福建省中电海峡智能装备研究院
Fujian Zhongdian Straits Institute of Intelligent Equipment
Asia Pacific Science Press
Advances in Management and Intelligent Technologies
ISSN(O):3079-5869
ISSN(P):3079-5850
Vol. 1 No.2 (2025)

Strategic Introduction of Private Labels and Coordination Mechanisms in Dual-Channel E-Commerce Platforms

Xuanyi Li*, Yilei Zhu, Xuan Chao

School of Marketing and Logistics Management, Nanjing University of Finance and Economics, Nanjing, Jiangsu, 210023, China

Corresponding author: Xuanyi Li

Abstract: In the context of dual-channel supply chains, a game-theoretic model is developed to examine the strategic implications of private label introduction by e-commerce platforms under both scenarios: with and without private labels. The model analyzes optimal decisions regarding pricing, advertising investments, wholesale prices, marginal profits, and equilibrium payoffs for manufacturers and platforms operating under a reselling model. The findings indicate that private label introduction significantly influences the strategic choices and profit outcomes of both manufacturers and platforms, with the direction of impact varying based on the manufacturer's unit reselling cost. Numerical simulations further validate the theoretical results and illustrate the effects of private label introduction on key variables within the supply chain. This research provides theoretical insights and managerial implications for e-commerce platforms to formulate private label strategies and optimize supply chain collaboration under varying market conditions.

Keywords: Dual-Channel Supply Chain; Private Label; E-commerce Platform; Game-Theoretic Analysis

Published: May 8, 2025

DOI:https://doi.org/10.62177/amit.v1i2.339

1.Introduction

With the deep penetration of Internet technologies and the rapid growth of the digital economy, the global e-commerce market has continued to expand, and online consumption has gradually become a major choice for consumers. In 2023, China's online retail sales reached 13.79 trillion yuan, accounting for 30.8% of total retail sales of consumer goods, indicating a rapid transformation in consumer purchasing behavior and the growing maturity of the e-commerce ecosystem. Against this backdrop, e-commerce supply chains have enhanced operational efficiency and coordination by effectively integrating data, logistics, and financial flows. For example, Alibaba's "Cainiao" logistics network improved its average delivery time by 45% during the 2023 "Double Eleven" shopping festival compared to 2018, highlighting the achievements of digital upgrades in e-commerce supply chain management.

In pursuit of breaking growth bottlenecks and improving profitability, e-commerce platforms have actively promoted private label strategies. Statistics show that by 2024, the global private label market reached $1.7 trillion, with a penetration rate exceeding 21% in the U.S. Amazon's private label, Amazon Basics, captured a 31% market share in the U.S. alkaline battery market and expanded into apparel, home goods, and other categories, effectively boosting platform profitability. In the Chinese market, private labels such as JD's "Jingzao" and Alibaba's "Taobao Xinxuan" have achieved rapid growth, with sales

surpassing 8 billion yuan and user bases exceeding 120 million, respectively. Leveraging platform traffic and data analytics, these private labels have swiftly responded to niche market demands.

However, the expansion of private labels has intensified the complex relationship of both competition and cooperation between e-commerce platforms and manufacturers. On the one hand, platforms capitalize on algorithmic recommendations and search rankings to give their private labels competitive advantages in standardized or low-to-mid-priced product segments, posing a threat to manufacturer brands. Surveys reveal that 61% of manufacturers are concerned about private labels cannibalizing their market share. On the other hand, manufacturers are actively developing direct sales channels, strengthening brand control through official websites, private traffic operations, and other direct-to-consumer strategies. Platforms such as Huawei Mall, iMaotai, and Nike's WeChat mini-program have all achieved rapid growth in online direct sales, further intensifying market competition with e-commerce platforms.

The proliferation of dual-channel supply chains has complicated the interactions between manufacturers and e-commerce platforms regarding sales channels, product positioning, and pricing strategies. While e-commerce platforms promote private label development, they also face increased cooperation frictions and "double marginalization" effects resulting from private label introduction. Due to product category heterogeneity, the introduction of private labels exhibits dynamic and context-dependent characteristics. Therefore, determining appropriate private label introduction strategies and effectively coordinating the interests of manufacturers under a dual-channel environment have become critical challenges affecting supply chain performance and platform competitiveness. Exploring the interaction mechanisms between e-commerce platforms and manufacturers in dual-channel settings and identifying key factors influencing strategic choices are essential for platforms to achieve differentiated development and collaborative gains.

With the rapid development of e-commerce and multichannel retailing, dual-channel supply chains have become a critical operational model for e-commerce platforms. To strengthen channel control and optimize profit structures, many platforms have adopted private label strategies, which have attracted increasing attention from academia. Existing studies have examined private label introduction in dual-channel environments from various perspectives, including market competition, channel power dynamics, consumer perceptions, and supply chain coordination.

From the perspective of market competition, Raju et al. (1995) found that introducing private labels enhances retailers' bargaining power in price competition and highlighted the moderating role of price sensitivity among competing products[1]. Chen et al. (2011) explored how differences in quality and cost between national brands and private labels affect profit distribution and supply chain coordination[2]. Kuo and Yang (2013) suggested that when the substitutability of national brands is low, retailers benefit from offering private labels with quality levels close to those of national brands to maximize profits[3]. Zheng et al. (2022) pointed out that introducing private labels intensifies competition among manufacturers and increases pricing uncertainty, especially under complex contractual relationships[4].

Li et al. (2022) used a cost-quality trade-off model to show that, under certain conditions, high-quality private labels can enhance retailers' overall profits[5]. Ma and Siebert (2024) demonstrated that launching private labels encourages retailers to adjust product portfolios and pricing strategies, thereby optimizing channel profits through demand shifting[6]. Reza-Gharehbagh et al. (2025) emphasized that retailers prefer collaborating with manufacturers offering low costs and high capacity or strong brand power to gain competitive advantages through pricing and promotional strategies[7]. Bedoui et al. (2024), based on empirical evidence, found that as market share increases, manufacturer brands become less responsive to private label promotional pricing[8].

