Issues in Personalized Pricing

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Introduction

In recent years, as digitalization and the use of data have progressed rapidly, increasing attention has gathered around "personalized pricing," in which different prices are presented to each individual customer. This method aims for firms to maximize profits by optimizing prices on the basis of individual data such as consumers' purchase histories, behavioral patterns, and even geographic location information. On the other hand, this personalized pricing carries issues such as the distortion of consumers' purchasing behavior and the protection of consumer information. Below, we summarize key issues to consider when implementing personalized pricing, from an economic perspective.

Definition of personalized pricing

In this paper, we define personalized pricing in line with Personalised Pricing in the Digital Era (OECD, 2018).

- Personalized pricing is a form of price discrimination in which firms predict each consumer's willingness to pay based on personal characteristics and behavior and set different prices accordingly.
- This practice is conducted on the basis of information voluntarily provided by consumers, information directly observed by firms, or information inferred from behavior.
- Unlike dynamic pricing, personalized pricing is based on the personal characteristics of consumers and is distinguished from dynamic pricing that adjusts prices in real time in response to changes in demand and supply.

Issue 1: Ratchet effect

In personalized pricing, the prices presented to each consumer are determined on the basis of the consumer's past purchase history. However, this mechanism has a problem: it gives rational consumers an incentive to deliberately distort their current purchasing behavior in order to lower future prices. This is called the "ratchet effect."

Consumers who have a high willingness to pay and a large quantity demanded would, in principle, purchase a large amount at the price presented. However, if that behavior leads the seller to recognize that "this consumer has a high willingness to pay," there is a possibility that a higher price will be presented in future transactions. Anticipating this, consumers intentionally hold back their current purchase quantities and induce the seller to misperceive them as "low–willingness-to-pay customers," so that they can purchase at lower prices in the future.

Because of this ratchet effect, sellers suffer a double loss. First, the purchase quantity from consumers who originally had high demand decreases, and the seller is forced to lower prices. Second, the accuracy of information regarding consumers' willingness to pay declines, and the precision of price discrimination deteriorates accordingly.

Villas-Boas (2004) shows that corporate profits can actually be higher when consumers' purchase histories cannot be identified. If they can be identified, strategic forward-looking behavior by consumers theoretically induces the ratchet effect. This can be regarded as the biggest challenge that personalized pricing faces.

Bonatti and Cisternas (2020), while pointing out the emergence of such a ratchet effect, explain a way to mitigate it: reflect not only the most recent transaction results but also older transaction records in today's price setting. In other words, dilute the impact that the most recent purchasing behavior has on the price presented. Then, communicate that this price-setting policy is being used to customers.

By doing so, even if consumers reduce their recent purchase quantity a little, the overall evaluation will be affected only slightly; the amount of decrease one can expect in the next period's presented price becomes small, and thus the motivation to deliberately reduce purchase quantity weakens.As a result, firms can grasp consumer demand more accurately, and the precision of price setting improves.

In summary, when considering the implementation of personalized pricing, the following become important issues:
Sub-issue 1.1: To what extent can the ratchet effect occur?
Sub-issue 1.2: How should we eliminate consumers' incentives to distort purchasing?

Issue 2: Possibility of resale

If consumers who purchased at low prices can resell the product to other consumers who were presented higher prices, arbitrage that exploits the price difference will occur, and the price discrimination intended by the business operator will, in effect, be nullified. This problem becomes particularly salient for goods such as digital content, where the costs of copying and distribution are low, and for goods like durable goods and limited items, for which secondary markets readily form.

Methods to restrict resale include prohibiting transfer through contractual clauses, technical protection measures such as DRM (Digital Rights Management), and granting each consumer non-transferable value elements specialized to that consumer (for example, a usage right limited to the named holder). However, these measures can impair consumer convenience and the overall efficiency of the market, and they may also conflict with regulations under competition law and consumer protection law. Therefore, managing resale possibility is an indispensable yet complex issue in implementing personalized pricing that requires careful consideration.

