Frontiers in Economics and Management Volume 5 Issue 1, 2024
ISSN: 2692-7608 DOI: 10.6981/FEM.202401_5(1).0018

Analysis of the Coordination and Optimization Path of Cross Border E-commerce Supply Chain based on Revenue Sharing

Ying Chen[1], Fuchang Li[2,*]

[1] School of Economics and Trade, Guangdong Eco-engineering Polytechnic, Guangzhou 510000, China

[2] School of Economics and Management, Yunnan Normal University, Kunming 650500, China

*Corresponding Author

Abstract

Supply chain coordination optimization can bring more profits to all parties involved in the supply chain. In addition, pricing and inventory are key factors determining supply chain optimization. In the cross-border e-commerce supply chain, factors such as long logistics transportation time, multiple intermediate links and high inventory costs lead to high commodity prices. Difficulties in returns and poor after-sales service have affected the shopping experience of consumers, leading to a decrease in secondary repurchases. Studying the coordination and optimization of cross-border e-commerce supply chain based on revenue sharing contracts for pricing and inventory can solve a series of problems.

Keywords

Cross-border E-commerce; Revenue Sharing Contract; Dual-channel; Supply Chain Coordination; Pricing.

1. Introduction

The competition in the 21st century is no longer between enterprises, but between supply chains. Due to the development of e-commerce and information technology breaking the limitations of practice and space on economic activities, supply chain management has shown a trend of globalization and electronization. The development of cross-border e-commerce models has provided new directions for the transformation and upgrading of traditional enterprises. According to the "2022 China Cross border E-commerce Market Data Report", the scale of China's cross-border e-commerce market reached 15.7 trillion yuan in 2022, accounting for 37.32% of China's total import and export value of goods trade of 42.07 trillion yuan. Among them, the scale of the export cross-border e-commerce market reached 12.3 trillion yuan, accounting for 78.34% of the total import and export cross-border value, an increase of 11.81% year-on-year from 2021. In terms of model structure, China's cross-border e-commerce B2B transactions in 2022 accounted for 75.6% and cross-border e-commerce B2C transactions accounted for 24.4%. In addition, the penetration rates of the cross-border e-commerce industry from 2018 to 2021 were 29.5%, 33.29%, 38.86% and 36.32%, respectively. Overall, the penetration rate of cross-border e-commerce in China is steadily increasing and cross-border e-commerce is gradually becoming a new highlight of China's foreign trade development.

In the Chinese cross-border e-commerce market, exports account for a relatively large proportion. This article mainly focuses on analyzing the export situation of cross-border e-commerce. At present, cross-border e-commerce exports are mainly divided into two transaction models: domestic manufacturers to foreign retailers (i.e. B2B, retail channels) and domestic manufacturers to foreign consumers (i.e. B2C, direct sales channels). Cross border e-

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commerce can leverage internet technology and electronic data exchange technology to achieve information transmission and sharing, analyze consumer preferences and demand changes, adjust product inventory in a timely manner, prevent out of stock or out of stock phenomena and reduce intermediate links to lower supply chain costs. For the B2C transaction model, retailers are not limited by geography or time and shopping is more free. Due to the reduction of intermediate links in products, consumers can obtain more high-quality and cost-effective products with lower prices. However, the operation process of cross-border e-commerce involves overseas. Moreover, cross-border logistics uses methods such as air parcel, mail and express delivery during delivery, which can easily lead to logistics delivery delays, product damage or loss. In addition, the goods require customs clearance, which makes it difficult to return them in the after-sales process of the supply chain and affects the shopping experience of consumers. In the two transaction modes of cross-border e-commerce exports, pricing and inventory are important factors affecting the profits of all parties involved in the supply chain. Therefore, in the context of cross-border e-commerce, studying how to optimize pricing and inventory through supply chain contracts, achieve a dual channel supply chain profit sharing mechanism and synergy effect, has both theoretical and practical significance, which can provide certain reference value for the development of cross-border e-commerce.

At present, domestic and foreign scholars have conducted certain research on the joint optimization of pricing and inventory. Qiu and Li [1] studied two operational strategies of inventory information sharing and hiding. By analyzing consumer behavior and market demand, they constructed a two-stage sales profit model for online retailers including customized optimal pricing and inventory decisions. Li et al. [2] constructed a dual channel supply chain model based on revenue sharing contracts under differential pricing conditions and conducted joint optimization research on pricing and inventory. Tang et al. [3] considered the decision-making behavior of strategic consumers and constructed single-stage and two-stage pricing and inventory decision-making models for retailers. They analyzed the impact mechanism of product value surplus rate on consumer behavior, optimal retail pricing, optimal inventory level and retailer profit. They found that in the single-stage model, the optimal retail price and optimal inventory level were positively correlated with product value surplus rate; In a two-stage model, there may be a threshold for the trend of the optimal price in the second stage to change with the residual value ratio. Wang[4] analyzed the impact of "double loss" on cold chain inventory, constructed a two-level cold chain inventory model where demand is affected by both price and freshness and studied the optimal preservation input, inventory and pricing strategy for integrated decision-making when DC combines distribution and logistics functions, with the objective function of maximizing total average profit. Wang et al. [5] considered the impact of residual value changes and customer heterogeneity on retailer pricing and inventory decisions.

Du et al. [6] studied the impact of strategic consumers having risk preferences on the joint pricing and inventory decisions of retailers. Hsieh et al. [7] studied the decision-making of price and inventory quantity in two models: decentralized, non coordinated and centralized integration. They analyzed the mixing of direct and retail channels with multiple manufacturers and a common retailer in the supply chain. Huang et al. [8] constructed a two-stage model to study pricing and production decisions in a dual channel supply chain with demand interruption. Research has shown that in both centralized and decentralized dual channel supply chains, the optimal production capacity has a certain degree of robustness under demand interruption and the optimal pricing decision is influenced by customer preferences for direct channels and changes in market size.