From the perspective of channel power dynamics, Ru et al. (2015) discovered that private label introduction helps mitigate double marginalization and, under certain conditions, increases the demand and wholesale price of national brands[9]. Liao et al. (2020) argued that private label positioning is influenced by procurement mechanisms and channel pricing authority[10]. Cheng et al. (2021), through a multi-tier supply chain model, found that when private labels possess significant market competitiveness, distributors play a positive role in coordinating upstream and downstream relationships[11]. Gielens et al. (2023), using cross-country data, showed that while private label market shares tend to converge globally, they still exhibit significant regional differences due to economic and cultural factors[12].

Regarding the mechanisms of dual-channel supply chains, Huang et al. (2011) developed models under centralized and decentralized decision-making to explore pricing and production adjustments in the face of demand disruptions[13]. Rodríguez and Aydın (2015), using a nested logit model, analyzed joint decisions on product assortment and pricing, revealing that inventory costs influence channel conflicts[14]. Ding et al. (2016) employed a Stackelberg game model to study tiered pricing strategies under manufacturer leadership, finding that uniform pricing under certain market conditions optimizes manufacturer profits[15]. Liu et al. (2016) compared pricing strategies under different information scenarios, showing that risk aversion and information asymmetry reduce overall supply chain efficiency[16]. Chen et al. (2017) examined joint price and quality decisions, noting that the introduction of new channels promotes product quality improvements and enhances channel structure efficiency[17]. Zhou et al. (2018) explored how service cost-sharing contracts, under free-riding behavior, impact service levels and profits, finding that differentiated pricing can mitigate channel price competition and increase manufacturer profits[18].

Chu et al. (2025) investigated the interaction between e-commerce platform private labels and manufacturer channel choices through a game-theoretic model, revealing that although private labels reduce manufacturer brand profits, they help alleviate double marginalization[19]. Zha et al. (2025) found that platforms can leverage private labels as strategic tools in pricing and negotiation[20]. Paha (2025) studied scenarios of quality information asymmetry, showing that manufacturers use wholesale pricing and market share contracts to counter retailers' informational advantages[21]. From the perspective of consumer perceptions, Fuduric et al. (2022) reported that consumers exhibit more positive attitudes toward national brands, posing challenges for private label market acceptance[22]. Mao et al. (2023) indicated that reference prices, package sizes, and consumer income levels significantly influence the likelihood of choosing private labels[23]. Choi and Turut (2023) observed that when private label quality approaches that of national brands, some consumers shift toward premium products, helping national brands maintain market share and profitability[24].

These studies collectively reveal the multifaceted impacts of private label introduction on market competition, channel power structures, pricing mechanisms, and supply chain coordination in dual-channel supply chains, providing a theoretical foundation for understanding private label strategies in e-commerce platforms. However, most existing research focuses on traditional retailers, with limited attention to dynamic games, coordination mechanisms, and multi-stakeholder interest balancing under e-commerce platform-led dual-channel environments.

The current literature offers important theoretical insights into the role of private labels in dual-channel supply chains, covering aspects of market competition, channel power, consumer perceptions, and supply chain coordination. In particular, game-theoretic and empirical studies have highlighted the complex effects of private label introduction on supply chain structure, profit distribution, and market strategies. Nevertheless, research focusing on platform-led dual-channel contexts remains scarce, especially regarding private label strategy choices, impacts on manufacturer cooperation, channel coordination, and supply chain balance. Therefore, this study centers on the issue of private label introduction by e-commerce platforms under a dual-channel environment, analyzing its effects on supply chain coordination and platform competitiveness through the lens of platform-manufacturer interactions. The goal is to explore strategies that optimize platform profitability and channel collaboration, offering theoretical support and practical insights for platforms in developing effective private label strategies.

2.Model Development and Solution

2.1 Problem Description

With the rapid growth of e-commerce, online platforms have gradually become a critical sales channel for manufacturers' national brand (NB) products. Under this environment, manufacturers distribute their products through two channels simultaneously: direct-to-consumer (DTC) online sales via their own channels, and indirect sales through e-commerce platforms where the platform sets the retail price. This dual-channel supply chain structure enhances manufacturers' access to consumers while granting the platform pricing power and traffic control over product sales. However, the coexistence of these channels not only expands market coverage but also intensifies internal competition, leading to increasingly complex trade-offs between manufacturers and platforms regarding pricing, advertising, and sales volumes.

To strengthen channel competitiveness and increase profitability, e-commerce platforms have begun to consider introducing

private label (store brand, SB) products, which are sold alongside national brand products on the same platform. The introduction of a private label adds a new self-controlled product line to the platform's portfolio, thereby reshaping the existing supply chain structure and decision-making processes. The substitutability between private labels and national brands, the allocation of platform resources, and consumer purchase choices—driven by factors such as price sensitivity, advertising effectiveness, and brand preference—together form a complex network of competition and cooperation between manufacturers and platforms.

Within this dual-channel environment, the decision-making sequence between the platform and the manufacturer can be summarized as follows: first, the platform decides whether to introduce a private label and determines the pricing strategy for the private label product; next, the manufacturer responds by setting its advertising investment level for national brand products sold on the platform and deciding on the pricing strategy for its direct sales channel; finally, consumers make their purchasing decisions between the platform channel and the direct channel based on product prices, advertising effects, and perceived brand value. Through this interactive process, the strategic choices of both the platform and the manufacturer jointly determine product demand, profit distribution, and the competitive dynamics between channels.

To facilitate analysis, the model is built under the following assumptions:

(1) Both the platform and the manufacturer are rational decision-makers seeking to maximize their own profits;

(2) Consumers' purchase decisions are influenced by product price, advertising effects, and brand utility, with substitutability existing between channels;

(3) The platform can influence sales performance through traffic allocation and recommendation algorithms;

(4) Manufacturers can enhance the perceived utility of national brand products on the platform by investing in advertising, while bearing the associated advertising costs.

Based on these assumptions, decision models are developed for two scenarios: one where the platform does not introduce a private label, and another where it does. By comparing the outcomes of the two scenarios in terms of pricing, advertising investment, profits, and channel demand, this study aims to explore the impact mechanisms of private label introduction on key stakeholders in the dual-channel supply chain.

The symbols and definitions used in the model are summarized in Table 1.

