

Postprint: A Review of Domestic Research on Big Data Shashu

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Abstract

[Purpose/Significance] This study reviews the current state of domestic literature on big data price discrimination, summarizes research characteristics, and aims to better align academic research with the practical development of the digital economy. [Method/Process] Employing bibliometric analysis and thematic analysis, it synthesizes existing conceptual definitions of big data price discrimination and examines algorithmic ethics, algorithmic power, algorithmic governance, data rights, information protection, user privacy, market abuse, strategic gaming behavior, and antitrust research from algorithmic, data, and platform perspectives. [Results/Conclusion] Current domestic research exhibits three main characteristics: research questions evolve with contemporary issues; interdisciplinary approaches have become normalized; and there is strong emphasis on learning from international experiences. Future directions should focus on strengthening empirical studies, promoting interdisciplinary collaboration, prioritizing technical-level investigations, and expanding legal domain research to enhance both the depth and breadth of scholarship on big data price discrimination.

Full Text

A Review of Research on Big Data-Enabled Price Discrimination in China

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Abstract

[Purpose/Significance] This article systematically reviews domestic literature on big data-enabled price discrimination, summarizing research characteristics to better inform the development of digital economy practices.

[Method/Process] Employing bibliometric and thematic analysis methods, we synthesize existing conceptualizations of big data-enabled price discrimination and examine research on algorithmic ethics, algorithmic power, algorithmic governance, data rights, information protection, user privacy, market abuse, gaming behavior, and antitrust issues from algorithmic, data, and platform perspectives. **[Result/Conclusion]** Current domestic research on big data-enabled price discrimination exhibits three key features: problem-oriented research that evolves with the times; multidisciplinary approaches that have become the norm; and emphasis on learning from international experiences. Future directions should strengthen empirical research, interdisciplinary collaboration, technical-level investigations, and legal domain expansion to enhance both depth and breadth in this field.

Keywords: big data-enabled price discrimination; price discrimination; algorithm; information protection

1. Introduction

According to the *China Digital Economy Development White Paper (2021)* published by the China Academy of Information and Communications Technology, the digital economy experienced rapid growth in 2020, becoming a critical pillar for China's new development paradigm [1]. This transformation has introduced new market dynamics, with internet platform-based online transactions emerging as a vital form of commodity exchange. However, it has also given rise to issues such as big data-enabled price discrimination. In late 2017, a Sina Weibo user named "Master Liao" shared his experience of being "killed by big data," sparking widespread public debate. In 2018, *Science and Technology Daily* published an article titled "Big Data Price Discrimination: Those Who Know You Best Hurt You Most," further amplifying public concern.

Cases of big data-enabled price discrimination have long existed internationally. Amazon's differential pricing experiment in 2000 represents an early practice of this phenomenon. By leveraging algorithmic tools, various online platforms customize prices for different users, constituting what is known as big data-enabled price discrimination. This practice is also referred to as algorithmic collusion, algorithmic discrimination, algorithmic consumer price discrimination, or simply price discrimination.

Since its exposure, big data-enabled price discrimination has sustained public attention, with numerous investigations and discussions emerging. The phenomenon encompasses user targets, platform agents, and methodological approaches (big data algorithms). Whether characterized as personalized pricing or big data-enabled price discrimination, users remain in a relatively disadvantaged position in the data environment. Due to the individual independence of platform accounts and device terminals, users easily fall into so-called information cocoons during usage, making the "thousand people, thousand prices"

phenomenon less detectable. Platforms, as the dominant parties implementing big data algorithms, collect user data, construct user profiles, and recommend information to users, establishing price levels within acceptable ranges. During this process, platforms wield absolute algorithmic power, enforcing user service strategies that gather gender, preferences, consumption habits, and other data to achieve differentiated services for different users. With the widespread application of smart terminals, scholars have increasingly focused on this phenomenon. Since the first public reports, Chinese researchers have explored the causes, processes, and nature of big data-enabled price discrimination, with domestic scholarship concentrating on price discrimination [2], consumer rights protection [3], algorithmic ethics [4], personal information protection [5], antitrust [6], and price fraud [7].

2. Literature Search Methodology

This study draws data from CNKI, Wanfang, and VIP databases, using subject terms (CNKI), titles or keywords (Wanfang), and titles or keywords (VIP) as search paths. Search terms included: “big data-enabled price discrimination,” “price discrimination,” “algorithmic discrimination,” “algorithmic collusion,” “algorithmic abuse,” “algorithmic supervision,” “algorithmic ethics,” “personalized pricing,” “pricing algorithms,” “algorithmic recommendation,” “algorithmic power,” and “algorithmic trap.” The search was conducted on December 2, 2021. After removing duplicates and irrelevant literature, 635 documents were retrieved. The temporal and document type distribution is shown in [Figure 1: see original paper].

[Figure 1: see original paper] Distribution of Domestic Literature on Big Data-Enabled Price Discrimination by Year and Type

Annual publication volume reveals that since big data-enabled price discrimination was listed among the top ten consumer rights violations in 2018, related research has increased yearly. Journal articles far outnumber newspaper articles, indicating widespread academic attention to this topic. With the promulgation of the *Shenzhen Special Economic Zone Data Regulations* (2021), *Shanghai Municipal Data Regulations* (2021), *Personal Information Protection Law of the People’s Republic of China* (2021), *Internet Information Service Algorithmic Recommendation Management Provisions* (2022), and *Opinions on Promoting the Standardized, Healthy, and Sustainable Development of the Platform Economy* (2022), data legislation and information protection topics have expanded the disciplinary scope of research, suggesting continued growth in related publications. Among the 635 documents examined, 31 were dissertations and 410 were journal articles, demonstrating professional academic engagement with the topic.

In related field research (see [Figure 2: see original paper]), law, economics, and computer science rank top three in literature volume, with philosophy and management also represented, confirming that big data-enabled price discrimination

is a multidisciplinary concern. Specific research content and characteristics are summarized in .

[Figure 2: see original paper] Distribution of Domestic Literature on Big Data-Enabled Price Discrimination by Discipline

**** Research Fields, Characteristics, and Content in Domestic Literature on Big Data-Enabled Price Discrimination

3. Conceptualizing Big Data-Enabled Price Discrimination

Big data-enabled price discrimination employs digital economy platforms to implement differential pricing for different consumers, constituting price discrimination in economic terms. Scholars thus characterize it as price discrimination behavior. Price discrimination theory, first proposed by British scholar Pigou in 1920, defines it as profit-maximizing behavior by monopolistic firms based on customer separation and direct sales assumptions, identifying three theoretical models: first-degree, second-degree, and third-degree price discrimination. Phillips emphasized the different margins between price and marginal cost for the same commodity. Mankiw identified market power as a key factor, arguing that enterprises with certain market dominance may implement price discrimination. Price discrimination is a neutral term in economics, influenced by multiple factors including costs, sellers, and market conditions. The development of digital platform economies has intensified information asymmetry, and user-characteristic-based big data-enabled price discrimination is regarded as price discrimination. Researchers examine its features and nature through economic theory, focusing on its impacts.

First, regarding the essential nature of big data-enabled price discrimination, enterprises use algorithms to price commodities, resulting in differential pricing outcomes. Big data-enabled price discrimination is considered essentially perfect price discrimination behavior, belonging to market segmentation pricing in economics, though it differs from differential pricing in terms of efficiency relationships [8]. It is viewed as a product of big data and algorithmic technology development at a certain stage, which would cause negative impacts if unregulated [9]. Second, regarding its legitimacy, scholars debate whether it should be characterized as price discrimination. Liang Zheng and Zeng Xiong [10] argue that numerous factors cause different prices for different users, and some behaviors constitute legitimate price discrimination that should not be entirely prohibited. Zhu Chengcheng contends that big data-enabled price discrimination should be legally characterized as price discrimination, primarily manifested as restrictions on implementers, similarity in traded commodities, discriminatory pricing, and serious damage to market competition order [11].

Differential pricing represents an important manifestation of big data-enabled price discrimination, potentially involving price fraud from a legal perspective. According to relevant legal interpretations, price fraud refers to “operators using false or misleading pricing forms or means to deceive or induce consumers

or other operators to transact” [12]. From a subjective intent perspective, legal researchers characterize big data-enabled price discrimination as price fraud, providing legal qualification. According to the *E-Commerce Law*, *Price Law*, *Consumer Rights Protection Law*, and other regulations, big data-enabled price discrimination represents operators abusing information advantages and intentionally implementing behaviors that violate consumers’ true intentions. This differs significantly from real-world differential pricing, violating fair transaction principles and consumers’ right to know [13], constituting legal price fraud with direct intentional fraud psychology, objective violation of disclosure obligations, and causing consumers unnecessary property losses as harmful consequences [14].