The research in this article also involves the coordination problem of dual channel supply chain. Wang et al. [9] studied the coordination problem of supply chain revenue sharing contracts based on risk avoidance and fairness preference. Liu et al. [10] constructed two different spot

ISSN: 2692-7608 DOI: 10.6981/FEM.202401_5(1).0018

market replenishment strategy models for replenishment problems in uncertain environments and shared the supply chain contract coordination problem. The study found that the designed revenue sharing risk sharing contract can better reduce the impact of uncertainty on returns compared to a single revenue sharing contract. Ramrakhyani et al. [11] applied the VMI-CI strategy to study the impact of payment delay and the time value of currency in Kanban manufacturing systems. Danbin et al. [12] studied the compensation strategy for dual channel supply chain coordination from the perspective of cooperation between electronic channels and traditional channels. The results showed that this compensation strategy can achieve dual channel supply chain coordination and ensure a win-win situation for members of the dual channel supply chain within a certain range.

Regarding the research on cross-border supply chain, the concept of "cross-border supply chain" has emerged in the economic and academic circles, which is a completely new concept and has not yet been accurately defined by the industry. Shen Shaoji, Executive Vice President of the China Warehousing and Distribution Association, once pointed out that a similar concept is the global supply chain. References [13-15] studied the cost-effectiveness of global supply chains, while references [16-17] investigated how participants in global supply chains achieve customer satisfaction through information sharing and cooperation, thereby improving overall supply chain performance.

The above literature indicates that there has been some research on pricing and inventory joint optimization by domestic and foreign scholars, but there is relatively little research on pricing inventory joint optimization based on revenue sharing contracts and even less research on pricing inventory joint optimization considering cross-border supply chain backgrounds. This article will introduce cross-border e-commerce based on the above literature, linking pricing and inventory joint optimization, dual channel supply chain coordination issues and cross-border supply chain for research. This is not only an inevitable trend in supply chain development, but also of great significance for China's foreign trade development and international competitiveness enhancement.

2. Problem Description and Assumptions

Assumption 1: There is only one importing country and one exporting country. Moreover, the importing country has not imposed import tariffs (goods that fall within the exemption scope of the importing country or whose value has not reached the threshold).

Assumption 2: The only manufacturer in the exporting country is called a domestic manufacturer; The only import state-owned retailer, known as a foreign retailer.

Assumption 3: In the Stackelberg model, domestic manufacturers act as leaders and determine wholesale prices, direct sales channel sales prices and total inventory capacity for foreign retailers; In traditional channels, foreign retailers act as followers ,determine retail prices and order quantities.

Assumption 4: In the random market demand, if domestic manufacturers export a single type of product and the residual value of unsold products is 0, there will be no corresponding additional costs in case of shortage, the remaining cost per unit of product is equal to the production cost per unit of product and the opportunity cost per unit of product shortage is equal to the net profit per unit.

Assumption 5: Both domestic manufacturers and foreign retailers are risk neutral and completely rational.

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3. Model Framework Analysis

Firstly, the cost-benefit structure of domestic manufacturers, foreign retailers, foreign consumers should be analyzed and a profit function for cross-border e-commerce export participants should be constructed.

Secondly, using revenue sharing contracts as a means of coordinating the interests of cross-border e-commerce export participants, this study analyzes the decision-making transmission mechanisms of wholesale price, retail price, direct sales price, domestic manufacturer inventory and foreign retailer inventory. Under random conditions, a joint optimization model for cross-border e-commerce export pricing and inventory based on revenue sharing contracts is constructed and then a method is designed to solve the model.

Thirdly, the pricing strategies, inventory strategies, coordination mechanisms of cross-border e-commerce export participants under consistent pricing (network prices are the same as physical prices) and differential pricing conditions, as well as the impact paths of revenue sharing contracts on the profits of domestic manufacturers and foreign retailers should be studied. Then the pricing and inventory optimization strategies, the total profit of the supply chain and the difference in profits between foreign retailers and domestic retailers under decentralized optimization and joint optimization conditions should be compared and analyzed.

4. Conclusion

The development of China's cross-border supply chain will definitely enable China to establish a global logistics system that connects the world, forming high standard global logistics service capabilities,which will strongly support China's global production and circulation. This article is a hot and cutting-edge research on the joint optimization of cross-border e-commerce export pricing and inventory based on revenue sharing. It is a topic worthy of in-depth research. In the module of model research, only a brief overview of the model framework is provided. The next goal is to set specific data models for each part based on assumptions and model frameworks, introduce case analysis and conduct deeper exploration.

Acknowledgments

The authors greatly appreciate the anonymous referees and the associate editor for their very valuable and helpful suggestions on an earlier version of the paper. This research is supported by the NSF of China (Grant No. 71962037), Zhu Qinghua Expert Workstation in Yunnan Province (202305AF150028),Humanities and Social Sciences Research Project of Yunnan Provincial Academy and School Education Cooperation(Grant No. SYSX202207), General Project of Yunnan Basic Research Plan(Grant No. 202201AT070035), Key Laboratory of Yunnan Provincial Department of Education:Development and Management of Digital Finance, Yunnan Postgraduate Tutor Team Construction Project(Financial Innovation and Risk Management), Yunnan Province Professional Degree Postgraduate Teaching Case Database Construction Project(Rural public management), Yunnan Normal University's Excellent Research and Innovation Team: Agricultural Supply Chain Finance Innovation and Risk Precision Prevention and Control.

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