Table 1 Notation and Definitions

Symbol	Definition
v	Consumer's perceived value for NB product in platform channel, uniformly distributed over [0,1]
δ	Consumer's perceived value discount coefficient for NB product in manufacturer's direct channel, $0 < \delta < 1$
η	Consumer's perceived value discount coefficient for SB product in platform channel, $0 < \eta < \delta < 1$
β	Advertising effectiveness coefficient for NB product's consumer utility in the platform channel, $0 < \beta < 1$
c	Manufacturer's unit selling cost when wholesaling NB product to platform
Π_k	Profit of supply chain member k, $k \in \{M, P\}$
U_i	Consumer utility of product in channel i, $i \in \{d, f, s\}$
D_i	Demand for product in channel i, $i \in \{d, f, s\}$
p_i	Unit retail price of product in channel i, $i \in \{d, f, s\}$
w	Unit wholesale price of NB product sold to platform
m	Unit margin earned by platform from NB product sales
e	Manufacturer's advertising investment for NB product
Subscripts	
M	manufacturer
P	e-commerce platform
d	manufacturer's direct channel (NB product)
f	platform's indirect channel (NB product)
S	platform's SB product channel
Superscripts	
RN	scenario without private label introduction
RS	scenario with private label introduction

2.2 Equilibrium Analysis without Private Label Introduction (RN)

In this section, the e-commerce platform does not introduce a private label (store brand, SB), and the decision-making sequence under this model follows: S1: The platform decides not to introduce a private label. S2: The platform sets the margin m for reselling the national brand (NB) product, while the manufacturer determines its advertising investment level e. S3: The manufacturer sets the direct sales price p_d for NB products in its own channel and the wholesale price w for selling NB products to the platform; demand is then realized.

Under this setting, consumers' utility functions are expressed as:

$$U_d^{RN} = e - p_d + \delta v \#(1)$$

$$U_f^{RN} = v - m - w + \beta e \#(2)$$

From the utility functions, we derive the critical perceived value thresholds v_1^{RN} and v_2^{RN} for consumer choice.

Accordingly, the demand functions for NB products in the direct channel and the platform channel are given by:

$$D_d^{RN} = v_1^{RN} - v_2^{RN} = -\frac{e - p_d + \delta(m + w) - \beta\delta e}{\delta(\delta - 1)} \#(3)$$

$$D_f^{RN} = 1 - v_1^{RN} = \frac{e + m - p_d + w - \beta e}{\delta - 1} + 1 \#(4)$$

The profit functions of the manufacturer and the platform are then formulated as:

$$\Pi_M^{RN} = p_d D_d^{RN} + (w - c) D_f^{RN} - \frac{e^2}{2} \#(5)$$

$$\Pi_P^{RN} = m D_f^{RN} \#(6)$$

Under this scenario, equilibrium solutions are obtained through a sequential optimization process. First, the manufacturer's profit function $\Pi_M^{RN}(p_d, w)$ is differentiated with respect to p_d and w to derive the manufacturer's reaction functions for direct sales price p_d and wholesale price w. Next, these reaction functions are substituted into the profit functions of both the manufacturer and the platform. By taking the first-order derivatives with respect to advertising investment e and platform margin m, the equilibrium advertising investment e^{RN*} and platform margin m^{RN*} are solved. Substituting e^{RN*} and m^{RN*} back yields the equilibrium direct price p_d^{RN*} and equilibrium wholesale price w^{RN*}. Finally, the equilibrium profits of the manufacturer and the platform can be calculated as:

$$\Pi_M^{RN*} = p_d^{RN*} D_d^{RN*} + (w^{RN*} - c) D_f^{RN*} - \frac{(e^{RN*})^2}{2} \#(7)$$

$$\Pi_P^{RN*} = m^{RN*} D_f^{RN*} \#(8)$$

2.3 Equilibrium Analysis with Private Label Introduction (RS)

In this section, the e-commerce platform introduces a private label (store brand, SB), and the decision-making sequence under this model follows: S1: The platform decides to introduce a private label. S2: The platform sets the margin m for reselling the national brand (NB) product, while the manufacturer determines its advertising investment level e. S3: The platform determines the selling price p_s of the SB product, while the manufacturer sets the direct sales price p_d for NB products in its own channel and the wholesale price w for supplying NB products to the platform; demand is then realized.

Under these conditions, consumers' utility functions are expressed as:

$$U_d^{RS} = e - p_d + \delta v \#(9)$$

$$U_f^{RS} = v - m - w + \beta e \#(10)$$

$$U_s^{RS} = \eta v \#(11)$$

Based on the utility functions, the critical perceived value thresholds v_1^{RS}, v_2^{RS}, and v_3^{RS} are derived.

Accordingly, the demand functions for NB products in the direct channel, NB products in the platform channel, and SB products are given by:

$$D_d^{RS} = v_1^{RS} - v_2^{RS} = \frac{e - p_d + p_s}{\delta - \eta} - \frac{e + m - p_d + w - \beta e}{\delta - 1} \#(12)$$

$$D_f^{RS} = 1 - v_1^{RS} = \frac{e + m - p_d + w - \beta e}{\delta - 1} + 1 \#(13)$$

$$D_s^{RS} = v_2^{RS} - v_3^{RS} = -\frac{e - p_d + p_s}{\delta - \eta} - \frac{p_s}{\eta} \#(14)$$

The profit functions of the manufacturer and the platform are formulated as:

$$\Pi_M^{RS} = p_d D_d^{RS} + (w - c) D_f^{RS} - \frac{e^2}{2} \#(15)$$

$$\Pi_P^{RS} = m D_f^{RS} + p_s D_s^{RS} \#(16)$$

Under this scenario, the equilibrium solutions are obtained through a sequential optimization process. First, the manufacturer's profit function $\Pi_M^{RS}(p_d, w)$ and the platform's profit function $\Pi_P^{RS}(p_s)$ are differentiated with respect to p_d, w, and p_s, yielding the manufacturer's reaction direct price p_d, the platform's reaction wholesale price w, and the platform's reaction SB price p_s. Next, p_d, w, and p_s are substituted into the profit functions of both the manufacturer and the platform. By taking the first-order derivatives with respect to the advertising investment e and the platform margin m, the equilibrium advertising investment e^{RS*} and platform margin m^{RS*} are solved. Substituting e^{RS*}, m^{RS*}, p_d, w, and p_s back yields the equilibrium direct sales price p_d^{RS*}, equilibrium wholesale price w^{RS*}, and equilibrium SB price p_s^{RS*}. Finally, the equilibrium profits of the manufacturer and the platform can be calculated as:

$$\Pi_M^{RS*} = p_d^{RS*} D_d^{RS*} + (w^{RS*} - c) D_f^{RS*} - \frac{(e^{RS*})^2}{2} \#(17)$$

$$\Pi_P^{RS*} = m^{RS*} D_f^{RS*} + p_s^{RS*} D_s^{RS*} \#(18)$$

3.Strategic Effects and Numerical Simulations of Private Label Introduction

In the preceding sections, game-theoretic models were developed for two scenarios: one where the e-commerce platform does not introduce a private label, and the other where it does. The optimal equilibrium solutions for pricing, advertising investment, and profit extraction by both the manufacturer and the platform under each setting were derived. The theoretical analysis revealed the mechanisms through which the introduction of a private label influences key decision variables and the profit distribution among supply chain participants.

To further validate the theoretical findings and explore the sensitivity of game outcomes to changes in key parameters, this section conducts numerical simulations based on the derived equilibrium solutions. The analysis focuses on the impact of private label introduction on the manufacturer's wholesale pricing, direct channel pricing, advertising decisions, the platform's profit margin, and the respective profits of both parties. By simulating variations in critical parameters, the analysis aims to visually demonstrate how private label strategies shape the behavior of each participant within a dual-channel supply chain, thereby providing empirical support for practical managerial insights.

3.1 Impact of Private Label Introduction on the Manufacturer's Wholesale Price in the Resale Channel

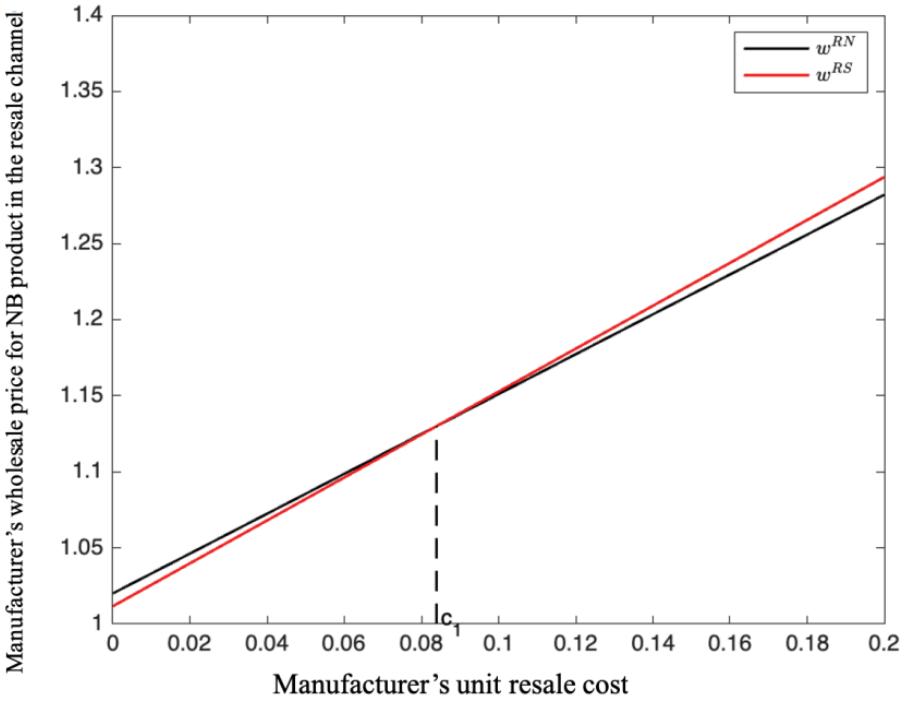
This section investigates how the manufacturer's wholesale price in the resale channel changes under two scenarios: with and without the introduction of a private label by the e-commerce platform. By comparing these settings, the analysis explores the influence of private label introduction on the manufacturer's pricing decisions, as stated in Proposition 1.

Proposition 1: There exists a threshold c_1 such that: (1) The introduction of a private label leads the manufacturer to reduce the wholesale price in the resale channel if and only if $c < c_1$; (2) The introduction of a private label leads the manufacturer to increase the wholesale price in the resale channel if and only if $c > c_1$.

This result indicates that the impact of private label introduction on the manufacturer's pricing strategy is contingent on the cost structure. When the manufacturer's resale cost is relatively low, competitive pressure from the platform's private label forces the manufacturer to lower the wholesale price to maintain the competitiveness of the national brand (NB) product in the platform channel, thereby preserving sales volume and profitability. Conversely, when the resale cost is high, the manufacturer responds to private label competition by raising the wholesale price to pass on part of the cost burden and

reduce dependence on the platform channel, thereby protecting its own profit margin.

Figure 1 Numerical Simulation of the Impact of Private Label Introduction on Wholesale Price in the Resale Channel



To further validate Proposition 1, a numerical simulation (Figure 1) illustrates the relationship between the manufacturer's unit resale cost and the wholesale price under scenarios with and without private label introduction. The horizontal axis represents the unit resale cost, while the vertical axis represents the manufacturer's wholesale price in the resale channel. The results show that as the unit resale cost increases, the wholesale price rises under both private label introduction (red line) and no private label introduction (black line). However, a critical threshold c_1 is observed: to the left of c_1, private label introduction results in a lower wholesale price compared to the non-introduction case, whereas to the right of c_1, the introduction of a private label leads to a higher wholesale price.。

This finding suggests that when considering private label introduction, the e-commerce platform should carefully evaluate the manufacturer's cost structure. For manufacturers with low resale costs, introducing a private label may intensify price competition and compress the manufacturer's profit. In contrast, for manufacturers with high resale costs, private label introduction may prompt the manufacturer to raise wholesale prices, transferring costs to the platform and potentially affecting the platform's overall procurement cost and product competitiveness.

