability of the product being included in a consumer’s consideration set. Specifically, as a product becomes more prototypical, it is more likely to be the second-preferred product in a consumer’s consideration set if it is not already the first-preferred product. To fix ideas, let product \( z \) be the prototypical product of a category. Furthermore, let \( \alpha \) proportion of consumers view product \( z \) as the second-preferred product if it is not already their most preferred product. The remaining \( 1 - \alpha \) proportion of consumers, who do not view product \( z \) as the prototypical product, are equally likely to consider any of the nonlocal products as their second-preferred product. Thus in our model, product \( z \) is the only prototypical
Fig. 1. Segmentation of Prototypical Product’s Consumers

\( z \) is the prototypical brand

\( z \) is the first-preferred product

\( k \) (the second-preferred product) is available

\( k \) (second-preferred) is not available

\( k \) (first-preferred) is not available

\( k \) (the first-preferred product) is available

Group 1a (P)
Consumers choose between their first-preferred product \( z \) and the second-preferred product \( k \)

Group 1b (P)
Consumers purchase their first-preferred product \( z \) if they gain a non-negative surplus

Group 2a (P)
Consumers purchase their second-preferred product \( z \) if they gain a non-negative surplus

Already included in Group 1 (P)

Consumer Demand. Using the parsimonious formulation of prototypicality, we proceed to derive the demand for the prototypical product and that for each of the nonprototypical products.

Demand for the prototypical product. The demand for the prototypical product \( z \) comes from two groups of consumers. One group of consumers is located on spoke \( l_z \) and product \( z \) is their most preferred product. The second group consists of consumers located on any of the other spokes, and for them product \( z \) is the second-preferred product in their consideration set. Figure 1 illustrates how consumers can be segmented, and the upper panel of Table 1 summarizes the demand from each group.

Group 1 (P). Some of the consumers in the first group need to decide whether to purchase the prototypical product \( z \) or the other product in their consideration set (see Group 1a (P)

 already included in Group 1 (P).

\[ \frac{1}{N-1} < \alpha < 1. \]

Figure 3 illustrates a market where consumers seek \( N = 11 \) varieties, but only \( n = 5 \) products are available. Of the available products, one is the prototypical product and the other four products are nonprototypical products. The prototypical product is offered by Store A, whereas the nonprototypical products are offered by Stores B1, B2, B3 and B4. We discuss this figure in greater detail in the section on experimental procedure.
in Figure 1). Specifically, for any consumer located on $l_z$, product $k$ is her second-preferred product with probability $\frac{1}{N-1}$, where $k \in \{1, \ldots, n\}$ and $k \neq z$. As the density of such consumers is $\frac{2}{N}$, the demand from these consumers for product $z$ is:

$$\frac{2}{N} \frac{1}{N-1} \sum_{k \neq z, k \in \{1, \ldots, n\}} \max \left\{ \min \left\{ \frac{1}{2} + \frac{pk - p_z}{2t}, 1 \right\}, 0 \right\}. \quad (3)$$

Other consumers in this group need to decide between buying the prototypical product and buying nothing, as their second preferred variety is not available in the market (see Group 1b (P) in Figure 1). Note that for any consumer on spoke $l_z$ her second preferred variety is not available with conditional probability $\frac{N-n}{N-1}$. Hence, the demand for product $z$ from these consumers is given by:

$$\frac{2}{N} \frac{N-n}{N-1} \min \left\{ \max \left\{ 0, \frac{v - p_z}{t} \right\}, \frac{1}{2} \right\}. \quad (4)$$

**Group 2 (P).** Next we consider the demand from consumers who regard product $z$ as the second-preferred product in their consideration set but still view product $z$ as the prototypical product (see Group 2a (P) in Figure 1). We know that for a consumer on spoke $l_i$, $i \notin \{1, \ldots, n\}$, product $z$ is the second-preferred product with probability $\alpha$. Furthermore, the density of such consumers is $\frac{2\alpha}{N} (N-n)$ and the demand for product $z$ from these consumers is:

$$\frac{2\alpha}{N} (N-n) \min \left\{ \max \left\{ 0, \frac{v - p_z}{t} - \frac{1}{2} \right\}, \frac{1}{2} \right\}. \quad (5)$$

As the prototypicality of product $z$ does not influence all consumers, some consumers view it as merely their second-preferred product. For a consumer on spoke $l_i$, $i \notin \{1, \ldots, n\}$, product $z$ is just the second-preferred product with conditional probability $\frac{1-\alpha}{N-1}$ and the density of such consumers is $\frac{2}{N} (N-n)$. The demand for product $z$ from this additional group of consumers is:

$$\frac{2(1-\alpha)}{N} \frac{N-n}{N-1} \min \left\{ \max \left\{ 0, \frac{v - p_z}{t} - \frac{1}{2} \right\}, \frac{1}{2} \right\}. \quad (6)$$

On aggregating the demand from this additional group (Group 2o (P)) with that from Group 1a (P), Group 1b (P) and Group 2a (P), we obtain the following total demand for the prototypical product $z$:

$$q_z = \begin{cases} \frac{2}{N} \frac{1}{N-1} \sum_{k \neq z, k \in \{1, \ldots, n\}} \max \left\{ \min \left\{ \frac{1}{2} + \frac{pk - p_z}{2t}, 1 \right\}, 0 \right\} \\ + \frac{2}{N} \frac{N-n}{N-1} \min \left\{ \max \left\{ 0, \frac{v - p_z}{t} \right\}, \frac{1}{2} \right\} \\ + \frac{2(N-n)}{N} (\alpha + \frac{1-\alpha}{N-1}) \min \left\{ \max \left\{ 0, \frac{v - p_z}{t} - \frac{1}{2} \right\}, \frac{1}{2} \right\} \end{cases} \quad (7)$$
Demand for a nonprototypical product. The demand for a given nonprototypical product \( k \) also comes from two groups of consumers. As discussed below, the nonprototypical product \( k \) is the most preferred product for consumers in Group 1 (NP), whereas for consumers in Group 2 (NP) it is the second-preferred product in their consideration set. We illustrate the consumer segmentation in Figure 2, and summarize the demand from each group in the lower panel of Table 1.

