



Research article

Leveraging live streaming for effective platform encroachment: Overcoming product quality disadvantages

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Abstract: In this paper, we examined the interaction between live streaming investment and store-brand (SB) encroachment in a supply chain comprising a national-brand manufacturer and an e-commerce platform. By developing a game-theoretic model, we analyzed how the platform utilizes live streaming to enhance the perceived quality of its SB and the subsequent strategic response from the manufacturer regarding wholesale pricing. Our analysis characterized three distinct equilibrium regimes: no encroachment, false encroachment, and substantive encroachment. Unlike studies that explain false encroachment through information asymmetry or manufacturer technology investment, we show that platform-controlled live-streaming investment can generate and reshape false encroachment by improving the SB's perceived quality and changing the encroachment thresholds. The results demonstrated that live streaming investment significantly elevates the cost threshold for encroachment and expands the feasible region for substantive encroachment. Notably, the impact of live streaming effort on the manufacturer's wholesale price is non-monotonic, reflecting a complex trade-off between the market expansion effect and the cannibalization effect. Furthermore, we derived the optimal live streaming effort in the extended analysis. Extended analyses also revealed that sales formats (reselling vs. agency selling) and pricing sequences (sequential vs. simultaneous) critically moderate the platform's encroachment incentives. Specifically, under agency selling, a higher commission rate strengthens the platform's incentive to introduce an SB, while simultaneous pricing facilitates the emergence of substantive encroachment. These findings provide a theoretical framework for platforms to optimize resource allocation between marketing investments and product positioning strategies.

Keywords: live streaming e-commerce; platform store brand; encroachment strategy; perceived quality; cost threshold

Mathematics Subject Classification: Primary: 91A65; Secondary: 90B06, 91A80

1. Introduction

Digital platforms are increasingly evolving from pure intermediaries into hybrid retailers by introducing store brands (SBs), commonly referred to as private labels in the retailing literature, that directly compete with national brands (NBs). Compared with acting solely as resellers, introducing SBs enables platforms to improve profit margins, strengthen bargaining power over upstream manufacturers, and gain greater control over product portfolios [1,2]. Consequently, platform encroachment through store brands has become an important strategic issue in supply chain management. This trend has accelerated rapidly in recent years. Leading retailers and digital platforms have continuously expanded their store-brand portfolios, including Amazon Basics, Walmart's Great Value, and JD.com's Jingzao, highlighting the growing role of store brands in platform competition. Some digital platforms have also begun promoting their store-brand products through live streaming channels. These practices suggest that live streaming may serve not only as a sales channel but also as a strategic instrument for developing and positioning platform-owned brands.

However, store brands face substantial challenges in competing with established national brands. Unlike established national brands, which benefit from long-term brand reputation and consumer trust, newly introduced store brands may face a perceived-quality disadvantage [3]. This perceived quality disadvantage remains a major obstacle to consumers' adoption of store brands, particularly for products whose quality cannot be fully evaluated before purchase. Recent market evidence further confirms this challenge. According to the 2025 EY Future Consumer Index, 48% of global consumers are willing to switch back from store brands to national brands when product performance and reliability become important purchasing considerations [4]. Therefore, improving consumers' perceived quality has become a critical strategic issue for the success of platform store brands.

To overcome this quality disadvantage, digital platforms have increasingly adopted live streaming as an emerging marketing tool. Industry evidence also demonstrates the growing importance of live stream shopping. Amazon reports that 90% of Amazon Live shoppers surveyed discovered a new product while watching a live stream, whereas Walmart reported that its first TikTok shoppable live stream generated seven times more views than anticipated and increased its TikTok followers by 25% [5,6]. Unlike traditional advertising, live streaming enables real-time product demonstrations, interactive communication, and immediate consumer feedback, thereby reducing information asymmetry and product quality uncertainty [7,8]. These characteristics suggest that live streaming may provide platforms with a strategic instrument to reduce the perceived-quality disadvantage of store brands. However, despite the rapid growth of live stream commerce, little is known about how live streaming affects platforms' store-brand encroachment decisions and manufacturers' strategic responses within supply chains. This issue is particularly important in platform markets, where platforms simultaneously sell national-brand products and develop their own store brands.

Motivated by the aforementioned practices, our research is an effort to address the following research questions:

(1) When e-commerce platforms introduce SB through live streaming marketing, how should manufacturers formulate wholesale pricing strategies to balance the trade-off between revenue gains and cost constraints?

(2) When a platform uses live streaming to support the introduction of its SB, how should it determine the optimal level of live-streaming investment under different levels of SB base quality?

(3) Is live streaming an effective tool for enhancing platforms' bargaining power or a competitive strategy against NB? Specifically, under what boundary conditions can live streaming effectively improve platforms' bargaining power in the supply chain?

To answer these questions, we develop a game-theoretic model of a supply chain consisting of a national-brand manufacturer and an e-commerce platform. The platform resells the NB product supplied by the manufacturer and may introduce its own SB. This setting reflects the dual role of major e-commerce platforms, which often serve as retailers of national brands and owners of private-label products. Because a newly introduced SB may lack the brand reputation and consumer trust enjoyed by an established NB, the platform can use live streaming to improve consumers' perceived quality of the SB. The manufacturer responds to the platform's potential encroachment through its wholesale-pricing decision.

This setting captures the main features of the practical context described above. Depending on the SB's production cost and perceived quality after live-streaming investment, the platform may choose no encroachment, false encroachment, or substantive encroachment. In the false-encroachment region, the platform introduces the SB as a credible competitive threat even though the SB obtains no positive equilibrium sales.

Our analysis shows that live streaming expands the feasible region of substantive encroachment by enhancing the perceived quality of store brands. Contrary to the conventional wisdom that store-brand encroachment inevitably cannibalizes national-brand sales, we show that national-brand sales may increase under certain conditions owing to manufacturers' strategic wholesale pricing responses. We further find that live streaming strategies are not always beneficial to the platform and that manufacturers' wholesale pricing responses are non-monotonic. Finally, although store-brand encroachment generally reduces manufacturers' profits, manufacturers may also benefit when the store brand's production cost and live streaming effort fall within specific ranges.

This study contributes to the literature in three important ways. First, we incorporate platform-controlled live-streaming investment into the analysis of store-brand encroachment and model its effect on the perceived quality of the SB. Second, we identify a mechanism of false encroachment that differs from other studies such as that by Yu et al. (2023). While Yu et al. (2023) focused on manufacturer technology investment under information asymmetry, we show how platform-controlled live streaming can generate and reshape false encroachment by improving the SB's perceived quality and changing the encroachment thresholds. Third, we link the platform's live-streaming decision with the manufacturer's wholesale-pricing response. Our results show that the effects of live streaming are not uniformly positive and depend on the SB's initial perceived quality, production cost, and live-streaming effectiveness.

The rest of this study is organized as follows: In Section 2, we review the related literature. In Section 3, we construct the model. We analyze and compare the SB encroachment strategies with and without live streaming in Section 4. In Section 5, we discuss some extensions. In Section 6, we conclude this paper. All proofs are provided in the Appendix.

2. Literature review

The research literature related to this paper mainly focuses on three aspects: 1. SB encroachment impact. 2. Consumer perceived quality. 3. Pricing strategies in live streaming.

2.1. SB encroachment impact

The rapid expansion of digital platforms has transformed store brands from traditional low-price substitutes into powerful strategic instruments within modern retail ecosystems. Unlike store brands in brick-and-mortar retailing, platform-based store brands (SBs) are supported by data-driven traffic allocation, algorithmic recommendation systems, and control over information display. These institutional advantages enable platforms to influence market competition more directly and shape manufacturers' pricing and channel strategies. The literature on platform SBs can be broadly categorized into three research streams. A first stream examines the equilibrium conditions and strategic consequences of SB encroachment. Studies also demonstrate that consumer preference structures and product quality positioning critically determine whether platform entry into store brand is profitable [9,10]. Building on this perspective, several studies model the interaction between platforms and manufacturers using Stackelberg frameworks, showing that although SB entry typically reduces manufacturer profits, it may alleviate double marginalization and alter equilibrium pricing outcomes [11,12]. While these studies provide important insights into encroachment incentives, they generally treat product quality perception and competitive intensity as exogenous factors. A second stream highlights the role of platform governance mechanisms in shaping competitive dynamics. Platforms can strategically allocate traffic, adjust information visibility, and utilize recommendation algorithms to shift demand toward their store brands [13,14]. Such governance tools affect not only market exposure but also manufacturers' expectations regarding demand and competitive pressure, often inducing defensive pricing or inefficient channel decisions [15,2]. Yu et al. [16] examined false encroachment through the lens of manufacturer technology investment under information asymmetry. In their setting, the manufacturer's investment affects the competitive relationship between the NB and the SB and thereby influences the platform's encroachment incentive. Here, we focus on a different strategic mechanism. We consider a platform that chooses live-streaming investment to improve consumers' perceived quality of the SB. This investment changes the SB's competitive position and shifts the thresholds separating no encroachment, false encroachment, and substantive encroachment. Thus, while Yu et al. (2023) explained false encroachment through manufacturer technology investment, we show how platform-controlled marketing investment can generate and reshape false encroachment through perceived-quality improvement.

A third stream investigates the role of promotional activities in enhancing SB market penetration. Researchers typically model promotions as static instruments such as coupon discounts or fixed marketing expenditures [17,7]. These approaches capture short-term demand stimulation but overlook emerging digital marketing formats that can continuously influence consumer perception and demand formation. Taken together, the literature highlights the strategic importance of platform SBs but largely treats marketing activities and quality perception as exogenous elements. In particular, little is known about how emerging marketing tools such as live streaming reshape consumers' quality perceptions and influence the strategic boundaries of platform encroachment. Yan et al. (2024) investigated the interaction between manufacturer encroachment and retailer promotion strategies, revealing that

promotional activities can influence upstream firms' encroachment decisions by changing market demand and competitive conditions [18]. Chang et al. (2023) investigated the interaction between supplier encroachment, strategic inventory, and information sharing under demand information asymmetry. Their findings revealed that operational strategies and information structures significantly influence encroachment decisions, highlighting the importance of considering multiple strategic factors in supply chain competition [19].

Despite the growing literature on platform SB encroachment, important gaps remain. Researchers mainly treat product quality perception and competitive intensity as exogenous, focusing on the conditions and consequences of SB entry [9,10,12]. Platform governance studies further emphasize traffic allocation and information control, but largely overlook how platforms can strategically reshape consumers' perceived SB quality [13,1]. Moreover, promotion studies typically model static instruments such as coupons or fixed marketing expenditures, emphasizing demand stimulation rather than quality perception [17,20]. Consequently, the mechanism through which dynamic digital marketing tools reshape the strategic boundaries of platform encroachment remains underexplored. Our study bridges these streams by modeling livestreaming effort as a strategic instrument that enhances perceived SB quality, thereby affecting the platform's encroachment incentive and the manufacturer's wholesale-pricing response. This extends encroachment research from exogenous quality positioning to perception-driven competition and broadens livestreaming research from demand stimulation to vertical strategic competition.

2.2. Consumer perceived quality

In digital retail markets characterized by severe information asymmetry, consumers cannot directly observe product quality and must instead infer it from observable signals. Consequently, product quality perception becomes a subjective construct formed through external cues such as price, information presentation, and social feedback. Research widely recognizes information asymmetry as a fundamental constraint shaping consumer decision-making, as it amplifies perceived uncertainty and risk and thereby influences purchase behavior [21]. Within this environment, firms and platforms actively manage quality signals to reduce uncertainty and guide consumer evaluation processes [22].

