Encyclopedia Entry: Price Discrimination

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Price discrimination is a common firm practice in which a firm charges different prices to different consumers for the same product. Here we present some guiding principles which underlie price discrimination and show how these principles manifest themselves in many observed pricing practices, even those which may not appear to be explicitly price discrimination.[1]

1 Optimal Pricing and Elasticity of Demand

To understand the economics underlying price discrimination, we start by considering firms' pricing decisions. Any firm's pricing decision depends on a basic trade-off: with a high price, the firm sells fewer units, but each at a higher price and hence higher profit; with a low price, the firm sells more units, but each at a lower price and hence lower profit.

Optimally, the firm sets its price to balance this trade-off, and the "right" balance depends on the elasticity of demand for its product—how responsive the demand is to changes in prices.[2] Elastic demand refers to the case in which demand is very responsive to changes in price: for example, if a 2% increase in the price leads to a 20% reduction in the quantity demanded (a "flat" demand curve). In contrast, inelastic demand refers to the case in which demand is not very responsive to changes in price; for example, a 20% increase in the price leads to a 2% reduction in the quantity demanded (a "steep" demand curve). In turn, the elasticity of demand for a firm's product relates to the availability of substitutes: whether rival companies produce similar products, or whether they imitate or copy ideas/products. For example, any patents or

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[1]Varian (1989) provides a comprehensive survey of the economics literature.

[2]Formally, we are speaking here of the *residual demand* for a firm's product, which corresponds to the market-level demand once the demand for the firm's rivals has been netted out. See chapter 6 in Carlton et al. (1990) for additional discussion.

copyright a firm has which restrict rivals from producing similarities would reduce the elasticity of demand for its product.

2   Inverse Elasticity Principle

It is well known that a firm will optimally balance this trade-off by choosing a price such that the price-cost margin (that is, the percentage profit earned by the firm on each unit sold) is inversely related to the elasticity of demand for its product. When facing inelastic demand, where few substitutes for its product are available, a firm can set high prices without losing customers, since the customers find it difficult to switch away from the firm's product. In contrast, when many substitutes are available, demand is more elastic and if the firm resolutely sets high prices in this setting, it will lose many customers since they can easily switch to one of the substitutes.

In many markets, the elasticity of demand may not be identical across different customers. This is expected as customers are situated in different circumstances where they have differential access to available substitutes. Students in a small college town, for instance, may have fewer restaurant options compared to workers living in a big city. Given these differences in demand elasticities, firms will optimally wish to set different prices for different people, which is price discrimination. This makes sense because, based on the inverse elasticity principle discussed above, it would be profitable for firms to charge consumers with less elastic demand a higher price, and vice versa.

More formally, assuming constant marginal cost of c, the inverse elasticity principle takes the following form:

$$\frac{p_i - c}{p_i} = \frac{1}{|\epsilon_i|} \implies \frac{p_i}{p_j} = \frac{1 - \frac{1}{|\epsilon_j|}}{1 - \frac{1}{|\epsilon_i|}},$$

where p_i is the price charged to customer segment i and $|\epsilon_i|$ is segment i's price elasticity of demand. This formula illustrates the intimate connection between price discrimination and the inverse elasticity pricing principle, as we see that, all else equal, a firm will set a higher price towards customer segments with a lower demand elasticity. In other words, more price sensitive customer segments receive a lower price, and vice versa.

Price discrimination whereby firms charge different prices to different customer segments via the inverse elasticity principle is called "third-degree price discrimination", and examples of this abound across many markets and industries:

- Museums charge lower prices for admission tickets to students, because students typically have less income and are therefore more price-sensitive.

- Movie theaters offer weekday discounts ("matinees", "discount Tuesdays", etc.) since people who go to movie theaters during weekdays are likely not fully employed, hence they may have lower income and therefore greater price sensitivity.

- Foods sold at airports, sporting events, and concerts tend to be more expensive, because consumers there are likely pressed for time and are therefore less price-sensitive.

- Booking a plane ticket well in advance would typically result in a lower price than booking it at the last minute, since people who can book the plane ticket well in advance are more likely to be leisure travelers—who have greater price sensitivity—rather than business travelers.

- In the market for online apps, developers monetize their apps using a "freemium" strategy (Kumar, 2014), whereby a basic product or service (such as an app or a video game) is provided free of charge, but cash (a premium) is charged for upgrades (such as additional features and virtual or physical goods) that expand the functionality of the free version. In such cases, the not-for-free upgrades are targeted to enthusiasts who are less price-sensitive.

All of these examples correspond to the inverse elasticity principle: consumers with more elastic demand (lower price sensitivity) obtain lower prices.