**Group 1 (NP).** The nonprototypical product \( k \) is the most preferred product for three sets of consumers. For one set of consumers in this group, their second-preferred product is available and it is a nonprototypical product (see Group 1a (NP) in Figure 2). In particular, for any consumer located on spoke \( l_k \), product \( j \) is her second-preferred product and a nonprototypical product with probability \( \frac{1 - \alpha}{N - 1} \), where \( j \in \{1, \ldots, n\} \) and \( j \neq k \). As the density of such consumers is \( \frac{2}{N} \), the demand from these consumers for product \( k \) is:

\[
\frac{2}{N} \frac{1 - \alpha}{N - 1} \sum_{j \neq k, j \in \{1, \ldots, n\}} \max \left\{ \min \left\{ \frac{1}{2} + \frac{p_j - p_k}{2t}, 1 \right\}, 0 \right\}
\]

The second set of consumers view the prototypical product \( z \) as the second-preferred product (see Group 1b (NP) in Figure 2). Now for a consumer on spoke \( l_k \), the prototyp
ical product $z$ is her second preferred product with probability $\alpha$. As the density of such consumers is $\frac{2}{N}$, the demand from these consumers for product $k$ is $\frac{2\alpha}{N} \max \left\{ \frac{1}{2} + \frac{p_z - p_k}{2t}, 0 \right\}$ if $p_k \geq p_z$. But if $p_z \geq p_k$, the demand becomes $\frac{2\alpha}{N} \left( \frac{1}{2} + \min \left\{ \frac{p_z - p_k}{2t(N-1)} ; \frac{1}{2(N-1)} \right\} \right)$. Hence the demand from this third subgroup can be written as

$$\alpha \frac{N}{N} \max \left\{ 1 + \min \left\{ \frac{p_z - p_k}{t} ; \frac{p_z - p_k}{t(N-1)} , \frac{1}{N-1} \right\} , 0 \right\}.$$ (9)

Note when $p_z \geq p_k$ such that the marginal consumer is on $l_z$, firm $k$ gets all the consumers on its own spoke ($l_k$) but only $\frac{1}{N-1}$ fraction of consumers on $l_z$ because these consumers consider any of the nonlocal products as their second-preferred product with equal probability.

For the third set of consumers in this group the second-preferred variety is not available (see Group $1c$ (NP) in Figure 2). Because for a consumer on spoke $l_k$ the second-preferred product is not available with probability $\frac{N-n}{N-1}$, the demand from this set of consumers for product $k$ is given by:

$$\frac{2(1-\alpha)}{N} \frac{N-n}{N-1} \min \left\{ \max \left\{ 0, \frac{v - p_k}{t} \right\} , \frac{1}{2} \right\}.$$ (10)

**Group 2 (NP).** Now we turn attention to consumers who consider the nonprototypical product $k$ as the second-preferred product. For a consumer on $l_i$, $i \notin \{1, \ldots, n\}$, product $k$ is her second-preferred product with conditional probability $1 - \frac{\alpha}{N-1}$. As the density of such consumers with their first-preferred product not available is $\frac{2}{N} (N - n)$, the demand for product $k$ is:

$$\frac{2(N-n)}{N} \frac{1-\alpha}{N-1} \min \left\{ \max \left\{ 0, \frac{v - p_k}{t} - \frac{1}{2} \right\} , \frac{1}{2} \right\}.$$ (11)

Hence the total demand for the nonprototypical product $k$ from the two groups of consumers is:

$$q_k = \left\{ \begin{array}{l}
\frac{2}{N} \frac{1-\alpha}{N-1} \sum_{j \neq k, j \notin \{1, \ldots, n\}} \max \left\{ \min \left\{ \frac{1}{2} + \frac{p_z - p_k}{2t} , 1 \right\} , 0 \right\} \\
+ \frac{2(1-\alpha)}{N} \frac{N-n}{N-1} \min \left\{ \max \left\{ 0, \frac{v - p_k}{t} \right\} , \frac{1}{2} \right\} \\
+ \frac{2\alpha}{N} \max \left\{ \frac{1}{2} + \min \left\{ \frac{p_z - p_k}{2t} ; \frac{p_z - p_k}{2t(N-1)} , \frac{1}{2(N-1)} \right\} , 0 \right\} \\
+ \frac{2(N-n)}{N} \frac{1-\alpha}{N-1} \min \left\{ \max \left\{ 0, \frac{v - p_k}{t} - \frac{1}{2} \right\} , \frac{1}{2} \right\}
\end{array} \right. $$ (12)

We assume that firms simultaneously choose their prices to maximize profits. We let the marginal cost be the same for all firms and normalize it to zero without loss of generality. We next examine the pure strategy equilibrium of this stylized game to gain insights into the rank order of the prices of the prototypical product and a nonprototypical product in competitive markets.
Analysis. Intuition may suggest that the prototypical product may be priced higher than a nonprototypical product. To examine this issue, consider the case when consumer valuations are low such that $\frac{1}{2} < \frac{v - p_j}{t} < 1$. In this case, as $v - p_j - t < 0$, some consumers may not find it attractive to buy the second-preferred product (nonlocal product). Yet, as $v - p_j - \frac{1}{2} > 0$, all consumers can buy their first-preferred product (local product). In such a situation, we may observe prices that run counter to our naive intuition. Specifically, we have the following proposition.

