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RESEARCH PAPER

An Analysis of the Abuse of Dominance using Artificial Intelligence (AI) enabled Price Discrimination from a Law and Economics Perspective

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ABSTRACT

This research examines AI-driven price discrimination in digital marketplaces, comparing it to competition law. While AI can enhance efficiency and customer welfare, it can also lead to exclusion and exploitative consequences. The EU and China have implemented competition laws and regulations to address unfair price discrimination, demonstrating that a legal reaction based on competition laws is not always necessary. Competition authorities must balance various factors to effectively address AI-driven price discrimination in digital markets. It evaluates the potential for abuse of dominance and the negative impact on competition and consumers. The research uses legal research methodology to examine price discrimination laws and their evolution, comparing them with traditional forms of dominance. It also examines the economic arguments of market efficiency and fairness, consumer detriment, and regulatory action. The paper recommends increased regulation of AI pricing and improved consumer protection measures to prevent unfair market conditions.

KEYWORDS Abuse of Dominant Position, Artificial Intelligence, Competition Law, Digital Markets, Price Discrimination

Introduction

The rise of Artificial Intelligence (AI) has significantly impacted digital markets, giving businesses an edge over consumers using Big Data and algorithms. This has led to the development of differential pricing strategies, where identical goods or services are offered at varying costs simultaneously. This is known as "AI-enabled price discrimination." This approach allows companies to provide personalized recommendations and customized prices to customers with higher accuracy. However, this approach has been widely used in business-to-consumer and business-to-business interactions, including marketplaces for aero plane tickets, e-commerce, and travel services. The potential for AI-enabled price discrimination by dominant corporations is a subject of concern. The existing competition law in Pakistan may not adequately address AI-driven price discrimination, and there is a lack of research on its consequences. This study aims to address these disparities by examining the potential for AI-driven price discrimination, assessing the effectiveness of existing competition legislation, evaluating the economic consequences of AI-driven pricing differentiation, proposing modifications to the legislation, and creating guidelines for policymakers and regulatory authorities. (Wu et al,2024)

Price discrimination occurs when products are sold at varying prices, even when the cost conditions for producing these products are the same. Economists generally support the practice of charging different prices to different consumers for the same product if the variation in price is justified by differences in costs, such as varying distribution expenses. However, competition rules occasionally prohibit price

discrimination, regardless of whether the ratio of price to marginal cost can be justified based on costs. Therefore, the use of AI in pricing discrimination raises concerns about its potential for anti-competitive behaviour and the need for regulatory intervention in the form of competition law. AI (Artificial Intelligence) has revolutionized the way businesses operate, enabling them to set prices that align with consumers' preferences and anticipate potential market responses. This approach is often compared to perfect competition, where companies have a certain level of market power, can prevent arbitrage, and can estimate consumer valuations. However, the use of AI in digital marketplaces has led to a shift from dynamic pricing, which involves altering prices based on real-time fluctuations without discrimination towards consumers. (Chioveanu, I.2024).

Price discrimination is not universally seen as inequitable, but it can be justified from an economic perspective due to its potential to enhance static efficiency and contribute to customer welfare. Personalized pricing, for instance, has more significant impacts than standard forms of price discrimination, as it can enhance static efficiency and incentivize innovation. However, the impact on consumer welfare remains uncertain. In digital markets, enterprises can use advanced analytical techniques to model and anticipate customers' willingness to pay, allowing them to collect information about their attributes and buying behaviour. This allows AI to approach first-degree price discrimination, where a monopolistic entity has complete knowledge of individual consumer willingness to pay. This approach can motivate businesses to lower prices for consumers with lower willingness to pay, particularly those with limited access to goods or services. This approach also maintains the profitability of consumers with higher willingness to pay. (Erdmann, et, al,2024)

The benefits of first-degree price discrimination are contingent upon the selected welfare standard. Armstrong's findings suggest that the advantages associated with first-degree price discrimination are contingent upon the selected welfare standard, which may not necessarily lead to a corresponding gain in consumer welfare. Therefore, the application of first-degree price discrimination in digital marketplaces can yield favourable outcomes, specifically when it leads to an increase in output and when total welfare is considered as the criterion for evaluating welfare. Moreover, AI has revolutionized the way businesses operate, allowing them to set prices that align with consumer preferences and anticipate market fluctuations. However, the impact on consumer welfare remains uncertain, and further research is needed to fully understand the multifaceted economic impacts of AI-enabled price discrimination. Empirical economic literature suggests that traditional pricing discrimination can enhance societal welfare across various industries, particularly when it leads to an increase in output. However, there is a scarcity of empirical economic literature that examines the impacts of AI (Artificial Intelligence) enabled price discrimination within digital markets. According to economic theory, the use of some strategies can enhance static efficiency in markets, surpassing the effectiveness of conventional price discrimination. This has the potential to optimize the quantity of goods or services exchanged. (Colombo, 2024)

AI-facilitated pricing discrimination is anticipated to have implications for the distribution of social welfare among various stakeholders, potentially resulting in a detriment to certain persons. For example, it has the potential to impact the allocation of excess between consumers and producers. By determining the greatest willingness to pay of each consumer, the producer could usurp the excess of the consumers, resulting in a negative impact on their overall welfare. The total impact of price discrimination facilitated by AI on consumer surplus is uncertain, and its effects are expected to differ across various markets. In the context of a monopoly, the use of AI (Artificial Intelligence) enabled price discrimination has the potential to enhance the accessibility

of products for consumers with lower incomes or reservation costs. This might lead to a more equitable distribution of benefits, benefiting both the consumers and the monopolistic entities. In this scenario, the utilization of AI to implement price discrimination has the potential to mitigate the inefficiency caused by a monopolistic market structure that employs a uniform pricing strategy. This approach could also enhance the allocation of welfare among both consumers and producers. (Assad et al, 2024)

