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Research on the Relationship Between International Trade and Network

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Abstract: In a rapidly globalizing world economy, international trade is undergoing unprecedented growth, marked by technological advancements, energy demand, and currency fluctuations. This study explores the intricate interplay between trade networks and international commerce. As the global economy transforms, this research sheds light on key trends and characteristics shaping the international trade landscape. Through an extensive review of relevant literature, this paper investigates the role of trade networks in international trade dynamics. It delves into the significance of network structures and their impact on trade patterns, revealing insights about the core-periphery structure where advanced economies dominate while others form the periphery. The study focuses on the international trade network's features, including its virtualization, globalization, and intelligent attributes. It examines how businesses adapt to digitalization, interact through virtual platforms, and embrace the knowledge-driven nature of modern trade networks. Additionally, the research explores the implications of trade networks for enterprises, emphasizing market penetration, supply chain efficiency, brand influence, technological innovation, and resource integration. The study highlights the works of various scholars who have analyzed international trade networks. Research findings underscore the importance of understanding network structures, role centrality, and the impact of digitalization on global trade. By analyzing the evolution of trade networks and their implications for different economies, this study offers valuable insights for policymakers and businesses navigating the complex landscape of international trade. Overall, this thesis contributes to a comprehensive understanding of the relationship between international trade and network structures, paving the way for more informed decisions in a rapidly changing global trade environment.

Keywords: trade network, international commerce, core-periphery structure

1. Introduction

1.1. Background

With the development of economic globalization, international trade has rapidly spread to various corners of the world and entered a new stage of rapid growth.

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The rapid development of international trade often has the following characteristics. When we focus on economic globalization and international service trade, we can find that industries such as financial products and telecommunications that provide services to other companies have increased in the total trade share. In contrast, businesses that promote regional connections have become more popular, such as tourism and long-distance telephone services, whose share continues to decline; When we focus on the roles played by different countries in international trade, developing countries attach greater importance to international trade performance, which also benefits from their technological achievements.

Research related to international trade has become a global focus. Theories related to international trade, such as the theory of demand differences, the theory of demand similarity, and the theory of absolute advantage, have received a lot of attention. Many scholars have also begun to study the topological structure in international trade, which is the network structure formed by international trade (scholars use countries as nodes and represent the import and export between trading partners with lines, forming an international trade network with research value). By analyzing the characteristics of network structure or using data to analyze the relevant properties of the network, scholars can not only analyze the roles played by different trading partners in the network and the market characteristics of different types of trade goods, but also infer the trend of international trade development and the changes in the network structure over time, and propose improvement suggestions for the development of international trade in different countries. This is a research with multiple meanings and is very interesting.

1.2. Related Research

Tajoli et al. investigated the networks of international trade in services by employing the BaTis database. The study examines global properties of service networks, identifies differences and similarities among them, and highlights influential countries in specific service trades. Two distinct sets of service categories with different network structures are discovered. The structure of links in the networks clarifies countries' roles more effectively than the amount of services traded. While most countries are connected in service trade, a small group of countries dominates the majority of flows. The central positions in service networks are predominantly occupied by advanced countries while emerging and developing nations rarely display high centrality [1]. Sajedianfard et al. addressed the common issue of missing data in trade network analysis, where some countries do not report trade flows. The author explores suitable data and methods to deal with missing data, presenting results using key network measures. The study uses an all-to-all potential connectivity approach, reconstructing a more complete dataset to study trade relations. The findings show that the imputed bigger network is robust for analyzing trade relations, providing richer insights, especially for non-reporting countries. The research emphasizes the importance of considering as many countries as possible in trade networks for policy-making purposes [2]. Fan et al. used a symmetric link weight matrix and international trade partner data to conclude that the international trade network has the characteristics of a central periphery, and there is a fact that a few countries exploit other countries. In addition, by exploring the microstructure and community structure of trade, it was found that trade centers such as the United States and China have made the world more interconnected, but the pattern of uneven economic development will continue to exist. Finally, through the importance of nodes and Bootstrap infiltration, it is concluded that the European Union holds significant importance in world trade, while the US trade advantage will gradually weaken [3].

Baskaran et al. estimate a feature parameter that reflects the topological structure of the trading network for 28 product groups and describes the evolution of the international trade structure. Afterward, when testing the predictions of the “Herschel Olin” model, the importance of the network in international trade was demonstrated by clearly explaining the scale characteristics of the network.

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The model believed that differences in factor endowments determined bilateral trade flows. The results indicate that differences in factor endowments increase bilateral trade in goods traded in a "decentralized" network [4].