**Proposition 1** When consumer valuations are low, the prototypical product charges a lower price: $p^*_z < p^*_k$.

We prove this claim in the Appendix. To follow the intuition for this result, first focus on a nonprototypical product. Note that most consumers in Group 1 (NP) could potentially purchase either of the products in their consideration set and that these consumers are less sensitive to price. In particular, when the firm offering the nonprototypical product reduces its price by one unit, the marginal consumer shifts by only $\frac{1}{2t}$ in the subgroup where consumers can purchase either product in their consideration set (see equation 8). By contrast, consumers in Group 2 (NP) are more sensitive to price. Specifically, if the nonprototypical product’s price is reduced by one unit, the location of the marginal consumer now shifts by $\frac{1}{t}$ (see equation 11). Furthermore, when consumer valuations are low, the products are less substitutable and as such the relative size of Group 2 (NP) is larger, and this induces the firm offering the nonprototypical product to charge a low price.

Now to appreciate why the prototypical product is priced lower, notice that the prototypical product is in the consideration set of most consumers ($\alpha > \frac{1}{n}$). Therefore, for many more consumers the prototypical product is the only preferred product available in the market (compared to the number of consumers for whom a nonprototypical product is the only preferred product that is available in the market). As such, a larger fraction of the demand for the prototypical product comes from the more price sensitive consumers, namely Group 2 (P). Hence, the firm offering the prototypical product is even more motivated to reduce its price to gain sales and improve its profits. Thus, when consumer valuations are low, the prototypical product’s price is lower than that of the nonprototypical product. For a concrete example, consider the case where $t = 1$, $N = 11$, $n = 5$, $v = 1.2$, and $\alpha = 0.55$. 

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3This implies that the consumer valuation is below a threshold and it is established in the Appendix.
equilibrium, the prototypical product is priced lower than a nonprototypical product, namely $p_z^* = 0.416 < p_k^* = 0.676$. It is useful to note that the demand for the prototypical product is $q_z^* = 0.285$, with 64.8% of the demand coming from the more price sensitive Group 2 (P). The demand for a nonprototypical product is $q_k^* = 0.078$ with only 1.5% of the demand emanating from the more price sensitive group, namely Group 2 (NP).

The preceding analysis offers insight into why a prototypical product may be priced lower. In reality, however, we also see higher priced prototypical products. Why does this happen? Of course, it is easy to argue that if a prototypical product is of higher quality or perceived to be of higher quality, it will command a higher price. However, will we observe a higher priced prototypical product even in a horizontally differentiated market? Our analysis suggests that it is possible. To see this possibility, consider a market where well over half of the varieties that consumers seek are available, namely $\frac{n}{N} > \frac{1}{2} + \frac{1}{N}$. Furthermore, let valuations be moderately high so that consumers can gain a surplus from buying any product in the market, implying $\frac{v-p_j}{t} > 1$. From analyzing the pure-strategy equilibrium of firms in this market, we have the following result.

**Proposition 2** When consumer valuations are moderately high, the prototypical product charges a higher price: $p_z^* > p_k^*$.

The proof for this result is presented in the Appendix. To appreciate the intuition for this finding, let us first examine the pricing of a nonprototypical product. When consumer valuations are high, all consumers can buy their nonlocal product as $v-p_j-t > 0$. Therefore, a larger fraction of consumers in Group 1 (NP) can buy either of the products in their consideration set. These consumers are less sensitive to a price cut and hence the firm offering the nonprototypical product is less motivated to cut its price. Next note that consumers in Group 2 (NP) need to decide between buying the nonprototypical product or nothing. There is no need to aggressively cut the price of the nonprototypical product to encourage these high valuation consumers to buy the product (in contrast to low valuation consumers). In particular, the demand from this group of consumers is insensitive to price as long as $p_k \leq v-t$ (see the min and max operator in equation 11). Together, these two effects motivate the firm offering the nonprototypical product to charge a high price.

\[4\] The corresponding thresholds on consumer valuations can be seen in the Appendix.
Recall that the prototypical product derives an even larger part of its demand from the less price sensitive segment, namely Group 2 (P). The demand from this group of consumers for the prototypical product is not sensitive to price provided \( p_z \leq v - t \) (see the min and max operator in equations 5 and 6). As such, the firm offering the prototypical product finds it attractive to charge an even higher price. Hence, when consumer valuations are high, we see a reversal in the rank order of prices charged by the prototypical product and a nonprototypical product: \( p_z^* > p_k^* \). It is interesting to note that when valuations are sufficiently high, the firm offering the prototypical product can go as far as charging the monopoly \( v - t \).

For an example of a case where the prototypical product charges a higher price, consider the situation where \( t = 1 \), \( N = 11 \), \( n = 5 \), \( v = 10 \), and \( \alpha = 0.55 \). In equilibrium, the prototypical product is priced higher: \( p_z^* = 8.94 > p_k^* = 6.46 \). The demand for the prototypical product is 0.379, of which 85.6% comes from Group 2 (P). By contrast, the equilibrium demand for a nonprototypical product is 0.116, and Group 2 (NP) accounts for 21.1% of it.