However, the use of AI in implementing price discrimination has the potential to provide advantages to consumers inside oligopolistic markets by increasing competition, resulting in an increase in consumer surplus while reducing business profits. In this scenario, businesses can strategically target their competitors' customer bases and new customer categories while preserving higher profit margins from their existing customer base. However, due to the similar strategic motivations to capitalize on price differentiation, the sector encounters a predicament close to the prisoner's dilemma, resulting in heightened rivalry compared to a scenario involving homogeneous prices. The implementation of AI-enabled price discrimination has the potential to impact dynamic efficiency, which is achieved through the creation, advancement, and dissemination of novel products and production methods. Dynamic efficiency is crucial for technical growth within industries, as it conserves resources in the production of established items and creates new ones. The impact of AI-enabled price discrimination on dynamic efficiency can be both positive and negative. (sun et al, 2024)

On a positive note, AI-enabled price discrimination can incentivize businesses to innovate and establish unique market positions. This can be achieved by enhancing production levels while maintaining sales. However, it is important to note that price discrimination can also have negative consequences, such as incentivizing rent-seeking behaviours that may diminish overall social welfare. The use of AI-enabled price discrimination by enterprises can enhance production and financial gains, but it also allows them to engage in economic activities that further solidify their existing position and yield more profits. This can lead to the industry's dynamic efficiency being enhanced. (Wu, 2024)

However, the benefits derived by customers from AI-enabled price discrimination are not always guaranteed. It is possible that this could result in rent-seeking behaviour, where individuals or entities seek protection from government intervention to gain an unfair advantage in the market and stifle competition. In heavily regulated sectors, the impact of AI-enabled price discrimination depends on the level of market dominance held by businesses. In conclusion, the use of AI-enabled price discrimination in digital marketplaces may not necessarily be unfavourable, as it has the potential to enhance static efficiency, facilitate dynamic efficiency, and sometimes improve customer welfare.

Literature Review

The relationship between antitrust law and artificial intelligence (AI) has more recently become the focus of much attention in legal and economic literature. Given that AI is becoming integrated in industries, applying price discrimination has been viewed as a sign of some players dominating a specific market exploiting their dominance. Drawing on these two areas of scholarship, this literature review explores and critiques the main ideas, theories, and legal issues connected with AI and PD, primarily from the legal and economic viewpoints. The review is structured into three key sections: First, it

is necessary to outline the traditional and legal understanding of the concept of 'price discrimination' and the second, the use of Artificial Intelligence in modern pricing strategies, and finally, the third, discuss the effects of AI based 'price discrimination' on the market structure, consumers, and the law.

Preliminary Data and Information on Price Discrimination The idea of price discrimination has been of significant interest for legal and economic regulations for many years. Traditionally, it defined a situation in which different consumers buy the same product at different prices depending on factors such as their willingness to pay or where they are from. Scholarly work by Stigler (1968) and Pigou (1920) laid the foundation for understanding the different types of price discrimination: First degree is known as individualized pricing, second degree as quantified pricing and the third degree as grouped pricing. Possible legal issues with price discrimination may be arising from the notion that it gives detrimental consequences to competition and the welfare of consumers, captured in writing by Robinson (1933) under The Economics of Price Discrimination and further discussed by Elhauge (1996) under Antitrust Law and Economics of Price Discrimination. A good deal of attention has therefore been given to the implementation of price discrimination measures specifically to competition law.

The Robinson Patman Act of the United States was a legal reform made in 1936 with the chief intention of checking on the unfair discrimination of price within firms that enjoyed an acceptable market power. AEU competition law is also similar to that of EU competition law, in that it addresses Article 102 of the Treaty on the Functioning of the European Union (TFEU) on the abuse of dominance, of which discriminatory pricing is part of. Authors like Whish & Bailey in their book on Competition Law (2018) and Jones & Sufrin in their book on EU Competition Law (2016) have elaborately described as to how these legal principles have developed and in liberalized world have been implemented. AI and Different Forms of Modern Pricing Strategy The flexibility that AI brings for pricing strategies is in its capacity to gather and analyze large swathes of data on the consumption habits of consumers across a range of markets. One of the benefits is that the price can be set and changed dynamically in real-time and can contain individual prices based on consumer behavior, consumer preferences, or previous purchases. Zuboff's The Age of Surveillance Capitalism (2019) and Agrawal, Gans, & Goldfarb's Prediction Machines (2018) have discussed the expansive function of AI in driving emerging organizational practices, including the pricing construct. The extent that AI can achieve first-degree price discrimination is simply unbeaten because firms in this setup can price discriminate with aggressive precision based on consumer data. Some studies show that the use of AI to implement price discrimination has some benefits while others argue that AI has negative implications. On the one hand, he noted that process can increase efficiency since it would better mirror the consumers' willingness to pay.

