Costly price discrimination

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Abstract

Standard theory neglects that enacting price discrimination is costly to firms. When this costliness is accounted for, perfect price discrimination is often socially inefficient. For pure monopolists it is sometimes socially inefficient. For monopolistic competitors it is always socially inefficient.

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1. Introduction

Is perfect price discrimination socially efficient? A survey of economists, or glance through any economics textbook, would universally suggest the answer is ‘yes’. Few readers beginning this paper would disagree. The perfectly price discriminating monopolist resolves the deadweight loss by expanding output, creating a social gain, and transfers consumer surplus to himself, which is socially neutral. The net result is increased social welfare. While this reasoning seems sensible, by the end of this paper you will be convinced that it is often wrong.

The ‘obviousness’ of perfect price discrimination’s social efficiency has precluded examinations of its accuracy.1 However, we show that under general demand and marginal cost functions, for pure monopolists, perfect price discrimination is sometimes socially inefficient.

For monopolistic competitors it is always socially inefficient. This occurs because firms face costs of enacting price discrimination.2 These costs, which include segmenting consumers, identifying elasticities, and preventing resale, are significant in all industries.3 This, of course, is the reason not all firms enact this pricing strategy. The omission of these transactions costs from existing theories of price discrimination is important because as Varian (1989: 604) points out, “A full welfare analysis of attempts to engage in [perfect] price discrimination cannot neglect the transactions costs involved in the negotiation itself”.

The intuition behind our model of how costly perfect price discrimination can lead to inefficiency is straightforward. To enact this pricing strategy a firm would be willing to expend resources up to the amount of its gain from doing so: the sum of the deadweight loss and consumer surplus, both of which are transferred to the monopolist under this price regime. However, the social gain of such a move is only the value of solving the deadweight loss. The private benefit of perfect price discrimination therefore exceeds the social benefit. Although this

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1 The first, and only, serious challenge to this conventional wisdom is Bhaskar and To (2004) who show that under monopolistic competition with fixed entry costs, perfect price discrimination can be socially inefficient.

2 While the costliness of price discrimination has been recognized in passing by some (see for instance Tirole, 2001 and Posner, 1975), no one has reconsidered the theory of price discrimination in light of these costs.

3 In fact, there is an entire industry known as “yield management” that charges firms for specialized consulting and software to help them implement price discrimination. These services can be extremely costly, with the software alone costing upwards of $10 million per year for a single large firm (see Lieberman 1991, 1993).
2. The general case and its implications

Fig. 1 depicts the traditional welfare analysis for a single-price monopolist. The area of triangle cde is the deadweight loss to society associated with the monopolist’s market power. Consumer surplus is given by the area of triangle abc.

Suppose this producer wants to convert his pricing strategy to one of perfect price discrimination. For reasons discussed above, doing so is costly. Let $C$ be the monopolist’s cost of enacting perfect price discrimination. For ease of exposition, here we assume the cost of perfectly price discriminating is a fixed cost of adopting the new pricing strategy. However, the results we derive apply equally when there are variable costs of perfectly price discriminating, though the interpretation changes slightly. We also assume that the cost of implementing perfect price discriminating is industry specific.

To determine the profitability of implementing perfect price discrimination, the monopolist must weigh the benefits of enacting perfect price discrimination against the cost, $C$. His benefit of perfectly price discriminating consists of two components. The first consists of transforming the area of the deadweight loss triangle cde into producer surplus. Formally, this area can be written as $\int_{Q_m}^{Q} [P(Q) - MC(Q)]$, where the derivative of perfectly price discriminating is the fixed cost of adopting the new pricing strategy. In the traditional perfect price discrimination analysis, this portion of the monopolist’s benefit is generally the only benefit considered.

Equally important to the monopolist, however, is the second component of his benefit from implementing perfect price discrimination. This is the triangle abc. The area of this triangle, $\int_{0}^{Q_m} [P(Q) - P_m]$, constitutes the consumer surplus enjoyed by consumers under uniform pricing, which is transferred to the monopolist by enacting perfect price discrimination.

This second portion of the monopolist’s benefit from perfectly price discriminating, the transferred consumer surplus, does not contribute to social welfare as does the first portion of his benefit, the transformed deadweight loss. There is no efficiency gain from transferring consumer surplus under a single-price strategy to producer surplus under a strategy of perfect price discrimination; there is only a transfer. Thus, the transferred consumer surplus represents a private benefit that is not a social benefit.

When the monopolist’s total private benefit of perfectly price discriminating, $\int_{Q_m}^{Q} [P(Q) - P_m] + \int_{Q_m}^{Q} [(P(Q) - MC(Q)] (transferred consumer surplus plus transformed deadweight loss)$, is greater than his cost of enacting perfect price discrimination, $C$, he will do so. In contrast, where his total private benefit of this pricing strategy is less than its cost, he will choose not to enact perfect price discrimination.

Two possibilities, with contradictory social welfare effects, arise when the monopolist finds perfect price discrimination privately profitable. In the first case, the cost of perfect price discrimination is less than or equal to the sum of transformed deadweight loss and deadweight loss generated under uniform pricing, $C \leq \int_{Q_m}^{Q} P(Q) - MC(Q)$. When he implements perfect price discrimination society gains. The deadweight loss of uniform pricing is removed, and it is removed at a cost less than the social benefit of doing so.

