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Interfaces with Other Disciplines

Pricing and market segmentation using opaque selling mechanisms

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ABSTRACT

In opaque selling certain characteristics of the product or service are hidden from the consumer until after purchase, transforming a differentiated good into somewhat of a commodity. Opaque selling has become popular in service pricing as it allows firms to sell their differentiated products at higher prices to regular brand loyal customers while simultaneously selling to non-loyal customers at discounted prices. We develop a stylized model of consumer choice that illustrates the role of opaque selling in market segmentation. We model a firm selling a product via three selling channels: a regular full information channel, an opaque posted price channel and an opaque bidding channel where consumers specify the price they are willing to pay. We illustrate the segmentation created by opaque selling as well as compare optimal revenues and prices for sellers using regular full information channels with those using opaque selling mechanisms in conjunction with regular channels. We also study the segmentation and policy changes induced by capacity constraints.

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1. Online travel sales

The selling of travel related services, e.g. hotel rooms and airline seats online has dramatically changed how service firms reach customers. Initial thoughts about online selling were very positive as firms had new channels to reach customers enabling increased opportunities for segmentation. Over time service providers have increased efforts to move customers back to company direct distribution channels (company websites and call centers) in an effort to control sales costs and commissions while maintaining direct contact with the customer to facilitate loyalty programs and other marketing efforts.

One of the early evolutions in online distribution of travel services was opaque selling. Pipeline started this evolution with its opaque selling of airline seats in 1998. Lastminute.com, Hotwire.com and Priceline.com, unlike other online distribution channels such as Expedia.com, Travelocity.com and Booking.com, offer customers opaque products with aspects of the service provider concealed until the transaction has been completed. For instance a customer purchasing a hotel room through Hotwire can not specify the hotel they wish to stay at, but rather only its star rating and general location within the destination city. Customers do not know the identity or exact location of their non-refundable selection property until after purchase. Opaque travel sites offer service providers a convenient channel to segment customers and distribute discounted products without cannibalizing or diluting full priced products. The opaque channels naturally segment customers as regular full price paying customers desiring to stay at the hotel of their choice with full cancellation flexibility are unique from those willing to purchase the discounted, non-refundable opaque product at the unknown service provider. Similar to the opaque posted price model of Hotwire, Priceline offers opaque services but without posted prices. Priceline's name-your-own-price model is similar to Hotwire where consumers only know the star level and region for a hotel. On Priceline, consumers post bids for the opaque service, having to then wait for the service provider to accept or reject their offer. While opaque selling originated in the United States, it is now quite common globally as Hotwire and Lastminute.com (a subsidiary of Travelocity) now sell opaque hotel rooms across Europe with Blink Booking and HallSt.com recent European opaque selling startups in Europe. For a more detailed description of Priceline's name-your-own-price model see Anderson (2009) or on Hotwire's posted price opaque model see Anderson and Xie (2012).

Opaque selling is common across all facets of travel; with air travel, the consumer is unaware of the itinerary (connections and layover durations) or airline and with rental cars, the consumer does not know the type of car or rental firm until after paying for the service. Green and Lomanno (2012) provide a detailed analysis of the hotel distribution landscape where they indicate that 2.3% of hotel bookings are opaque whereas about 7.1% are made through regular full information online travel agents (OTAs). Similarly they indicate that the OTA share of transactions are increasing and can be as high as 30% or 40% for independent hotels. The level of opacity or uncertainty varies across the different opaque channels as some choose to offer cancelation opportunities as in the case of Lastminute.com, provide user generated feedback (review scores)

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as in the case of Hotwire.com, or list some of the amenities offered by the service provider. Similarly the degree of opacity may also be impacted by the market, as markets with fewer similar competitors offer decreased opacity over markets with a larger number of service providers.

Opaque selling has recently started to receive interest in the academic literature, most of the early research has focused on models similar to Priceline's name-your-own-price (NYOP) bidding mechanism where customers post bids for opaque services. Anderson (2009) provides a detailed background on the nature of Priceline's NYOP model as well as a dynamic programming based model for the setting of prices by firms on Priceline. Fay (2004) develops a stylized model of a monopolist firm using a NYOP channel and investigates whether repeat bidding should be allowed. Strictly speaking, Priceline does not allow repeat bidding within a 24 hour period but there are numerous methods to circumvent this limitation, see BiddingforTravel.com for examples. Fay indicates that partial repeat bidding, i.e. repeat bidding by knowledgable customers may be less profitable than complete repeat bidding. Fay (2008) extends the monopolist model to a duopoly model with firms pricing into two consumer segments. One segment is loyal to a particular service provider, the second has preferences distributed between the two firms along a line as in the traditional Hotelling model (Hotelling, 1929). Fay (2008) is the first paper to investigate how product opacity affects the market. Fay studies two competing service providers selling products to two types of customers (business and leisure) on both an opaque posted price channel and a traditional distribution channel. Fay shows that opaque selling benefits the monopoly service provider when customers have heterogenous values for products. Shapiro and Shi (2008) extend the model of Fay (2008) to N firms with the number of firms indicating the degree of opacity – uncertainty in knowledge of service provider increases with number of firms. Shapiro and Shi focus on providing a rationale for opaque selling. They explain why service providers are willing to distribute products through opaque travel sites such as Priceline and Hotwire and lose the advantage of product differentiation. Similarly Wang, Gal-Or, and Chatterjee (2009) develop a game theoretic model of a supplier using both regular posted price full information channels as well as a NYOP channel to reach heterogeneous customers. They develop a two-stage game where suppliers set posted prices in period 1 and after observing demand in period 1, set threshold prices on NYOP channel in period 2. Consumers observe fixed posted prices in the first period then decide to buy (at posted prices) or bid in period 2. Fixed posted prices combined with demand uncertainty results in the NYOP channel generating improved revenues for the service provider.