Zou Kailiang and Peng Rongjie [15] point out that big data-enabled price discrimination abandons business ethics and civilization and should be characterized as price fraud by platform merchants. The “fraud” concept here should extend its recognition scope, adopting the economic law attributes and legislative purpose positioning in the *Price Law* as more appropriate. Merchants should adhere to the principle of good faith in informing consumers; otherwise, they constitute passive price fraud.

Examining its formation process, researchers characterize it as algorithmic discrimination. Starting from the technical path of “data collection, data storage, data calculation, and commercial application,” Zhu Jianhai [16] identifies the essence of big data-enabled price discrimination as algorithmic price discrimination, manifesting primarily in algorithms and applications. Liao Jiankai [17] notes that big data-enabled price discrimination uses algorithmic design and computer technology to analyze and process consumer personal data, constructing consumer profiles with prominent technical features, representing typical abuse of algorithmic power by operators. Enterprises over-collect user data through authorization clauses or user agreements, mastering personalized characteristics such as registration information, usage data, and “collision” information to provide different commodities and prices for different users, implementing refined marketing that essentially results from platforms’ excessive utilization of user data [14].

4. Thematic Analysis of Big Data-Enabled Price Discrimination

To facilitate thematic analysis, we conducted keyword frequency statistics, identifying 28 high-frequency words appearing more than 30 times, as shown in

**** High-Frequency Keywords in Domestic Research on Big Data-Enabled Price Discrimination

High-frequency vocabulary related to big data-enabled price discrimination exhibits the following characteristics: (1) Data-centered terms dominate, with “data” (448 occurrences), “big data” (34), and “information” (85) reflecting the primary focus on data issues. (2) Algorithm governance topics include “algo-

rithm” (243), “ethics” (53), and “artificial intelligence” (43) as technical challenges. (3) Economics-related terms are most numerous, with “consumer” (167), “pricing” (54), and “antitrust” (51) demonstrating the phenomenon’s economic impacts. Keywords appearing more than 100 times include data, algorithm, price, discrimination, consumer, and platform, indicating concentrated research on user data, algorithmic rules, platforms, and effect impacts, particularly on the foundation (data) and process (algorithm) of price discrimination. Keywords appearing more than 50 times include price discrimination, information, rules, protection, and law, showing that big data-enabled price discrimination involves numerous existing legal issues, with personal information protection as the primary concern. Keywords appearing fewer than 50 times include technology, supervision, and artificial intelligence, indicating that regulatory issues in AI environments are receiving attention.

Among algorithm-related keywords, algorithmic ethics, algorithmic governance, algorithmic power, algorithmic black box, and algorithmic regulation account for 15.33%, 10.95%, 5.84%, 5.84%, and 4.38% respectively, representing high-frequency terms in algorithm research. In data-related keywords, information protection, data rights, user privacy, data security, data monopoly, and data ethics account for 7.32%, 6.1%, 3.66%, 3.66%, 3.66%, and 3.66% respectively, representing high-frequency terms in data research. In economics-related keywords, monopoly, market, and game theory account for 26%, 23.45%, and 7% respectively, representing high-frequency terms in platform research.

These keywords reflect discipline-corresponding characteristics: research primarily involves algorithms, data, and platforms. As renowned communication scholar Marshall McLuhan stated, media are extensions of humans. Enterprises collect user data and use algorithms as media to extend precise user positioning, constructing relatively objective user profiles to achieve “thousand people, thousand faces” effects, leading to big data-enabled price discrimination. The prerequisite is operators’ comprehensive data collection and platforms’ absolute monopoly, with direct consequences being user rights violations. The medium is big data algorithms, and the implementation process violates philosophical ethics.

Big data-enabled price discrimination involves data collection, algorithmic processing, and precise recommendation, where data is the key element, algorithms provide technical support, and platforms serve as the implementation scenario. Specific elements are shown in [Figure 3: see original paper].

[Figure 3: see original paper] Key Elements of Big Data-Enabled Price Discrimination

4.1 Algorithm Research on Big Data-Enabled Price Discrimination

Originally applied in mathematics and computer science, algorithms have evolved to incorporate learning processes and are now widely used in daily life. Through human-machine interaction, specific pattern-based operations achieve

automated decision-making assistance. As technology advances, algorithms like genetic algorithms and neural networks become increasingly intelligent. Algorithmic decision-making mechanisms embedded with value judgments consequently raise value and ethical issues. Through algorithmic analysis, internet platforms can implement collaborative filtering based on users, items, or models to predict potential user needs and achieve precise recommendations based on feature analysis. Algorithms do not necessarily create price discrimination but are crucial factors enabling it. Algorithmic ethics, algorithmic discrimination, algorithmic collusion, and algorithmic regulation have become focal research topics.

4.1.1 Algorithmic Ethics in Big Data-Enabled Price Discrimination

Algorithms are considered mathematical structures that accomplish specified goals under given conditions. However, machine learning algorithms based on complex rules create algorithmic ethical issues due to their uncertainty and opacity. Researchers discuss algorithmic ethics related to big data-enabled price discrimination from three perspectives: principles, practice, and risks.

(1) Principle analysis from an object perspective. The data foundation for intelligent algorithmic recommendations derives from user behavior, social networks, geographic location, and smart devices. Audience rights transfer in intelligent algorithmic recommendation technology includes privacy transfer, autonomy transfer, informed consent transfer, equality transfer, and forgotten transfer, triggering phenomena such as panopticon, disciplinary manipulation, “technical black box,” algorithmic discrimination, and permanent records [18]. Through computer instructions, algorithms construct pseudo-environments within users’ self-scopes, forming relatively narrow personal information worlds involving ethical issues for platforms, users, industries, and society. Li Feixiang [4] proposed a three-dimensional ecosystem covering data, platforms, and users for big data-enabled price discrimination. Software developers mastering massive user data artificially design biased big data analysis algorithms, leading to algorithmic discrimination. Platforms rely on user profiles and other technologies to analyze processed abstract data, highly abstracting users and analyzing behavioral characteristics to conduct backroom operations and implement big data-enabled price discrimination under information asymmetry [19]. From individual, enterprise, and social perspectives, personal privacy rights, right to know, and autonomous choice are violated; corporate integrity ethics and competitive balance are disrupted; national security and social values are impacted; and precise marketing through big data-enabled price discrimination leads to social ethical anomie and moral dilemmas [20].

(2) Practice analysis based on types. Recommendation algorithms analyze users’ subjective preferences through objective data, inherently creating certain algorithmic failures, algorithmic injustice, and algorithmic discrimination [21]. In recommendation algorithm practice, user-based collaborative filtering, model-based recommendation, content or popularity-based recommenda-

tion, network structure-based recommendation, and tag-based recommendation are commonly used models. Content-based recommendation extracts user preferences and browsing records to conduct enhanced direct “interference,” creating information cocoons. Collaborative filtering divides user groups, predicts group preferences, builds virtual communities, and achieves information sharing. Network structure-based recommendation aims to develop new products for new users. Big data-enabled price discrimination involves information collection, specific push, and personalized pricing stages, where model defects and data biases in information collection algorithms plant seeds of algorithmic discrimination, infringing on citizens’ basic rights. Specific push algorithms weaken users’ autonomous choice capabilities, causing information narrowing and “algorithmic authority” under information asymmetry. Pricing algorithms establish price discrimination rules, achieving behind-the-scenes control that damages consumers’ legitimate interests [22]. Big data-enabled price discrimination constitutes algorithmic bias phenomena combining big data and algorithms, harming specific individuals’ rights. Its high concealment leaves individuals unaware within information cocoons, trapped in designated “algorithmic prisons,” exacerbating digital divides and information society stratification.

