Proceedings of the 5th International Conference on Financial Technology and Business Analysis
DOI: 10.54254/2754-1169/2026.37788

Algorithmic Differential Pricing in the Digital Economy: Inherent Logic and Hierarchical Industry Regulatory Framework

Zhimeng Cheng

Suzhou High School of Jiangsu Province, Suzhou, China
mickycheng0605@outlook.com

Abstract. Digital platforms implement personalized pricing relying on massive user data and algorithm technologies, and big data driven "big data ripening" has continuously triggered consumer disputes, making algorithmic differential pricing a key challenge for digital economy governance. Taking algorithmic differential pricing as the research object, this paper draws on theories of price discrimination, behavioral pricing and regulatory economics and adopts theoretical analysis and logical deduction to explore its operational logic. Algorithmic differential pricing represents traditional price discrimination adapted to digital contexts. Supported by user data portraits, it realizes personalized "thousands of people, thousands of prices" and approximates first degree price discrimination. The outcome of algorithmic tiered pricing hinges on data advantages, user lock in and market competition, and its welfare effect is dual sided rather than simply beneficial or detrimental to markets. This paper establishes a hierarchical industry differentiated regulatory framework covering flexible supervision, stringent supervision and bottom line protection to reconcile industrial market features and consumer rights demands. It extends theoretical studies on algorithmic price discrimination and offers references for prudent regulatory practice for platform algorithmic pricing.

Keywords: algorithmic differential pricing, big data, price discrimination, platform economy, differentiated regulation

1. Introduction

In practical scenarios, certain digital platforms exhibit phenomena such as higher quotations for old users than for new users for the same hotel service, as well as differentiated quotations for identical travel services across different terminals. This kind of behavior is a big data phenomenon that is widely concerned by society. In recent years, price disputes related to travel, takeout, and online tourism platforms have continued to increase, and algorithmic differential pricing has gradually become a hot topic in society. Existing relevant studies mostly focus on a single dimension of this phenomenon and fail to conduct comprehensive analysis of its mechanism, welfare consequences and regulatory paths. This article answers three questions: First, what is the difference between algorithmic differential pricing and traditional price discrimination? Second, how does this pricing

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2754-1169/2026.37788

method work, and what are the pros and cons? Third, how should regulation protect consumers without hindering the development of the industry?

Many scholars have studied this topic, roughly divided into four categories. The first is the overall research. Relevant studies summarized the research status of big data ripening from the perspectives of algorithm, data, and platform [1]. The second is the principle of economics. Relevant studies found that network externalities will make the platform more motivated to kill and mature [2]. Companies price differently based on purchase history. Firms set differentiated prices according to consumer purchase history [3]. The switching cost perspective can explain why platforms may raise prices for long-term users [4]. The third category is welfare impact. Price discrimination does not necessarily harm consumers, depending on the specific situation [5]. Relevant studies found that large platforms are more inclined to engage in price discrimination than small platforms [6]. The fourth category is legal supervision. Relevant studies discussed the challenge of algorithmic collusion to anti-monopoly [7]. Relevant studies analyzed the regulatory difficulties [8]. Relevant studies talked about governance methods from the perspective of data confirmation [9]. Relevant studies proposed legal correction from the perspective of platform private power [10].

Most of the previous studies only focus on one side, and there are still gaps in the analysis of the pricing process and the calculation of welfare impact. This paper takes big data algorithm differential pricing as the research object, combines the relevant theories of price discrimination, behavioral pricing, and regulatory economics, and clarifies the operation law and welfare impact of this pricing method through theoretical analysis and logical deduction. On this basis, this paper puts forward the idea of differentiated supervision in different industries. Theoretically, the traditional price discrimination theory is applied to the new scenario of the algorithmic economy; In practice, the idea of sub-industry supervision can provide a reference for regulatory authorities to find a balance between protecting consumers and promoting the development of the digital economy.

