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A Study on Perceived Fairness in AI-Driven Personalized Pricing: A Consumer Perspective

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Abstract. In recent years, AI-driven personalized pricing has proliferated across industries such as retail, mobility, and aviation. While enhancing firms' revenue efficiency, this practice has also raised growing concerns regarding transactional fairness. From a consumer-centric perspective, this paper examines the formation mechanisms of perceived price fairness in AI-driven pricing contexts and its influence on market behavior. As a theoretically oriented review, this study integrates literature analysis and logical reasoning, drawing on consumer behavior theories, the principle of dual entitlement, and representative governance practices to construct an analytical framework spanning technological foundations and policy responses. The findings indicate that algorithmic opacity and information asymmetry are key antecedents of perceived unfairness, which in turn trigger strategic consumer responses, including intensified price search, identity obfuscation, delayed purchasing, and channel migration. At the firm level, this paper proposes equilibrium-oriented strategies such as value-anchored tiered pricing, selective disclosure of pricing logic, and protective pricing mechanisms for high-value customers. At the regulatory level, it highlights the need for calibrated algorithmic transparency, clearer consumer data rights, and well-defined legal boundaries for exploitative pricing, aiming to strike a balance between algorithmic efficiency and social equity.

Keywords: Artificial Intelligence, Personalized Pricing, Price Fairness Perception, Consumer Behavior, Algorithmic Regulation

1. Introduction

In recent years, with the deep embedding of big data analytics and machine learning algorithms into business decision-making processes, AI-driven personalized pricing strategies have progressively evolved from theoretical constructs into widespread commercial realities [1]. Driven by escalating commercial demand, this pricing strategy has expanded from niche applications into diverse industries, including aviation, sports ticketing [2], pharmaceuticals [3], tourism, and luxury goods markets. This phenomenon has not only induced substantial changes within the business community but has also prompted consumers to reconsider their perceptions and adapt their strategies accordingly.

This paper focuses on the formation mechanisms of consumer-perceived fairness within the context of AI-driven personalized pricing and its guiding influence on the evolution of firm

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strategies. Specifically, the study aims to address two interrelated questions: First, what are the core antecedents of consumer price fairness perceptions in an environment characterized by algorithmic opacity? Second, how do such perceptions subsequently shape consumers' market coping strategies and, in turn, impose feedback constraints on firms' algorithmic pricing behaviors?

This inquiry is particularly timely, as the proliferation of algorithmic decision-making in commerce has outpaced both consumer literacy and regulatory development. Understanding the psychological and behavioral responses of consumers is therefore essential for firms seeking sustainable deployment and for policymakers aiming to preserve market fairness.

Through a critical examination and theoretical synthesis of research materials—including consumer behavior theories, the principle of dual entitlement concerning price fairness perceptions, relevant domestic and international legislative drafts, and illustrative industry governance practices—this study endeavors to construct a comprehensive research framework that bridges the explication of technical principles and the analysis of policy responses. The aim is to mitigate the current estrangement between technological logic and humanistic considerations within the digital governance landscape. By elucidating the intrinsic mechanisms of consumer psychological responses, this paper seeks, on the one hand, to provide theoretical references for firms in delineating more sustainable algorithmic ethical guidelines and, on the other hand, to offer forward-looking institutional insights for legislative and regulatory bodies. Building upon this foundation, this paper further advances preliminary judgments regarding the co-evolutionary trajectory of AI-driven personalized pricing and consumer rights protection, while also providing directional policy recommendations concerning core issues such as algorithmic transparency regulation and the delineation of data rights boundaries.

2. Conceptualization and characteristics of AI personalized pricing

AI personalized pricing denotes the commercial practice whereby firms leverage machine learning algorithms and high-frequency behavioral data at the individual consumer level to charge differential prices for identical goods or services across distinct consumers [4]. Compared with traditional pricing models, its fundamental distinction resides in the shift of the pricing decision basis from the marginal cost of goods or aggregate market supply and demand to algorithmic predictions of individual willingness to pay. This transition represents a paradigmatic shift from cost recovery and market-clearing mechanisms to value extraction based on heterogeneous consumer valuations.

Conceptually, it is imperative to differentiate AI personalized pricing from adjacent terminologies. First, it must be distinguished from conventional dynamic pricing. Although the latter also entails temporal price adjustments, such fluctuations primarily reflect aggregate shifts in market supply and demand (e.g., peak-hour surcharges), rather than individually targeted quotations based on personal characteristics. Second, it differs from explicit third-degree price discrimination, which involves segment-based pricing according to observable group attributes (e.g., student or senior discounts). AI-personalized pricing approximates, in technical terms, the economic concept of first-degree price discrimination, wherein firms endeavor to approach each consumer's reservation price, thereby maximizing the extraction of consumer surplus [5]. Nevertheless, constrained by information asymmetries and algorithmic predictive accuracy, real-world AI personalized pricing typically manifests as an imperfect form of first-degree price discrimination, the efficacy of which depends on the breadth of data held by the firm and the inferential capacity of its algorithms.

