

Antitrust Regulation of Differential Pricing Algorithms

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Abstract. Differentiated pricing algorithm is a new pricing mechanism generated under the conditions of digital economy, which poses a deep test to the regulatory tools of anti-monopoly law. The academic community has long been embroiled in disputes over its anti-monopoly legal attributes: the negation theory attributes it to excessive pricing behavior targeting consumers, while the affirmation theory advocates regulating it through differential treatment clauses. Both positions have their own rationality, but neither fully addresses the diversity of competitive damages caused by behavior. This article is based on the coexistence pattern of exploitation, exclusivity, and distortion, and reviews the shortcomings of the current regulatory framework in terms of normative basis, determination of market dominance, behavioral requirements, and value orientation. It advocates using case analysis and economic analysis as methodological starting points to construct a diversified and composite regulatory structure of "differential treatment+predatory pricing", "differential treatment+ultra-high pricing", and simple "differential treatment". Through the coordinated governance of anti-monopoly law, consumer rights protection law, and personal information protection law, the dual value of competition order and consumer welfare is nurtured.

Keywords: differentiated pricing, algorithm, Anti-Monopoly Law, Differential treatment, Diversified and composite regulations

1. Introduction

Around 2018, the phrase 'big data kills familiarity' entered the public eye. In the case of Hu Hongfang v. Ctrip, which is known as the first case of big data murder, a diamond VIP customer named Hu paid a much higher room rate than the store price when booking a hotel through the Ctrip app. The court ultimately determined that the operator should bear the responsibility of refund, compensation, and three liability based on price fraud under the Consumer Rights Protection Law, but did not conduct a substantive examination on whether his behavior constituted big data murder [1]. The resolution of one case cannot conceal a more universal question: should antitrust laws intervene when operators use data and algorithms to implement differentiated pricing for consumers? What path should be taken to adjust? This issue not only involves the balance between competition order and consumer welfare, but also tests the interpretation and application of traditional antitrust laws in the digital economy, and has become an unavoidable topic in competition law research.

2. Concept definition and behavioral logic of differentiated pricing algorithm

2.1. Conceptual analysis and terminology selection

There are various expressions in academia regarding the same type of economic phenomenon, such as "price discrimination," "big data killing," "algorithmic personalized pricing," and "differentiated pricing." The semantics of various concepts overlap, but their normative meanings and value orientations are not the same. It is necessary to clarify this in the discussion of anti-monopoly law.

Price discrimination "is an economic category that can be classified into first, second, and third levels of accuracy, and is a value neutral description; However, the term 'discrimination' often implies negative evaluation in law, and transplanting neutral concepts from economics directly into legal discourse inevitably leads to confusion in evaluation [2]. The term 'big data killing' is a product of the infiltration of media discourse into the field of law. The word 'killing' presupposes a narrative framework of subjective malice of operators and harm to consumers, which Lei Xi called the 'framework effect'. He believes that using this term is not conducive to evaluating the behavior from a neutral standpoint [3]. Although "algorithmic personalized pricing" is relatively neutral, in a two-sided market structure, the platform's ability to obtain consumers' willingness to pay is subject to cross network externalities, and pricing under the name of "personalization" may not accurately touch the reserve price of each consumer. This term has tension in antitrust analysis. In view of this, Wang Huiqun advocates using "differentiated pricing" as the unified term for antitrust analysis, emphasizing the separation of price behavior itself from moral judgment [4]. From this standpoint, except for citations of economic principles, the concept of "differentiated pricing" is used throughout the following text.

2.2. The operating mechanism of algorithms

The development of differentiated pricing algorithm roughly goes through three stages. One is data collection. Operators collect consumer registration information through methods such as clicking on contracts, and use algorithm technology to track and record their regular behaviors such as browsing, searching, placing orders, and evaluating on the platform, as well as unconventional behaviors such as flash sales and returns, gradually accumulating to form a "data warehouse". The second is user profiling. The algorithm tags the collected data, categorizes consumers based on dimensions such as consumption frequency, consumption habits, consumption region, and consumption ability, and calculates their willingness to pay based on the preference behavior model. The true meaning of the so-called "portrait" in anti-monopoly law is not only to identify consumer preferences, but also to grasp the highest price that consumers can afford, which is known as the "reserve price" in economics. The role of the portrait as a tool for overpricing is thus highlighted. The third is differential pricing output. Operators implement different pricing strategies for different consumers on the same goods or services based on their assessment of payment willingness.