2. Basic theory

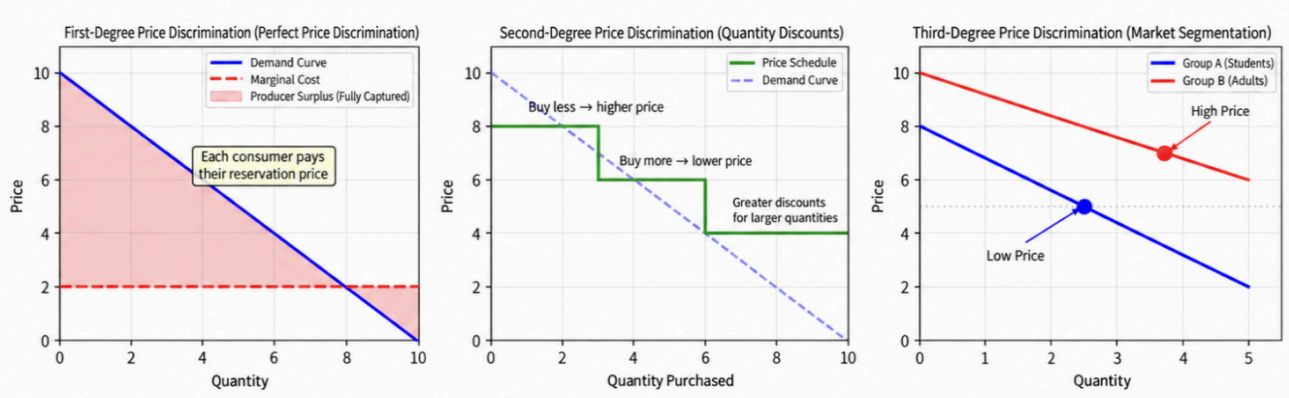

Figure 1. Three forms of traditional price discrimination (picture credit: original)

Price discrimination means that the same good or service is sold to different people for different prices, and the price difference is not due to different costs. As early as 1920, the economist Pigou divided price discrimination into three categories. Primary price discrimination, also known as complete price discrimination, is when businesses know how much money everyone is willing to pay at most and then charge the highest price. Secondary price discrimination is to buy more cheaply, such as half the price of the second cup. Third-level price discrimination is divided by population, such as student tickets and elderly tickets. In reality, in the past, secondary and tertiary

DOI: 10.54254/2754-1169/2026.37788

were more common, and primary could hardly be done, because it was impossible for merchants to know everyone's bottom price. The traditional price discrimination theory is based on the premise of limited information and a divisible market, and the differences between the three forms are shown in Figure 1.

The popularity of big data and algorithm technology has reshaped the realization form of price discrimination. Algorithmic differential pricing, also known as personalized pricing, is popularly manifested in big data ripening, which means that the platform collects consumer identity characteristics, consumption behavior, and preference information, measures individual willingness to pay based on algorithmic models, and sets differentiated prices for homogeneous goods or services to different consumers. Compared with traditional price discrimination, this model has three characteristics: Pricing units have shifted from group segmentation to individual users, gradually approaching primary price discrimination; The pricing mechanism has the characteristics of high concealment and dynamic adjustment, and it is difficult for consumers to identify differential treatment; Pricing power is highly dependent on data resources and algorithm models, and the scale of data reserves directly affects the implementation effect of platform differential pricing. According to behavioral price discrimination (BBPD), companies distinguish between new and old customers according to the purchase history of consumers and set different prices for people with different loyalty. As long as consumer behavior data is available, companies can increase profits through "tracking + personalized pricing". If network externalities exist among consumers, platforms may implement more severe differential pricing for new and existing users. The differences between traditional and algorithmic pricing are shown in Table 1. Generally speaking, algorithmic differential pricing is data-driven, algorithmically enabled, and dynamic price discrimination for everyone.