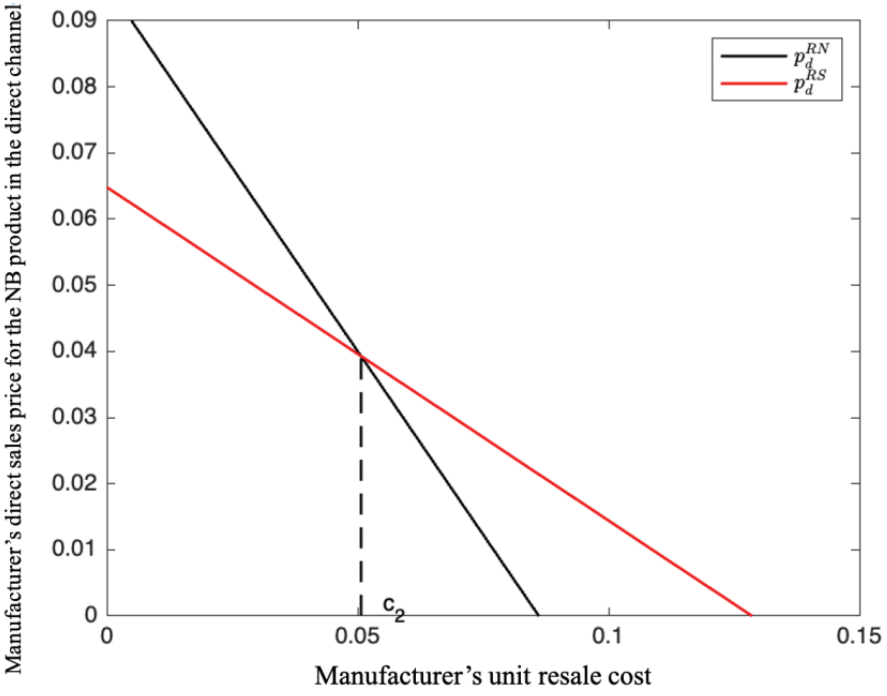
3.2 The Impact of Private Label Introduction on the Manufacturer's Pricing Strategy in the Direct Sales Channel for NB Products

This section analyzes how the introduction of a private label (Store Brand, SB) by the e-commerce platform affects the manufacturer's pricing strategy for national brand (NB) products in its self-operated direct sales channel. The results are summarized in Proposition 2.

Proposition 2: There exists a threshold c_2 such that: (1) Introducing a private label leads the manufacturer to lower the price of NB products in the direct sales channel if and only if $c < c_2$; (2) Introducing a private label leads the manufacturer to raise the price of NB products in the direct sales channel if and only if $c > c_2$.

This finding reflects the manufacturer's pricing incentives under different cost structures. When the unit cost of reselling NB products to the platform is relatively low, the introduction of a private label intensifies competition between the platform channel and the direct sales channel. To maintain sales and competitiveness in the direct channel, the manufacturer is inclined to lower the direct channel price to attract consumers. Conversely, when the unit resale cost is high, the manufacturer prefers raising the direct channel price to mitigate competitive pressure and preserve profit margins in the face of private label competition.

Figure 2 Numerical Simulation of the Impact of Private Label Introduction on NB Product Pricing in the Direct Sales Channel



To validate Proposition 2, a numerical simulation was conducted (see Figure 2). The horizontal axis represents the unit resale cost c for the manufacturer, and the vertical axis represents the selling price of NB products in the direct sales channel. The black line depicts the pricing without private label introduction, while the red line represents the pricing with private label introduction. The simulation shows that both pricing curves decline as c increases, intersecting at the critical threshold c_2. For $c < c_2$, the red line is below the black line, indicating a lower price with private label introduction; for $c > c_2$, the red line exceeds the black line, indicating a higher price with private label introduction.

These results suggest that the e-commerce platform should carefully consider the manufacturer's resale cost structure when deciding to introduce a private label. The cost structure significantly influences the manufacturer's pricing behavior in the direct sales channel and thus affects the overall competitive dynamics within the dual-channel supply chain.

3.3 The Impact of Private Label Introduction on the Manufacturer's Advertising Investment Strategy

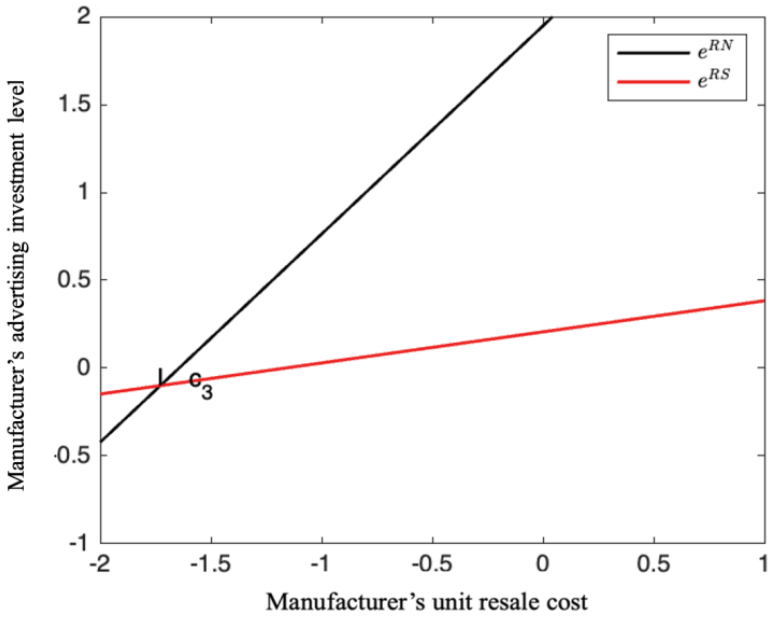
This section examines how the introduction of a private label (Store Brand, SB) by the e-commerce platform influences the manufacturer's advertising investment decision. The findings are summarized in Proposition 3.

Proposition 3: The manufacturer's advertising investment level without private label introduction is always higher than the advertising investment level with private label introduction.

This conclusion highlights the marginal effect of advertising under different competitive environments. When the platform does not introduce a private label, the manufacturer faces competition only within the NB product channel on the platform. In this context, advertising has a stronger marginal impact on increasing NB product sales and profits, thereby incentivizing the manufacturer to invest more in advertising to support sales. However, once the platform introduces a private label, the manufacturer faces intensified competition not only from the platform's private label but also from its own direct sales channel. As a result, the spillover effect of advertising diminishes, reducing its contribution to increasing sales and subsequently weakening the manufacturer's incentive to raise advertising investment.