(3) Ethical risks. Scholars discuss ethical issues surrounding technological value neutrality versus value load, focusing on algorithmic discrimination. Artificial intelligence algorithms have deep learning capabilities that extract data, mine potential patterns, and solve complex problems, but this process creates crises in equality concepts, causing individual relative inequality and forming discrimination applicable to specific populations, posing risks to legal protection models of equality rights under behavioralism logic [23]. Algorithm-induced 视野窄化 (narrowing of perspectives) and 立场固化 (solidification of positions) lead to information bubbles and cocoons, trapping people in algorithmic routines that exert inhibitive or imprisoning effects on human cognition, judgment, and decision-making, creating ethical issues such as credit discrimination and “prisoner” risks in algorithmic society [24]. Diao Shengfu and Yao Zhiying [25] propose that big data technology triggers privacy leaks, data dominance behaviors, and breaches of three bottom lines: data authenticity, security, and fairness.

4.1.2 Algorithmic Power in Big Data-Enabled Price Discrimination

Algorithms are structured decision-making processes. In AI environments, algorithms as tools label and recommend personal data, constituting relatively advantageous algorithmic power. Algorithmic power is becoming a “quasi-public power,” with algorithm controllers possessing power in the digital age, manifested as algorithmic abuse and algorithmic discrimination. Big data algorithms make services more intelligent and personalized, abstracting personal profiles through deep learning, breaking general rules, extending power scope, forming technical blind spots and substantive inequality, and triggering crises in equality concepts, discrimination identification, and equality rights protection models [23]. Algorithmic power originates from the evolution of law-technology relationships, with its alienation essence being the 疏离对立 (estrangement and opposition) between

law and technology, forming both technically defective non-transparent algorithmic black boxes and legally protected non-disclosed algorithmic black boxes. Imbalanced algorithmic power should focus on regulating algorithmic power, improving from endpoint to whole-process, from public-private domain transition to integration, and combining technical regulation with power constraints to constrain algorithmic power abuse and protect individuals' algorithmic interpretability rights, standardizing audit-supervision integration and third-party constraint mechanisms [26]. Big data-enabled price discrimination is a typical manifestation of algorithmic power abuse, with main forms including discrimination between old and new users, devices, consumption habits and capacity, and default bundling. The abuse of power is the root cause of big data-enabled price discrimination [27]. As a tool for big data-enabled price discrimination, algorithmic power's tension brings unforeseeable algorithmic bias and internal conflicts of algorithmic errors, changing the original "power-rights" structure, causing algorithmic value mutation, exacerbating inequality and digital divides, and enhancing data sharing insecurity [28].

4.1.3 Algorithmic Governance of Big Data-Enabled Price Discrimination (1) **Chinese algorithmic supervision research.** Algorithm application enhances user stickiness and enables precise marketing, but algorithmic price discrimination damages users' legitimate rights and interests. Algorithmic discrimination's individual rules challenge generally applicable laws, exacerbating substantive inequality. The "monitoring network" and "data profiling" under algorithmic automatic association lead to information leakage by data subjects, creating "power of the strong" in digital society. Therefore, standardizing algorithmic behavior, establishing data protection systems, adding algorithmic interpretation request rights, personal data right to be forgotten and right to modification, and clarifying punitive compensation mechanisms for algorithmic abuse are expected effective solutions [29]. Consequently, legal regulation of algorithmic price discrimination in big data-enabled price discrimination has attracted concentrated scholarly attention. Laws and regulations including the *Cybersecurity Law*, *Civil Code*, and *Internet Information Service Algorithmic Recommendation Management Provisions* all address related behaviors, as detailed in .

**** Research on Relevant Laws and Regulations on Big Data-Enabled Price Discrimination in China

(2) **International algorithmic supervision research.** From an algorithmic perspective, algorithmic transparency, algorithmic interpretability, and algorithmic accountability are strategic mechanisms proposed for algorithmic supervision. Algorithmic transparency belongs to ex-ante supervision, addressing the algorithmic black box problem. Algorithmic interpretation rights are data subjects' rights to explain algorithms to users, enhancing algorithmic transparency [38]. Through investigating international governance of algorithmic discrimination in big data-enabled price discrimination, scholars summarize characteristics

of foreign algorithm-related laws. For example, the U.S. balances algorithmic verification through ex-ante testing and ex-post review, eliminating technological disadvantages and enhancing algorithmic transparency through algorithmic accountability mechanisms. The *Algorithmic Accountability Act* (2019) and *Algorithmic Transparency and Accountability Statement* (2017) clarify data controllers' obligations in algorithmic operations and users' algorithmic rights, introducing scenario elements [38]. The European Parliament's Panel for the Future of Science and Technology released the *Framework for Algorithmic Accountability and Transparency Governance* in 2019, advocating for establishing algorithmic impact assessment mechanisms and algorithmic transparency and responsibility governance systems.

4.2 Data Research on Big Data-Enabled Price Discrimination Algorithm development has prompted academic attention to data. Big data-enabled price discrimination is precisely algorithmic abuse behavior based on personal data, with data rights, personal information protection, and user privacy as key scholarly concerns.

4.2.1 Data Rights in the Context of Big Data-Enabled Price Discrimination In the big data era, operators collect data and use algorithmic analysis to enhance data added value. Two basic requirements enable big data-enabled price discrimination: obtaining consumers' personal data and implementing differential pricing. The big data era has given rise to new rights—data rights. Despite controversies over the scope of personal data rights, they have gained widespread recognition and attention. Regulating algorithmic behavior is the prerequisite for governing algorithmic abuse in big data-enabled price discrimination, and reasonable algorithmic operation depends on improved personal data rights protection systems [29]. The 2020 *Shenzhen Special Economic Zone Data Interim Regulations (Draft)* first proposed the concept of “data rights and interests protection,” specifying rules for personal privacy collection and processing [19]. Big data-enabled price discrimination represents data managers' abuse of data rights. Researchers have explored personal and enterprise data rights in this context, with data portability rights, personal data rights, enterprise data rights, and data protection legal models receiving attention [39].

(1) Introduction of personal data rights. The open nature of personal data differs from relatively private personal information. Through big data profiling and tracking technologies, personal data can be statistically analyzed and predictively modeled. Big data-enabled price discrimination uses stored personal data and transaction data as reference bases, infringing on users' personal data rights to some extent. Xing Genghang et al. [40] introduced data portability rights to examine the evolutionary trajectory of consumers' willingness to exercise data portability rights when e-commerce platforms implement big data-enabled price discrimination, exploring the possibility of curbing big data-enabled price discrimination through data portability rights. Zheng Fei and Li Siyan [41] argue that personal data rights, as a new type of right, require consid-

eration of practical needs, value embodiment, legal logic, and implementation costs, including conceptual standards for emerging rights justification, whether rights can be accommodated by existing legal systems, and whether rights can be realized.

(2) Enterprise data rights regulation. Big data-enabled price discrimination is a social problem arising from enterprise algorithmic application, involving the legitimacy of data acquisition, processing, and usage, thereby raising questions about the legitimacy of relevant enterprise data rights. Ye Jiamin [42] argues that enterprises generate algorithmic discrimination issues when using algorithms to process data, with big data-enabled price discrimination being a manifestation. Therefore, clarifying the connotation and boundaries of enterprise data behavior and standardizing enterprise data power systems are crucial. First, enterprises should be granted data acquisition rights with personal information security protection as the basic premise. Second, enterprises' data processing powers should be regulated to avoid information cocoons and algorithmic discrimination. Third, appropriate enterprise data licensing systems should be established to prevent information security risks and algorithmic collusion hazards.

(3) Legal models for data protection. Big data-enabled price discrimination originates from information asymmetry and low data acquisition costs, featuring strong targeting and high concealment. Its technical path follows information collection–data analysis–dynamic differential pricing. Establishing personal data rights, improving personal data legislation, and building big data monitoring mechanisms are necessary paths for governance [43]. Countries have different experiential models for governing this issue. The U.S. has formed an algorithmic accountability-centered model, while the EU has formed a data protection-based model. Germany's *Federal Data Protection Act*, the UK's *Personal Data Protection Act*, and the EU's *General Data Protection Regulation* (GDPR) all contain relevant provisions. The GDPR, effective in 2018, establishes data protection as a fundamental principle, specifying data subject rights and data controller obligations, particularly strictly defining personal data access rights, modification rights, and data portability rights, and establishing a data protection officer system. Drawing on the GDPR, researchers consider regulating data protection and user profiling in big data-enabled price discrimination. GDPR Article 71's algorithmic interpretation right incorporates whether data controllers can use personal information for automated decision-making (such as user profiling) into the scope of data subjects' right to know [44]. The EU model thus provides legal regulation at the data protection level, though its lack of detailed explanation of data controllers' and processors' obligations creates implementation challenges for legal accountability mechanisms [5]. Du Jialu [45] argues that big data-enabled price discrimination is a manifestation of improper user profiling utilization, suggesting that GDPR's data subject automated decision-making types could be referenced to explore user profiling utilization and protection methods, while also considering users' reasonable expectations regarding data processing purposes.