Table 1. Comparison of characteristics

Comparative dimension	Traditional price discrimination	Algorithmic differential pricing
Grounding	Observable population characteristics	Multi-dimensional individual behavior data
Pricing granularity	Group/market segmentation	Individual (1000 people, 1000 prices)
Pricing basis	Demand elasticity, purchase quantity	Willingness to pay portrait, purchase history
Degree of realization	Mainly in three levels, rare in one level	Approaching primary price discrimination

3. Algorithmic tiered pricing mechanism

The most common practice of algorithmic price discrimination is tiered pricing, where platforms categorize users into different tiers based on factors such as payment willingness, consumption frequency, and price sensitivity, then set distinct prices for each tier. As illustrated in Figure 2, such pricing logic can be interpreted via a two-stage analytical model. In the first stage, platforms implement a uniform pricing strategy to expand user bases while collecting and accumulating user consumption records and behavioral characteristic data. In the second stage, the platform relies on the accumulated data in the early stage to complete the identification of new and old users, maintains high pricing for existing users who have already formed user lock-in, and implements price discounts or subsidy strategies for incremental new users, thus forming a price stratification pattern oriented towards killing mature users. This model indicates that if the platform can identify and lock in existing users, the differential pricing of the second phase algorithm will enhance the overall revenue of the platform. However, the sustainability of this pricing model is limited by consumer platform transfer costs and market competition intensity. The higher the cost for consumers to switch platforms, the more willing the platform is to raise prices for existing users.

DOI: 10.54254/2754-1169/2026.37788

Small and medium-sized enterprises tend to directly raise prices, while large platforms are more inclined to use data advantages to achieve complete price discrimination. So, the ultimate result of algorithmic tiered pricing is determined by the combination of data advantage, consumer lock-in, and market competition.

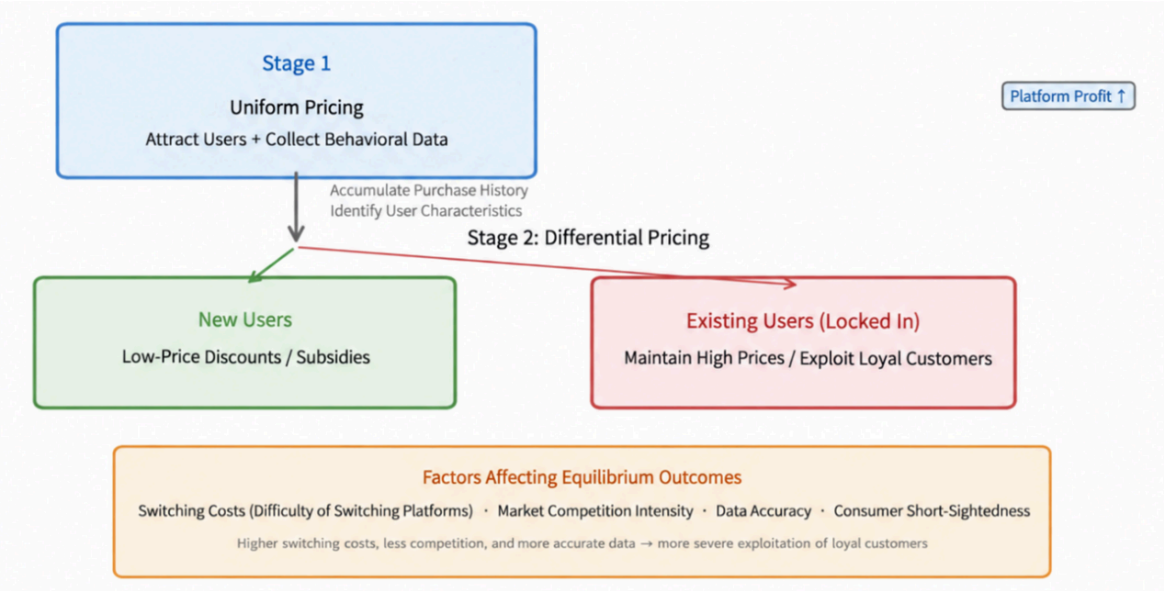

Figure 2. Two-period hierarchical pricing equilibrium mechanism (picture credit: original)