It is worth noting that differentiated pricing can be further divided into two categories based on the formation mechanism of consumer willingness to pay: pricing based on consumer preferences and pricing based on consumer misconceptions. The price difference in the former depends on identifiable factors such as transaction time, peak demand, or product preference, and consumers are aware of the reasons for the difference; The latter, on the other hand, leverages psychological characteristics such as high search costs and bias in estimating their own needs, to induce consumers to make incorrect payment intentions through price incentives, repeated quotes, false quotes, and other means, thereby maximizing the surplus of cancellation fees. The legal culpability of the two is

significantly different, which constitutes an important starting point for scenario based judgment in subsequent antitrust analysis.

2.3. Legal characteristics

Compared to traditional price discrimination, algorithmic differentiation pricing presents three characteristics that deserve attention from antitrust laws. Firstly, the directness of exploitation. Traditional price discrimination often occurs between operators and downstream operators, with a typical form of damage to the market position of competitors or counterparties; The implementation target of algorithm differentiation pricing is directly the end consumers, and the acquisition of consumer surplus constitutes its primary form of damage. Secondly, the concealment of the pricing process. Online transactions are completed in a closed one-on-one environment, making it difficult for consumers to compare quotes from different sellers or even from the same seller to different consumers horizontally; In addition, algorithmic pricing is highly dynamic, and regulatory agencies are not easily able to fully observe the actual pricing of consumer terminals. Thirdly, the technological barriers that behavior relies on. The implementation of algorithm differentiation pricing relies on massive data, complex computing power, and continuous learning. The top platform that masters data elements and algorithm resources gains a dual information advantage relative to competitors and consumers, making it increasingly difficult for potential competitors to cross barriers and enter the relevant market.

3. Proving the antitrust law attribute of differentiated pricing algorithm

3.1. The difference between affirmative and negative theories

There are basically two positions in academia regarding whether differentiated pricing should be included in the scope of anti-monopoly law.

The representative viewpoint of negation theory was proposed by Professor Xu Guangyao. The core of its argument lies in the fact that the original intention of big data to kill consumers is not to create discrimination between different consumers, but to use algorithms to accurately identify the reserve price of each consumer, in order to extract as much profit as possible; The price of 'one thousand people, one thousand prices' is only the appearance of this behavior, not its essence. More importantly, price discrimination must cause harm to competition before antitrust laws can intervene; The counterpart of big data killing is end consumers, who purchase products for personal consumption and do not participate in competition. Killing behavior often has no direct impact on competition. In this sense, categorizing it as price discrimination would actually lead to an unsolvable anti-monopoly law, which can only be analyzed through the approach of "overpricing".

The affirmative theory insists that differentiated pricing should be included in the regulation of anti-monopoly laws. Chen Qunfeng and Zhou Enhui advocate that the ultimate consumer, as the recipient of the algorithm, should be regarded as the transaction object under the Anti Monopoly Law, and the "counterparty" of the differential treatment clause covers consumers with explanatory space [5]. Meng Yanbei emphasized that differentiated pricing belongs to exploitative abuse and can be intervened by anti-monopoly laws when it is difficult to seek other legal remedies for significant unfair transactions [6]. Professor Yu Ling holds a cautious attitude towards both ends mentioned above, believing that the economic effects of algorithmic consumer price discrimination are constantly changing, and it is not appropriate to simply ban it. Instead, the logical premise should be

that the behavior is illegal and illegitimate, and adjustments should be made through case economic analysis [7].

