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Perfect price discrimination with costless arbitrage

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Abstract

The ability of a monopoly seller to prevent resale is often presented as a necessary condition for first degree price discrimination. In this paper, we explore this claim and show that, even with costless arbitrage markets, price discrimination may continue to be both feasible and profit maximizing despite potential resale. With finite numbers of consumers, arbitrage markets may be 'thin', in the sense that there can be too few low-valuation consumers to supply high-valuation consumers. We examine both *ex ante* and *ex post* arbitrage markets and show how a monopoly can exploit potential 'thinness' to profitably price discriminate. In each case, we present sufficient conditions for equilibrium price discrimination. We note that the form of such discrimination depends on the nature of the arbitrage market and consider business strategies that a monopoly might adopt to exacerbate market thinness. Our results show how market depth and the effectiveness of arbitrage can be the key elements for price discrimination, rather than the per se prevention of reselling.

JEL classification: D42; L11

Keywords: Price discrimination; Arbitrage; Personalised pricing

1. Introduction

According to most treatments (e.g., Varian, 1989), price discrimination requires firms to (1) have some market power, (2) be able to sort consumers and (3) be able to prevent resale. When it

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comes to the benchmark case of first degree or perfect price discrimination the first two conditions become stronger in that the firm must also be able to make take it or leave it offers to consumers and possess perfect information regarding a consumer's type.

This paper explores the possibility of first degree price discrimination in an environment where (3), the no resale condition, is not satisfied. It is commonly asserted that this change to the standard treatment undermines the possibility of price discrimination. Consider, for instance:

> It is clear that if the transaction (arbitrage) costs between two consumers are low, any attempt to sell a given good to two consumers at different prices runs into the problem that the low-price consumer buys the good to resell it to the high-price one. (Tirole, 1988, p.134)

To our knowledge there have been no attempts to model the resale market to test whether it is in fact true that this possibility undermines price discrimination.[2]

To explore this, we completely relax (3) and assume the opposite: that resale can occur free of transaction or transportation costs. Moreover, we assume that any trader – the monopolist producer or arbitrageurs – can make take it or leave it offers to any consumer and knows that consumer's type. Despite the complete relaxation of the no resale condition, we demonstrate that price discrimination is still both feasible and potentially profitable for a monopolist seller.

Our contribution highlights the importance of the number of low-valuation consumers in driving price discrimination. In a model with two consumer types and a monopolist with unlimited capacity, we model two variants of resale. In the first, following an initial round of sales by the monopolist, the monopolist and initial purchasers can act as sellers in an *ex post* market. We term this *ex post arbitrage*. In this situation, we demonstrate that there are conditions under which the monopolist sells to all consumers initially and charges high-valuation types a higher price than the price to low-valuation types. The possibility of *ex post* arbitrage constrains the monopolist's pricing to high-valuation consumers but does not prevent them from engaging in price discrimination. The reason is that, in equilibrium, the high-valuation consumers are not certain that low-valuation consumers will trade in the *ex post* market and are, therefore, willing to accept a higher up-front price. There is no discounting or risk aversion driving this result although the presence of either would strengthen it.

In the second variant, we consider forward markets for the sale of the monopolist's product. In these markets, low-valuation consumers can sell forward contracts to high-valuation ones and settle these by purchasing the requisite stock from the monopolist later on. In this situation, it may be worthwhile for the monopolist to set a pricing policy equivalent to a perfect price discrimination outcome whereby each consumer is charged their willingness to pay. This is because the monopolist has an incentive to speculate on there being insufficient low types for trade to have occurred in the forward market rather than foreclosing on that possibility by setting a single high price.

In each case, it is *uncertainty regarding the resale market* – specifically, the possibility that a resale market may be 'thin' – that drives the result. Put simply, when a monopolist can observe a consumer's type, the low-valuation consumers are those who can perform an arbitrage as well as a consumption function. The monopolist can choose to foreclose on these by not selling to those consumers (i.e., charging a high price) or, if there is a strong enough possibility that the numbers of such consumers may be low, sell to them and price discriminate. As such, the main contribution

[2] An exception is Alger (1999) who demonstrates that arbitrage, in a model where consumer types are private information, can eliminate price discrimination.