To validate Proposition 3, a numerical simulation was conducted (see Figure 3). The horizontal axis represents the manufacturer's unit resale cost c, and the vertical axis represents the advertising investment level. The black line shows the advertising investment level without private label introduction, while the red line represents the investment level with private label introduction. The simulation shows that as c increases, the advertising investment level rises under both scenarios, but the two curves do not intersect at any point. The inequality $e^{RN*} > e^{RS*}$ holds consistently across the entire range, further validating Proposition 3.

Figure 3 Numerical Simulation of the Impact of Private Label Introduction on the Manufacturer's Advertising Investment



This result indicates that under private label introduction, the manufacturer's willingness to invest in advertising on the platform declines. Therefore, the platform should account for the potential reduction in advertising incentives and the possible impact on the overall allocation of promotional resources when formulating private label strategies.

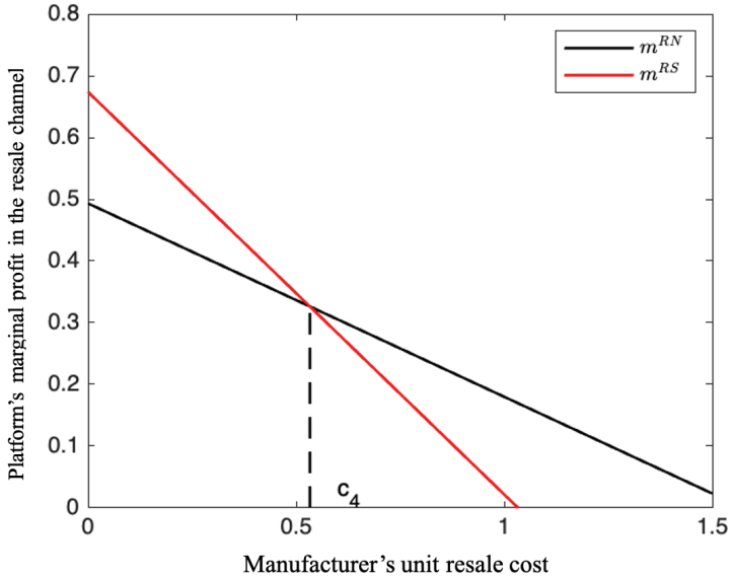
3.4 The Impact of Private Label Introduction on the E-Commerce Platform's Marginal Profit Decision in the Resale Channel

This section investigates how the introduction of a private label (Store Brand, SB) by the e-commerce platform influences its marginal profit decision regarding the resale of National Brand (NB) products, as summarized in Proposition 4.

Proposition 4: There exists a threshold c_4 such that: (1) The introduction of a private label leads the platform to increase the marginal profit in the resale channel if and only if $c < c_4$; (2) The introduction of a private label leads the platform to decrease the marginal profit in the resale channel if and only if $c > c_4$.

This conclusion reflects the platform's profit adjustment strategy under different manufacturer cost structures. When the manufacturer's unit resale cost is low, the platform can obtain greater profitability by raising the marginal profit, making private label introduction beneficial for enhancing resale channel returns. Conversely, when the manufacturer's unit resale cost is high, the platform faces rising costs and supply pressure, and thus may need to reduce the marginal profit to relieve channel pressure and maintain sales competitiveness.

Figure 4 Numerical Simulation of the Impact of Private Label Introduction on the Platform's Marginal Profit in the Resale Channel



To validate Proposition 4, a numerical simulation was conducted (see Figure 4). The horizontal axis represents the manufacturer's unit resale cost, and the vertical axis represents the platform's marginal profit in the resale channel. The black line shows the marginal profit without private label introduction, while the red line represents the marginal profit with private label introduction. The simulation results indicate that both curves decline as the unit resale cost increases, intersecting at the $_{th}$reshold c_4. For $c < c_4$, the red line is above the black line, suggesting that private label introduction increases the platform's marginal profit. For $c > c_4$, the red line falls below the black line, indicating that private label introduction instead leads to a reduction in marginal profit.

This finding suggests that when deciding whether to introduce a private label, the e-commerce platform should comprehensively consider the manufacturer's cost level and its own need to adjust channel profitability. When the manufacturer's cost is low, private label introduction can enhance the platform's bargaining power and profit margin; however, when the manufacturer's cost is high, private label introduction may intensify channel competition pressure, requiring the platform to lower marginal profits to stabilize supply chain cooperation.

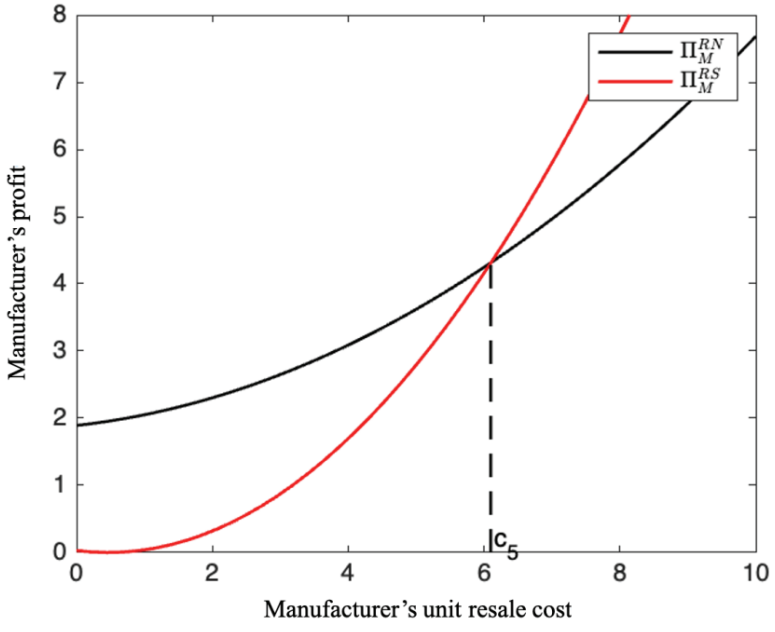
3.5 The Impact of Private Label Introduction on the Manufacturer's and Platform's Profit

This section examines how the introduction of a private label affects the profits of both the manufacturer and the e-commerce platform, as presented in Propositions 5 and 6.

