

ERASMUS UNIVERSITY ROTTERDAM

BACHELOR THESIS

**"How to measure e-commerce flows arriving at the
European seaports?"**

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Field: Urban, Port and Transport Economics

June 13, 2024

Abstract

As the global impact of Chinese cross-border e-commerce continues to grow, European ports play a crucial role as key logistics nodes in handling the influx of e-commerce traffic from China. This study gathers and analyzes data on exports from Chinese cross-border e-commerce platforms to European ports, including the value of goods traded through these platforms, the total value of goods imported from Europe to China, and the volume of goods transported by different methods. This approach allows for a quantitative exploration of the movement of e-commerce goods from China to Europe. The research utilizes various data acquisition techniques, including surveys and detailed data analysis of major European statistical offices and websites, as well as visits to official website of the General Administration of Customs of China and the Ministry of Trade, to ensure a comprehensive understanding of e-commerce flows.

Additionally, the paper delves into the structural characteristics of the e-commerce supply chain by analyzing the supply chain structures under different transaction modes, revealing the full pathway of e-commerce logistics from production to consumption. The results indicate that although the supply chain structures vary, most processes include key stages such as production, transshipment, distribution, and final delivery, with the transshipment stage being particularly critical, involving various transportation modes.

Table of Contents

Section 1 Introduction

1.1 Research Background	4
1.2 Research Significance	5
1.3 Research Question and Sub-Research Question	6
1.4 Contribution to Knowledge	7
1.5 Research Structure	8

Section 2 Literature Review

2.1 Inspiration of Research Question	9
2.2 Chinese Cross-Border E-commerce Platform	10
2.3 Chinese Cross-Border E-commerce Logistics	12
2.4 Chinese Cross-Border E-commerce and European Port	14
2.5 Summary of Literature	15
2.6 The Conceptual Framework	17

Section 3 Methodology

3.1 Measurement of E-commerce Flows	21
3.2 Source About E-commerce	23
3.3 Structures of E-commerce Supply Chains	25

Section 4 Data and analysis

4.1 The Penetration Rate	26
4.2 Export to European Port	27
4.3 Transportation Methods and Volume	32
4.4 Transaction modes and Structures of E-Commerce Supply Chains	33

Section 5 Conclusion

41

References

42

Appendix

45

Section 1 Introduction

In this section, we will introduce the background of this research, providing an overview of existing studies and theories. This is followed by a discussion on the significance of the research, emphasizing its contribution to the existing body of knowledge. Next, we detail the main research questions and sub-research questions. Subsequently, the paper's contribution to the knowledge in the relevant fields is articulated. Finally, we outline the structure of this paper, ensuring that readers have a clear understanding of the overall framework and flow of the paper.

1.1 Research Background

The expansion of globalization and e-commerce has been a crucial driver in the rise of international trade and logistics demands. This growth, facilitated by reduced trade barriers and market integration, has fostered greater economic connectivity between nations. Additionally, with advancements in technology and the widespread adoption of the internet, e-commerce has become an integral part of the global trade framework. Smartphones, a standout product of this technological advancement, have popularized online shopping among consumers who appreciate the convenience and broad selection of products it offers. In this regard, China has taken a leading role, particularly through the evolution of its e-commerce platforms like Alibaba, JD.com, and Pinduoduo. These giants have not only transformed consumer shopping habits by establishing expansive online sales platforms and sophisticated logistics networks, but they have also significantly propelled the development of the global supply chain and logistics industry, profoundly impacting international trade patterns.

According to the report on cross-border e-commerce by the Central People's Government of the People's Republic of China (In 2020, China's cross-border e-commerce import, and export volume increased by more than 30% year-on-year, 2021), the import and export value of China's cross-border e-commerce has been on an upward trend in recent years. The rapid development of China's cross-border e-commerce not only meets the diverse and personalized needs of foreign consumers but also helps Chinese products reach the global market, becoming a significant driving force in the growth of foreign trade. Figure 1 shows the transaction volume of Chinese cross-border e-commerce (the export and import to

overseas and international markets) from 2019 to 2023, expressed in billions of renminbi, and the annual growth rates displayed as percentages based on the total transaction volume in 2018. The graph indicates that although there has been a recent slowdown in the growth rate of cross-border e-commerce demand, it continues to expand rapidly. This data was not only extracted from GlobalData but also involved extensive research on Chinese cross-border e-commerce. To gather comprehensive information, we also explored numerous relevant data websites within China. Data regarding the transaction scale of Chinese cross-border e-commerce was gathered from iiMedia and 100EC. This information can be accessed by searching for "China Cross-Border E-Commerce Market Data Monitoring Report" in Chinese.

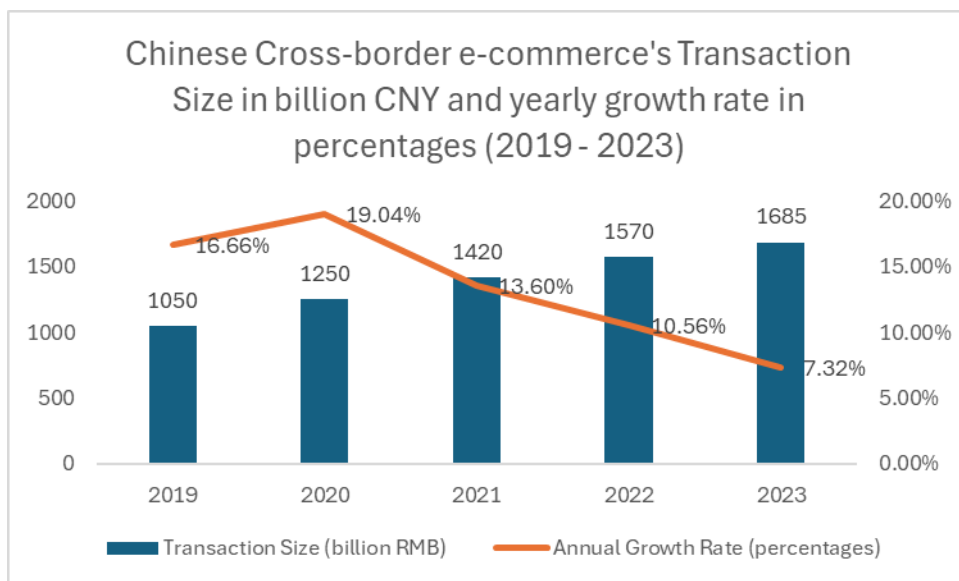


Figure 1 Chinese Cross-border e-commerce's transaction size and yearly growth rate 2019 – 2023

Source: GlobalData Banking and Payments Intelligence Center, 2023

1.2 Research Significance

With the ongoing growth of global trade, particularly the rapid expansion of China's cross-border e-commerce, profound impacts have been felt on the structure of global logistics and supply chains. As one of the world's largest e-commerce markets, the growth in China's e-commerce activities has not only transformed domestic market operations but has also significantly altered international trade processes, especially affecting the operation of European port networks. Europe, as a significant trade partner of China, places equal strategic importance on its seaports and airports. Seaports such as the ports of Rotterdam

(Netherlands), Hamburg (Germany), and Antwerp (Belgium), along with airports including Amsterdam Schiphol Airport (Netherlands), Frankfurt Airport (Germany), and Paris-Charles de Gaulle Airport (France) serve as critical junctions connecting the Chinese and European markets. These seaports were chosen because they rank among the top three in Europe in terms of cargo throughput (Exploring the EU container port sector in 2023, 2024). According to the research of Liu et al. (2021), Chinese cross-border e-commerce has not only experienced significant growth in the domestic market but has also demonstrated considerable potential and vitality in international markets, especially in collaboration with Europe.

Gathering data on the volume and value of China's cross-border e-commerce and understanding the operational processes of entire e-commerce platforms can provide clear and direct insights into how these ports' operational efficiency, logistics setups, and technological innovations are influenced, which is key to understanding the modernization of global supply chains. Studying this topic offers valuable insights to port managers, policymakers, and business strategists, helping them to better adapt to these changes and optimize port operation and development strategies. Additionally, considering the dual pressures of environmental sustainability and economic efficiency, how China's cross-border e-commerce fosters the adoption of green technologies and process optimizations at European ports is a critical aspect of this research. This not only aids in driving ports towards low-carbon development but also enhances their competitiveness in the global logistics network.

1.3 Research Question and Sub-Research Questions

Regarding Chinese cross-border e-commerce platforms, recent entrants like Temu, Shein, and Ochama in the European market, alongside earlier platforms like Aliexpress, deserve mention. These platforms, founded by the likes of Alibaba, JD.com, and Pinduoduo, enable Chinese SMEs to reach overseas consumers directly, eliminating complex intermediaries. This direct trading method lowers the barriers to entering international markets and stimulates the rapid growth of cross-border e-commerce. As these new Chinese platforms expand in the European market, their reliance on European seaports like Rotterdam, Hamburg, and Antwerp has significantly increased, but also the airports in Amsterdam, Germany and France. The increasing in goods and business activities challenges European ports to innovate and optimize their logistics and storage operations, yet simultaneously enhances their overall operational efficiency. However, understanding and measuring the e-commerce traffic

arriving at European ports is essential to assess the impact of Chinese cross-border e-commerce platforms on numerous European ports. And that leads to the main research question:

"How to measure e-commerce flows arriving at the European seaports?"

By formulating relevant sub-research questions, we can more clearly and comprehensively answer our main research question, and these crucial sub-research questions will provide a structured analytical framework for this research. To accurately measure the e-commerce traffic arriving at European ports, reliable data and data sources are required as support. This leads to our first sub-research question:

"How to get information about e-commerce?"

Secondly, exploring the typical structures of e-commerce supply chains helps us to understand how these configurations optimize logistical processes and their specific effects on port operations and management. The second sub-research question related to this is:

"What are typical examples of structures of e-commerce supply chains?"

The goal of this research aims to investigate the role of strategic alliances between Chinese and European ports, analyzing their impact on port efficiency, economic competitiveness, and the broader implications for global trade dynamics, particularly on how Chinese cross-border e-commerce platforms impact the development and operation of the European port network.

1.4 Contribution to Knowledge

This study makes a significant contribution to the academic field by exploring the impact of Chinese cross-border e-commerce on European port networks. Firstly, it develops a new theoretical framework based on existing theories of international trade and logistics management, specifically analyzing and explaining how cross-border e-commerce affects port operations and logistics networks. This provides new hypotheses and research avenues for future studies. Secondly, the paper uses empirical data to validate the specific impacts of cross-border e-commerce activities on port operational efficiency, cargo handling capacity, and supply chain structure, offering insights for port managers and policymakers to make more precise decisions based on data. Additionally, the research demonstrates how cross-border e-commerce fosters technological innovation in supply chain management, especially in port logistics operations and technological applications, providing empirical support and theoretical guidance for advancements in e-commerce and supply chain management technology. Finally, based on the findings, this paper presents specific recommendations for the management and development policies of European ports aimed at helping them effectively respond to challenges posed by e-commerce, optimize resource allocation and operational strategies, and enhance competitiveness and sustainability.

1.5 Research Structure

To ensure that readers can clearly follow the progress of the study and understand its profound significance, this paragraph introduces the five main sections. The first section primarily provides the background and significance of the research, laying the foundation for understanding the research framework. The following literature review (Section 2) delves into the operational modes of cross-border e-commerce platforms and logistics processes, and how these factors affect the operation of European ports, also addressing the second sub-research question. The third section details the methodology of the research, describing the execution and analysis methods, sources of data, and the data collection process, while also reporting the data required for the first sub-research question. The fourth section presents data and results, showcasing the findings through empirical data and answering the first sub-research question based on the analyzed results. Finally, the conclusion summarizes the key findings of the research and, by synthesizing the analysis and integrating answers to the two sub-research questions, responds to the main research question and suggests directions for future research.

Section 2 Literature Review

In this section, we will discuss various scholarly analyses of cross-border e-commerce platforms and the logistics routes of e-commerce, including the cooperation between Chinese cross-border e-commerce platforms and European ports. We will start with the academic research that have provided inspiration for the theme of this thesis. Secondly, we will mention an exploration of the historical development of Chinese cross-border e-commerce platforms and the academic literature related to their operations, this will include an assessment of the functions and influence of cross-border e-commerce platforms. Next, we will focus on the logistics of cross-border e-commerce, examining its operational models and their impact on supply chain management. This includes not only transportation processes but also the selection of locations for overseas warehouses. Finally, we will pay special attention to the research about how China's cross-border e-commerce activities interact with the European port network, thereby affecting port operations and strategic development.

2.1 Inspiration of Research Question

The inspiration of this research question is due to the research of Liang et al. (2021), which focuses on cross-border e-commerce transactions between China and countries along the "Belt and Road" initiative. Their paper delves into the increasing significance of cross-border e-commerce platforms in global trade and their growth trends. Europe, being the primary overseas market for Chinese cross-border e-commerce, makes the study of collaboration between European ports and Chinese e-commerce particularly vital. This includes a focus on the efficiency and sustainability of port facilities, as well as their impact on maritime and terrestrial transportation infrastructure.

Van der Putten and Kranenburg's paper (2022) offers extensive and priceless insights that serve as a foundation for my research question. With an emphasis on Dutch ports, this study provides a thorough overview of how European port networks manage their interactions with Chinese economic activities, particularly the expanding area of cross-border e-commerce. The report's contents are especially important for my research because they highlight the operational, economic, and strategic factors that European ports need to take into account when responding to the growth of well-known Chinese e-commerce platforms like Tmall and JD.com, as well as newer platforms like Temu.