4.2.2 Information Protection in the Context of Big Data-Enabled Price Discrimination Users' personal information is held by merchants, and commodity prices are monopolized by merchants, leaving users in a weak position in transactions. Essentially, this is a monopolistic behavior. Big data-enabled price discrimination is a product of the information age, viewed by new institutional economics researchers as a consequence of information property rights contention. Scholars theoretically elaborate on personal information protection in this context.

(1) Theoretical elaboration on information protection. Personalized pricing is essentially a monopolistic behavior. Scholars theoretically discuss personal information protection in the digital economy, seeking governance solutions at the notification-consent or user authorization level. Information processing research focuses on big data algorithm-related topics to explore regulatory methods. Post-hoc supervision should combine digital economy and legal issues to promote in-depth research. At the micro level, algorithmic power, data rights, personal privacy, and information protection constitute main research content; at the macro level, regulatory agency algorithmic supervision and algorithmic ethics become common governance concepts.

(2) Legal dilemmas in information protection. As China's first law specifically targeting personal information protection, the *Personal Information Protection Law* (effective November 1, 2021) details obligations for personal information processors in Article 24, considered a legal norm to curb big data-enabled price discrimination. The law uses "notification-consent" as its core, regulating personal information processing to ensure transparency and fairness in automated decision-making, providing legal basis for governance. However, it faces implementation challenges including vague "significant impact" judgment standards [5], public disclosure of assessment results [35], and difficulties at the judicial level. The *Consumer Rights Protection Law* expands the scope and implementation channels of consumers' right to know beyond the basic right to know. Scholars explore legal dilemmas and solutions for big data-enabled price discrimination from an information protection perspective. First, notification-consent and right-to-know legal dilemmas: laws require operators to obtain user consent when collecting personal information, but default checkboxes in some platform notification consent forms make implementation difficult [50]. Platforms exploit consumers' relative isolation, concealing differential pricing facts without consumers' knowledge, infringing on individual users' right to know [51]. Second, automated decision-making dilemmas: big data-enabled price discrimination uses algorithms to process personal information for automated decision-making. Although the *Personal Information Protection Law* regulates automated decision-making, the applicable conditions for algorithmic interpretation rights need improvement [5].

(3) Regulatory path exploration for information protection. First, legislative model revision: algorithms are the technical means of big data-enabled price discrimination. While the *Personal Information Protection Law* regulates

the entire automated decision-making process at the legal level, conditions for algorithmic interpretation rights require refinement. Jin Youfang et al. [5] argue that data collection is key to governance, notification-consent implementation should be graded, users should be granted rights to withdraw consent, and supervision systems should be improved. Zou Kailiang and Liu Jiaming [52] propose establishing consumers' personal information rights systems through a "relative control" concept, suggesting the use of "scenario theory" to expand the temporal extension of consumers' right to know, strictly defining operators' liability for damages, and improving effective regulation under the *Consumer Rights Protection Law*. Second, judicial relief models: although big data-enabled price discrimination has become a hot topic, few rights protection cases exist due to difficult burden of proof. While *Personal Information Protection Law* Articles 69 and 70 address these rules, unclear burden of proof allocation remains problematic. Expanding the scope of public interest litigation subjects to provide rights protection for personal information subjects is an effective solution. As targets of big data-enabled price discrimination, consumers are in a weak position; smoothing judicial relief channels, implementing consumer public interest litigation, and reversing the burden of proof are effective paths to protect legitimate consumer rights [54]. Wang Weibo suggests that constructing information desensitization mechanisms and operator commitment systems in non-monopoly fields are effective comprehensive governance paths [55].

4.2.3 User Privacy in the Context of Big Data-Enabled Price Discrimination Privacy rights initially described people's right to enjoy solitude. Viktor Mayer-Schönberger, author of *Big Data*, stated that big data initiates era transformation. Like other technologies, it must undergo the technology maturity curve process. Privacy leaks make individuals on network platforms transparent, being endowed with subject value demands as technical tools. Thus, big data-enabled price discrimination stems from the dualism of technological value: "technological value neutrality" and "technological value load" [25]. Big data technology transforms abstract concepts into data, whose generation leads to privacy leaks.

The big data era has brought big data technology development but also generated problems like big data-enabled price discrimination. Digital platform data collection and analysis trigger personal privacy rights crises, with privacy in the big data era involving moral and ethical boundaries [56]. Privacy issues in the information age arise from both scattered user privacy data and lack of defense frameworks for public privacy problems, with concepts like privacy, privacy rights, and data rights emerging alongside practical issues. Virtual networks in the big data era facilitate privacy data collection and processing; AI automated decision-making achieves this through data learning and intelligent generation, with user privacy recorded by platforms as data, constituting infringement risks. Big data-enabled price discrimination builds scenarios through content push and other methods, shifting implementation environments from ordinary media contexts to intelligent media scenarios, triggering security traps [57].

Algorithmic recommendations based on user information are the main manifestation of big data-enabled price discrimination. Recommendation algorithms' data collection relates to user privacy rights issues. Big data technology brings citizens' personal privacy crises, showing diversified and complex characteristics [58]. Users voluntarily transfer personal data to enjoy platform services, but privacy transfer against users' subjective will or illegal collection constitutes privacy infringement [59]. Privacy rights are considered important components of personality rights in China, with privacy in the *Civil Code* including private life and private information. In big data environments, personal privacy includes basic personal information, user behavior preferences, and device usage information. Big data-enabled price discrimination infringes on user privacy rights during data collection, processing, and usage, first through personal information access via terms of use and default consent, and second through excessive algorithmic decision-making. Although the *Cybersecurity Law* Chapter 4 and *General Principles of Civil Law* Article 111 propose legal norms for personal privacy, they still exhibit lagging characteristics.

4.3 Platform Research on Big Data-Enabled Price Discrimination In the digital economy environment, internet technology, big data information, platform enterprises, platform customers, platform rules, and platform supervision form an ecosystem. Imbalance in the platform economic ecosystem leads to differential pricing phenomena [60]. Platforms are the main venues for big data-enabled price discrimination, with market abuse, gaming behavior, and antitrust as main research contents.

4.3.1 Market Abuse Behavior in Big Data-Enabled Price Discrimination In economics, big data-enabled price discrimination is often associated with differential pricing. The former is an unequal strategy implemented by enterprises with information advantages, while the latter is a pricing strategy formulated according to consumer characteristics. They differ essentially in nature but share certain formal similarities, with big data-enabled price discrimination being a manifestation of market abuse. Based on economic perspectives, scholars explore the causes, manifestations, and solutions of market abuse behavior in this context.

(1) Causes of market abuse. Big data-enabled price discrimination can achieve first-degree price discrimination because merchants with market monopoly positions abuse their market dominance. Data monopoly is the fundamental reason platforms implement market monopoly and damage user rights [27]. Big data and algorithms are the technical conditions for platform price discrimination, and two-sided market attributes are necessary conditions for platforms to abuse markets [10]. Market abuse is the external manifestation of big data-enabled price discrimination, with its essence being the evolution of legal relationships among parties under platform economy [60]. The prototype of big data-enabled price discrimination is "precise marketing" or "differential pricing," its variant is price discrimination or price fraud, and its nature is

improper profit from trust [61].

(2) Manifestations of market abuse. Relevant market, market dominance position, and abuse behavior are main considerations for identifying market abuse. Under big data conditions, market abuse shows exclusivity and exploitative characteristics [62]. In traditional industries, market abuse implementers are operators with market advantage positions, with forms including restricting/competing, unfair transactions, predatory pricing, refusal to deal, restrictive dealing, tying, and differential treatment. However, under big data conditions, two-sided markets emerge, where economies of scale, user stickiness, precise profiling, compatibility, and standardized access restrictions strengthen operators' market dominance, creating conditions for implementing big data-enabled price discrimination. The absence of big data abuse behavior identification standards creates difficulties in identifying market abuse. Platform manifestations include: pricing based on user historical consumption habits, consumption frequency, and client usage, achieving differential pricing to varying degrees [11].

