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Consumers' quality choices during demand peaks☆

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ABSTRACT

In a number of product categories, average prices decrease when demand exogenously increases. The literature disagrees on whether this effect is due to firms' reactions to high demand or to changes in consumer behavior. I propose a strategy that enables the identification of supply and demand movements by examining unpredictable and short-lived exogenous demand shocks. During these periods, firms do not have time to adjust pricing or advertising strategies, and most activity comes from changes in consumer behavior. My model shows that during periods of exogenous high demand, consumers migrate toward cheaper, lower-quality products. I focus on ice cream purchases, which have a seasonal peak during the summer and increase during less-predictable periods of unseasonably high temperatures. Using individual-level data, I test model implications and estimate structural parameters, finding evidence consistent with consumers' quality shifts. I also reject alternative supply-side theories' explanations for the main drivers of the observed price dynamics.

1. Introduction

Mounting empirical evidence indicates that periods of exogenous high demand are characterized by lower rather than higher prices. The literature has presented different explanations for this apparently puzzling phenomenon. Some papers point to changes in consumer behavior during demand peaks as the main driver of the observed price decreases (Nevo and Hatzitaskos, 2006; Warner and Barsky, 1995), whereas others focus on firm behavior (Chevalier et al., 2003).

Distinguishing between supply and demand movements is a well-known identification problem. This paper proposes a solution consisting of studying not seasonal demand peaks but rather exogenous demand peaks that are short lived and difficult to predict. In this case, it is difficult for supermarkets to respond to a demand increase by introducing new products, launching important advertisement campaigns, or even discounting product prices. Therefore, price movements during these periods should be driven by changes in consumer behavior.

I focus on the demand for ice cream, which experiences peaks during the summer and periods of unseasonably high temperatures. These periods are characterized by lower average prices conditional on purchases. While summer is a perfectly predictable event that happens every year at fixed dates, the occurrence and duration of higher temperatures can be predicted only with error and only a short time in advance. Firms probably anticipate and react to the increased demand during the summer but not during the less-predictable and shorter-lasting periods of high temperatures. Note also that unseasonably high temperatures occur on different days in different regions of the country, so any changes in firms' strategies during these periods must be local.

I begin by developing a model wherein products are differentiated by quality and temporal shocks affect the marginal utility of the product. I show that during periods of positive shocks, consumers shift their choices toward cheaper, lower-quality products. The shift in quality choices decreases the category's average price.

The model has three testable implications. First, during exogenous demand peaks, cross-price elasticities increase. Second, during exogenous demand peaks, the volume market share of high-quality products decreases because consumers shift toward cheaper products. Finally, variation in prices during peak demand periods is stronger when measured by a variable price index rather than by a fixed price index. A variable price index weights product prices by the volume market share of the product at each period. Therefore, the index captures not only variation in prices

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but also shifts in demand. In contrast, a fixed price index weights product prices by the average (across all periods) product volume market share, so the weight of each product is the same throughout the period. Notice, therefore, that if the market share of the low-quality product increases during the demand peak, then the variable price index captures both the price variation and the increase in the weight of the cheaper product. The fixed price index, however, captures only price changes, as it maintains fixed quality choices.

I then proceed to the empirical analysis, which focuses on the demand for ice cream during the summer and unseasonably high temperatures. In the empirical implementation, the quality indicator is whether the product is a national (high-quality) or store (low-quality) brand. Although I do not wish to begin a debate on actual taste differentials, I claim that in France, there is a widespread belief that store brand products are of lower quality than are national brand products. This perceived quality difference can also be inferred from prices: national brands are, on average, much more expensive than store brands.

I test the above model's implications and estimate the structural demand parameters. Although, as argued, changes in firms' strategies are not likely during periods of higher temperatures, I also test and discard alternative supply-side explanations that could generate the same implications of the quality choice demand model. More precisely, I determine whether price and price elasticity movements can be attributed to the entry of new products or changes in promotional activities. Finally, I consider whether the empirical evidence could be explained by changes in the consumer mix and search intensity (Warner and Barsky, 1995) during demand peaks.

