Empirical Analysis of Trade Cost Impacts on Cross-Border e-Commerce Competitiveness: A Case Study of China and 'Belt and Road' Countries in the Digital Economy

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Abstract: Trade expenses significantly influence the growth of the digital economy and international e-commerce. Minimizing the expenses associated with international transactions and enhancing the efficacy of digital commerce are crucial strategies for international e-commerce platforms to boost their profitability. Moreover, it represents a vital approach for nations to foster external economic engagement and achieve lasting economic progress. This study utilizes the dataset from China and the nations involved in the "Belt and Road" initiative to perform an empirical examination of how lowering trade expenses can enhance the competitiveness of international e-commerce. The research identifies that several elements, including geographical distance, regulatory differences, levels of economic development, and economic liberty, impact the expenses of international e-commerce. Specifically, strategies like diminishing the costs of information retrieval, streamlining delivery and logistics expenses, and reducing the costs associated with sales channels can offer significant opportunities and competitive advantages for the growth of international e-commerce.

1 INTRODUCTION

At a time when inflationary pressure continues to rise and the cost of production and living is rising, solving the problem of economic development has become an increasingly urgent global challenge. In the meantime, the swift advancement in information technologies, including artificial intelligence, big data, blockchain, and cloud computing, is propelling a significant information technology revolution globally (Zhichao, Xue, 2019; Peiyao and Tao, 2019). In the face of simultaneous economic and technological shifts, the concept of the digital economy has taken centre stage. It significantly contributes to the enhancement of supply chain and industrial chain efficiency by enabling swift and effective data flow and distribution. This role of the digital economy is critical for optimizing and upgrading these chains, thus playing a key role in the ongoing transformation. Furthermore, it supports the seamless development of economic and industrial activities both domestically and internationally (Yanghua, 2024), and has become an important engine to boost economic growth and pull the recovery of the global economy.

Over the last ten years, swift progress in digital technologies and infrastructure has dramatically transformed the realm of business operations, modifying organizational structures and corporate culture. These alterations have paved the way for new methods of innovation, marketing strategies, and product categories (Zeljko and Dmitry, 2019). Additionally, the widespread adoption and convenience of social media have catalyzed the inclination towards online purchases on an international level, laying a foundational stone for e-commerce expansion and propelling the growth of cross-border online trade. This surge in e-commerce activity has notably impacted global commerce. E-commerce, benefiting from its low entry costs, offers an advantageous platform for small and medium-sized enterprises to generate global revenue, marking a significant stride in their development. E-commerce promotes the optimization of supply chain management, further reduces logistics costs, and its platform attributes also increase the transparency of

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market prices, reduce the cost of obtaining information for all parties, bring a fierce and healthy competitive environment, and give entrepreneurs the opportunity to start and expand their business.

On the whole, big data technology has broken the information barriers in the trade market, and e-commerce enterprises can obtain valuable information by means of information technology so as to effectively reduce information search, sales channels, delivery and transportation and many other operating costs, and make innovative decisions for consumer behavior, opening up the living space of enterprises and ushering in new trade development opportunities. Therefore, the digital economy, as an emerging economic form, can not only reduce enterprise costs and improve economic profits, but also promote the development of the overall cross-border e-commerce trade.

China has leveraged policy support, tax incentives, and streamlined customs procedures to effectively lower the trading costs associated with e-commerce. Additionally, the development of a robust electronic payment system, data protection mechanisms, and network security infrastructure has contributed to market standardization. Hence, this investigation seeks to analyze the transaction costs involved in e-commerce interactions between China and a selection of Belt and Road Initiative nations. It endeavors to formulate a strategy that elevates the competitive edge of cross-border e-commerce transactions and bolsters the development of the national economy.

2 LITERATURE REVIEW

China's total foreign trade ranks among the top in the world, and the scale of digital economy development is also relatively large. According to preliminary statistics in 2023, there will be 645,000 enterprises with export and import performance in China, among which more than 100,000 cross-border e-commerce entities (Shouwen, 2024). This shows that China, as the world's largest exporter, has a large scale of digital economy development and has made important contributions to global digital economy growth. Therefore, the current trade performance of China's cross-border e-commerce has important research significance under the topic of how to achieve "cost reduction and efficiency increase".