AI-personalized pricing exhibits two salient characteristics: high-frequency price updating and profound personalization [3]. This technological capability enables firms to respond to market

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demand in real time, swiftly adjusting prices through AI-driven personalized decision-making, thereby enhancing market competitiveness [6]. Against this backdrop, the penetration rate of AI personalized pricing continues to rise, its application has become increasingly prevalent, and consumer awareness of this pricing modality is growing more pronounced. This heightened awareness transforms the practice from a background operational mechanism into a salient component of the transactional experience, with direct implications for brand perception.

3. Research on consumer perceived fairness

3.1. Antecedents of price fairness perception

With the rapid proliferation of algorithmic pricing strategies in sectors such as aviation, ride-sharing, and online retail, consumers have become increasingly sensitive to frequent fluctuations in price signals. Taking the airline industry as an illustrative case, the phenomenon of peak pricing approaching flight departure times essentially reflects a demand-driven pricing strategy predicated on variations in time sensitivity and willingness to pay. By precisely capturing consumers' urgency-related psychology, firms seek to maximize the extraction of consumer surplus—the differential between the price actually paid by the consumer and their maximum willingness to pay. However, this mechanism of price differentiation, underpinned by individual-level data, constitutes de facto price discrimination in economic terms.

Within a pricing environment characterized by limited transparency, once consumers recognize that they have paid a premium relative to a reference group for a homogeneous product, perceptions of price unfairness are likely to be triggered. According to the principle of dual entitlement, consumers generally perceive that firms lack the entitlement to alter transaction terms through the manipulation of demand curves unilaterally, and this sense of unfairness is further exacerbated when the basis for pricing involves algorithmic logics that are opaque and difficult for consumers to observe or verify. The opacity of algorithmic determination introduces attributional ambiguity, wherein consumers must infer the reasons for price differentials under conditions of incomplete information, often defaulting to negative interpretations of firm motives. The emergence of price fairness perceptions not only erodes consumer trust toward specific brands but also systematically increases the psychological costs and perceived risks associated with subsequent transactions [7]. As an adaptive response to such negative perceptions, consumers frequently initiate a series of strategic consumption adjustment behaviors.

3.2. Corresponding adjustments in consumption strategies

Confronted with the perceived unfairness engendered by AI-driven personalized pricing, consumers do not passively acquiesce to price differentials; rather, they respond through a repertoire of strategic behaviors aimed at safeguarding their economic interests and re-establishing a sense of transactional equity. These strategic adjustments can be categorized into four types: intensified price search, data obfuscation, purchase timing delay, and channel migration.

First, intensified price search. When consumers suspect the presence of an algorithmic premium, they exhibit a propensity to compare prices across different platforms and devices in order to verify the reasonableness of quoted prices [8]. Although this behavior incurs additional time costs, it partially mitigates the firm's informational advantage. By aggregating price signals from multiple sources, consumers reconstruct a reference price framework that has been obscured by algorithmic personalization, thereby regaining a comparative benchmark against which fairness can be assessed.

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The proliferation of price comparison websites and peer-to-peer information sharing has substantially reduced the marginal cost of such search activities. However, from the firm's perspective, widespread cross-platform price discovery undermines the informational asymmetry upon which personalized pricing models depend.

Second, identity obfuscation and data shielding. Consumers deliberately obscure their digital footprints through measures such as clearing browsing histories, disabling location permissions, or utilizing guest modes, thereby intentionally perturbing the algorithmic inference of their willingness to pay to reduce the probability of being targeted with elevated prices. This form of defensive information management reflects a growing level of consumer literacy regarding data collection practices and a recalibration of the implicit social contract governing data exchange. The adoption of such countermeasures signals that consumers increasingly perceive personal data flows as a vulnerability that must be managed, which carries significant implications for the long-term viability of data-intensive business models.

Third, purchase timing is delayed. Drawing upon experiential awareness of algorithmic fluctuation patterns, consumers strategically postpone transactions, awaiting a price reversion to a psychologically acceptable range. While this behavior may enable consumers to avoid short-term premiums, it is also associated with opportunity costs and the utility loss inherent in delayed consumption. Over time, consumers develop heuristic expectations regarding price trajectories based on repeated observations, effectively acquiring a form of informal predictive capability that allows them to optimize purchase timing to some extent. The prevalence of purchase delay introduces volatility into firms' demand forecasting models and complicates inventory management and revenue optimization efforts.

Fourth, brand relationship dissolution and channel migration. When perceived unfairness exceeds a tolerable threshold, consumers may permanently disengage from specific platforms or migrate from algorithm-intensive online channels to offline channels or alternative markets characterized by greater price transparency, thereby avoiding the persistent erosion of their interests resulting from algorithmic price discrimination. This represents the most consequential response from the firm's perspective, as it entails the potential loss of future transaction streams. Channel migration reallocates transaction volume away from algorithmic pricing environments, thereby reducing immediate revenue and diminishing the data inflow that sustains algorithmic systems.

The aforementioned strategic adjustments indicate that consumer behavior within algorithmically governed pricing environments has acquired pronounced game-theoretic characteristics, whereby rational responses at the individual level collectively constitute a significant market-based constraint on algorithmic pricing mechanisms at the aggregate level.