2.2 Chinese Cross-Border E-commerce Platforms

The study by Xue et al. (2016) is particularly relevant to our interest in the development history and operational processes of Chinese cross-border e-commerce platforms. Their paper provides a detailed review of the evolution of China's cross-border e-commerce from its initial exploratory stage to the formation of a mature industry ecosystem. The article notes that as early as the early 2000s, with the widespread adoption of the internet and advances in electronic payment technologies, China's e-commerce industry began to take shape. However, significant growth in cross-border e-commerce began when the Chinese government introduced a series of supportive policies, including the establishment of e-commerce pilot cities and comprehensive cross-border e-commerce pilot zones, which significantly lowered the barriers to entering the global market. Additionally, to promote exports, the Chinese government implemented several policies including tax incentives and streamlined foreign exchange management, greatly boosting the development and international competitiveness of cross-border e-commerce platforms. Regarding platform operational processes, the paper delves into how Chinese cross-border e-commerce optimizes operations through the integration of supply chain management, logistics services, payment systems, and customer service. Firstly, cross-border e-commerce platforms often collaborate with multiple international and domestic logistics providers to establish an efficient logistics network, ensuring that goods are delivered quickly and safely to international buyers. For example, some large platforms have set up overseas warehouses to store goods near major markets to reduce delivery times and transportation costs. Moreover, these platforms have adopted advanced supply chain technologies such as cloud computing and big data analytics to predict market trends and optimize inventory management. The platforms also accommodate different national consumer habits by offering a variety of payment methods, such as accepting international credit cards and electronic wallets, ensuring the security and convenience of transactions. Furthermore, to enhance customer satisfaction, cross-border e-commerce platforms have established multilingual customer service systems to address consumer issues during the purchasing process, such as returns, refunds, and product inquiries, thereby improving the overall shopping experience. In summary, the development of China's cross-border e-commerce platforms is driven by both policy support and market demand, successfully carving out a place in the global e-commerce market through continuous optimization of operational processes and technological applications. This systematic progress has not only enhanced the platforms' competitiveness but also provided global consumers with more shopping options and a better service experience.

The paper by Want et al. (2020) explores how cross-border e-commerce enterprises enhance the quality of supply chain relationships by managing information flows, logistics, and cash flows to integrate the supply chain. This research provides theoretical support and practical guidance for understanding the integration of cross-border e-commerce supply chains. By effectively managing these three flows, cross-border e-commerce platforms can significantly improve the quality of supply chain relationships, thus standing out in the fierce market competition. The paper discusses how, in the development history of Chinese cross-border e-commerce, the management of information flows, logistics, and cash flows has always been central to platform operations. From the early stages in the 2000s, through the initial growth phase from 2010-2015, to the rapid development period from 2015 to the present, cross-border e-commerce platforms have continuously optimized the management of these three flows, enhancing supply chain efficiency and transparency. In terms of information flow management, early platforms improved international trade transparency and efficiency by optimizing information flows; modern platforms use big data and artificial intelligence technologies to monitor and manage information flows in real-time, enhancing supply chain responsiveness and customer satisfaction. In logistics management, the development of cross-border logistics infrastructure and third-party logistics services has significantly improved logistics efficiency; currently, platforms reduce logistics costs and time through a global warehousing network and intelligent logistics systems, enhancing customer experience. Regarding cash flow management, the development of financial technology has made payment methods more diverse and convenient; modern platforms enhance the flexibility and stability of cash flow through secure and efficient payment solutions and financial services, reducing financial risks. Overall, the research by Want et al. closely aligns with the development trajectory and operational models of Chinese cross-border e-commerce platforms, further validating the importance and feasibility of managing information flows, logistics, and cash flows in the integration of cross-border e-commerce supply chains.

In the paper of Horst Treiblmaier and Christian Sillaber (2021), they provide a more detailed description of managing information flows, logistics, and cash flows in cross-border e-commerce platforms. Although their overall research direction is very similar to that of Want et al. (2020), it notably emphasizes and analyzes blockchain technology. In this study, they thoroughly explore how blockchain technology can enhance the operations of e-commerce platforms by improving transparency, trust, efficiency, and security. These characteristics are particularly crucial for Chinese cross-border e-commerce platforms, as they directly impact international buyers' trust and satisfaction. With blockchain's immutability and distributed ledger features, every step from production to delivery can be transparently recorded and rigorously verified, significantly enhancing consumer trust in the platform. Additionally, the application of blockchain technology in supply chain management allows for real-time tracking of goods, ensuring supply chain transparency, reducing logistical errors and

interruptions, and thus optimizing overall supply chain management efficiency. In terms of payments, blockchain solutions can simplify the process of cross-border transactions, reducing the high fees and time delays that may be incurred with traditional banking systems. Moreover, the potential of blockchain in protecting consumer privacy cannot be overlooked. It allows for the processing of international transactions without disclosing sensitive personal information, helping platforms comply with strict data protection regulations.

2.3 Chinese Cross-Border E-commerce Logistics

The core of cross-border e-commerce logistics still relies on traditional logistics, which are extensively discussed in Marasco's paper (2008). The article highlights that traditional logistics services primarily focus on transportation, warehousing, inventory management, and order processing. These services are the cornerstone of supply chain management, aimed at ensuring the effective flow of goods from origin to destination. Marasco emphasizes that although these fundamental functions remain at the heart of logistics services, the emergence of third-party logistics providers has allowed for the expansion and deepening of service scopes. By integrating and optimizing these traditional services, third-party logistics providers can offer more customized solutions to their clients, thus not only reducing costs but also adding value by enhancing the overall efficiency and responsiveness of the supply chain. Additionally, the paper discusses how traditional logistics theories have gradually evolved into more complex supply chain management concepts, including broader strategic planning and customer relationship management, which are essential components of modern third-party logistics services.

In the field of cross-border e-commerce logistics, there are few academic papers specifically studying the logistics processes of Chinese cross-border e-commerce, but numerous Chinese news websites, such as McKinsey & Company and The Paper, report on this topic. According to a report from The Paper (2021 China Cross-border E-commerce Export Logistics Service Provider Industry Research Report, 2021), the process begins when a consumer places an order on an e-commerce platform. The system automatically checks the inventory and confirms the order details, involving inventory management, order verification, and payment processing. Once the order is processed, warehouse staff pick and pack the items based on order requirements, preparing them for shipment. The packaged goods are first transported domestically, usually from the warehouse to an international transportation hub suitable for export, such as an international airport or seaport. This stage may involve ground transportation methods, such as trucks or trains.

After arriving at the export hub, the goods go through customs clearance for export, a critical step that includes declaring, inspecting, and paying taxes on the goods. Once the customs procedures are completed, the products are shipped to the destination country using the designated international transportation method (air or sea), with efficiency and costs influenced by the mode of transport and distance. Upon arrival in the destination country, the goods must go through import customs clearance, including the payment of any tariffs, taxes, and undergoing necessary quarantine inspections. The clearance process significantly impacts the circulation speed and cost of the goods. After clearance, the goods are taken over by the logistics service provider in the destination country for last-mile delivery. This step might involve various delivery options, such as courier services directly to the customer's door or pickup points for customer collection. Finally, the goods are delivered to the consumer's specified address or picked up at a designated location, completing the entire cross-border shopping logistics process.

The logistics processes described above do not cover all models, as Chinese cross-border e-commerce involves several different logistics models, each with its own unique processes. Similarly, in the field of logistics models, there is a lack of outstanding academic research specific to Chinese cross-border e-commerce, and no papers analyze the logistics processes used by each major Chinese cross-border e-commerce platform. Therefore, most of the following reports are sourced from Chinese information websites or news networks. Firstly, the direct mailing model, as reported by Baidu Forum (Cross-border Xingyun: What are the common cross-border e-commerce logistics models, 2023), is a traditional cross-border logistics method where goods are sent directly from the seller's overseas warehouse to the buyer's address. This model generally has longer shipping times but usually costs less, making it suitable for consumers who are not in a rush to receive their goods. Another report discusses the bonded warehouse model (Detailed explanation of BBC (bonded warehouse model) customs clearance process in cross-border import e-commerce, 2019), where goods are pre-stored in a bonded warehouse within the buyer's country. This model significantly shortens shipping times and can reduce customs costs to some extent. The most common model is the overseas warehouse model, which will be discussed in more detail in subsequent articles. In brief, sellers set up warehouses in the target market country or region and store large quantities of goods. When a consumer places an order, the goods are shipped directly from the overseas warehouse, greatly enhancing logistics efficiency and the shopping experience. Lastly, the drop shipping model (Cross-border e-commerce "drop shipping" business model, legal risks and compliance suggestions, 2022) involves sellers not holding any inventory themselves; instead, once a consumer places an order, the product is purchased directly from the supplier who then ships it. This model reduces the seller's inventory and upfront investment risks.

Specifically for large platforms, the Alibaba Group (including Tmall International and Alibaba B2B platform) primarily uses the bonded warehouse model and overseas warehouse model. Tmall International can quickly fulfill domestic orders through the bonded warehouse model, while Alibaba's global network of overseas warehouses supports rapid distribution of bulk commodities. JD Global, also a leader in Chinese cross-border e-commerce, leverages JD's own logistics system and extensively uses the bonded warehouse model. JD has overseas warehouses in several key global markets to boost the efficiency of cross-border logistics. Temu, a newer platform under Pinduoduo, often uses the direct mailing model, especially for price-sensitive products, but Pinduoduo is also experimenting with building overseas warehouses and using bonded warehouses to enhance user experience. Another well-known Chinese cross-border e-commerce platform is Vip International, which primarily uses the bonded warehouse model, focusing on offering brand discounts and significantly reducing logistics costs and times through bonded warehousing.

The location of overseas warehouses plays a crucial role in the logistics of cross-border e-commerce. A detailed and precise master's thesis written by my fellow student, Wang, explores this topic extensively, focusing on how cross-border e-commerce businesses can optimize the location of their overseas warehouses in China. The paper analyzes the logistics demands of cross-border e-commerce and employs various statistical and optimization methods to determine the best locations for overseas warehouses. The study begins by defining the importance of warehouse site selection, emphasizing that scientific site selection can significantly enhance logistics efficiency, reduce operational costs, and optimize supply chain management. The thesis then outlines the key factors influencing location decisions, including geographical position, accessibility, logistics costs, market proximity, and local policies and economic conditions. The researcher used quantitative analysis methods such as Data Envelopment Analysis (DEA) and multi-objective optimization models to assess the performance of different potential sites and proposed a comprehensive evaluation model. This model integrates multiple indicators, aiming to find the optimal warehouse location that balances operational efficiency with cost reduction.

2.4 Chinese Cross-Border E-commerce and European Port

The background and analytical framework for this paper are drawn from the report by Gomez-Herrera et al. (2014), which thoroughly examines various factors that promote and hinder

cross-border e-commerce within the EU. This provides a robust starting point for understanding the impact of Chinese cross-border e-commerce on European logistics infrastructure. Initially, the paper discusses the drivers of e-commerce growth, such as improvements in electronic payment systems and logistics delivery services, which directly relate to how the expansion of Chinese cross-border e-commerce depends on the efficiency and connectivity of European port networks. For example, Chinese e-commerce platforms rely on efficient logistics and rapid cargo handling capabilities, prompting European ports to upgrade their technology and operational processes to accommodate the high volume of goods from China. Additionally, the paper addresses the obstacles, particularly the high costs of cross-border delivery and legal and regulatory differences, highlighting the challenges European ports face in handling goods from Chinese cross-border e-commerce. These challenges include dealing with tariffs, varying standards for goods inspections, and complex return processes, all of which can affect the efficiency and cost of port operations.

In exploring how Chinese cross-border e-commerce impacts the development and operations of European port networks, the paper by He et al. (2021) offers invaluable perspectives and analytical tools. This paper provides a detailed analysis of the interdependence between international logistics and cross-border e-commerce, specifically on how enhancing logistics services can boost the efficiency and success of e-commerce. These insights are directly applicable to understanding how Chinese e-commerce drives the adaptation and evolution of the European port networks. The paper highlights the critical role of logistics efficiency in the success of cross-border e-commerce. For European ports, this translates into the need to efficiently handle large volumes of goods arriving from China, which often require rapid customs clearance and distribution. The growth of Chinese e-commerce directly prompts European ports to enhance their logistical capabilities, such as by increasing automation in loading and unloading, improving goods tracking systems, and optimizing storage and distribution strategies to accommodate high-frequency cargo movements.

2.5 Summary of Literature

After a thorough review of the relevant literature, we can draw several key conclusions about the development of Chinese cross-border e-commerce. This growth is the result of a combination of policy support and market demand. Beginning in the early 2000s with the proliferation of the internet and advancements in electronic payment technologies, Chinese e-commerce platforms like Alibaba and JD.com quickly rose to prominence. Government policies, such as the establishment of comprehensive cross-border e-commerce zones,

provided significant support to these platforms through tax incentives and streamlined customs procedures. These measures significantly lowered market entry barriers, facilitating the global expansion of these platforms. By continuously innovating, such as developing new logistical solutions and market entry strategies, these platforms have effectively connected Chinese manufacturers with global consumers, enhancing the international circulation of Chinese goods. However, we found some recent reports and news articles that suggest that this significant growth is slowing down, which could be attributed to several factors. First, Chinese cross-border e-commerce faces challenges in adapting to global markets and managing cultural differences. Integrating into local markets and complying with international trade regulations are critical for success. Additionally, tense political relations between China and other countries, and high tariffs, further slow the development of Chinese cross-border e-commerce.

On the other hand, the rapid expansion of Chinese cross-border e-commerce is inseparable from its efficient logistics and supply chain management systems. Collaborations with domestic and international logistics providers allow e-commerce platforms to achieve rapid international delivery, meeting global consumer demands. Major platforms like Alibaba and JD.com enhance cross-border delivery efficiency and accuracy by establishing overseas warehouses and adopting advanced logistics technologies, such as automated warehouse systems and real-time data analysis to precisely forecast product demand and optimize inventory management, reducing transportation delays. These platforms also employ blockchain technology to enhance the transparency and security of their supply chains. Despite this, the cross-border logistics sector still requires further development and improvement, including addressing complex international logistics regulations and increasing the flexibility of logistics networks to adapt to market changes.