**Discussion.** Our analysis clarifies how prototypicality affects the rank order of prices in a horizontally differentiated market. This finding may raise some interesting questions. For example, we know that as the level of prototypicality increases, the prototypical product becomes more salient in consumers’ mind and thus assumes a more advantageous position in the market. Therefore, will prototypicality hurt a nonprototypical product’s sales and profits? Consistent with our intuition, as prototypicality increases the demand for the prototypical product increases whereas the demand for the nonprototypical decreases. Yet, when consumer valuations are moderately high, profits of the nonprototypical product might still increase as the level of prototypicality increases. We obtain this rather counterintuitive result because an increase in prototypicality softens price competition when valuations are moderately high. To appreciate the intuition for this finding, note that as the level of prototypicality increases, the prototypical product draws a larger fraction of its sales from consumers for whom it is the only choice available in the market. As such, the prototypical product charges a higher price as \( \alpha \) increases. Anticipating this behavior, the nonprototypical product also charges a higher price. Thus prices are strategic complements, and this helps to soften competition and improve the profits of the nonprototypical product. For

\[ v \geq \frac{t[N(2-\alpha)+(1-\alpha)(n-4)]}{(1-\alpha)(n-2)}, \]
illustration, when $t = 1$, $N = 11$, $n = 5$, $v = $10, and $\alpha = 0.4$, the prototypical product charges $p^*_z = $7.473, sells $q^*_z = 0.272$, and earns $\pi^*_z = $2.031, whereas the nonprototypical product sets $p^*_k = $5.546, sells $q^*_k = 0.141$ and gains $\pi^*_k = $0.783. Now if $\alpha$ increases to 0.55, the prototypical product’s price, sales and profits increase ($p^*_z = $8.943, $q^*_z = 0.325$, and $\pi^*_z = $2.908). On the other hand, the nonprototypical product’s sales decrease yet its profits increase because of the increase in its price ($p^*_k = $6.461, $q^*_k = 0.138$, and $\pi^*_z = $0.892). We prove the claim that prices are strategic complements in the Appendix. Next it is useful to note that prototypicality might not always mitigate price competition. For instance when consumer valuations are low, it could heighten price competition. This is because now the prototypical product tries to motivate its captive low-valuation consumers to buy its product rather than nothing. Consequently, the prototypical product’s price decreases as the level of prototypicality increases. The nonprototypical products may also cut their prices. For example, when $t = 1$, $N = 11$, $n = 5$, $v = $1.2 and $\alpha = 0.28$, the equilibrium prices are $p^*_z = 45.7$ cents and $p^*_k = 66.68$ cents, and the equilibrium profits are $\pi^*_z = 8.77$ cents and $\pi^*_k = 5.78$ cents. But when $\alpha = 0.55$, $p^*_z$ drops to 41.57 cents and $p^*_k$ declines to 67.58 cents. Furthermore, $\pi^*_z$ increases to 11.84 cents whereas $\pi^*_k$ decreases to 5.23 cents.

Next, in developing our model we considered a market where consumers seek $N$ diverse varieties of products, but firms only offer $2 < n < N$ products. This may raise the question of how diversity in consumers’ tastes affects the relative price of the prototypical product. Our initial analysis of this issue suggests that as diversity in consumers’ tastes increases, the prices of both the prototypical and nonprototypical products decrease when consumer valuations are low. However, the opposite holds when consumer valuations are high. To see why, note that a more diversified consumer taste has two consequences. First, each firm’s product is less likely to be the first-preferred product. Next, the second-preferred variety of consumers is more likely to be available. This implies that prototypicality is even more valuable to a firm when consumers’ tastes become more diverse; further, it increases a firm’s incentive to cater to consumers who consider its product as the second-preferred choice. In this situation, if consumer valuations are low, consumers are more sensitive to price lowering the equilibrium prices of prototypical as well as nonprototypical products. For example, consider the case where $t = 1$, $n = 5$, $v = $1.2, and $\alpha = 0.4$. If $N = 11$, the equilibrium

\[\frac{N-n}{N-1}\]
prices are $p^*_k = 67.1$ cents and $p^*_z = 43.3$ cents. But when we increase $N$ to 12, $p^*_k$ decreases to 66.4 cents and $p^*_z$ decreases to 42.3 cents. Conversely, if consumer valuations are high, the prototypical product can charge a higher price due to the increased demand from some of the captive consumers. The nonprototypical products can also follow this lead and raise their price but to a lesser extent. For a numerical example, consider the case where $t = 1$, $n = 5$, $\alpha = 0.4$ but $v = $10. Now if $N = 11$, the equilibrium prices are $p^*_k = $5.55 and $p^*_z = $7.47. Then, if we increase $N$ to 12, $p^*_k$ increases to $6.349$ and $p^*_z$ increases to $8.924$.

A related question is what would happen if a firm could influence its level of prototypicality through investment. To explore this issue, consider a two-stage model. The firm decides on the optimal level of prototypicality in the first stage, and then it chooses the optimal price in the second stage. Because of the complexity of the demand function, we do not have a closed-form for this problem. However, it lends itself to numerical analysis. Suppose the firm producing the prototypical product can enhance prototypicality by making an investment at a cost of $\alpha^2$. Our analysis shows that as the diversity in consumers’ tastes increases, the optimal $\alpha^*$ rises. Specifically, if $N = 10$, $n = 5$, $t = 1$, $v = 1.2$ and $c = 0.1$, then $\alpha^* = 0.515$. But if we increase $N$ to 11, $\alpha^* = 0.582$. We obtain this result because prototypicality becomes more valuable when consumers’ tastes are more diverse. In such a situation, the prototypical product can benefit from being included in the consideration set of a larger fraction of consumers. In the following experimental section, we venture to assess to what extent our model can predict the rank order of prices in a competitive market.

**EXPERIMENTAL INVESTIGATION**

The theoretical analysis shows how the rank order of prices can vary with consumer valuations: if valuations are low, the prototypical product will be lower priced compared to a nonprototypical product, whereas if the valuations are high, the rank order will be reversed. To perform a causal test of the model, it is important to exogenously vary consumer valuations and prototypicality and then observe their effects on product prices. This level of control over demand is difficult to accomplish in a field setting. In a laboratory, however, it is easier to manipulate the demand conditions and study firm behavior (e.g., Lim and Ho 2007). Hence, we explore the possibility of testing the model in the laboratory.

