



Research on Channel Selection Strategies of Overseas Distributors under Channel Erosion and Channel Loyalty

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Abstract. Having emerged from personal purchasing services, evolved from overseas shopping, and matured through cross-border e-commerce, China's cross-border import industry has undergone four stages—initial exploration, rapid expansion, model adjustment, and upgrading—and has become a new driver of economic growth. Parallel imports have spurred the diversification of market participants and channel transformation; overseas distributors have demonstrated strong adaptability and a continuously expanding influence, with sales models shifting from direct sales towards indirect channels. Differences in channel models significantly influence consumer perceptions and the selection of optimal channels. Faced with competition from local authorised dealers, channel erosion, loyalty effects and shifting demand, how overseas distributors select channels to optimise their operations has become a new challenge in global supply chain management. To this end, this paper constructs a Stackelberg game model to examine, in particular, the impact of factors such as channel erosion, loyalty efficiency, demand uncertainty and stock-out costs on the optimal channel selection by overseas distributors.

Keywords: Cross-border E-commerce Supply Chain; Channel Selection Strategy; Channel Erosion Effects; Channel Loyalty Effects; Demand Uncertainty.

1 Introduction

Cross-border imports constitute a vital component of China's foreign trade. The sector has evolved through four distinct phases—from its early days as a form of proxy purchasing, through the development of overseas online shopping, to the maturity of cross-border e-commerce—and has become a new driver of economic growth. Parallel imports, as a specific form of trade, refer to the unauthorised importation into the country of products that have been lawfully placed on the market overseas; their existence is primarily driven by price differentials between regions and product scarcity. China adheres to the principle of exhaustion of trademark rights; provided that no consumer confusion arises and the products are genuine, parallel imports are not directly

prohibited. Parallel imports are a global phenomenon on a massive scale, with the total global market value amounting to approximately hundreds of billions of US dollars annually. Since the 1980s, well-known brands across multiple sectors, including electronics, automobiles and luxury goods, have been significantly impacted by parallel import channels. In European, American and Asian markets, grey market products have long accounted for a significant share, presenting a widespread challenge for manufacturers in global supply chain management.

In recent years, China's parallel import market—particularly in the automotive sector—has experienced policy-driven growth and expansion, gradually recovering following the pandemic. As the market has developed, parallel import channels have become increasingly diverse, evolving from early direct sales models into a complex landscape of indirect sales. This has enabled overseas dealers to choose between direct sales channels via cross-border import integrators or participation in parallel import channels through local authorised dealers, thereby creating a diverse range of channel options.

Based on this, this paper constructs a research framework for the co-opetition between overseas distributors and local authorised distributors, exploring optimal channel selection strategies for overseas distributors under the combined influence of channel erosion and loyalty effects.

2 Literature Review

Parallel imports, as a key component of cross-border imports, refer to genuine products that have been legally released onto overseas markets but are not authorised by the brand owner. They are becoming increasingly common worldwide due to exchange rate differences, product shortages and 'free-riding' behaviour, and account for a significant share of markets such as the mobile phone market in Malaysia and the memory card market in India. A wealth of academic research has emerged on parallel imports. While early studies largely focused on pricing issues, over the past five years scholars have expanded their scope to include sales channels, after-sales service and organisational structures. Among these, Feng Ying et al. (2024)^[1] continued the exploration of pricing issues, Cheng Mingbao et al. (2024)^[2] examined sales channel decisions, and Cao Wenbin et al. (2023)^[3] focused on after-sales service, whilst Wu et al. (2024)^[4] utilised blockchain technology to demonstrate that parallel imports benefit retailers in the low-end market but are detrimental to those in the high-end market. With regard to different market participants, research over the past five years indicates that manufacturers may benefit from global pricing and channel management (Huang et al., 2020)^[5], authorised dealers exhibit varying attitudes under different market structures (Wu et al., 2024)^[4], whilst consumers, although gaining access to low-price purchasing channels, find it difficult to enjoy the full range of value-added services and after-sales guarantees offered by authorised channels.