Figure 1: Diagram of Literature Review

However, it propagated proper concerns regarding consumer detriment and fairness within the market. Papers such as Pricing Algorithms and Antitrust (Ayelet Ganzach & Markus Stucke, 2016) and The New Antitrust Paradigm (F. Scott Morton, 2019) consider the economic effects of these algorithms, although proposing that they can foster collusion, exclusion, and dominance. Furthermore, AI enables firms to capitalize on information failures, which has implications for opacity and unclear responsibility in formulating prices (Gal & Elkin-Koren, 2017).

Effect of price discrimination through artificial intelligence on market competitiveness and consumer surplus In regard to law and economics, AI enabled price discrimination has the following difficulties. A vast literature exists with respect to the detrimental effect on consumers and competition when the practice of 'third degree' price discrimination is carried to extremes. The two main platforms that are now being considered to evaluate the influence of AI on the two karyokinetic, are the economic theories of Monopoly power which was discussed by George Bork in 'The Antitrust Paradox' published in 1978 and the economic theory of Market efficiency. AI's potential to advance market power through aggressive and discrimination tariffs would undermine consumers, monopolize markets, and erect barriers toward entrants and innovations, as explained by Khan (2017) in his article Competition in Digital Markets. Scholars in the field of economics are not clear on whether efficiency gains accrue from the use of AI to engage in price discrimination or whether the practice hinders competition. On the one hand, texts such as the Varian's Intermediate Microeconomics (2014) predict that PD positively affects resource allocation and firm profits. Critics on the other hand warn that AI can deepen market imparity by overcharging vulnerable consumers, as released in AI for Good? (Sartor, 2020).

In addition, the application of AI for the economic analysis of antitrust and dominance abuse is still unfolding, and Posner (2019), and Coyle (2020) argue that current antitrust instruments are insufficient to capture the opaque nature of AI. Legal Measures and Regulatory Issues AI-enabled price discrimination raises issues that the existing legal system of banning abuse of dominance seeks to address. As noted separately by Newman (2019) and Hovenkamp (2020), the current antitrust laws appear insufficient to regulate the AI markets which are faster and complex in their interactions. Firstly, proving intentional abuse of dominance pursuant to Article 102 TFEU or Section 2 of the Sherman Act has become challenging but even more challenging when the agent is an AI-based system with opacity. Some recent works have raised the question about the regulation to deal with the problems resulting from applications of AI infused price discrimination. Regulation in the Digital Economy: Trends, Issues and Potential Reforms as proposed by Ohlhausen and Berman in their article written in 2021 contain propositions such as enhanced risk assesment of AI based pricing algorithms, mandatory disclosure obligations and the elaboration of standards for algorithmic reviews. Moreover, in the book Digital Platforms and Antitrust Law by Nicolas Petit published in 2020, new directions in the legal thinking are offered concerning AI, for instance, the reversal of the burden of proof on the dominant firms employing AI for pricing techniques, and consumer protection measures.

The literature shows that there is general agreement that AI use for price discrimination has major legal and economic implications. The possibility of utilizing AI as a means of abuse of dominance raises several legal and academic challenges that have to be addressed at both a legal and regulatory level. Kunz (2019) reports that while Gal (2020) and Stucke (2018) note the benefits of AI uses in pricing, possible negative impact on competition and consumer benefits should not be ignored. All in all, a constant appeal for the role of regulation and for enforcement measures with regards to

the peculiarities of AI based PD was identified. Some of the authors have pointed out the need to develop a more active antitrust law that considers the ever-emerging new forms of market power in light of the advancing technologies in the use of AI. This paper argues that the further development of competition law in this context is critical when considering the potentially beneficial role of AI in improving efficiency within the marketplace, without the risk of contributing to concerns of industry consolidation or negative impacts on consumers. This literature review provides the context for subsequent research that is needed to explore the legal and economic instruments that can be employed to effectively address AI-based price discrimination adequately. (Dötsch,2024). The paper's literature findings also stress the necessity of more future research to analyze the empirical evidence of the AI pricing strategies, with the effectiveness of the regulations that have been set impacting the market.

AI (Artificial Intelligence) has the potential to enable price discrimination, which can lead to undesirable outcomes for dominant market participants. This issue is of concern to competition authorities, as it could limit competition and cause harm to consumers by creating exploitative consequences and exclusionary effects. In countries like China and the European Union, competition law may be applicable to address this issue. Price discrimination is a common characteristic observed in many exclusionary tactics employed by businesses to establish or safeguard their market dominance through the exclusion of competitors. These practices can include predatory pricing, bundled discounts, and margin squeeze, with the intention of excluding rivals from the market. Exclusionary price discrimination can impede free competition and negatively impact consumer welfare. Competition authorities in various jurisdictions pay special attention to this issue, and it is crucial to examine such instances to differentiate between situations where the entity involved has a vested interest and the capability to prevent competitors, and situations when the same behaviour yields operational advantages. (Hacker, 2024)

Predatory pricing strategies can have two phases: the sacrifice phase, where a company intentionally sets prices below the competitive equilibrium level to eliminate a competitor or discourage new entrants from entering the market, and the recoupment phase, where the incumbent company takes advantage of its enhanced market power to raise its prices. Price discrimination can be used to compensate for any profits lost during the predatory phase. Fidelity rebates are another type of price discrimination, where sellers offer discounts to buyers as an incentive to make a purchase. The Court of Justice of the European Union (CJEU) has softened its attitude on fidelity rebates, and the Commission must consider economic information submitted by a defendant to justify the use of loyalty rebates.

