



Price discrimination and investment incentives

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ABSTRACT

We examine a model of a monopolist selling to two segments of consumers with different preferences for quality. We show that if the firm is unable to price discriminate between the segments, then there is less investment in quality. We find that both consumer segments, and society overall, may suffer if the firm is unable to price discriminate. We extend the model to duopoly competition, and find that our results still hold.

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1. Introduction

The effect of price discrimination on social welfare has been a topic of interest among economists for a long time, at least since Pigou (1920), who conjectured that price discrimination decreases welfare if the total output decreases at the same time. In 1936, the Robinson–Patman Act was passed to disallow price discrimination in the intermediary markets in the United States, and price discrimination between consumers is routinely a source of public relations problems for companies.

The central question we ask is how the ability to price discriminate affects a firm's incentives to invest in quality and, in turn, how this affects consumer and social welfare.

We are concerned with markets where different segments of consumers have different valuations for product quality. Business travelers care much more about their flight landing on time than do leisure travelers on the same flight going for a week-long vacation with no particular plans. A sick patient who might have a tumor cares much more than a healthy person about the kind of MRI machine his hospital has. Hospitals and welders care about oxygen quality much more than oxygen-bar owners, and a business owner cares much more about her hard drive not failing than does a consumer

with nothing irreplaceable on that hard drive. In such markets, firms must make both pricing decisions and investment decisions for quality, and their incentives to invest depend critically on whether they are allowed to price discriminate between the two segments.

We study a model of a monopolist supplier choosing both quality and prices. The firm operates in a market where consumers have different preferences for quality. There are two segments: discerning consumers who care about quality and undiscerning ones who do not. We examine the firm's choices under two regimes: one in which the firm is allowed to price discriminate and another in which it is not. It turns out that the supplier invests less in quality when it cannot price discriminate between the two segments. We find that the undiscerning segment that does not care about quality always suffers if price discrimination is not allowed, and that the discerning segment that cares about quality may also suffer. It turns out that if the investment cost function is not too convex, all consumers are worse off in a regime without price discrimination. Our results also hold if the markets differ in another way: the consumers value quality similarly, but have different price elasticities.¹ The driving force is that consumers have different relative valuations for quality. We extend our model to a duopoly setting (with differentiated Bertrand competition), and find that our results continue to hold with strategic competition.

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¹ See the Appendix A for the formal proof.

We can interpret our model as being an upstream supplier (or an oligopoly of upstream suppliers) selling goods to almost perfectly competitive downstream retailers or intermediaries, where in some markets consumers care about the attribute, and in others they do not. Alternatively, the attribute could be something that only particular retailers care about, such as an RFID tag or particular packaging.² In these cases, our model is a reduced-form model of vertical relations.

What is the intuition behind our results? When price discrimination is allowed, the monopolist ensures that only the discerning segment pays more because of a higher investment. Without price discrimination, both segments pay for it through the uniform price. The undiscerning segment is the weak segment that gets stuck with a higher price because of the monopolist's inability to price discriminate, and this results in a lower welfare for this segment. The discerning segment is the strong segment that gets a lower price with uniform pricing.³ However, the lower price does not necessarily imply an increase in welfare. While the price is lower, investment also decreases in a regime with no price discrimination. Thus, depending on how much the investment decreases, consumers can be worse off. The magnitude of the drop in investment depends on the shape of the investment cost function.

1.1. Applications

1.1.1. Parallel trade in the pharmaceutical market

Our model has two groups of consumers—one that cares about an attribute, and another that does not. Alternatively, one of the groups can care more about (have a higher willingness to pay for) the attribute. The prohibition of trade arbitrage (parallel trade) in the medical drugs market is an important issue in the medical literature.⁴ In particular, the U.S. consumers' willingness to pay is much higher than that of the average world consumer; for example, [Danzon \(2007\)](#) argues: "It is particularly important that the United States maintains its bar on drug importation." Generally, this argument is based on the fact that the prices in the developing countries would increase tremendously—the standard argument that prohibiting price discrimination increases prices in the weak market.

Our results show that not only is the welfare of the consumers in the poor markets ultimately reduced when parallel trade is allowed, but also, pharmaceutical firms invest less in R&D, and consumers in the wealthier markets may suffer because they get a worse version of the drug, even if at a lower price.^{5,6}

The theoretical industrial organization literature has suggested other reasons for why parallel trade in the pharmaceutical market should be disallowed.⁷ [Hausman and MacKie-Mason \(1988\)](#) show that if there are significant marginal cost reductions in volume, all consumers might be better off from price discrimination. [Layson \(1994\)](#) examines general conditions for a product not to be

² Note that in our model, there are no marginal cost savings provided by the attribute, and, thus, there are no cost differences of serving the downstream retailers.