Regarding the collaboration between Chinese cross-border e-commerce and European ports and its impact on port operations, the literature provides numerous insights. As the volume of e-commerce goods from China to Europe increases, key logistical nodes like the Port of Rotterdam and the Port of Hamburg must continually enhance their capacity to handle the growing cargo. This includes not only expanding physical infrastructure but also integrating advanced information technologies, such as more efficient cargo tracking and processing systems. Moreover, this cooperation also presents challenges, including how to manage and optimize the efficiency of customs clearance for goods imported from China and how to coordinate regulatory requirements across different countries and regions. Successful collaboration requires supportive policies and a deep integration of business strategies between the regions.

2.6 The Conceptual Framework

To better understand and evaluate the e-commerce flows from Chinese cross-border e-commerce platforms to European ports, this study introduces a new conceptual framework. This framework integrates logistics, information flows, and financial flows discussed in Want et al. (2020), along with supply chain management, and collaboration with European ports to optimize maritime and air freight channels and effectively utilize overseas warehouses. And in Figure 2, we have included the conceptual framework of Chinese cross-border e-commerce platforms that we elaborated by ourselves.

Firstly, the dimension of logistics optimization encompasses the design of the transportation network, the application of logistics technology, and collaboration with global logistics partners. To optimize transportation processes and reduce costs, cross-border e-commerce platforms should carefully design their transportation networks to ensure every step from suppliers to consumers is as efficient as possible. This includes choosing the right mode of transport (such as maritime, air, or rail) based on cost-effectiveness, transit time, and the type of products. For instance, for urgent or high-value goods, platforms might prefer air freight to shorten delivery times, while bulk goods might be more economically shipped by sea. Additionally, by analyzing transport routes and nodes, e-commerce platforms can avoid common bottlenecks and delays, thereby enhancing the reliability of overall transportation. Modern logistics technologies, such as automated warehousing systems, robotic sorting, real-time data tracking, and blockchain technology, can become vital tools for cross-border e-commerce. Automated warehousing systems can quickly and accurately handle storage and retrieval operations, significantly improving warehouse efficiency. Robotic sorting systems reduce human errors and speed up packaging and sorting processes. Real-time data tracking ensures platforms can monitor the status of each package, promptly addressing potential delays or issues. Blockchain technology provides a transparent, tamper-proof platform for supply chain data, enhancing trust among all parties involved.

Secondly, to effectively manage information flows in international operations, cross-border e-commerce platforms need to adopt advanced information technologies. This includes implementing Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems that integrate information from different business sectors, such as inventory data, customer data, and order information, ensuring the accuracy and real-time updating of

information. For example, through an ERP system, e-commerce platforms can automatically track inventory levels, forecast product demand, thus optimizing inventory management and reducing instances of surplus or shortage. CRM systems help platforms maintain customer information, tailor marketing efforts, and enhance the quality of customer service and satisfaction. Maintaining seamless data communication is crucial, especially when handling international orders and logistics tracking. Cross-border e-commerce platforms can implement cloud computing services to achieve centralized data storage and global access, ensuring operational teams worldwide can instantly access and update necessary information. Additionally, using Application Programming Interfaces (APIs) to connect different e-commerce tools and services, such as online payment systems, logistics tracking services, and market analysis tools, can seamlessly integrate various data sources, improving the efficiency and accuracy of data processing. As the e-commerce ecosystem expands, information integration between platforms becomes another key area for enhancing operational efficiency. Cross-border e-commerce platforms can achieve real-time information sharing and collaboration by integrating systems with suppliers, logistics partners, and third-party marketplaces. For instance, platforms can integrate suppliers' inventory management systems to instantly access product supply information, responding more quickly to market changes. Integration with logistics partners' systems can provide complete information on the transportation paths of goods, enhancing customers' visibility and trust in the logistics process.

Regarding cash flow, effective financial management is the cornerstone of continuous operation for cross-border e-commerce. By adopting advanced financial management software and technologies, platforms can monitor and optimize cash flows in real time. This includes automated financial reporting, cost control, and revenue management. For example, by dynamically analyzing the cost-effectiveness of various marketing activities and sales channels, platforms can optimize their advertising spending and resource allocation, thereby improving overall profitability. Moreover, cross-border e-commerce platforms must handle transactions in multiple currencies, using effective foreign exchange management strategies to minimize forex risks and ensure profit maximization. To support international transactions, cross-border e-commerce must integrate various payment methods to accommodate the payment preferences of customers in different countries. This includes credit cards, electronic wallets, and online bank transfers. By partnering with international payment service providers like PayPal and Alipay International, platforms can offer secure, convenient payment solutions, reducing payment friction and enhancing customer satisfaction. Additionally, optimizing the payment process helps reduce the costs and delays associated with transactions, increasing the speed of cash flow.

Optimization of supply chain management primarily focuses on product design and manufacturing, inventory management, order processing, and goods distribution. The previously mentioned dimensions of logistics and information flow optimization have already addressed inventory management and goods distribution. In terms of product design and manufacturing, cross-border e-commerce platforms can work closely with manufacturers to optimize product designs to meet the demands of international markets. This includes considering consumer preferences and regulatory requirements in specific regions to ensure products are successfully sold across different markets. For instance, e-commerce platforms may encourage manufacturers to adopt modular designs to simplify production processes and reduce costs, while increasing product customizability to meet broader market needs. And order processing is a critical part of the supply chain, directly affecting customer satisfaction and operational efficiency. Cross-border e-commerce platforms can integrate advanced order management systems to automate order entry, processing, and execution. These systems can handle orders from around the world in real-time, automatically selecting the best shipping warehouse and logistics routes. Additionally, cross-border e-commerce platforms can plan efficient return and exchange policies to further enhance the shopping experience for customers.

The final dimension involves optimizing cooperation between cross-border e-commerce and European ports, starting with strengthening partnerships. This includes establishing strategic partnerships with port management authorities to develop customized logistics solutions that adapt to evolving trade demands and policy changes. For example, e-commerce platforms can collaborate with major ports like the Port of Rotterdam and the Port of Hamburg to optimize cargo handling processes, reducing the time for goods to enter and exit the port and improving throughput efficiency. Additionally, by participating in digital and automation transformation projects at ports, e-commerce platforms can integrate more deeply into port operations, achieving data sharing and business collaboration. Regarding transportation methods, such as maritime or air freight, e-commerce platforms need to optimize logistics routes based on the characteristics of goods, cost-effectiveness analysis, and market demand. Maritime transport is generally suitable for bulky, heavy goods with low time sensitivity, offering lower costs but longer transit times; air freight is suited for high-value, lightweight, urgently needed goods, offering speed at a higher cost. Through close collaboration with shipping and airline companies, e-commerce platforms can secure more favorable transportation prices and more reliable services. Furthermore, e-commerce platforms can dynamically adjust the use of maritime and air transport based on historical data and market trends to meet the varying demands of different seasons and market changes. Use of overseas warehouses is a key strategy for optimizing cooperation with European ports for cross-border e-commerce. By establishing or renting warehouses at strategic locations in Europe, e-commerce platforms can achieve local storage and rapid distribution of goods. This

significantly shortens delivery times, reduces logistics costs, and enhances customer satisfaction. For example, an e-commerce platform might set up a warehouse near the Port of Rotterdam, utilizing the port's advantage as a logistics hub in Europe to quickly distribute goods to major European markets. Moreover, overseas warehouses can also provide value-added services such as localizing product labels, quality checks, and customized packaging, further enhancing service quality and market responsiveness.

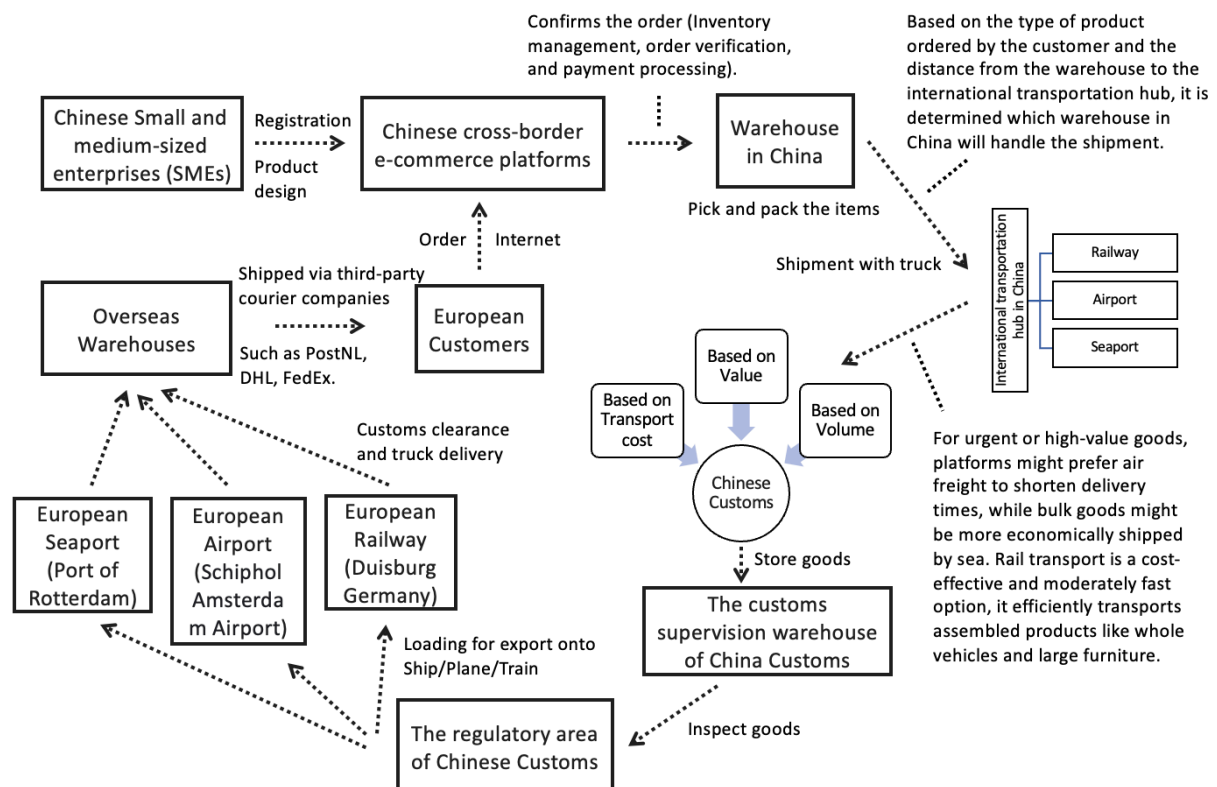


Figure 2 The conceptual framework of Chinese cross-border e-commerce platforms

Source: From own elaboration based on literature review

Section 3 Methodology

This chapter will discuss the methods for the optimal solution to the primary and secondary research questions, including defining the scope and sources of data collection and utilizing quantitative analysis methods to process the collected data.

3.1 Measurement of E-commerce Flows

To address the primary research question "How to measure e-commerce flows arriving at the European seaports?" we need to consider various aspects. It's essential not only to analyze the quantity of different types of goods but also to consider whether each category arrives in Europe by sea or air. This requires accessing specific data on trade and transportation, which involve the value and volume related to the goods. Ultimately, the export volume related to Chinese cross-border e-commerce to Europe will be compared with the total imports from Europe to China. This comparison will provide a new perspective on the trade cooperation between China and Europe, as no previous research has been able to definitively quantify the volume of goods imported via Chinese cross-border e-commerce nor assess its impact accurately.

Before beginning data collection, we engaged in detailed and logical discussions to define the needed data and outline the analytical steps. In the initial phase, the thesis aimed for a more detailed research direction, focusing on the top-ranking Chinese cross-border e-commerce platforms by market share. Figure 3 shows the market share of export of Chinese cross-border e-commerce platforms in 2022, sourced from China's statistics website (2022 China Cross-Border E-commerce Market Data Report, 2022). A search on Baidu (a Chinese search engine like Google) with keywords like "market share of Chinese cross-border e-commerce platforms" can retrieve similar data. From the figure, it is evident that Tmall Global, as the largest cross-border e-commerce market in China, holds a market share of 52.5%. Tmall Global specifically caters to Chinese brands, offering high-quality products to upscale consumers abroad. JD Worldwide is second with a market share of 18.5%, focusing on tech products and leveraging JD's extensive user base and advanced logistics system to provide a robust platform for Chinese brands to enter foreign markets, as evidenced by its establishment of Ochama overseas, offering various Chinese food products. Pinduoduo, though relatively new, has quickly grown into one of the main e-commerce platforms in China,

especially for agricultural products and daily consumer goods, offering cost-effective shopping options through social elements and group buying features. Its recently launched subsidiary, Temu, has become popular abroad by providing affordable and comprehensive product ranges, although it holds only 15% of the market share due to its shorter establishment period compared to other platforms. Suning, ranked fourth, has a market share of 4%, and its innovative e-commerce model of "brand discounts, time-limited sales, and genuine product guarantee" has made its platform's apparel, shoes, bags, beauty products, mother and baby products, and home goods popular overseas.

Appendix 2 shows the market share of exports from Chinese cross-border e-commerce platforms from 2018 to 2022. It is evident that Alibaba not only occupies a significant portion of the export market share each year but also that its market share has been increasing annually. Appendix 2 also reveals that the few platforms dominating the cross-border market have remained unchanged from 2018 to 2022, indicating their strong leadership in the cross-border e-commerce sector.