Maluck and Donner described the complex web of trade relationships in the contemporary economy, due to the complex supply chains. To understand the complex interrelationship between different countries and economic sectors, the author develops a comprehensive understanding of the fundamental structural characteristics of this network. In this paper, the authors use the input-output data of several regions, decompose 186 national economies into 26 industry sectors, and analyze the structure of the international trade network from 1990 to 2011 using the method of interdependence network. At the same time, by studying these complex networks, new insights of global trade are gained, to identify key elements of the global economy. Through specific studies, the authors found that specific industrial sectors tend to favor different patterns, such as the selection of geographical locations, and close countries tend to trade more frequently. As for the evolution of the structure of trade networks, the paper gives an example of an extreme event, the 2008~2009 financial crisis, which showed an anomaly compared to the normal annual fluctuations in the structure of the network leading to a significant reorganization of related trade patterns (tracked and quantified by a widely available online promotion) [5]. Culture and the network can interact based on their impact on international trade to mitigate the negative impact of cultural differences. Lee investigated the impact of the internet and culture on international trade, as well as the possible interactions between the two. The author uses bilateral datasets from 34 OECD countries to sustain the positive impact of cultural relationships and networks on trade. This article also explored how various types of networks affect national trade, such as the "interactive effect" mentioned in the article. Is means that networks such as foreign direct investment, immigration, and the Internet play an important role in reducing the deterrent effect of cultural differences on international trade. The author also proves that the interactive effect of the Internet is the strongest, followed by foreign direct investment and immigration [6]. International trade is an important form of economic exchange between countries, and it is deeply influenced by international relations, which in turn affects the evolution of international relations. Only by establishing and maintaining good and stable international relations can favorable external conditions be provided for international trade, promoting the prosperity and development of international trade, and thus greatly promoting the economic growth and social progress of various countries. The development of international relations not only relies on the leading role of national governments and news media but also requires the active participation and effective support of various social forces and civil society organizations. Only in this way can the international market environment be more just and reasonable, enabling countries to enjoy equal rights and obligations internationally and engage in fair cooperation and competition.[7]. Baskaran et al. gave the parameters of the study reflect the changes in the international trade structure between 1980 and 2000, showing the topological structure of the trading network and demonstrating the importance of the network in international trade. The research results indicate that the donation gap has increased the bilateral goods trade network that trades in a "decentralized" manner. For goods traded in a "centralized" network, differences in factor endowments are less important [8].

2. Theory Description

2.1. Adjacency Matrix

The adjacency matrix can clearly show the relationship between the various countries, which is a dominant concept in graph theory [9]. There is a simple undirected graph with four nodes: A, B, C, and D. The adjacency matrix for this graph would be a 4x4 matrix, where each row and column represent a node, and the entries indicate whether there is an edge connecting the nodes or not. The

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value “1” is typically used to indicate a connection between nodes, and “0” represents no connection. The legend for the adjacency matrix is shown in Table 1.

Table 1: Example of adjacency matrix.

	A	B	C	D
A	0	1	0	1
B	1	0	1	0
C	0	1	0	0
D	1	0	0	0

From the matrix, it can interpret the following connections:
- There is an edge between nodes A and B.
- There is an edge between nodes A and D.
- There is an edge between nodes B and C.

2.2. Degree and Degree Distribution

In graph theory, the degree of a node (also known as vertex) in a graph is defined as the number of edges that are incident to that particular node [10]. In a social network graph, the degree distribution might indicate that most people have a small number of friends (nodes with low degrees), but there are a few individuals with an extensive network of connections (nodes with high degrees). Understanding the degree distribution can help identify influential nodes, detect communities, and infer properties of the network's overall structure.

2.3. Core-Periphery Structure

A core-periphery structure refers to a network or system where there is a central core that is more developed, economically advanced, and influential, while the surrounding periphery regions are less developed and have lower levels of economic activity and influence. This concept is often used to describe economic, social, or political relationships among different regions or countries.

In a trade network context, the core-periphery structure can be observed in how certain countries or regions dominate in terms of trade and economic activities, while others play more peripheral roles. For example, in the global trade network, countries like the United States, China, and Germany can be considered part of the core due to their significant economic activities, high trade volumes, and advanced industries. On the other hand, smaller and less developed countries may be situated on the periphery, with limited participation in global trade and a dependency on the core countries for imports and exports. This structure can lead to imbalances in economic power and development between core and peripheral regions.

3. Characteristics of the International Trade Network

3.1. Virtualization

The development of ITN is based on modern information technology. Contemporary information technology, such as computer systems and information processing, allows people to trade in virtual economic venues, such as virtual commodity markets and virtual financial institutions. In the INT, both producers and consumers interact through digital information as an intermediary. Both parties do not need to meet to complete transactions, greatly reducing the time and cost of transactions, and reducing a series of costs in the operation of international trade. But this kind of virtuality is not

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nihilistic, both parties engage and sign contracts through telecommunications networks, and economic activities are taking place.

3.2. Globalization

ITN has broken through the temporal and spatial limitations of commercial activities, as it uses digitization and informatization as a carrier for communication and interaction, allowing for unrestricted trade in both time and place. Various trading countries can quickly find trading partners through a worldwide computer network, complete trade activities quickly, improve trade efficiency and reduce trade costs. Of course, this is closely related to the characteristics of the Internet itself, it is because it has no national boundaries. Just by connecting to the international internet, people from any country or region can achieve trade communication and cooperation, and global resources can also be shared.