Proposition 5: There exists a threshold c_5 such that: (1) The introduction of a private label reduces the manufacturer's profit if and only if $c < c_5$; (2) The introduction of a private label increases the manufacturer's profit if and only if $c > c_5$.

This result reveals that the manufacturer's profit is jointly influenced by the platform's private label introduction decision and the manufacturer's cost structure. When the manufacturer's unit resale cost is low, the marginal profit from the resale channel is relatively high. In this case, the introduction of a private label strengthens the platform's bargaining power, squeezes the manufacturer's profit margin in the resale channel, and leads to a decline in overall profit. Conversely, when the manufacturer's unit resale cost is high, the marginal profit from the resale channel is limited. To maintain channel competitiveness, the platform tends to lower the wholesale price and reduce channel margins. Under such conditions, introducing a private label alleviates downward price pressure on the manufacturer by partially substituting the resale channel with private label sales, thereby providing compensatory revenue and increasing the manufacturer's overall profit.

Figure 5 Numerical Simulation of the Impact of Private Label Introduction on the Manufacturer's Profit



To validate Proposition 5, a numerical simulation was conducted (see Figure 5). The horizontal axis represents the manufacturer's unit resale cost c, and the vertical axis represents the manufacturer's profit Π_M. The black line shows the manufacturer's profit without private label introduction, while the red line shows the profit with private label introduction. The simulation results indicate that both curves increase with rising c, intersecting at c_5. For $c < c_5$, the red line lies below

the black line, implying that private label introduction reduces the manufacturer's profit. For $c > c_5$, the red line exceeds the black line, indicating that private label introduction improves the manufacturer's profit.

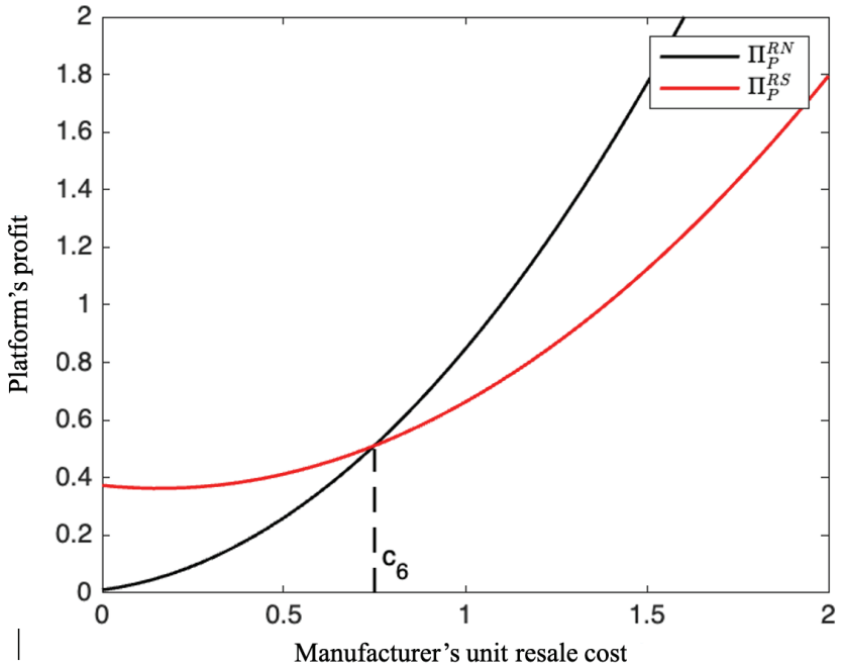
This finding suggests that when evaluating the impact of a platform's private label introduction, manufacturers should closely consider their own resale cost levels. For manufacturers with low resale costs, attention should be paid to the risk of profit compression due to private label competition. Conversely, for manufacturers with higher resale costs, private label introduction may help alleviate competitive pressure and enhance profit performance.

Proposition 6: There exists a threshold c_6 such that: (1) The introduction of a private label increases the platform's profit if and only if $c < c_6$; (2) The introduction of a private label decreases the platform's profit if and only if $c > c_6$.

This result highlights that the platform's profit is jointly influenced by the manufacturer's unit resale cost and the private label strategy. When the manufacturer's unit resale cost is low, the marginal profit from selling NB products through the resale channel is relatively high. Under such circumstances, the platform can further compress the manufacturer's bargaining power by introducing a private label, thereby enhancing its own profitability. Therefore, introducing a private label becomes a favorable strategy for boosting the platform's profit.

Conversely, when the manufacturer's unit resale cost is high, the marginal profit available from the resale channel diminishes. Even with a private label, the platform struggles to extract additional gains through price pressure. Moreover, the introduction of a private label may divert some consumer demand away from NB products toward the platform's private label (SB) products, reducing the sales and profitability of NB products and ultimately lowering the platform's overall profit. In such cases, the platform is more inclined not to introduce a private label, thereby maintaining channel stability and preserving NB product revenues.

Figure 6 Numerical Simulation of the Impact of Private Label Introduction on the Platform's Profit



To validate Proposition 6, a numerical simulation was conducted (see Figure 6). The horizontal axis represents the manufacturer's unit resale cost c, and the vertical axis represents the platform's profit Π_P. The black line shows the platform's profit without private label introduction, while the red line represents the platform's profit with private label introduction. The results indicate that both curves increase as c rises, intersecting at c_6. The figure shows that when $c < c_6$, introducing a private label improves platform profit; whereas when $c > c_6$, introducing a private label reduces platform profit, making it more beneficial for the platform to retain the original resale model.

These findings suggest that, in determining whether to introduce a private label, the platform should carefully consider the manufacturer's unit resale cost. Introducing a private label can help expand profit margins when costs are low, while refraining from introducing a private label may help avoid profit loss due to market cannibalization when costs are high.

