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How car dealers adjust prices to reach the product efficiency frontier in the Spanish automobile market

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ABSTRACT

This paper investigates the relationship between the dynamics of price discounts at the dealership level and product efficiency in the Spanish auto market. Using data envelopment analysis (DEA), product efficiency scores are estimated for 2092 different vehicles commercialized during 2010, using an innovative database that accounts for more than 75 technical attributes of each model. By alternating official and discounted prices on the DEA specification, we are able to propose a measure of competitive improvement in the retailing stage. We also introduce a decomposition of this measure into two indices that account for the "commercial effort" made by the dealer and the "intensification of competition" that results from the discounting efforts of the other dealers. Finally, we explore the importance of a number of drivers of dealer discounts. As expected, the results confirm the existence of an inverse relationship between product efficiency and dealer discount. Also as expected, discounts are significantly larger for generalist brands, aged models and gasoline engines.

1. Introduction

Business competitive analysis is concerned with the ability of competitors to deliver products with a similar or superior product/price relationship in the marketplace, which are produced at a similar or lower cost. Competitive advantage exists when the firm either offers more value for a given price (product differentiation) or when costs are lower for a similar product. Price is the variable that splits the value created between the firm and the customer. While the difference between price and cost is what provides a profit margin for the firm, the difference between the value of the product and its price is what provides the rational reason for a customer to purchase. Price setting is critical, as no competitive advantage can emerge if customers do not purchase the product. If the price is just too high for the merits of the product, sales (and profits) will tend to be low. Alternatively, if the price is too low for the merits of the product, sales will be high, but margins will be unreasonably low. The right price is the one that reflects appropriately the merits of the product in the marketplace.

There is a growing body of literature aimed at evaluating the relative merits of competing products on the basis of product attributes and prices. This line of research can be traced back to the seminal work of Lancaster [36] who described a product as a combination of attributes or a vector in the quality-price space. This representation allowed the construction of a theoretical frontier with the highest quality/price ratio attainable. The competitiveness or appeal of a product could then be approximated by the distance of the product vector to the frontier of *best-buy* products. Most customers are not attracted to buy either the highest quality or the lowest price product. Instead, products with the best quality/price relation will be favored by the bulk of the market, since prospective customers will seek to maximize that ratio [44]. Product efficiency, as measured by comparison with the *best-buy* frontier, can then be considered as an indicator of the relative (to the frontier) customer perceived value, or the value received for the money paid [4,47].

The estimation of customer perceived value is an important research topic in business strategy and marketing [54,17,29]. The traditional approach was to use bi-dimensional maps of perceived value [6,26]. This methodology requires listing the relevant attributes of the product, asking well-informed consumers to evaluate those attributes for a given product and then to weight the importance of each of the attributes. The information is then combined into a composite indicator of relative quality-performance that can be compared to the relative price of the product. While this approach is quite straightforward, it also introduces obvious biases in product assessment, since subjective evaluation will vary as a function of variables such as age or income [5].

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To avoid these biases, other approaches have relied on objective methods to weight the (measurable) attributes of the product into a product efficiency ratio that approximates customer value. Non-parametric frontier techniques, such as data envelopment analysis (DEA), are being increasingly used in the literature to make these comparisons. DEA is a frontier tool that has been extensively used to measure efficiency in production by comparing input–output vectors with an empirically constructed best-practice frontier (see [38,39] for recent surveys of DEA applications). The adaptation of the DEA framework to the estimation of the product efficiency was first proposed by Kamakura et al. [32]. They applied this tool to measure product efficiency in several markets, including automobiles. The DEA framework was able to generate a set of weights for the attributes of each product which maximized the efficiency score of that product (i.e., a benefit of the doubt evaluation). After this pioneering work, many authors have applied this technique to different sectors such as computer printers [18], notebooks [23], numerical control machines [49], mobile phones [47,37], computer printers [45], digital cameras [13] and, most notably, automobiles. To our knowledge, the DEA approach has been applied to evaluate the product efficiency of automobiles by Papagapiou et al. [41], Papachristodoulou [42], Fernández-Castro and Doldán [22], Fernández-Castro and Smith [24], Bauer et al. [4], Staat and Hammerschmidt [48], Oh et al. [40], Choi and Oh [12] and, more recently, Hwang et al. [31] and González et al. [27]. Within the automobile industry other papers have focused exclusively in evaluating specific issues, such as the environmental impact of the car models [34,10,53,28].