Beyond serving as passive indicators, quality signals increasingly function as strategic instruments in platform-dominated markets. Platforms can actively shape consumer beliefs through governance mechanisms such as recommendation algorithms, information display optimization, and strategic brand labeling [23,24]. By controlling the visibility and framing of product information, platforms influence consumers' relative quality benchmarks and redirect demand across competing brands [25,26]. This strategic manipulation becomes particularly salient when platforms introduce store brands (SBs). Studies show that SBs do not compete solely through price but also operate as quality signals that alter consumers' expectations about brand positioning. As a result, national brand manufacturers may adjust their pricing and quality investment strategies in response to platform encroachment [27,28]. These findings highlight that product quality perception is not an exogenous attribute but an endogenous strategic variable that platforms can leverage to influence brand substitution and channel competition [29,25]. Wu et al. (2025) investigated how perceived quality information prediction and sharing strategies affect supply chain decisions under information uncertainty, demonstrating that effective information management can improve firms' decision-making and profitability [30].

Studies establish that information asymmetry makes perceived product quality an important determinant of consumer decisions, while firms and platforms can use quality-related information to reduce uncertainty and shape consumer evaluations [31,32]. In platform markets, research further shows that recommendation algorithms, information presentation, and other governance mechanisms can strategically influence consumer beliefs and demand allocation [23,24]. Studies on SB competition also recognize perceived quality as a strategic factor affecting brand substitution and manufacturers' responses to platform encroachment [27,28]. However, research mainly considers relatively static or structural quality signals and provides limited insight into how interactive digital marketing can actively reshape perceived quality. We address this gap by modeling livestreaming effort as a strategic mechanism to enhance perceived SB quality and examine its implications for platform encroachment and supply-chain competition.

2.3. Live streaming and consumer decision-making

Live streaming e-commerce, which emerges from the deep integration of social media broadcasting and online retailing, has become a prominent innovation in digital commerce enabled by real-time interactive technologies. Unlike traditional e-commerce formats that rely primarily on static images or pre-recorded videos, live streaming embeds synchronized product demonstrations, real-time explanations, and instant two-way communication into the shopping process. Through these features, live streaming fundamentally reshapes how consumers acquire product information and experience online shopping. Research highlights that real-time interactivity represents the defining characteristic distinguishing live streaming e-commerce from traditional online retail. By combining entertainment content, social interaction, and consumption behavior within a single contextual environment, live streaming reconstructs consumers' shopping journeys and strengthens engagement with retail platforms [33,34]. As a result, firms increasingly adopt live streaming as an important channel innovation to enhance brand visibility, stimulate consumer participation, and improve sales conversion. Empirical evidence further indicates that live streaming has rapidly diffused across global markets and has become a critical component of modern digital retail ecosystems, reshaping firms' marketing strategies and competitive positioning [13,1]. The emergence of live streaming has also fostered new forms of collaboration among platforms, brands, and streamers, gradually forming multi-layered supply and promotion networks that significantly influence the organizational structure of online retail markets [35,36].

Beyond its technological novelty, live streaming e-commerce systematically affects consumer decision-making by altering how product information is processed and evaluated. Compared with traditional online retail environments, live streaming integrates product demonstration, information explanation, and consumer feedback within a real-time interactive setting, thereby significantly transforming consumers' cognitive environment and decision pathways. Studies show that the high visibility and interactive presentation of products in live streams help consumers construct clearer cognitive representations of product attributes, reducing uncertainty, and strengthening purchase intentions.

In addition to information processing, the experiential dimension of live streaming plays an important role in shaping consumer behavior. The immersive and socially interactive nature of live shopping environments enhances consumers' sense of presence and emotional engagement, fostering trust, and strengthening their identification with products or brands [37]. Moreover, entertainment value,

interactive participation, and streamer popularity further increase perceived utilitarian and hedonic value, influencing purchase decisions through cognitive and emotional pathways [7]. The temporal characteristics of live streaming also influence consumer decision dynamics. Time-limited promotions and real-time interactions compress consumers' decision windows, encouraging faster purchasing decisions and reducing the likelihood of cross-platform comparisons or delayed choices [38,39]. In this context, emotional arousal and perceived value often mediate the relationship between live stream attributes and purchase intentions. Moreover, trust in streamers and emotional attachment to live content can simplify consumers' evaluation processes, reducing cognitive effort and accelerating purchasing behavior. Wang (2025) studied the role of live-stream channels in dual-channel supply chains and found that dynamic commission mechanisms can coordinate interactions among manufacturers, retailers, and streamers while influencing pricing decisions and profit distribution [40].

Research on live streaming e-commerce primarily emphasizes its effects on consumer engagement, information processing, trust, emotional responses, and purchase intention [33,7]. Other researchers examine live-stream channels from a supply-chain perspective, focusing on channel coordination, commission mechanisms, pricing, and profit distribution [40]. However, this literature largely views live streaming as a channel or demand-enhancing mechanism, paying limited attention to its role in reshaping consumers' perceptions of product quality and consequently altering competitive interactions among supply-chain members. In particular, studies do not sufficiently explain how a platform's livestreaming investment can strengthen the perceived quality of its SB and influence its encroachment strategy. We extend live-streaming research by linking livestreaming effort to perceived quality, SB competition, and vertical pricing decisions, thereby revealing its broader strategic role beyond demand stimulation and channel coordination.

Table 1. A brief view of the reviewed literature.

Researches	SB introduction	Live streaming	Service effort	Encroachment strategy	Quality
Zhang et al. [28]	√	—	—	√	√
Li et al. [1]	√	√	√	—	—
Hemmati et al. [41]	√	√	√	—	√
Yu et al. [16]	√	√	—	√	—
Xiao et al. [25]	√	—	—	√	√
Chen et al. [7]	—	√	√	—	—
Chu et al. [11]	√	—	—	√	—
Zha et al. [35]	√	√	—	—	—
This study	√	√	√	√	√

Table 1 compares this study with the literature along five dimensions. Relative to other research, our study is distinctive in three aspects: (i) incorporating live-streaming marketing into the analysis of platform SB encroachment; (ii) accounting for the SB's introduction, marginal production cost, and

perceived-quality decision; and (iii) we take the platform's perspective to examine how live-streaming investment changes the boundaries among no encroachment, false encroachment, and substantive encroachment. In contrast, most studies treat quality as exogenously given or analyze encroachment defense solely from the manufacturer's viewpoint [16]. Our work reveals the strategic role of live streaming as an endogenous quality-enhancing tool in platform competition.

3. Model setting

We consider a supply chain consisting of one national-brand manufacturer and one e-commerce platform. The manufacturer sells the national-brand (NB) product to the platform at a wholesale price w , and the platform resells the NB product to consumers. The platform may introduce a store-brand (SB) product that competes with the NB.

We focus on the platform's live-streaming investment in the SB. A newly introduced SB generally has less brand recognition and consumer trust than an established NB. Product demonstrations and real-time information disclosure can reduce consumers' uncertainty about the SB and improve its perceived quality. Accordingly, we model live streaming as a platform investment that enhances the SB's perceived quality. This focus does not imply that NB manufacturers do not use live streaming or that the platform promotes only SB products through this channel. Rather, we isolate the platform's live-streaming investment in the SB to examine how it affects the platform's encroachment decision and the manufacturer's wholesale-pricing strategy. The NB's established brand reputation and baseline marketing support are reflected in its initial perceived quality.

Consumers differ in their willingness to pay for product quality [21]. Following Zhou et al. [42] and Hemmati et al. [41], we assume that the SB has a lower initial perceived quality than the NB [43]. Specifically, the initial perceived quality of the NB is normalized to 1. Additionally, a_0 represents the SB's base perceived quality relative to the NB, where $0 < a_0 < 1$. This assumption captures the initial perceived-quality disadvantage of a newly introduced SB rather than a universal difference in physical product quality. Established NBs typically benefit from stronger brand recognition, consumer familiarity, and accumulated trust. As a result, consumers may perceive an established NB as more reliable than a newly introduced SB, even when their physical product qualities are similar [44].

Let θ denote a consumer's sensitivity to product quality. Accordingly, the quality-related valuation of the NB is θ , while that of the SB is θa_0 . We use the same quality-sensitivity parameter for both brands because the purpose of the model is to isolate the effect of differences in perceived product quality [8,45]. As such, if the two brands were assigned different consumer sensitivity parameters, the demand difference would reflect perceived quality and brand-specific sensitivity, making it difficult to identify how live streaming affects the SB's perceived-quality disadvantage. This specification follows the standard vertical-differentiation framework and avoids conflating quality differences with heterogeneous consumer responses to brands.

The platform can use live streaming to reduce consumers' uncertainty about the SB through product demonstrations, real-time explanations, and interactive communication. Importantly, live streaming does not improve the SB's physical or manufacturing quality. Instead, it changes how consumers evaluate the product. Thus, the term $a_0 + \lambda s$ represents the SB's perceived quality after live-streaming investment rather than its actual product quality, where s denotes the platform's live-streaming effort and λ is the live streaming quality conversion coefficient, capturing the efficiency of live streaming in boosting perceived quality.

We assume that the perceived-quality improvement generated by live streaming remains within the vertically differentiated range, that is, $0 < a_0 + \lambda s < 1$. This condition preserves vertical differentiation between the two brands while enabling live streaming to narrow the initial perceived-quality gap. Moreover, if live streaming raises the SB's perceived quality above that of the NB, the SB would become the higher-perceived-quality product, which represents a different market setting beyond the scope of this study.

The cost structure includes the marginal production costs and the cost of live streaming investment [46]. The manufacturer incurs a unit production cost c_n for the NB, while the platform incurs a unit production cost c_s for the SB. Due to production expertise and scale economies of the manufacturer, $c_n < c_s$. We normalize $c_n = 0$, which is common in the literature. To simplify the analysis and concentrate on the endogenous impact of live streaming on perceived quality, the live streaming cost function is convex: $C(s) = \frac{s^2}{2}$, reflecting increasing marginal costs of live streaming investment.

We do not introduce a fixed cost for launching the SB. The distinction between false and substantive encroachment is instead based on whether the SB obtains positive equilibrium demand. As shown below, an SB may generate zero sales while affecting the manufacturer's wholesale-pricing decision because its potential introduction constitutes a credible competitive threat.

The sequence of events for the baseline model (with exogenous live streaming effort s) is as follows (see Figure 1): First, the manufacturer sets the wholesale price w for the NB product. Second, after observing w , the platform decides whether to introduce an SB. Conditional on launching the SB, the platform simultaneously determines the retail price of NB p_n and the retail price of SB p_s , while the live streaming effort s is treated as an exogenous fixed parameter rather than an endogenous decision variable of the platform. Finally, consumers make purchasing decisions based on retail prices and perceived qualities, and market demand is realized. To verify the robustness of the main findings, the later extensions endogenize live streaming effort as a platform decision variable and analyze alternative pricing sequences, including simultaneous pricing.