The insight of the negation theory lies in revealing the exploitative nature of the "kill to maturity" behavior and being wary of the explanatory trap of simplifying complex economic phenomena into a single type; However, there is still room for further reflection on whether its interpretation of "competition damage" strictly limited to the relationship between operators reflects the actual form of competition damage in the platform economy.

3.2. Types of damage caused by diversified competition

The damage caused by differentiated pricing algorithms to the competitive order is not singular, but presents a multi-dimensional structure. One is exploitative damage. This is the most intuitive form of damage caused by differentiated pricing, manifested by operators accurately identifying consumers' willingness to pay through algorithms, and transferring consumer surplus to themselves in the form of profits. From the perspective of occupancy effect, charging high prices to consumers with higher willingness to pay and seizing the consumer surplus that they could have enjoyed; From the perspective of market expansion effect, attracting those with lower willingness to pay at lower prices to enter the market, and the profits from this expansion also belong entirely to the operators. When differentiated pricing coexists between consumer preferences and misconceptions, its degree of exploitation deepens and efficiency advantages may not necessarily exist. Secondly, exclusive damage. This is the main damage that traditional price discrimination focuses on. Under the conditions of platform economy, differentiated pricing has not disappeared, but has emerged in a new form: operators are able to engage in predatory pricing by charging high prices to their loyal customers and engaging in low price competition with competitor customers through cross subsidy mechanisms; Personalized pricing thus upgrades subsidies across product markets to subsidies based on consumer grouping within the same product market, strengthening the applicability of predatory pricing. Thirdly, distorted damage. This is the secondary damage caused by price discrimination. When the target of differentiated pricing is downstream distributors or speculative consumers, differentiated pricing distorts the resale costs of downstream markets, leading to a disruption of downstream market competition order; Especially in scenarios where the platform charges differentiated commissions to merchants, such damages deserve special attention. The three types of damages are intertwined in the same behavior and can also manifest separately. Recognizing the diversity of competition damages does not deny the core position of exploitative damages, but provides a more comprehensive conceptual framework for antitrust analysis.

3.3. The necessity of anti-monopoly law intervention system

Based on the above analysis, there is a sufficient institutional necessity for anti-monopoly law to intervene in the regulation of differentiated pricing. Firstly, from the perspective of welfare effects in economics, platform differentiation pricing is not neutral. Research on horizontal differentiation models shows that price discrimination reduces corporate profits and overall social welfare; When the marginal cost is relatively low compared to the externalities of the cross network, price discrimination increases platform profits, which in turn harms consumer welfare. This research conclusion provides an economic basis for the intervention of anti-monopoly law. Secondly, there are insufficient adjustments in other departmental laws. On the one hand, Article 14 of the Price Law prohibits price discrimination only between operators and does not cover differential pricing that occurs between operators and end consumers; On the other hand, although the Consumer Rights

Protection Law has the function of balancing the power gap between consumers and operators, its individual rights protection mechanism is difficult to form a systematic deterrence in the face of platforms that have access to massive data and a level of rationality far exceeding that of individuals. In the absence of adjustments in various departmental laws, the anti-monopoly law plays an irreplaceable role in filling the gap in maintaining competition order. Thirdly, the expansion of private power on platforms has led to structural imbalances that urgently need to be corrected by competition laws. The Internet business platform has grasped a kind of management power similar to that of the state by providing quasi market services, and achieved differentiated pricing for consumers with the help of big data and algorithm models to achieve the purpose of cannibalizing consumer surplus; The operation of such private power naturally has a tendency towards rent-seeking, and is prone to disorder when lacking external checks and balances. As a fundamental law for maintaining the competition mechanism, the Anti Monopoly Law is duty bound to correct this structural imbalance.