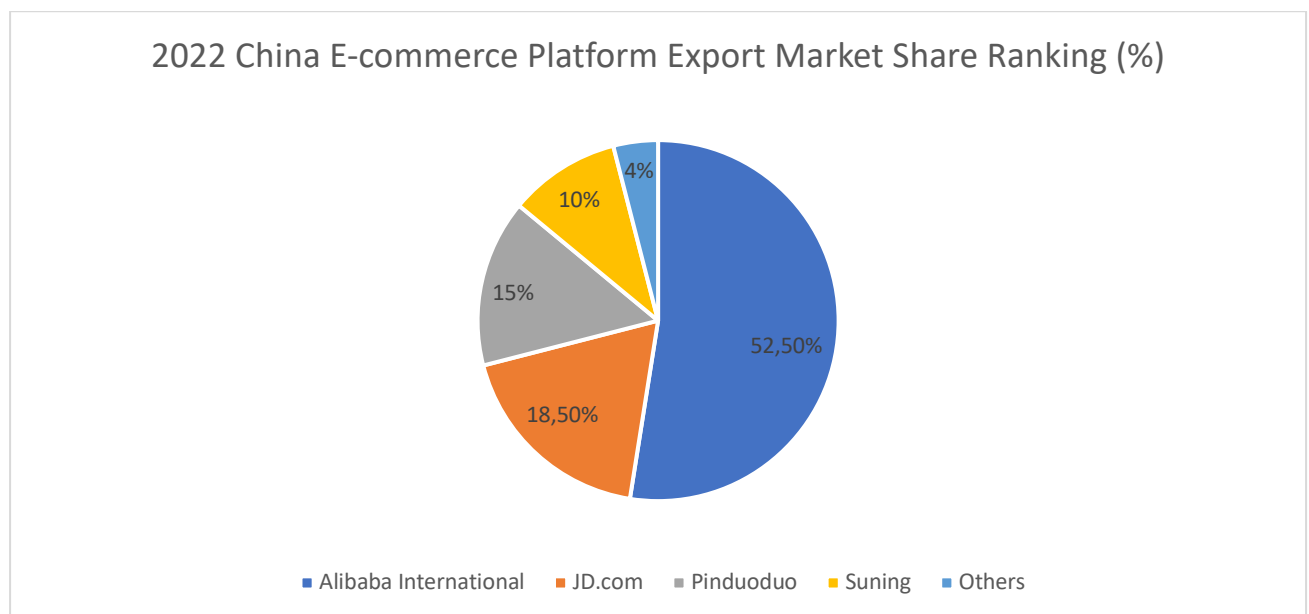


Figure 3 Market share distribution of Chinese cross-border e-commerce platforms in 2022

Source: 2022 China Cross-Border E-commerce Market Data Report, 2022

Another Chinese cross-border e-commerce platform that has recently gained traction in Europe is Shein. However, this company primarily focuses on exporting low-priced clothing and does not have the extensive user base or advanced logistics systems like Alibaba and

JD.com in China. Additionally, due to its relatively recent establishment, there is not much data available on its exports to European ports.

However, due to various factors, analyzing the export volumes of the top five Chinese cross-border e-commerce platforms to European ports is quite impractical. The main reason is that subsequent research requires data related to product categories and logistics methods, which are not available from each platform's annual reports or official websites. Initially, we did not fully understand this limitation, but an interview with officials from China's Ministry of Trade clarified that detailed data on the specific types of goods from each cross-border e-commerce platform, their quantities, and whether they reach Europe by sea or air are considered state secrets. According to the description given by the Ministry of Commerce official, export data typically contains core business information such as sales volume, market distribution, and customer demographics. If this information were to be made public, it could be exploited by competitors, potentially affecting a company's competitive strategies and market position. Furthermore, Chinese authorities maintain strict control over data management, especially concerning information related to cross-border data flows. The government may need to protect this data to avoid potential risks to national economic security. Lastly, the public disclosure of detailed export data could cause market fluctuations in demand for certain products or services, impacting market stability. Companies might prefer to analyze and utilize this data within a controlled internal environment to avoid unnecessary market disruptions. Therefore, this has led to a stagnation in this research direction. Additionally, the market share of the top five Chinese cross-border e-commerce platforms changes annually, which would necessitate a large database for support, further rendering this research direction impractical.

3.2 Source About E-commerce

Although it is impractical to analyze the market share of the top five Chinese cross-border e-commerce platforms regarding exports to European ports, by collecting data on the overall volume of goods and changes in product categories imported to Europe through these platforms from 2018 to 2022, we can still address our primary and first secondary research questions. To find the correct data, we established several search directions: firstly, data on the total exports from China to Europe via cross-border e-commerce platforms, which is crucial for this study, and can be measured either in value or in volume per container; secondly, the modes of transportation for the goods exported through these platforms, such as how much volume or value of goods are shipped by sea or air to European ports;

considering the confidentiality of some data, if specific quantities for each type of good cannot be obtained, then the proportions of each category and its transportation methods can also be used; next, regarding product categories, the total volume of goods exported by cross-border e-commerce platforms broken down by category, targeting percentage data if specific transaction scales are confidential; and lastly, the number of product categories from 2018 to 2022, with annual changes, which is also critical for our research.

After defining our search direction, we conducted a very careful search. Although most data had to be queried on Chinese websites, academic sites like Google Scholar helped complete the literature review section. We also consulted many relevant academic papers from Chinese academic websites (like Google Scholar), using keywords such as "cross-border e-commerce," "overseas logistics," and "e-commerce product categories." However, detailed data on the trade scale between Chinese cross-border e-commerce platforms and European ports during 2018-2022 was scarce, indicating few studies on the cooperation and impact between cross-border e-commerce and European ports in China, possibly due to the lack of transparency and public availability of data. Conventional web searches (on Baidu, like Google) also failed to yield the necessary data for our research questions. Eventually, through connections with China's Ministry of Trade, we secured an interview with a government official who confirmed that many data related to Chinese cross-border e-commerce are confidential and not publicly available, thus unsearchable online. However, after this interview, the official provided some data related to our search directions for subsequent analysis. The data provided by the official is relatively reliable for our study, as the Ministry of Trade is an official agency of the Chinese government, responsible for overseeing all trade information of Chinese companies, including sales and export figures of e-commerce platforms. As an official source, the data it releases typically undergoes a rigorous data collection and verification process, ensuring the officiality and authority of the information. Moreover, in the process of data collection and analysis, the Ministry of Trade often collaborates with other government agencies such as the National Bureau of Statistics and the General Administration of Customs. This collaboration makes the data more comprehensive, covering various stages from production and distribution to consumption.

As mentioned in the previous paragraph, our research also required data on the total trade volume of goods imported from China to European ports, which was sourced from CBS (Centraal Bureau voor de Statistiek), the principal Dutch governmental institution responsible for compiling and publishing statistical data since 1899. Using CBS-Statline, we searched for "wederuitvoer" (re-export) and selected the entry titled "Internationale handel en doorvoer; waarde, gewicht, goederen, vervoerwijze" ("International trade and transit; value, weight, goods, mode of transport"). This site provided not only the types of goods imported from

China to European ports from 2018 to 2022 but also the volumes transported by sea or air, a crucial resource for later data analysis.

3.3 Structures of E-commerce Supply Chains

When researching the second sub-question ("What are typical examples of structures of e-commerce supply chains?"), it is crucial first to clearly define the key components of the supply chain for Chinese cross-border e-commerce platforms. These components include manufacturers, domestic distributors, warehousing and logistics, customs clearance services, international logistics providers, and the final overseas consumers. Understanding and defining the roles and interrelationships of these components within the supply chain is essential. Definitions of these key components and the structure of the supply chains for Chinese cross-border e-commerce platforms can be backed by academic literature that provides a theoretical framework and context for current business practices, all of which are detailed in the Section Literature Review. However, to apply theory to practice, in the upcoming Data and Analysis section, we will provide the e-commerce supply chain structures for different transaction models (B2B and B2C) and use a supply chain map to make these structures more intuitive and clearly visible.

Section 4 Data and Analysis

In this section, we will explore the e-commerce flows from Chinese cross-border e-commerce platforms to European ports by analyzing a range of collected data, some of the data sets are missing samples from 2018, so we are using data from 2019 to 2023. However, for those cases where the data from 2018 is complete, we have used the data spanning from 2018 to 2022. First, we will assess the penetration rate of Chinese cross-border e-commerce, a key indicator for understanding its impact on the global market. Next, this paper will reference data from Eurostat to analyze China's overall exports to Europe, and utilize data provided by a Ministry of Commerce official on goods exported to Europe through Chinese cross-border e-commerce platforms, which is also published by the General Administration of Customs of China. Through UN Trade and Development, we have gathered data on the volume of goods transported by different methods (sea and air) from Chinese cross-border e-commerce to European ports. However, this data does not specify product types, so we can only attempt to sketch out the main trends and patterns using the available information. Finally, this section will also examine the main transaction models of cross-border e-commerce and visually represent the e-commerce flows from China to Europe through a supply chain map.

4.1 The Penetration Rate

The penetration rate of Chinese cross-border e-commerce is a crucial metric for analyzing cross-border e-commerce flows. This rate typically indicates the prevalence or market share of cross-border electronic commerce within a market or industry. By examining the trends in this penetration rate, we can indirectly understand the direction of development for the volume of goods entering Europe by sea or air.

In Figure 4, we can see that the penetration rate of Chinese cross-border e-commerce has seen significant growth since 2019. The Penetration Rate is a metric derived by dividing the total value of China's cross-border e-commerce imports and exports by the total value of China's goods trade imports and exports. In 2019, the penetration rate was 3.32%, which grew to 4.03% by 2023. This indicates that an increasing number of Chinese businesses and consumers are participating in cross-border e-commerce activities, especially in the expansion of foreign trade and international markets. Additionally, the chart also shows the trend in annual growth rates. From 2019 to 2020, the annual growth rate of cross-border e-

commerce was 17.17%, indicating a rapid initial growth rate. However, the growth rate dropped to 6.68% negative in 2021 and further increased to 2.75% in 2022. Despite this, the data for 2023 show a recovery in the annual growth rate to 8.04%. These fluctuations may be related to various factors, such as the global economic environment, changes in international trade policies, and market saturation levels.

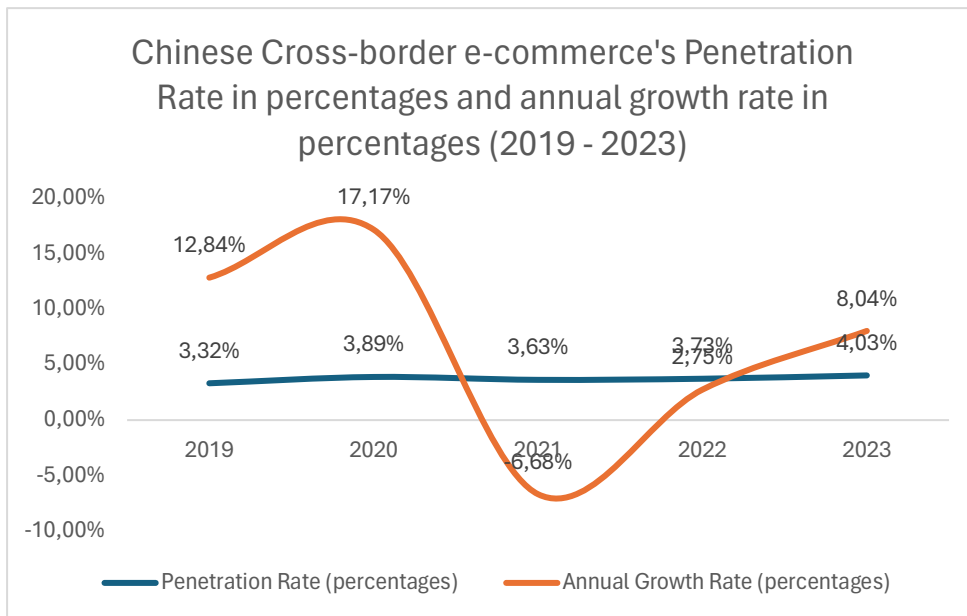


Figure 4 Chinese cross-border e-commerce's Penetration Rate and annual growth rate 2019-2023

Source: 100EC 2024 and Gov.cn 2021-2014

4.2 Export to European Port

As many European statistical bureaus or websites, such as the Netherlands' CBS and the European Union's Eurostat, do not have information on exports to European ports via cross-border e-commerce platforms, the focus of this study is on measuring the e-commerce flows from Chinese cross-border e-commerce platforms to European ports and how to access the related data.

In Figure 5, the overall import turnover from China to Europe shows a consistent increase from 2018 to 2022. In 2018, the import turnover was €342.6 billion, and by 2022, this figure had risen to €627.3 billion, demonstrating a significant growth trend. Particularly from 2021

to 2022, the annual growth rate reached an impressive 32.40%, reflecting a strong demand for Chinese products, potentially due to the recovery from the COVID-19 pandemic. As restrictions eased and economic activities resumed, businesses responded to consumers' pent-up demand, leading to a significant rebound in imports. Additionally, there might have been a notable increase in European demand for Chinese consumer electronics, machinery, and other manufactured goods, thanks to China's robust manufacturing capabilities and competitive pricing.