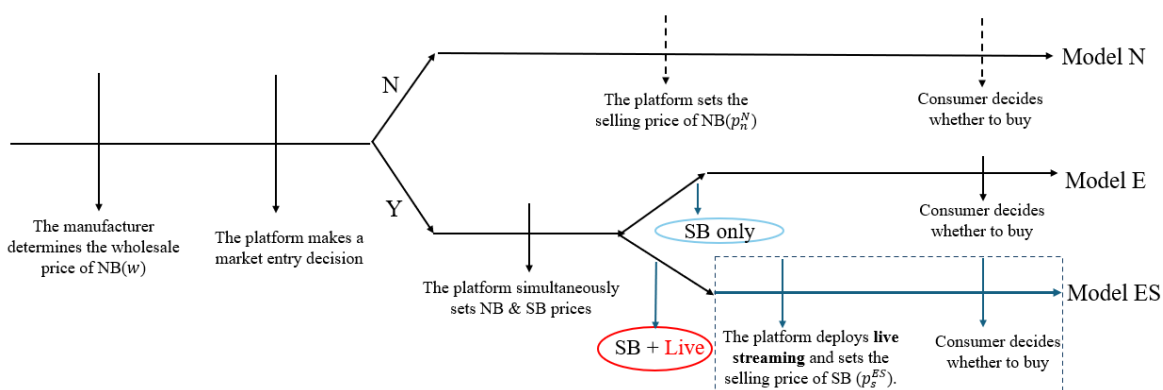


Figure 1. The sequence of events.

We use linear utility functions to describe consumer purchase behavior. The utility of purchasing the national brand (NB) is $u_n = \theta - p_n$ and that from purchasing the store brand (SB) is $u_s = \theta(a_0 + \lambda s) - p_s$. Setting $u_n = 0$ gives the indifference point for purchasing NB: $\theta_1 = p_n$. Similarly,

$u_s = 0$ yields the indifference point for SB: $\theta_2 = \frac{p_s}{a_0 + \lambda s}$. The condition $u_n = u_s$ determines the point at which consumers are indifferent between NB and SB, leading to $\tilde{\theta} = \frac{p_n - p_s}{1 - (a_0 + \lambda s)}$. Let $\tilde{U} = u_n(\tilde{\theta}) = u_s(\tilde{\theta}) = \tilde{\theta} - p_n = \tilde{\theta}(a_0 + \lambda s) - p_s$ denote the utility level of the marginal consumer who is indifferent between the NB and the SB; this threshold serves as a critical benchmark for market segmentation, as consumers with $\theta > \tilde{\theta}$ purchase the NB, while those with $\theta_2 < \theta < \tilde{\theta}$ purchase the SB, based on the relative magnitudes of θ_1 , θ_2 , and $\tilde{\theta}$.

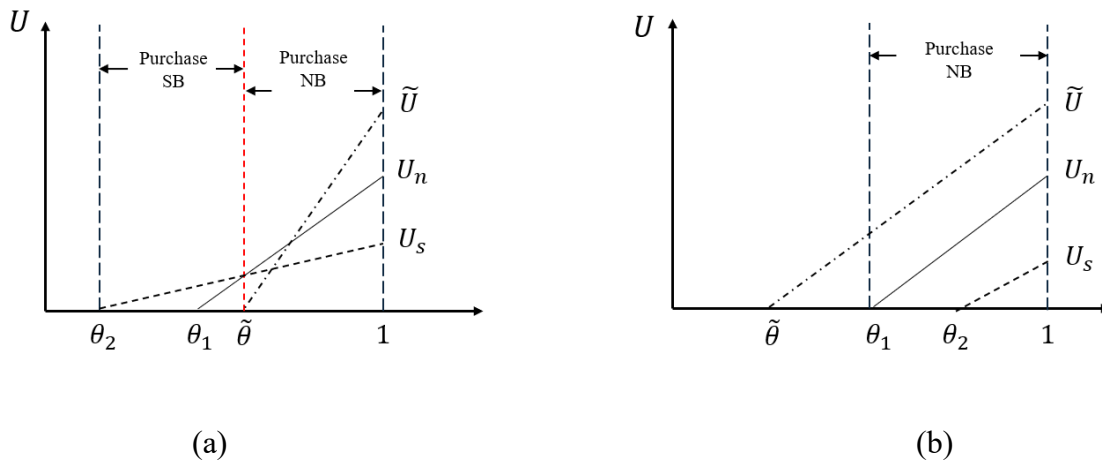


Figure 2. Demand analysis for the platforms under different consumer valuations (i.e., θ_1 , θ_2).

As shown in Figure 2, when the platform introduces its store brand (SB) with live streaming promotion, consumer purchase behavior is divided into the following regimes based on valuation intervals: (a) SB has positive demand, and NB and SB coexist: If $0 < \theta_2 < \theta_1 < \tilde{\theta} < 1$ (i.e., $\frac{p_s}{a_0 + \lambda s} < p_n < p_s + [1 - (a_0 + \lambda s)]$), consumers with valuations in $[\tilde{\theta}, 1]$ purchase NB, and those in $[\theta_2, \tilde{\theta}]$ purchase SB. As shown in Figure 2(a), the demand functions are: $Q_n = 1 - \tilde{\theta} = 1 - \frac{p_n - p_s}{1 - (a_0 + \lambda s)}$, $Q_s = \tilde{\theta} - \theta_2 = \frac{p_n - p_s}{1 - (a_0 + \lambda s)} - \frac{p_s}{a_0 + \lambda s}$. (b) SB has no demand (false encroachment). If $0 < \tilde{\theta} < \theta_1 < \theta_2 < 1$ (i.e., $p_n < \frac{p_s}{a_0 + \lambda s}$), NB generates only actual demand, while SB exists merely as a potential competitive threat. As shown in Figure 2(b), the demand functions are: $Q_n = 1 - \theta_1 = 1 - p_n$, $Q_s = 0$. (c) If $\tilde{\theta} < 0$ and $\theta_1 < \theta_2$ (i.e., $p_n < \frac{p_s}{a_0 + \lambda s}$ and $\theta_2 \geq 1$), the SB's price-quality ratio is so unfavorable that no consumer finds it worthwhile to purchase the SB. In this case, the SB fails to attract any demand, and the market is fully covered by the NB.

Live streaming can influence consumer demand through multiple channels, including perceived-quality improvement, information disclosure, social interaction, entertainment, consumer engagement, impulse purchasing, and network externalities. We focus on the perceived-quality channel. This focused specification enables us to identify how live streaming compensates for the SB's initial

perceived-quality disadvantage and changes the platform's encroachment incentives and the manufacturer's wholesale-pricing response.

We abstract from the social-interaction and impulse-purchase effects of live streaming and do not introduce a separate live-streaming investment by the NB manufacturer in the baseline model. Adding these elements would create a bilateral investment competition problem and would make it difficult to isolate the perceived-quality mechanism that is central to our research question. The omission does not imply that these effects are unimportant; rather, they define the scope of this model.

Table 2. Notations.

Symbol	Description
π_M^i	Profit of the manufacturer under scenario i
π_P^i	Profit of the platform under scenario i
θ	Consumers' quality sensitivity
c_j	Unit production cost associated with product j
λ	Live-stream intensity sensitivity coefficient
Q_j	Demand quantity of product j in the market
s	Live-stream effort level for store-brand products
α	Commission rate charged by the platform
a_0	Base quality level of the store-brand product
$j \in \{n, s\}$	Product index for NB and SB, respectively
p_j	Retail price of product j
w	Wholesale price charged for the NB product

4. Analysis

In this section, we analyze the platform's encroachment decisions under three models. Model N serves as the benchmark, in which the platform does not introduce a store brand and sells only the national brand. Model E considers the case where the platform introduces a store brand without live streaming, enabling us to examine the strategic role of encroachment in the absence of live streaming. Model ES extends Model E by incorporating live streaming as a marketing tool for the store brand, enabling us to investigate how live streaming reshapes the platform's encroachment strategy and its interaction with the manufacturer.

4.1. No store brand introduced (Model N)

We first consider the benchmark case where the platform does not introduce a store brand (SB). In this case, the profit functions of the platform and the manufacturer are given by:

$$\pi_P^N = (p_n^N - w^N)Q_n^N, \quad (1)$$

$$\pi_M^N = w^N Q_n^N. \quad (2)$$

The equilibrium strategies are $w^N = \frac{1}{2}$, $p_n^N = \frac{3}{4}$, $\pi_P^N = \frac{1}{16}$, $\pi_M^N = \frac{1}{8}$.

4.2. Introduce store brand without live streaming (Model E)

The platform determines the retail prices of the SB denoted by p_s^E and the NB denoted by p_n^E . Given these prices, consumers make purchasing decisions and the corresponding sales quantities Q_s^E and Q_n^E are realized. Therefore, the platform chooses p_n^E and p_s^E to maximize its profit:

$$\pi_P^E = (p_n^E - w^E)Q_n^E + (p_s^E - c_s^E)Q_s^E. \quad (3)$$

Maximizing the above profit will yield the platform's optimal selling quantities as follows: (Q_n^{E*}, Q_s^{E*})

$$= \begin{cases} \left(\frac{1-w}{2}, 0\right), & \text{if } w \geq w^E = \frac{1+c_s}{a_0} - 1, \\ \left(1 - \frac{1+w-a_0-c_s}{2(1-a_0)}, \frac{1+w-a_0-c_s}{2(1-a_0)} - \frac{a_0+c_s}{2a_0}\right), & \text{if } w < w^E = \frac{1+c_s}{a_0} - 1. \end{cases} \quad (4)$$

Based on the platform's response function, the manufacturer decides the wholesale price w to optimize his profit:

$$\pi_M^E(w) = \begin{cases} w \cdot \frac{1-w}{2}, & \text{if } w \geq w^E = \frac{1+c_s}{a_0} - 1, \\ w \cdot \left(1 - \frac{1+w-a_0-c_s}{2(1-a_0)}\right), & \text{if } w < w^E = \frac{1+c_s}{a_0} - 1. \end{cases} \quad (5)$$

Solving the above optimization problem, we can obtain the manufacturer's optimal wholesale price and other results. Proofs and thresholds for the main results are given in the Appendix.

Proposition 1. When $0 \leq c_s < c_{s1}^E$, the platform should introduce SB with positive sales, which represents substantive encroachment. When $c_{s1}^E < c_s \leq 1$, the platform should never introduce SB, and no encroachment occurs. When $c_{s2}^E \leq c_s \leq c_{s1}^E$, the platform should introduce SB, but the equilibrium sales of SB are zero, which results in false encroachment. In addition, $\frac{\partial c_{s1}^E}{\partial a_0} < 0$, $\frac{\partial c_{s2}^E}{\partial a_0} > 0$.

Proposition 1 shows that the platform's equilibrium encroachment choice depends on the unit production cost c of SB. For relatively high unit production costs of the store brand (SB), that is, when $c_{s1}^E < c_s \leq 1$, the platform will not introduce the SB in equilibrium. In this region, the SB lacks cost-effectiveness: Launching the SB not only fails to generate incremental profit but also increases the platform's operational burden. Consequently, the "encroachment threat" is not credible. The platform exclusively resells the national brand (NB), and the market structure is identical to the benchmark case without SB introduction. Accordingly, the manufacturer has no incentive to offer wholesale price concessions. When $0 \leq c_s < c_{s2}^E$, the SB's cost disadvantage is sufficiently small. Combined with its base quality a_0 and cost advantage, the platform will always introduce the SB to capture part of the market share. In this case, the equilibrium wholesale price increases with the SB's unit production cost c , yet it remains strictly lower than the wholesale price in the absence of SB introduction. This implies that, to prevent the SB from significantly reducing the platform's ordering incentive for the NB, the manufacturer must lower the wholesale price as a strategic concession.

When $c_{s2}^E \leq c_s \leq c_{s1}^E$, an increase in the wholesale price, relative to the no-SB benchmark, paradoxically stimulates the platform to increase its order quantity. Our findings are consistent with those documented in the literature. Notably, when the SB's unit production cost lies within this intermediate range, the equilibrium demand for the SB is still zero; however, the platform's optimal decision differs from that in the benchmark case without the SB. This theoretical logic is well reflected in the operational practice of mainstream retail platforms such as Costco and Amazon, which often retain the layout of potential store brand product lines without large-scale sales, forming a typical false encroachment layout to constrain the pricing of national brand suppliers.

