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Role of Logistics Integration Capability in Enhancing Performance in Omni-Channel Retailing: Supply Chain Integration as Mediator

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Abstract: Although the importance and benefits of logistics integration in omni-channel (OC) retailing have been discussed in the literature, the impacts of logistics integration from the dimension of internal and external logistics remain unknown. To fill this gap, this study aims to investigate the relationships among internal and external logistics integration capabilities, supply-chain integration (SCI), and financial performance (FP) in OC retailing based on the dynamic capability view. An empirical study is conducted based on a survey of 230 OC retailers in China's market. Factor analysis and regression analysis are conducted to examine the hypotheses of the proposed conceptual model. The quantitative analyses show that the internal logistics integration capability is significantly related to the external logistics integration capability, and they both have positive effects on SCI, while the external logistics integration capability generates a higher impact (i.e., almost 1.5 times that of the internal logistics integration capability). The numerical results also demonstrate that the logistics integration capabilities and SCI have similar positive effects on FP (i.e., all the relevant regression coefficients show values around 0.25), and SCI plays a partial intermediary role in the relationships between logistics integration capabilities and FP. Furthermore, the quantitative evidence addresses the fact that the FP is not influenced by OC retailers' characteristics, indicating a fair business environment in the OC retail industry.

Keywords: omni-channel retailing; logistics integration capability; supply-chain integration; dynamic capability view

Citation: Liu, Y.; Song, G. Role of Logistics Integration Capability in Enhancing Performance in Omni-Channel Retailing: Supply Chain Integration as Mediator. *Sustainability* **2023**, *15*, 9053. https://doi.org/10.3390/su15119053

Academic Editors: Paulina Golinska-Dawson, Kanchana Sethanan and Karolina Werner-Lewandowska

Received: 5 April 2023
Revised: 30 May 2023
Accepted: 30 May 2023
Published: 3 June 2023

1. Introduction

China's retail market has become one of the largest marketplaces in the world. In 2021, China's online retail market kept growing steadily, becoming a key driver for growth, employment and consumption. China's online retail sales hit RMB 13.1 trillion in 2021, up 14.1% year-on-year, 3.2 percentage points higher than the year before [1]. In addition, the scale of China's physical retail market continues to expand, and its format continues to innovate. China's government encourages retailers to integrate online and offline channels, and it guides them to gradually improve their levels of informatization. Retailers are being motivated to integrate their offline logistics, services, and experiences to enjoy the advantages of online business, capital, and information flows while expanding intelligent and networked omni-channel (OC) layouts [2]. OC retailing occurs with the integration of offline physical and online digital sale channels, providing consumers with a seamless and consistent shopping experience by eliminating channel differences [3–5].

The outbreak of COVID-19 has led to a surge in online customer demand, and brick-and-mortar retail has been seriously affected by the epidemic and urgently needs to be transformed and upgraded. OC retailing can quickly realize channel conversion through

the deep integration of offline brick-and-mortar retail and online retail, thus show advantages in the face of supply chain risks brought by the epidemic, promoting cost reductions and efficiency increases, and achieving high-quality development of the retail industry [6]. Therefore, in the post-pandemic era, under the encouragement and guidance of the government, a number of retailers in China are seeking new breakthroughs in the OC retail business, providing consumers with more comprehensive shopping experiences, entertainment, and social interactions. For example, as one of the largest traditional domestic retailers in the electronics sector, Suning has created the OC business mode across online and offline channels based on the integration of their supply chain among two sale channels, and in doing so, has formed sustainable competitive advantages. However, the retailers still face several problems in the process of developing OC retailing in China. For example, some CEOs stated that they face the dilemma of being unable to respond quickly to changes in market demand [7].

Because it is the only contact between retailers and customers in OC retailing, and given the fact that it directly affects customer satisfaction, OC retail logistics is viewed as the focus of OC retailing in the literature [8,9]. Especially when epidemic prevention and control are more stringent and the daily order volume basically doubles, logistics should also be regarded as the core of OC retailing in practice [10]. Recent studies have also addressed logistics integration in OC retailing. For example, the integrated inventory, picking, delivery, and return activities of order fulfillment were identified as dominant developmental areas for retail logistics in the transition from multi-channel to OC retail strategies [11]. Some other studies highlighted the benefits of logistics integration in OC retailing. For example, the integration capabilities of logistics technologies, organizations, and management determined the success of OC retail strategies and the ability to create competitive advantages for the supply chain [12]. The positive effects of logistics integration on performance and sales were also found in OC retailing [13,14].

Although the importance of logistics integration in OC retailing and the potential benefits it brings have been discussed in the literature, most studies were qualitative. There has been limited quantitative research on the impact of logistics integration on OC retailers' performance. In fact, there was a total lack of research on OC retail logistics and more scholars were encouraged to become involved [15]. From a systematic literature review, scholars have found that the domain of supply chain management and inventory management in the OC environment is still absent [16]. From a holistic review of OC-related studies, Nguyen et al. (2022) found that most studies in the logistics and supply chain theme concern logistics and supply chain network design, last-mile distribution, inventory and warehouse management, and reserve logistics [17]. That is, among the small amount of quantitative research, most scholars focused on the scope of logistics integration. For example, Song et al. (2019) conducted a scope-based study to examine the impacts of logistics integration on the operational and financial performance (FP) of OC retailers from the perspective of logistics information, process, and organization [18]. Mirzabeiki and Saghiri (2020) found that integration of the information systems of logistics is crucial in making omni-channels more efficient and consumer-responsive [19]. They also focused on building an integrated distribution network for OC retail logistics [20,21]. However, the impacts of logistics integration from the dimension of internal (inside the retailers) and external (between retailers and their logistics partners) logistics remain unknown. Thus, we summarize the research gap in Table 1. To fill this research gap, this study aims to empirically analyze the effectiveness and mechanism of the impacts of internal and external logistics integration capabilities on FP while considering logistics information, process, and organization to provide guidance for OC retailer development. A dynamic capability view (DCV) provides a theoretical lens to the empirical study. More in detail, this study attempts to answer the following research questions:

RQ1: *How do OC retailers' internal logistics integration capabilities influence their external logistics integration capabilities*?
RQ2: *How do OC retailers' internal and external logistics integration capabilities impact SCI*?

RQ3: *How do OC retailers' internal and external logistics integration capabilities and SCI affect FP?*

Table 1. Research gap.

	Research Gap	References
Research Method	Most of the studies on the impact of logistics integration on OC retailers' performance were qualitative. Quantitative research was limited.	[15,17]
Research Content	The measurement of the impact of logistics integration on OC retailer's performance is mainly from the perspective of content, such as information, process and orgaization. The impacts of logistics integration from the dimension of internal and external logistics remain unknown.	[17,18]

The remainder of this study is laid out as follows. Section 2 reviews related literature on OC retailing, logistics integration in OC retailing, and SCI and firm performance with the application of DCV. Section 3 describes the conceptual model. Section 4 illustrates the research methodology. Section 5 shows the analysis results. Section 6 provides implications based on the discussion, and Section 7 concludes the paper.

