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Countercyclical pricing: A consumer heterogeneity explanation

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HIGHLIGHTS

- A consumer heterogeneity based explanation is proposed for countercyclical pricing.
- We allow for heterogeneity in consumer valuations for a seasonal good.
- Heterogeneity is both across consumers and for a single consumer across seasons.
- We derive conditions under which optimal prices will be countercyclical.
- We provide empirical support for the model from two seasonal product categories.

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ABSTRACT

We show that a seasonal good could be priced countercyclically due to the heterogeneous seasonal shifts in consumer valuations. We provide empirical support for our explanation based on two product categories (canned soup and tuna) studied in the literature.

1. Introduction

The observation of countercyclical pricing, i.e., a fall in the retail prices of products during periods of peak demand, is an economic anomaly that has attracted several alternative explanations in the research literature. Peak demand periods for products may be due to seasonality, may be weather related, or may be due to the appeal of the product with respect to religious or other holidays. The empirical evidence on countercyclical pricing has come from different product categories, including fast-moving consumer goods, food products, consumer appliances, and clothing. Demand for a given product can peak during periods of high overall demand (for example, clothing during the Christmas period, when demand for other products is also high) or peak demand can occur idiosyncratically for a particular product, even if there is no overall high demand (for example, tuna during Lent). This distinction is important when evaluating different explanations for countercyclical pricing.

In a comprehensive study, Chevalier et al. (2003) [henceforth CKR] examined three different explanations for countercyclical pricing. First, they considered an explanation driven by consumer search (Warner and Barsky, 1995). The prediction is that, in high demand periods, consumers are more vigilant and better informed, and therefore there is a shift in price-elasticity.[1] Increased price elasticity leads to a lower optimal mark-up of price over marginal

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[1] MacDonald (2000) proposes an alternative advertising based mechanism for the increase in price elasticity. In this model, the exogenous demand during the peak season reduces the effective cost of advertising, thereby allowing firms to increase their informative advertising.

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costs when demand is high. CKR argue that the economies of scale in search or advertising apply only during periods of high overall demand (e.g., the Christmas season) and would not apply to periods when there is high idiosyncratic demand (e.g., tuna during Lent). They do not find empirically that price elasticity increases during the peak demand season for the categories they studied, thereby effectively ruling out this explanation for countercyclical pricing for their data.

Second, CKR consider a tacit collusion explanation, arising out of dynamic interactions among retailers (Rotemberg and Saloner, 1986). The theory suggests that collusive price levels would be difficult to maintain in high demand states as the pay-off to deviating goes up. In the context of retailer pricing, such periods would correspond to periods of overall high demand (such as Christmas), but not to the product-specific demand peaks (such as tuna during Lent). CKR rule out the collusion model by documenting that retail margins are countercyclical around these idiosyncratic demand peaks.

Third, CKR consider retailers choosing categories with exogenous demand shocks as loss-leader categories to increase total retail traffic (Lal and Matutes, 1994). This explanation assumes that consumers (a) do not know the prices of products until they arrive at the store and (b) face positive transport or search costs to visit the store. Under this setting, consumers realize that they face a potential 'hold-up' problem and therefore decide against visiting the store. The retailer's solution to this dilemma is to make a commitment to prices by advertising. With costly advertising, retailers will advertise low prices for products that are likely to be high in demand. Thus, charging low prices for high demand products (i.e., countercyclical pricing) is a way to attract customers to the store. CKR find empirical support for the loss-leader explanation by observing lower retail margins for several categories, including tuna (where peak demand is during Lent) and soup (where peak demand is during the cold weather periods).

In a subsequent study, Nevo and Hatzitaskos (2005) [henceforth NH] explain the decrease in the average price of tuna during the Lent period by an increase in the relative share of cheaper brands, accompanied by a fall in average price sensitivity. The authors also question CKR's empirical test of the loss-leader pricing. In the loss-leader pricing model, high demand is *relative to other products*, but, for CKR, high demand is interpreted relative to the typical demand over time for the same product. Because the categories form a small part of the overall shopping basket, NH argue it is unlikely that retailers would use these products as loss leaders.

