



Loss Aversion and Ordering Decisions in Supply Chains: A Systematic Review of Coordination, Performance, and Effectiveness

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ABSTRACT

This study investigates the most commonly used supply chain coordination tools and evaluates their performance in the context of loss aversion. Using a systematic literature review, 71 articles published between 2005 and 2024 were extracted from the Web of Science database and analyzed. The findings categorize coordination tools into two main types: contractual and non-contractual mechanisms. Among contractual forms, wholesale price contracts were found to be the least effective in mitigating loss aversion effects, while revenue sharing contracts showed the highest efficiency. Buyback and trade credit contracts also demonstrated superior performance over traditional options and wholesale price contracts by better addressing overstocking fears and demand uncertainty. Non-contractual coordination tools, such as centralized inventory systems, backordering, and supplier selection methods, were found to influence ordering behavior by reducing the cognitive impact of loss aversion. The novelty of this study lies in its comprehensive categorization and ranking of coordination tools in relation to behavioral biases, particularly loss aversion rooted in Prospect Theory. It is also the first to systematically identify and evaluate contract performance under such behavioral considerations. The results have significant implications for researchers and practitioners aiming to design more efficient and psychologically informed supply chain systems.

Keywords: Supply chain coordination, Supply chain contracts, Newsvendor problem, Prospect theory, Loss aversion.

Introduction

Supply chain coordination is a group of strategies and tools used by supply chain participants to match their aims and achieve overall satisfaction. This coordination is important for news vendors and inventory managers who aim to optimize order quantities in uncertain and fluctuating demand and supply. However, these actors have different ways of thinking, preferences, and rational levels. Therefore, they are also affected by cognitive biases. One of the well-known biases investigated by several researchers is loss aversion, which was initially explained by Kahneman and Tversky (1979) as one of the basics of the value function in prospect theory. According to them, loss aversion occurs when people feel the pain of losing something more strongly than the pleasure of gaining the same amount. Loss aversion affects ordering decisions, typically making them order less than the optimal quantity. This results from the fear of overstocking and the associated perceived loss of unsold inventory at market prices (Xinsheng *et al.*, 2015; Ma *et al.*, 2016; Xu *et al.*, 2017; Xu *et al.*, 2018; Zhou *et al.*, 2018; Chan *et al.*, 2019; Li *et al.*, 2021; Wang *et al.*, 2023). Accordingly, newsvendors tend to increase their order quantities when shortage costs are high, thereby reducing the risk of understocking (Xinsheng *et al.*, 2015; Xu *et al.*, 2018; Chan *et al.*, 2019). However, higher salvage values lead to larger order quantities and overstocking (Liu *et al.*, 2014; Xinsheng *et al.*, 2015; Yu *et al.*, 2021; Wang *et al.*, 2023). This study investigates the most commonly used supply chain coordination tools and ranks them according to their characteristics. Therefore, a systematic literature review was conducted to address this question and answer the following questions:

Received: 27.03.2025 –Accepted: 24.06.2025 –Published: 15.07.2025

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- How did the research evolve with time?
- In which journals were these articles published, what were their ranks, and what were their countries?
- What are the most common analysis methodologies used in the investigated papers?
- What are the most commonly used contracts in supply chain coordination?
- What other coordination tools are used in the supply chain?
- Which are the best and least efficient contracts used?
- What are the recommendations for future studies?

Research Methodology

This study uses a systematic literature review to answer these research questions. It began by determining the main aim of this study and the suitable keywords and codes to be used in searching databases. I only used the Web of Science database, and the final code that I found most suitable was: ("supply chain" or "newsvendor*") and ("coordinat*" or "contract*") and ("loss avers*" or "prospect theory" or "reference dependence" or "reference point*") This code is thorough, detailed, and centered around the main objective.

As illustrated in **Figure 1**, the first database search yielded 216 articles. These articles were then filtered to obtain only English articles and review articles. Thus, a total of 185 articles were included. To add more credibility to this study, old, low-cited articles were excluded. I focus on articles with 20 or more citations. Therefore, I divided the 185 studies into two groups: 125 studies with fewer than 20 citations and 60 studies with 20 or more citations. To ensure that recent studies were not ignored, I included articles from 2020 onward that were ranked Q1, even if they had low citations. Of the 125 studies, 73 were excluded: 42 had fewer than 20 citations and were published before 2020, and 31 were published after 2019 but ranked below Q1 and had low citations. Consequently, I selected well-cited and well-ranked papers, excluding older articles with low citations.