(3) Solutions for market abuse. Some scholars argue that big data-enabled price discrimination should be incorporated into corresponding legal systems, establishing and improving legal norm systems [13]. The *Consumer Rights Protection Law*, *E-Commerce Law*, *Antitrust Law*, *Tort Liability Law*, and *Price Law* all contain relevant norms. Song Yi and Liu Hui [64] propose using the *Consumer Rights Protection Law* to improve the *E-Commerce Law*, ensuring consumers' right to know and guaranteeing fairness and transparency to constrain market abuse. Chen Qinyao [65] argues that big data-enabled price discrimination infringes on personal information rights, fair transaction rights, right to know true information, and autonomous choice rights, and that existing laws cannot effectively solve the problem, though ex-ante prevention and ex-post responsibility supervision based on existing laws are effective paths. Cao Tianxiang [66] suggests using the "equally efficient competitor test" as a standard for identifying market abuse, supplementing big data discriminatory pricing into judicial interpretations of market abuse under China's *Antitrust Law*. In the big data context, platforms have dual identities in transactions, with supply-demand relationships being new intermediary relationships, while supply-demand parties have equal-rights dependency relationships [59]. Some scholars believe big data-enabled price discrimination belongs to price discrimination behavior that can be solved through market regulation measures. For example, Liang Zheng and Zeng Xiong argue that the fundamental solution lies in introducing competition mechanisms, enhancing user bargaining power, achieving data sharing among enterprises, and implementing more inclusive market supervision policies [10].

4.3.2 Gaming Behavior in Big Data-Enabled Price Discrimination

From game theory perspectives, scholars analyze gaming objects and evolutionary trends in big data-enabled price discrimination, establishing game models to study influencing factors.

Regarding gaming objects, researchers propose: information property rights

games [8] including demand information property rights and effective price information property rights, and information property rights games under two pricing models (online uniform pricing “big market” vs. online perfect price discrimination “micro market”); merchant-consumer profit maximization games [38] involving three-party interaction balance points among regulators, platforms, and users [10]; and citizen-capital games, i.e., digital technology abuse and data supremacists breaking rights-power boundaries [39].

In game model construction, researchers analyze dynamic game evolution between buyers and sellers based on simulation data to explore optimal solutions. Big data-enabled price discrimination is the result of dynamic evolutionary games between merchants and consumers. Yu Desheng and Li Xing [67] used Matlab for numerical simulation of game results, constructing merchant-consumer payoff matrices to demonstrate different equilibrium point evolution trajectories and study transaction evolution processes in digital platforms. Pan Ding and Xie Han [68] constructed evolutionary game models, identifying enterprise loss yield rates, regulatory expected costs, penalty intensity, and regulatory success rates as key factors affecting government regulatory strategies and enterprise big data-enabled price discrimination strategy choices. Yu Min [69] studied information asymmetry and gaming between merchants and customers in the digital economy based on Tmall shopping data, establishing e-commerce adverse selection risk avoidance models. Wu Bin et al. [70] proposed gaming evolution models for e-commerce platforms and government departments based on prospect theory and mental accounting theory, finding that consumer reporting behavior, raising cost reference points, lowering benefit reference points, increasing penalty intensity, and improving government department commission coefficients can effectively curb e-commerce platform big data-enabled price discrimination. Wei Xianrui [71] analyzed e-commerce enterprises’ strategic selection processes for big data-enabled price discrimination using the Hotelling model from an enterprise perspective.

4.3.3 Antitrust Regulation of Big Data-Enabled Price Discrimination

(1) Monopoly behavior identification. Big data-enabled price discrimination is a typical monopoly behavior of enterprises in the digital economy era, characterized by extremely efficient monopoly tools, strong concealment from consumers and government antitrust regulators, and highly combinable strategy applications [72]. Its typical manifestation is price discrimination, constituting monopoly behavior to some extent. The *Antitrust Law* aims to protect market competition, with Article 17(6) fixing “differential treatment in transaction prices and other conditions for transaction counterparts with identical conditions.” Identifying monopoly behavior requires analyzing the platform operator’s market dominance position and implemented differential treatment [73]. Big data-enabled price discrimination faces identification difficulties in big data-related market definition, implementers’ market dominance, big data price discrimination, reasonable defense, and institutional supply and supervision guidance [74]. From subject, behavior, and legal consequence perspectives,

it belongs to price discrimination categories regulated by the *Antitrust Law*. As operators rely on market dominance abuse to form initial monopoly, this data advantage may bring new data concentration in the second monopoly level, constituting multilateral monopoly behavior [75].

(2) Antitrust law application framework. In 2020, the Political Bureau of the CPC Central Committee first proposed “strengthening antitrust and preventing disorderly capital expansion,” requiring improved legal norms for platform enterprise monopoly identification, data collection and usage management, and consumer rights protection, resolutely opposing monopolistic and unfair competition behaviors to promote healthy platform economy development. In 2021, the *Anti-Monopoly Guidelines for the Platform Economy Sector* were issued, fully considering platform economy characteristics and incorporating multi-sided markets, online-offline integration, and network effects, covering numerous platform economy issues. The guidelines improve relevant legal attributes: if identified as differential treatment through market dominance abuse, it constitutes illegal behavior [76]. First, antitrust regulation paths: platform economy antitrust involves monopoly agreements, market dominance abuse, business concentration, and administrative power abuse excluding/limiting competition [77]. Big data algorithm usage has changed traditional market structures, with antitrust analysis of big data-enabled price discrimination gaining attention. Traditional antitrust law focuses on competition among operators, while big data era markets involve more transactions between operators and users. Zhou Wei points out that big data-enabled price discrimination is a typical manifestation of personalized pricing algorithms, and antitrust law protects market competition processes, so different types of personalized pricing algorithms should be evaluated differently regarding occurrence fields, judgment standards, and proof levels to seek reasonable frameworks in Chinese antitrust law [78]. Shan Maofeng notes that big data-enabled price discrimination takes consumer damage as its logical starting point, representing the symbiosis of market regulation and macro-control under humanistic concepts in economics, making market share paradigm the basic path for antitrust regulation [79]. Antitrust analysis frameworks such as data platform competition data nature and data property rights [80] and identification rules [81] have been discussed. Second, antitrust regulation laws and case analysis: the EU’ s *Digital Services Act* and *Digital Markets Act* contain relevant provisions for large digital platform monopoly behaviors. China’ s *E-Commerce Law*, *Antitrust Law (Revised Draft) (Exposure Draft)*, *Online Transaction Supervision and Management Measures (Exposure Draft)*, and *Anti-Monopoly Guidelines for the Platform Economy Sector (Exposure Draft)* have added norms for identifying digital platforms’ market dominance. Big data-enabled price discrimination is included in economics antitrust regulation scope, but antitrust responsibility pursuit is limited to single-track operator paths. Guo Jianglan [82] argues that preventing big data-enabled price discrimination requires establishing a dual-track accountability path of “operator responsibility + algorithmic technical responsibility.” Digital platforms are the main structure of platform economy, acting as gatekeepers, with data as their

factor structure and algorithms as their behavior structure. Digital platform competition is difficult to explain with existing price-centric monopoly theories, so Yang Dong and Zang Junheng [83] point out that antitrust supervision needs to be market-power-centered, constructing a ternary fusion analysis framework of data, platforms, and algorithms. Ye Ming and Guo Jianglan [84] believe that algorithmic price discrimination behaviors adopt differential, dynamic, or personalized pricing methods from a technologically neutral standpoint, blurring legal nature boundaries, so the *Antitrust Law* subject scope should be appropriately broadened to consider consumer interests more, establishing combined formal and substantive illegal review standards and implementing dual-track responsibility norms of operator responsibility and algorithmic technical responsibility.

5. Research Characteristics and Future Directions

Through bibliometric and thematic analysis, this article synthesizes domestic research on big data-enabled price discrimination, summarizing its characteristics as follows:

5.1 Research Characteristics 5.1.1 Humanistic Concern in Algorithmic Domain

In pursuing profit maximization, algorithm processors choose algorithms favorable to themselves, from data collection to user model construction, product push, and pricing. This big data-enabled price discrimination process is actually dominated by algorithms, representing typical algorithmic discrimination [82]. When algorithms form algorithmic collusion and big data monopoly during operation, damaging market mechanisms, they constitute preconditions for big data-enabled price discrimination. Algorithmic interpretation rights and algorithmic transparency have attracted attention, with algorithmic regulation becoming a main research topic. Internationally, big data-enabled price discrimination is more often called algorithmic consumer price discrimination. Researchers investigate foreign governance experiences focusing on regulations like the *General Data Protection Regulation* and *Algorithmic Accountability Act*, with algorithmic regulation, data security, and data rights becoming consensus, reflecting humanistic concern in the algorithmic domain.