Issues to consider include:
Sub-issue 2.1: Given the characteristics of the merchandise, can resale occur, and to what extent is resale easy for consumers?
Sub-issue 2.2: How effective are methods that restrict resale?

Issue 3: Personalized pricing and competition among firms

The effectiveness of personalized pricing is often discussed without taking the existence of competitors into account. In principle, however, its evaluation needs to consider how the competitive environment would change if this method spread across an industry. Economic research indicates that if multiple competing firms all introduce personalized pricing, price competition is likely to intensify.

3.1 Intensification of price competition

In competition among firms that offer horizontally differentiated products, if each firm introduces personalized pricing tailored to individual customers, price competition can intensify and both firms' profits can be harmed. This is shown by research using the Hotelling model by Thisse and Vives (1988). They compared two scenarios: one in which firms compete by setting a single uniform price, and another in which they engage in price discrimination tailored to each customer. They clarified that, in competition with horizontal differentiation, the profit rate for both firms is higher when they set a uniform price than when they engage in price discrimination.

The mechanism is as follows.
• Uniform price setting: A price cut generates two opposing effects—a "positive effect" of stealing customers from a rival and a "negative effect" of reducing revenue from existing loyal customers. Because of this negative effect, firms become cautious about cutting prices.
• Personalized pricing: Firms can maintain high prices for loyal customers while lowering prices only for

rivals' customers. In other words, the negative effect of price cuts is eliminated; price competition intensifies over neutral customers who are indifferent between the two firms, and as a result equilibrium profits decline. In personalized pricing, the "stopper" that restrains price competition disappears.

It can also be rephrased as follows: under a uniform price, a price cut triggers revenue reduction from existing customers and thus a restraint operates, but under individualized prices, price competition occurs independently for each consumer and no such restraint operates.

For example, consider two dry cleaners that compete only in terms of location and price. If one store issues discount coupons to residents in the middle area, the other will follow suit, and an intense coupon war will begin, harming the profits of both stores. By contrast, if both stores refrain from issuing coupons and maintain a single posted price, competition will be restrained. A uniform price setting functions as an effective "stopper" because price cuts come with revenue reduction from existing customers.

Thus, when a firm introduces personalized pricing, competitors will adopt the same method; as a result, price competition may become more intense than before and profits may decline.

Points to consider include:
Sub-issue 3.1: Do direct competitors exist?
Sub-issue 3.2: Are competitors planning to introduce personalized pricing, or are they capable of doing so?
Sub-issue 3.3: Is competition between firms both using personalized pricing likely to arise, and to what extent is price competition likely to intensify as a result?

3.2 The perspective of product differentiation

Foros, Kind, and Nguyen-Ones (2024) point out that competition between firms using personalized pricing weakens the degree of differentiation and harms firms' revenues.
Under a uniform price, firms seek to differentiate on non-price elements and thereby soften competition. The targets of differentiation are wide-ranging, including product functions and design, brand image, service quality, and location.

For example, if two cafés in the same city are located close to each other and their taste and service are almost the same, customers will switch stores for a small price difference, and both stores will fall into fierce price competition. To avoid this, if one opens farther away or changes its interior or menu to avoid direct comparison, downward price pressure from competition is weakened and profits are preserved. In this way, under a uniform price, the strategy of "softening price competition through differentiation" is effective. Put differently, when a firm moves closer to a competitor (weakening differentiation), there is a positive effect of being able to steal the competitor's customers, but there is also a negative effect of strengthening the competitor's incentive to cut prices, thereby intensifying price competition. Because of

this trade-off, differentiation is maintained.

By contrast, under individualized prices (personalized pricing), the structure differs. Because firms can set prices for each customer, they can flexibly reduce to nearly marginal cost the “minimum price that must be offered when a given customer is about to buy from another firm.” Under a uniform price, there was a restraint because price cuts reduced revenue from existing customers, but under individualized prices, price competition occurs independently for each consumer and that restraint does not operate.