Vertically integrated companies can engage in anti-competitive behaviour known as margin squeeze, which makes it difficult for a competing firm to operate profitably. They can choose a non-discriminatory approach to wholesale pricing or set very high wholesale rates, cutting into the margins of both their downstream business and rivals. Pricing discrimination between subsidiaries and rivals can also be used to keep rivals out of the downstream market and protect their leadership position.(Eliza,2024)

Price discrimination can be exploitative and detrimental to consumers when it incurs significant costs, diminishes consumer surplus in the immediate term, and lacks compensatory benefits. To address this issue, competition authorities must evaluate the market's capacity to address the issue. Graef argues that by implementing measures to address exclusionary abuses and maintain market competitiveness, the potential for a

dominant entity to exploit customers is reduced. Competition Commissioner Vestager suggests that safeguarding consumers can often be achieved by preventing dominant corporations from eliminating their competitors from the market.

If persistent exploitative behaviour is uncorrected by market forces, it may indicate a market dysfunction. A market study is necessary to identify the underlying causes for inefficient performance and determine the significance of these issues. Competition authorities should consider the involvement of competition authorities as a means of intervention. Botta and Wiedemann discuss the benefits of competition law enforcement, such as the imposition of transparency standards and the provision of opt-out rights. Economic analysis within competition law enables the assessment of both the favourable and unfavourable impacts on competition and consumers, as well as the evaluation of the societal effectiveness of competition remedies. (Ezrichi,2024)

In the digital era, machine learning and AI-based price discrimination have increased the potential risks associated with consumer manipulation. Competition authorities should exercise caution in addressing the issue of exploitative consequences arising from the implementation of AI-based price discrimination. AI-enabled pricing discrimination has the potential to enhance dynamic efficiency and lead to increased profits for dominant firms through innovation. However, the benefits derived from price discrimination may not always be equitably distributed across consumers.

Various ideological perspectives in the field of law and economics have shaped US antitrust policies and European competition law. An examination of these influential factors in the progression of US antitrust can help assess the advancement of legislation and regulations pertaining to dominating businesses.

The Sherman Act Section 2 has been analyzed in various ways, with the focus on the structural and conduct components. The Harvard 'structural' School of Industrial Organization thought was established to align the application of Section 2 with industry and markets in general. This approach introduced the S-C-P paradigm, which posits a causal connection between market structure, company conduct, and performance. This method emphasizes the process rather than the outcome and differs from the output approach, which measures harm to competition by considering productive and allocated efficiency. (Stucke,2024)

The Harvard structural school rejected the notion of a singular objective of economic efficiency for antitrust, instead recognizing various aims such as equitable distribution of resources, economic stability, decentralization of economic power, optimal allocation of factors of production, and consumer sovereignty. Its objective was not to safeguard economic efficiency but to curtail the expansion of major corporations. The Chicago School argued that the fundamental principles of firms were rationality and the pursuit of maximum profit.

In the 1970s, the US Supreme Court adopted certain principles of the Chicago School perspective, such as the principle of reason in Continental TV and the rule of reason in tie agreements. However, the theory has evolved due to the recognition that knowledge can be unevenly distributed, transaction costs are present, consumer behaviour can vary over time, and counterfactual scenarios may be imperfect.

Both the Chicago and Post-Chicago Schools agree that the fundamental nature of antitrust law is around economics. Both schools dismissed the significance of subjective questions and held contrasting views regarding market failures. The Chicago

School believed that markets naturally gravitate towards efficiency, viewing market flaws as transitory and advocating for cautious intervention. The post-Chicago School believed that market failures do not inherently repair themselves, allowing firms to exploit defects and generate inefficient outcomes even within competitive marketplaces.