4. The dilemma and reflection on the current regulation of anti-monopoly laws

4.1. Unidirectional dilemma of regulatory basis: limitations of differential treatment clauses

The regulation of differentiated pricing in China's current anti-monopoly law mainly falls under the "differential treatment" clause in Article 22, Paragraph 1, Item 6 (formerly Article 17) of the Anti Monopoly Law, and is further refined by Article 17 of the Anti Monopoly Guidelines of the State Council on the Platform Economy. The "Guidelines" explicitly include the expression of differential treatment based on big data and algorithms, implementing differential transaction prices or other transaction conditions according to the payment ability, consumption preferences, usage habits, etc. Of the counterparty, so as to extend the scope of the terms to end consumers, which should be approved.

However, one-dimensional normative basis is difficult to undertake the regulatory responsibility of multiple damages. Firstly, the legal structure of Article 22 (1) (6) is largely inherited from Article 102 (c) of the EU Treaty on the Functioning of the European Union, which originally targeted exclusive abuse and distorting abuse, and exploitative abuse was not within its scope. After the inclusion of exploitative damages in the differential treatment rules in our country, three types of damages are mixed together in the same clause, and "differential treatment" has become a descriptive term for behavioral manifestations, making it difficult to directly correspond to the actual consequences of damages. Law enforcement agencies still need to re analyze the types of damages after determining differential pricing, and the rules have not provided substantial guidance for analysis. Secondly, the disconnect between form and substance raises concerns about rough law enforcement. If only the appearance of "differential pricing" can be used to determine illegality, law enforcement agencies do not need to conduct competitive analysis within the framework of the elements of damage consequences. This "formal inclusion" model undermines the rigor of antitrust analysis. The fundamental crux of one-dimensional evaluation lies in the fact that using one clause to deal with three types of damages will inevitably lead to either insufficient resources or excessive expansion

4.2. The difficulty of adapting the main requirements: the dilemma of determining market dominance

The anti-monopoly regulation of differentiated pricing is based on the premise that operators have market dominance, but the determination of market dominance under platform economy conditions faces three challenges.

Firstly, traditional methods of defining relevant markets have failed in bilateral markets. Traditional SSNIP testing assumes unilateral markets and static competition, while digital platforms embody the characteristics of multilateral markets, asymmetric pricing, and dynamic competition: bilateral or multilateral platforms may involve more than one related market, and network externalities between each market need to be considered; Under asymmetric pricing, the price increase test on the free end may fail due to a large loss of users; The frequent cross-border competition further blurs the boundaries of the market. Wang Wenjun also pointed out that the EU Google case, the US Microsoft case, China's 3Q case, and recent cases such as Alibaba and Meituan all demonstrate the inadequacy of the traditional "structure behavior effect" analysis paradigm [8].

Secondly, the traditional dominance criteria based on market share are difficult to reflect the true picture of platform power. The considerations listed in Article 18 of the Anti Monopoly Law are based on the market structure of traditional industrial economy, placing market share at the core. However, in the digital economy, traffic, users, and data have become the core elements of competition. Cross border network effects and lock-in effects significantly increase consumer transfer costs, and the strength of platform market power cannot be judged solely by market share. In the Alibaba "choose one from two" case, the State Administration for Market Regulation comprehensively considered both cross-border network effects and lock-in effects. Although this enforcement approach has demonstrative significance, it still takes time to systematize the relevant considerations at the regulatory level.

Again, there are regulatory blind spots in differentiated pricing under relative advantage. The increasing popularity of differentiated pricing strategies and the replicability and non exclusivity of algorithms do not mean that only large platforms can implement differentiated pricing, nor are they the only ones who use it to violate pricing laws. The hard threshold of market dominance restricts the regulation of a large number of platforms with relative advantages by the Anti Monopoly Law, which to some extent undermines the regulatory function of the Anti Monopoly Law.