4. Optimization pathways for firm algorithmic pricing strategies

The strategic adjustments undertaken by consumers impose direct market constraints on firms' pricing strategies. Given that judgments regarding price fairness are inherently subjective, consumers' perceptions of and responses to price inequality exhibit considerable variation. Specifically, when price inequality is advantageous to the consumer, its impact on fairness perception tends to be relatively limited; conversely, when it is disadvantageous, perceptions of unfairness are significantly intensified [9]. Consequently, without relinquishing the efficiency gains of algorithmic pricing, firms may seek to establish a dynamic equilibrium between profit maximization and customer relationship maintenance through the following pathways.

First, implement value-anchored tiered pricing. Firms should embed price differentials within perceptible value distinctions. By aligning higher prices with additional benefits—such as priority

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services, exclusive access, or quality enhancements—targeted at segments with greater willingness to pay, the premium receives functional or experiential justification, thereby mitigating the attributional basis of perceived unfairness. This approach shifts consumers' cognitive framework from comparing identical products at different prices to evaluating differentiated offerings across price tiers. The key challenge lies in designing a tiered structure in which each incremental price increase corresponds to a meaningful and communicable enhancement, while ensuring that the baseline offering remains viable.

Second, promote limited disclosure of pricing logic. Without revealing proprietary algorithmic parameters, firms may provide general explanations linking price fluctuations to objective variables such as demand intensity, timing, or inventory levels. This reframes consumers' attribution of price differences from firm intent to broader market dynamics, thereby reducing the likelihood that elevated prices are perceived as exploitative conduct [10]. Rooted in attribution theory, this strategy shifts causal interpretation from discretionary opportunism to impersonal market forces. Such disclosures may take the form of contextual cues regarding demand conditions or availability constraints, thereby enhancing perceived transparency.

Third, establish compensatory buffering mechanisms for adverse pricing experiences. In cases where consumers perceive that they have paid a substantial premium, firms may offer compensatory measures such as targeted discounts, loyalty rewards, or future purchase rebates. These goodwill gestures serve to counterbalance negative perceptions and maintain the stability of long-term relationships. Effective implementation requires both timeliness and proportionality, transforming potentially negative experiences into opportunities for reinforcing trust.

Fourth, implement channel- and time-segmented differential pricing. By confining preferential pricing to specific channels, time periods, or eligibility conditions, such differences are more likely to be interpreted as limited opportunities rather than generalized discrimination. This reduces the salience of cross-consumer price comparisons and mitigates the triggering of unfairness perceptions. From a social-psychological perspective, fairness judgments are sensitive to perceived accessibility: when a discount is contingent upon a voluntary action, it is more likely to be regarded as a legitimate incentive.

Fifth, introduce protective pricing mechanisms for high-value customers. By incorporating customer loyalty parameters into algorithmic pricing systems, firms can limit excessive premiums or offer price guarantees to core customer segments. Although this may involve short-term revenue trade-offs, it contributes to the accumulation of long-term trust and reduces customer attrition risk. The identification of such customers should extend beyond transactional frequency to include relational depth, and protective measures may range from explicit guarantees to implicit algorithmic adjustments.

5. Conclusion

This paper has undertaken a systematic examination of the relationship between AI-driven personalized pricing and consumer perceived fairness. By synthesizing insights from consumer behavior theory, the principle of dual entitlement, and relevant literature on algorithmic pricing practices, the study constructs a comprehensive analytical framework linking pricing mechanisms, consumer psychological responses, and firm strategy optimization. At the theoretical level, this study identifies three principal pathways through which perceptions of unfairness are generated in environments characterized by algorithmic opacity: attributional ambiguity amplifies negative inferential tendencies, violations of the principle of dual entitlement undermine perceptions of transactional equity, and asymmetric sensitivity to disadvantageous price differentials intensifies

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perceptions of unfairness. These findings extend traditional price fairness theory into the context of digital marketplaces.

At the practical level, the paper outlines a set of dynamic equilibrium strategies available to firms: embedding price differences within perceptible value distinctions, providing limited transparency regarding pricing logic, implementing compensatory mechanisms, structuring context-dependent price differentiation, and protecting high-value customer segments. The central objective of these strategies is to manage consumer perceptions in a manner that maintains pricing flexibility within acceptable psychological boundaries.

This study also acknowledges several limitations. First, as a review-based analysis, it lacks primary empirical validation; future research may employ experimental or field data to test the proposed mechanisms. Second, industry heterogeneity has not been examined in depth, and variations across sectors may significantly influence the effectiveness of different strategies. Third, the role of third-party intermediaries—such as price comparison platforms and consumer advocacy organizations—remains underexplored.

In conclusion, consumer perceived fairness in AI-driven personalized pricing represents an interdisciplinary issue at the intersection of economics and psychology. Achieving a sustainable balance between efficiency and fairness requires firms to recognize consumer equity concerns and to proactively adjust their pricing strategies within an increasingly algorithm-driven commercial environment.

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