5.1.2 Emphasis on User Rights Protection

From data collection and processing to post-hoc supervision, research on big data-enabled price discrimination addresses current social hot events and proposes numerous governance suggestions. Regarding data collection, researchers deeply interpret personal information protection and user privacy under the digital economy using existing laws like the *Personal Information Protection Law* and *Consumer Rights Protection Law*, seeking governance paths at the notification-consent or user authorization levels. Data processing research concentrates on big data algorithm topics to explore regulatory methods. Algorithmic recommendation, algorithmic rights, and user information are key topics.

Post-hoc supervision should combine digital economy and legal issues to promote in-depth research. At the micro level, algorithmic power, data rights, personal privacy, and information protection constitute main research content; at the macro level, regulatory agency algorithmic supervision and algorithmic ethics become common governance concepts.

5.1.3 In-Depth Examination of Market Behavior

Internet economy development has rapidly advanced algorithmic technology, digital economy, and data management technology. Big data analysis based on consumer personal characteristics has become a primary commercial marketing method. From online transactions to daily necessities, the digital economy has become an important development form. Big data-enabled price discrimination emerged with internet economy development. Chinese literature began with market behavior phenomena. Algorithmic technology is widely applied on the internet. While recommendation algorithms generating personalized push and sorting selections bring convenience to users, they also involve rights infringement and differential treatment. Personal privacy leakage, algorithmic inducement, and overconsumption have become criticized aspects of online consumption. With increasing online investigations and news reports, big data-enabled price discrimination has attracted more scholarly attention. The digital transaction platform it relies on is the main research object, generating economic issues like platform monopoly and market abuse, with gaming between data producers and users becoming a focus.

5.2 Future Directions

5.2.1 Strengthening Empirical Research

Big data-enabled price discrimination is a typical type of algorithmic discrimination. Notable cases attracting attention include Ctrip [53], Meituan food delivery [83], and Didi Chuxing [84]. However, research remains limited to theoretical speculation. Although some scholars use questionnaires, online surveys, and economic model construction to empirically study user loyalty and consumption willingness factors [85] and market order competition damage [86] in the context of big data-enabled price discrimination, actual case data and online survey data are insufficient, creating research dilemmas of similar theoretical elaboration paths and hindering deep analysis. Investigation of platform terms of use, user agreements, data processing rules, algorithmic recommendation technology, and user surveys are essential dimensions. Empirical data on information collection, disclosure, sharing, and algorithmic transparency based on user privacy are basic requirements for enhancing research effectiveness and crucial paths for implementing policies and applying theoretical research to practical frameworks. Regarding survey objects, content, and forms, high-consumption users, active users, and member users on network platforms should be key survey targets, covering consumption habits, user agreements, user stickiness, algorithmic cognition, legal awareness, and information protection. Systematic research from empirical perspectives like online surveys, questionnaires, in-depth interviews, event studies, and experimental methods can compensate for current research limitations.

5.2.2 Enhancing Interdisciplinary Collaboration

Examining big data-enabled price discrimination requires reflecting on data, platforms, and users, involving data collection and processing, algorithmic rules, platform trust mechanisms, and user data rights awareness [4]. The phenomenon encompasses technology, economy, and digital dimensions, with obvious technical and economic attributes in actual cases, posing requirements for interdisciplinary scholarship. Current literature shows multidisciplinary characteristics but insufficient integration across fields and relatively few interdisciplinary achievements. Given theoretical thinking and methodological differences, academic analysis requires comprehensive examination of algorithmic technology and digital economy, conducting interdisciplinary collaboration. Specifically, computer science theories like classification decision algorithms, clustering algorithms, decision tree classification models, and constructive methods and system analysis methods; economics theories like price theory, supply-demand theory, equilibrium analysis, and static analysis; and law theories like communication ethics, human rights theory, social survey methods, and comparative research methods are all available for interdisciplinary reference. Formally, collaborative institutional research can conduct joint studies on sub-themes or from macro perspectives, fully leveraging disciplinary advantages to explore interdisciplinary growth points. In content, research should combine previous disciplinary approaches to expand scope and achieve effective research result integration.

5.2.3 Emphasizing Technical-Level Research

Algorithmic automated decision-making causes information asymmetry and algorithmic black box problems [87]. Intelligent algorithms enhance enterprise platform competitive advantages through deep mining of big data to predict consumer potential needs, forming price discrimination against users and causing algorithmic collusion and bias [6]. Through recommendation algorithms, classification algorithms, and other technologies, platforms use personalized push, search filtering, and sorting selection to provide information to users, generating big data-enabled price discrimination phenomena based on algorithmic technology. Therefore, algorithms are the implementation foundation. Research should focus on algorithmic processing procedures, clarifying relationships between algorithmic technology and algorithmic discrimination, and promoting algorithmic regulation. Algorithmic transparency, personal data empowerment, and anti-algorithmic discrimination are three regulation methods, requiring targeted decision-making systems, scenario-object differentiation, and identity transcendence to guard against discrimination, bias, and injustice [88]. Algorithms are the main research topic and important solution path. Social science research on algorithmic ethics and algorithmic power clarifies general regulation paths from a humanistic level, while algorithmic technology research on collaborative filtering and clustering algorithms represents fundamental execution-level excavation to avoid the phenomenon.

5.2.4 Expanding Legal Domain Research

China's *E-Commerce Law* and *Price Law* regulate big data-enabled price discrimination. *E-Commerce Law* Article 18(1)'s "personal characteristics" include

device information, service records, subject identity, and behavioral preferences, with its applicable scenarios and identification standards viewed as “optimal solutions for regulating big data-enabled price discrimination” [9], and “natural search result provision obligations” considered measures to curb the phenomenon [89]. The *Antitrust Law* and *Price Law* also explicitly prohibit price discrimination. The *Opinions on Promoting the Standardized, Healthy, and Sustainable Development of the Platform Economy* severely crack down on platform enterprises’ illegal collection and use of personal information and market dominance abuse. Whether antitrust or consumer fair transaction, existing legal-economic frameworks position themselves after big data-enabled price discrimination occurs, focusing on regulating operators’ monopolistic behaviors. Laws like the *Personal Information Protection Law*, *Internet Information Service Algorithmic Recommendation Management Provisions*, *Data Security Law*, and *Cybersecurity Law* provide top-level design for internet information services, with both principle-level provisions and specific review and protection measures. As a digital economy product, big data-enabled price discrimination is an internet technology product. Laws and regulations should both supervise algorithmic technology and promote technological innovation. Regulating personal data utilization, establishing privacy protection systems, merging constitutional and civil law privacy-related regulations, and clarifying specific liability attribution for personal privacy in network environments are essential for privacy protection research.

References

- [1] China Digital Economy Development White Paper [EB/OL]. [2022-12-30]. http://www.caict.ac.cn/kxyj/qwfb/bps/202104/t20210423_{374626}.htm.
- [2] Li Zimeng. Illegal Analysis and Regulation of Big Data Price Discrimination [J]. *Journal of Jiaozuo University*, 2020, 34(4): 17-20.
- [3] Wang Hengrui. Protection of Consumers’ Fair Trading Rights under Big Data Price Discrimination [J]. *Big Data Era*, 2018(11): 20-24.
- [4] Li Feixiang. Ethical Reflection, Governance, and Enlightenment Behind “Big Data Price Discrimination” [J]. *Journal of Northeastern University (Social Science Edition)*, 2020, 22(1): 7-15.
- [5] Jin Youfang, Wang Kaili, Zhang Tinghan. Legal Regulation of “Big Data Price Discrimination” from the Perspective of *Personal Information Protection Law* [J]. *Journal of Zhejiang Sci-Tech University (Social Sciences Edition)*, 2021, 46(6): 693-701.
- [6] Shen Liangliang. Application and Legal Challenges of Algorithms in Market Competition—Starting from Big Data Price Discrimination [J]. *Journal of Taiyuan University (Social Science Edition)*, 2019, 20(3): 26-31.
- [7] Sun Shanwei. Legal Regulation of Price Fraud under Big Data Background—Taking Big Data “Price Discrimination” as Example [J]. *Northern Economy and Trade*, 2018(7): 51-52.
- [8] Wang Chan. How to Regulate “Big Data Price Discrimination”?—Analysis from New Institutional Economics and Game Theory Perspectives [J]. *Social*