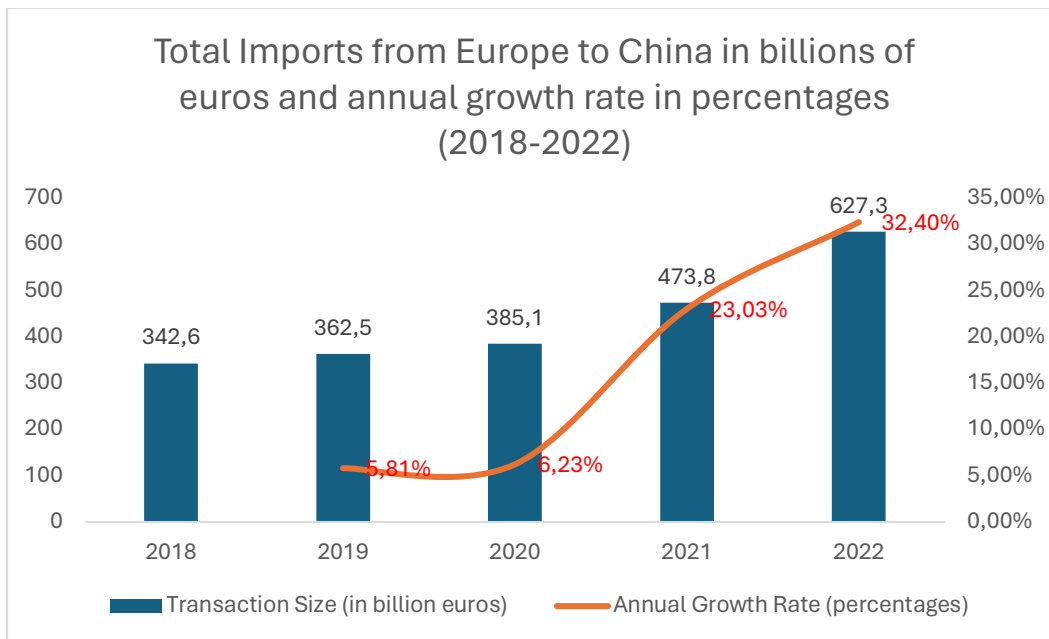


Figure 5 Total Imports from Europe to China and annual growth rate 2018-2022

Source: Eurostat, 2024

Before analyzing the data on exports from Chinese cross-border e-commerce platforms to Europe, it's important to state that neither Chinese nor European statistical agencies provide specific accurate data. Most reports and databases only offer data on the total volume of imports and exports through Chinese cross-border e-commerce platforms. Therefore, a key aspect of this study involves defining and estimating the scale of exports from Chinese platforms to Europe. Given the lack of specific data, the optimal solution is to estimate the proportion of goods exported to Europe via Chinese cross-border e-commerce platforms as a percentage of total exports from these platforms. To obtain an accurate and objective estimation, we first refer to a report from Eurostat about EU trade with other countries. According to Figure 6 in the report, the EU has particularly close trade relations with China, with China being the EU's largest import partner at 20.5%. Although this data pertains to all foreign trade, not specifically through cross-border e-commerce platforms, and only represents EU countries (not all European countries), it allows us to infer that the import

percentage from China to EU countries in the cross-border e-commerce sector is also around 20%, and including all European countries, this percentage would likely be higher than the initial 20%.

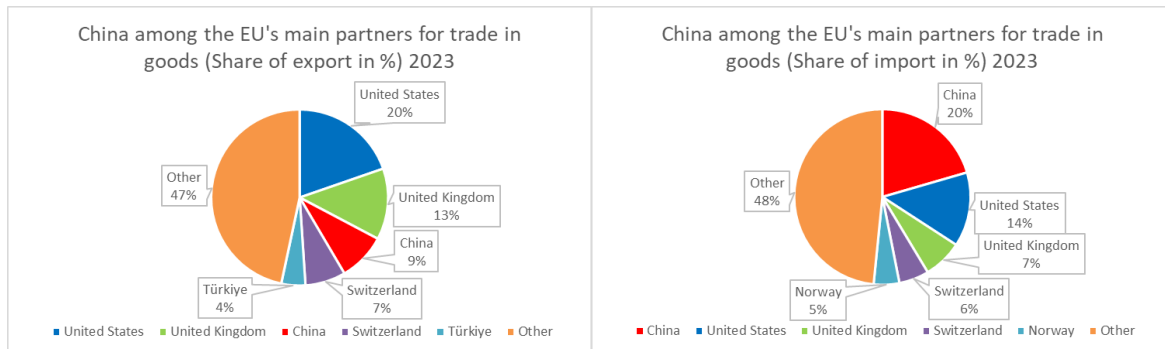


Figure 6 Total Imports from Europe to China and annual growth rate 2018-2022

Source: Eurostat, 2024

Furthermore, a report from China's Ministry of Trade (Appendix 10) indicates that in 2023, 37.4% of China's exports to the US were via cross-border e-commerce platforms, while data from UN Comtrade shows that China's total export trade to the US in 2023 amounted to \$501.22 billion (Appendix 11). Although this total does not specifically segment cross-border e-commerce, by comparing China's total exports to the US and Europe, we can estimate the proportion of exports to Europe via Chinese e-commerce platforms. According to Eurostat, Europe's imports from China in 2023 totaled \$549.98 billion (514 billion euros), which is significantly higher than China's exports to the US, suggesting that the proportion of exports to Europe via Chinese e-commerce platforms could be comparable to that to the US. However, the relatively low figure for exports to the US in 2023 is influenced by increased tariffs on Chinese imports by the US and other international factors. Historically, China's export volume to the US has always been greater than to Europe. From this analysis, we estimate that the proportion of exports to Europe via Chinese cross-border e-commerce platforms is between 20%-40%. Choosing a midpoint within this range is reasonable, hence we decide to use 30% as our estimated proportion for exports to Europe through Chinese cross-border e-commerce platforms.

The Figure 7 displays relevant data, indicating that the transaction size in 2018 was €25.6 billion, which grew to €63.5 billion by 2022. Although the growth rate decreased from 2021 to 2022, from 37.37% to 6.73%, the overall growth trend remains healthy. The decrease in the growth rate from 2021 to 2022 could be attributed to market saturation, referring to a

decline in European consumers' desire to purchase from established cross-border platforms like Alibaba (Aliexpress) and JD, possibly because these platforms no longer offered novel products or competitive prices. While data for 2023 is lacking, the emergence of new cross-border platforms like Pinduoduo's Temu and Shein suggests that exports from China to Europe through cross-border e-commerce platforms are likely to continue increasing in 2023-2024, with a significant chance of exceeding the previous peak growth rate (37.37%).

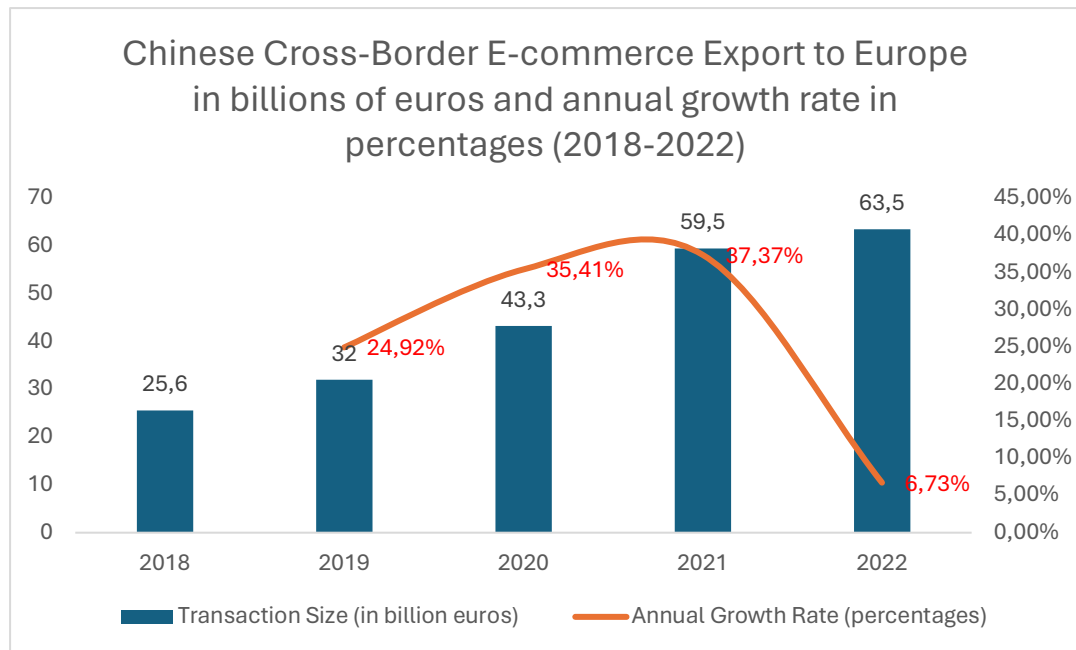


Figure 7 Chinese cross-border e-commerce Export to Europe and annual growth rate 2018-2022

Source: Ministry of Trade and General Administration of Customs of China Official Website (GACC), 2023

In Figures 8 and 9, we compare the two sets of transaction volumes and the proportion of cross-border e-commerce exports in total exports. It is evident that the overall import transaction volume is significantly higher than exports through e-commerce platforms, and the proportion of cross-border e-commerce exports in total exports is very low, which is a logical observation. This comparison reveals that although cross-border e-commerce is growing, it still represents a small fraction compared to traditional trade, possibly due to various factors such as logistical constraints, market acceptance, and the maturity of cross-border e-commerce channels.

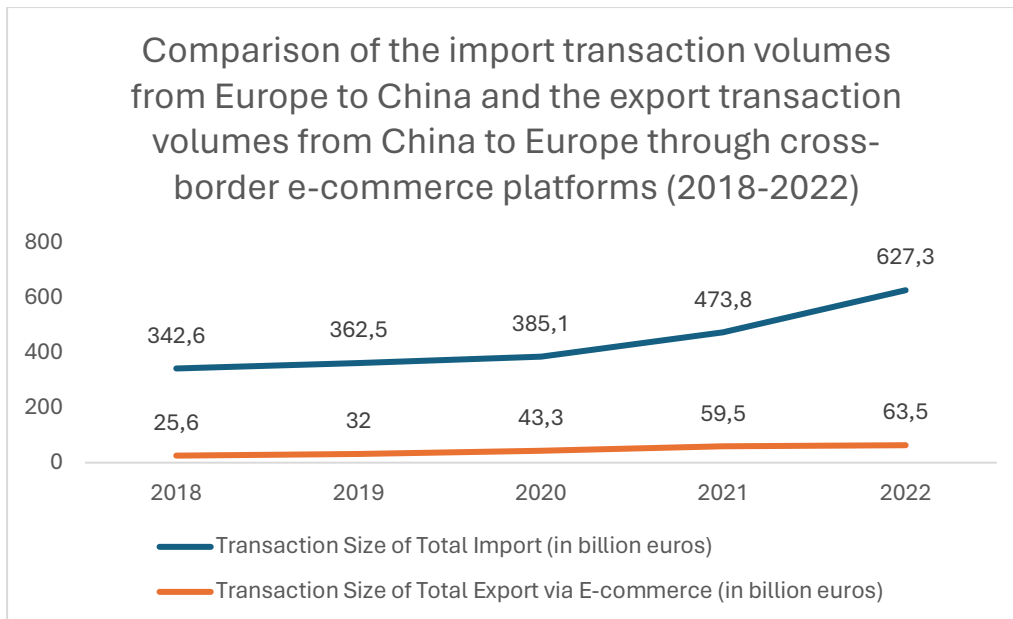


Figure 8 A comparison of the overall import transaction volumes from Europe to China and the export transaction volumes from China to Europe through cross-border e-commerce platforms 2018-2022

Source: Eurostat, 2024 and GACC, 2023

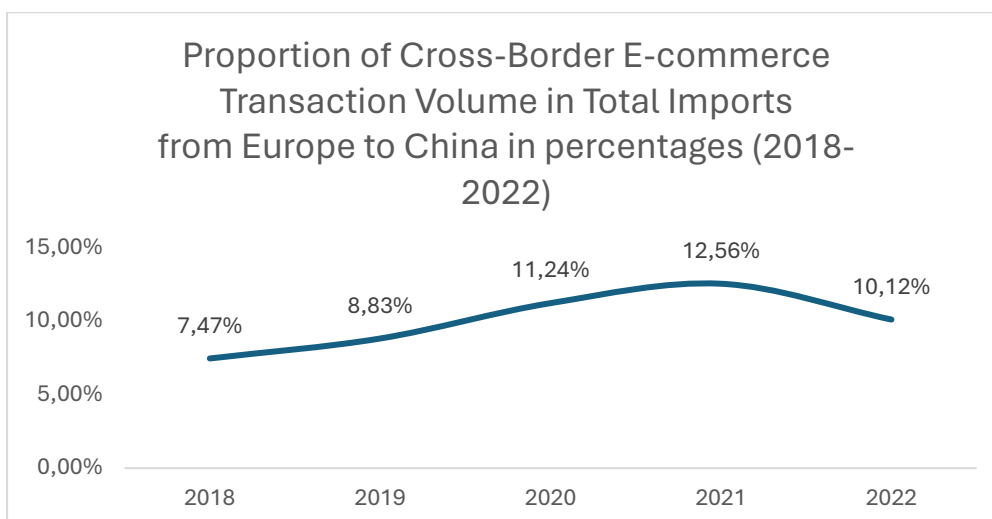


Figure 9 Proportion of Cross-Border E-commerce Transaction Volume in Total Imports from Europe to China 2018-2022

Source: Eurostat, 2024 and GACC, 2023

4.3 Transportation Methods and Volume

Through the United Nations Conference on Trade and Development (UNCTAD), we have gathered data on the volume and proportion of each mode of transportation used for exports from Chinese cross-border e-commerce platforms to European ports. Figure 10 clearly illustrates the dominant role of maritime shipping in cross-border e-commerce, highlighting its cost-effectiveness and large-scale transport capabilities, such as for large electronics, furniture and home decor, machinery and heavy equipment, bulk textiles and clothing, as well as automotive parts and large volumes of raw materials. Although air freight carries a smaller portion of the goods value compared to sea freight, it plays a crucial role in transporting fast-moving consumer goods, high-value items, or products that require rapid delivery. While air freight accounts for a smaller share, it is vital for responding to rapid market changes and meeting urgent needs. Additionally, the unit of measurement for this data is the value of the goods, and the total value of goods shipped by sea is higher because it transports a greater volume than air freight. The limited cargo capacity of air freight means it transports fewer goods, which inevitably results in a lower total value compared to sea freight. However, in terms of the value per item, due to customer demand and the specificity of the items, it is highly likely that the value of individual goods shipped by air could be higher than those shipped by sea. Meanwhile, rail transport, as a cost-effective and environmentally friendly option, is becoming increasingly significant in trade between China and Europe. It offers a solution that is less costly than air freight and faster than sea shipping, particularly suited for medium-distance goods transport.