While NH draw attention to shifts in brand preferences around idiosyncratic demand peaks, neither CKR nor NH account for consumer heterogeneity in their analyses. Different from these works, the present study focuses on heterogeneity in consumer valuations for a seasonal good. Based on this heterogeneity, we propose a demand-side explanation to countercyclical pricing that is consistent with the empirical findings documented by CKR and NH. We build a simple model that assumes two consumer segments in the market, a high valuation segment and a low valuation segment. The valuation of both segments increases in the in-season, but the magnitude of the increase can be different. We derive conditions under which a monopolist will price discriminate across seasons, whereby, in the off-season, the firm sets a higher price so as to serve only the high segment consumers, whereas, in the in-season, the increase in valuations allows the firm to profitably decrease the price to serve both segments.

Our analytical model yields three empirically testable predictions regarding the range of valuations and segment sizes over which the optimal pricing scheme is countercyclical. In our empirical analysis, we test these conditions on data from four consumer panels in the canned soup and tuna categories. For all four empirical settings, we first document the seasonal patterns in the sales levels and the countercyclical price movements. We then show evidence that the conditions specified by our model are satisfied in both product categories.

Overall, our results highlight the importance of taking into account the consumer-level heterogeneity in demand behavior when investigating economic phenomena. These differences may be difficult to capture in aggregate data (as used by CKR and NH), especially when demand varies both across periods and across consumers.

2. Model

Assume a monopolist retailer selling a seasonal product. There are two consumer segments in the market with differing valuations: the low segment (L) and the high segment (H), both of which have (exogenously) higher valuation for the good in-season (I) versus off-season (O). V_i^s, the valuation of segment $i \in \{H, L\}$ in season $s \in \{I, O\}$, varies across segments and seasons in the following manner.

	Off-season	In-season
Low segment	$V_L^O = v - b - s_L$	$V_L^I = v - b$
High segment	$V_H^O = v - s_H$	$V_H^I = v$

Here, v, b, s_L, and s_H are positive numbers such that $v > b + s_L$ and $v > s_H$. The valuations are summarized in Fig. 1.

Market size is normalized to 1, with $k \in (0, 1)$ denoting the proportion of the high segment consumers in the market. Let p^O and p^I denote the off-season and in-season price, respectively. The off-season demand (D^O) and the in-season demand $\left(D^I\right)$ for the good are given by the following equations:

$$D^O = \begin{cases} 1 & p^O \le v - b - s_L \\ k & v - b - s_L < p^O \le v - s_H \\ 0 & p^O > v - s_H \end{cases}$$

$$D^I = \begin{cases} 1 & p^I \le v - b \\ k & v - b < p^I \le v \\ 0 & p^I > v. \end{cases}$$

Assuming no change in marginal cost across seasons, we can normalize the marginal cost to zero. The firm's optimal pricing schedule is obtained as in the following table.

Conditions	Off-season price	In-season price	Cyclical or countercyclical pricing
(1) $k < \frac{v-b-s_L}{v-s_H}$, $k < \frac{v-b}{v}$	$v - b - s_L$	$v - b$	Cyclical
(2) $k > \frac{v-b-s_L}{v-s_H}$, $k < \frac{v-b}{v}$	$v - s_H$	$v - b$	Cyclical($b > s_H$), or countercyclical ($b < s_H$)
(3) $k < \frac{v-b-s_L}{v-s_H}$, $k > \frac{v-b}{v}$	$v - b - s_L$	v	Cyclical
(4) $k > \frac{v-b-s_L}{v-s_H}$, $k > \frac{v-b}{v}$	$v - s_H$	v	Cyclical

Under all conditions except for condition 2, the in-season price is unambiguously higher than the off-season price. Under condition 2, if $b > s_H$, the optimal price is lower in-season versus off-season. Accordingly, when the following three conditions are