- Science Abstracts, 2021(8): 2021, 8(1): 3-18.
- [9] Fu Lixia. Research on Illegality Determination of Big Data Price Discrimination Behavior: Issues, Controversies, and Responses [J]. Journal of Huazhong University of Science and Technology (Social Science Edition), 2020, 34(2): 95-104.
- [10] Liang Zheng, Zeng Xiong. Policy Responses to “Big Data Price Discrimination” : Behavior Qualification, Regulatory Dilemmas, and Governance Solutions [J]. Science Technology and Law (Chinese-English), 2021(2): 2021, 8(1): 3-18.
- [11] Zhu Chengcheng. Illegal Analysis and Legal Regulation of Big Data Price Discrimination—Analysis from Consumer Rights Protection Perspective [J]. South China Finance, 2020(4): 92-99.
- [12] Notice of National Development and Reform Commission on Interpretation of Relevant Provisions of *Prohibition of Price Fraud Behavior* [EB/OL]. [2022-12-30]. https://www.ndrc.gov.cn/xxgk/zcfb/tz/201506/t20150624_{{963374}}_{{ext}}.html.
- [13] Liu Jiaming. Qualification and Legal Regulation of Big Data “Price Discrimination” [J]. Journal of Hunan Agricultural University (Social Science Edition), 2020, 21(1): 56-61, 68.
- [14] Deng Zhichao. Legal Boundaries of Big Data from “Price Discrimination” [J]. Journal of Huaihua University, 2018, 37(8): 93-95.
- [15] Zou Kailiang, Peng Rongjie. Legal Qualification and Regulation of Big Data “Price Discrimination” –Two-Dimensional Perspective Based on “Algorithm” Regulation and Consumer Rights Protection [J]. Finance and Economy, 2020(7): 51-57.
- [16] Zhu Jianhai. Theoretical Justification and Path Optimization for Antitrust Regulation of “Big Data Price Discrimination” [J]. Journal of Northwest Minzu University (Philosophy and Social Science Edition), 2021(5): 112-121.
- [17] Liao Jiankai. Dilemmas and Solutions for Legal Regulation of “Big Data Price Discrimination” –From Consumer Rights Protection to Operator Algorithmic Power Governance [J]. Journal of Southwest University of Political Science and Law, 2020, 22(1): 70-82.
- [18] Kuang Wenbo. Logical Path, Ethical Issues, and Regulatory Strategies of Intelligent Algorithmic Recommendation Technology [J]. Journal of Shenzhen University (Humanities & Social Sciences Edition), 2021, 38(1): 144-151.
- [19] Wang Yuxing, Yuan Bo. From Big Data Price Discrimination to Privacy Leakage: Ethical Analysis and Reflection on Privacy Issues from Software and Hardware Perspectives [J]. Science • Economy • Society, 2021, 39(3): 72-81.
- [20] Hu Mengmeng. Analysis of Social Ethical Anomie in Precision Marketing Behind “Big Data Price Discrimination” [J]. Journal of Beijing Institute of Economics and Management, 2019, 34(1): 23-27, 46.
- [21] Hu Jian. Algorithmic Governance and Its Ethics [J]. Administrative Tribune, 2021, 28(4): 2021, 8(1): 3-18.
- [22] Li Dan. Algorithmic Discrimination Against Consumers: Behavioral Mechanisms, Profit and Loss Definition, and Collaborative Regulation [J]. Journal of Shanghai University of Finance and Economics, 2021, 23(2): 17-33.
- [23] Cui Jingzi. Crisis and Response of Equal Rights Protection Under Algo-

- rithmic Discrimination Challenges [J]. *Science of Law (Journal of Northwest University of Political Science and Law)*, 2019, 37(3): 29-42.
- [24] Peng Lan. “Prisoner” Risks in Algorithmic Society [J]. *Global Media Journal*, 2019, 6(1): 3-18.
- [25] Diao Shengfu, Yao Zhiying. Value Load and Responsibility Ethics Construction of Big Data Technology—Starting from Big Data “Price Discrimination” [J]. *Journal of Shandong University of Science and Technology (Social Science Edition)*, 2019, 21(5): 8-13, 51.
- [26] Zhao Yiding, Chen Liang. Alienation and Legal Regulation of Algorithmic Power [J]. *Yunnan Social Science*, 2021(5): 123-132.
- [27] Lu Fangwei. Research on Regulation of Big Data “Price Discrimination” in B2C E-commerce Platforms [D]. Xiangtan: Xiangtan University, 2020.
- [28] Guo Zhe. Reflecting on Algorithmic Power [J]. *Law Review*, 2020, 38(6): 33-41.
- [29] Li Muhan. Perfection of Legal Governance of Algorithmic Abuse in Digital Era [J]. *Yunnan Social Science*, 2021(3): 134-140.
- [30] Yang Suihao. Research on Legal Issues of Big Data “Price Discrimination” [J]. *Modern Business*, 2020(27): 42-44.
- [31] Xing Junbin. Research on Civil Law Protection of Personal Information [D]. Taiyuan: Shanxi University, 2019.
- [32] Tang Hanyu, Hou Debin. Discussion on Civil Law Protection of Personal Information from Big Data Price Discrimination [J]. *Modern Business Trade Industry*, 2021, 42(25): 127-129.
- [33] Huang Jianguo, Sun Weijie. *Algorithmic Regulations Target “Big Data Price Discrimination”* [N]. *Jiangsu Economic Daily*, 2022-01-10(A01).
- [34] Yu Junjie. Regulating Algorithmic Recommendation Activities, Clarifying Users’ Right to Know and Choose [N]. *Xinhua Daily Telegraph*, 2022-01-05(4).
- [35] Zhang Linghan. Platform Algorithmic Accountability System and Its Improvement in *Personal Information Protection Law (Draft)* [J]. *Review of Economic and Trade Law*, 2021(1): 36-46.
- [36] Cao Yanghua. Illegality Determination of Algorithmic Personalized Pricing—Analysis Based on *Personal Information Protection Law* [J]. *Economic Research Guide*, 2021(34): 2021, 8(1): 3-18.
- [37] Zhang Yijing. Research on Government Regulation of Personalized Pricing—Based on Algorithmic Analysis Perspective [J]. *Internet Information Law Research*, 2020(2): 228-245, 2021, 8(1): 3-18.
- [38] Song Meisong. Research on Legal Regulation of Big Data “Price Discrimination” Driven by Algorithms [D]. Changchun: Jilin University, 2021.
- [39] Xu Mingyue, Chen Xiaowei. Legal Regulation of “Big Data Price Discrimination” —From Consumer Rights Protection Perspective [J]. *Journal of Southwest Petroleum University (Social Science Edition)*, 2021, 23(6): 72-80.
- [40] Xing Genghang, Lu Fang, Zhou Zhongbao, et al. Can Data Portability Rights Govern “Big Data Price Discrimination” ? [J/]. *Chinese Journal of Management Science*, 2022, 30(3): 85-95.
- [41] Zheng Fei, Li Siyan. Rights Evolution and Convergence in Big Data Era: From Privacy Rights, Personal Information Rights to Personal Data Rights