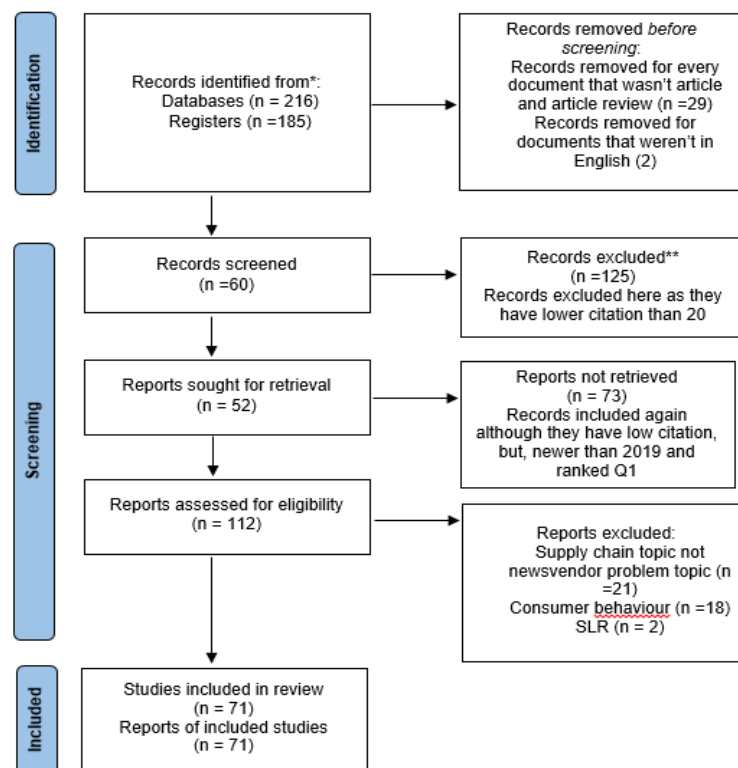


Figure 1. Prisma flow figure

Source: adapted from Prisma 2020 (own illustration)

Therefore, I included 52 out of 125 articles for review. As a result, 112 articles were read, with 52 articles specified and 60 articles included before. After reviewing the abstracts and titles of these 112 articles, some papers were excluded as follows: 21 papers were excluded as they focused on biases that are not connected to prospect theory, loss aversion, and reference dependence, and their topics were not related to the newsvendor problem. Moreover, 18 articles studied consumer behavior unrelated to newsvendor behavior. In addition, two articles that were systematic literature reviews were excluded. In total, 41 studies were excluded. Ultimately, 71 articles were included in this review. These articles were published from 2005 to 2024.

Findings from the Literature

Bibliometric Analysis

In this section, the quantitative aspects, trends, and journal ranks of the articles are analyzed.

The Number of Articles Over Time

As **Figure 2** shows, the number of published articles increases with time. Improvements in scientific research tools and technology have facilitated the efficient writing of papers. Furthermore, the supply chain has become more complex with expanding trade relations and foreign investments. Therefore, further research is required in this regard. The curve also shows that by 2023, publications on this topic were the highest, and 11 articles were counted on this topic. This may have occurred because some journals delayed publishing papers due to the 2020 pandemic.