In the second case, the cost of enacting perfect price discrimination exceeds the dead weight loss of maintaining uniform pricing, $C > \int_{Q_m}^{Q} P(Q) - MC(Q)$. Because the monopolist’s benefit from pursuing perfect price discrimination equals $\int_{Q_m}^{Q} P(Q) - P_m + \int_{Q_m}^{Q} P(Q) - MC(Q)$, he is willing to expend resources up to this point to implement perfect price discrimination. Since $\int_{0}^{Q_m} P(Q) - P_m + \int_{Q_m}^{Q} P(Q) - MC(Q) > C > \int_{Q_m}^{Q} P(Q) - MC(Q)$, here perfect price discrimination is privately profitable but social welfare reducing. Every dollar spent by the monopolist beyond $\int_{Q_m}^{Q} P(Q) - MC(Q)$ to implement perfect price discrimination generates a benefit to him by transforming would-be consumer surplus into producer surplus. But from the perspective of social welfare, these dollars are a waste—resources expended only to affect the transfer of other resources. Thus, the monopolist’s private cost/benefit calculus leads him to pursue price discrimination when it is socially inefficient. Proving this formally is straightforward:

**Proposition 1.** For all price searchers, perfect price discrimination is privately profitable but socially inefficient when the cost of enacting perfect price discrimination exceeds the deadweight loss generated under uniform pricing, but is less than or equal to the sum of transformed deadweight loss and transferred consumer surplus.

**Proof.** From above, the price searcher’s private benefit from enacting perfect price discrimination is:

$$\int_{0}^{Q_m} [P(Q) - P_m] + \int_{Q_m}^{Q} [P(Q) - MC(Q)].$$

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4 This assumes costless uniform pricing. If uniform pricing is also costly, $C$ refers to the additional cost of adopting the more complex pricing strategy of perfect price discrimination.
The social benefit from the price searcher enacting perfect price discrimination is only:
\[ \int_{Q_0}^{Q_1} [P(Q) - MC(Q)]. \]

So, when \( \int_{Q_0}^{Q_1} [P(Q) - P_m] + \int_{Q_0}^{Q_1} [P(Q) - MC(Q)] \geq C > \int_{Q_0}^{Q_1} [P(Q) - MC(Q)]; \) \( \int_{Q_0}^{Q_1} [P(Q) - P_m] + \int_{Q_0}^{Q_1} [P(Q) - MC(Q)] \geq 0; \) enacting perfect price discrimination is profitable for the price searcher, and \( \int_{Q_0}^{Q_1} [P(Q) - MC(Q)] - C < 0; \) enacting perfect price discrimination is socially inefficient. □

It immediately follows that when perfectly price discriminating is costly, under monopolistic competition it is always socially inefficient. Proving this is straightforward:

**Proposition 2.** Under monopolistic competition, perfect price discrimination is always socially inefficient.

**Proof.** Because of freedom of entry, under monopolistic competition the price searcher cannot earn positive economic profit in equilibrium. For the zero economic profit condition to hold, the price searcher cannot earn positive economic profit on any part of his activities, including perfectly price discriminating. Thus, the zero economic profit condition under monopolistic competition requires that for each price searcher in an industry:
\[ C = \int_{Q_0}^{Q_1} [P(Q) - P_m] + \int_{Q_0}^{Q_1} [P(Q) - MC(Q)]. \]
Since, from above, perfect price discrimination is socially inefficient whenever \( C > \int_{Q_0}^{Q_1} [P(Q) - MC(Q)], \) enacting perfect price discrimination must always be socially inefficient under monopolistic competition. □

3. Conclusion

We have demonstrated how under plausible conditions price searchers are led to pursue “too much” perfect price discrimination, generating welfare losses even when perfect price discrimination is used. This occurs because price discrimination is costly to implement and the firm will invest resources both to transform the deadweight loss, which creates a social benefit, and transfer existing consumer surplus to itself, which does not. For pure monopolists, enacting perfect price discrimination is sometimes socially inefficient. For monopolistic competitors, enacting perfect price discrimination is always socially inefficient.

The straightforwardness of our argument, once it has been explained, makes it susceptible to the claim that it is ‘obvious’. However, the obviousness of our result is rivaled only by the alleged obviousness of perfect price discrimination’s social efficiency. Of course, both cannot simultaneously be true.

The widely-held belief that perfect price discrimination is socially efficient is conditional on ignoring all costs of enacting price discrimination. However, these costs are generally substantial and always exist. Once they are incorporated into the analysis, the social efficiency of perfect price discrimination is no longer obvious.

We examined the inefficiency of costly perfect price discrimination only under the relatively simple cases of linear demand and linear marginal cost functions. Future analyses should investigate whether the propositions regarding the inefficiency of perfect price discrimination derived in this paper also hold under less simplifying assumptions about demand and production costs.

We also circumscribed our discussion to the case of perfect price discrimination. But there is good reason to think that the general problem of inefficiency we described also applies to second- and third-degree price discrimination. Here too, if price discrimination is costly, since the price searcher’s benefits of price discrimination involve not only the transformed deadweight loss under uniform pricing but also the transferred consumer surplus, in a subset of cases price discrimination will prove privately profitable but be socially inefficient.

**References**


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5. Note that this condition for social inefficiency applies even when there is no fixed cost of market entry for the firm. Thus, unlike previous analyses of monopolistic competition that require fixed entry costs for perfect price discrimination to be inefficient, our theory does not.