Traditional research has largely viewed the channel erosion effect as a negative impact of parallel imports on brand owners and authorised distributors, arguing that such 'free-riding' behaviour erodes market share, deteriorates channel relationships, undermines differentiated pricing strategies and diminishes brand value; however, few

studies have considered the potential growth in sales and profits resulting from channel erosion from the perspective of overseas distributors. In recent years, research on channel conflict has primarily focused on the impact of manufacturers opening online channels on offline retail. Studies such as Kim and Chun (2018)^[6] and Li et al. (2019)^[7] have examined the cannibalisation and competitive effects of online and offline channels, whilst Choi et al. (2024)^[8] and Chen et al. (2023)^[9] analysed the complementary and cannibalisation mechanisms under channel conflict, whilst Luo et al. (2024)^[10] empirically revealed the interactions between online and offline channels. However, the existing literature has not yet incorporated overseas distributors as a key actor to investigate the cannibalisation and loyalty effects triggered by channel conflict when they enter the domestic market.

The academic community has produced a wealth of research on coordination mechanisms addressing dual uncertainty in demand and supply. In traditional supply chain research, early literature highlighted that simple wholesale price contracts struggle to address the risks of overproduction and short delivery, and proposed coordination mechanisms such as risk-sharing contracts, buy-back contracts and buy-back–revenue-sharing contracts, emphasising the need to establish appropriate mechanisms to address dual uncertainty. Among these, Chou et al. (2020)^[11] noted that intermediate inventory can serve as a buffer mechanism to manage both types of uncertainty simultaneously. Over the past five years, scholars have further extended the concept of uncertain demand to the field of green and sustainable supply chains: Zhao et al. (2019)^[12] examined coordination issues in supply chains under stochastic demand when both manufacturers and retailers bear corporate social responsibility; Gao and Zhang (2020)^[13] applied uncertainty theory to explore pricing, greenness and sales effort decisions in green supply chains; Jia et al. (2022)^[14] analysed emission reduction and pricing strategies of green manufacturers in pre-sale and spot markets using stochastic models, and classified low-carbon consumers.

3 Problem Description and Model Construction

This study constructs a global cross-border e-commerce supply chain comprising overseas brand suppliers, local authorised distributors, overseas distributors and cross-border import integrators, focusing on two distinct pathways for overseas distributors to enter the local market: firstly, indirect sales channels, whereby overseas distributors establish strategic partnerships with local authorised distributors to share resources and maximise profits by leveraging the latter's sales networks and brand recognition; secondly, direct sales channels, whereby overseas distributors utilise cross-border import integrators to enter the market via parallel imports, bypassing the official authorisation system, but facing greater market uncertainty.

Within this authorised market structure, this study aims to investigate the optimal channel selection strategies and market performance of overseas distributors under these dual models, specifically analysing the following key issues: First, under indirect and direct sales channels, how can overseas distributors maximise their own profits through pricing and quantity decisions, taking into account the effects of channel

cannibalisation and channel loyalty? Second, how do channel cannibalisation, channel loyalty and market demand uncertainty influence pricing and quantity decisions, as well as market share, under the two channel types? Third, by comparing market performance across the two channel choices, this study provides a theoretical basis and decision-making support for the channel strategies of overseas distributors entering local markets.

To focus on the key points, this paper will examine direct sales channels in detail: Under the direct sales model, overseas distributors enter the local market by competing with local authorised distributors. This mode of market entry makes it difficult for overseas distributors to obtain information on local market demand; see the studies by Yang et al. (2025)^[15], Petruzzi et al. (1997)^[16] and Ahmadi et al. (2015)^[17], we introduce a random variable ϵ to represent stochastic demand, where $\epsilon \in [A, B]$ and this random variable follows a uniform distribution $U(A, B)$.