3 Nonlinear Pricing

One particular kind of price discrimination is called nonlinear pricing, which refers to the practice of charging consumers a price depending on the quantity purchased. Examples include electricity and telephone service. Nonlinear pricing and other related pricing schemes where consumers with heterogeneous preferences pay different amounts for products targeted to their preferences falls under the rubric of "second-degree price discrimination" in the economics literature (see Mussa and Rosen (1978), Maskin and Riley (1984), Wilson (1993)). In this literature, the firm's pricing problem is modelled as a second-best contracting problem under asymmetric information between the firm and its customers, where a firm's prices is constrained by the

need to incentivize the customers to choose the products which the firm intends for them to buy. While the mathematical formulations of such models are complex, the optimal pricing formulas emerging from such models nevertheless maintain a structure in line with the inverse elasticity principle above. As an example, nonlinear pricing contracts typically exhibits *quantity discounts*. For instance, a coffee shop may charge $4 for a 12oz coffee, $4.5 for a 16oz coffee, and $5 for a 20oz coffee, resulting in decreasing per-unit prices of $0.33/oz, $0.28/oz, and $0.25/oz, respectively.

From the perspective of the inverse elasticity principle, it makes sense for consumers who buy more to pay less per unit, since demand is typically more elastic at higher quantities. Additional examples include "buy one get one 50% off", "buy 5 for the price of 4", etc. Quantity discounts may also be implemented via *subscription plans*, whereby customers are granted unlimited access at a subscription fee which is far lower than if the consumer purchases à la carte; examples include online newspapers (such as New York Times), movie streaming services (such as Netflix), online e-book (such as Kindle Unlimited), and gym memberships.

4   Other Forms of Price Discrimination

While above we have considered cases where the firm explicitly price discriminates by setting different prices for different customers, it turns out that other real-world instances of price discrimination are more subtle, and result not only from firms' pricing decisions, but also from certain market and institutional features. We consider several of them next.

4.1   Secondary Markets

Market segmentation refers to a form of indirect price discrimination whereby market institutions can help firms price discriminate by sorting consumers by their valuations. One key example is secondary markets, i.e., markets for used goods (see for example Hendel and Lizzeri (1999) and Chen et al. (2013)). With the existence of secondary markets, consumers with high preference for quality buy new goods, while consumer with lower preference for quality buy used goods, and therefore the existence of secondary markets allows new good producers to raise prices and get higher profits.

As an example, we consider a simplified example of the automobile market. Suppose cars

live for two periods, the first period as a new car and the second period as a used car. Suppose there are two consumers: one is "picky" with a high preference for quality and the other is "non-picky" with a low preference for quality. The following table summarizes the two consumers' willingness to pay (WTP) for new and used cars, respectively.

Consumer type	WTP from driving a new car for one period	WTP from driving a used car for one period
Picky: High-preference for quality	$7000	$2000
Non-picky: Low-preference for quality	$3000	$3000

Assume that the cost for producing a car is $2000. Without a secondary market, consumers can only buy new cars and must hold onto them for two periods. In this case, in order to sell to both consumers, the highest price the firm can charge for a new car is $3000 + $3000 = $6000, allowing it to sell one car to each customer every two periods (since each car lives for two periods) for an average profit of ($6000 − $2000) × 2 ÷ 2 = $4000 per period.

When there exists a secondary market, the situation changes drastically. Now, the owner of a new car in the current period knows that she can sell it as a used car in the secondary market in the next period. Consequently, the picky consumer can buy a new car in *every* period and sell the used version of it to the non-picky customer in the following period for a price of $3000. Taking into account the resale value, the picky consumer's willingness to pay for a new car in every period increases to $7000 + $3000 = $10000. In this case, the firm will optimally set a price of $10000 for a new car, selling one car in every period (only to the picky consumer) and obtaining a profit of $10000 − $2000 = $8000 per period—higher than the case without a secondary market.

In the above simple example, the existence of a secondary market allows new and used cars to be sold at different prices to different types of consumers, and such price discrimination leads to a higher profit for the firm.

4.2 Bundling

Bundling refers to the practice of selling two or more products as a single package. It can serve as an effective mechanism to price discriminate among consumers with heterogeneous valuations

(Stigler (1968) and Adams and Yellen (1976)). Examples of bundling include cable television (multiple channels are combined in a subscription package), newspapers (several sections such as news, politics, sports, and entertainment are bundled together), computer systems (which combine microprocessor, memory, and other components), restaurants' prix fixe menus (a multi-course meal is offered at a fixed price), etc.

Consider bundling in movie distribution, where movie distributors often require movie theaters to acquire "bad" movies if they want to show "good" movies from the same distributor.[3] Suppose a distributor offers two movies, a good one and a bad one, to two theaters. The following table shows the two theaters' valuations for each movie:

Theater	Valuation for the good movie	Valuation for the bad movie
A	$8000	$2500
B	$7000	$3000

Without bundling, the distributor charges $7000 = \min\{\$8000, \$7000\}$ for the good movie and $2500 = \min\{\$2500, \$3000\}$ for the bad movie, and the total profits are $2 \times (\$7000 + \$2500) = \$19000$. With bundling, the distributor charges $10000 = \min\{\$8000 + \$2500, \$7000 + \$3000\}$ for the two-movie bundle, resulting in total profits $20000 = 2 \times \$10000$, higher than without bundling.