2. Literature Review

2.1. Omni-Channel Retailing

With the rapid technological advancements in the past few years, the way consumers interact with retailers has dramatically changed. Customers could access information, compare offers, purchase and pay for the offerings via numerous touchpoints. Furthermore, the COVID-19 pandemic accelerated changes both in consumer behavior (e.g., the increasing adoption of digital touchpoints) and retailer strategies (e.g., the expansion of "click-and-collect" options) [22,23]. Therefore, OC retailing, a retail strategy used to synergistically manage a myriad of touchpoints with the goal of providing consumers with seamless and consistent shopping experience, is considered the future of retailing [4,5].

The basic characteristics of OC retailing can be summarized as follows: more extensive and diverse channel types, higher channel visibility and disappearance of channel boundaries, transformation of shopping experience connotation and maximization of purchase value. As a result, OC retailing can also be called seamless retail [24]. We can understand OC retailing from two perspectives, both from the perspective of retailer operation management and from the perspective of consumer experience.

Consequently, to remain competitive and enhance the purchasing process, many leading retailers are focusing on the OC retail strategy to connect all possible touchpoints between in-store and online experiences [25]. For example, ACE Hardware, an OEM to world's leading door hardware brands, connects acehardware.com and Ace App to consumers' local Ace Hardware stores, enabling over 75% of the population to be reached within 15 min. Thus, ACE Hardware is considered to be positioned as the fastest and most convenient OC retailer. Walmart Inc., with more than 10,500 stores and numerous Ecommerce websites in 20 countries, has continuously improved its OC retail strategy by increasing user access via APPs, innovating user experience in shopping-guided VR venues, optimizing delivery services, and adding offline experience areas.

2.2. Logistics Integration in OC Retailing

In OC retailing, customers can seamlessly switch between traditional stores, online channels, and mobile channels depending on their preferences [24]. Thus, it is crucial to meet customer's needs in OC retailing [26]. However, as OC retailing develops, customer demands on retailer inventory accuracy and real-time tracking ability increase, posing new challenges to OC retail logistics [27]. Especially in the post-pandemic era, the surge in online customer demand has also put forward challenges in logistics responsiveness [6]. Therefore, to improve the level of logistics customer service in OC retailing, which is

defined as the abilities or skills to meet the customer's requirements and expectations, chiefly in terms of the time and place of deliveries [28], OC retailers should offer a variety of delivery and returns options (e.g., home delivery and in-store returns), and provide timely delivery and return services [29]. Meeting the consumer needs mentioned above makes OC logistics complex and multi-fold. Thus, for retailers in rapidly changing OC retail markets, it is mandatory to strengthen the integration of internal cross-channel and external cross-organization functional activities [15]. The importance of OC retail logistics integration has been confirmed by scholars. For example, logistics integration facilitates SCI, which creates more business opportunities and improves customer experience [30]. Thus, firm performance could be comprehensively improved in OC retailing. Moreover, logistics integration should be a strategic priority when implementing the OC strategy [31].

Internal logistics integration of OC retailers aims to integrate the logistics activities among different retail channels within the enterprise [11]. Scholars have conducted in-depth discussions on the contents and functions of OC internal logistics integration. For example, a typology of internal logistics networks in OC grocery retailing was built and the advantages of different warehousing, picking, internal transportation, and last-mile delivery systems were presented [32]. Internal logistics process integration could reduce the costs related to redundancy and duplication, thus producing an attractive market for customers while advancing long-term profit goals [33].

External logistics integration of OC retailers aims to integrate the logistics activities between OC retailers and external logistics service partners, which refer primarily to third-party logistics (3PLs) [34]. In the practice of retailers implementing OC retail strategies, the demand for rapid access to products both in retail stores and online shops has made retailers reliant upon external logistics partners to reach the fringes of their customer network [35,36]. Therefore, 3PLs that cooperate with OC retailers are very important because they are responsible for a retailer's home delivery, which interfaces with customers [8], and manage the hourly arrival rates of e-commerce orders [37]. Scholars have conducted in-depth discussions on the contents and functions of OC external logistics integration. For example, external logistics integration with 3PLs was divided into information, organizational, and process integration [34]. By conducting multiple case studies and using multiple sources of data, scholars indicated that the integration of the information systems of logistics service providers was crucial in making omni-channels more efficient and consumer-responsive [19]. Effective external integration with 3PLs not only allows OC retailers to respond rapidly to customer needs, but also fosters customer satisfaction and the effective allocation of resources while increasing operational efficiency [38]. This can positively affect an OC retailer's competitive advantage and FP as well [39].

Furthermore, several studies claim that internal integration positively affects external integration, due to the fact that organizations must first develop the former through system, data, and process integration before they can engage in meaningful external integration [40,41]. Therefore, for OC retailers, the integration of internal logistics will be realized earlier than that of external logistics. Since OC retailing is still in its infancy, retailers are more inclined to first carry out cross-channel logistics integration within enterprises. Thus, it is particularly important to study the benefits of an OC retailer's internal logistics integration. However, researchers have called for further quantitative studies to test these impacts [4], indicating that some gaps exist. First, the number of relevant quantitative studies on the effect internal logistics integration has on external logistics integration is still small; second, the impacts of an OC retailer's logistics integration capability on its performance from internal and external dimensions remained unexamined [18]. Therefore, this study fills the academic gap by quantitatively examining the impact of internal logistics integration capability on external logistics integration capability, and the effectiveness and mechanism of their impacts on a retailer's FP in OC retailing.

2.3. SCI and Firm Performance

Previous studies have discussed the impact of SCI on firm performance and its enhancers. By reviewing related studies on the relationship between SCI and firm performance, we found that a number of studies revealed that the internal and external integration of logistics and supply-chain activities were beneficial to financial efficiency (e.g., cost reduction and profit and return-on-assets improvement), operational effectiveness (e.g., reduction in lead time and stock-out, increase in order fill rate, and improvement of flexibility and delivery reliability), managerial improvement (e.g., better quality standards and optimized human resources), and social benefits (e.g., environmental sustainability) [41–46]. However, some scholars have argued that SCI could have a negative impact on firm performance because, when the level of SCI is high, it can lead to a wastage of resources and the emergence of opportunistic behaviors [47–49]. For example, Zhao et al. (2015) showed that the impact of SCI on firm FP could reflect an inverted U-shape, which means that excessive or insufficient SCI could undermine its positive impact on firm FP [48]. Thus, there is no full agreement on SCI impact.