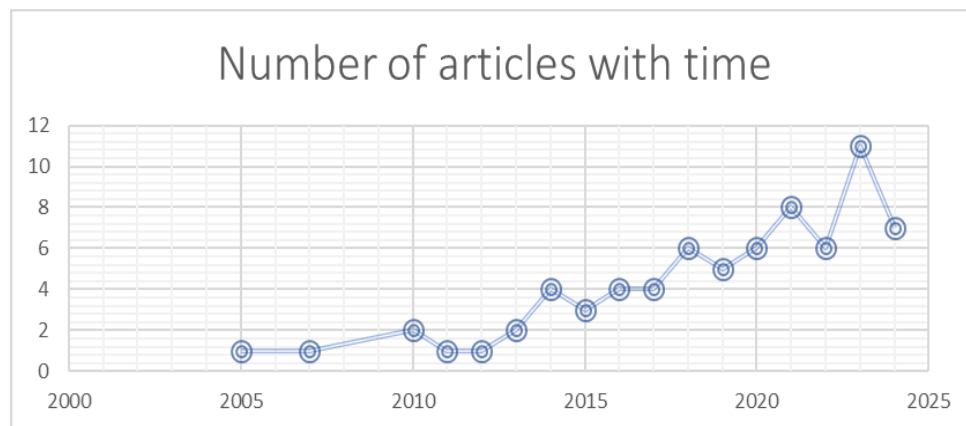


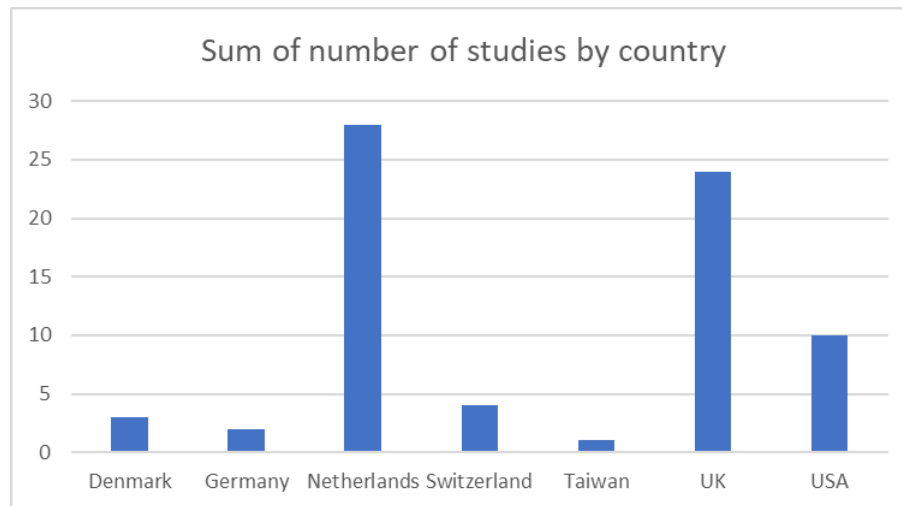
Figure 2. Articles over time

Source: created by the author based on data taken from Web of Science

Countries of Publication

This section analyzes the distribution of the reviewed articles by country. As the **Figure 3** shows, most articles were published in journals based in the Netherlands; all were ranked as Q1, estimated at 38.89% of the total articles. The UK ranked second with 24 publications (33.33%), followed by the USA with 10 (13.89%). The remaining 10 articles (13.89%) were published in journals from other countries. These countries were among the highest-ranked countries in publications. According to *SJR - International Science Ranking* (n.d.), the USA ranks as the largest and best publisher among 243 countries with 16 million publications and an H-index of 3051. The UK ranks third with 4.8 million publications and an H-index of 1928. The Netherlands is the 15th largest publisher, with publications counted around 1.3 million and an H index of 1373. Still, the remaining 23 countries in the bar chart are among the largest 23 in publishing.



**Figure 3.** Countries of publications

Source: created by the author based on data taken from Web of Science

The Publisher

As clarified in the methodology section, only old papers that ranked Q1 with low citations were included. As a result, Q1-ranked journals published 69 of 71 articles. **Table 1** shows the names of the journals. This has enhanced the research conducted using the excellent papers examined in this study.

Table 1. Journal ranks

Source Title	rank
Annals Of Operations Research	Q1
Asia Pacific Management Review	Q1
Computers & Industrial Engineering	Q1
Computers & Operations Research	Q1
Decision Sciences	Q1
Decision Support Systems	Q1
European Journal Of Operational Research	Q1
Industrial Management & Data Systems	Q1
International Journal Of Production Economics	Q1
International Journal Of Production Research	Q1
International Journal Of Systems Science-Operations & Logistics	Q1
International Transactions In Operational Research	Q1
Journal Of Business & Industrial Marketing	Q1
Journal Of Operations Management	Q1
Journal Of Retailing And Consumer Services	Q1
Journal Of The Operational Research Society	Q1
Kybernetes	Q1
M&Som-Manufacturing & Service Operations Management	Q1
Management Science	Q1
Mathematics	Q2
Mathematics And Computers In Simulation	Q1

Naval Research Logistics	Q1
Operational Research	Q2
Or Spectrum	Q1
Production And Operations Management	Q1
Sustainability	Q1
Transportation Research Part E-Logistics And Transportation Review	Q1

Source: created by the author based on data taken from Scimago Journal & Country Rank

Analysis Methods Used in the Articles

This section explores the types of analysis methods employed in the reviewed studies. Of the total articles analyzed, 80.28% (57 articles) utilized modeling and simulation techniques, while 15.49% (11 articles) conducted experiments to examine the relevant variables. The remaining 4.23% (3 articles) applied real-world data analysis. Notably, the use of real-world data has only emerged in recent years, beginning in 2021.

