Discriminating Prices for the Discriminating Consumer

Researchers at Northwestern University’s Kellogg School of Management have created mathematical models to study how different types of price discrimination (particularly those involving product size and store location) influence sales. This information can, in turn, be used to maximize profitability. The research was conducted by Dipak Jain and Romana J. Khan. The writer is Dr. Brad Wible, a Science and Technology Policy Fellow in Washington, D.C., sponsored by the American Association for the Advancement of Science. This article has been reprinted with permission from Kellogg Insight © Kellogg School of Management, insight.kellogg.northwestern.edu.

With sales and profits dependent upon the prices retailers set for their products, a too generous discount or a too lengthy sales promotion can destroy a business. As a result, retailers are constantly searching for better pricing strategies.

A report in the Journal of Marketing Research by Dipak Jain (Dean, Kellogg School of Management) and Romana Khan (a graduate of the Kellogg School, who currently serves as Assistant Professor of Marketing at the McCombs School of Business, University of Texas) methodically describes how varying prices can improve profitability by taking advantage of differences in demand for different package sizes from one store to another.

“We thought, ‘How can price be used to segment different customers so that they’ll see value they like and be willing to pay the price?’” said Jain, who also serves as Professor of Marketing and the Sandy and Morton Goldman Professor of Entrepreneurial Studies. “So we looked at optimal schemes and combinations.”

A seller who charges different prices for the same good is said to engage in price discrimination. Price discrimination focuses not on differences based on race, gender, or religion, but on differences in customers’ preferences for products or services. Sellers attempt to increase profits by matching prices of products to customers’ willingness to pay.

In a nondiscriminating market—one with just one price for a product—some customers would be willing to pay even more, and others would buy the product only if it were a bit cheaper.

In both cases, money that could be spent by customers is not spent. By recognizing different demands and sensitivities among consumers and adjusting prices accordingly, price discrimination segments the market, providing more attractive options to more customers and making them more likely to buy.

In the 1920s and 1930s, English economist Arthur Pigou outlined three degrees of price discrimination. In the purest type, first-degree discrimination, the price varies with every sale as the vendor tries to squeeze as much as possible from each customer. This occurs when buyers and sellers haggle over the prices of man

In second-degree discrimination, the price of a good depends on its quantity. The restaurateur loading her truck with 30-gallon jugs of mayonnaise can pay a fraction per ounce compared to the bachelor buying a few ounces for yet another solitary dinner of tuna salad. While some of this difference in retail price is dictated by the wholesale cost retailers pay for volume products, discrimination is an explicit strategy to alter retail price beyond what is needed simply to recoup differences in wholesale cost. This nonlinear pricing strategy, the “bulk discount” in which twice as much stuff does not cost twice as much money, segments the market by allowing more customers to find appealing size-price combinations.

“The real application of this is Walmart,” said Jain. “Why have they been
so successful? They offer quantity-based segmentation, not quality segmentation. They offer brand-name value, but you have to buy a larger size than you would buy at a supermarket.”

Third-degree price discrimination, or micromarketing, exploits differences in demand from one community to the next by varying prices from store to store. Anyone who has saved a few cents by buying toothpaste and batteries at the K-Mart across town rather than the K-Mart down the block has experienced the third degree of price discrimination.

“With store-based pricing, there’s a sense of arbitrage. You cannot prevent that,” said Jain, acknowledging the inherent imbalance between markets that is exploited in third-degree discrimination. “[Text]books, for example, may cost less in India than they do in the U.S. because Indians aren’t willing to pay $100 for a [text]book.”

While second- and third-degree price discrimination have been recognized and practiced for decades, there is sparse empirical evidence of their relative impact on demand and profit. Khan and Jain created mathematical models to study how several factors, including product size and store location, influenced sales. They then were able to predict how second- and third-degree price discrimination, separately and together, could impact profits.