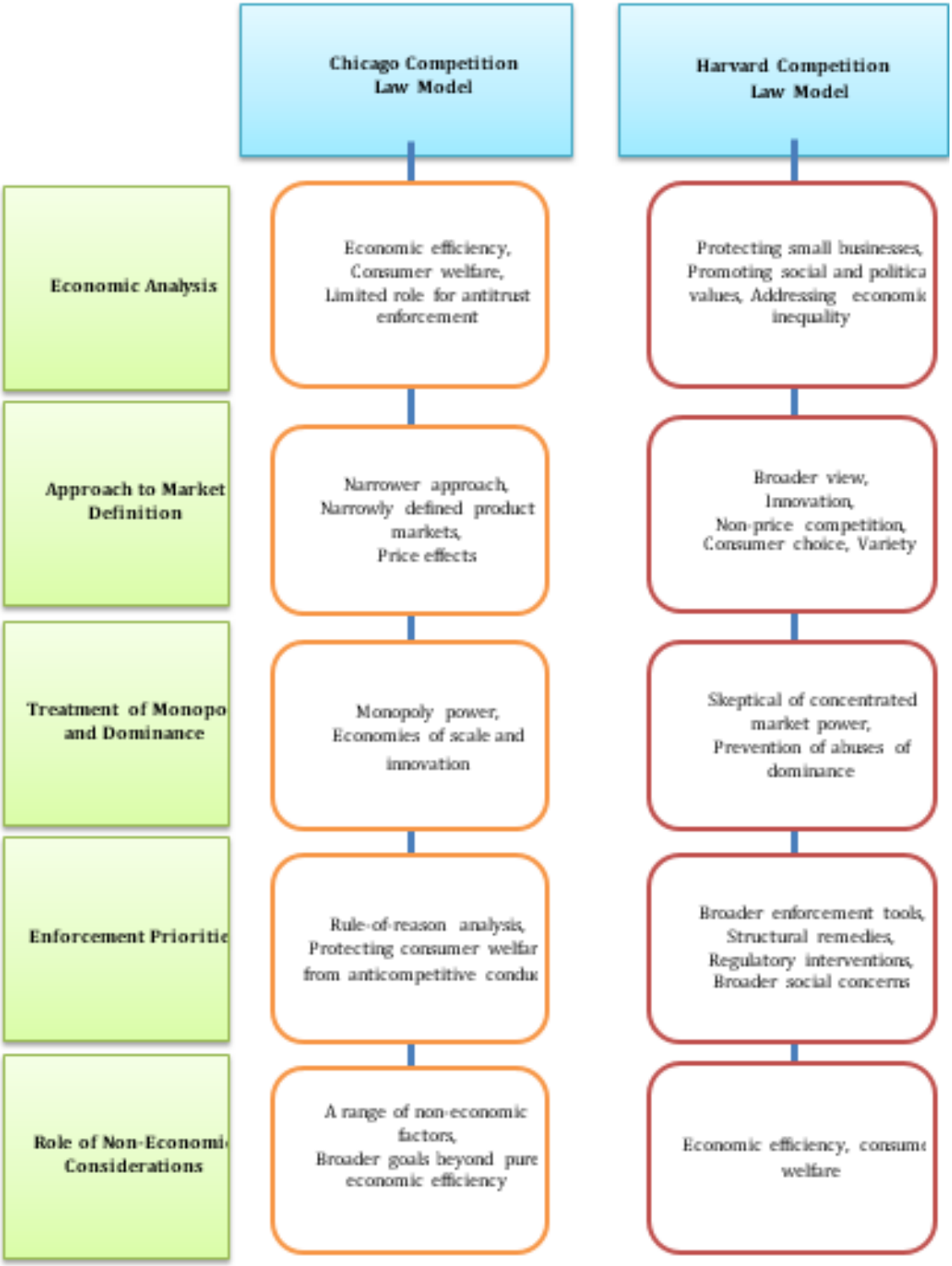

Figure 2. Authors own proposed comparative legal framework of Harvard & Chicago

Legal responses from the perspective of competition law and policy:

The European Union and China both aim to safeguard free competition and promote consumer welfare through competition law interventions. The European Union's Article 102(c) explicitly identifies price discrimination as an abuse of dominant position, while the Chinese legal framework addresses discriminatory treatment of undertakings through Article 22(1)(6) of the Anti-Monopoly Law (AML). The Chinese legal framework also provides guidance on the interpretation of this provision in the context of digital markets. The Algorithm Recommendation Regulations have recently been implemented, imposing further restrictions on undertakings to prevent them from participating in discriminatory practices using recommendation algorithms. However, there are instances where pricing discrimination might be deemed an abuse of dominant market position and is therefore illegal. In the EU, price discrimination is considered an abuse of power when a seller places different conditions on equivalent transactions with other trading parties. Competition regulators may struggle to detect price discrimination in the digital market due to the prevalence of Big Data and sophisticated algorithms.

Artificial Intelligence (AI) has been assessed as enabling price discrimination in the EU, with the Digital Markets Authority (DMA) enacting obligations for gatekeepers and the Platform to Business Regulation (P2B Regulation) safeguarding businesses from deceptive platform commercial practices. The Commission's 2021 Guidance on the interpretation and application of the Unfair Commercial Practices Directive (UCPD) clarifies that businesses may engage in price discrimination if they provide either the whole price or the basis for the price's calculation. The European Union's law prohibits unfair and anti-competitive price discrimination in digital marketplaces caused by artificial intelligence (AI). More research is needed to determine if current restrictions are being economically enforced and if they lead to excessive or insufficient enforcement. In China, the Anti-Monopoly Law Article 22(1)(6) considers price discrimination an abuse of market dominance and punishable under Chinese competition law.

The introduction of interim provisions on prohibiting abuse of dominant market positions in the digital economy has been a significant step towards enhancing and unifying AML safeguards. These provisions are informed by market realities and enforcement procedures, and include provisions for tailored care, such as the use of big data and algorithms to set transaction prices or other conditions that favour one party over another based on their financial resources, consumer tastes, or technology adoption patterns.

The Platform Economics Guidelines were developed to address platform economics concerns, ensuring the regulation of monopolistic action in the platform market. Article 17 addresses considerations for tailored care, including the use of big data and algorithms to set transaction prices or other conditions that favour one party over another based on their financial resources, consumer tastes, or technology adoption patterns.

Companies' use of discriminatory recommendation algorithms is limited by new regulations enacted under the Algorithm Recommendation Regulations. Article 21 mandates that there be no price discrimination in the sale of goods and services by businesses. Illegal pricing practices, such as discriminating amongst customers based on their tastes and buying habits, are prohibited. Competition law in China addresses the issue of price discrimination made possible by AI (Artificial Intelligence). Business-to-business price discrimination for equivalent products or services is illegal under the Price Law, while the Cyber Security Law regulates consumer data collection and usage,

while the E-Commerce Law prohibits search results tailored to a user's interests, preferences, and purchases. The Personal Information Protection Law prohibits unfair discrimination when using personal information for automated decision-making in commercial activities like trade pricing.

In summary, AI has both positive and negative consequences in digital marketplaces. While it offers benefits such as leveraging large data and generating new value for businesses, it also presents challenges such as excess data and uncertainty about how to effectively use it. It is crucial to examine the potential risks posed by AI and address the concerns highlighted by this influential technology to ensure that the implementation of AI is in accordance with human values and beliefs.