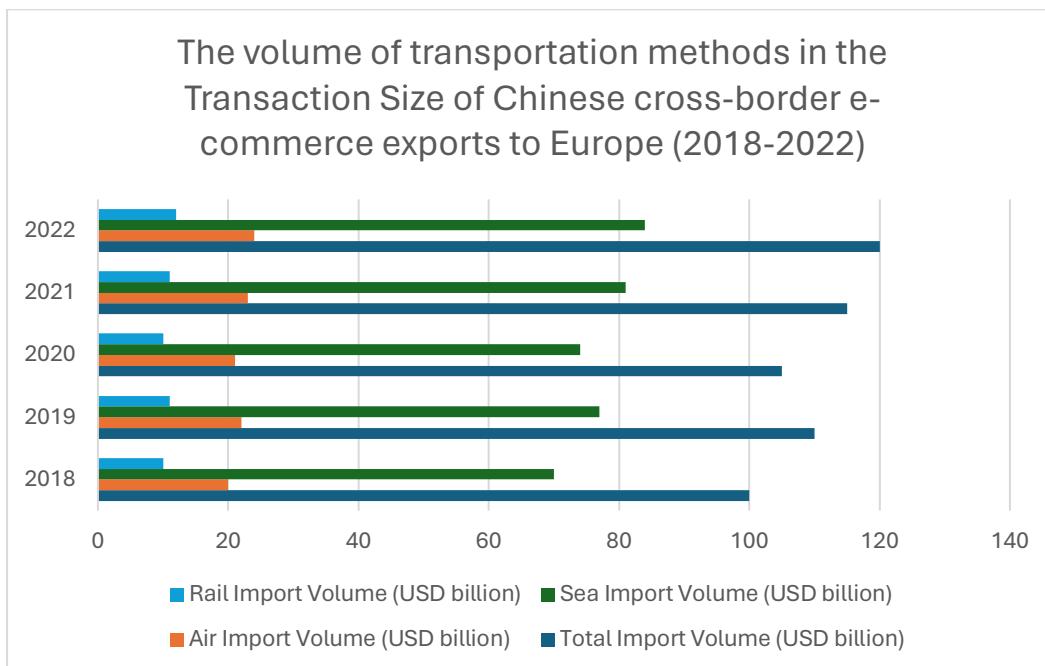


Figure 10 The volume of transportation methods in the Transaction Size of Chinese cross-border e-commerce exports to Europe 2018-2022

Source: United Nations Conference on Trade and Development (UNCTAD), 2023

In analyzing the shipment processes of goods from Chinese cross-border e-commerce platforms to European ports, different types of goods often select the most appropriate mode of transportation based on factors such as the nature of the goods, cost-effectiveness, transit time, and environmental impact. However, we have not found data detailed enough to show which type of goods uses which transportation mode for exports to European ports. We can only make educated guesses based on scholarly articles and reports. For instance, sea transport, known for its cost efficiency and large capacity, is most commonly used for bulk goods, as previously mentioned. Most goods transported by sea do not require fast delivery. Air transport is renowned for its quick delivery times and, despite its higher cost, is ideal for transporting lightweight, high-value items, or products that need to arrive quickly. This includes valuable electronics such as smartphones and laptops; emergency medical supplies, including pharmaceuticals and medical devices; fashion and high-end clothing that are highly seasonal and time-sensitive; and perishable foods such as fresh fruits and seafood. Additionally, for business documents and design samples that need rapid processing, air transport is the preferred choice. With the development of the China-Europe Railway Express, rail transport has become a cost-effective and moderately fast option, especially suitable for transport across the Eurasian continent. It efficiently transports assembled products like whole vehicles and large furniture, as well as building materials such as steel and cement. Rail is also suitable for transporting large batches of consumer goods and kitchenware. For countries on the periphery of Europe, rail offers a faster and more economical transportation option than sea freight and a less expensive alternative to air freight.

4.4 Transaction modes and Structures of E-Commerce Supply Chains

The main transaction models of Chinese cross-border e-commerce platforms exporting to European ports reflect the dynamic and diversified trends of global trade. In this field, there are two primary and traditional transaction modes—B2B (Business to Business) and B2C (Business to Consumer). The B2B transaction model is one of the main forms of trade between Chinese cross-border e-commerce and the European market. In this model, Chinese manufacturers and wholesalers trade directly with European business buyers, usually involving bulk commodities and wholesale supply contracts. These transactions often involve

industrial products, high-tech equipment, bulk apparel, and other manufactured goods, which enter through major European ports and are then distributed to various business users. This mode requires robust logistical support and a complex supply chain management system to ensure that every link from production to delivery meets efficiency and cost-effectiveness standards. Figure 11 shows that the B2B mode has long dominated Chinese cross-border e-commerce. From 2019 to 2023, although the market share of B2B has decreased from 80.5% to 70.2%, this change may be due to more businesses starting to sell directly to consumers or a market trend towards more segmented consumer demands.

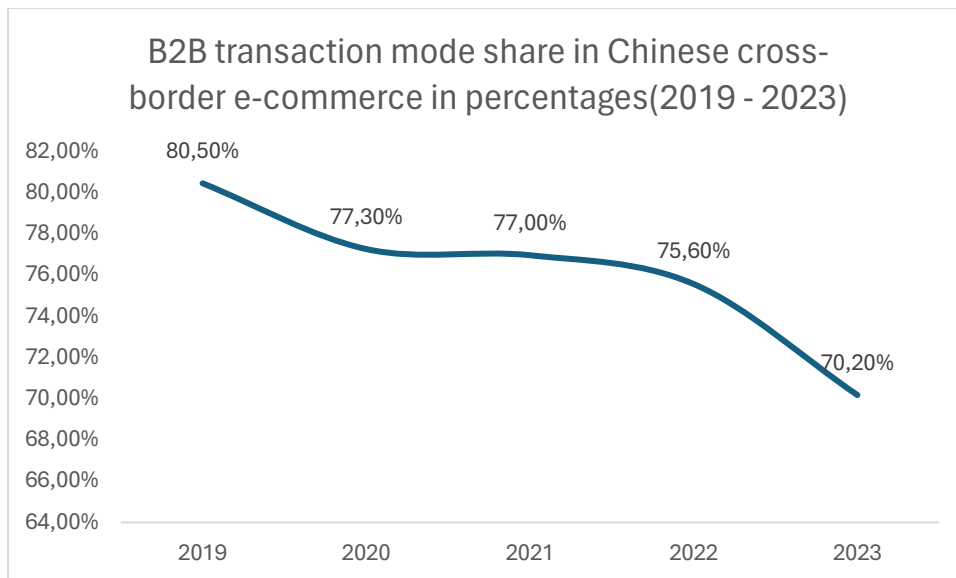


Figure 11 B2B transaction mode share in Chinese cross-border e-commerce 2019 - 2023

Source: 100 EC Net Economy Society, 2024

As mentioned in the Methodology section, using a supply chain map provides a clearer understanding of the e-commerce supply chain structures under each transaction model. Table 12 illustrates the e-commerce supply chain structure and process for the B2B transaction model of Chinese cross-border e-commerce platforms exporting to European ports, involving multiple key steps from manufacturing to final delivery. The process begins with manufacturers in China, who produce goods based on the orders and specifications from European buyers. This includes all stages from raw material procurement to production scheduling and quality control. Once production is complete, the goods are stored in the manufacturer's or a third-party logistics provider's warehouse, waiting for order processing and subsequent shipment. Logistics arrangements are handled by third-party logistics service providers coordinated by the manufacturer or the e-commerce platform, who choose the most appropriate transportation method (sea, air, or rail) and manage all related logistics tasks. Next is the export customs clearance stage, where manufacturers must prepare and

submit all necessary export documentation to ensure compliance with international trade regulations and import regulations of the destination countries in Europe. After leaving China, the goods are transported to designated European ports by the selected transportation method. Upon arrival in Europe, the goods undergo the import customs clearance process, which includes paying duties, inspecting the goods, and providing import documentation. After clearance, the goods are received and moved to distribution centers in Europe or directly shipped to the final buyers.

Cross-border e-commerce exports in the B2B (Business to Business) model							
1. Market Research and Product Selection	2. Establishing Business Relationships	3. Contract Negotiation and Signing	4. Production and Stock Preparation	5. Logistics Arrangements	6. Customs Declaration and Clearance	7. Payment and Settlement	8. After-sales Service and Support
↓	↓	↓	↓	↓	↓	↓	↓
Research industry trends and select products with market potential for sale.	Establish connections with potential business partners through B2B platforms or industry trade shows.	Negotiate with buyers on price, delivery terms, payment conditions, etc., and sign contracts.	Organize production or stock preparation according to order requirements.	Choose an appropriate logistics method, such as sea freight, air freight, or courier, for transporting bulk goods.	Prepare customs documentation required for export and carry out customs clearance in the destination country.	Complete payments and settlements according to contract terms, using methods like bank transfers.	Provide necessary technical support and product warranty services.

Table 12 Supply chain map for Chinese cross-border e-commerce platforms under the B2B transaction model

Source: Zhejiang (a province of China) e-commerce association

With the advancement of e-commerce technology and changes in consumer buying behaviors, the B2C mode has become increasingly important in China’s cross-border e-commerce exports. In B2C transactions, Chinese retailers sell goods directly to European consumers through e-commerce platforms such as Alibaba's Tmall International, JD International, or Pinduoduo's Temu. These transactions typically include consumer goods such as electronics, home goods, and personal care products, which are shipped directly from China to consumers, often utilizing rapid logistics services like air freight to meet demands for quick delivery. Figure 13 indicates a growth trend in the B2C model, with its market share increasing from 16.07% in 2019 to 22.13% in 2023. This suggests that consumers are increasingly inclined to purchase products directly through e-commerce platforms, possibly driven by improvements in e-

commerce technology, enhancements in logistics services, and changes in international consumer behaviors.

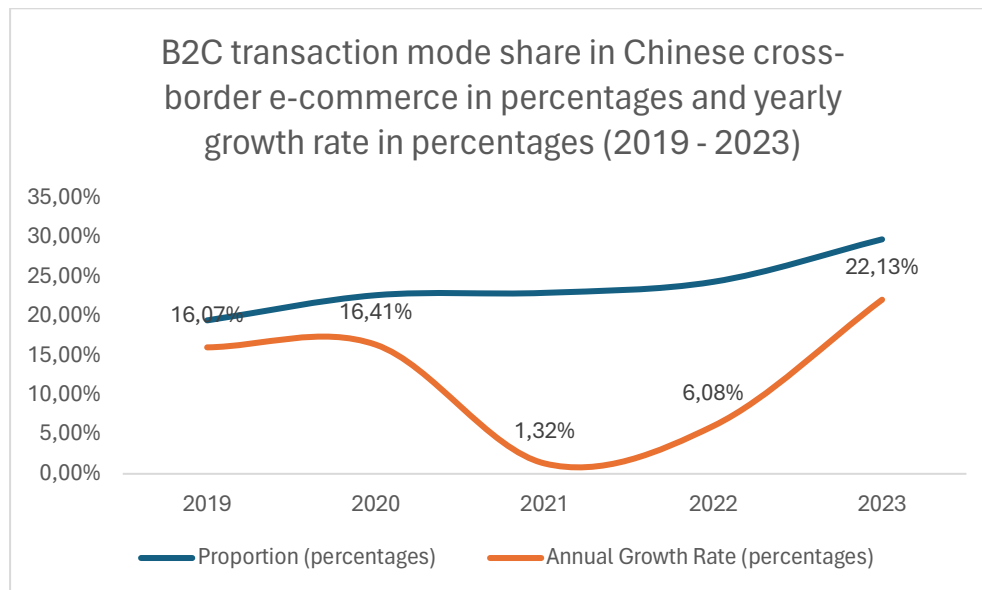


Figure 13 B2C transaction mode share in Chinese cross-border e-commerce and yearly growth rate 2019 - 2023

Source: 100 EC Net Economy Society, 2024

Table 14 shows the e-commerce supply chain structure and process under the B2B transaction model for Chinese cross-border e-commerce platforms exporting to European ports. This supply chain map comes from the Zhejiang (A province of China) E-commerce Association, which primarily supports Alibaba's operations, including tasks related to cross-border freight and warehousing. Their daily work revolves around processes related to cross-border e-commerce. Everything starts with the manufacturing of the product, typically done in factories in China. These factories produce goods according to international quality standards to ensure they meet the demands of overseas markets. Subsequently, information about these products, along with images and detailed descriptions, are uploaded to e-commerce platforms such as Alibaba's Tmall International, JD International, or other platforms specifically targeting European consumers. After consumers place orders on the platform, the order information is instantly transmitted to the warehouse management system, where order processing takes place, including selecting the products, confirming inventory, and packaging. Once the orders are packaged, the most appropriate transportation method is chosen based on the type of goods and destination, usually air freight to minimize transit time. The goods are then transported to Europe by third-party logistics companies or courier service providers, who are responsible for the entire cargo transport and tracking process. Upon arrival in Europe, the goods first go through import customs clearance. This

step involves handling relevant documentation for export and import, paying duties, and ensuring all goods comply with European regulations and standards. After clearance, the goods are delivered to consumers through the distribution network in Europe. This usually involves local courier services, which are responsible for delivering the goods accurately and swiftly to the consumer's designated delivery address. Once the consumer confirms receipt, the order process is considered complete. The e-commerce platform continues to provide customer support, handling any inquiries or after-sales issues, such as returns and exchanges.