Khan and Jain scoured 12 month’s worth of data from Dominick’s Finer Foods, a popular Chicago-area grocery chain. They focused on each store’s weekly sales, prices, and profits for four brands of nonprescription painkillers: Tylenol (acetaminophen), Advil (ibuprofen), Bayer (aspirin), and Dominick’s house brand. The market for over-the-counter painkillers holds great promise for retail grocers, with annual sales growing to almost $3 billion in 2004 as more drugs are granted nonprescription status.

Each painkiller came in three package sizes: 25, 50, and 100 tablets. So few people bought the Dominick’s brand 25-tablet package, however, that Khan and Jain focused on the 11 other products, which accounted for 62 percent of nonprescription painkillers sold.

The variations in package size and corresponding price revealed Dominick’s second-degree price discrimination strategy, with price per tablet decreasing dramatically as packages got larger. For example, the total price of four 25-tablet packages of Bayer was over twice as much as a single package of 100 tablets.

In addition to information about product size and price, which allowed study of second-degree price discrimination, Khan and Jain also studied stores’ locations and the types of customers they served. Such information is key to understanding third-degree price discrimination. They analyzed features like the distance from each store to various competitors, such as Chicago-area rival Jewel-Osco.

To understand the typical clientele at each store, they studied features of the neighborhood, such as the percentage of people over age 60, the percentage of racial minorities, the number of people in an average household, and the percentage of homes valued at over $150,000.

As expected, when prices increased, demand generally waned. Closer analyses, however, revealed variations in this relationship depending on store location. For example, increased prices reduced demand more in neighborhoods with many older people and large households than it did in affluent areas, where consumers were more likely to buy regard- less of price. Such findings suggest that third-degree price discrimination, varying prices from one neighborhood to another based on socioeconomic factors, should prove profitable.

![Figure 1](image-url)
Some patterns of consumer preference could not be traced back to measured factors such as product size and store location, so they must have reflected the influence of some unknown features. For example, Jain speculated, “Some customers might not have space in their house to store that much, so they won’t buy that much.”

Overall, though, the need for retailers to provide products that are attractive to the complex tastes and motivations of consumers highlights yet another reason to offer several variations of a product through price discrimination. As Jain said, “Let the customer decide what is best for him or her.”

Armed with this evidence of relationships between product sizes, store locations, and consumer demand, Khan and Jain were able to calculate the specific influences of second- and third-degree price discrimination on profits (see Figure 1). They estimated that Dominick’s weekly store profits would bottom out at $67,000, down from $75,000, if the company switched from its existing pricing strategy to one that ignored discrimination altogether, keeping the price per pill the same across all package sizes and all stores.

In contrast, combining second- and third-degree price discrimination could increase profits by roughly 35 percent, topping off at $92,000 per week. But second-degree discrimination alone could improve upon the nondiscriminating strategy by nearly 30 percent, lifting profits to $86,000, while third-degree discrimination alone could raise profits by only around 10 percent, to $73,000.

This work clearly shows that while a combination of second- and third-degree discrimination is optimal, the benefit of offering only quantity discounts is far greater than that of store-to-store pricing alone. In addition to having a greater impact on profit, second-degree discrimination is much easier to implement. Central managers can save time and effort by focusing on a single set of prices to be applied across all stores, rather than tweaking prices from one neighborhood to the next.

“Many people will say, ‘This doesn’t surprise me,’” acknowledged Jain. “But the real beauty of the paper is that it’s a methodological demonstration of why this works and how it can be done. It’s no longer hearsay or intuition.”

Encouraged by these findings, Jain described plans to expand upon and apply this research. “I’m now looking at how price promotions can be a way to prevent cannibalization,” he said. “Suppose you offer product X, then launch product Y. If some of your customers who bought X switch to Y, you’ve cannibalized your own X.”

“For example,” continued Jain, “a single company owns Gap, Old Navy, and Banana Republic. Let’s devise a price mechanism such that a Gap customer might buy from Banana Republic, but won’t go to Old Navy thinking he or she can get the premium value at a cheaper price.”

– Dipak Jain

In the vibrant world of retail sales, where striking the right balance between such “traders up” and “traders down” can mean the difference between bonuses and bankruptcy, this work by Khan and Jain adds some much needed rigor to our understanding of some traditional pricing practices.