The expression “extremely low sales” in this paper is interpreted from a practical business perspective. In reality, an introduced SB would typically generate at least some minimal level of sales, even if negligible in magnitude. We model this scenario as false encroachment, where equilibrium sales are zero. The strategic rationale is that the platform uses the mere presence of the SB as a threat to induce the manufacturer to lower the wholesale price, even without intending to sell the SB. This contrasts with substantive encroachment, where the SB achieves positive sales and directly competes with the national brand. Analytical results show that, in this region, the wholesale price is lower than that under no encroachment. Hence, even a “false encroachment” strategy exerts a negative externality on the manufacturer, forcing it to reduce the wholesale price; otherwise, the SB would obtain positive demand. Moreover, in this interval, the platform's order quantity decreases as c increases. The intuition is as follows: The higher the SB's encroachment cost, the easier it is for the manufacturer to deter substantive encroachment. As a result, the manufacturer can raise the wholesale price without substantially weakening the platform's incentive to introduce the SB. Within this region, the platform nominally introduces the SB, but its equilibrium sales remain zero. By strategically adopting a “false encroachment” posture, the platform induces a reduction in the wholesale price and thereby improves its own profit. Although the manufacturer suffers from the lower wholesale price, it successfully avoids the larger loss that would arise if the NB were substantially substituted by the SB.

In summary, as long as the SB's unit production cost disadvantage is not significant (i.e., $c_s \leq c_{s2}^E$), the platform should choose to encroach. Importantly, the unit production cost thresholds (c_{s2}^E, c_{s1}^E) can be equivalently transformed into quality thresholds for the SB. That is, as long as the SB's quality disadvantage is not substantial, the platform has an incentive to introduce it. However, even when a low-quality SB enjoys relatively high production efficiency, the platform's incentive to introduce such a product remains limited.

Table 3. Equilibrium outcomes in model E.

	$0 \leq c_s < c_{s2}^E$	$c_{s2}^E \leq c_s \leq c_{s1}^E$	$c_{s1}^E < c_s \leq 1$
w^E	$\frac{1 - a_0 + c_s}{2}$	$\frac{c_s}{a_0}$	$\frac{1}{2}$
p_n^E	$\frac{3 - a_0 + c_s}{4}$	$\frac{a_0 + c_s}{2a_0}$	$\frac{3}{4}$
p_s^E	$\frac{a_0 + c_s}{2}$	$\frac{a_0 + c_s}{2}$	-
π_p^E	$\frac{(1 - a_0 + c_s)^2 + 2(a_0 - c_s)(3 - 3a_0 - c_s)}{16(1 - a_0)}$	$\frac{(a_0 - c_s)^2}{4a_0^2}$	$\frac{1}{16}$
π_m^E	$\frac{(1 - a_0 + c_s)^2}{8(1 - a_0)}$	$\frac{c_s(a_0 - c_s)}{2a_0^2}$	$\frac{1}{8}$
Q_n^E	$\frac{1 - a_0 + c_s}{4(1 - a_0)}$	$\frac{a_0 - c_s}{2a_0}$	$\frac{1}{4}$
Q_s^E	$\frac{3(1 - a_0) - c_s}{4(1 - a_0)} - \frac{a_0 + c_s}{2a_0}$	0	0

*Note: where $c_{s1}^E = a_0, c_{s2}^E = \frac{2a_0 - 1}{1 - a_0}$.

4.3. Introduce store brand with live streaming (Model ES)

Next, we consider the problem of introducing live streaming to promote the SB.

Before presenting the numerical results, we note that the parameter values used in Figures 3–10 are normalized values chosen to illustrate the analytical results rather than to calibrate the model to a particular firm. The numerical examples represent different combinations of the SB's initial perceived-quality position, production-cost disadvantage, and live-streaming effort. A lower a_0 corresponds to an SB with a larger initial perceived-quality disadvantage, whereas a higher a_0 represents a more established or standardized SB. The examples are used to illustrate how these factors jointly affect the platform's encroachment decision and the manufacturer's response.

The platform's profit stems from the profit from the sales price difference between the NB and the store brand SB, after deducting the live streaming promotion costs.

$$\pi_p^{ES} = (p_n^{ES} - w^{ES})Q_n^{ES} + (p_s^{ES} - c_s^{ES})Q_s^{ES} - \frac{s^2}{2}. \quad (6)$$

Maximizing the above profit will yield the platform's optimal selling quantities as follows:

$$(Q_n^{ES*}, Q_s^{ES*}) = \begin{cases} \left(\frac{1-w}{2}, 0\right), & \text{if } w < w^{ES} = \frac{c_s}{a_0 + \lambda s}, \\ \left(\frac{(1+c_s-a_0-\lambda s)-w}{2(1-a_0-\lambda s)}, \frac{(a_0+\lambda s)w-c_s}{2(a_0+\lambda s)(1-a_0-\lambda s)}\right), & \text{if } w \geq w^{ES} = \frac{c_s}{a_0 + \lambda s}. \end{cases} \quad (7)$$

Based on the platform's response function, the manufacturer decides the wholesale price w to optimize his profit:

$$\pi_M^{ES}(w) = \begin{cases} w \cdot \frac{1-w}{2}, & \text{if } w < w^{ES} = \frac{c_s}{a_0 + \lambda s}, \\ w \cdot \left(\frac{(1+c_s-a_0-\lambda s)-w}{2(1-a_0-\lambda s)}\right), & \text{if } w \geq w^{ES} = \frac{c_s}{a_0 + \lambda s}. \end{cases} \quad (8)$$

We can obtain the manufacturer's optimal wholesale price and other results as in Table 4.

Table 4. Equilibrium outcomes in model ES.

	$0 \leq c_s < c_{s2}^{ES}$	$c_{s2}^{ES} \leq c_s \leq c_{s1}^{ES}$	$c_{s1}^{ES} < c_s \leq 1$
w^{ES}	$\frac{1 - (a_0 + \lambda s) + c_s}{2}$	$\frac{c_s}{a_0 + \lambda s}$	$\frac{1}{2}$
p_n^{ES}	$\frac{3 - a_0 - \lambda s + c_s}{4}$	$\frac{a_0 + \lambda s + c_s}{2(a_0 + \lambda s)}$	$\frac{3}{4}$
p_s^{ES}	$\frac{a_0 + \lambda s + c_s}{2}$	$\frac{a_0 + \lambda s + c_s}{2}$	-
π_m^{ES}	$\frac{[1 - (a_0 + \lambda s) + c_s]^2}{8[1 - (a_0 + \lambda s)]}$	$\frac{c_s(a_0 + \lambda s - c_s)}{2(a_0 + \lambda s)^2}$	$\frac{1}{8}$
π_p^{ES}	$\frac{[1 - (a_0 + \lambda s) + c_s]^2}{8[1 - (a_0 + \lambda s)]} + \frac{(a_0 + \lambda s - c_s)^2}{8(a_0 + \lambda s)} - \frac{s^2}{2}$	$\frac{(a_0 + \lambda s - c_s)^2}{4(a_0 + \lambda s)^2} - \frac{s^2}{2}$	$\frac{1}{16}$
Q_n^{ES}	$\frac{1 - (a_0 + \lambda s) + c_s}{4[1 - (a_0 + \lambda s)]}$	$\frac{a_0 + \lambda s - c_s}{2(a_0 + \lambda s)}$	$\frac{1}{4}$
Q_s^{ES}	$\frac{3(a_0 + \lambda s) - c_s[2 - (a_0 + \lambda s)]}{4(a_0 + \lambda s)[1 - (a_0 + \lambda s)]}$	0	0

*Note: where $c_{s1}^{ES} = \frac{(a_0 + \lambda s)(1 - a_0 - \lambda s)}{2 - a_0 - \lambda s}$, $c_{s2}^{ES} = \frac{a_0 + \lambda s}{2}$.

Proposition 2. *The effect of potential live streaming-enabled store brand (SB) encroachment on manufacturers:*

(i) *When the platform's live streaming effort is low, potential store brand (SB) encroachment reduces the wholesale price; when the live streaming effort is sufficiently high, there exists a c_w . When $c_s < c_w, w^E < w^{ES}$; and when $c_s > c_w, w^E > w^{ES}$.*

(ii) *When the platform's live streaming effort is low, potential store brand (SB) encroachment increases the sales volume (Q_n) of NB; when the live streaming effort is sufficiently high, there exists a c_q . When $c_s < c_q, Q_n^E > Q_n^{ES}$; and when $c_s > c_q, Q_n^E < Q_n^{ES}$.*

Figure 3 and Figure 4 illustrate Proposition 2. The impact of the platform's live streaming-enabled SB promotion on manufacturers manifests in two aspects: the manufacturer's wholesale pricing and the sales volume of the NB. On the one hand, as indicated in Proposition 2, the manufacturer's wholesale pricing strategy is non-monotonic, which is shaped by the platform's live streaming effort. When the live streaming effort is relatively low, live streaming brings limited improvement in the perceived quality of the SB, and the threat of encroachment is not credible. Consequently, manufacturers will strategically raise the wholesale price to gain higher profits. At this point, for low-cost SB, live streaming does not enhance the platform's bargaining power; instead, it strengthens the manufacturer's pricing initiative, resulting in a higher wholesale price with live streaming than without. This contradicts the traditional view that "live streaming will inevitably force manufacturers to reduce prices." Notably, we find that within a narrow range ($c_w < c_s < c_q$), live streaming drives up the wholesale price, yet the platform's resale volume of the NB increases instead. This phenomenon reveals a subtle strategic equilibrium between manufacturers and platforms within the specific cost range where live streaming effort is insufficient, and SB's threat remains a false encroachment: Manufacturers obtain short-term gains through price increases, while the platform takes the initiative to expand NB sales volume by sacrificing part of the unit gross profit to maintain total profit. This finding is corroborated by JD Jingzao's operations: It implemented low-intensity live streaming for some low-cost SBs without large-scale sales promotion, yet this prompted cooperating NB manufacturers to moderately raise wholesale prices, and JD Jingzao offset unit gross profit losses by expanding NB resales. Similarly, Amazon conducted low-intensity live streaming for some Amazon Basics daily necessities without prioritizing SB sales, instead inducing cooperating national T-shirt brand Gildan to moderately raise wholesale prices, with Amazon stabilizing overall profits via expanded Gildan T-shirt set resales.

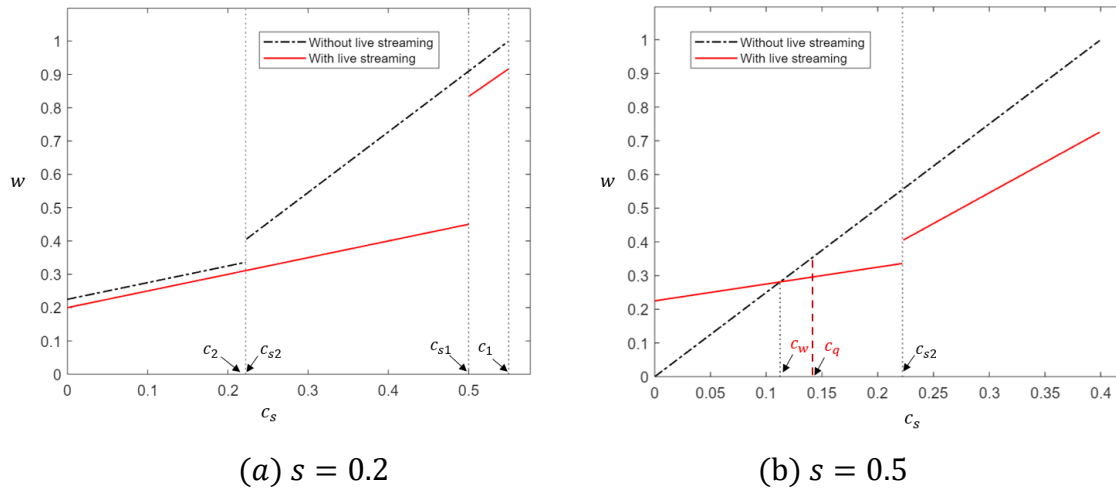


Figure 3. Wholesale price of the manufacturer under Model ES.