Since its inception in 2013, the Belt and Road Initiative has acted as a catalyst for expanding trade relations between China and the countries along the BRI route. According to data from China's General Administration of Customs, trade volumes have surged from 6.46 trillion yuan at the outset of the initiative to 11.6 trillion yuan, marking an average annual growth rate of 7.5%. This growth has elevated China's trade with BRI countries from 25% to 29.7% of its total international trade. Notably, in 2023, cross-border e-commerce transactions between China and these countries amounted to 2.38 trillion yuan, with exports accounting for 1.83 trillion yuan (a 19.6% increase) and imports totaling 548.3 billion yuan (a 3.9% increase). The consumer base engaging in cross-border e-commerce imports expanded to 163 million in 2023, further underscoring the initiative's impact on the digital commerce economy.

A plethora of academic investigations have underscored the pivotal role digital commerce plays in the economic advancement of nations. Contemporary studies predominantly shed light on the determinants shaping cross-border electronic commerce within the digital economy paradigm and their effects on global trade dynamics. In a seminal work, a scholar delineates the framework for the elevated progression of China’s cross-border e-commerce under the digital economy umbrella, pinpointing hurdles including regulatory oversight, the breadth of support services, and the cultivation of premier brand identities, make a blueprint for enhancing trade development via digital innovations is proposed (Peng, 2024). Researcher Wang, Y. delves into the repercussions of the digital economy on China’s cross-border e-commerce evolution, mediated by factors such as transaction costs and productive efficacy. Research indicates a significant boost provided by the digital economy to China's cross-border e-commerce, particularly affecting trade exports (Yu and Yi, 2017). Additionally, another study uses an enhanced trade gravity model to measure the logistics performance index, offering empirical insight into the factors affecting transaction volumes in cross-border e-commerce between China and the Belt and Road countries. This analysis demonstrates that factors such as geographical closeness, per capita income, and consumer demographics play a crucial role in influencing the scale of cross-border e-commerce transactions (Yanan, 2020).

To sum up, there is a lot of empirical research on international trade, so as to provide references and suggestions for theoretical practice. But a closer look can also reveal some shortcomings:

Initially, the prevailing research largely focuses on the effects of digital trade development, focusing on the impact of cross-border e-commerce on international trade, considerable attention has been

paid to the role of the digital economy in facilitating the growth of cross-border trade and the prospective expansion of cross-border e-commerce. Nonetheless, these analyses often overlook the specific factors contributing to the competitiveness of cross-border e-commerce or the ways in which digital trade costs can affect the competitive advantage of e-commerce transactions. Furthermore, there is a notable scarcity of comparative analyses regarding various trade costs. While the influence of disparate trade costs on the growth of cross-border e-commerce is acknowledged, there exists a lack of detailed comparison regarding the prioritization of trade cost management.

Hence, the unique contribution of this manuscript lies in its utilization of empirical analysis techniques to investigate the effects of different trade costs on both cross-border e-commerce and the broader digital trade landscape. It aims to pinpoint critical factors by evaluating the positive and negative impacts of various trade costs and their management approaches, thereby offering insights into optimizing cross-border e-commerce operations.