4.3. Ambiguity of behavioral requirements: absence of recognition standards and proof rules

Even if the subject requirements are met, there are still many unclear aspects in determining the behavioral requirements. Firstly, the criteria for determining 'same conditions' are still somewhat vague. Article 17, Paragraph 2 of the Guidelines adopts the "substantial difference" standard, which considers factors such as transaction security, transaction costs, credit status, transaction stage, and transaction duration. However, the concretization of this standard still requires the accumulation of individual cases. Secondly, the burden of proving competition damage is too heavy. The concealment of algorithmic differential pricing makes it difficult for consumers and even law enforcement agencies to fully observe terminal pricing; The dynamic nature of pricing makes it difficult to quantify the damage effects, and antitrust investigations and evidence collection are fraught with difficulties. Thirdly, the flexible interpretation of legitimacy reasons gives law enforcement agencies greater discretion. Article 17, paragraph 3 of the Guidelines lists "legitimate trading customs and industry practices", "preferential activities for new users", "non discriminatory random transactions", and fallback clauses, but there is no clear answer at the rule level on what

constitutes "legitimate" and "reasonable period". Although this flexibility leaves ample room for individual discretion, it may also compromise the predictability of law enforcement due to unclear standards, as evidenced by the hesitation and disagreement of courts in determining personalized pricing in judicial practice.

4.4. The tension of value balance: the dilemma between inclusive prudence and effective regulation

The anti-monopoly regulation of differentiated pricing algorithms also faces a dilemma at the conceptual level. A one size fits all ban may have a strong deterrent effect, but its cost is the improper erasure of potential efficiency gains. Lei Xi cited research from the UK Competition and Market Regulation Authority, which pointed out that although algorithmic personalized pricing sometimes harms consumer interests, it can also increase consumer welfare at times; The decision of the Office of Natural Gas and Electricity Market to ban regional differential pricing in 2009 did not promote competition, but rather weakened it. Conversely, after shifting towards a rational analysis path, the practical constraints of regulatory capacity and regulatory costs may lead to its degradation into a disguised one size fits all approach.

At the law enforcement level, the mismatch between regulatory capacity and regulatory targets is equally prominent. The anti-monopoly regulation of digital platforms faces at least three challenges: strong concealment of behaviors such as algorithm collusion and algorithm discrimination, and difficulty in investigation and evidence collection; The trade-off between restrained law enforcement and strict law enforcement tests the balance between innovation potential and competitive order; The law enforcement team requires both legal training and economic literacy, and the cultivation of versatile talents is not a one-time effort. The above difficulties are not unique to antitrust laws, but they are significantly amplified in the field of differentiated pricing algorithms, which combines technical, covert, and dynamic aspects.

5. The improvement path of differentiated pricing algorithm for antitrust law regulation

5.1. Correction of regulatory concepts: equal emphasis on case analysis and inclusive prudence

Oppose one size fits all generalized evaluation and advocate adhering to the basic stance of case analysis. The economic effects of differentiated pricing are actually constantly changing. Given the differences in platform business types, charging models, and consumer composition, the judgment of its anti-monopoly legal attributes must rely on specific scenarios, distinguishing between situations based on consumer preferences and based on consumer misconceptions, static pricing and dynamic pricing. At the same time, anti-monopoly analysis should be based on economic analysis as a fundamental tool, using indicators such as consumer surplus, total social welfare, and competition structure to test the damage effects. Multiple factors such as empirical research on economic effects, consumer perception of fairness, impact of enterprise costs and profits, and innovation effects should be included in the review; The empirical and econometric methods of economics are of great significance in enhancing the objectivity, scientificity, and credibility of antitrust regulation. On this basis, the attitude of anti-monopoly law towards differentiated pricing algorithms should be to regulate them rather than simply prohibit them.

5.2. Reconstruction of regulatory path: a multi-dimensional and composite regulatory structure

In response to the shortcomings of the one-way evaluation of the "differential treatment" clause mentioned above, it is advisable to adopt and develop Professor Wang Xianlin's "three-way composite regulatory structure". One is to adopt a "differential treatment+predatory pricing" evaluation model for exclusive abuse against competitors, revealing the essence of the parallel implementation of differential pricing and cross subsidies; Secondly, for exploitative abuse targeting consumers, adopt the evaluation model of "differential treatment+super high pricing", use the comparison method of similar products and the same method to determine the existence of super high pricing, and return to the original function of the high pricing system; Thirdly, the original intention of the differential treatment system design is to simply apply the "differential treatment" evaluation to the distorted abuse targeting downstream distributors. On this basis, Professor Wang Huiqun's typological supplement can be further introduced: from the perspective of "pricing power allocation", different regulatory paths can be classified and applied according to the platform's business types (information aggregation, online advertising, matching transactions, intermediary self operation, others) and corresponding charging methods (subscription/membership fees, advertising fees, commissions, commodity/service fees, etc.), so that anti-monopoly analysis is in line with the platform's multilateral market structure. Comparison of product time for a company