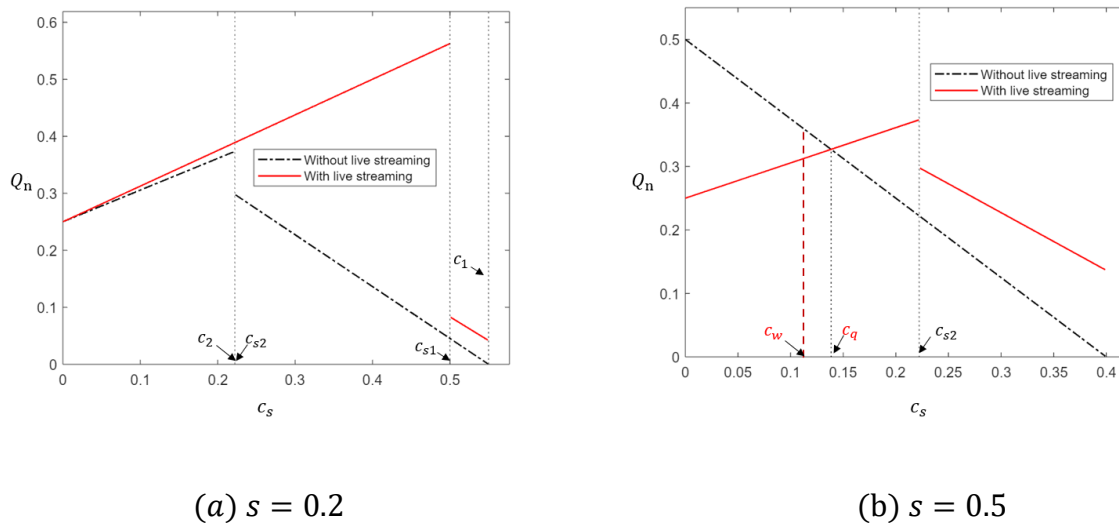


Figure 4. NB sales volume under Model ES.

Proposition 3. Under a live streaming promotion, the equilibrium structure remains qualitatively similar to the no-live streaming case (see Table 3), but the profitability regions shift.

(i) When the SB's unit production cost lies in the low-cost region (i.e., $c_s \geq c_{s2}$), the platform introduces the SB. When the cost exceeds the upper threshold (i.e., $c_s \geq c_{s1}$), SB introduction is no longer profitable, and the platform reverts to the single-NB resale structure.

(ii) Under substantive encroachment, profit comparisons depend on the SB's base quality a_0 . When a_0 is low, live streaming can effectively reshape market competition: for $c_s < c_s^*$, we obtain $\pi_P^{ES} > \pi_M^{ES}$, whereas the ranking reverses otherwise. When a_0 is sufficiently high, the platform's profit under live streaming always dominates that without live streaming, i.e., $\pi_P^{ES} > \pi_M^{ES}$.

Proposition 3 further reveals that the platform's equilibrium encroachment strategy is jointly determined by the interaction between the SB's base quality a_0 and live streaming effort s . When the SB's base quality is very low, live streaming serves as an effective quality-enhancement mechanism. By strengthening perceived quality, the platform can substantially increase its profitability and shift the

competitive balance in its favor. In this region, live streaming acts as a strategic lever that transforms an otherwise weak product into a credible competitor. When the SB's base quality is moderate, however, the marginal empowerment effect of live streaming becomes less pronounced. Nevertheless, the platform typically maintains market dominance due to the SB's intrinsic competitiveness.

This mechanism helps explain why major platforms such as Amazon (e.g., Amazon Basics), Walmart, and Tmall strategically position their store brand in high-frequency, low-loyalty mass-consumption categories. Similarly, Douyin focuses its self-operated store brand on high-demand necessities. In such categories, live streaming, through real-time interaction and scenario-based demonstrations, effectively enhances consumers' perceived quality and trust in the SB, helping the SB narrow the perceived-quality gap with established national brands. Moreover, these products typically involve low technological barriers. Live demonstrations help narrow perceived quality gaps with established brands, while low production complexity enables platforms to rely on ODM or OEM arrangements to improve cost efficiency. As a result, the SB becomes viable along cost and perceived-quality dimensions, generating substantial profit premiums in the low-cost region, as illustrated in Figure 5.

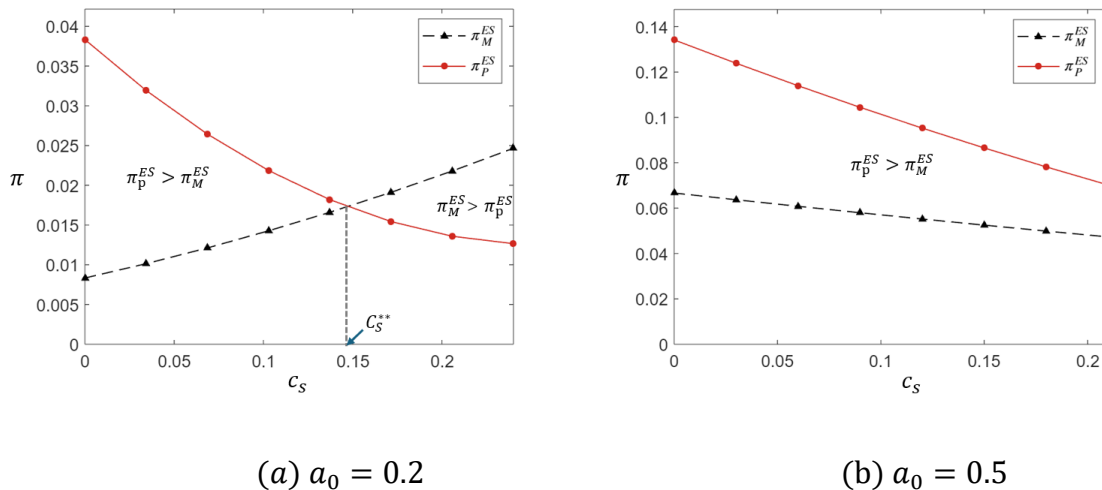


Figure 5. Profit under substantive encroachment.

Proposition 4. *Live streaming shifts the encroachment thresholds and systematically restructures the market partition.*

- (i) *With live streaming, both encroachment thresholds increase, i.e., $c_{s1} > c_1, c_{s2} > c_2$.*
- (ii) *The cost range shrinks from $c_s > c_{s1}$. Since $c_s > c_1$, the no-encroachment region becomes smaller, implying that the platform is more likely to introduce the SB.*
- (iii) *The feasible interval (c_{s1}, c_{s2}) narrows because both its lower and upper bounds shift upward. Some parameter values previously associated with false encroachment, specifically $c_s \in (c_2, c_{s2})$, are upgraded to substantive encroachment.*
- (iv) *The upper bound for positive SB sales increases from c_2 to c_{s2} , enabling the SB to sustain positive demand even at higher production costs. Consequently, the parameter space in which the platform earns direct profits from SB sales expands.*

Proposition 4 highlights the fundamental role of live streaming: It transforms the exogenous “static” base quality a_0 into an endogenously adjustable perceived quality $a_0 + \lambda s$. As s increases,

both upper boundary curves c_{s1} and c_{s2} shift upward, regardless of whether the base quality is low or high. Economically, live streaming raises the platform's cost tolerance and enlarges the feasible profit space. More importantly, it enhances the platform's strategic flexibility. By adjusting s , the platform can reclassify a high-cost SB from no encroachment to false encroachment (as a bargaining instrument), or even to substantive encroachment (as a direct profit source). Managerially, this implies that the encroachment decision should no longer be viewed as a binary choice ("introduce or not"), but rather as a resource allocation problem over the joint strategy space (a_0, s) . As shown in Figure 6, it is observed that when the basic quality of products reaches a medium level, the upper limit of live streaming investment declines, and the corresponding effectiveness is weakened. This dynamic perspective, optimizing encroachment through coordinated quality positioning and marketing intensity, distinguishes our analysis from the conventional encroachment literature. For instance, when JD introduces its JD Jingzao products, live streaming promotion investment should be determined according to product types, which helps maximize its corporate interests.

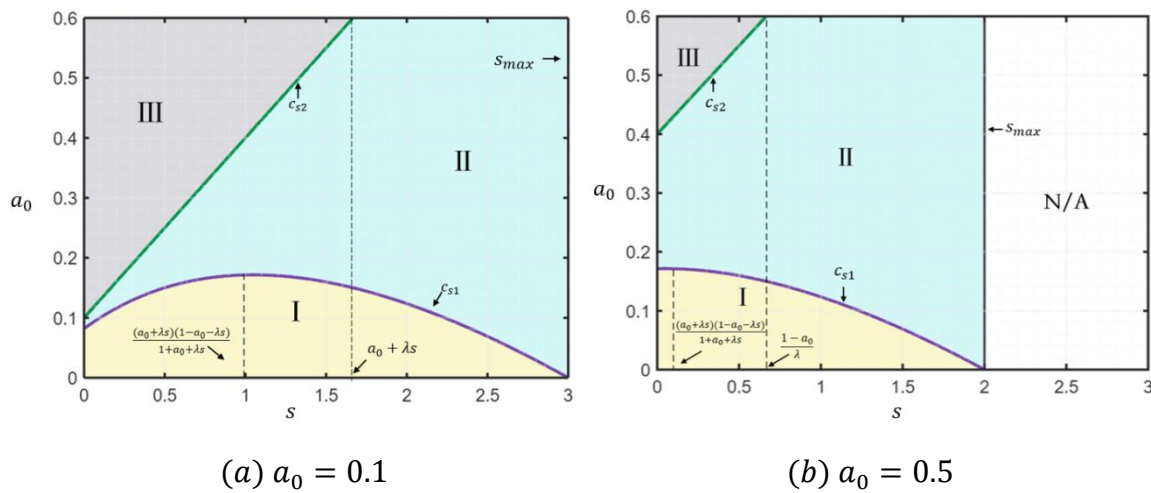


Figure 6. The equilibrium decisions under the Model ES.

Proposition 5.

- (i) The marginal effect of live streaming effort on platform profit, $\frac{\partial \pi_P^*}{\partial s}$, exhibits an inverted U-shape with respect to the SB base quality a_0 . There exists a unique optimal base quality $a_0^* \in (0,1)$ such that $\frac{\partial \pi_P^*}{\partial s}$ increases monotonically when $a_0 < a_0^*$ and decreases monotonically when $a_0 > a_0^*$.
- (ii) The marginal effect of live streaming effort on the brand manufacturer's profit satisfies $\frac{\partial \pi_M^*}{\partial s} < 0$. Moreover, $\left| \frac{\partial \pi_M^*}{\partial s} \right|$ decreases monotonically with respect to a_0 ; that is, the higher the SB base quality, the weaker the marginal adverse impact of live streaming on the manufacturer.