Many studies have also identified and analyzed the factors that affect SCI. For example, Huo et al. (2016) found that strategic supply-chain cooperation and IT integration had positive impacts on SCI [50]. Yu et al. (2017) concluded that IT and marketing capabilities positively affected SCI [51]. Song et al. (2019) conducted empirical research and found that logistics information and organization integration capabilities were crucial factors affecting SCI [18]. Song and Song (2021) revealed that human capital has a positive impact on SCI in OC retailing [40]. Furthermore, some scholars noticed the mediating role of SCI on firm performance. For example, Zhao et al. (2015) found that top management support had a positive impact on firm FP by influencing SCI [48]. Kim (2017) found that IT could not directly affect firm performance. However, it indirectly had a positive impact on firm performance through SCI [52]. Feng et al. (2017) revealed that guanxi indirectly affected firm operational performance through SCI and implied that it was vital for managers to recognize the mediating role of dynamic SCI capabilities [53].

Despite the relatively mature studies related to SCI and its relationship with firm performance, some gaps still exist. First, most of the extant research objects were manufacturing firms, a small number were 3PLs, and only a few were retailers. Thus, contributions in the context of OC retailing remain absent. Second, there have been few quantitative studies examining the impact of logistics integration capabilities on SCI and none for internal and external logistics integration capabilities. Moreover, owing to the lack of consistent conclusions, it is easy for retailers to become skeptical about the significance of SCI and doubtful about the benefits of the OC retail strategy. Therefore, it is necessary to carry out research that identifies the factors that determine the success of SCI and examines the benefits that retailers can obtain from OC retailing. For this purpose, this study examines the impacts of internal and external logistics integration capabilities on SCI and its impact on retailer FP in the context of OC retailing.

2.4. Dynamic Capability View

Understanding and explaining the source of a firm's competitive advantage has always been a core issue in strategic management research. The dynamic capability view (DCV) has gradually developed and attained acceptance [54]. The DCV argues that dynamic capability reflects a firm's ability to integrate, build, and reconfigure its internal and external competences to address rapidly changing external environments. It reflects a kind of comprehensive ability of an enterprise to obtain sustainable competitive advantages [55].

Given that customer demand is highly unstable, and that customer requirements for order response, goods distribution, and real-time tracking have increased [27,37], the development of OC retailing is characteristic of a dynamic environment. Especially in the COVID-19 era, retailers are facing a high degree of dynamics and competition [56,57]. In such an environment, retailer's internal logistics integration across different channels can help them to respond to customer orders quickly and efficiently [58] and the external logis-

tics integration between retailers and 3PLs can help them to better respond to the customer requirements for timely deliveries and real-time tracking of goods [19,37], so as to provide customers with a satisfactory shopping experience and improve the competitiveness of OC retailers by reducing logistics costs [27]. Therefore, both the internal and external logistics integration capabilities of OC retailers can be viewed as their dynamic capabilities to cope with rapidly changing customer demand in OC retailing.

Studies have also provided evidence that logistics integration capabilities can be viewed as dynamic capabilities that reduce supply-chain risk, enhanced agility, and secure sustainable competitive advantages. For example, logistics capabilities helped in mitigating supply-chain uncertainty and risk by optimizing integrative processes [59]; for firms to obtain a sustainable competitive advantage, logistics integration capabilities were of vital importance [33]; logistics integration could have a positive impact on the sustainability performance of the supply chain from a DCV perspective [60]; logistics integration was positively related to supply-chain agility, which has a significant impact on firms' competitive capabilities via the DCV [61,62]. Additionally, many studies have leveraged SCI as a dynamic capability [53,63,64]. For example, by building a conceptual and empirical model, a detailed explanation why SCI helped firms to improve agility in the face of supply-chain risks was provided [64].

Therefore, the DCV is a suitable theory supporting our research because we explore the impacts of two logistics integration capabilities (i.e., internal and external) and SCI, which can both be viewed as dynamic capabilities affecting retailer FP in the context of the rapidly changing OC retailing environment. Moreover, the DCV is mostly applied to manufacturing firms in the existing research, with little attention being paid to retailers. Therefore, this study broadens the scope of application of the DCV to the rapidly changing OC retailing environment.

3. Conceptual Model

Based on the DCV, this paper examines the relationships among retailers' internal and external logistics integration capabilities, SCI, and FP in OC retailing. The conceptual model is illustrated in Figure 1, and the rationale is explained afterward.

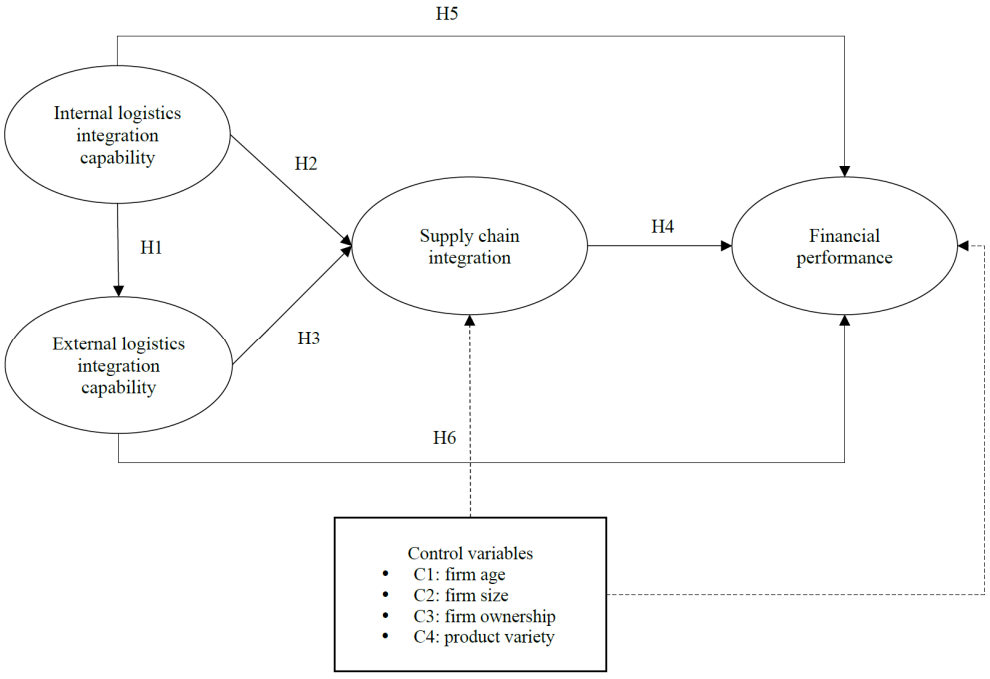

Figure 1. Conceptual model.