Prior experimental research on horizontally differentiated markets is limited, and it has
primarily examined location choices rather than price competition (Brown-Kruse Cronshaw and Schenk 1993, Brown-Kruse and Schenk 2000). In a working paper, Barreda et al. (2010) examine both location and pricing decisions. Often, players differentiate less than the normative prediction in these experiments. In light of the sparse experimental literature, it is important to assess whether players can come to conform to the qualitative predictions of our model. In particular, we seek answers to two empirical questions:

1. **Will the prototypical product charge a lower price compared to a nonprototypical product when consumer valuations are low?** According to Proposition 1, the prototypical product should be lower priced compared to a nonprototypical product. More specifically, if \( t = 1, N = 11, n = 5, \alpha = 0.55 \) and \( v = 1.2 \), we should observe \( p^*_z = 0.416 < p^*_k = 0.676 \) in equilibrium. Study 1 assesses whether participants can learn over the several iterations of the game to behave in a manner that is directionally consistent with this prediction.

2. **Will the prototypical product shift to charging a higher price compared to a nonprototypical product when consumer valuations are high?** Proposition 2 predicts that the prototypical product will charge a higher price compared to a nonprototypical product. In equilibrium, when \( t = 1, N = 11, n = 5, \alpha = 0.55 \) and \( v = 10 \), we should see \( p^*_z = 8.94 > p^*_k = 6.46 \). Study 2 tests the descriptive validity of this prediction.

**Study 1**

The purpose of Study 1 is to assess the predictive accuracy of Proposition 1. Toward this goal, in the laboratory we keep consumer valuation low but exogenously vary the level of prototypicality of products so that we can study its impact on prices. Further we randomly assign participants to play the role of a firm offering either the prototypical product or a nonprototypical product and thereby control for all participant-specific variables which are beyond the scope of our research. The experimental evidence suggests the prototypical product may be lower priced than a nonprototypical product when consumer valuations are low. On comparing the observed prices against the equilibrium predictions, we observe small but significant departures from the norms. We also see heterogeneity in the behavior of individual participants. Below, we outline the experimental design and procedure and then discuss the key findings.
Experimental Design. For this study, we use two groups of participants. We randomly assign the fifteen participants in each group to three oligopolies of five participants in every trial. Recall that in our model in our model there is one prototypical product in a category. Accordingly, in each oligopoly, one participant plays the role of the firm offering the prototypical product while the remaining four participants play the role of a firm selling a nonprototypical product. We treat prototypicality as a within-participant variable with each participant offering the prototypical product for ten trials and the nonprototypical product for another forty trials. As discussed earlier, the prototypical product is more likely to be feature in consumer’s consideration set. In our experiment, the probability of the prototypical product being included as the second-preferred product in consumers’ consideration is 55%, whereas the corresponding probability for a nonprototypical product is 4.5%. The other variables of the model are held constant across all the participants over all the trials: \( N = 11, \, n = 5, \, t = 1, \) and \( v = \$1.2 \). By changing the participants in each oligopoly from trial to trial and not revealing their identity, we obtain data on multiple replications of the pricing game (see also Amaldoss and Jain 2005).

Procedure. The participants in the study are graduate and undergraduate students. As we are interested in investigating the pricing behavior of firms, we abstract away from the demand side of the market by using the aggregate demand function derived from our consumer model (see Selten and Apesteguia 2005 for a similar design). Thus participants play the role of firms, whereas the computer plays the role of consumers. The detailed instructions provided to participants are available upon request.

— Insert Figure 3 here —

Even though the computer plays the role of consumers according to the demand function of our model, we provided participants a verbal description of the market so that they could understand the actions of the computer. Specifically, we illustrated a town with eleven streets emanating from the center of the town. At the end of five of these streets there is a store, but there is no store on the other six streets. The products from the five stores are labeled A, B1, B2, B3, and B4. All the stores offer products of the same quality level. Each street is half a unit long with an equal number of consumers residing in each street. Furthermore, consumers are spread uniformly along each street. The product available in their street is the most preferred product of consumers. In addition to this product, their
consideration set may include another product. The probability of product A being this second-preferred product is 55%, whereas the probability of products B1, B2, B3 or B4 being the second-preferred product is only 4.5%. Thus in our experiment, product A is the prototypical product while products B1, B2, B3 and B4 are the nonprototypical products. In the tradition of experimental economics literature, we do not use labels such as prototypical and nonprototypical products while describing the experimental protocol to participants. Instead, the prototypical product is referred to as product A, while the nonprototypical products are labeled B1, B2, B3 or B4. It costs money for consumer to travel from their house to a store. It costs less to travel to a store if the consumer resides in the same street where the store is located, but more if the consumer travels to another street to purchase its product. The travel cost is equal to the distance traveled. The total cost of purchasing a product thus includes the price of the product and the travel cost. Depending on the total cost of purchasing each of the products in her consideration set, a consumer first decides whether or not to purchase any product. If she decides to buy, then she selects which product to buy: A, B1, B2, B3 or B4. This description of the market is intended to help participants understand how consumers might react to their prices.

While setting prices, our participants can use a calculator, which is purely a computational tool and does not offer any guidance on normative behavior. The calculator is helpful to rule out poor computational skills as an explanation for our results. At the beginning of each trial, the participant offering the prototypical product is asked to indicate her product’s price and the likely average price of all the nonprototypical products in the market. The prices are expressed in cents. Based on these two inputs, the calculator displays the likely profits of the prototypical product using the demand function of our consumer model (see also Selten and Apesteguia 2005). Similarly, each player offering a nonprototypical product is asked to specify her price and also provide estimates of the likely price of the prototypical product and the likely average price of the other nonprototypical products. Using these three pieces of information, the calculator displays the likely profits from the participant’s nonprototypical product. After viewing the likely profits, each participant can revise her price as well as the expected prices of her competitors. It is clarified to each participant that her competitors may not behave as she predicts. Furthermore, her actual earnings only depend on the actual prices charged by her competitors, not her beliefs about their prices. That is, a participant’s likely profits will be close to her actual profits only to the extent
that her expectations are accurate. The calculator thus serves as a mere computational tool and offers no advice on what prices our participants should charge. The calculator, however, makes it easy for participants to see the profit implications of their pricing decisions and explore ways to improve profits.