Proposition 5 indicates that different values of a_0 represent different SB product categories or different intrinsic quality positions. From the platform's perspective, live streaming improves the perceived quality of the SB and thereby strengthens its market competitiveness. When the SB has a higher base quality, the perceived-quality improvement generated by live streaming is more likely to

be converted into effective competitive advantage and profit improvement. Thus, the marginal effect of live streaming effort on platform profit increases with a_0 . However, this should be interpreted as a comparative-static result rather than as an optimization result. From the manufacturer's perspective, live streaming intensifies the substitution pressure imposed by the SB on the NB. Therefore, an increase in live streaming effort reduces the manufacturer's profit under substantive encroachment. Nevertheless, as the SB base quality a_0 increases, the negative marginal impact of live streaming on the manufacturer becomes weaker. This is because when the SB is already relatively competitive, additional live streaming produces a smaller incremental threat. By contrast, when the SB has a low base quality, live streaming creates a stronger improvement in perceived quality and therefore imposes a stronger marginal pressure on the manufacturer. This proposition suggests that live streaming should not be treated as a uniform marketing tool for all store-brand products. Its strategic value depends on the initial quality position of the SB, the production cost condition, and the product category. Platforms should therefore adjust live streaming effort according to the base quality of the SB rather than relying on a fixed level of live streaming investment across all products.

Proposition 6. *Under dual-brand competition with the introduction of the store brand (SB), define the sales.*

(i) *If $c_s < c_s^{**}$, then $\Delta Q < 0$; that is, SB equilibrium sales exceed those of NB, and the SB becomes the dominant brand in the market.*

(ii) *If $c_s > c_s^{**}$, then $\Delta Q > 0$; that is, NB equilibrium sales exceed those of SB, and the market remains NB-dominated, where $c_s^{**} = \frac{(a_0 + \lambda s)(2w + a_0 + \lambda s - 1)}{a_0 + \lambda s + 1}$.*

Proposition 6 indicates that sales dominance under dual-brand competition is determined by the SB's cost–quality advantage. When the SB's unit production cost is sufficiently low, its superior quality–price ratio makes it particularly attractive to medium and low-valuation consumers, enabling it to capture a larger market share [21]. Moreover, the NB continues to serve high-valuation consumers who are highly sensitive to baseline quality. As a result, the dual-brand structure effectively segments heterogeneous consumers and mitigates the “market void” that arises under a single-brand regime, thereby maximizing total demand coverage.

As shown in Figure 7, as c_s decreases, SB sales rise rapidly and dominate the market in the low c_s region. This indicates that the platform's profit focus shifts toward the high-margin SB channel. Moreover, competitive pressure from SB forces the manufacturer to lower the wholesale price w , which in turn expands the retail margin of the NB channel. The trends of the two total sales curves demonstrate that when $c_s < c_{s2}^{**}$, total sales remain at a relatively high level. The advantage in total sales is more pronounced under the high penetration scenario ($s = 0.6$). This reveals that the platform's overall profit is considerably higher than that under an NB-dominated single-brand market structure. Furthermore, a higher market penetration strengthens the profit amplification effect of the dual-brand configuration. The two thresholds respectively represent the upper bounds of c_s for SB market viability.

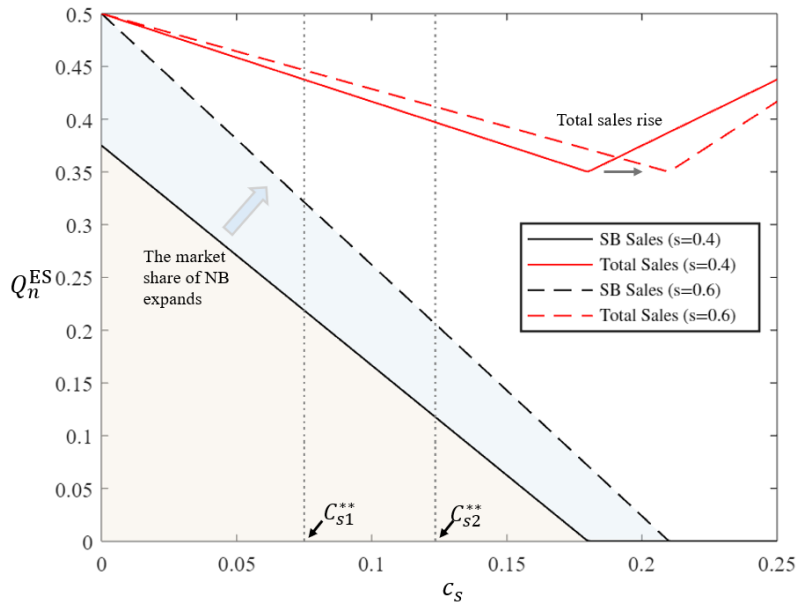


Figure 7. SB and Total sales volume.

Proposition 7 *The live streaming efficiency parameter λ , which maps streaming effort into perceived quality enhancement ($g = a_0 + \lambda s$), jointly restructures the encroachment threshold partition and the platform's profit profile, with the SB marginal cost c_s acting as a non-monotonic moderator.*

(i) *The substantive-encroachment threshold c_{s2}^{ES} increases monotonically in λ , whereas the no-encroachment threshold c_{s1}^{ES} exhibits an inverted-U shape in λ .*

(ii) *When $c_s < c_{s2}^{ES}$, the platform profit π_P^{ES} increases monotonically in λ , and $\frac{\partial \pi_P^{ES}}{\partial c_s} > 0$.*

(iii) *When c_s is sufficiently high, there exists a critical efficiency level $\hat{\lambda}$. When $\lambda < \hat{\lambda}$, the platform does not encroach; when $\hat{\lambda} < \lambda < \lambda_1$, $\frac{\partial \pi_P^{ES}}{\partial \lambda} < 0$; when $\lambda > \lambda_1$, $\frac{\partial \pi_P^{ES}}{\partial \lambda} > 0$.*

Proposition 7 reveals that live streaming efficiency operates through two distinct channels: a threshold channel that restructures the encroachment partition and a profit channel whose direction depends on the SB's cost position. The inverted-U response of c_{s1}^{ES} implies that marginal improvements in streaming efficiency at low levels may widen the false-encroachment region, lending credibility to the manufacturer's entry threat without generating real SB sales; only a substantial efficiency leap converts this hollow threat into substantive competition. The profit-trap result further cautions platforms against incremental live streaming investment for high-cost SBs: Moderate efficiency gains can trigger encroachment before the quality premium matures, leaving the platform worse off than under no encroachment. As shown in Figure 8, the inverted-U response of c_s implies that marginal efficiency gains at low λ may widen the false-encroachment region; only a substantial efficiency leap converts this hollow threat into substantive competition.

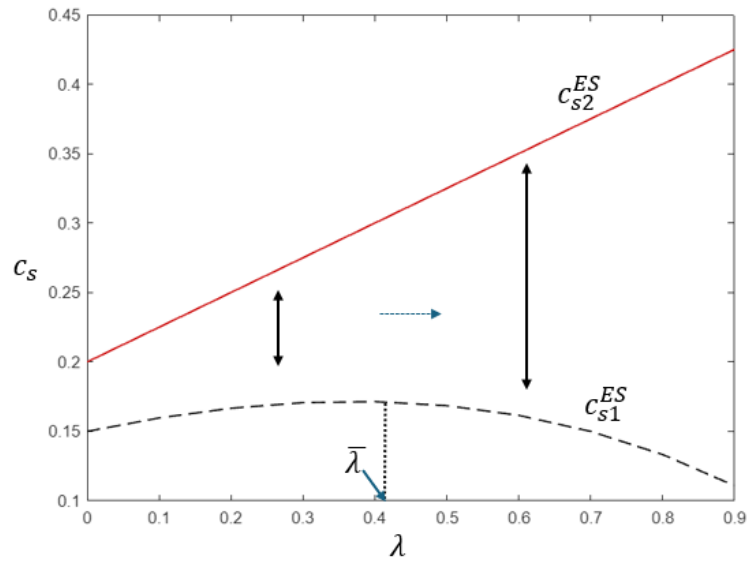


Figure 8. Impact of λ on encroachment thresholds.

As shown in Figure 9, moderate gains for high-cost SBs can trigger encroachment before the quality premium matures, leaving the platform worse off than under no encroachment, whereas the counterintuitive $\frac{\partial \pi_p^{ES}}{\partial c_s} > 0$ arises from weaker cannibalization of the NB by a costlier SB.

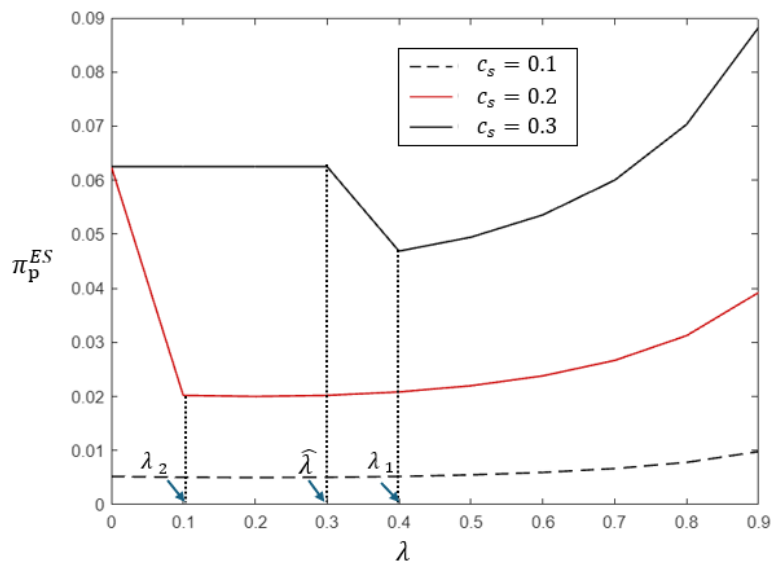


Figure 9. Platform profit across different c_s under Model ES.

This mechanism helps explain why platforms such as Amazon and JD.com concentrate live streaming resources on selected SB categories rather than uniformly promoting their private-label portfolios.

4.4. Summary

Comparing the three models reveals that live streaming fundamentally reshapes the platform's encroachment equilibrium through three channels. First, it raises the lower and upper cost thresholds for encroachment, expanding the region of substantive encroachment and shrinking the no-encroachment zone; some false-encroachment cases are upgraded to substantive competition. Second, the manufacturer's wholesale-price response to live streaming is non-monotonic: At low streaming effort, the SB threat is not credible, enabling the manufacturer to raise w , whereas at high effort, the platform gains bargaining power and forces a lower w . Third, the platform's profit gain from live streaming depends on the SB's base quality, the marginal benefit follows an inverted-U shape, and the NB's sales may increase under certain cost ranges due to strategic wholesale adjustments. Overall, live streaming transforms encroachment from a static cost-based decision into a dynamic quality-investment trade-off.