Material and Methods

This work employs doctrinal legal research method in examining abuse of dominance through AI enabled price discrimination using legal and economic frameworks. Doctrinal research refers to the investigation, analysis and interpretation of legal principles based on doctrines, statutes and case laws. It can be described as a research method that examines legal documents, case laws or legal systems to determine the roles of the law in each sector or domain and a way of considering its use in regard to particular situations. The study seeks to consider principal legal principles and antitrust laws, with special focus on the abuse of dominance and its definition in different countries. It enables the identification of gaps in the currently existing legislation and decisions made by the courts, leading to the conclusion of a) whether the current legislation can effectively govern the behaviours in the market driven by AI, and b) whether changes to the legislation are required. Applying doctrinal research, the study will be able to provide a comprehensive analysis of the case laws which have previously addressed either price discrimination or abuse of dominance and the extent to which the existing judicial rationalisation can address AI related issues.

The research has focused on three key areas: According to the method there are chiefly three methods such as primary legal sources, secondary legal sources, and comparative legal analysis. The first procedure will be to examine and assess the primary legal sources of instrumental, statutory and regulatory provisions that give form, texture and content to the prohibitions, and regulation of the practices of price discrimination and abuse of dominance. These cases will be surrounded by certain preliminary judgments that presented abuse of dominance as a doctrine, which the research will critically dissect price discrimination; market exclusion; and anti-competitive conduct.

The work has also incorporated neoclassical model to justify the effect of AI based pricing on competition and consumer surplus. This involves using first-degree price discrimination theory in relation to the implementation of artificial intelligence in the determination of price discrimination effects and their impact on competition. Some of the outputs of this research are the legal framework analysis, judicial precedents analysis, as well as policy and regulatory recommendation. Arguing at the intersection of legal doctrine and economics, the proposed research will provide significant information on how current legal systems can address the issues raised by new AI applications in the market.

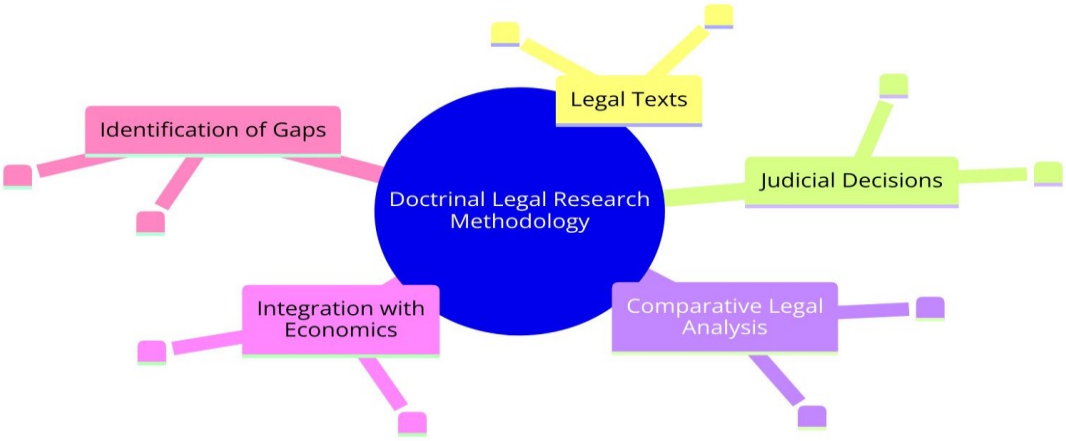

Figure 3: Diagram of Adopted Research Methodology

Results and Discussion

Analysis of Case 1: Google Search (EU, 2017)

Google was fined €2.42 billion by the European Commission for violating antimonopoly law in a case where it favoured its services in comparison shopping searches. This case highlights how dominant market leaders can leverage AI to control search results, leading to market competition. The use of AI algorithms by digital platforms deepens market control, demonstrating its potential to warp competition. This case signals for future investigations into AI-driven techniques and mechanisms for erroneous anti-competitive practices, highlighting the need for further investigation into AI-driven practices.

Analysis of Case 2: Intel (EU, 2009)

Intel was fined €1.06 billion for ensuring zero end-user desktop computer manufacturers and distributors were buying chips from other companies by offering rebates to those using Intel's processor. This case highlights the potential use of AI technology for discriminatory pricing strategies, potentially barring competition by influencing consumer behaviours. The case highlights the potential abuse of exclusivity agreements in AI-intensive industries, like Hutchison's case. The analysis of Intel's case provides insights into how pricing algorithms can be abused to limit competition.

Analysis of Case 3: Amazon Marketplace (EU, 2020)

Amazon's use of AI technologies to manipulate product prices has been a subject of ongoing research by the European Commission. This case highlights how AI can enhance dominant platforms' data accumulation and monopoly, leading to efficient price discrimination practices. Amazon's use of big data in wrongful ways, particularly in price discrimination, poses significant threats to smaller sellers. The use of AI in this way allows dominant firms to harness inside information, resulting in a monopoly on marketplace data.

Analysis of Case 4: Apple App Store (EU, 2020)

Apple has been accused of bullying APK owners through policies that charge high commissions and ban third-party payment gateways. The investigation is ongoing, and while Apple plays a gatekeeper role through the App Store, it could indirectly

contribute to discriminatory prices by controlling app dissemination. This case demonstrates how a monopolistic market can regulate pricing mechanisms in a closed environment, using AI and data analytics to manipulate dynamic price schemes, further suffocating developers and limiting consumer access.