The DCV suggests that the ability to integrate is a key factor affecting dynamic capabilities [55]. According to the DCV, internal logistics integration capability can be regarded as a dynamic capability, which helps retailers to deal with the changing environment and gain competitive advantages; that is, the stronger the internal logistics integration capability, the stronger the OC retailer's response ability to rapidly changing customer orders [27]. In OC retailing, since consumers have access to an increased variety of shopping channels, if the level of logistics integration among channels is insufficient, retailers will probably lose their competitive advantages [3,65], whereas high-level internal logistics integration can ensure excellent performance for OC retailers and can generate competitive advantages. This, in turn, promotes long-term, stable strategic cooperation with their partners [66], which promotes the external logistics integration of retailers with 3PL partners. Additionally, existing studies have argued that internal integration is an antecedent to external integration, which means that a firm's internal integration is regarded as the primary precondition of external integration [67]. They claimed that firms must first develop their internal system, data, and process integration before they can engage in external integration [40,41]. Thus, in the early stage of OC retailing development, retailers are more inclined to first carry out internal logistics integration in practice so as to promote subsequent external logistics integration with 3PLs. Therefore, we hypothesize the following:

H1. *A retailer's internal logistics integration capability is positively related to their external logistics integration capability in the context of OC retailing.*

As OC retailing develops, consumer expectations for order responses and delivery times increase [27]. Thus, the fulfillment processes of OC retail ordering require integrated internal and external logistics with both forward and reverse capabilities [11]. An efficient integrated logistics process can compress the uncertainty arising from changes in consumer orders, volatilities in demand, and fluctuations in delivery time [33]. From DCV theory, logistics integration can also help in minimizing supply-chain uncertainty and risk, increasing its sustainability and agility [59–61]. Moreover, logistics integration played a vital role in the integration and coordination of supply chains because it could establish cooperation networks not only within the organization, but also with upstream and downstream partners [68]. By integrating the logistics of internal channels and external partners, OC retailers could realize the sharing of inventories and processes and the integration of orders, which would help them improve the integration and the competitive advantage of the overall supply chain [39,69]. The integration of logistics issues facilitated the integration of supply chain and reduced the total costs in OC retailing [30]. Both an OC retailer's logistics information integration capability and logistics organization integration capability had significant positive impacts on the level of SCI [18]. Therefore, we reach the following hypotheses:

H2. *A retailer's internal logistics integration capability is positively related to SCI in the context of OC retailing.*

H3. *A retailer's external logistics integration capability is positively related to SCI in the context of OC retailing.*

On the basis of the DCV theory, SCI is widely considered a dynamic capability for coping with environmental uncertainties [63,70]. This dynamic capability is a multidimensional resource reconfiguration capability that enables firms to improve market perception and market-oriented ability, to respond to environmental changes, and to understand customer needs [55]. In the context of OC retailing, some researchers confirmed this view by proposing that a well-structured supply chain based on an integration strategy could be both effective and responsive to customer needs [4,71]. Therefore, it is helpful to eliminate operational costs caused by customer demand uncertainty and non-value-added activities [49,72,73]. In the literature, a high level of SCI can help in reducing inventory levels and increasing market share, thus improving financial indicators [74–76]. Furthermore,

it was also confirmed in OC retailing that the level of a retailer's SCI had a significantly positive impact on its FP [18]. Therefore, we hypothesize the following:

H4. *A retailer's SCI is positively related to FP in the context of OC retailing.*

Logistics process integration is an important measure of a firm's competitiveness [74], which is also true in the context of rapidly changing OC retailing [8]. While gaining competitive advantages, logistics integration can also help firms reduce costs and increase profits because of better production plans and controls, goods deliveries, customer service, and improved productivity [68,77]. On the one hand, an efficiently integrated logistics process could reduce the costs related to redundancy and duplication and was necessary to produce an attractive market for customers while advancing long-term profitability goals [33]. On the other hand, supply-chain members were willing to share information about logistics in an integrative relationship to improve overall performance in terms of cost and quality [77]. In OC retailing, channel-integrated warehouses designed for retailers and 3PLs enable firms to improve their responses to seasonal demands and rapid growth in demand, and also help them to reduce logistics costs [19,27]. In the context of OC retailing, internal retailer information and organization integration capabilities of logistics management were positively related to external information and organization integration capabilities, which positively affected FP [34]. Therefore, we reach the following hypotheses:

H5. *A retailer's internal logistics integration capability is positively related to FP in the context of OC retailing.*

H6. *A retailer's external logistics integration capability is positively related to FP in the context of OC retailing.*

4. Methodology

4.1. Research Process

An empirical study was conducted based on a survey of OC retailers in China. The detailed research process used in assessing the hypothesized conceptual model was based on a three-step procedure, as is shown in Figure 2. First, a data pre-test was applied to examine the reliability of the collected data. Second, factor analysis was conducted to identify the factor groups based on the common characteristics of the identified measured items and to test the validity of the hypothesized factor construct. Lastly, hierarchical regression analysis was employed to examine the hypotheses of the proposed conceptual model and the effects of the control variables.

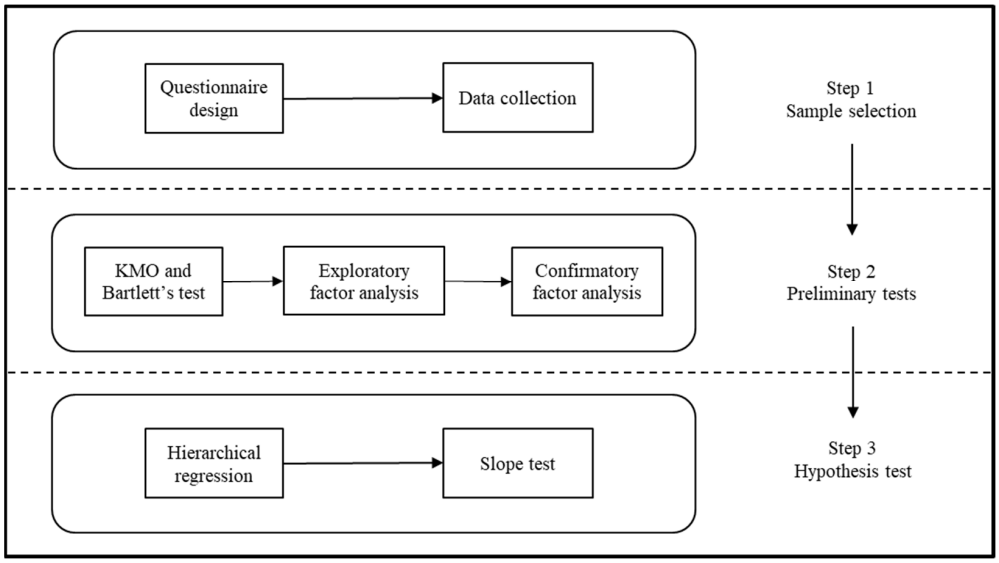

Figure 2. Research process.

4.2. Measures and Survey Development

In this study, each factor was measured using multiple variables identified from previous studies. In the literature, many researchers promoted information, process and organization integration as the key measures of OC integration [11,18]. Thus, our measured items in each factor involved these three dimensions. Specifically, internal logistics integration capability (II) is measured by internal information integration, internal process integration and internal organization integration among different channels [43,47,77–80]. External logistics integration capability (EI) is measured by external information integration, external process integration and external organization integration with 3PLs [75,76,81–84]. The same goes for supply chain integration (SCI) [85]. In addition, this study uses FP to test the benefits of adopting the OC retail strategy because the OC retailing concept is still in its infancy in China, and financial indicators are suitable for short-term examinations. In referring to the previous research results of scholars, financial performance (FP) is measured by revenue, operations cost, return on equity, return on investment and the return on assets [38,43,47]. Table 2 presents detailed information on the measured items.