(1) Functions under channel erosion effects

Based on the phenomenon of market segmentation, we have established differentiated consumer demand functions. The superscript DE denotes the scenario under the direct sales model influenced by the channel erosion effect: Authorised market demand function: $D_A^{DE} = \min(a - bv, a - bp_a^{DE})(1 - \alpha)$; Parallel import market demand function: $D_G^{DE}(p_b^{DE}, \epsilon) = bv - bp_b^{DE} + \alpha \min(a - bv, a - bp_a^{DE}) + \epsilon$, where $0 < p_b^{DE} < v < p_a^{DE}$, $\alpha \in (0, 1]$. Overseas distributor profit function: $\Pi_{OD}^{DE} = (1 - \theta)\pi_{OD}^{DE}$,

$$\pi_{OD}^{DE} = \begin{cases} p_b^{DE} D_G^{DE}(p_b^{DE}, \epsilon) - w_c^{DE} q_b^{DE} - h[q_b^{DE} - D_G^{DE}(p_b^{DE}, \epsilon)], & D_G^{DE}(p_b^{DE}, \epsilon) \leq q_b^{DE} \\ p_b^{DE} q_b^{DE} - w_c^{DE} q_b^{DE} - s[D_G^{DE}(p_b^{DE}, \epsilon) - q_b^{DE}], & D_G^{DE}(p_b^{DE}, \epsilon) > q_b^{DE} \end{cases} \quad (1)$$

Profit function for local authorised dealers: $\pi_{LD}^{DE} = (p_a^{DE} - w_a^{DE})D_A^{DE}$.

(2) Functions under channel loyalty effects

In particular, when $\alpha = 0$, consumers are assumed to maintain absolute loyalty to the authorised channel; the superscript DL denotes the scenario of the direct sales model under the influence of the channel loyalty effect. The consumer demand functions for different market segments can be simplified as follows: authorised market demand function: $D_A^{DL} = \min(a - bv, a - bp_a^{DL})$; parallel import market demand function: $D_G^{DL}(p_b^{DL}, \epsilon) = bv - bp_b^{DL} + \epsilon$, where $0 < p_b^{DL} < v < p_a^{DL}$. The profit function for overseas distributors: $\Pi_{OD}^{DL} = (1 - \theta)\pi_{OD}^{DL}$,

$$\pi_{OD}^{DL} = \begin{cases} p_b^{DL} D_G^{DL}(p_b^{DL}, \epsilon) - w_c^{DL} q_b^{DL} - h[q_b^{DL} - D_G^{DL}(p_b^{DL}, \epsilon)], & D_G^{DL}(p_b^{DL}, \epsilon) \leq q_b^{DL} \\ p_b^{DL} q_b^{DL} - w_c^{DL} q_b^{DL} - s[D_G^{DL}(p_b^{DL}, \epsilon) - q_b^{DL}], & D_G^{DL}(p_b^{DL}, \epsilon) > q_b^{DL} \end{cases} \quad (2)$$

Profit function for the domestic authorised dealer: $\pi_{LD}^{DL} = (p_a^{DL} - w_a^{DL})D_A^{DL}$.

4 Model Solving and Decision Analysis

(1) Direct sales model influenced by the channel erosion effect

Theorem 1: Under the influence of channel erosion effects, the optimal selling price p_a^{DE*} for authorised product A and the optimal selling price p_b^{DE*} and optimal order quantity q_b^{DE*} for parallel-imported product B for the local authorised dealer are

respectively: $p_a^{DE*} = \frac{a+bw_a}{2b}$, $[1 - F(z^*)] = \frac{(w_c+h)}{(p_b^{DE*}+s+h)}$, $z^* = B - \frac{B-A}{p_b^{DE*}+s+h}(w_c+h)$, $p_b^{DE*} \equiv p(z) = \frac{a+bw_c+\mu}{2b} - \frac{\theta(z)}{2b}$, where $\theta(z^*) = \int_z^B (u-z)f(u)du = \frac{(B-z^*)^2}{2(B-A)}$, $p_b^{DE*} = \frac{a+bw_c+\frac{A+B}{2}}{2b} - \frac{(B-A)}{4b} \left(\frac{w_c+h}{p_b^{DE*}+s+h} \right)^2$, $q_b^{DE*} = z^* + bv - bp_b^{DE*} + \frac{\alpha}{2}(a-bw_a)$, Since $\epsilon \sim U[A, B]$, numerical iteration is required to solve for z^* and p_b^{DE*} .