In this paper, we build on previous literature to evaluate product efficiency in the Spanish automobile market. In doing so, we pay special attention to overcoming some of the most common empirical limitations of previous research for at least three concerns. A first aspect that has been largely overlooked in previous studies is the fact that car dealers usually make significant price adjustments, cutting the model's official price in order to boost sales. Using the official price list may be right for comparing computer printers, but will most likely be misleading for comparing automobiles, as some dealers make significant discounts which are not registered in the official price list. As a consequence, real market prices can be markedly different from official ones. Our empirical application will use both official prices and discounted prices for all the models analyzed. The comparison of product efficiency scores under official and discounted prices will indicate how effective car dealers are in adjusting real prices in order to reach the *best-buy* frontier.

The second limiting aspect of previous literature that will be addressed in this paper is the focus on a narrow piece of the market. The number of models and versions included in empirical analyses is usually very small, relative to the actual extent of the market. To overcome this limitation, in this paper we have collected data on 2092 different versions of 103 different models belonging to 25 different brands. Using a large sample is very useful in order to provide a closer approximation of the real underlying frontier when using non-parametric frontier methods. The frontier is not estimated as a parametric function but as an envelope of the data observed. If few data are available, the (envelope) frontier may be an unreasonably imperfect representation of the actual market frontier. The third limiting aspect of previous research that will be addressed in this paper is the number of attributes considered in measuring product efficiency. In general terms, previous research has been limited to a few visible and objective attributes of the car, without a consensus about which variables should be used. While some papers rely on attributes such as horse power, size and fuel efficiency (e.g. [40]), other papers evaluate product efficiency on the basis of horse power, safety and equipment (e.g. [48]). Horse power is the only variable that appears consistently in the literature reviewed. In this paper we combine information on more than 75 attributes which account (in the same DEA model) for most of the car features that have been used in previous research and even add a new variable on car reliability.

In order to achieve these goals, this paper builds on a previous research carried by the authors in which a preliminary analysis of product efficiency in the Spanish auto market was done [27]. Here we considerably extend the sample and number of attributes considered and we put the focus on the comparison between the estimates of product efficiency using the official price and using the discounted price. This comparison will bring new insights to the analysis of the competitive dynamics at the dealership level. In particular, we will test some hypothesis related to these dynamics as presented in the next section.

2. Hypotheses

Despite the recent liberalization of the European automotive market [7], the distribution of cars in Spain has remained fundamentally unchanged. Franchising is the dominant mode of governing automobile distribution [2]. Traditional dealers have stable franchise relationships with car manufacturers, which grant exclusive territories and impose commercial conditions and sale quotas [52]. The market is a differentiated oligopoly in which different brands compete with differentiated models that appeal to segmented customers. In such a scenario, market prices should adjust to reflect the relative merits of each product.

However, price setting in this sector occurs in two stages. First, manufacturers determine official (listed) prices for each model's version, as well as the prices for the extra equipment and auto parts. In doing so, the manufacturer takes into account the information about competing products and its own positioning strategy in the marketplace. Manufacturers also establish the transfer prices at which vehicles are sold to dealers. In a second stage, dealers have considerable discretion (as compared to other activities) to adjust the final price of each deal according to market circumstances. In this process, the dealer is able to incorporate local information about market dynamics, adjusting final prices to the comparative merits of the model, taking into account the offers of competing brands. Because of the franchise structure of the manufacturer–dealer relationship, the dealer has every incentive to set prices in a way that maximizes its own profit. This may produce double marginalization problems, since the dealer would take the transfer price as the unit cost, with the effect of reducing sales volumes below the level that would maximize the manufacturer's profit. In order to avoid double marginalization problems, manufacturers establish sales targets to dealers [52], which are then rewarded with discounts in the transfer price of the vehicles when targets are met. Dealer discounts are one of the most important instruments through which dealers are able to meet sales targets.

To establish sales targets, the manufacturer uses demand prospects which do not always reflect the real situation of the market, since competing products may be more attractive than initially expected. However, if the market works efficiently at the dealership level, then the magnitude of discounts should be inversely related to the actual relative merits of each product (i.e., product efficiency). In other words, if a car model has more valuable features than competing products and is offered at a similar price, then the dealer will not need to give large discounts in order to meet sales targets. In contrast, when the features of a model are inferior to competing products of similar price, then the dealer would need to adjust the price significantly in order to balance the product/price ratio to a competitive level.

Hypothesis 1. the magnitude of dealer discounts would be inversely related to product efficiency.