3 RESEARCH

3.1 Research Design

The investigation bifurcates into two distinct segments: Firstly, examining the effect of trade costs on the proliferation of domestic e-commerce trade within China, and secondly, analyzing the disparity in digital competitiveness and trade costs across various nations in the international trading arena. The examination of e-commerce trade at the provincial level in China utilizes data extracted from the "China Statistical Yearbook" and information from six issues of the "Cross-border E-commerce Comprehensive Pilot Zone List" published by The State Council, covering the development of cross-border e-commerce pilot zones and per capita GDP from 2015 to 2022. In parallel, the analysis of digital competitiveness among countries employs data from the World Development Indicators (WDI) of the World Bank, the CEPII database, the China Customs database, and relevant scholarly works. It is crucial to acknowledge that barriers to trade between two countries can appear in different guises, such as tariffs, quotas, and an assortment of non-tariff barriers, including import licenses or technical standards. Additionally, the time it takes to ship goods can act as another type of trade barrier (François, Alen, Siobhan, Nadia and Michele, 2019). Otherwise, as supply chains increasingly globalize, it's critical to account for the geographical positions of supply chain participants in evaluating the performance advantages of supply chain practices, such as purchasing tools (Frank and Eamonn, 2017). Therefore, another section includes data on China's GDP and that of 36 other countries and regions connected to the "Belt and Road" initiative. This data elaborates on the geographical and institutional distances, differences in economic freedom, and the export values between China and these entities, emphasizing the data from the year 2019.

The challenge arises from the inability to directly quantify the alleged costs, leading researchers to predominantly utilize indirect methodologies. They propose models that simulate bilateral trade flows and associate these flows with surrogate variables designed to signify trade barriers (David, 1999). In assessing countries' digital competitiveness, most of the previous studies used the traditional gravity model to study the trade flow between two countries, which can estimate the influence of geographical distance, economic scale, economic freedom and other factors on the trade flow. However, considering that the logarithmic transformation of the independent variable is carried out and there may be more complex nonlinear relationships between variables, this paper chooses to establish the following generalized additive model for analysis:

$$\log(\text{Exports} + 1) = \beta_0 + s(\log(\text{GDP} + 1)) + s(\log(\text{Dist} + 1)) + s(\text{Policy}) + s(\text{Freedom}) + \epsilon \quad (1)$$

Exports represent China's exports in countries or regions along the Belt and Road, and s(GDP) is a smooth term of GDP to capture the non-linear relationship between GDP and exports. s(Dist) is the smoothing term of geographical distance from China, s(Policy) is the smoothing term of institutional differences, and s(Freedom) is the smoothing term of economic freedom.

3.2 Empirical Research

Analyzing the annual changes in average metrics of digital economic growth across China's provinces uncovers a deliberate extension of cross-border e-commerce pilot zones from coastal areas to a wider expanse of the country. This expansion correlates with economic disparities, where coastal provinces typically exhibit superior economic performance compared to their inland counterparts, a trend that aligns with the establishment of these pilot zones. Furthermore, an upward trajectory in the Gross Domestic Product of these provinces over time

suggests a linkage to the pilot zones' establishment, a hypothesis supported by linear model analysis which fails to refute this association. The advent of the digital economy has significantly bolstered the trade competitiveness of provinces by streamlining information search costs, marketing channel expenditures, and management services, thereby mitigating governance costs and influencing cross-border trade expenses to achieve cost reduction and efficiency enhancement.

The inception of cross-border e-commerce pilot zones has catalyzed investments in infrastructure, digital innovation, digital industry, and governance. The adoption of a clustered development approach coupled with favorable policy frameworks has curtailed operational and managerial expenses for e-commerce enterprises, thereby fostering a competitive and collaborative development atmosphere among e-commerce entities.

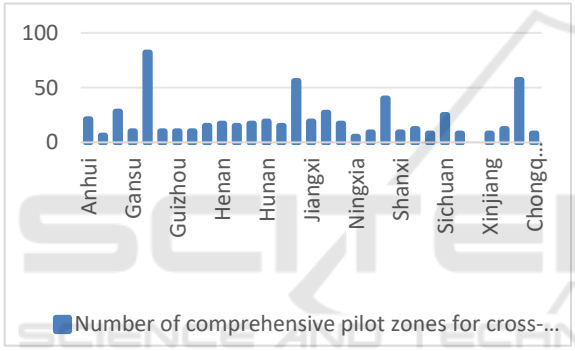

Figure 1: Construction of cross-border trade pilot zones in China's provincial-level administrative regions.