3.3. Intelligent Features

ITN is a trade activity that utilizes new means based on network technology, which not only has the characteristics of virtualization and globalization but also includes the characteristics of intelligence. In this network, people place more emphasis on technology and knowledge, rather than just focusing on the product itself. Information has become the most important strategic resource. Having advanced knowledge or technology within the network can provide important resources in the fiercely competitive international trade market, attract more customers, and ultimately increase internal revenue.

4. The Precedent of International Trade Networks

4.1. Overview of Macroscopic Research on the Current Situation of International Trade Networks

Globalization and international relations are two important characteristics of the contemporary world, which interact and influence each other, jointly shaping the prospects for diversified development of contemporary international trade. International relations determine the stability and security of the international trade environment, affect the willingness and ability of countries to participate in international trade and shape their position and role in international trade.

Under the impact of the digital economy wave, significant changes have taken place in the transaction targets, transaction objects, transaction methods, and even the production organizations behind international trade activities. Digital trade has the characteristics of lower production and transaction costs, more significant economies of scale and scope, higher organic capital composition, platformization of transactions, and networked supply chains.

4.2. The Current Situation and Influencing Factors of International Trade Networks Faced by Enterprises

The trade network of enterprises has significantly promoted their export domestic value-added rate. The more developed a company's trade network is, the higher the proportion of domestic production factors in its exported products, thereby increasing the domestic value-added rate of exported products. The trade network of enterprises has a significant impact on the competitiveness of exported products. Specifically, the following are the impacts:

Market penetration ability: The wider a company's trade network, the stronger its market penetration ability for exported products. Trade networks can help companies better understand the

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needs and trends of target markets, thereby better meeting market demand and improving product market share and competitiveness.

Supply Chain Efficiency: A company's trade network can help establish a more efficient supply chain, thereby reducing production costs and improving product price competitiveness.

Brand influence: A company's trade network can help expand its brand influence, enhance brand awareness and reputation, and thereby increase its market share and competitiveness.

Technological innovation capability: The trade network of enterprises can help them obtain more technological innovation resources and information, thereby improving their technological innovation capability, promoting continuous product upgrading and innovation, and enhancing product competitiveness.

Resource integration capability: The trade network of enterprises can help them integrate various resources, including talent, technology, capital, etc., thereby improving their resource integration capability, promoting their continuous development and growth, and improving the competitiveness of their products.

5. Conclusion

In conclusion, INT becoming increasingly famous around the world, and it has grown significantly faster and constantly expanding. The analysis results show that services are a key factor in the globalization process, and In the future, services will become increasingly important. Trade networks are changing over time, becoming intelligent, globalized, and virtualized. Nowadays, the position of countries (Naturally, nodes of the INT represent different countries in the world.) is also very important, as they need to monitor their evolution for a correct understanding of global market trends. At the same time, monitoring the co-evolution of trade networks in goods and services is crucial, not only to highlight the similarities between products and networks but also to reflect their differences. We also need to use technology or data analysis to understand their increasingly intertwined relationships, so that future trade networks can be more perfect and developed.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

References

[1] *Tajoli L, Airoldi F, Piccardi C. The network of international trade in services[J]. Applied Network Science, 2021, 6(1): 1-25.*

[2] *Sajedianfard N, Hadian E, Samadi A H, et al. Quantitative analysis of trade networks: data and robustness[J]. Applied Network Science, 2021, 6(1): 46.*

[3] *Fan Y, Ren S, Cai H, et al. The state's role and position in international trade: A complex network perspective[J]. Economic Modelling, 2014, 39: 71-81.*

[4] *Baskaran T, Blöchl F, Brück T, et al. The Heckscher–Ohlin model and the network structure of international trade[J]. International Review of Economics & Finance, 2011, 20(2): 135-145.*

[5] *Maluck J, Donner R V. A network of networks perspective on global trade[J]. PloS one, 2015, 10(7): e0133310.*

[6] *Lee J H. Culture, network, and international trade[J]. Journal of International Logistics and Trade, 2015, 13(2): 21-31.*

[7] *Chen Z .On the Influence of International Relations on International Trade[J].Modern Economics & Management Forum, 2022, 3(1):30-33.*

[8] *Baskaran T, Blöchl F, Brück T, et al. The Heckscher–Ohlin model and the network structure of international trade[J]. International Review of Economics & Finance, 2011, 20(2): 135-145.*

[9] *Nagoor Gani, A., Latha, S.R. A new algorithm to find fuzzy Hamilton cycle in a fuzzy network using adjacency matrix and minimum vertex degree. SpringerPlus 5, 1854 (2016).*

[10] *Avrachenkov, K., Markovich, N.M. & Sreedharan, J.K. Distribution and dependence of extremes in network sampling processes. Compu Social Networks 2, 12 (2015).*