Source: created by the author based on data taken from Web of Science

For more details, **Figure 4** shows that modeling analysis methodology was used the most in 2021, with seven studies, which can also be explained by the delayed models estimated after the pandemic in 2020. In addition, the experimental method was centered on 2023, with three articles conducting experiments. However, real-world data were only employed in 2023 in two articles and 2021 in one article. This indicates that there has been a stronger concentration on utilizing this subject in more practical and realistic ways.

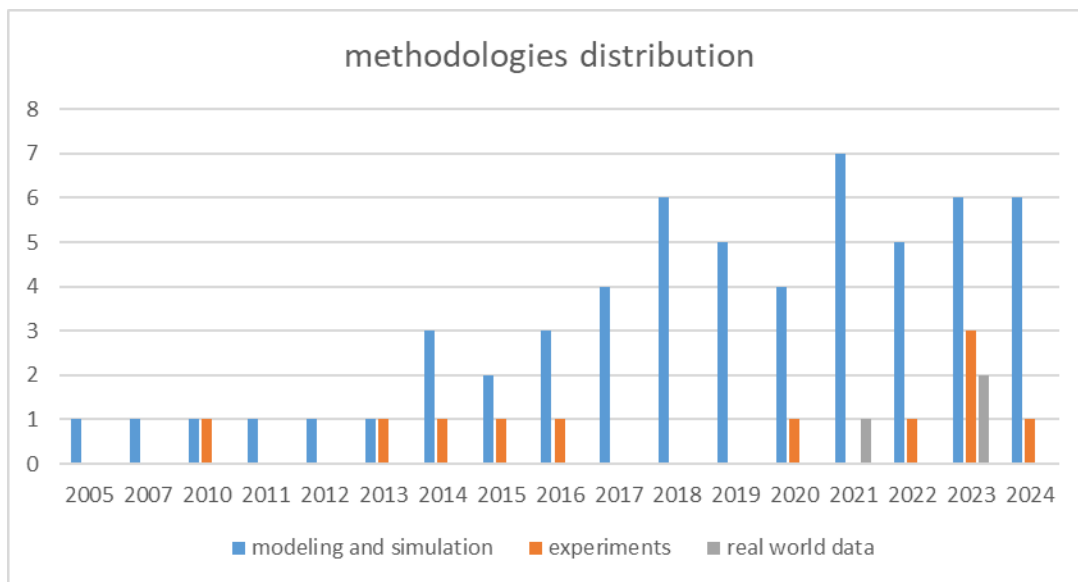


Figure 4. Distribution of methodologies

Source: created by the author based on data taken from Web of Science

Thematic Analysis

After conducting a thematic analysis, this study categorized supply chain coordination methods into supply control and contractual tools.

Supply Control

Inventory problems and supplier errors are significant factors that render coordination inefficient. Many methods have been used to address these issues. For example, backordering is an effective strategy that allows newsvendors to reduce their initial orders and postpone them until demand is realized. This reduces the overstocking (Xu *et al.*, 2017). In addition, a centralized inventory structure is an efficient method for handling autonomous demand locations and