Corollary 1: Under the influence of the channel erosion effect, the relationship between the market performance of overseas distributors and demand uncertainty is as follows:

- a) The selling price of overseas distributors, p_b^{DE*} , increases as B increases.
- b) The selling price of domestic authorised distributors, p_a^{DE*} , is independent of demand uncertainty B .
- c) The import quantity q_b^{DE*} of the overseas distributor increases as B increases.

Corollary 1 indicates that, under the channel erosion effect, the optimal selling price $\{p_b^{DE*}\}$, quantity q_b^{DE*} and profit Π_{OD}^{DE*} increase as demand uncertainty B rises, whilst the domestic authorised distributor’s optimal selling price p_a^{DE*} and quantity q_a^{DE*} regarding B are independent of the upper bound of demand uncertainty B . This is because, as the upper bound of demand uncertainty B increases, the range of market demand fluctuations widens. To mitigate the risks of excess inventory and stock-out losses, the overseas distributor will choose to increase safety stock and raise the total order quantity to cope with the uncertainty of growing random demand. In the direct sales channel, the overseas distributor holds the pricing power for the parallel-imported product. To pursue higher unit revenue and hedge against the risk of demand fluctuations, the overseas distributor will raise the selling price of the parallel-imported product. Furthermore, due to the channel erosion effect, some consumers with a high willingness to pay shift to the parallel-import market to purchase the parallel-imported product, which drives an increase in demand for the parallel-imported product in the domestic market. The marginal benefits resulting from this proactive adjustment by overseas distributors exceed the marginal costs arising from increased risk, ultimately leading to an increase in their expected profits. In contrast, within the direct sales channel, pricing and quantity decisions made by authorised domestic distributors in the authorised market are unrelated to the demand uncertainty faced by overseas distributors in the parallel import market and are not subject to interference from uncertain demand.

(2) Direct sales model under the influence of the channel loyalty effect

Theorem 2: Under the influence of channel loyalty effects, the optimal selling price for authorised product A and the optimal selling price p_b^{DL*} and optimal order quantity q_b^{DL*} for parallel-imported product for the local authorised dealer are respectively:

$p_a^{DL*} = \frac{a+bw_a}{2b}$, $[1 - F(z^*)] = \frac{(w_c+h)}{(p_b^{DL*}+s+h)}$, $z^* = B - \frac{B-A}{p_b^{DL*}+s+h}(w_c+h)$, $p_b^{DL*} \equiv p(z) = \frac{a+bw_c+\mu}{2b} - \frac{\theta(z)}{2b}$, $p_b^{DL*} = \frac{a+bw_c+\frac{A+B}{2}}{2b} - \frac{(B-A)}{4b} \left(\frac{w_c+h}{p_b^{DL*}+s+h} \right)^2$, where $\theta(z) = \int_z^B (u-z)f(u)du = \frac{(B-z)^2}{2(B-A)}$, $q_b^{DL*} = z^* + bv - b \left(\frac{a+bw_c+\mu}{2b} - \frac{\theta(z)}{2b} \right)$, Since $\epsilon \sim U[A, B]$, it is necessary to use numerical iteration to solve for z^* and p_b^{DL*} .

Corollary 2: Under the influence of the channel loyalty effect, the relationship between the market performance of overseas dealers and the price sensitivity coefficient is as follows:

- a) The selling price p_b^{DL*} of overseas distributors decreases as b increases.
- b) The selling price p_a^{DL*} of domestic authorised distributors decreases as b increases.

Corollary 2 indicates that, under the channel loyalty effect, the optimal selling price p_b^{DL*} of overseas distributors for parallel-imported product decreases as the price sensitivity coefficient b increases; the profit of overseas distributors Π_{OD}^{DL*} increases as the price sensitivity coefficient b rises, whilst the optimal selling price p_a^{DL*} of the parallel-imported product for domestic authorised dealers decreases as b increases. This is because, as the price sensitivity coefficient b increases, consumers become more price-sensitive; if a price increase is implemented, it would lead to a significant decline in demand. To maintain or expand their market share, both the overseas distributor and the local authorised distributor will opt to lower their selling prices. However, by strategically reducing the selling price of parallel-imported product, the overseas distributor achieves a substantial increase in sales volume, ultimately leading to an upward trend in its profits.