Several factors explain why consumers would shift toward cheaper and lower-quality products during demand peaks. When the weather is warm, consumers buy ice cream for barbecues with friends or give their children ice cream daily, so they may be less worried about the quality of the product. Instead, during the winter or on colder days, consumers may buy ice cream as a special dessert, so in this case, quality is important. Another possibility is that consumers care not only about unit prices but also about the total price (this is similar to the non-fungibility of money argument in Hastings and Shapiro, 2013). Thus, during periods of increased demand in which they buy more ice cream, consumers prefer cheaper products to reduce their total expenditure in that category. However, during colder periods in which consumers purchase little ice cream, they feel they can indulge. Both explanations are consistent with my model and results, but this paper does not distinguish between them.

The empirical exercise uses French home-scan data. Household-level information on store visits, purchases, and product characteristics, including prices, are collected for three years (1999, 2000, and 2001) from a nationally representative survey. The data also include characteristics of both the home and the individuals that compose the household. This dataset is complemented by daily temperature data for different regions in France. I collected the historical weather data from the Weather Underground.[1]

Evidence shows that consumers are more price elastic during periods of exogenous increases in demand. As a result, they tend to shift product choices toward cheaper products. This greater elasticity and the shift in demand drive prices down. The decrease in prices is, however, less important than the decrease measured by average aggregate transaction prices. As demand migrates toward cheaper products, ignoring product differentiation and examining only average category prices leads to an overstatement of the importance of the price decrease. The results highlight the importance of considering product differentiation. I also find evidence against alternative supply-side explanations that could generate some of the same implications as the quality-level demand model. Finally, no evidence supports the hypothesis that periods of high temperatures or summer periods are characterized by higher consumer search activity, nor that changes in the consumer mix drive the results.

The paper is organized as follows. In the next section, I briefly review the literature on price movements during exogenous demand peaks. The model and its implications are presented in Section 3, in which I also discuss identification issues and the testable implications of alternative theories. Section 4 describes the data, presenting some descriptive statistics of interest. The empirical analysis is presented in Section 5. I test the model implications and the alternative theories, and I estimate demand and price elasticities. Section 5 includes a robustness exercise in which the demand parameters are estimated considering an alternative indirect utility specification. The final section concludes.

2. Literature review

Warner and Barsky (1995) use data on daily prices for consumer goods in seventeen outlets from November 1987 to February 1988, reporting that for the eight goods considered, prices fall as the weekend approaches, reaching their weekly minimums on Fridays and Saturdays and rising to their peak prices on Mondays. Prices also fall in December, although they reach their lowest point in January. The explanation given by the authors for this pricing pattern is based on economies of scale in search costs: in periods characterized by an exogenously high intensity of shopping activity, such as weekends and Christmas, searches for the best price are more efficient. With better-informed consumers, the demand perceived by retailers is more elastic, driving decreases in price–cost margins and retail prices.

Chevalier et al. (2003), henceforth CKR, test three theories of imperfect competition that generate countercyclical prices using weekly data from a supermarket chain in Chicago. The first of the theories tested is economies of scale in search costs, as proposed by Warner and Barsky (1995). The second is based on Rotemberg and Saloner (1986), in which countercyclical markups result from changes in the ability of firms to tacitly collude during periods of high demand when the gains from charging a price below the collusion price are higher. The third is the class of loss leader models of advertising (Lal and Matutes, 1994). In these models, retailers advertise high-demand products at low prices to attract customers to their stores. Once at the store, consumers learn about unadvertised prices, which are set equal to reservation prices. Given sufficiently high transportation costs, consumers purchase both the advertised product and the rest of their basket at the same store.

The first two models predict lower prices during periods of aggregate peak demand but not during periods of product-specific high demand. The loss leader models, however, predict price decreases during product-specific demand shifts as well. The main strategy used by CKR involves separating periods of high overall demand from periods of idiosyncratic peak demand. The authors find evidence that prices decline even during product-specific demand peaks. Moreover, CKR estimate category-level demand, finding no evidence of higher sensitivity during demand peaks.

CKR's empirical analysis is performed either at the category level or using an aggregate of highly price-correlated products. In both cases, they construct variable price indexes in which the price weights are the market shares of each product in each period. Because there is no product differentiation, neither brand nor quality shifts are identifiable.

Nevo and Hatzitaskos' (2006) explanation for price falls during demand peaks is based on changes in brand-level demand, which could be of two types. First, price sensitivity may be higher during periods of peak demand leading to lower equilibrium prices (because the mix of consumers might be changing or a given consumer might be more price sensitive because the product is used differently during a period of high demand). Second, brand preferences within a product category might change (because during peak demand, the product is used differently), leading consumers to migrate toward low-quality products.

[1] www.wunderground.com.