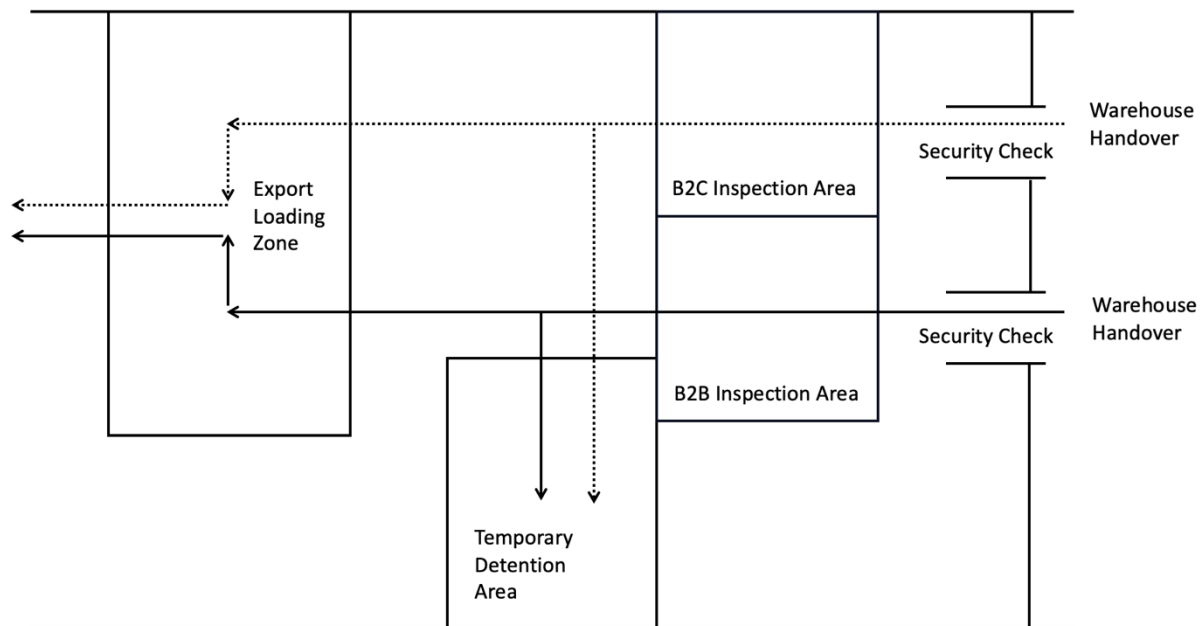
Cross-border e-commerce exports in the B2C (Business to Customer) model									
1. Market Research and Product Selection	2. Platform Registration and Product Listing	3. Marketing and Promotion	4. Order Processing	5. Payment Processing	6. Logistics and Distribution	7. Customs Declaration	8. Logistics and Distribution	9. Customs Clearance	10. After-sales Service
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Understand the needs and preferences of target market consumers and select suitable products for sale.	Register a store on a B2C platform, upload product information including images, descriptions, and pricing.	Attract potential buyers through marketing efforts both on and off the platform to increase product visibility.	After receiving an order, conduct order review, inventory check, and order confirmation.	Buyers complete payments through the platform, and sellers confirm receipt of funds.	Workers pick the products, package, and ship them, followed by domestic transportation.	Declare the goods, ensuring inspection and payment of taxes are completed.	International transport, via air or sea.	Customs clearance upon entry, including payment of duties, taxes, and quarantine inspections.	Provide returns and exchanges services, handle customer inquiries and complaints.

Table 14 Supply chain map for Chinese cross-border e-commerce platforms under the B2C transaction model

Source: Zhejiang (a province of China) e-commerce association

When exporting goods from Chinese cross-border e-commerce platforms to foreign countries, the entire process involves complex regulatory stages (China Customs), loading (sea/air ports), and overseas reception (overseas warehouses). Each stage's detailed operational process ensures effective regulation of goods, safe transit, and swift handling. Before goods are exported, they are transported from warehouses in China to the customs supervision warehouse of China Customs (the regulatory area of China Customs). As shown in Figure 15, the export process begins with a security inspection of the export goods, after which the goods are sent to the appropriate inspection areas based on their commercial nature (B2C or B2B). In these areas, customs officials conduct a detailed examination to ensure all export goods comply with international trade regulations and standards. Goods that do not meet the

requirements are moved to a temporary detention area, where they await further processing or return. Goods that pass inspection are then transported to the export loading area, where they are finally verified and prepared for shipping or loading onto aircraft.



Chinese Customs Supervision Process Flowchart (Before Export Freight)

Table 15 Chinese Customs Supervision Process Flowchart (Before Export Freight)

Source: Zhejiang (a province of China) e-commerce association

Once goods pass the preliminary checks by China Customs, they are transported to the loading area, ready for final overseas shipment. As shown in Figure 16, this stage includes several key steps. Initially, goods are unloaded at the warehouse entry platform after registration at the freight terminal electronic checkpoint. To ensure safety, goods undergo a security check before entering the warehouse. Workers then assemble the goods onto transport pallets and perform weighing/re-weighing to meet shipping requirements. Goods are then moved to the loading bay, waiting to be loaded onto ships or airplanes. Ground staff are responsible for pulling goods from the loading bay to the dock or plane side, completing the final loading. Figure 15 also depicts the document flow in the cross-border e-commerce goods export process, a crucial element for ensuring smooth customs clearance and compliance with international trade regulations. Before export, relevant goods information and data are electronically compiled and reported to customs through the "9610 data submission" step. Once submitted, the system automatically generates and sends a "9610 notification," confirming successful data submission and marking the official entry of goods into the customs regulatory process. These goods then enter the "inspection" phase, where

customs officials verify the accuracy of declared information, ensuring all goods meet export and import legal requirements. After successful inspection, the "customs clearance" operation is carried out, a step where goods are legally cleared to leave the exporting country and enter the destination country. Once clearance is completed, an "arrival notification" is sent to inform relevant parties that the goods are about to arrive. Before goods reach their destination, "electronic verification" is conducted to ensure all documents and data match the actual transported goods. Additionally, depending on the specific requirements of the destination country, further "documents" may need to be submitted for final confirmation. Once all documents and data are ready, the related goods information undergoes "loading planning and commercial preparation" to ensure that goods can be quickly and efficiently distributed and processed upon arrival. Finally, the "handover to maritime authority" step completes the entire document flow, ensuring all documents and data are formally transferred to the customs or other relevant maritime institutions of the receiving country, thus completing the entire export process.

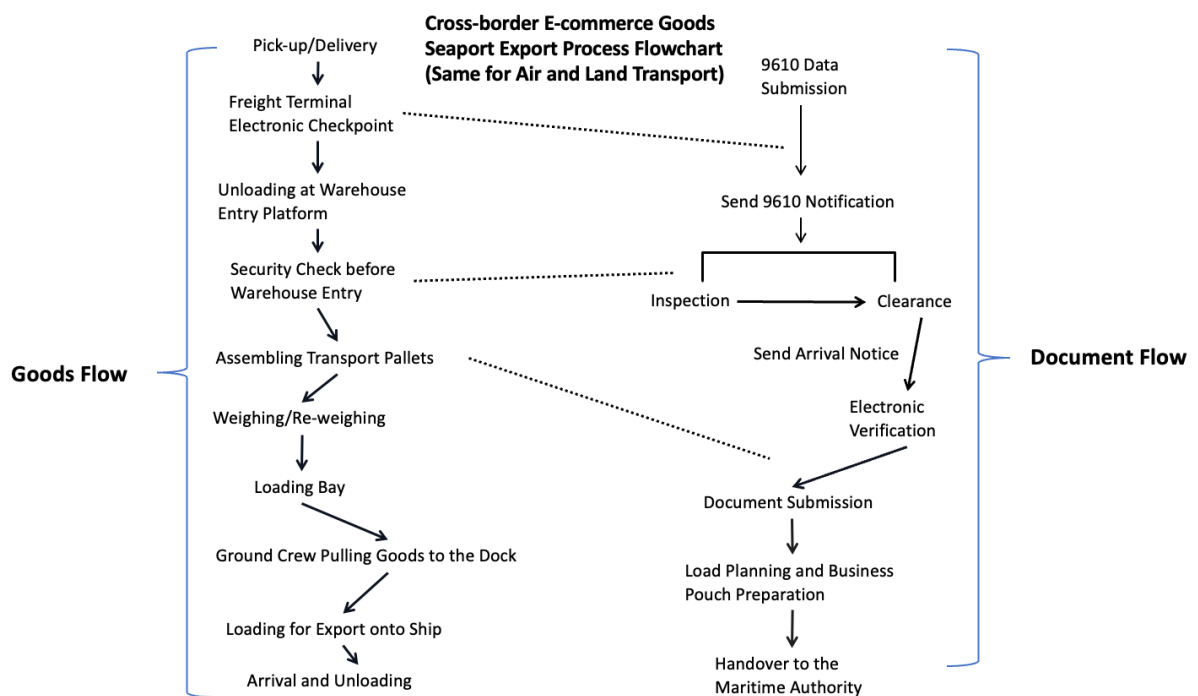


Table 16 Chinese Cross-border E-commerce Goods Seaport Export Process Flowchart (Same for Air and Land Transport)

Source: Zhejiang (a province of China) e-commerce association

Note. In the context of China's sea and air freight, the "9610" refers to a customs surveillance code introduced by China's General Administration of Customs. It allows e-commerce retailers to deliver goods separately while declaring all imported and exported goods collectively.

Figure 17 describes the operational process after goods arrive at overseas ports. On the right of the figure is Customs clearance and truck delivery, which includes the process of goods being retrieved and transported by receiving personnel after the transport ship/plane arrives at the overseas port and passes through customs clearance. Because this process is not complex, it is not detailed here. Upon entering the overseas warehouse, exported goods proceed to the B2C inspection area and the B2B tally area for classification into small batches for consumers and large batches for business customers, respectively. Afterward, a series of security checks and sorting ensures goods are accurately distributed to the correct destinations. After these processes, goods reach the Receiving area, where they are placed in specific shelving areas and packaged according to order requirements (Workstation). Finally, the packaged goods are dispatched from the overseas warehouse, delivered to consumers or business customers by truck or other means of transportation.

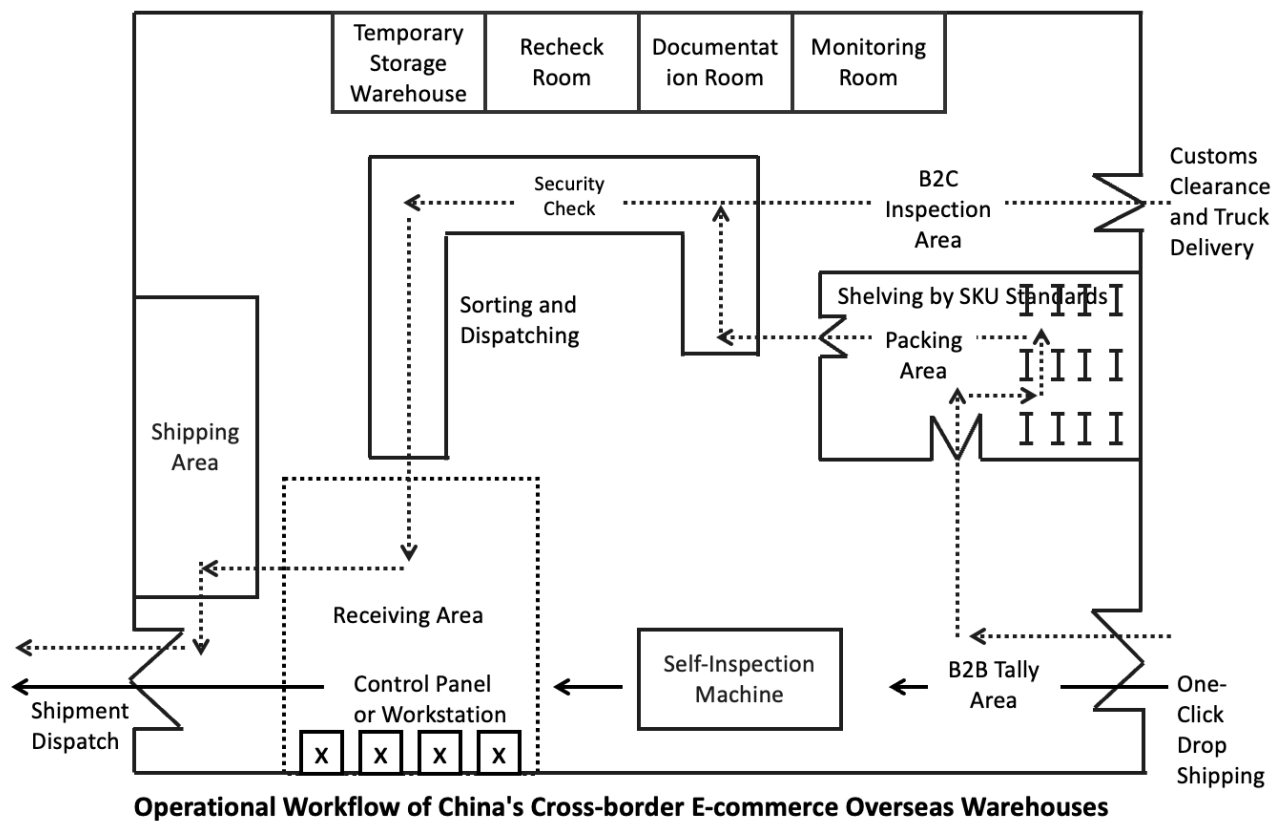


Table 17 Operational Workflow of China's Cross-border E-commerce Overseas Warehouses

Source: Zhejiang (a province of China) e-commerce association

Section 5 Conclusion

This study aimed to explore quantitative methods for measuring the influx of Chinese cross-border e-commerce goods into European ports and the impact of these flows on the structure and operations of these ports. Extensive collection and analysis of export data from Chinese cross-border e-commerce platforms have highlighted the significance and influence of these goods on major European ports.

The findings suggest that while the proportion of cross-border e-commerce in global trade has been increasing year by year, its specific impact on European ports presents complex and variable characteristics. As logistical nodes, European ports not only need to handle large volumes of goods from China but also need to adapt to the rapid growth trend of e-commerce, optimizing their logistics and supply chain structures. Furthermore, a deep analysis of the processes at European ports handling e-commerce goods has also confirmed the critical nature of the transshipment stage, involving various transportation methods and temporary storage strategies, which directly affect port operational efficiency.

Additionally, this paper explored the typical structures of e-commerce supply chains, thereby revealing the complete pathway from production to consumption, which has significant implications for policymakers and business analysts. The study indicates that effective supply chain management and technological innovation are key to enhancing port handling capacities and adapting to the demands of e-commerce growth.