The academic community has not yet reached a unified conclusion on the welfare consequences of algorithmic differential pricing. Traditional welfare economics holds that although complete price discrimination can maximize total output, all consumer surplus is taken away by producers, resulting in a serious imbalance in social wealth distribution. Consumers with limited information suffer losses. After obtaining more consumer information and dividing the market into smaller segments, businesses may increase profits without reducing consumer surplus, but they may also harm both consumers and overall welfare. Therefore, the consequences of price discrimination are not fixed. If competitive factors are taken into consideration, the situation becomes even more complex. On the one hand, purchase history based differential pricing may intensify inter platform competition, lower prices and benefit consumers. On the other hand, given lock in effects and network externalities, such differential pricing may lift overall prices and damage consumer interests. Overall, the impact of algorithmic differential pricing has two sides: in a highly competitive and transparent data environment, differential pricing can help expand production and improve efficiency; But in the case of platform monopoly and severe information asymmetry, differential pricing may become a tool for plundering consumer surplus. Therefore, the evaluation of this behavior needs to be based on specific market conditions.

4. Algorithmic antitrust and consumer protection theory

From the perspective of anti-monopoly law, algorithmic differential pricing mainly involves the abuse of differential treatment clauses in market dominance. China's Antimonopoly Law stipulates that operators with dominant market positions cannot discriminate in price and other aspects against trading targets under the same conditions. Therefore, to identify algorithmic differential pricing as illegal, several conditions must be satisfied simultaneously: the platform holds a dominant market

DOI: 10.54254/2754-1169/2026.37788

position, has engaged in differential treatment conduct, and such conduct has eliminated or restricted competition. But there is debate in academia about this: it may not be illegal if the price difference is due to different costs or helps to improve production and efficiency. Whether consumers are considered "counterparties" in the differential treatment clause is also controversial, which limits the direct application of anti-monopoly law. A simple comparison can be made: in the case of unified pricing, the platform cannot subdivide prices according to user data; In the case of differential treatment, the platform can take away more consumer surplus through data segmentation. If the policy of "transparency supervision and data portability" is introduced to make it convenient for consumers to compare prices and transfer data, the information advantage and user locking effect of the platform will be weakened, and the space for differential pricing will be small. In addition, if several platforms use the same pricing algorithm, they may form an implicit conspiracy to raise prices together.

Because the impact of algorithmic differential pricing has two sides, regulatory policies can not be banned all at once, but should be regulated in layers and classifications according to the competitive structure of the industry and the vulnerability of consumers. Evolutionary game theory also supports this idea: in the tripartite game between the government, the platform, and consumers, the intensity of supervision, punishment, and the loss rate of consumers jointly affect the ripening strategy of the platform, and moderate punitive damages can significantly restrain the ripening behavior in the short term. Based on this, this paper proposes a hierarchical industry differentiation regulatory framework, as shown in Table 2. First, flexibly oriented supervision applies to fully competitive industries. Core measures include algorithm filing for platforms, pricing transparency requirements, and compliance guidance via industry self-regulation. Secondly, industries with strong monopolies or involving people's livelihood needs, such as online tourism, travel, takeout, etc., should strengthen anti-monopoly law enforcement and price supervision, focus on examining whether there is abuse of market dominance, and ensure that the pricing process can be explained clearly through algorithmic audit. Third, regardless of the industry, the bottom line of consumer protection must be upheld: the right to know, the right to fair trade, and the right to personal information should be safeguarded, and the provisions of the Personal Information Protection Law stipulating that automated decision-making shall not impose unreasonable differential treatment should be enforced. Meanwhile, data confirmation and data portability can enhance consumers' bargaining power and capacity for rights protection. Through such an arrangement of "hierarchical classification and whole-process synergy", a balance can be struck between consumer protection and digital economy innovation.