Analysis of Case 5: Facebook Data Privacy (EU, 2019)

Facebook was fined €50 million by the European Commission for using user data without consent, despite having a dominant market position. This case highlights the connection between data control and market control, as data collected without personal information can be used for price discrimination. The case demonstrates how personal data can be exploited by dominant platforms, leading to the consumer pricing model known as PDAC, perpetuating inequities and diminishing market efficiency.

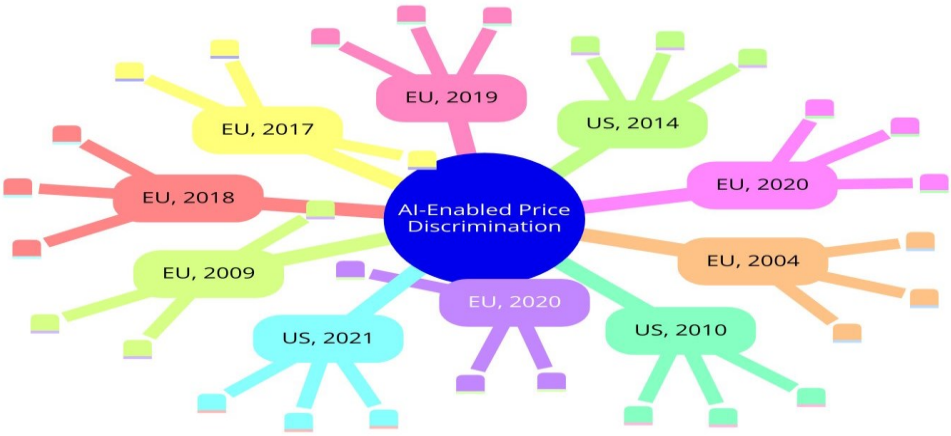

Figure 4: Tree of Cases for Analysis

Analysis of Case 6: Google Android (EU, 2018)

Smartphone manufacturers were forced to preload Google apps to compete with Google services, leading to a €4.34 billion fine. This case highlights the market foreclosure where Google tied its services, restricting consumer freedom and locking out competitors. AI-driven platforms can adopt discriminative pricing mechanisms, using data or bundling to shut out rivals from strategic segments. Google Android serves as a reference point for how dominance in technology can kill competition, and the need for significant control over AI's participation in market conduct.

Analysis of Case 7: Microsoft (EU, 2004)

Microsoft was fined €497 million for bundling media player with the Windows operating system, denying customers the right to choose. This could signal how AI-powered platforms could create ossification and competition restrictions, potentially leading to price discrimination. The example of Microsoft demonstrates how other digital platforms could replicate such practices, and the current issue is how AI might be used to support market support and manipulate options and prices.

Analysis of Case 8: Facebook-WhatsApp Merger (US, 2014)

Facebook and WhatsApp's merger raises concerns about privacy and market power due to the interconnectedness of user data. Facebook's dominance in data and access to personal information from other sites has led to AI models determining consumer behavior and data, resulting in customized pricing. Critics argue that

ownership of consumer information benefits firms in implementing artificial intelligence and digital technology-driven efficiency. However, gaps in regulation exist in addressing data-driven dominance, affecting market transparency and fairness.

Analysis of Case 9: Ticketmaster-Live Nation Merger (US, 2010)

The merger of Ticketmaster and Live Nation, which was rumored to grant monopolistic control of the live event market, was approved with certain terms and conditions. Both companies retain the power to manipulate ticket prices, which could be exacerbated by AI. This merger control is a classic example of monopolies in vertically related industries, where strong firms use algorithm product pricing to exploit their market power.

Analysis of Case 10: Apple vs. Epic Games (US, 2021)

Epic Games sued Apple for monopoly power over app downloads, distribution, and in-app payments. The ruling was somewhat in Apple's favor, but it called for changes to payment options. The case highlights the competitive advantage in digitally enabled ecosystems with Apple^printk=3. AI could fuel this dominance by enabling dynamic treatment of developers and consumers, deepening Apple's market grip. The Epic Games case represents the conflict over digital spaces, and AI could potentially enable Apple to replicate and entrench monopolies through closed ecosystems that impose high costs on competitors, engaging in price discrimination.

Summary of Analysis

In all these cases, there is the common thread of data and technology to improve market superiority. Despite the presence of only a handful of cases which are directly associated with AI assisted price discrimination, a growing trend can be seen of AI being used in market related practices. Where the technology is deeply embedded into the pricing formula, chances of abuse of dominance through discriminative prices is realized. The cases show why and how standard antitrust and competition laws are now appropriate and necessary because they address issues around AI technology dominated digital and data related markets. When it comes to decision making, regulators will have to work out methods for evaluating the impact of the AI algorithms on market activity, and consumer and competitive impacts on fairness and openness.

Recommendations for the Regulation of AI-Enabled Price Discrimination in Pakistan

The article proposes comprehensive recommendations to regulate AI-enabled price discrimination in Pakistan. It suggests building on the current competition act of Pakistan 2010, which should be updated to include AI pricing issues. This is necessary due to the increasing market power of individual firms and the potential for algorithmic collusion, dynamic pricing, and data monetization. The article also recommends passing a transformative Data Privacy Law that governs the use of customer information in AI pricing strategies. This is crucial as it can lead to the improper use of consumers' data for wrong charges. The proposed laws would require consumer permission to use their information in AI pricing structures and punish violators.