markets. It combines information to determine locations that have high risks and decrease the overall inventory levels. This centralized model reduces the effects of loss aversion and reference dependence connected to shortage or overstocking costs (Ho *et al.*, 2010). Moreover, the higher the fulfillment rate of suppliers, the more trustworthy they become. Accordingly, loss-averse retailers place larger orders (Wang *et al.*, 2023). However, the lower the level of loss aversion in retailers, the more they deal with less reliable, lower-cost suppliers. To address this, retailers use sequential ordering and change unreliable suppliers if disruptions are expected. Large shortage costs encourage them to view any shortage as a disturbance, encouraging adaptable order modeling (Li & Li, 2018). Retailers give importance to quality, in addition to quantity, usually using a tournament system with incentives and penalties to control suppliers. To encourage suppliers to learn and solve problems quickly, retailers use punishments, such as temporarily leaving inefficient suppliers. They may use two benchmarks to choose or punish suppliers: an auction-style model, assessing suppliers' capability to reach others' quality levels, and a newsvendor-style model, depending on the supplier's previous profits. Retailers work with a few suppliers offering distinct products (Valluri & Croson, 2005). Some suppliers allow retailers to pay only for delivered products. In addition, they allowed them to place emergency orders later, if needed, at a price favorable to the suppliers. With increasing emergency order prices, suppliers can influence retailers to make large orders. This emergency order mechanism increases the ability of all parties to adapt and generate more profits (Shen *et al.*, 2011; Ma *et al.*, 2016; Huang *et al.*, 2022). Loss-averse newsvendors sometimes prefer to buy from the supplier when the actual demand is known, especially if there is good capacity and lower prices (Xu *et al.*, 2022). Therefore, suppliers may let retailers cancel orders at a specific price after demand is realized. This flexibility encourages loss-averse retailers to order more, knowing that they can cancel excess orders if the demand falls short (Ma *et al.*, 2012). All these coordination tools can control overstocking and understocking problems, reduce the loss aversion impact, and encourage more rational ordering that optimizes suppliers' and retailers' profits.

Contractual Coordination Tools

This study identifies five commonly used contract forms in supply chain coordination. **Table 2** summarizes the contracts' names, number of articles, and authors who investigated these contracts. According to the table, wholesale price contracts captured the most spotlight, with 12 studies investigating them, as this contract is traditional and plays a significant role in the supply chain. Additionally, eight articles examined buyback contracts, six concentrated on options, four studied revenue-sharing agreements, and two investigated gain-loss share contracts (Enwa *et al.*, 2022; İlhan *et al.*, 2022; Mobeen *et al.*, 2022; Zhang *et al.*, 2022; Burghate & Mundada, 2023; Tabassum *et al.*, 2023).

Table 2. Contractual coordination in SC with loss aversion impact

Contract	Articles	Number of articles
Wholesale price contract	(Shen <i>et al.</i> , 2011; Du <i>et al.</i> , 2014; Chen <i>et al.</i> , 2014; Davis, 2015; Vipin & Amit, 2017; Du <i>et al.</i> , 2018; Asian <i>et al.</i> , 2020; Vipin & Amit, 2021; Zhao <i>et al.</i> , 2022; Li <i>et al.</i> , 2023; Cao & Tang, 2024; Zhang <i>et al.</i> , 2024)	12
buyback contract	(Wang & Webster, 2007; Zhang <i>et al.</i> , 2016; Ji <i>et al.</i> , 2017; Lam & Chang, 2020; Venkataraman & Asfaw, 2020; Liu <i>et al.</i> , 2021; Hofstra & Spiliotopoulou, 2022; Zhang <i>et al.</i> , 2024)	8
options	(Chen <i>et al.</i> , 2014; Liu <i>et al.</i> , 2014; Lee <i>et al.</i> , 2015; Vipin & Amit, 2017; Xu <i>et al.</i> , 2019; Liu <i>et al.</i> , 2023)	6
revenue sharing	(Becker-Peth & Thonemann, 2016; Hu <i>et al.</i> , 2016; Zhang <i>et al.</i> , 2016; Lam & Chang, 2020)	4
Gain-loss sharing	(Wang & Webster, 2007; Deng <i>et al.</i> , 2013).	2

Source: created by the author based on data taken from Web of Science

Contract Performance

As **Figure 5** shows, this study can rank the contracts and their performance based on the articles reviewed. Most studies agree that a traditional wholesale price contract is the least efficient contract it cannot coordinate the supply chain well with the actor's loss aversion and reference dependence. If the supplier raises the wholesale price, a loss-

averse retailer raises its price accordingly. This creates double marginalization, resulting in decentralization and inefficiency (Du *et al.*, 2014; Davis, 2015; Vipin & Amit, 2017; Du *et al.*, 2018; Asian *et al.*, 2020; Zhao *et al.*, 2022; Li *et al.*, 2023; Cao & Tang, 2024; Zhang *et al.*, 2024). Furthermore, this contract did not solve the loss aversion impact in high-shortage cost cases (Shen *et al.*, 2011; Hu *et al.*, 2016), high-profit margin products (Cao & Tang, 2024), or low salvage value situations (Liu *et al.*, 2014; Xinsheng *et al.*, 2015; Yu *et al.*, 2021; Wang *et al.*, 2023). In addition, using this contract may cause real shortages (Li *et al.*, 2023) and overstocking (Vipin & Amit, 2017).



