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Quality-based Price Discrimination: Evidence from Internet Retailers' Shipping Options☆

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Abstract

This paper tests various implications of quality-based price discrimination theory in the context of internet book retailers' shipping menus. Many internet retailers create quality variants of a homogeneous good by bundling it with several shipping options that differ by delivery time. This practice can allow retailers to extract further surplus from consumers through quality-based price discrimination. We find that the design of shipping menus offered by large retailers is consistent with main implications of quality-based price discrimination theory. Fringe sellers, however, do not appear to engage in price discrimination based on quality.
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Keywords: Price discrimination; Online retailing; E-commerce; E-retailing; Shipping; Delivery; Shipping fees; Shipping options; Vertical differentiation

Introduction

Shipping, handling, and delivery services are an integral part of catalog and internet retailing. With the growing volume of e-commerce, the management and pricing of shipping services have become crucial tasks for internet retailers. Recent research has focused on how retailers split total price of a good into a base price and a shipping fee, how they use shipping fees to raise customer acquisition and retention rates as well as purchase quantities, and how they choose free shipping thresholds.[1] Much less attention has been paid, however, to how a retailer designs its menu of shipping options and the motivations behind offering a variety of shipping options simultaneously.

Shipping menu design poses challenges for any internet retailer. Offering a single shipping option to all consumers may be cost-effective and easy to implement, but runs the risk of losing consumers who value faster delivery. Faster shipping options, such as two-day or overnight delivery, however, are available at much higher prices from shipping companies, and a retailer must have an infrastructure that allows faster handling and flow of goods to make them shipment-ready. Furthermore, to be able to offer these fast options at attractive fees, a retailer may need to serve a sufficiently large number of customers who value such options. Scale economies can help larger retailers provide these options at lower costs due to favorable terms they can obtain from shipping companies. Small and specialized retailers may choose to offer a more limited menu of shipping options, especially if their niche is a consumer segment with relatively homogeneous needs for delivery speed. One therefore expects to see differences across retailers in the breadth of their shipping menus.

Internet retailers that can offer multiple shipping options face a mechanism design problem. They need to determine how many options to offer, the delivery times for these options, and the fees charged for them. This problem also presents an opportunity: a retailer can price-discriminate based on the delivery times specified in these options and extract more surplus from consumers compared to nondiscriminating pricing. In fact, a retailer can offer a menu of shipping options that induces a consumer with an unobserved willingness to pay for delivery time to self-select into an option designed specifically for that consumer. This paper investigates whether such strategic design of shipping menus prevails in the context of internet book retailing. The results indicate that only a subset of the firms in the

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[1] See, e.g., Dinlersoz and Li (2006), Hossain and Morgan (2006), Lewis (2006), Yang, Essegaier, and Bell (2005), and Srinivasan, Anderson, and Ponnavolu (2002).

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market, mainly large and well-known retailers, offer broad menus the designs of which are consistent with the implications of the theory of quality-based price discrimination. Fringe firms offer narrower menus and do not appear to engage in such discrimination.

A product is often marketed at different quality levels. One motivation behind this practice is the use of quality variants to price-discriminate among consumers with different but unobserved tastes for quality. The first systematic theoretical analysis of this practice is due to Mussa and Rosen (1978), who analyzed how a monopolist can induce consumers with unobserved heterogeneous tastes for quality to self-select from among the product-qualities it offers. The monopolist can extract greater surplus overall if it offers a socially suboptimal quality level for its low quality product to prevent consumers who have high willingness to pay for quality from settling for the low quality. The result is a quality range broader than required for efficiency, and markups that increase with quality.[2] Some implications of the monopoly case extend to more general market structures, where firms have some degree of market power due to horizontal or vertical product differentiation.[3]