5 Numerical Analysis

Under the channel erosion effect, assuming that demand uncertainty ϵ follows a uniform distribution over $[0, B]$ (where B varies between 1 and 100), and setting consumer willingness to pay $v = 80$ and the channel erosion rate $\alpha = 0.5$, a numerical analysis was conducted to investigate the impact of demand uncertainty on the selling prices, import volumes and profits of domestic and overseas distributors. The results are shown in Figure 1.

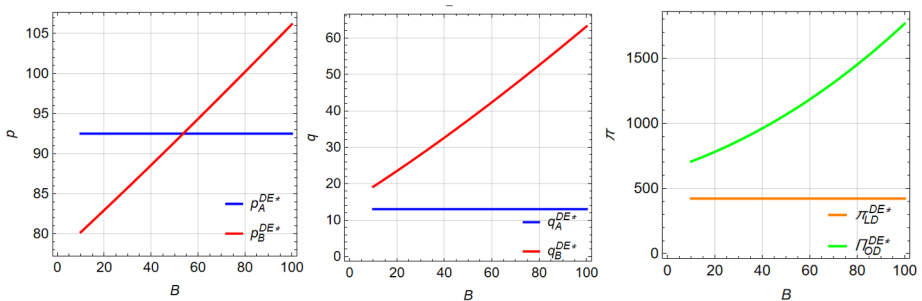


Fig. 1. Relationship between price, quantities, profits and B .

As can be seen from Figure 1, under the channel erosion effect, the relationship between the selling price and B shows that as the uncertain upper limit of demand, increases, the selling price of domestic authorised dealers remains unchanged, whilst that of overseas dealers rises. This is because domestic authorised dealers, as market leaders, set the prices for authorised products first; their profit function depends solely on

their own pricing and the certain demand in the authorised market, and is not directly affected by the uncertainty faced by overseas dealers.

Under the channel erosion effect, with the channel erosion rate α set at 0.5 and the demand uncertainty parameters $A = 0$ and $B = 50$, a numerical analysis was conducted to investigate the impact of the price sensitivity coefficient b on the selling prices, import volumes and profits of domestic and overseas distributors. The results are shown in Figure 2.

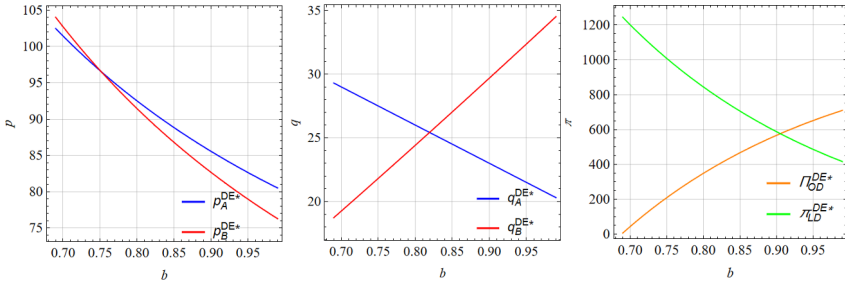


Fig. 2. Relationship between price, quantities, profits and b .

As shown in Figure 2, under the channel erosion effect, the relationship between selling price and b indicates that as the price sensitivity coefficient increases, the selling prices of both domestic authorised dealers and overseas dealers decrease. This is because a higher price sensitivity coefficient indicates that consumers are more price-sensitive, and the pricing leverage effect is stronger. When the price sensitivity coefficient increases, raising prices leads to a significant drop in demand; consequently, both domestic authorised dealers and overseas dealers will proactively lower the selling prices of authorised products and parallel-imported products to maintain their market share.

6 Conclusion

Through theoretical derivations and numerical analysis, this study systematically reveals the optimal equilibrium paths for these strategies under different scenarios.