After all the players confirm their prices, the computer displays the results of the trial. Participants offering the prototypical product are informed of their own prices and profits along with the average price and average profits of the nonprototypical products. Participants selling a nonprototypical product see on their results screen their own price and profits; in addition, they observe the price and profits of the prototypical product as well as the average price and profits of the other nonprototypical products.

At the start of the experiment, participants play five practice trials to familiarize themselves with the structure of the game. At this stage, if they have any questions about the instructions, the supervisor answers them. After all the participants become familiar with the structure of the game, they play fifty actual trials: ten trials as the producer of the prototypical product and another forty trials as a producer of a nonprototypical product. Neither the identity of the participant nor the identity of any of her competitors in any trial is revealed. This anonymity together with the random assignment of participants to the three oligopolies in each trial reduces scope for building reputation over the course of the experiment. The goal of our participants is to maximize their individual profits over the fifty trials of the game. At the end of the experiment, their cumulative earnings in the experiment are converted into dollars and paid.\footnote{In our experiment, we did not offer any financial incentive for participants to truthfully reveal their expectations. Providing such an incentive in addition to the profits earned in each trial would add another layer of complexity to an already complicated game and potentially impede comprehension. Therefore, the participants in our experiment, after gaining some experience, could potentially enter random numbers as their expectations, and yet set their price to maximize actual profits (rather than the expected profits displayed by the calculator). Thus, after gaining some proficiency, some participants may choose not to use the calculator.}

**Results.** We conduct our analysis on a body of 1500 pricing decisions (15 participants per group \( \times \) 2 groups \( \times \) 50 trials = 1500 decisions). Table 1 summarizes the mean prices of the prototypical product and that of a nonprototypical product and the corresponding equilibrium predictions. The table also presents the average prices observed in each group.
The rank order of the prices of the prototypical and nonprototypical products is in agreement with the theoretical prediction. However, we observe departures from the point predictions of the equilibrium solution and heterogeneity in the behavior of individual participants.

**Mean Price.** Proposition 1 predicts that the prototypical product will be lower priced if consumer valuation is low. Across the two groups, the average price of the prototypical product is 43.89 cents whereas the price of a nonprototypical product is 65.22 cents. A random effects analysis of the pricing decisions rejects the null hypothesis that these two mean prices are the same ($t = 9.37, p < 0.001$). A similar pattern of results is observed in each of the two groups. In Group 1, the price of the prototypical product is 44.11 while that of a nonprototypical product is 65.40 ($t = 13.04, p < 0.001$). In Group 2, the average prices of the prototypical and nonprototypical product are 43.67 and 65.03, respectively ($t = 4.97, p < 0.001$).

— Insert Table 2 here —

Next we compare the observed behavior against the point predictions of the model. In equilibrium, the prototypical product’s price should be 41.57 when $v = 1.2$. In actuality, the average price across the two groups is 43.89 ($t = 3.83, p < 0.001$). We can also reject the null hypothesis that the predicted and actual prices are the same at the level of individual groups (Group 1: $t = 3.66, p < 0.001$; Group 2: $t = 2.11, p < 0.036$). While the nonprototypical product’s price should be 67.58 in equilibrium, on average the price in the two groups is 65.22 ($t = 7.74, p < 0.001$). Again, we can reject the null hypothesis that the predicted and observed prices are the same in each of the groups (Group 1: $t = 6.72, p < 0.001$; Group 2: $t = 4.92, p < 0.001$). Thus, although the observed prices are directionally consistent with the equilibrium predictions, they deviate from the point predictions. Having examined the aggregate behavior across participants, we advance to explore the differences in the behavior of individual participants.

**Individual Differences.** Here we investigate the average price charged by individual participants across trials. Figure 1 compares the empirical distribution of the average prices for the prototypical product with that for a nonprototypical product. The empirical distribution is qualitatively consistent with the equilibrium solution. Specifically, the average price of the prototypical product ranges from 30 to 71, whereas that of the nonprototypical product ranges from 49.38 to 98.75. A nonparametric test rejects the null hypothesis that
the average prices of the prototypical and nonprototypical products are drawn from the same
distribution ($M = 13.5, p < 0.001$). Such individual-level differences could be ascribed to
variations in participants’ learning abilities (Camerer and Ho 1999, Ho et al. 2007)

— Insert Figure 4 here—

**Discussion.** The observed prices are consistent with the qualitative predictions of the
equilibrium solution; but deviate from the point predictions of the solution in small but
significant ways. A related question is whether the prototypical product yields higher profits
despite its lower price. According to the equilibrium solution, the prototypical product
should provide higher profits compared to a nonprototypical product. On average, the profits
earned in a trial from the prototypical and a nonprototypical products are 11.20 and 4.98,
respectively. On fitting a random effects model to the data, we reject the null hypothesis
that these profits are the same ($t = 33.57, p < 0.001$). We obtain similar results in each
group (Group 1: $t = 28.89, p < 0.001$; Group 2: $t = 20.06, p < 0.001$). Thus the profits are
in keeping with the theoretical prediction. Next recall that according to Proposition 2, the
results of Study 1 can be reversed if one raises consumer valuation. Can we observe such a
reversal in the rank order of prices? We explore this issue in the following study.