5.3. Improvement of recognition rules: typological transformation of constituent elements

Firstly, update the criteria for determining market dominance, taking into account factors such as data control ability, user size and activity, cross-border network effects, lock-in effects, and conversion costs, and weaken the single weight of market share standards. Secondly, clarify the interpretation space of "transaction counterparty", recognize the eligible status of end consumers under differential treatment clauses, and respond to the legislative purpose of China's Anti Monopoly Law to safeguard consumer interests. Thirdly, the standard of proof for rationalizing competition damage. In the scenario of differentiated pricing targeting consumers, there is no need to prove actual quantifiable market damage, but evidence should be provided that the operator's algorithmic pricing causes consumers to pay more costs to obtain their original welfare level. Fourthly, typify legitimate reasons. Refine the legitimate reasons listed in Article 19 of the Interim Provisions on the Prohibition of the Abuse of Market Dominance and Article 17, Paragraph 3 of the Guidelines, clarify the judgment dimensions of terms such as "legitimate trading habits", "reasonable period", and "non discriminatory random trading", and enhance the predictability of law enforcement.

5.4. The construction of collaborative governance: the connection between anti-monopoly law and relevant laws

Although anti-monopoly law plays a core role in regulating differentiated pricing, it is difficult to exhaust regulatory needs solely based on one aspect. The ideal pattern is a collaborative governance structure that complements the functions of the Consumer Rights Protection Law and the Personal Information Protection Law. The Anti Monopoly Law is based on market structure and competitive order, regulating dominant operators; The Personal Information Protection Law constrains the input of algorithms through mechanisms such as mandatory disclosure obligations, informed consent, withdrawal rights, and exit rights, thereby weakening the implementation basis of differentiated

pricing from the source; The Consumer Rights Protection Law provides specific remedies for individual consumer rights. A collaborative structure of "restraining the strong, regulating input, and protecting the weak" is formed among the three, avoiding the unilateral advancement and functional dislocation of any law. At the same time, law enforcement should promote innovation in regulatory tools, use big data and artificial intelligence technology to enhance the penetration and adaptability of anti-monopoly regulations, strengthen the construction of a composite law enforcement talent team, and enhance the ability to respond to the technical and dynamic phenomenon of differentiated pricing algorithms.

6. Conclusion

Differentiated pricing algorithm is a new pricing mechanism that has emerged under the conditions of the digital economy. It should not be simplified as a legal behavior under the "differential treatment" clause, nor should it be obscured by the moral label of "big data kill". On the normative standpoint of anti-monopoly law, the true complexity of this behavior comes from the diversity of its competitive damages: exploitation, exclusivity, and distortion coexist in a staggered manner, making the mechanical application of a single clause inevitably inadequate. In this regard, the anti-monopoly law should not prohibit personalized pricing across the board, as this behavior may also bring about improvements in distribution efficiency and incentives for product diversification under specific conditions, and should not be withdrawn from the regulatory field due to the complexity of the platform economy. The feasible approach is to use case analysis and economic analysis as methodological starting points, differentiate corresponding different types of damages through a composite regulatory structure of "differential treatment+predatory pricing", "differential treatment+super high pricing", and simply "differential treatment", and cultivate the dual value of competition order and consumer welfare through collaborative governance between the Anti Monopoly Law, Consumer Rights Protection Law, and Personal Information Protection Law. This is not only the rightful response of anti-monopoly law to the digital economy, but also an institutional path to seek a dynamic balance between technological innovation and rights protection.

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