Despite the abundance of theoretical studies, empirical investigations of quality-based price discrimination are still scant. It is not easy to find good measures of quality by which products can be ranked unambiguously, especially when products possess many vertically differentiated attributes. In a notable study, Kwoka (1992) provides a formal test of quality-based price discrimination, using detailed price and cost data on four car models produced by Chrysler, a large U.S. automobile manufacturer. Assuming Chrysler has some market power due to brand loyalty, he finds that the firm offers socially sub-optimal qualities for all models in the product line except for the top quality model, which also has the highest markup. Although this is a well-conceived study, a small sample from only one firm in the market limits the generality of the conclusions. Furthermore, vehicle length, the measure of quality used in the study, may not be a very good proxy for the overall quality of an automobile, even within the same manufacturer. It is difficult to capture the notion of quality with a scalar for a product that has so many different attributes.

This paper provides more comprehensive tests of quality-based price discrimination theory using data from internet book retailers' shipping options. Our analysis addresses some of the difficulties in testing the theory. First, books are homogenous goods, and shipping options create an observable univariate quality dimension for otherwise identical books across retailers. This quality dimension can be measured by a retailer's reported average delivery time for a shipping option. Consumers regard delivery time as one of the most important features of a shipping option.[4] Longer delivery time means worse shipping quality, and consumers generally care less about other features of a shipping option.[5]

Second, we are able to offer various tests based on theories' implications on markups and the relationship between the fees and the qualities of shipping options. Because shipping services of internet retailers are provided by a small number of nationwide shipping companies, we can approximate the retailers' cost of shipping by using business shipping rates of major delivery service providers. These approximations allow construction of markup estimates for shipping options. Because we cannot measure markups precisely, we also offer tests that do not rely on cost or markup estimates.

Third, because the data on shipping options are readily available through the websites of a large number of internet book retailers, we are able to conduct an industry-wide study. We are able to explore how the ability to price-discriminate varies across different types of firms. This multifirm approach also helps us assess which types of retailers appear to engage in quality-based price discrimination.

Fourth, a priori there are several reasons why a price-discriminating outcome may exist. While it may be difficult or unlawful for retailers to discriminate across consumers using the base price of a product, it may be much easier to do so based on the quality and fees of shipping options. Many empirical studies also indicate that internet retailers can exercise some amount of market power as a result of horizontal differentiation, brand name, or imperfect information due to search costs in internet markets.[6] These considerations also apply to the well-documented price dispersion in internet markets.[7] Given some amount of market power, some retailers may be able to more easily engage in quality-based price discrimination.

We find evidence that quality-based price discrimination through shipping options prevails among larger and well-known internet book retailers. Certain theoretical studies suggest that when the market is sufficiently competitive, firms that offer several quality-variants of the same basic product adopt a constant markup on all quality variants, regardless of the cost of quality.[8] This implication is rejected for the set of relatively large and well-known book retailers. These retailers offer three to four different shipping options with a wide range of quality choices. Their markups on shipping options also exhibit a statistically significant increase as shipping quality increases across options within a retailer. More importantly, a longer average

[2] See also Cooper (1984), Maskin and Riley (1984), and Gabszewicz et al. (1986).

[3] See, e.g., Katz (1984). In theory, market power is neither necessary nor sufficient for price discrimination. See, for instance, a specific case analyzed by McAfee, Mialon, and Mialon (2006). In practice, some amount of market power can make price discrimination easier for a firm.

[4] See, for instance, Smith (2007), who finds that in on-line shopping the most popular reason for shopping cart abandonment after a consumer placed a product into the cart is unreasonable shipping options.

[5] Other features of a shipping option such as return policy and shipment package quality may also be important for consumers. However, the data suggests that these attributes usually apply to all shipping options of a retailer. Therefore, they do not generate additional quality differences across shipping options within a firm.

[6] See Clay et al. (2002), Brynjolfsson and Smith (2000), and Baye, Morgan, and Scholten (2004).

[7] See, e.g., Baye, Morgan, and Scholten (2004).

[8] See Rochet and Stole (2002), and Armstrong and Vickers (2001)