A smaller body of research focusses solely on opaque selling and the not simultaneous use of opaque selling and full information selling. Wilson and Zhang (2008) look at a retailer setting prices on a NYOP channel. They develop ϵ optimal policies for the retailer that encourage the customer to bid their maximum reservation price. Hann and Terwiesch (2003) use data from a European NYOP retailer to investigate consumer transactions costs (the cost of resubmitting bids) of using a repeat bidding NYOP channel. In a related paper Spann, Skiera, and Schafers (2004) investigate consumers' frictional or transactions costs as well as their willingness to pay using data from a German NYOP seller of flights from Germany to Spain. Anderson (2009) uses consumer bid data from a US based hotel in a dynamic programming framework to determine optimal threshold prices to post on Priceline.com.

Related research looks more generally at opaque selling where prices are posted but some aspect of the service or service provider is hidden i.e. the selling mechanism similar to that provided by Hotwire.com. Jiang (2007) develops a Hotelling type model to illustrate how a firm should price on regular full information channels versus opaque channels. Jiang indicates that opaque selling can be Pareto improving for both customers and suppliers when customers are differentiated in their willingness to pay. Jiang compares opaque selling and regular selling (selling full-information products), providing insight when to implement opaque selling. Jerath, Netessine, and Veeraraghavan (2010) compare opaque selling with last-minute direct selling and obtain the conditions under which opaque selling is preferred. In their model two firms of equal capacity offer a differentiated service via three channels: regular posted price, posted last-minute sales, and last-minute sales through an opaque intermediary. Their goal is to investigate under what market conditions a firm should directly offer last-minute discounts versus offer those discounts through an intermediary. Jerath et al. relax the posted price rigidity of Wang et al. (2009) through introduction of the direct last-minute discounts. They conclude that direct last-minute selling is preferred over the opaque intermediary when consumer valuations are high or if the service offerings are relatively homogeneous. Anderson and Xie (2012) use a nested logit model in combination with logistic regression and dynamic programming to illustrate how a service firm can optimally set prices on an opaque sales channel. The choice model allows the characterization of consumer tradeoffs when purchasing opaque products while the dynamic programming approach allows the characterization of the optimal pricing policy as a function of inventory and time remaining.

While there is an extensive body of research on the use of auctions, very little of this research looks at the simultaneous use of auctions and posted prices. Firms can use auctions to reach customers whom may not otherwise purchase, as posted prices may be too high. Conversely auctions potentially dilute revenues as customers willing to pay posted (full prices) may purchase (at lower prices) via the auction. The opaque nature of Priceline's NYOP model helps to avoid this dilution. Etzion, Pinker, and Seidmann (2006) is one of the few auction related papers that looks at the simultaneous use of auctions and posted prices. Similar to our development they look at a firm with excess supply facing consumers who strategically choose to purchase at posted prices or bid (resorting to posted prices if their bid fails). Different from our model, consumers do not face any product opacity with the auction but do incur a waiting cost associated with bidding. van Ryzin and Vulcano (2004) look at firm using posted prices as well as an auction mechanism, unlike our model of endogenous channel choice (strategic customers similar to Etizon et al.) they assume separate streams of customers to each channel with the seller deciding on inventory allocation across the channels. Huang and Sosic (2011) and Caldentey and Vulcano (2007) also look at firms using auctions in concert with posted prices. Both assume customers arrive according to a poisson process and focus on dynamic inventory management strategies for the seller. Huh and Janakiraman (2008) illustrate the optimality of (s, S) inventory management policies for firms using several different selling mechanisms (including name-your-price mechanisms) in settings where firms can replenish inventory at prescribed costs. Cai, Chao, and Li (2009) investigate the potential benefits of a NYOP retailer in addition to a posted price channel with consumers allowed to return to posted price channels upon failed bid attempts.

We develop a stylized model of consumers looking to acquire travel services through either full information or opaque channels (both posted price and bidding). Consumers choose their channel or sequence of channels (in the case of bidding first followed by posted prices) that maximizes their surplus. Our paper is unique from the literature in that it is the only paper that investigates a firm using two opaque (posted and bidding) channels simultaneously with regular full information posted price channels. Second, prior research assumes two or more exogenous customer segments (i.e. business and leisure) with the opaque channels

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