Table 2. List of measured items.

Measurement Variables	Item	Reference(s)
Internally integrated IS	II1	[43,47,77–80]
Real-time information sharing	II2	
Internal mechanism for information confidentiality	II3	
Logistics process integration among channels	II4	
Internal joint decision-making	II5	
Specialized team for joint decision-making	II6	
Information sharing with 3PLs	EI1	[75,76,81–84]
Unified data interface	EI2	
Joint inventory management with 3PLs	EI3	
Trans-organizational working team	EI4	
Regular communication with 3PLs	EI5	
Compatibility of organization culture	EI6	
Effective coordination among departments	SCI1	[85]
Effective coordination among channels	SCI2	
Information integration with partners	SCI3	
Process integration with partners	SCI4	
Organization integration with partners	SCI5	
Revenue	FP1	[38,43,47]
Operations cost	FP2	
ROA	FP3	
Return on Equity	FP4	
Return on investment	FP5	

We designed a questionnaire based on these identified items and divided it into two parts. In the first part, the overall characteristics of logistics integration capabilities and the SCI of OC retailers were evaluated, whereas the improvements of retailer FP caused by the adoption of the OC retail strategy were investigated in the second part. The Likert scale was adopted to measure the items [86]. The respondents were asked to determine the strength of their agreement with each statement based on a five-point scale (1 = definitely disagree; 5 = definitely agree). Before we launched the questionnaire, a pilot test was conducted by interviewing eight logistics and supply chain professionals who were part of the top management department in retailing to ensure the questionnaire's content validity. Concerns were raised that some respondents might not understand the professional academic terms used in the questionnaire, leading to the re-wording of some questions to improve clarity and validity.

Additionally, the retailer's attributes were also considered. Several extant studies have shown that larger and older firms achieved higher levels of SCI and outperformed their

counterparts and new entrants because of their additional resources and abilities [18,87]. As an important characteristic of firms in China, stated-owned retailers are more likely to achieve better performances because of their deeper understanding of relevant policy [43]. Moreover, retailers with a higher product variety (PV) are more likely to provide consumers with products that match their needs, which results in the firms' better performance in the context of OC retailing [8]. Therefore, firm age, firm size, firm ownership, and PV were applied as control variables in our model and were investigated based on the questionnaire. Firm age was measured by the number of years that a firm had been in the Chinese market; firm size was measured by annual sales in the previous fiscal year in millions of RMB; and firm ownership distinguished between firms that were state-owned, local-private, joint-venture, and foreign. Finally, as PV was defined as the assortment of products a firm provided over a specific period [88], it was measured by its number of stock-keeping units (SKUs).

4.3. Sample Selection

To gather empirical evidence, we chose a sample of OC retailers in China's market. There are a few reasons for this. First, China exists as the world's second largest consumer market and the largest online retail market [89]. Second, China's government encourages retailers to integrate online and offline channels to create an OC retailing model [2]. Third, retailers in China's market are actively exploring the integration of online and offline sale channels to provide customers a seamless shopping experience.

To obtain a representative sample, we randomly selected 700 retailers that were registered members of the China General Chamber of Commerce (CGCC). In total, 700 questionnaires were designed via an e-survey instrument and emailed to retailers by CGCC as a website link, and the top managers were asked to answer the questionnaire anonymously to increase the usable response rate. Since these members are physical retailers, we first asked whether the retailer was implementing an OC strategy and had taken channel integration measures. Only the retailers who had conducted an OC strategy were allowed to answer the follow-up questions in the questionnaire, and every question was mandatory to answer. Each respondent was given four weeks to answer the questionnaire. A reminder was sent at the end of the second week. Many firms responded, but some claimed that they were unprepared or that they had not yet considered OC retail strategies. On the basis of a comprehensive check of returned products, 230 usable questionnaires were accepted, translating to a response rate of 32.9 percent. These 230 retailers, having either established their own official websites or cooperated with e-commerce platforms, are actively integrating online and offline sale channels and developing OC retail strategies. We then tested non-response bias based on the differences between early and late responses [90]. By comparing the late responses (86) obtained after the reminder email with the early responses (144), we found that the t-test results showed no significant differences, suggesting that non-response bias was not a concern. The profiles of the respondents and their firms are summarized in Table 3.

Table 3. Profile of respondents and their firms.

Characteristics	Percentage (%)
Firm age (number of years in Chinese market)	
<5	21
5–10	23
11–15	16
16–20	13
>20	27

Table 3. *Cont.*

Characteristics	Percentage (%)
Firm size (annual sales in RMB M)	
<50	17
50–100	14
100–200	9
200–2000	25
>2000	35
Ownership of the firm	
State owned	40
Local private	50
Foreign	4
Joint venture	6
Number of SKU	
<500	52
500–1000	14
1000–5000	12
5000–10,000	4
>10,000	18

5. Analysis Results

5.1. Preliminary Study

To ensure the suitability of collected data for the factor analysis, a Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test were conducted [91]. The result of the KMO test for the whole dataset was 0.948, and Bartlett's test for sphericity showed a satisfactory result. Therefore, both measures indicated that the dataset was suitable for factor analysis.

5.2. Exploratory Study

Factor analysis was performed to analyze the interrelationships among many variables and to explain them in terms of their common underlying factors. The information contained in the original variables was organized into a smaller set of dimensions with a minimum loss of fidelity. Exploratory factor analysis (EFA) was first employed using SPSS 25.0. Through the principal component analysis method, 22 measurable variables were loaded on four factors, as shown in Table 4. The cumulative variance explained by the four factors was 0.770, and the alpha value of each group was higher than the recommended 0.70 benchmark [92], indicating good reliability. Therefore, 22 variables could be explained by the four factors named in the conceptual model.

Table 4. Results of EFA.