**Study 2**

In this study, we maintain consumer valuation at a high level but vary the level of prototyp-
icality of the product so that we can examine its effect on prices. As in Study 1, we randomly
assign participants to play either the role of a firm offering the prototypical product or the
role of a firm selling a nonprototypical product so that we can control for individual specific
variables. As predicted, we observe a reversal in the rank order of prices: on average, the
prototypical product is higher priced than a nonprototypical product. The observed prices,
however, deviate from the point predictions of the model. We also observe individual level
differences in prices. Below, we outline the experimental design and procedure, and then
discuss the key findings.

**Experimental Design.** We use two groups of participants. In each trial, we randomly
assign the fifteen participants in each group to three oligopolies of five participants. In each
oligopoly, one participant plays the role of the firm offering the prototypical product and
the other four participants play the role of a firm selling a nonprototypical product. As in the previous study, prototypicality is a within-participant variable, with each participant offering the prototypical product for ten trials and the nonprototypical product for another forty trials. We let the probability of the prototypical product being the second-preferred product in consumers’ consideration be 55%, while the corresponding probability for a nonprototypical product is 4.5%. However, we keep the other variables of the model constant across all the participants over all the trials: \( N = 11, n = 5, t = 1, \) and \( v = \$10. \)

**Procedure.** The experimental procedure is identical to the previous study, except that consumer valuation is now increased to \( v = 10. \) Note that all the other model parameters are as in Study 1. In this study, we express price in dimes so that the prices can be easily expressed using numbers between 1 and 100.

**Results.** Table 2 presents the mean prices of the prototypical product and that of a nonprototypical product and the corresponding equilibrium predictions. The table also presents the average prices observed in Group 1 and Group 2. As predicted by Proposition 2, we observe a reversal in the rank order of the prices of the prototypical and nonprototypical products. The observed prices, however, are significantly different from the predictions. Furthermore, we see differences in the behavior of individual players. These results are based on 1500 observations (15 participants per group \( \times \) 2 groups \( \times \) 50 trials = 1500 trials).

**Mean Price.** According to Proposition 2, the prototypical product should be higher priced if consumer valuation is high. Across the two groups, the average price of the prototypical product is 89.11 dimes and the price of a nonprototypical product is 67.17 dimes. Using a random effects model, we can reject the null hypothesis that these two mean prices are the same \( (t = 16.08, p < 0.001). \) We obtain similar results at the level of individual groups. In Group 1, the price of prototypical product is 89.57 whereas that of a nonprototypical product is 66.33 \( (t = 13.77, p < 0.001); \) in Group 2, the corresponding prices are 88.65 and 68.01, respectively \( (t = 9.59, p < 0.001). \)

— Insert Table 3 here —

According to the equilibrium solution, the prototypical product’s price should be 89.43 when consumer valuation rises to \( v = 10. \) Across the two groups, the average price of the prototypical product is 89.11. The observed difference between the theoretical prediction and the actual price is only marginally significant \( (t = 1.03, p < 0.10). \) On probing further,
we note that the difference is not significant in Group 1 but significant in Group 2 (Group 1: \( t = 1.63, p > 0.10 \); Group 2: \( t = 2.52, p < 0.02 \)). While the nonprototypical product’s price should be 64.60 in equilibrium, on average the price in the two groups is 67.17. Now we can reject the null hypothesis that the predicted and observed prices are the same (Group 1: \( t = 8.84, p < 0.001 \); Group 2: \( t = 4.82, p < 0.001 \)). Even though the observed prices are in keeping with the predicted rank order, we see some significant departures from the point predictions. Next we investigate the heterogeneity in the prices set by individual participants.

**Individual Differences.** Using the average price charged by individual participants, we compare the empirical distribution of the prototypical product’s prices with that for the nonprototypical products. As Figure 2 shows, the empirical distribution of prices is qualitatively consistent with the equilibrium solution. The average price of the prototypical product ranges from 83.5 to 90 while that of the nonprototypical product ranges from 58.45 to 88.23. Using a nonparametric test, we can reject the null hypothesis that the average prices of the prototypical and nonprototypical products are drawn from the same distribution (Sign test \( M = 15, p < 0.001 \)).

— Insert Figure 5 here—

**Discussion.** As in Study 1, the prototypical product yields higher profits compared to a nonprototypical product. On average, the profits earned from the prototypical product are 33.53, whereas the corresponding profits from a nonprototypical product are 7.69. We reject the null hypothesis that these two profits are the same (\( t = 105.5, p < 0.001 \)). Taken together, the two studies provide empirical support for the idea that the rank order of prices of the prototypical and a nonprototypical product can vary with consumer valuation. While the empirical evidence is consistent with the qualitative predictions of the equilibrium predictions, we observe some differences from the point predictions.

**CONCLUSION**

This paper was motivated by a desire to understand how the prototypicality of a product affects its price. Toward this end, we captured the notion of prototypical product in a model of horizontal differentiation. Our theoretical and experimental investigation offers insights on a few questions of practical significance.
• When should a prototypical product be lower priced? Some might naively expect a prototypical product to always be higher priced. Yet some prototypical products are lower priced compared to the other products in the category. For example, Chapstick, despite being the prototypical lip balm in the minds of many consumers, is sold at a lower price. Our analysis shows that if the base valuation for products in a category is low, then it is profitable for the prototypical product to charge a lower price compared to a nonprototypical product. We obtain this result because when firms do not offer all the varieties that consumers seek, some consumers need to decide whether to purchase their second-preferred product or buy nothing. Furthermore, the prototypical product attracts a large proportion of such consumers. Now, if consumer valuations are low, the prototypical product needs to charge a low price to entice these consumers to buy it. A nonprototypical product also serves these consumers, but they account for a much smaller proportion of its demand. Therefore, a nonprototypical product’s price is not cut as aggressively.

