Price discrimination via information provision ☆

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ABSTRACT

We study price discrimination where different prices are offered as a bundle with different levels of information about a product. The seller's price discrimination induces high valuation buyers to purchase a good without information and low valuation buyers to purchase with information. Our analysis highlights several interesting results about price discrimination: (i) the seller's choice of information provision is the combination of full information and no information, (ii) products can be cheaper without information provision than with information provision, (iii) as a result of price discrimination, prices can be more dispersed as buyers' valuations become largely similar, and (iv) the high valuation buyers purchase a damaged good and may earn negative surplus. Furthermore, we investigate under which circumstances price discrimination is more profitable than uniform pricing. We show that a decline in transportation costs which facilitate price discrimination can be welfare reducing.

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1. Introduction

Price discrimination is often associated with information differentiation. One example is that many traditional merchants operate brick-and-mortar (offline) stores as well as online sites. A crucial difference between online shopping and offline shopping is the accessibility of information about products. In the offline store, people can learn better about the product, for example, by reading parts of novels, by trying on clothes, and so forth. On the other hand, when they shop online, it may be more difficult for consumers to decide whether the products really match their preferences. Another example is travel agency sites such as priceline.com or hotwire.com. These websites offer two options to buyers: buyers can choose hotels and flights with detailed information (transparent goods), or they can do so without knowing the brand and location of hotels or the brand and schedule of flights (opaque goods). Namely, they are offered both bundles which include different levels of information about the services at different prices. In addition, advance-purchase discounts or buy-now discounts can also be thought of as the type of price discrimination based on information provision because consumers are offered the discounts at the expense of a chance of evaluating the product fully or updating a previous valuation.

In these examples, buyers have two kinds of private information. One is their prior valuation for a good or service. The other is a signal that they receive about how well the product fits their taste. To receive a signal or process information, the buyers have to pay transportation costs, or alternatively, have to exert costly effort. Once the buyers receive a signal, they update their valuations. In addition, the seller can control the level of information by choosing a marketplace or a product design.

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We provide a simple model of price discrimination through information differentiation which incorporates all these economic forces. We show that the self-selection is incentive compatible only when high valuation buyers purchase the product with less information and low valuation buyers purchase the one with more information. The intuition is as follows. When a buyer purchases a good or a service without information, he has to take some risks of ending up being mismatched with it. The buyer who has a high expected valuation, thereby becoming sufficiently optimistic, will face relatively less risks, and so he may decide to buy the product even without further information. Knowing this, a seller is able to separate high valuation buyers from low valuation buyers by offering a cheaper price together with less information.

Information-driven price discrimination generates several interesting results. The seller's optimal choice of information provision is the combination of full information and no information. Our model thus explains why products are often cheaper without information provision than with information provision, and similarly, why online prices are lower than offline prices.[1] In addition, the optimal choice of information provision results in that a lower price may be offered to the *ex ante* higher valuation buyer. Price discrimination can be strengthened as consumers are more homogeneous in their preferences. That is, the price difference gets larger as the buyers' valuations are closer to each other. Also, the result can be interpreted as that the high valuation buyers purchase a damaged good and may earn negative surplus.

We also study the conditions under which price discrimination is more profitable than selling only online or offline. Price discrimination is found to be profitable when the consumer heterogeneity is neither too large nor too small. This is intuitive because either the compensation to the low type or information rent to the high type is too costly, otherwise. Alternatively, price discrimination is profitable when transportation (effort) cost is small enough. This result implies that price discrimination is introduced when it is relatively easy for consumers to visit offline stores. On the other hand, our analysis shows that price discrimination may lead to lower consumer surplus and social welfare. Taken together, a decline in transportation cost can be welfare reducing.

Our paper presents a model of second-degree price discrimination where a seller offers a menu of options and lets buyers select what they want (Mussa and Rosen, 1978; Maskin and Riley, 1984). There are several papers which study price discrimination in an environment where buyers are initially uncertain of their valuations and learn their preferences by additional information. The seminal paper, Lewis and Sappington (1994) studies how information provision affects second-degree price discrimination of offering menus of different prices and quantities. Miravete (1996) compares *ex ante* two-part tariffs and *ex post* two-part tariffs in telecommunication

industry. Courty and Li (2000) study sequential screening through refund policy. Grubb (2009) also studies a similar issue but focuses on the case that consumers are overconfident in that they overestimate the precision of their demand forecasts. In these papers, contracts are signed when consumers have partial private information, that is, before they learn their valuations. Compared to these papers, our paper differs in the sense that the provision of different levels of information is the screening mechanism itself. In other words, buyers' self selection arises by their purchase of different goods with different levels of information.

In this sense, Bar-Isaac et al. (2010) and Nocke et al. (2011) are the closest papers. Bar-Isaac et al. (2010) study whether the firm wants to make it more or less difficult for consumers to learn their true valuation for the good. Nocke et al. (2011) show how advance-purchase discounts can serve to price discriminate in an intertemporal setting where consumers' uncertainty is resolved over time. Differently from the first paper, our model allows price discrimination among consumers. Our paper also complements the second paper by incorporating endogenous provision of information and studies the seller's optimal choice of prices and information provisions. Our simple model also allows us to analyze the effect of price discrimination on welfare.

In what follows, for ease of exposition, our description of the model will follow mostly the offline and online scenario. Section 2 introduces the basic model. Section 3 analyzes the cases where either only online or only offline stores are available. In Section 4, the seller is allowed to price discriminate by having both types of stores, and we derive the optimal price discrimination. In Section 5, we then compare the profits of three cases: selling only online, only offline, and at both stores. We will show which is most profitable to the seller. Section 6 extends the model by relaxing several assumptions. Section 7 concludes.

2. Basic model

2.1. Seller

There is a monopoly seller with a single product, which can be sold at offline and/or online stores. A significant difference between shopping at online and at offline stores is the informativeness of the signal that a buyer may receive. In other words, the monopolist offers a product with different levels of information: one with more information and another with less information. We assume that production cost is zero.[2]

2.2. Buyers

There is a continuum of buyers with a unit demand. Each buyer's match value, v, for the product is either v_H with probability θ or v_L with probability $(1 - \theta)$, where

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[1] Brynjolfsson and Smith (2000) find that prices on the Internet are 9–16% lower than prices in conventional outlets. See also Carlton and Chevalier (2001), Brown and Goolsbee (2002), and Chevalier and Goolsbee (2003) for empirical studies on online prices.

[2] The production cost can be added to the model, but our main results remain the same. To focus on the effect oaf information provision on prices, we prefer not to include it.