4.Conclusion and Future Directions

This study systematically investigates the strategic choice of private label introduction by e-commerce platforms under a dual-channel environment and its impact on the supply chain. By developing game-theoretic models for two scenarios—one in which the platform introduces a private label and one in which it does not—the research provides an in-depth analysis of the optimal decision-making behavior of manufacturers and platforms regarding pricing, advertising investment, wholesale pricing, marginal profit, and profit outcomes. The study not only derives equilibrium solutions for key variables but also employs numerical simulations to visually demonstrate the influence of private label introduction on both parties' strategies and profits. The results reveal that the introduction of a private label exerts dynamic effects on the relationship between manufacturers and platforms within the supply chain, with the direction and magnitude of these effects being contingent on critical parameters such as the manufacturer's unit resale cost. Specifically, when the unit resale cost is low, introducing a private label enhances the platform's profitability while compressing the manufacturer's profit margin; conversely, when the cost is high, private label introduction may increase the manufacturer's profit while reducing the platform's profit. This study offers theoretical insights and managerial implications for e-commerce platforms in formulating appropriate private label strategies under different cost structures.

Nevertheless, several limitations remain in this research. First, the model adopts simplified assumptions regarding consumer preferences, advertising effects, and market demand, without fully accounting for consumer heterogeneity and the influence of multidimensional perceived value on purchasing behavior. Second, the analysis is based on a static game model, failing to capture the long-term dynamics and strategy evolution within the supply chain. Future research could expand in several directions: (1) incorporating consumer behavior experiments or multi-source data for empirical validation to enhance the model's practical explanatory power; (2) employing dynamic game models or multi-stage decision frameworks to explore strategy evolution and equilibrium in long-term cooperation between platforms and manufacturers; and (3) extending the model to consider multiple manufacturers and competitive multi-platform environments to analyze strategic differences and coordination mechanisms in private label introduction. These expansions are expected to further enrich the theoretical framework for private label strategies under dual-channel settings and provide more adaptive theoretical and practical guidance for supply chain management and platform decision-making.

Funding

Postgraduate Research & Practice Innovation Program of Jiangsu Province (KYCX23_1833)

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

[1] Raju J S, Sethuraman R, Dhar S K. The introduction and performance of store brands[J]. Management science, 1995, 41(6): 957-978.

[2] Chen L, Gilbert S M, Xia Y. Private labels: Facilitators or impediments to supply chain coordination[J]. Decision Sciences, 2011, 42(3): 689-720.

[3] Kuo C W, Yang S J S. The role of store brand positioning for appropriating supply chain profit under shelf space allocation[J]. European Journal of Operational Research, 2013, 231(1): 88-97.

[4] Zheng Q, Jang H, Pan X A. Store-brand introduction and multilateral contracting[J]. Manufacturing & Service Operations Management, 2022, 24(1): 467-468.

[5] Li X, Cai X, Chen J. Quality and private label encroachment strategy[J]. Production and Operations Management, 2022, 31(1): 374-390.

[6] Ma M, Siebert R B. The impact of private label introduction on assortment, prices, and profits of retailers[J]. The Journal of Industrial Economics, 2024, 72(1): 356-389.

[7] Reza-Gharehbagh R, Khouja M, Hammami R. Retailer-manufacturer partnerships in E-commerce: Dual product strategy

and market share dynamics[J]. European Journal of Operational Research, 2025, 322(1): 85-104.

[8] Bedoui Y, Jin Y, Gil J M. Price Transmission During Promotions: A Case Study of Spanish Milk Brands[J]. Agribusiness, 2024.

[9] Ru J, Shi R, Zhang J. Does a store brand always hurt the manufacturer of a competing national brand?[J]. Production and operations management, 2015, 24(2): 272-286.

[10] Liao B, Yano C A, Trivedi M. Optimizing store-brand quality: Impact of choice of producer and channel price leadership[J]. Production and Operations Management, 2020, 29(1): 118-137.

[11] Cheng R, Duan Y, Zhang J, et al. Impacts of store-brand introduction on a multiple-echelon supply chain[J]. European Journal of Operational Research, 2021, 292(2): 652-662.

[12] Gielens K, Dekimpe M G, Mukherjee A, et al. The future of private-label markets: A global convergence approach[J]. International Journal of Research in Marketing, 2023, 40(1): 248-267.

[13] Huang S, Yang C, Zhang X. Pricing and production decisions in dual-channel supply chains with demand disruptions[J]. Computers & Industrial Engineering, 2011, 62(1): 70-83.

[14] Rodríguez B, Aydın G. Pricing and assortment decisions for a manufacturer selling through dual channels[J]. European Journal of Operational Research, 2015, 242(3): 901-909.

[15] Ding Q, Dong C, Pan Z. A hierarchical pricing decision process on a dual-channel problem with one manufacturer and one retailer[J]. International Journal of Production Economics, 2016, 175197-212.

[16] Liu M, Cao E, Salifou K C. Pricing strategies of a dual-channel supply chain with risk aversion[J]. Transportation Research Part E, 2016, 90108-120.

[17] Chen J, Liang L, Yao D Q, et al. Price and quality decisions in dual-channel supply chains[J]. European Journal of Operational Research, 2017, 259(3): 935-948.

[18] Zhou Y W, Guo J, Zhou W. Pricing/service strategies for a dual-channel supply chain with free riding and service-cost sharing[J]. International Journal of Production Economics, 2018, 196: 198-210.

[19] Chu Q, Zhang Z, Wu T J, et al. Interaction between online retail platforms' private label brand introduction and manufacturers' channel selection[J]. Journal of Retailing and Consumer Services, 2025, 84: 104208.

[20] Zha Y, Ren L, Li Q. Cooperation or coopetition? Online platforms' private label products encroachment and brand manufacturers' pricing model selection[J]. Journal of Modelling in Management, 2025.

[21] Paha J. Wholesale Pricing with Asymmetric Information About the Quality of a Private Label[J]. Review of Industrial Organization, 2025, 66(1): 71-88.

[22] Fuduric M, Varga A, Horvat S, et al. The ways we perceive: A comparative analysis of manufacturer brands and private labels using implicit and explicit measures[J]. Journal of Business Research, 2022, 142: 221-241.

[23] Mao Z, Duan Y, Liu W. Consumers' choice of private label considering reference price and moderating effect[J]. Journal of Retailing and Consumer Services, 2023, 71: 103216.

[24] Choi S C, Turut O. National brand's competition with premium private labels: The role of context-dependent preferences[J]. Journal of Business Research, 2023, 165: 114038.