• When should a prototypical product be higher priced? Some of us may expect the prototypical product to be higher priced because of its higher perceived quality. In the absence of any quality difference, is it still profitable to charge a higher price for the prototypical product? We find that even if the prototypical product does not induce any positive affect and thereby improve its perceived quality, it is profitable to charge a higher price for the prototypical product. The rationale for this is as follows. A large proportion of consumers consider the prototypical product as their second-preferred product. Moreover, the prototypical product is the only option for many of these consumers. Now if valuations are high, consumers are not sensitive to price provided the net utility is positive. Therefore, the prototypical product finds it profitable to charge a high price. In the case of a nonprototypical product, we observe a similar effect but at a much lower strength because a nonprototypical product is the second-preferred product for a far lower fraction of consumers.

• What is the descriptive validity of our theoretical analysis? One can point to anecdotal evidence in support of our theoretical predictions. However, it is easy to counterargue each example by offering some idiosyncratic explanation, such as product quality, positive affect and brand equity. Going beyond anecdotal evidence, our theoretical analysis
explains how the relative price of a product can be shaped by its prototypicality. The two experiments go even further. They provide a causal test of the model. Consistent with theory, on average participants sell the prototypical product at a higher price than a nonprototypical product when consumer valuation is high. Furthermore, the rank order of prices is reversed when consumer valuations are lower.

**Directions for further research.** In this paper, we have only taken an initial step in analyzing the strategic implications of prototypicality. There are several avenues for further research. For example, we assumed that prototypicality is a cognitive construct; that is, it improves the salience of a product in consumer’s mind without affecting product valuation. It is possible that the prototypicality of a product could influence consumer’s affective evaluation of the product (Cohen 1982). To understand the normative implications of such affective influences, it will be useful to first pin down how emotion influences the purchase decision, and then embed it in a competitive model. This will be a fruitful avenue for further research. Furthermore, prototypicality could lead to reference-dependent preferences, and this needs further scrutiny (e.g., Orhun 2009). We have examined how prototypicality influences prices, not how a prototype is established in the marketplace. Future research can build on the existing psychological literature and explore the possibility of developing a normative model of prototype formation in a horizontally differentiated market.
REFERENCES


Fig. 3. An illustration of the spokes model with $N = 11$ and $n = 5$

Table 1. Consumer Demand by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a (P)</td>
<td>$\frac{2}{N} \sum_{k \neq z, j \in {1, \ldots, n}} \max \left{ \min \left{ \frac{1}{2} + \frac{p_{jk} - p_{jk}}{2t}, 1 \right}, 0 \right}$</td>
</tr>
<tr>
<td>1b (P)</td>
<td>$\frac{2}{N} N - n \min \left{ \max \left{ 0, \frac{v - p_{jk}}{t} \right}, \frac{1}{2} \right}$</td>
</tr>
<tr>
<td>2a (P)</td>
<td>$\frac{2}{N} \alpha (N - n) \min \left{ \max \left{ 0, \frac{v - p_{jk}}{t} - \frac{1}{2} \right}, \frac{1}{2} \right}$</td>
</tr>
<tr>
<td>2b (P)</td>
<td>$\frac{2}{N} \left( \frac{1 - \alpha}{N - 1} \right) \min \left{ \max \left{ 0, \frac{v - p_{jk}}{t} - \frac{1}{2} \right}, \frac{1}{2} \right}$</td>
</tr>
<tr>
<td>1a (NP)</td>
<td>$\frac{2}{N} \sum_{j \neq k, j \in {1, \ldots, n}} \max \left{ \min \left{ \frac{1}{2} + \frac{p_{jk} - p_{jk}}{2t}, 1 \right}, 0 \right}$</td>
</tr>
<tr>
<td>1b (NP)</td>
<td>$\frac{2}{N} \max \left{ 1 + \min \left{ \frac{p_{jk} - p_{jk}}{t}, \frac{p_{jk} - p_{jk}}{t(N - 1)}, \frac{1}{N - 1} \right}, 0 \right}$</td>
</tr>
<tr>
<td>1c (NP)</td>
<td>$\frac{2}{N} \alpha \min \left{ \max \left{ 0, \frac{v - p_{jk}}{t} \right}, \frac{1}{2} \right}$</td>
</tr>
<tr>
<td>2 (NP)</td>
<td>$\frac{2}{N} \left( \frac{N - n}{N - 1} \right) \min \left{ \max \left{ 0, \frac{v - p_{jk}}{t} - \frac{1}{2} \right}, \frac{1}{2} \right}$</td>
</tr>
</tbody>
</table>
Study 1: Distribution of Average Prices of Individual Participants (v=1.2)

Study 2: Distribution of the Average Price of Individual Participants (v=10)
Table 2. Study 1: Mean Prices ($v = 1.2$)

<table>
<thead>
<tr>
<th>Type of Product</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Average</th>
<th>Equilibrium Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prototypical Product</td>
<td>44.11</td>
<td>43.67</td>
<td>43.89</td>
<td>41.57</td>
</tr>
<tr>
<td>Nonprototypical Product</td>
<td>65.40</td>
<td>65.03</td>
<td>65.21</td>
<td>67.58</td>
</tr>
</tbody>
</table>

Note: Prices are expressed in cents

Table 3. Study 2: Mean Prices ($v = 10$)

<table>
<thead>
<tr>
<th>Type of Product</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Average</th>
<th>Equilibrium Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prototypical Product</td>
<td>89.57</td>
<td>88.65</td>
<td>89.11</td>
<td>89.43</td>
</tr>
<tr>
<td>Nonprototypical Product</td>
<td>66.33</td>
<td>68.01</td>
<td>67.17</td>
<td>64.61</td>
</tr>
</tbody>
</table>

Note: Prices are expressed in dimes