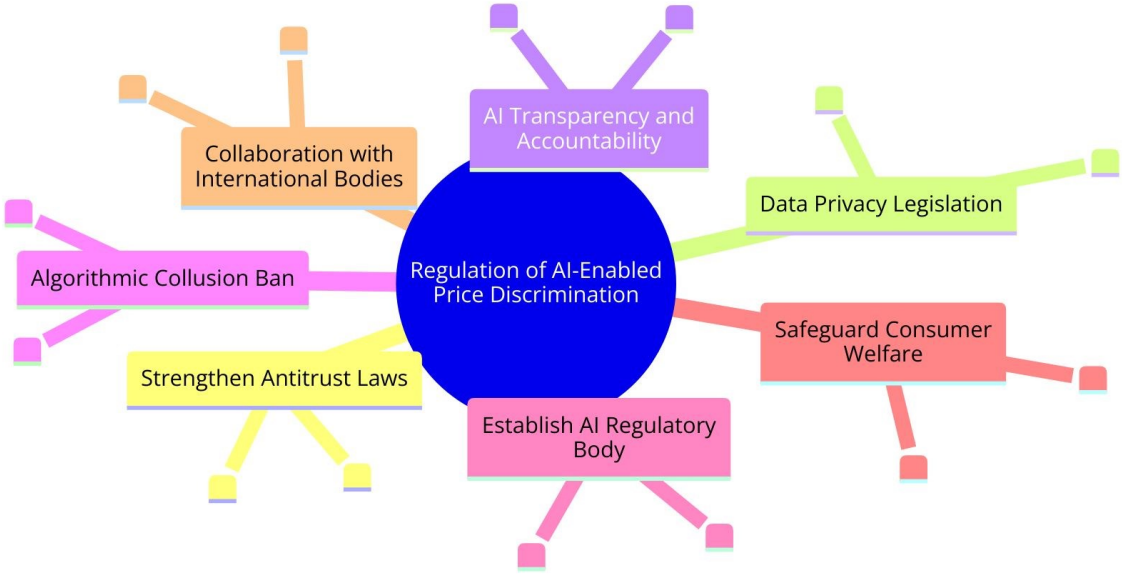

Figure 5: Diagram of Recommendations

The article also suggests proposing laws that compel companies to disclose how they employ artificial intelligence to set their prices. This is essential to prevent discrimination and ensure transparency. The article recommends that AI-based firms for price discrimination must file regular reports with the Competition Commission of Pakistan (CCP) of the algorithms used and data sourced from the companies. The article also recommends legislation or prevention of AI practices that give rise to algorithmic collusion. This is necessary due to the complexity of AI issues and the potential misuse of dominant players in digital ecosystems. The article suggests creating an AI and Technology Oversight Commission to oversee the utilization of AI and technology in various industries and setting appropriate prices.

The article also suggests safeguarding consumer welfare by setting limits on how far businesses take price discrimination. This is important as price fluctuations can exploit consumer behaviour or preferences of goods and services. The article recommends placing regulations on general and particular use of AI control of price discrimination for necessary products and services, especially on vulnerable population segments.

Lastly, the article suggests engaging other countries and international agencies and adopting international benchmark practices for AI in pricing. Pakistan can learn from the EU's control of market domination in cases like Google Search and Intel, emphasizing the need for global consistency in AI regulation.

Conclusion

The increasing use of Artificial Intelligence (AI) in civil and business functions, particularly in setting prices, raises concerns about global legal issues. In Pakistan, where regulatory frameworks are new and adapting to new technological environments, aggressive enforcement of laws covering AI-facilitated price discrimination is crucial. International cases like Google Search, Intel, and Amazon Marketplace illustrate the abuse of dominance through AI, leading to unfair market outcomes and monopolization. In Pakistan, where digital markets are growing rapidly, firms may adopt AI-based systems for price adjustment based on consumer response, distorting market competition and furthering wealth divides. The challenges of

regulation regarding AI-supported behaviours, such as dynamic pricing and data monetization, are highlighted. The lack of corresponding data protection laws in Pakistan highlights the need for a rational comprehensive legal framework to address the high levels of unrevealed intricacy of AI systems. The Competition Act of 2010 does not address the abuse of dominance, and reforms are warranted to address the challenges posed by AI in Pakistan's rapidly growing digital market.

Pakistan needs to strengthen antitrust frameworks, create comprehensive data privacy laws, and enforce AI transparency and accountability. The Competition Commission of Pakistan (CCP) has not created a new competition law to address AI-based price discrimination. Data privacy laws should be formulated to protect consumers from AI-based price models and involve penalties for misuse. AI transparency and accountability should be enforced, requiring companies using AI for pricing to disclose their pricing formulas. Pakistan should also prevent algorithmic collusion by prohibiting AI in high price implementation and developing strict auditing mechanisms. An AI Regulatory Authority should be established to oversee AI across different industries, involving international comparable agencies to track trends. Additionally, Pakistan should protect consumer welfare by implementing laws that protect consumers from AI-enabled pricing strategies that could exploit behavioural information to extract higher prices. Social integration with overseas authorities and integrating best practices from the EU and USA will be crucial in response to global changes. Overall, Pakistan needs to develop a progressive framework of regulation to protect consumers, foster fair competition, and fully harness the potential of AI in market practices.

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