The above example shows that when consumers have different tastes for multiple products, it makes sense for the firm to bundle the products together, as bundling can reduce heterogeneity in consumers' valuations and lead to greater profits for the firm.

This benefit of bundling is especially apparent when consumers' valuations are negatively correlated, as is the case in the above example: theater A's valuation for the good movie is higher than B's, while its valuation for the bad movie is lower than B's; these differences partially cancel out each other, leading to more similar valuations for the bundle. However, bundling can enhance the firm's profits even when valuations for the two products are uncorrelated.[4]

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[3]Such "line forcing" contracts are common in media industries; see [Ho et al.](Ho et al.) (2012) for an empirical analysis of the video rental market.

[4]See McAfee et al. (1989) and Crawford (2008).

4.3 Search Markets

In many markets, consumers are not fully aware of firms' prices in the market, and it is costly for them to find out—often involving time and travel costs. These costs are called *search costs*, and the markets in which customer face such costs are called *search markets*. A prominent example is the gasoline market, where posted prices change often and consumers are usually not fully aware of the prices charged by all the gasoline stations within an area at the time they make their purchases. furniture, etc.

In search markets, prices for the same item can be very different across different stores, an outcome which again can reflect a price discrimination motive on the part of firms. Consider consumers looking for the cheapest restaurant in which to savor deep dish pizza (a regional specialty) in Chicago. Suppose there are two types of consumers: tourists visiting Chicago who only know the prices of the small number of restaurants they see on their visit, and natives living in Chicago who have learned from experience the prices at all restaurants and who will only go to the least pricey restaurants.[5] In equilibrium, a segmented market can arise. There are "tourist trap" restaurants catering exclusively to a tourist clientele serving expensive deep-dish pizza, as well as local eateries serving lower-priced pizzas catering to both natives and tourists. This is yet another instance of price discrimination: more informed consumers, who are aware of more substitutes, will have more elastic demand, and will hence purchase at lower prices.

Summary: The fundamental idea behind price discrimination is the inverse elasticity principle: firms charge a lower price for consumers who have a higher elasticity of demand, and vice versa. From this perspective, many observed pricing practices fall under the umbrella of price discrimination as they allow firms to extract additional surplus from customers with heterogeneous preferences.

References

Adams, William James, and Janet L. Yellen. 1976. "Commodity Bundling and the Burden of Monopoly." *Quarterly Journal of Economics* 90 475–498.

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[5]See Salop and Stiglitz (1977) for a formal version of this model.

Carlton, Dennis W, Jeffrey M Perloff, and Klaas T van't Veld. 1990. *Modern industrial organization*. Scott, Foresman/Little, Brown Higher Education Glenview, IL.

Chen, Jiawei, Susanna Esteban, and Matthew Shum. 2013. "When Do Secondary Markets Harm Firms?" *American Economic Review* 103 (7): 2911–2934.

Crawford, Gregory S. 2008. "The discriminatory incentives to bundle in the cable television industry." *Quantitative Marketing and economics* 6 (1): 41–78.

Hendel, Igal, and Alessandro Lizzeri. 1999. "Adverse Selection in Durable Goods Markets." *American Economic Review* 89 (5): 1097–1115.

Ho, Katherine, Justin Ho, and Julie Holland Mortimer. 2012. "The use of full-line forcing contracts in the video rental industry." *American Economic Review* 102 (2): 686–719.

Kumar, Vineet. 2014. "Making" freemium" work." *Harvard business review* 92 (5): 27–29.

Maskin, Eric, and John Riley. 1984. "Monopoly with Incomplete Information." *The RAND Journal of Economics* 15 (2): 171–196.

McAfee, R. P., J. McMillan, and M. Whinston. 1989. "Multiproduct Monopoly, Commodity Bundling, and Correlation of Values." *Quarterly Journal of Economics* 104 371–383.

Mussa, Michael, and Sherwin Rosen. 1978. "Monopoly and product quality." *Journal of Economic theory* 18 (2): 301–317.

Salop, Steven, and Joseph Stiglitz. 1977. "Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion." *The Review of Economic Studies* 44 (3): 493–510.

Stigler, George J. 1968. "A Note on Block Booking." In *The Organization of Industries*, edited by Stigler, George J. 165–170, Homewood, IL: Irwin.

Varian, Hal R. 1989. "Price discrimination." *Handbook of industrial organization* 1 597–654.

Wilson, Robert B. 1993. *Nonlinear pricing*. Oxford University Press.