The findings reveal that: (1) regarding pricing strategies: Under a direct sales channel, due to the channel erosion effect, the optimal selling price of parallel-imported products set by overseas dealers will rise as market demand volatility increases. Due to the channel loyalty effect, as the consumer price sensitivity coefficient increases, overseas distributors and local authorised distributors will respectively lower the selling prices of parallel-imported products and locally authorised products. (2) Regarding sales channel selection strategies: when demand uncertainty is high and channel erosion rates are high, direct sales channels should be selected. Under the channel loyalty effect, direct channels are chosen when the price sensitivity coefficient is high and the upper limit of demand uncertainty is high.

Overall, direct channels, retain autonomous pricing power at the cost of bearing inventory and stock-out risks, competing for high profit margins in uncertain markets.

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Disclosure of Interests

I declare that I am not involved in competing interests in relation to the content of this article.

References

1. Feng Ying, Chen Suyu, Wei Min, et al. Optimal Grey Market Structure and Pricing Decisions Taking into Account the Reference Price Effect [J]. *Chinese Journal of Management Science*, 2024(1).(in Chinese)
2. Cheng Mingbao, Wu Shuo, Su Xixiong, et al. A Study on Channel Selection Strategies for Dominant Manufacturers in a Grey Market Context [J]. *Theory and Practice of Systems Engineering*, 2025, 45(04): 1265–1277.(in Chinese)
3. Cao Wenbin, Zhang Siqi. A Study on Operational Strategies for Grey Market Supply Chains Considering Product Competition and After-Sales Service [J]. *Logistics Science and Technology*, 2023, 46(14): 124–132.(in Chinese)
4. Wu J, Cheng H, Li L. Blockchain-enabled downward traceability to combat gray market[J]. *International Journal of Production Economics*, 2024, 278: 109415.
5. Huang H, He Y, Chen J. Cross-market selling channel strategies in an international luxury brand's supply chain with gray markets[J]. *Transportation Research Part E: Logistics and Transportation Review*, 2020, 144: 102157.
6. Kim J C, Chun S H. Cannibalization and competition effects on a manufacturer's retail channel strategies: Implications on an omni-channel business model[J]. *Decision Support Systems*, 2018, 109: 5-14.
7. Li B, Li X, Liu H. Consumer Preferences, Cannibalization, and Competition[J]. *MIS Quarterly*, 2018, 42(2): 661-678.
8. Choi T M, Chen Y, Chung S H. Online-offline fashion franchising supply chains without channel conflicts: Choices on postponement and contracts[J]. *International Journal of Production Economics*, 2019, 215: 174-184.
9. Chen L, Nan G, Li M, et al. Manufacturer's online selling strategies under spillovers from online to offline sales[J]. *Journal of the Operational Research Society*, 2023, 74(1): 157-180.
10. Luo X, Zhang Y, Zeng F, et al. Complementarity and cannibalization of offline-to-online targeting: A field experiment on omnichannel commerce[J]. *Mis Quarterly*, 2020, 44(2): 957-982.
11. Chou Y C, Kamano K, Yu M S. Dynamic matching of uncertain demand with uncertain supply for bike sharing systems[J]. *International Journal of Industrial Engineering*, 2019, 26(6).
12. Zhao X, Dou J. Coordination of a socially responsible two-stage supply chain under random yield and demand[J]. *RAIRO-Operations Research*, 2024, 58(6): 4971-4995.
13. Gao R, Zhang Z. Analysis of green supply chain considering green degree and sales effort with uncertain demand[J]. *Journal of Intelligent & Fuzzy Systems*, 2020, 38(4): 4247-4264.

14. Jia H, Li J, Liang L, et al. Advance selling of uncertain demand in low-carbon supply chain[J]. *Industrial Management & Data Systems*, 2022, 122(12): 2680-2709.
15. Yang Ruipeng, Gao Ruoxin, Yang Ruina. Supply Chain Decision-Making under Uncertain Demand: A Study of Dual Competition in Price and Service [J]. *Journal of Systems Management*, 2025, 34(02): 353–362.(in Chinese)
16. Petruzzi N C, Dada M. Pricing and the newsvendor problem: A review with extensions[J]. *Operations research*, 1999, 47(2): 183-194.
17. Ahmadi R, Iravani F, Mamani H. Coping with gray markets: The impact of market conditions and product characteristics[J]. *Production and Operations Management*, 2015, 24(5): 762-777.

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