Figure 5. Contract's performance ranks

Source: created by the author based on data taken from Web of Science

Options are more efficient than wholesale price contracts because of the following: some problems, such as price volatility, are controlled by setting a fixed price in advance (Chen *et al.*, 2014; Lee *et al.*, 2015; Xu *et al.*, 2019). In addition, some options provide discounts to early payers. This creates risk sharing by providing early payments and reducing the supplier's loss aversion (Davis *et al.*, 2014; Dutta & Kaur, 2023). However, this contract encourages retailers to order more with these discount incentives (Davis *et al.*, 2014; Lee *et al.*, 2015; Dutta & Kaur, 2023). Consequently, suppliers and retailers reduce prices and minimize double marginalization. However, these early payment options did not reach the effectiveness of the standard option (Liu *et al.*, 2014). Moreover, the standard options do not have discounts. Therefore, it is considered expensive. In addition, suppliers' satisfaction decreases because of the fulfillment penalty (Davis *et al.*, 2014; Dutta & Kaur, 2023). This simulates loss aversion and affects ordering decisions, resulting in overstocking, mainly if shortage costs, replenishment, and expected retail prices are high (Chen *et al.*, 2014; Liu *et al.*, 2014; Lee *et al.*, 2015; Xu *et al.*, 2019). In contrast, higher option prices and salvage values decrease ordered quantities and cause real shortages (Chen *et al.*, 2014; Liu *et al.*, 2014; Lee *et al.*, 2015; Vipin & Amit, 2017; Xu *et al.*, 2019).

This study observed that buyback and trade credit contracts operate more efficiently than options and wholesale price contracts do. They solved more problems and had more advantages than others. Refunds for unsold products reduces overstocking fears and loss aversion (Wang & Webster, 2007; Zhang *et al.*, 2016; Venkataraman & Asfaw, 2020; Vipin & Amit, 2021; Zhang *et al.*, 2024). If the buyback price is as high as the retail price, news vendors will order more without fear of overstocking (Liu *et al.*, 2021; Hofstra & Spiliotopoulou, 2022; Zhang *et al.*, 2024). In addition, this contract handled the uncertainty problem by obligating the supplier to redirect an unsold product to another market (Ji *et al.*, 2017). Moreover, suppliers decrease wholesale prices as long as retailers are loss-averse (Liu *et al.*, 2021; Vipin & Amit, 2021). This reduces double marginalization to the lowest (Zhang *et al.*, 2016; Ji *et al.*, 2017; Venkataraman & Asfaw, 2020; Liu *et al.*, 2021; Zhang *et al.*, 2024). Another finance method allows retailers to pay after demand realization. This method helps retailers to order optimal quantities (Chen *et al.*, 2013; Wu *et al.*, 2021). Furthermore, some contracts finance unsold products and compensate for defective ones (Abdelmuhsin *et al.*, 2022; Ruchin *et al.*, 2022; Turlaev *et al.*, 2022). Accordingly, overstocking loss aversion decreases, and order increases. In



addition, interest earnings increase supplier profits and improve suppliers' technology and quality (Jin *et al.*, 2024). Suppliers can also obtain credit from the retailers. Consequently, they can control wholesale prices and production quantities. However, when the retailer is dominant, his loss aversion can reduce the wholesale price and Pareto efficiency. Therefore, interest rates and profit distributions should be set to create efficient supply chain coordination (Yan *et al.*, 2020). However, this contract requires other methods to operate efficiently. For example, distribution-free GLB combines buyback and gain-loss-sharing contracts. It provides credit availability and a loss share that decreases loss aversion, increases profits, and controls demand variation (Wang & Webster, 2007). Additionally, combining trade credit with a loss-sharing contract increases overall utilities and profits, creating more centralization (Wu *et al.*, 2021). Moreover, integrating trade credit with bank credit protects retailers from suppliers' control over credit size (Jin & Zhang, 2021). This combination helps suppliers increase the wholesale price regardless of how much the retailer is concerned about fairness, and motivates retailers to make larger orders (Chen *et al.*, 2017). On the other hand, flexible trade credit contracts are combined with a minimum order quantity (MOQ) method, which simulates orders and prevents overproduction, resulting in Pareto improvement and a resilient supply chain (Asian *et al.*, 2020). In addition, Jin *et al.* (2024) investigated the Credit Guarantee (GQ) scheme, where the supplier compensates for unmatched products with ordered products, and the Guarantee Quality and Sales (GQS) scheme, where suppliers compensate retailers for shortages when real demand becomes high. They showed that suppliers and retailers prefer the GQS scheme because it provides win-win outcomes when the bank's interest rate is higher than that of the supplier (Jin *et al.*, 2024).