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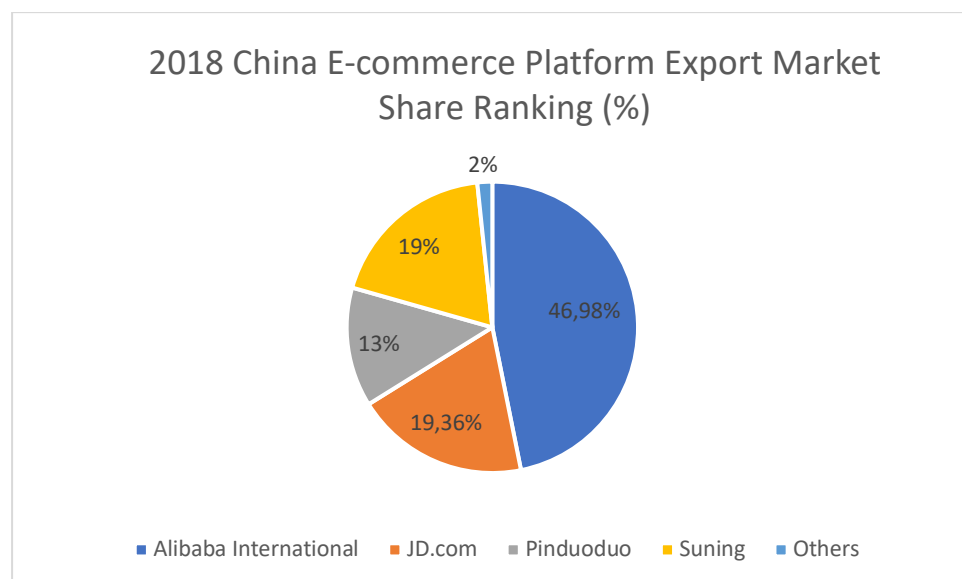
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Appendix

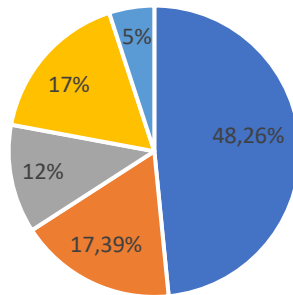
Appendix 1 Chinese Cross-border e-commerce's transaction size and yearly growth rate 2019-2023, Source: GlobalData Banking and Payments Intelligence Center.

<i>Year</i>	<i>Transaction (in billions of CNY)</i>	<i>Annual Growth Rate (%)</i>
2019	1050	16.66%
2020	1250	19.04%
2021	1420	13.60%
2022	1570	10.56%
2023	1685	7.32%

Appendix 2 The market share of exports from Chinese cross-border e-commerce platforms from 2018 to 2022, Source: China Cross-Border E-commerce Market Data Report.

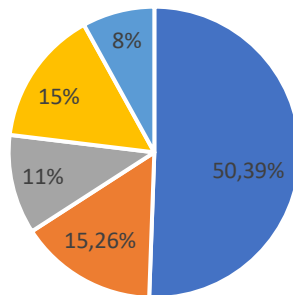


2019 China E-commerce Platform Export Market Share Ranking (%)



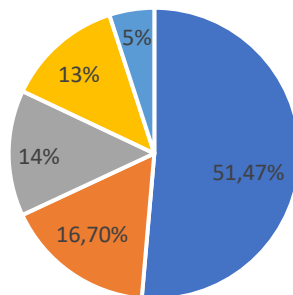
■ Alibaba International ■ JD.com ■ Pinduoduo ■ Suning ■ Others

2020 China E-commerce Platform Export Market Share Ranking (%)

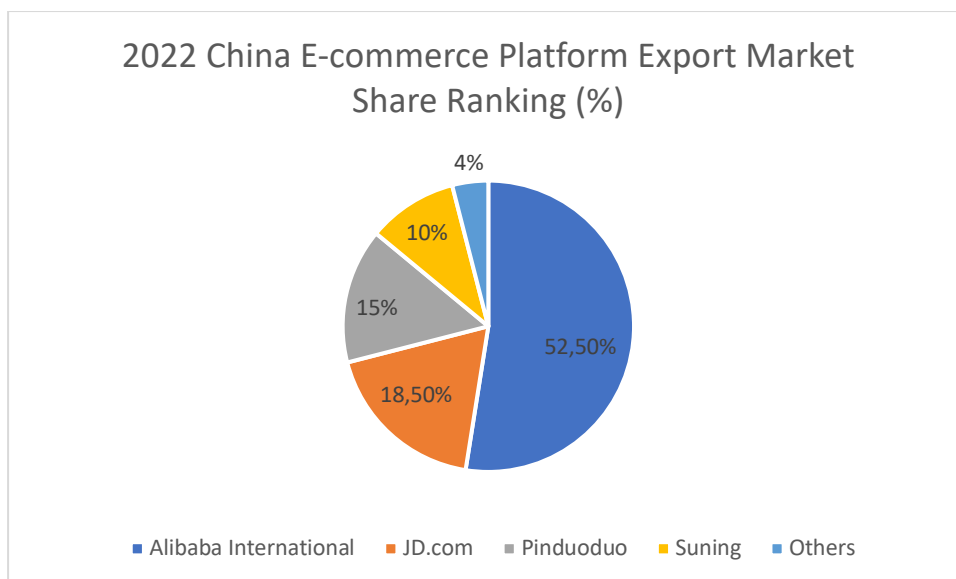


■ Alibaba International ■ JD.com ■ Pinduoduo ■ Suning ■ Others

2021 China E-commerce Platform Export Market Share Ranking (%)



■ Alibaba International ■ JD.com ■ Pinduoduo ■ Suning ■ Others



Appendix 3 Chinese Cross-border e-commerce's Penetration Rate in percentages and yearly growth rate in percentages 2019-2023, Source: 100EC Net Economy Society.

<i>Year</i>	<i>Penetration Rate (%)</i>	<i>Annual Growth Rate (%)</i>
2019	3.32%	12.84%
2020	3.89%	17.17%
2021	3.63%	-6.68%
2022	3.73%	2.75%
2023	4.03%	8.04%

Appendix 4 The total value of China's goods trade imports and exports and The total value of China's cross-border e-commerce imports and exports.

<i>Year</i>	<i>The total value of China's goods trade imports and exports (billions of CNY)</i>	<i>The total value of China's cross-border e-commerce imports and exports (billions of CNY)</i>
2019	31540	1050
2020	32160	1250
2021	39100	1420
2022	40070	1570
2023	41760	1685

Appendix 5 Overview Table of Import and Export from Europe to China 2018-2022. Source: Eurostat.

<i>Year</i>	<i>Transaction Size (in billions of euros)</i>		
	Import	Export	Total
2018	342.6	187.9	530.5
2019	363.5	198.5	562.0
2020	385.1	202.8	587.9
2021	473.8	223.5	697.3
2022	627.3	230.5	857.8

Appendix 6 Overview Table of China's Cross-Border E-commerce Import and Export in general in billions of USD 2018-2022, Source: General Administration of Customs of China Official Website (GACC).

<i>Year</i>	<i>Transaction Size (in billions of USD)</i>		
	Export	Import	Total
2018	92.7	67.3	160.0
2019	115.8	71.4	187.2
2020	156.8	77.6	234.4
2021	215.4	82.3	297.7
2022	229.9	79.2	309.1

Appendix 7 Overview Table of China's Cross-Border E-commerce Import and Export to Europe (30% of data in general) in billions of Euros (1 USD = 0,92 Euros) 2018-2022, Source: General Administration of Customs of China Official Website (GACC).

<i>Year</i>	<i>Transaction Size (in billions of Euros)</i>		
	Export	Import	Total
2018	25.6	18.6	44.2
2019	32.0	19.7	51.7
2020	43.3	21.4	64.7
2021	59.5	22.7	82.2
2022	63.5	21.9	85.4

Appendix 8 Comparison of the import transaction volumes from Europe to China and the export transaction volumes from China to Europe through cross-border e-commerce platforms 2018-2022, Source: Eurostat and GACC.

<i>Year</i>	<i>Transaction Size of Total Import (in billion euros)</i>	<i>Transaction Size of Total Export via E-commerce (in billion euros)</i>
2018	342.6	25.6
2019	363.5	32.0
2020	385.1	43.3
2021	473.8	59.5
2022	627.3	63.5

Appendix 9 The proportion of transportation methods in the Transaction Size of Chinese cross-border e-commerce exports to Europe 2018-2022, Source: Eurostat and GACC.

<i>Year</i>	<i>Proportion (%)</i>
2018	7.47%
2019	8.83%
2020	11.24%
2021	12.56%
2022	10.12%

Appendix 10 The import and export dynamics of Chinese cross-border e-commerce, Source: Ministry of Trade.

2023年中国跨境电商进出口情况

据中国海关统计，2023年，我国跨境电商进出口2.37万亿元人民币，比2022年（下同）增长15.3%，占同期我国货物贸易进出口总值的5.7%，比重提升0.8个百分点。其中，出口约1.84万亿元，增长20.2%，占同期我国出口总值的7.7%；进口约5335.2亿元，增长1.1%，占同期我国进口总值的3%（详见下表）。

2018年至2023年跨境电商进出口总体情况表

年份	金额（亿元）			同比（%）			出口进口比例
	进出口	出口	进口	进出口	出口	进口	
2018年	10557	6116	4441	-	-	-	1.4
2019年	12903	7981	4922	22.2	30.5	10.8	1.6
2020年	16220	10850	5370	25.7	39.2	9.1	2.0
2021年	19237	13918	5319	18.6	28.3	-0.9	2.6
2022年	20599	15321	5278	7.1	10.1	-0.8	2.9
2023年	23744	18409	5335	15.3	20.2	1.1	3.5

从出口目的地看，美国（37.4%）、英国（8.7%）、德国（4.7%）、俄罗斯（4.6%）、法国（3.7%），合计占出口总额近6成。泰国（2.5%）、越南（2.4%）、马来西亚（2.4%）、澳大利亚（2.1%）等新兴市场活跃。美国（15.6%）、日本（13.5%）、澳大利亚（11.2%）、法国（7.9%）、韩国（7.2%）、新西兰（7%）、德国（6.4%）、意大利（3.6%）、英国（3.4%）、荷兰（3.3%）是主要进口来源地。

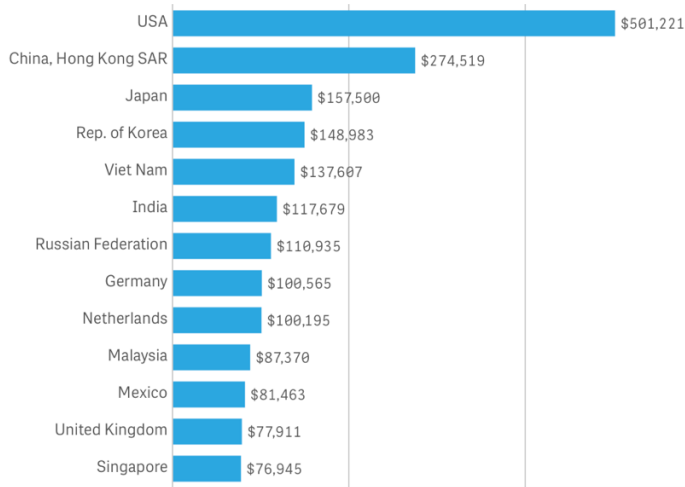
跨境电商出口商品中，消费品占97.3%，主要为服饰鞋包及珠宝配饰、家居家纺及厨房用具、手机等各类数码产品及配件、家用办公电器及配件等。进口消费品占97%，主要为美容化妆及洗护产品、食品生鲜、医药保健品及医疗器具、奶粉、服饰鞋包及珠宝配饰等。

跨境电商出口货物主要来自广东、浙江、福建及江苏。进口货物的消费地集中在广东、江苏、浙江、上海和北京。

Appendix 11 Overview Table of China's Foreign Trade Export Data 2023, Source: UN Comtrade database.

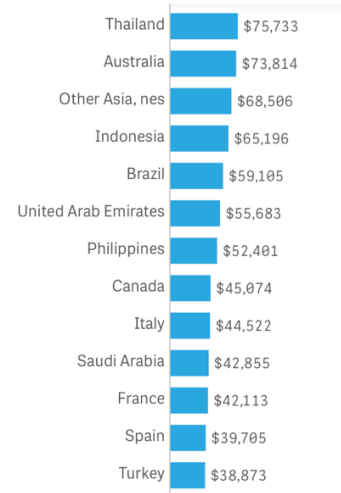
Destination of exports

(MLN US\$)



Destination of exports

(MLN US\$)



Appendix 12 The volume and proportion of transportation methods in the Transaction Size of China's cross-border e-commerce exports to Europe 2018-2022, Source: United Nations Conference on Trade and Development (UNCTAD).

<i>Year</i>	<i>Total Import Volume (USD billion)</i>	<i>Air Import Volume (USD billion)</i>	<i>Sea Import Volume (USD billion)</i>	<i>Rail Import Volume (USD billion)</i>	<i>Air Import Share (%)</i>	<i>Sea Import Share (%)</i>	<i>Rail Import Share (%)</i>
2018	100.22	20.05	70.04	10.02	20.02%	70.00%	10.00%
2019	110.35	22.37	77.35	11.31	20.06%	70.00%	10.00%
2020	105.49	21.24	74.24	10.05	20.05%	70.50%	9.50%
2021	115.21	23.46	81.27	11.16	20.05%	70.40%	9.60%
2022	120.04	24.59	84.25	12.37	20.07%	70.00%	10.00%

Appendix 13 China among the EU's main partners for trade in goods 2023, Source: Eurostat, 2024

Countries	Share of Export (%)	Countries	Share of Import (%)
United States	19.70%	China	20.50%
United Kingdom	13.10%	United States	13.70%
China	8.80%	United Kingdom	7.20%
Switzerland	7.40%	Switzerland	5.50%
Turkey	4.40%	Norway	4.70%