- [J]. Journal of Shanghai University of Political Science and Law (Rule of Law Review), 2021, 36(5): 137-149.
- [42] Ye Jiamin. Three-Dimensional Construction of Enterprise Data Rights from Algorithmic Risk Prevention Perspective [J]. Journal of Jiangxi University of Finance and Economics, 2021(1): 139-148.
- [43] Zhang Haiyue. Research on Legal Regulation of “Big Data Price Discrimination” [D]. Lanzhou: Lanzhou University, 2020.
- [44] Wu Lilan. Legal Regulation of Big Data Price Discrimination Under Platform Economy [C]// Shi Weidong. Shanghai Law Research: Digital Economy Legal Collection. Shanghai: Shanghai Law Society, 2020: 137-143.
- [45] Du Jialu. Utilization and Protection of User Profiling—Against the Background of Personal Information Protection Law (Draft) [C]// Shanghai Law Research Collection (2020 Vol. 15, No. 39)—Digital Economy Legal Collection. Shanghai: Shanghai Law Society, 2020: 137-143.
- [46] Yang Hong. Governance of “Big Data Price Discrimination” Requires Law, Technology, Industry Self-Regulation, and Third-Party Supervision [N]. China Economic Herald, 2021-09-08(2).
- [47] Dong Jingya. Legal Thinking on Big Data “Price Discrimination” Based on Consumer Rights [J]. Journal of Wuhan Metallurgical Management Cadre Institute, 2021, 31(3): 23-25.
- [48] Gao Lingzhe. Discussion on Information Property Rights from Big Data “Price Discrimination” [J]. China New Communications, 2018, 20(14): 53-54.
- [49] Yang Jie. *Personal Information Protection Law Officially Enacted—Taking a Legislation Path with Chinese Characteristics* [J]. China Telecom Industry, 2021(9): 47-51.
- [50] Qin Zengqi. Reflection on Notification-Consent Rules in Personal Information Protection [D]. Lanzhou: Northwest Normal University, 2020.
- [51] Mao Chunchun. Discussion on Regulatory Path of “Big Data Price Discrimination” [J]. China Market Supervision Research, 2021(7): 49-53.
- [52] Zou Kailiang, Liu Jiaming. Legal Regulation Dilemmas and Solutions for Big Data “Price Discrimination” —Considering Only from *Consumer Rights Protection Law* Perspective [J]. Price Theory and Practice, 2018(8): 47-50.
- [53] Liu Qi. Legal Regulation of E-commerce Platform Operators’ “Big Data Price Discrimination” Behavior [D]. Wuhan: Zhongnan University of Economics and Law, 2019.
- [54] Shang Yumeng. Research on Legal Regulation Path of “Big Data Price Discrimination” Under Algorithmic Tools [D]. Xi’ an: Chang’ an University, 2021.
- [55] Wang Weibo. Incentives, Dilemmas, and Governance of Big Data Price Discrimination [J]. China Price, 2021(7): 57-61.
- [56] Duan Weiwu, Ji Changlin. Privacy Rights in Network and Big Data Era [J]. Science and Society, 2014, 4(2): 90-100.
- [57] Jiang Shuting, Song Zhaokuan. Big Data “Price Discrimination” Traps and Response Strategies in Intelligent Media Era [J]. China Broadcasting, 2021(4): 44-48.
- [58] Jiang Pengxiang. Ethical Reflection on Personal Privacy Crisis in Big Data

- Era [D]. Nanjing: Nanjing Forestry University, 2017.
- [59] Yan Daocheng, Liu Jialin. Analysis of Moral Issues and Value Risks Brought by Big Data “Price Discrimination” and Their Regulation [J]. Yumeng Journal, 2021, 42(2): 90-99.
- [60] Zhu Changgen, Chen Yeqi. Research on Regulating E-commerce Platform Differential Pricing Behavior Under Big Data Background [J]. Price Monthly, 2021(12): 89-94.
- [61] Si Yingqi. Legal Regulation of Big Data “Price Discrimination” from Consumer Protection Perspective [J]. Journal of Liupanshui Normal College, 2020, 32(2): 71-77.
- [62] Wang Xin, Li Xiufang. Generation Logic and Governance Path of Big Data Price Discrimination—Also Discussing Interpersonal Distrust in “New Acquaintance Society” [J]. Journal of Yanshan University (Philosophy and Social Science Edition), 2020, 21(2): 57-63.
- [63] Xiang Jie. Research on Regulating Abuse of Market Dominance by Big Data Platforms [D]. Beijing: China University of Political Science and Law, 2020.
- [64] Song Yi, Liu Hui. Research on Legal Regulation of E-commerce Platform Operators’ Big Data Price Discrimination Behavior [J]. Enterprise Reform and Management, 2021(11): 60-61.
- [65] Chen Qinyao. Research on Legal Regulation of Big Data “Price Discrimination” [J]. Journal of Anhui Administration Institute, 2021(1): 86-92.
- [66] Cao Tianxiang. Legal Regulation of Abuse of Market Dominance Behavior Under Big Data Background [D]. Harbin: Heilongjiang University, 2020.
- [67] Yu Desheng, Li Xing. Dynamic Evolutionary Game Research on Consumers and Merchants’ Big Data “Price Discrimination” [J]. Price Theory and Practice, 2019(11): 129-132.
- [68] Pan Ding, Xie Han. Evolutionary Game of Government Supervision and E-commerce Enterprises’ “Price Discrimination” Behavior in Digital Economy [J]. Economy and Management, 2021, 35(1): 77-84.
- [69] Yu Min. Can “Big Data Price Discrimination” Be Avoided?—E-commerce Adverse Selection Risk Avoidance [J]. Price Theory and Practice, 2019(4): 141-144.
- [70] Wu Bin, Cheng Jing, Song Yan. Evolutionary Game Analysis of E-commerce Platform “Price Discrimination” Phenomenon from Mental Accounting Perspective [J]. Operations Research and Management Science, 2020, 29(11): 37-44.
- [71] Wei Xianrui. Strategic Selection of E-commerce Enterprises on Big Data Price Discrimination [D]. Dalian: Dongbei University of Finance and Economics, 2018.
- [72] Wang Shiqiang. Antitrust in Digital Economy: Enterprise Behavior and Government Supervision [J]. Economist, 2021(4): 91-101.
- [73] Wang Xianlin. Legal Thinking on Monopoly and Antitrust Issues in Platform Economy Sector [J]. Journal of Zhejiang Gongshang University, 2021(4): 34-45.
- [74] Li Ye. Research on Antitrust Regulation of Price Discrimination Behavior

Under Big Data Background [D]. Zhengzhou: Henan University of Economics and Law, 2020.

[75] Li Fengtuan, He Yingjie, Guo Dongyang. Formation Mechanism and Antitrust Regulation of Monopoly in Big Data Field [J]. Chinese Certified Public Accountant, 2021(8): 43-49, 3.

[76] Zhang Aijun, Wang Fang. Political Security Risks of “Big Data Price Discrimination” [J]. Future Communication, 2021, 28(2): 46-51, 124-125.

[77] Du Chuang. Platform Economy Antitrust: Theoretical Framework and Problem Analysis [J]. Financial Review, 2021, 13(4): 12-22, 123-124.

[78] Zhou Wei. Antitrust Regulation of Personalized Pricing Algorithms in AI Era [J]. Wuhan University Journal (Philosophy & Social Science Edition), 2021, 74(1): 108-118.

[79] Shan Maofeng. Research on Antitrust Regulation of Algorithmic Price Discrimination [D]. Beijing: Beijing Jiaotong University, 2020.

[80] Fei Fangyu, Yan Zixin, Chen Yongwei, et al. Data Nature, Property Rights, and Competition in Digital Economy Era [J]. Research on Financial and Economic Issues, 2018(2): 3-21.

[81] Yin Jiguo. Legal Regulation of Big Data Operators’ Abuse of Market Dominance [J]. Studies in Law and Business, 2020, 37(4): 73-87.

[82] Guo Jianglan. Perfection of Antitrust Liability for “Big Data Price Discrimination” Behavior [J]. Commercial Research, 2021(4): 132-136.

[83] Yang Dong, Zang Junheng. Antitrust Regulation of Digital Platforms [J]. Wuhan University Journal (Philosophy & Social Science Edition), 2021, 74(2): 160-171.

[84] Ye Ming, Guo Jianglan. Legal Regulation of Algorithmic Price Discrimination Behavior in Digital Economy Era [J]. Price Monthly, 2020(3): 33-40.

[85] Han Yong. Causes and Governance Paths of Algorithmic Discrimination [J]. Youth Journalist, 2021(8): 94-95.

[86] Yuan Fan, Wang Dongju. Research on Meituan Food Delivery Big Data “Price Discrimination” Behavior and Improvement Strategies [J]. China Storage & Transport, 2021(12): 160-161.

[87] Mao Ziyi, Bai Yu. Analysis of Disadvantages of Current Enterprise Information Decision Models—Taking Didi and Meituan “Price Discrimination” as Examples [J]. Management and Administration, 2019(11): 43-46.

[88] Zheng Zhihang, Xu Zhaoxi. Legal Regulation and Judicial Review of Algorithmic Discrimination in Big Data Era—Taking US Legal Practice as Example [J]. Journal of Comparative Law, 2019(4): 111-122.

[89] Ding Xiaodong. On Legal Regulation of Algorithms [J]. Social Sciences in China, 2020(12): 138-159, 203.

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