Revenue share and gain-loss contracts are the most efficient. As previously shown, prices and parameters are some of the most significant problems in all contracts. Everyone can ask for a specific share of profit to compensate for high prices. For example, manufacturers can demand a large profit share to increase production if their shortage costs are high (Zhang *et al.*, 2016). On the contrary, retailers ask for a higher share if manufacturers raise the wholesale price. Accordingly, the manufacturer decreases its price and creates Pareto efficiency (Hu *et al.*, 2016). In addition, the retailer's share of revenue is its reference point. Thus, the larger the retailer's share of sales, the higher the orders (Becker-Peth & Thonemann, 2016; Liu *et al.*, 2021); Additionally, using the contract will increase orders (Lam & Chang, 2020). Moreover, using modified gain-loss sharing (MGL) contracts solves information asymmetry, which reduces the manufacturer's production and profit. Under this contract, manufacturers can adjust prices based on the retailer's response (Deng *et al.*, 2013). Moreover, revenue share contracts solve myopic loss aversion that results from frequent losses (Lam & Chang, 2020). Thus, profits will increase, aims will be centralized, prices will be lowered, and double marginalization will be removed. Sharing losses between suppliers and retailers decreases loss aversion (Wang & Webster, 2007; Zhang *et al.*, 2016). This makes the revenue loss share contract the most efficient.

Conclusion

This study uses a systematic literature review to assess the performance of supply chain coordination to find solutions to the newsvendor problem in the context of loss aversion. By analyzing 71 articles extracted from the Web of Science database, supply chain coordination tools were characterized as contractual and supply-control tools. In addition, this study can analyze and rank the contract's performance. In conclusion, this area of study has gained attention over time and has become more practical in the last few years. In addition, most of the articles used modeling and simulation in the analysis, whereas fewer studies conducted experiments, and only three articles used real data analysis. In addition, this study found that with more control over supply and centralized decisions, risks and costs are reduced, which reduces loss aversion and increases order. Moreover, the analysis reveals that the wholesale price contract is the least efficient, while the revenue share contract performs the best (Atalayin *et al.*, 2024; Chauhan & Angadi, 2024; Galea-Holhoş *et al.*, 2024; Samaranayake *et al.*, 2024; Shaiba *et al.*, 2024; Varoneckaitė *et al.*, 2024).

A few recent studies investigated ideas that could be analyzed further, such as myopic loss aversion and the impact of frequent feedback on supply chain coordination (Lam & Chang, 2020), Contracts for Difference (CFD) that address oil and coal prices (Li *et al.*, 2020), contracts for sharing costs like quality cost-sharing contracts to share quality costs (Zhao *et al.*, 2022), cost-sharing contracts that share service sector costs (Wang *et al.*, 2023), dual revenue contracts for sharing recycling costs (Wang *et al.*, 2023), green supply chain contracts, and coordination for sharing greenhouse gas emission reduction costs with different types of biases (Cao & Yu, 2018; Liu & Chen, 2019; Zhongwei & Tan,



2019; Sun & Zhong, 2022; Tsao *et al.*, 2024), and Flat Penalty Service-Level (FSL) for better supplier fulfillment rate (Duhaylongsod *et al.*, 2023). Moreover, this study found several forms of reference points that supply chain actors set and rely on to make decisions. These benchmarks can be studied further and more deeply, such as the number of competitors in the market (Long & Wu, 2024; Wang, 2010), initial sales (Zhou *et al.*, 2018), profit margin (Bai *et al.*, 2021), level of utility (Xu *et al.*, 2023), inventory (Long & Wu, 2024), the market demand (Mandal *et al.*, 2018; Guo & Cao, 2020), average demand (Bai *et al.*, 2019), equality concern (Qu *et al.*, 2022), portion of profit, and Nash equilibrium (Liu *et al.*, 2024). All of these studies have investigated new ideas that require more attention. Finally, I recommend that future studies focus on real-world data, which is the least used in the literature.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

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