Item	Factor 1	Factor 2	Factor 3	Factor 4
II1	0.768			
II2	0.729			
II3	0.749			
II4	0.674			
II5	0.700			
II6	0.506			
EI1		0.610		
EI2		0.644		
EI3		0.640		
EI4		0.775		
EI5		0.741		
EI6		0.647		

Table 4. *Cont.*

Item	Factor 1	Factor 2	Factor 3	Factor 4
SCI1			0.672	
SCI2			0.838	
SCI3			0.522	
SCI4			0.829	
SCI5			0.598	
FP1				0.773
FP2				0.794
FP3				0.786
FP4				0.789
FP5				0.813
Mean	3.608	3.621	3.503	3.745
S.D.	0.769	0.757	0.811	0.737
Cumulative variance explained	0.201	0.396	0.589	0.770
Cronbach's α	0.929	0.933	0.916	0.936

5.3. Confirmatory Study

Confirmatory factor analysis (CFA) was then conducted using SPSS AMOS 21.0. By drawing and fitting the model, we assessed the adequacy of the goodness-of-fit of the underlying factor structure. Table 5 shows that the model was acceptable because the overall model fit was adequate based on the results of the main fit indices ($\chi^2(187) = 1.697$, RMSEA = 0.055, CFI = 0.973, GFI = 0.891, AGFI = 0.852, NFI = 0.937, and TLI = 0.966). Convergent validity was tested using a t-value that was statistically significant to the factor loading [93]. Table 5 shows that all t-values exceeded the critical ratio at the 0.05 level of significance. Therefore, these 22 variables were significantly related to the specific factor construct, and we could verify the posited relationships among the variables and constructs. Item reliability refers to the R^2 value in the observed variables, and these were accounted for by the latent variables influencing them. Thus, R^2 could be used to measure the reliability of observed items [94]. Table 5 shows that the R^2 values of all variables were greater than 0.3, indicating the acceptability of the results [95]. Thus, the t-value and R^2 values further provided sufficient evidence of convergent validity.

Table 5. Parameter estimates of CFA.

Factor	Item	Standardized Factor Loading	t-Value	R^2
Factor 1: Internal integration (II)	II1	0.79	-	0.63
	II2	0.85	17.83	0.72
	II3	0.77	14.38	0.59
	II4	0.83	13.81	0.68
	II5	0.83	13.80	0.68
	II6	0.81	13.55	0.66
Factor 2: External integration (EI)	EI1	0.85	-	0.72
	EI2	0.81	15.05	0.66
	EI3	0.87	16.97	0.75
	EI4	0.79	14.50	0.62
	EI5	0.86	16.88	0.75
	EI6	0.86	14.50	0.75
Factor 3: Supply chain integration (SCI)	SCI1	0.86	-	0.75
	SCI2	0.80	14.52	0.63
	SCI3	0.81	15.83	0.65
	SCI4	0.80	14.90	0.64
	SCI5	0.86	16.70	0.73

Table 5. *Cont.*

Factor	Item	Standardized Factor Loading	t-Value	R^2
Factor 4: Financial performance (FP)	FP1	0.82	-	0.67
	FP2	0.91	17.35	0.83
	FP3	0.85	15.60	0.72
	FP4	0.85	15.37	0.72
	FP5	0.91	17.54	0.83

To assess the discriminant validity for all constructs, we then used average variance extracted (AVE) values. The results in Table 6 show that all values of AVE exceeded the recommended 0.5 benchmark, and their square roots were higher than the corresponding correlations. Therefore, the results provided adequate evidence of discriminant validity for the measurement [96].

Table 6. Discriminant validity.

	AVE	II	EI	SCI	FP
Internal integration (II)	0.662	*0.814*			
External integration (EI)	0.707	0.818 **	*0.841*		
Supply chain integration (SCI)	0.683	0.768 **	0.804 **	*0.826*	
Financial performance (FP)	0.755	0.674 **	0.690 **	0.672 **	*0.869*

Notes: The square root of AVE is depicted on the diagonal in italics. ** $p < 0.01$.

5.4. Hypotheses Testing and Results

We used hierarchical regression to test the hypotheses for the following reasons. First, regression analysis is an appropriate statistical analysis method when studying the effects of multiple independent variables on one dependent variable [97]. Second, hierarchical regression analysis is still being used by scholars to test the mediating effect [56]. The control variables were first entered into the regression model to test their effects on the dependent variables. Then, the independent variables were fed into regression with control variables as another block. Therefore, we explored five regression models.

To avoid multi-collinearity, we computed the variance inflation factors (VIF) at each step of the hierarchical regression model. The result of the collinearity statistical analysis revealed that the dataset was suitable for analysis by a regression model because the maximum VIF was 3.956, which is smaller than the recommended threshold of 10. Thus, multi-collinearity was not an issue. Table 7 presents regression and correlation results among the factors shown in Table 8.

Table 7. Results of hierarchical regression analysis.

Model	EI	SCI		FP	
	1	2	3	4	5
Independent variable					
Internal integration (II)	0.796 ***		0.369 ***		0.231 **
External integration (EI)			0.550 ***		0.282 **
Supply-chain integration (SCI)					0.236 **
Control variable					
Firm age (C1)	0.002	0.020	0.010	0.029	0.040
Firm size (C2)	0.023	0.036	0.050	0.016	0.016
Firm ownership (C3)	0.070	0.035	0.039	0.043	0.046
Product variety (C4)	0.038	0.145 ***	0.026	0.097 **	0.003
Constant	0.874 ***	3.303 ***	0.336	3.486 ***	1.054 ***
F-model	94.279 ***	4.321 **	83.032 ***	2.685 *	37.279 ***
Adjusted R^2	0.671	0.055	0.682	0.029	0.526

Notes: Significant at: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Table 8. Correlation analysis.

	II	EI	SCI	FP	C1	C2	C3	C4
Internal integration (II)	1							
External integration (EI)	0.818 **	1						
Supply chain integration (SCI)	0.768 **	0.804 **	1					
Financial performance (FP)	0.674 **	0.690 **	0.672 **	1				
Firm age (C1)	0.124	0.093	0.074	0.008	1			
Firm size (C2)	0.166 *	0.119	0.055	0.073	0.525 **	1		
Firm ownership (C3)	0.061	0.014	0.015	0.055	0.034	0.060	1	
Product variety (C4)	0.278 **	0.280 **	0.260 **	0.203 **	0.253 **	0.362 **	0.055	1

Notes: Significant at: * $p < 0.05$, ** $p < 0.01$.

From Model 1 in Table 7, the positive and significant coefficient of internal integration ($\beta = 0.796$, $p < 0.001$) indicates that the retailer's internal logistics integration capability was positively related to the external logistics integration capability. Thus, H1 was supported. The results from Model 3 show that the regression coefficient of internal integration was 0.369 at a significance level of 0.001. The regression coefficient of external integration was 0.550 at a significance level of 0.001, indicating that SCI was significantly affected by both internal and external logistics integration capabilities. Thus, H2 and H3 were accepted. Furthermore, the results from Model 5 in Table 7 show that internal integration ($\beta = 0.231$, $p < 0.01$), external integration ($\beta = 0.282$, $p < 0.01$), and SCI ($\beta = 0.236$, $p < 0.01$) were all positively and significantly related to the retailer's FP, providing support for H4–H6. Furthermore, the F-test and the value of the adjusted R^2 in each model provided evidence that the results of the regression models were accepted.

Regarding the control variables, Table 7 shows that retailer characteristics (i.e., age, size, and ownership) were not significantly related to performance, whereas the results of Models 2 and 4 show that retailer PV played a significant role in both SCI ($\beta = 0.145$, $p < 0.001$) and FP ($\beta = 0.097$, $p < 0.01$). Then, a slope test was conducted to further reveal the relationships between the retailer's PV and performance. First, we divided PV into the following two categories: high PV (>5000 SKUs) and low PV ($\leq$5000 SKUs). Second, we used the Pearson correlation coefficient to examine the relationships between PV, SCI, and FP of each group. The results illustrated in Figure 3 indicate that when PV is low, it is positively related to both retailer SCI and FP. However, when PV is high, the positive impact on SCI weakens. Higher PV even shows a negative relationship to FP. In other words, as PV increases, its positive impacts weaken.