5. Extension

5.1. Endogenization of live streaming effort

In the main model, the live streaming effort s is treated as an exogenous parameter. In this extension, we further allow the platform to endogenously determine the live streaming effort when introducing the store brand. Other model settings remain unchanged. Let $A(s) = a_0 + \lambda s$ denote the perceived quality of the store brand under live streaming, where $0 < A(s) < 1$. The platform chooses s, p_n , and p_s after observing the wholesale price w . Since live streaming improves the perceived quality of the store brand but also incurs the convex cost $\frac{s^2}{2}$, the optimal live streaming effort is determined by the trade-off between the quality-enhancement effect and the marginal live streaming cost. The optimal live streaming effort is given by:

$$s_{ES}^* = \begin{cases} s_G^*, & 0 \leq c_s < \frac{A(s_G^*)[1 - A(s_G^*)]}{2 - A(s_G^*)}, \\ s_F^*, & \frac{A(s_F^*)[1 - A(s_F^*)]}{2 - A(s_F^*)} \leq c_s \leq \frac{A(s_F^*)}{2}, \end{cases} \quad (9)$$

Here, s_F^* satisfies $2s_F^*(a_0 + \lambda s_F^*)^3 = \lambda c_s(a_0 + \lambda s_F^*)^3$, and s_G^* satisfies $8s_G^*(a_0 + \lambda s_G^*)^2[1 - a_0 - \lambda s_G^*]^2 = \lambda c_s^2[2(a_0 + \lambda s_G^*) - 1]$; the optimal solutions in the other regions are not economically reasonable. Proofs and thresholds for the main results are given in the Appendix.

Proposition 8.

(i) If the SB production cost is low, the platform chooses ($s_{ES}^* = s_G^*$) and uses live streaming to support substantive encroachment.

(ii) If the SB production cost is moderate, the platform chooses ($s_{ES}^* = s_F^*$) or a boundary level of live streaming to strengthen the credibility of false encroachment.

(iii) If the SB production cost is sufficiently high, the platform chooses no live streaming.

Therefore, the optimal live streaming effort is non-monotonic with respect to the SB production cost.

Proposition 8 shows that live streaming is a strategic investment rather than a uniformly effective marketing tool. When the SB has a clear cost advantage, excessive live streaming is unnecessary because the product can already obtain positive demand. When the SB is close to the encroachment boundary, live streaming becomes more valuable because it improves perceived quality and may transform a weak SB into a credible competitor. However, when the cost disadvantage is too large, the convex live streaming cost dominates the quality-enhancement effect, and the platform withdraws from live streaming investment. This logic is consistent with the practices of Amazon Basics, JD Jingzao, Tmall, and Douyin, which tend to use live streaming more intensively for daily necessities, household consumables, and low-value accessories, but more cautiously for durable or technology-intensive products such as home appliances and 3C products. Figure 10 provides a numerical illustration of Proposition 8. As c_s increases, the platform profit under endogenous live streaming is higher than that without live streaming in the viable encroachment region, confirming that live streaming mainly creates value near the boundary of SB introduction.

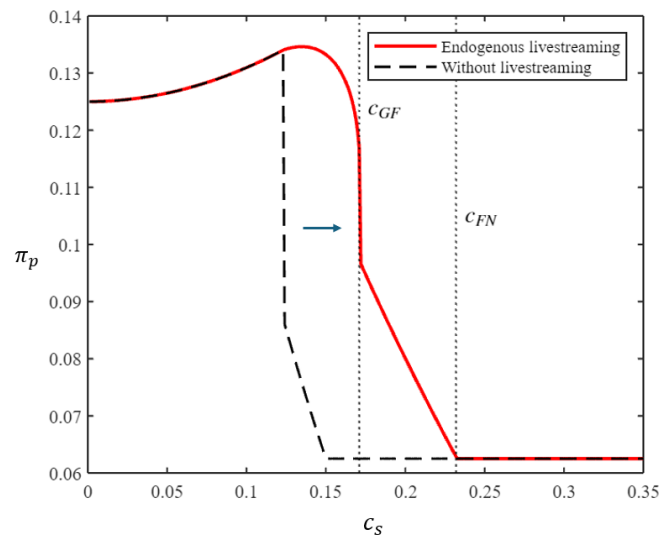


Figure 10. The platform profits when live streaming effort is endogenous.

Corollary 1. *Comparative statics of optimal live streaming effort in false encroachment: In the false-encroachment region, the platform's optimal live streaming effort s_F^* has the following properties:*

- (i) $\frac{\partial s_F^*}{\partial a_0} < 0$, that is, a higher intrinsic product quality reduces the platform's need to invest in live streaming to maintain the encroachment threat.
- (ii) $\frac{\partial s_F^*}{\partial c_s} \geq 0$, a larger cost disadvantage forces the platform to raise live streaming effort to keep the threat credible.

The above results indicate that the optimal live streaming effort decreases with the base quality of the store brand, but increases with the production cost of the store brand in the false-encroachment region. Economically, when the store brand already has a relatively strong base quality, the platform does not need to rely heavily on live streaming to enhance consumers' perceived quality. In contrast, when the store brand suffers from a greater production-cost disadvantage, the platform must increase

live streaming investment to maintain the credibility of the encroachment threat. However, such investment is effective only within a moderate cost range; once the cost disadvantage becomes too large, the marginal benefit of live streaming cannot offset its convex cost. This corollary suggests that live streaming should be used as a differentiated strategic tool rather than a uniform marketing instrument. For store-brand products with relatively high base quality, excessive live streaming may be unnecessary and may waste marketing resources. For store-brand products with moderate cost disadvantages, live streaming can help transform a weak store brand into a credible bargaining tool against national-brand manufacturers. However, for store-brand products with excessively high production costs, platforms should avoid over-investing in live streaming because the product lacks sufficient economic viability.

5.2. Agency selling mode

In the baseline model, the platform operates under the reselling mode, whereby it purchases the NB product from the manufacturer at a wholesale price and subsequently sells it to consumers at a retail price. In practice, however, many e-commerce platforms, such as Amazon, Tmall, and JD.com, also widely adopt the agency selling mode, under which manufacturers sell directly to consumers through the platform while the platform charges a proportional sales commission.

The agency selling mode alters the profit structure and the allocation of pricing power between the platform and the manufacturer, which may in turn affect the platform's incentives to introduce a SB and invest in live streaming promotion.

In this extension, we analyze equilibrium strategies under the agency selling mode and compare them with those obtained under the reselling mode. Variables associated with the agency selling mode are denoted by superscript A. The platform charges a commission rate $\alpha \in (0,1)$, meaning that the platform receives a fraction α of NB sales revenue as commission income.

All other assumptions, including consumer utility, market segmentation, and the live streaming cost function, remain identical to those in the baseline model. In this case, the profit functions of the platform and the manufacturer are given by:

$$\pi_P^{A,\bar{s}} = \alpha p_n Q_n + (p_s - c_s) Q_s, \quad (10)$$

$$\pi_M^{A,\bar{s}} = (1 - \alpha) p_n Q_n. \quad (11)$$

The optimal equilibrium sales volume is:

$$Q_n^{A*} = \begin{cases} \frac{1}{2}, & c_s > c_s^{A,\bar{s},1}, \\ \frac{1 - \alpha(c_s - a_0)}{2(1 - \alpha)}, & c_s^{A,\bar{s},2} \leq c_s \leq c_s^{A,\bar{s},1}, \\ \frac{1 - \alpha(1 - a_0) - c_s}{2(1 - \alpha)}. & c_s < c_s^{A,\bar{s},2}. \end{cases} \quad (12)$$

$$Q_s^{A*} = \begin{cases} 0, & c_s > c_s^{A,\bar{s},2}, \\ \frac{a_0[1 - \alpha(1 - a_0) - c_s]}{2a_0(1 - \alpha)}. & c_s < c_s^{A,\bar{s},2}. \end{cases} \quad (13)$$

where $c_s^{A,\bar{s},1} = a_0 - \frac{\alpha(1-a_0)}{2(1-\alpha)}$, $c_s^{A,\bar{s},2} = \frac{a_0(1-\alpha)}{1-\alpha+\alpha a_0}$.

With the introduction of live streaming, the profits of the platform and manufacturer are, respectively,

$$\pi_P^{A,S} = \alpha p_n Q_n + (p_s - c_s) Q_s - \frac{s^2}{2}, \quad (14)$$

$$\pi_M^{A,S} = (1 - \alpha) p_n Q_n, \quad (15)$$

where $c_s^{A,S,1} = a_0 + \lambda s - \frac{\alpha(1-(a_0+\lambda s))}{2(1-\alpha)}$, $c_s^{A,S,2} = \frac{(a_0+\lambda s)(1-\alpha)}{1-\alpha+\alpha(a_0+\lambda s)}$.

Proposition 9.

(i) $c_s^{A,S,1} > c_s^{A,\bar{S},1}$ and $c_s^{A,S,2} > c_s^{A,\bar{S},2}$.

(ii) When $c_s \in (c_s^{A,\bar{S},1}, c_s^{A,S,1})$, the platform does not introduce the SB without live streaming, but can implement “false encroachment” with live streaming; when $c_s \in (c_s^{A,\bar{S},2}, c_s^{A,S,2})$, the platform can implement only “false encroachment” without live streaming, but this shifts to “substantive encroachment” with live streaming.

Proposition 9 indicates that, for the same SB product, it may be abandoned due to prohibitive costs in the absence of live streaming, yet become a viable strategic option when live streaming is employed. In scenarios without live streaming, the platform’s decision to introduce an SB is static, depending solely on factors such as base quality and commission rates. However, with the introduction of live streaming, the platform can proactively adjust the SB’s perceived quality by modulating the live streaming efforts, thereby enabling flexible encroachment strategies across a broader range of cost conditions. Specifically, under the agency selling mode, live streaming effectively reshapes the platform’s encroachment decision logic. The platform’s optimal choice is no longer a binary judgment of “whether to introduce the SB,” but rather a dynamic consideration of the combination of “live streaming effort and encroachment strategy,” maximizing profitability through strategic live streaming deployment. Comparing Figure 11 with Figure 6(a), we can find that low-quality products achieve the best live streaming performance under the agency and resale models. This also explains the practical logic observed on platforms such as Amazon and Tmall, which employ high-intensity live streaming to promote store brands in high-frequency, essential categories (e.g., daily necessities and cosmetics) under the agency mode, while adopting low-intensity live streaming for categories with high base quality (e.g., home appliances and 3C accessories).

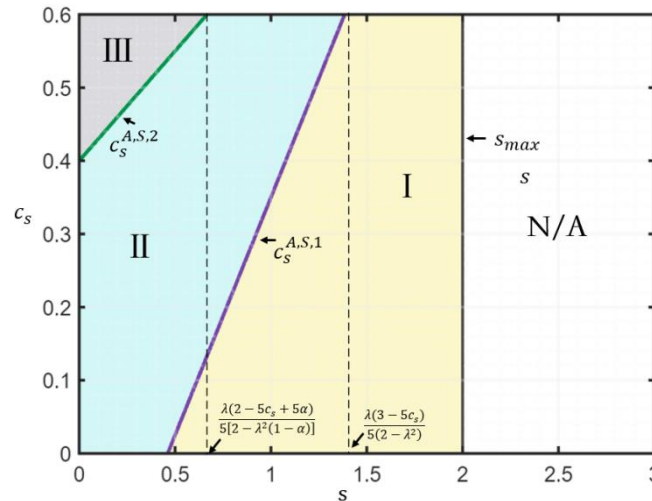


Figure 11. The equilibrium decisions under Agency selling mode.

Proposition 10.

Define $\Delta_c = c_s^{A,S,1} - c_s^1$, where c_s^1 is the critical cost threshold between “no encroachment” and “substantive encroachment” under the reselling mode, $|\frac{\partial \Delta}{\partial s}| > 0$.

(i) When $\alpha > \hat{\alpha}$, $\Delta_c > 0$, indicating that the platform is more inclined to introduce the SB under the agency selling mode.