³ See [Schmalensee \(1981\)](#) for more on weak and strong segments.

⁴ See [Maskus \(2001\)](#), [Hornbeck \(2005\)](#), and [Danzon \(2007\)](#) for examples and empirical evidence.

⁵ Note that we implicitly assume that both consumer segments are being served. With uniform pricing, it is possible that the monopolist will choose to not serve the weaker segment. The investment incentives in our model are the same for a uniform-pricing monopolist regardless of whether the non-discerning market is served. Thus, by making this assumption we are stacking our model against welfare improvement due to price discrimination.

⁶ Another interpretation of this example is that consumers in different countries differ not in their taste for quality, but rather in their willingness to pay. While our baseline model focuses on differences in preferences for quality, we provide an extension in [Appendix A](#) to show that our results still hold in the case of consumer segments with different willingness to pay.

⁷ Parallel trade is illegal in other contexts, as well. In December 2010, the Supreme Court of the United States was deadlocked by a 4–4 vote on the case of [Costco](#) importing [Omega](#) watches without the manufacturer's permission. The lower court decided against [Costco](#), and found in [Omega's](#) favor ([New York Times, 2010](#)).

developed at all because of the inability of the producer to price discriminate. However, neither of the two explanations seems to apply to the pharmaceutical market, especially for the blockbuster drugs.⁸

The closest paper to ours is [Valletti \(2006\)](#), who also examines a manufacturer's investment incentives. [Valletti \(2006\)](#) examines a monopolist possibly subjected to uniform prices in markets that differ in demand and/or cost characteristics, and he also finds that the investment incentive is reduced without price discrimination in the case of different demands. If the markets differ by the marginal costs of serving them, then price discrimination reduces the incentive to invest. [Valletti \(2006\)](#) also uses a restriction on parallel trade as an application of the model. While [Valletti](#) deals with cost and demand parameter dispersions across markets, we generalize [Valletti's](#) demand function, show that the result holds in a duopoly, and further show that the ability to price discriminate (or a restriction on parallel trade) might make the consumers in the higher willingness-to-pay markets also better off due to increased investment, and that a restriction on parallel trade might result in a Pareto improvement.

Following [Valletti \(2006\)](#), we treat parallel trade as an example of third-degree price discrimination. While a restriction on parallel imports prohibits firms from engaging in arbitrage, it does not prohibit consumers from doing so, implying that this may be an example of second-degree price discrimination. However, although there is some anecdotal evidence of consumers importing drugs, from Canada to the United States, for example, such drug importation is illegal according to the FDA, and, moreover involves significant practical obstacles (such as traveling to a foreign country, limited potential for litigation, issues with the health insurance provider, and limited manufacturer/physician support). Furthermore, the existing literature on health documents two major market-separation concerns as being countries that allow parallel trade and state-sponsored insurance plans that use other countries' prices for bargaining (see [Danzon, 2007](#)).

2. Net neutrality

Another application is net neutrality. Some content—voice over IP and high-quality video—has to be delivered to consumers at high speed, without any delay. Any lag significantly worsens the consumer experience, and, thus, these content providers highly value increases in the speed of content delivery. Other content—such as email or news—can be delivered to consumers at almost any speed, without sacrificing the quality of the consumer experience. Our model predicts that forcing net neutrality (internet service providers being unable to charge different rates for different types of content) results in lower investment, and, further, that neutrality may be disadvantageous for both content providers who need high bandwidth and those who do not.

[Krämer and Wewiorra \(2009\)](#) also find that net neutrality lowers investment by the monopolist internet service provider (ISP). However, they find that the welfare of the content providers (CPs—consumers in our model) is unambiguously lower if the ISP does not practice net neutrality. The difference with our paper lies in the modeling choices. [Krämer and Wewiorra \(2009\)](#) assume that the ISP cannot charge CPs if there is net neutrality; and thus, abandoning net neutrality leads to higher prices for the CPs that get priority access, and to lower quality for the same price (of zero) for the CPs that do not get it. [Choi and Kim \(2010\)](#) find that the ISP's investment might decrease under a regime in which discrimination is possible. Again, the difference lies in the assumptions. [Choi and Kim](#) assume that there are two CPs competing in a covered Hotelling market, and only one of them is allowed to get priority access. If one CP gets priority access, the other one ends up with

⁸ There are economies of scale in the pharmaceutical markets; however, they manifest themselves in a high up-front fixed cost, not as diminishing marginal costs. Also, while [Layson's](#) argument might apply to drugs that cure diseases not prevalent in the developed world, it is harder to make that case for drugs aimed primarily at developed countries.

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