Notably from Model 5 in Table 7, the positive effects of internal and external logistics integration capabilities and SCI on retailer FP were all significant. Therefore, a mediating effect test was carried out to determine whether SCI played an intermediary role. Table 9 presents the results of the mediating effect test. The F-test, the value of the adjusted R2, and maximum VIF in each model provided evidence that the results of the test could be accepted and that multi-collinearity was not an issue.

By comparing Models 1, 2, and 3 in Table 9, it was found that, when using internal logistics integration capability and SCI as independent variables simultaneously for hierarchical regression on FP, the regression coefficients of both internal logistics capability and SCI were very significant (β-II = 0.370, β-SCI = 0.341, $p < 0.001$), revealing that SCI played a partial intermediary role in the relationship between internal logistics integration capability and FP. Similarly, by comparing Models 4, 5, and 6 in Table 9, it was found that, when simultaneously using external logistics integration capability and SCI as independent variables, both regression coefficients were very significant (β-EI = 0.412, β-SCI = 0.301, $p < 0.001$), revealing that SCI also played a partial intermediary role in the relationship between external logistics integration capability and FP.

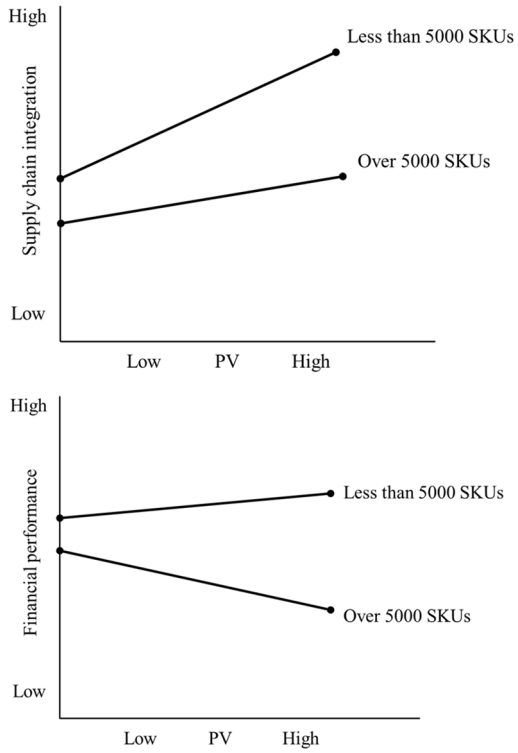

Figure 3. Effects of retailer product variety.

Table 9. Results of mediating effect test.

Model	FP	SCI		FP		SCI
	1	2	3	4	5	6
Internal integration (II)	0.646 ***	0.370 ***	0.809 ***			
External integration (EI)				0.671 ***	0.412 ***	0.862 ***
Supply chain integration (SCI)		0.341 ***			0.301 ***	
Constant	1.416 ***	1.217 ***	0.583 **	1.314 ***	1.199 ***	0.383 *
F-model	190.035 ***	119.284 ***	327.068 ***	207.038 ***	120.322 ***	417.421 ***
Adjusted R^2	0.452	0.508	0.587	0.474	0.510	0.645
Maximum *VIF*	1.000	2.435	1.000	1.000	2.831	1.000

Notes: Significant at: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

6. Discussion and Implications

6.1. Enabling Role of Internal Logistics Integration Capability in External Dimension

In this study, we integrated three aspects to measure internal and external logistics integration capabilities and examine their effects on retailer performance. In OC retailing, the internal logistics integration of retailers is more complicated than that of traditional manufacturers. There are two completely independent channels (i.e., online and offline) within a firm, and each has its own related departments. In the early stage of OC retailing, online and offline channels were regarded as separate business units. For example, Suning's online shopping platform presented a separate name, "Suning e-commerce," implying that it was too difficult to achieve internal logistics integration. Thus, in this study, we explored the benefits brought by this difficult internal integration.

Our results showed that the hypothesized positive impact of internal logistics integration capability on external logistics integration capability in OC retailing (H1) was supported. This finding is consistent with previous studies on manufacturers that revealed how a firm's internal integration capability promoted its external integration [42,82,98]. It also supports the view that addresses the importance of internal logistics integration

in OC retailing [11,71]. Internal logistics integration of different channels is beneficial to the improvement of retailer information processing and coordination capabilities [98], making it easier to integrate with 3PLs. Thus, it has a positive impact on external logistics integration. This result gives confidence to retailers developing OC retail strategies to overcome difficulties and to promote internal logistics integration capabilities.

6.2. Logistics-Driven SCI in OC Retailing

Our empirical results show that, for OC retailers, logistics integration is an important influencing factor for SCI because significant positive relationships between retailer's internal and external logistics integration capabilities and SCI in OC retailing were confirmed (H2 and H3). This finding has also been recognized in previous studies that showed how logistics integration played vital roles in SCI [33,68,76,85]. In the context of OC retailing, via logistics integration, retailers not only improve their SCI [18], but also improve their competitive advantage [39].

These results also indicate that in the context of OC retailing, the positive impact of external logistics integration capability on SCI was more significant than that of internal logistics integration capability. This is a new discovery that can be explained as follows. First, according to the DCV, under increasingly fierce and complicated competitive environments, it is difficult for any retailer to maintain competitiveness by virtue of its own advantages, because resource management is more important than resource ownership [54]. Thus, establishing cooperative relationships with firms owning heterogeneous and complementary resources is an important means for retailers to achieve better OC retailing. Second, according to the practices of OC retailers, external logistics integration mostly refers to the integration of retailers and 3PLs that undertake home delivery services. In the context of OC retailing, home delivery is a mode that interfaces customers face-to-face [8]. Thus, in OC retailing, external logistics integration is more sensitive than internal logistics integration, which means that it is reasonable that a retailer's external logistics integration capability more significantly affects SCI compared to internal logistics integration capability. Therefore, retailers should devote more efforts to promoting external logistics integration capabilities.

6.3. Critical Factors Affecting FP of OC Retailers

Most of the SCI study objects were manufacturing firms instead of retailers. The empirical results of our study support H4, implying positive effects of SCI on FP in OC retailing. This agrees with previous research on manufacturing firms that concluded that a firm's FP could be improved through proper SCI [69]. It also verifies that SCI is a core dynamic capability that creates competitive advantages in rapidly changing environments based on DCV theory [53,70].