Recent empirical findings on a country's digital competitiveness indicate that boosting digital trade competitiveness markedly lowers the expenses associated with cross-border commerce between China and the "Belt and Road" affiliated countries. The economic growth level, extent of economic liberty, geographical proximity, and institutional variances between China and its trading counterparts each play a role in shaping the costs linked to China's cross-border e-commerce trade. A greater alignment in cultural and economic progression levels enhances the efficiency of cross-border trade relations. Consequently, e-commerce entities tend to favor trading partners that are geographically nearer, as this choice leads to diminished logistics costs.

Table 1: Regression result of digital competitiveness of Belt and Road countries.

Term	Estimate	Std. Error	t value	Pr(>t)
Parametric Coefficients				
Intercept	20.31924	3.26022	6.232	<0.0001 ***
Policy	-0.48604	0.39872	-1.219	0.235
Freedom	0.03078	0.04549	0.677	0.505
Approximate Significance of Smooth Terms				
s(log_GDP)				0.0807 .
s(log_Dist)				<0.0001 ***

P.S. Note: *** p < 0.001, **p < 0.01. *p < 0.1

The Gross Domestic Product of a nation serves as a robust indicator of its economic and trade prowess, facilitating enterprises within that nation to leverage digital trade platforms for publicity, negotiation, and transactions, thereby enhancing trade pairings between parties. This mechanism also permits the efficient oversight and management of the transportation process through real-time data exchange, elevating the efficiency of customs processes in cross-border trade. It underscores the pivotal role of GDP in diminishing costs and augmenting efficiency within cross-border trade enterprises, markedly influencing export volumes.

Moreover, the relationship between geographical distance and trade volumes exhibits a nonlinear dynamic, where increased distances escalate trade costs, consequently diminishing trade volumes. Given the significant impact of geographical distance on logistics expenses for cross-border e-commerce, effective communication and matching strategies are crucial in the preliminary stages. Selecting cost-efficient transport solutions and negotiating appropriate contracts are imperative measures to minimize the tangible distances involved.

Conversely, while the effects of institutional disparities and economic freedom levels on trade volumes appear minimal, macro-level observations indicate a trend where countries boasting higher economic freedom often register superior trade volumes. This insight underscores the complex interplay between regulatory environments and trade outcomes.

4 CONCLUSIONS

In light of the research conducted, it becomes evident that prompting traditional enterprises towards digital transformation holds critical importance. This transition is pivotal for optimizing resource allocation

and bolstering the competitiveness of products. The path to research, development, and innovation within digital technologies is marked by lengthy cycles, substantial investment requirements, and uncertain returns. Consequently, the effective employment of digital technology across various domains such as production, logistics, payment systems, and management is paramount to achieving cost efficiency and enhanced productivity (Saeed, 1998).

Furthermore, the development and refinement of current cross-border trade pilot zones and e-commerce systems reveal substantial opportunities for cost reduction and efficiency enhancement. It necessitates a comprehensive coordination among customs, national taxation bodies, and inspection agencies. It's essential to prioritize the development of public information service platforms to create an enabling environment for cross-border e-commerce. Improving the integration and efficiency of cross-border trade pilot zones, as well as boosting industrial competitiveness, are crucial measures for maintaining strong international connections. Such efforts not only refine the operational structure but also lay the groundwork for future innovations in cross-border trade.

Third, the establishment of relevant trade cooperation mechanisms between countries is conducive to reducing tariff barriers, providing free and convenient space for trade exchanges, and effectively reducing trade costs. Combined with geographical advantages, trade cooperation has driven the digital competitiveness of countries along the "Belt and Road", narrowing the marginal trade differences between different countries, and is a feasible way to maximize the function of digital trade competitiveness in cross-border trade of "reducing costs and increasing efficiency".

In order to effectively alleviate the trade cost problems caused by cultural and institutional differences, do a good job in the language construction of cross-border e-commerce network platforms to ensure the accuracy and popularity of translation (Anqi, 2020). Vigorously introduce language professionals, deeply understand the cultural and institutional differences of different countries and solve the obstacles of online transactions while reducing logistics costs.

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