(ii) when $\alpha < \hat{\alpha}$, $\Delta_c < 0$, indicating that the platform's incentive to encroach is lower under the agency selling mode,

$$\text{where } \hat{\alpha} = \frac{2(a_0 + \lambda s)}{(a_0 + \lambda s)^2 - (a_0 + \lambda s) + 2}.$$

Proposition 10 indicates that, for the agency selling mode, the platform earns a commission α from NB sales. When α is relatively high, the platform becomes more dependent on the NB and thus has a stronger incentive to introduce an SB as a supplementary profit source. In contrast, under the reselling mode, the platform bears the procurement cost of the NB and is therefore more sensitive to the profitability of the SB. Live streaming further moderates this trade-off by enhancing the perceived quality of the SB. Moreover, the absolute value of Δ increases monotonically with the live streaming effort s ($|\frac{\partial \Delta}{\partial s}| > 0$). This indicates that live streaming amplifies the difference in encroachment incentives between the two selling formats.

5.3. Simultaneous pricing

In the baseline model, the platform determines the SB retail price after observing the manufacturer's wholesale price. We refer to this sequential pricing regime as Model M.

In practice, however, pricing decisions are often made simultaneously without prior knowledge of competitors' pricing choices. To examine the robustness of our results, we therefore consider a simultaneous pricing regime, denoted as Model S, in which the manufacturer commits to the wholesale price w while the platform simultaneously determines the SB retail price p_s .

Proposition 11. Let c_s^1 denote the critical encroachment cost under sequential pricing and c_s^* denote the corresponding threshold under simultaneous pricing. Because the platform can jointly optimize pricing decisions under simultaneous pricing, substantive encroachment yields higher profitability. Consequently, $c_s^* < c_s^1$ implying that the platform is more likely to engage in substantive encroachment under simultaneous pricing than under sequential pricing.

Proposition 11 shows that the main insights derived under sequential pricing remain robust. As shown in Figure 12, a reduction in encroachment cost or an improvement in NB quality continues to facilitate the implementation of genuine SB encroachment. From the platform's perspective, for any given live streaming effort s , equilibrium profit under simultaneous pricing exceeds that under sequential pricing. This directly strengthens the platform's capability and incentive to bear SB encroachment costs c_s . From the manufacturer's perspective, the equilibrium wholesale price under simultaneous pricing is generally lower than that under sequential pricing, indicating weakened bargaining power and greater wholesale price concessions. The resulting reduction in procurement costs further enlarges the platform's pricing flexibility and profit space for SB introduction. The relationship $c_s^* < c_s^1$ implies that simultaneous pricing expands the profitability region in which substantive encroachment is feasible. Under sequential pricing, the manufacturer sets the wholesale price before observing the platform's SB retail decision and therefore enjoys a first-mover advantage. Simultaneous pricing eliminates this advantage, thereby strengthening the platform's incentive to pursue substantive encroachment.

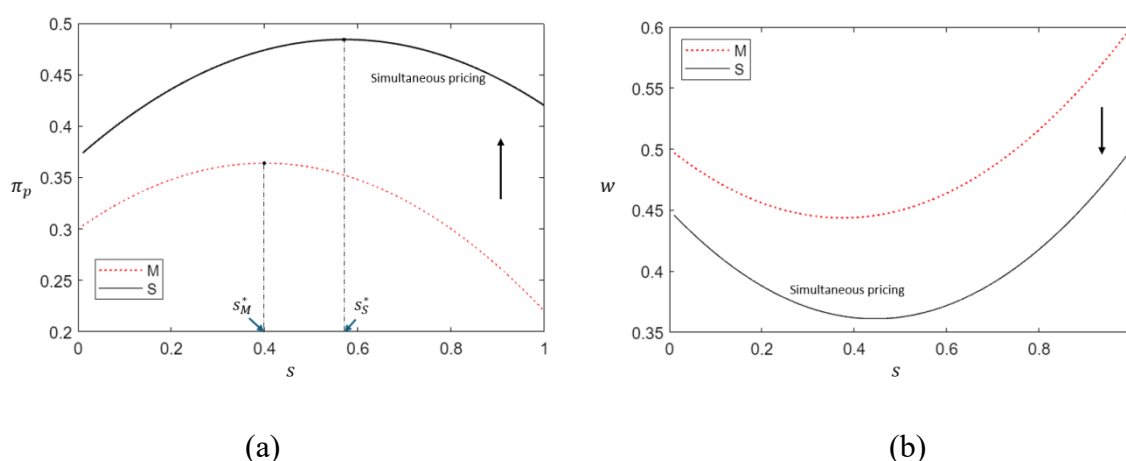


Figure 12. Platform profit and wholesale price under two scenarios.

6. Conclusions

In this study, we investigate how live streaming investment influences platform store-brand encroachment in a supply chain consisting of a national-brand manufacturer and an e-commerce platform. By developing a game-theoretic model, we examine the interaction among live streaming investment, perceived product quality, wholesale pricing, and platform encroachment decisions. Unlike researchers who treat store-brand quality as exogenous, we explicitly model live streaming as a strategic quality-enhancement mechanism and analyze its implications for platform competition. Our analysis yields several important findings.

(i) Live streaming reshapes the platform's encroachment strategy by changing the equilibrium boundaries among no encroachment, false encroachment, and substantive encroachment. Counter to intuition, store-brand encroachment does not necessarily reduce national-brand sales. This finding challenges the conventional view that platform encroachment necessarily harms national brands.

(ii) Live streaming investment has a non-monotonic effect on manufacturers' wholesale pricing decisions because the credibility of store-brand encroachment depends on the intensity of live streaming. When live streaming effort is relatively low, the improvement in the perceived quality of the store brand is insufficient to establish a credible encroachment threat, enabling manufacturers to raise wholesale prices. As live streaming intensity increases, the platform's bargaining power gradually strengthens, leading manufacturers to reduce wholesale prices.

(iii) The value of live streaming investment depends critically on the intrinsic quality of the store brand. Specifically, the marginal benefit of live streaming exhibits an inverted U-shaped relationship with store-brand quality, implying that high-intensity live streaming is not universally optimal across product categories.

(iv) Live streaming investment changes the distribution of supply chain profits rather than uniformly benefiting the platform. Although store-brand encroachment generally reduces manufacturers' profits, manufacturers may also benefit when the store brand's production cost and live streaming effort fall within specific ranges.

The results provide several implications for platform managers. First, the decision to introduce an SB should be evaluated jointly with the platform's live-streaming investment. When the SB's production cost is sufficiently high, additional live streaming may not generate enough incremental margin to justify the investment, and the platform should avoid treating live streaming as a substitute for basic cost efficiency. When the SB's cost is moderate, a limited launch or pilot program may enable the platform to maintain a credible encroachment threat without committing to large-scale SB sales. When the SB has a sufficient cost advantage and live streaming is effective in improving perceived quality, the platform can use live streaming to support substantive encroachment and expand SB demand. Second, platforms should allocate live-streaming resources across product categories rather than apply a uniform investment level. Products whose quality can be demonstrated or explained effectively in real time are more suitable for intensive live streaming. For products whose performance can be evaluated only through long-term use or technical testing, additional live-streaming effort may have a weaker effect on perceived quality. Platforms should therefore consider the SB's initial perceived quality, production cost, and the effectiveness of live streaming jointly when determining investment intensity. Third, platforms should distinguish the bargaining value and the direct sales value of an SB. In the false-encroachment region, the platform may benefit from introducing the SB even when the SB generates no positive equilibrium sales, because the potential threat can induce a lower wholesale price from the NB manufacturer. However, this strategy is credible only when the platform can pursue substantive encroachment if negotiations fail.

Table 5. Main results, managerial/practical insights.

Main findings	Implications for platforms	Implications for manufacturers
High SB production cost leads to no encroachment	Screen SB categories carefully and avoid excessive live-streaming investment when the expected margin cannot cover the SB and streaming costs.	Maintain the NB's wholesale-price position and avoid unnecessary concessions.
Moderate SB cost may lead to false encroachment	Use a limited SB launch or pilot program to preserve bargaining leverage, while maintaining the ability to pursue substantive encroachment if necessary.	Assess the credibility of the threat before reducing the wholesale price.
Low SB cost and effective live-streaming support substantive encroachment	Coordinate SB cost efficiency, live-streaming intensity, pricing, and product positioning.	Strengthen NB quality, brand differentiation, and consumer engagement.
Live streaming has a non-monotonic effect on wholesale pricing	Do not assume that more live streaming always improves bargaining power.	Do not automatically respond with wholesale-price reductions; identify the relevant encroachment regime first.
The value of live streaming differs across product categories	Allocate live-streaming resources to products whose quality can be demonstrated effectively in real time.	Focus on categories where brand reputation and quality differentiation remain important.
Agency selling strengthens the platform's SB incentive	Use commission structures strategically when choosing between reselling and agency selling.	Negotiate commission rates, pricing rights, and contractual protection carefully.
Simultaneous pricing favors substantive encroachment	Prepare for stronger SB competition and greater pricing flexibility.	Anticipate weaker bargaining power and strengthen NB differentiation.

The results also provide implications for NB manufacturers. First, manufacturers should not respond to platform live streaming by automatically lowering the wholesale price. The optimal response depends on whether the platform is using the SB primarily as a bargaining threat or pursuing substantive substitution. In the false-encroachment region, a carefully calibrated wholesale-price concession may prevent a more costly shift toward substantive encroachment. In contrast, when live

streaming makes the SB a strong substitute, manufacturers may need to combine pricing adjustments with stronger product differentiation. Second, manufacturers should strengthen the NB's sources of competitive advantage, including product quality, brand communication, verified consumer reviews, and direct customer engagement. These measures are particularly important when the SB has a low base perceived quality but live streaming is highly effective, because the platform can then obtain a relatively large perceived-quality improvement from additional live-streaming effort. Third, manufacturers should pay attention to the selling format and pricing sequence used by the platform. Agency selling and simultaneous pricing may increase the platform's incentive to introduce the SB and reduce the manufacturer's pricing advantage. Manufacturers should therefore consider commission terms, pricing rights, and contractual safeguards when negotiating with platforms.

Table 5 summarizes the main analytical findings and translates them into differentiated recommendations for platforms and NB manufacturers.

This study has several limitations. First, we focus on a single platform, one NB manufacturer, and one SB, whereas actual live-streaming markets may involve multiple platforms, manufacturers, and competing private labels. Second, the model focuses on the platform's live-streaming investment in the SB and does not explicitly consider live-streaming investment by the NB manufacturer or potential spillover effects across the two brands. In practice, both firms may choose their own live-streaming efforts, and a live stream featuring one product may also affect consumers' perceptions of the competing product. Third, we capture the perceived-quality effect of live streaming but abstract from other potential effects, including social interaction, entertainment, consumer engagement, impulse purchasing, and network externalities. Finally, the assumption that the SB has a lower initial perceived quality than the NB limits the scope of the analysis to newly introduced or less-established store brands. These assumptions enable us to isolate the role of platform-led live streaming in reducing the SB's initial perceived-quality disadvantage, but they also limit the generalizability of our findings. In future studies, researchers could allow the platform and the NB manufacturer to choose live-streaming efforts strategically and examine bilateral investment competition, cross-brand spillovers, and the joint effects of live streaming on perceived quality and total market demand.

Author contributions

Xiaoya Han: Conceptualization, methodology, writing – review & editing; Mengdie Li: Formal analysis, visualization, writing – original draft; Xin Liu: Supervision, validation, writing – review & editing. All authors have read and approved the final manuscript.

Use of Generative-AI tools declaration

The authors declare that they did not utilize any artificial intelligence (AI) tools in the creation of this article.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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