Therefore, differentiation elements such as product design or location cannot influence a rival’s price setting. No matter how much one differentiates, rivals will use that information to lower the presented price to the customer in question. As a result, even if one differentiates, one cannot reduce rivals’ willingness to cut prices.
In this case, firms move more toward “approaching the rival to steal customers” than toward “creating differences to sell at higher prices.” For example, in location competition, both firms cluster near customers and the distance between them shrinks. Consequently, differences in products and services also become small, the level of inter-firm differentiation declines, and, naturally, price competition intensifies and firms’ profits shrink. The same type of phenomenon occurs in non-price elements other than location, such as product specifications and quality choices and service content.
In summary, under a uniform price, non-price elements serve as “weapons to soften competition,” but under individualized prices those weapons stop working. Personalized pricing thus compresses differentiation between firms; in equilibrium, more similar products and services tend to line up in the market, and firms’ profits become smaller.

The following becomes a point to consider:
Sub-issue 3.3: To what extent does personalized pricing weaken the degree of differentiation?

3.3 Summary

As seen above, competition between firms both using personalized pricing has two effects: a direct effect of intensifying price competition, and an indirect effect of intensifying price competition by weakening the market’s degree of differentiation. When deciding whether to introduce this method, one should take into account that if personalized pricing spreads throughout an industry, competition may become more intense.

4. Fairness and privacy

A major concern with personalized pricing is that consumers are likely to perceive the price setting as unfair. Priester, Robbert, and Roth (2020) showed the following.

Compared with segmentation-based price discrimination (third-degree price discrimination, a method that changes prices according to attributes such as students or seniors), personalized pricing more readily provokes direct social comparison with others and tends to strengthen dissatisfaction with price differences under the same conditions.

In addition, when the basis of price calculation uses data that are novel to consumers—such as location information—it becomes harder to justify the price setting than when it is based on relatively familiar criteria such as purchase history, and a stronger sense of unfairness is generated.

Furthermore, because the approach inherently presupposes the collection and analysis of consumer data, concerns about privacy are pronounced. Consumers with strong privacy concerns tend to evaluate individualized prices as more unfair, and it has been empirically shown that such consumers recognize little difference in fairness between location-based and purchase-history-based price setting. This means they harbor equal distrust toward the use of either type of data. In addition, the algorithms of personalized dynamic pricing and the processes of data use are non-transparent, and the fact that consumers cannot grasp how their own data are reflected in price determination readily gives the impression of being manipulated.

As described above, while personalized pricing has the potential to increase revenue, it entails psychological and ethical risks such as perceptions of unfairness and privacy concerns. Because these concerns can lower customer satisfaction and brand credibility and can trigger undesirable behavioral responses such as negative word of mouth and avoidance behavior, firms must exercise careful judgment when implementing it.

Key issues include:
4.1: To what extent does the method of collecting consumer information readily provoke backlash from the standpoint of fairness?
4.2: What methods exist to mitigate fairness concerns?

Summary

Personalized pricing (PDP) is an advanced pricing strategy that aims to improve corporate revenue by optimizing prices based on each consumer's characteristics and behavioral history. However, there are multiple economic and ethical issues in its application. First, reflecting past purchasing history in price

setting can produce a “ratchet effect,” in which consumers deliberately distort purchasing behavior, thereby harming the accuracy of demand information and opportunities for revenue. Second, price discrimination can be nullified through arbitrage via resale by low-price purchasers, so it is necessary to examine merchandise characteristics and the effectiveness of resale-prevention measures. Third, in competitive environments, it has been shown that the spread of personalized pricing intensifies price competition both directly and indirectly and lowers the level of differentiation among firms. Furthermore, personalized pricing readily induces strong consumer perceptions of unfairness and privacy concerns, posing a high risk of damaging brand credibility and customer satisfaction. Therefore, when deciding whether to introduce personalized pricing, it is essential to comprehensively evaluate its potential revenue effects together with these structural and psychological risks.

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