Table 2. Regulatory framework for hierarchical industry differentiation

Regulatory hierarchy	Applicable industry characteristics	Key regulatory tools	Regulatory objectives
Flexible regulators	Full competition and good data flow	Algorithm filing, pricing transparency, industry self-discipline	Give full play to allocation efficiency
Strong regulators	Industries with strong monopolies and just needed for people's livelihood	Antitrust law enforcement, algorithm audit, price supervision	Curbing the abuse of differential treatment

DOI: 10.54254/2754-1169/2026.37788

Table 2. (continued)

Bottom line protection	All industries	The right to know, the right to fair trade, the right to data, the right to carry data, and the price comparison mechanism	Consumerism

5. Conclusion

Focusing on the differential pricing of big data algorithms, this paper analyzes the theoretical basis, operation mechanism, welfare impact, and regulatory path, and draws three conclusions. First, algorithmic differential pricing is essentially data-driven, algorithmically enabled, and individual-oriented dynamic price discrimination. It is a new development of traditional price discrimination theory in the era of the digital economy, which can be explained by behavioral price discrimination, transfer cost, and network externalities. Secondly, algorithmic hierarchical pricing realizes thousands of people and thousands of prices through the closed loop of data collection, user identification, and differential pricing. The final result depends on the joint action of data advantage, consumer locking, and market competition. The welfare impact has two sides, which should be judged according to the specific market situation. Thirdly, algorithmic differential pricing cannot be simply prohibited, but should be regulated according to industry competition structure and consumer vulnerability, while strengthening algorithmic transparency, anti-monopoly law enforcement, and consumer data rights protection, so as to take into account efficiency and fairness.

The theoretical contribution of this paper is to integrate the research scattered in the fields of economics and law into a unified analytical framework, answer the questions of what algorithmic differential pricing is, how to operate, what impact it has, and how to govern it, and make up for the shortcomings of existing studies that only focus on a single dimension. At the practical level, the idea of differentiated supervision in hierarchical industries can provide a reference for regulatory authorities, anti-monopoly law enforcement agencies, and consumer rights protection mechanisms. This paper mainly employs theoretical analysis and logical deduction as research methods and does not conduct empirical tests based on real-world platform transaction data. The analysis of welfare effects is mainly qualitative research and judgment, lacking quantitative calculation as support. Based on the micro data of platform desensitization, the follow-up research can complete the empirical evaluation of the loss of algorithmic differential pricing welfare, compare the implementation efficiency of various regulatory schemes, and provide more sufficient empirical evidence for the construction of an inclusive prudential regulatory system in the field of the digital economy.

References

[1] Li, S. M., Zhang, L., & Zhang, L. B. (2022). Review of domestic big data ripening research. *Knowledge Management Forum, 7*(6), 674–691.
[2] Zhao, C. Y., Ding, Q. L., & Liu, Z. Q. (2023). Network externalities and price discrimination based on purchasing behavior: An economic analysis of "killing ripe". *World Economy, 46*(6), 210–236.
[3] Acquisti, A., & Varian, H. R. (2005). Conditioning prices on purchase history. *Marketing Science, 24*(3), 367–381.
[4] Zhen, Y. K. (2022). Big data "killing ripe" from the perspective of transfer cost. *Management World, 38*(5), 84–117.
[5] Bergemann, D., Brooks, B., & Morris, S. (2015). The limits of price discrimination. *American Economic Review, 105*(3), 921–957.
[6] Hou, W. W., Jing, W. J., & Gu, Z. M. (2023). Platform enterprise size, data advantage and price discrimination. *Management Review, 35*(1), 66-74.

DOI: 10.54254/2754-1169/2026.37788

[7] Zhao, X. M. (2024). Reflection and correction of the concept of algorithm-implied collusion in anti-monopoly regulation. *Journal of Jishou University (Social Sciences Edition), 45*(4), 149-160.
[8] Zou, K. L., Xu, P. J., & Zeng, W. Q. (2026). Regulation dilemma and solution approach of algorithmic personalized pricing. *Journal of Beijing University of Science and Technology (Social Sciences Edition), 42*(2), 72-79.
[9] Li, G. H., Liang, Y. T., & Su, J. L. (2023). Analysis of the governance of big data "killing ripeness" of e-commerce platforms in the context of data confirmation. *Operations Research and Management, 32*(11), 227-232.
[10] Choe, C., King, S., & Matsushima, N. (2018). Pricing with cookies: Behavior-based price discrimination and spatial competition. *Management Science, 64*(12), 5669-5687.