Moreover, this study is an early attempt to examine the impacts of logistics integration on firm performance from internal and external dimensions. H5 and H6 are supported, revealing that both internal and external logistics integration capabilities of OC retailers positively affect FP, conforming to other conclusions that showed scope-based logistics integration capabilities were positively related to a firm's FP [34,80]. The conclusion also applies to the post-pandemic era. Retailers with good logistics integration capabilities can quickly allocate their logistics resources, realize instant distribution, and improve the response speed to the surge of online orders, thus reducing profit loss.

More importantly, this study determined the effectiveness and mechanism of the impacts that were heretofore undetected. First, the results showed that external logistics integration capability had a greater effect on retailer FP in OC retailing than internal logistics integration capability. The underlying cause can be described as follows. In the context of OC retailing, the fundamental goal of retailers is to provide consumers with a seamless shopping experience, and logistics distribution directly affects a consumer's shopping experience and satisfaction [8]. Thus, the success of OC retail strategies depends largely on whether logistics can satisfy consumer demands. Therefore, external logistics

integration with 3PLs that undertake home delivery is more sensitive to customer demand uncertainties, and a higher external logistics integration capability enables retailers and their 3PL partners to communicate in a more timely and accurate manner while better responding to changes in demand [27], consequently improving FP. Second, our results also revealed a partial intermediary role of SCI in the relationships between retailer internal and external logistics integration capabilities and FP. As discussed, the logistics integration of OC retailers is more complicated and difficult than traditional manufacturers because of the independence of different sales channels. Thus, the integration of logistics among different channels within firms and between firms and 3PLs requires strategy. While top management teams develop strategic plans for internal and external logistics integration, they also facilitate the integration of the entire supply chain. Thus, the internal and external logistics integration capabilities of OC retailers also affect their FP by partially affecting SCI from a strategic perspective.

6.4. Fair Business Environment of the OC Retail Industry

Finally, the empirical results of this study indicate that retailer characteristics (i.e., age, size, and ownership) do not affect performance in the context of OC retailing. This conclusion differs from prior studies that suggested that older and larger firms were more likely to outperform younger and smaller peers [18]. Our results suggest that business and competition environments of OC retailing are fair, lacking prejudice and discrimination, because the practice of OC retailing is still in its initial stage, regardless of retailer age, size, or ownership [24].

Our results also reveal that retailer PV can affect SCI and FP. The in-depth slope tests illustrate that the positive impacts of retailer PV on SCI and FP weakened when PV became higher. There is evidence that shows higher levels of PV confuse customers, making it more difficult for retailers to predict demand and coordinate supply [99,100]. Therefore, we offer some explanations. When PV is relatively low, increasing PV increases both products and related information in the retailer supply chain, which is beneficial for SCI and positively affects FP. However, when PV becomes higher, increasing PV means that retail business become more complex and more difficult to manage, making it more difficult for retailers to forecast customer demands and coordinate with supply-chain partners, which adds to the burden of SCI. The cost of SCI thus increases as the difficulty of integration increases, which negatively affects FP.

7. Conclusions and Outlook

This study applied DCV theory to empirically examine the relationships among internal and external logistics integration capabilities, SCI and FP of OC retailers. The results showed that a retailer's internal logistics integration capability positively and significantly affected external logistics integration capability. Both internal and external logistics integration capabilities had a significant role in promoting SCI and FP, and the impacts of external logistics integration capabilities were greater. Moreover, SCI was positively related to retailer FP and played a partial intermediary role in the relationships between internal and external logistical integration capabilities and FP. Additionally, this study found that the effects of retailer characteristics on performance were insignificant, reflecting upon the fairness of the business environment of the OC retail industry. However, a retailer's PV still influences the SCI and FP of OC retailers.

This study contributes to the literature in four ways. First, it is an early attempt to empirically explore the impact of retailer logistics integration capability on FP from internal and external perspectives in the context of OC retailing. It reveals the effectiveness by showing the difference between internal and external logistics integration capabilities while also revealing the partial intermediary role of SCI in the relationships between logistics integration capabilities and retailer FP. Thus, we provide a necessary supplement to the literature while linking logistics integration and OC retailing. Second, as a quantitative study exploring the impact of logistics integration on SCI, we clarify that logistics integration is a

significant factor affecting SCI for retailers as they explore OC retail strategies. Furthermore, the impact of external integration capability is greater. Thus, we fill an academic gap in SCI research. Third, although DCV theory has been widely used in the research of logistics and SCI, most studies focused on manufacturing firms, and only a few looked at retailers. This study confirms the opinion that logistics integration capability and SCI are dynamic capabilities in the context of OC retailing. Thus, it enriches the application of DCV theory to this effect. Lastly, this study tests the impacts of control variables on retailers' SCI and FP. We showed that retailers' characteristics did not significantly affect their performance in OC retailing. However, their PV did affect their performance. This differs from previous research and indicates a fair business environment in the OC retail industry.

Some valuable practical insights are proposed for OC retailers in this study. First, by showing the benefits of internal logistics integration, we provide retailers with the confidence to overcome difficulties and integrate multiple-channel logistics within their firms. Second, we show that the positive impacts of external logistics integration on retailer SCI and FP are greater than internal logistics integration, providing guidance for resource allocation and strategic choices of OC retailers. During the initial stage of OC retailing development, it is very important for retailers to choose a 3PL partner. Thus, OC retailers should pay special attention to cultivating logistics integration capabilities with 3PL partners. Third, the results of this study confirm that SCI has a significantly positive impact on retailer FP in the context of OC retailing. This finding will provide retailers with the impetus to reform, enabling them to be more confident, to increase investment, and to accelerate their implementation of OC retail strategy. Lastly, our findings reveal the fairness of the Chinese business environment. All retailers, regardless of age, size, or ownership, operate in a fair competitive environment. However, our results show that retailers cannot blindly increase their PV because too much variety will weaken the positive impacts on SCI and FP in OC retailing.

Although this study provides both theoretical and managerial contributions, there are still a few limitations, for which we now offer guidance for future research. First, this study used financial indicators to measure the short-term performance of retailers because the development of the OC retail strategy is still in the early stage. Future research could collect years of operational data to measure long-term performance to investigate the long-term impacts of OC retail strategies. Second, this study quantitatively examined the impacts of logistics integration capabilities on SCI. However, for the SCI of OC retailers, there are other enhancers apart from logistics integration. Therefore, there is an opportunity to examine the impacts of more potential factors, such as market factors. Third, this study only selects OC retailers in China as samples, but China's policies and business culture are different compared with those of western countries [101]. Therefore, future research can be conducted as a comparative study between different countries [102], while cultural factors can be considered in the model to measure their impacts on the OC retail strategy.

Author Contributions: Conceptualization, G.S.; Data curation, G.S.; Formal analysis, Y.L.; Investigation, Y.L.; Methodology, Y.L.; Project administration, G.S.; Resources, G.S.; Supervision, G.S.; Writing—original draft, Y.L.; Writing—review and editing, Y.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research is supported by Beijing Social Science Fund (No. 22JCC082), and Beijing Laboratory of National Economic Security Early-warning Engineering (Beijing Jiaotong University).

Data Availability Statement: The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

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