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Digital Economy and Trade in Services

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Abstract

This study utilizes data on digital economy development and service trade exports from 121 countries between 2003 and 2022. Through trend analysis and model validation, we demonstrate that the development level of the digital economy has a significant positive impact on service trade growth. Heterogeneity analysis further reveals that digital economy development exhibits stronger promoting effects on service trade in developing countries. The paper's contributions primarily lie in employing a novel methodology for measuring digital economy development. Finally, recommendations are provided to enhance future research.

Keywords

Digital Economy; Trade in Services; Digital Governance.

1. Introduction

1.1. Global Digital Economy Development

In recent years, the global digital economy has entered a phase of rapid growth, emerging as a core engine driving worldwide economic expansion. Its development exhibits three key characteristics: First, continuous expansion in scale, with the digital economy's share in GDP steadily increasing. Cutting-edge technologies like cloud computing, big data, and artificial intelligence are rapidly advancing and deeply transforming traditional industries. Second, the pandemic has significantly accelerated digital transformation across society, sparking booming new business models including remote work, online education, and digital entertainment. Third, while data has become an increasingly vital production factor, intense regulatory competition persists among nations regarding cross-border data flows, digital taxation, and platform monopolies. The global digital governance framework remains fragmented and lacks unified standards.

1.2. Development of Global Trade in Services

Digital service trade, deeply integrated with the digital economy, has become the primary driver of global service trade growth. Traditional sectors like tourism and transportation were severely impacted by the pandemic, while digital delivery services-including telecommunications, computer services, intellectual property licensing, and professional management consulting-demonstrated remarkable resilience, with their share steadily increasing. The globalization of service trade now follows a bilateral and regional agreement-driven pattern, as more Free Trade Agreements (FTAs) establish dedicated chapters on service and digital trade to lower market access barriers and promote mutual recognition of standards. However, protectionism persists, particularly in sensitive service sectors involving national security, where market liberalization coexists with regulatory barriers.

China has become the second largest economy in the global digital economy, boasting a massive internet user base and dynamic business model innovation, with global leadership in e-commerce and mobile payments. In terms of service trade, China has actively promoted

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openness, with the most prominent initiative being the establishment of a negative list for cross-border service trade and pilot programs in regions like the Hainan Free Trade Port. In recent years, China has applied for and formally joined the Regional Comprehensive Economic Partnership (RCEP) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), demonstrating its determination to deepen service trade liberalization. At the policy level, the national government has continuously launched initiatives such as the "14th Five-Year Plan for the Digital Economy" and the "Digital China" strategy. On one hand, it strongly supports the construction of new infrastructure like 5G and industrial internet; on the other hand, it promotes international cooperation through platforms such as the China International Fair for Trade in Services (CIFTIS), striving to build an open, inclusive, balanced, and mutually beneficial digital globalization environment.

Overall, the deep integration of digital technology and service trade is reshaping the global economic and trade landscape. Globally, while the digital economy is developing rapidly, governance challenges persist, while service trade liberalization advances steadily under the impetus of regional agreements. As a key participant, China has not only achieved leapfrog development in its domestic digital economy but also proactively expanded service trade openness through a series of policies, actively integrating into and attempting to lead the formulation of new global rules for digital trade. In the future, how to strike a balance between promoting open innovation and safeguarding national security will be a common challenge faced by all countries.

2. Literature Review

Kevin Barefoot et al. defined the digital economy as encompassing three major categories: digital infrastructure, e-commerce, and digital media, and measured it based on a supply-use framework. Their research shows that the annual growth rate of the U.S. digital economy from 2006 to 2016 was significantly higher than that of the overall economy [1]. Avi Goldfarb et al. pointed out that the digital economy has profoundly transformed the manner and scope of economic activities by significantly reducing five types of economic costs: search, replication, transportation, tracking, and verification [2]. Mahmudov Baxriddin Jurayevich et al. emphasized that the digital economy is crucial for Uzbekistan's economic growth through promoting industrial modernization and efficiency improvements, but its current GDP share remains only 2.2%, necessitating enhanced integration of digital infrastructure with industries to narrow the gap with developed countries [3]. Z Shu et al. found through theoretical models and empirical analysis that the development of China's service trade, particularly producer services, can effectively reduce pollution emission intensity in manufacturing enterprises through three pathways: promoting technological progress (especially quality improvement of innovation), cost reduction, and optimized resource allocation. This approach brings more significant green transformation effects for non-state-owned enterprises and non-export-oriented businesses, providing a viable green development path for developing countries [4]. The study by Oriaku Christiana Eberechukwu et al. demonstrates that trade openness and foreign direct investment have positive interactive effects on Nigeria's economic growth, with trade openness significantly promoting economic growth in both short-term and long-term contexts [5]. The research by Karim Barkat et al. indicates that trade openness has a dual impact on the environmental consequences of OECD countries: direct effects exacerbate CO_2 emissions, while indirect effects generated through economic growth improvement enhance environmental conditions, collectively validating the Environmental Kuznets Curve hypothesis [6]. Naziru Yusuf Huang Xuebo et al. explored how to promote the opening and innovation of cross-border service trade under Hainan's customs control framework, proposing specific development pathways using Sanya City as a case study [7]. Di Changya et al., based on panel

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data from 18 sample regions in China between 2012 and 2021, empirically demonstrated that the digital economy significantly boosted the high-quality development of China's service trade, noting that human capital levels played a mediating role. The study further revealed that the digital economy's stimulating effect on service trade in central and western regions outperformed that in eastern regions, with more pronounced effects following the implementation of the "Digital China" strategy in 2015. This research provides theoretical and empirical references for advancing high-quality service trade development through digital economy enhancement [8]. Boning Li et al verified that the digital economy has driven service trade to break through traditional constraints through technological innovation and policy dividends. The scale of China's digital service trade increased from US$48.859 billion in 2005 to US$271.81 billion in 2019, yet still faces challenges such as a lower proportion of service trade compared to the global average and European-American dominance in rule-making [9]. Adnan Sose et al analyzed how to strengthen developing countries' taxation rights over transnational digital services by incorporating Article 12B of the United Nations Model Tax Convention into existing treaties within the digital economy. They also assessed the importance of explicitly defining "computer software" payments as royalties to support developing countries 'tax negotiations in service trade liberalization. The digital economy has effectively promoted the development of service trade by reducing transaction costs, fostering technological progress, and optimizing resource allocation, as evidenced by cases such as China's service trade development and Hainan's cross-border service trade innovation.At the same time, the development of digital economy also provides an institutional guarantee for the development of service trade through tax policy adjustment (such as strengthening the right to levy taxes on digital services), helping developing countries better participate in global service trade [10].

3. Current Situation of Digital Economy Development.

Due to the varying development levels of different countries, the digital economy in these nations also differs accordingly. Developed countries have a higher level of digital economic development, while developing countries generally exhibit relatively lower levels. As shown in Figures 1 to 9, Australia, South Korea, the United States, and Japan demonstrate relatively high levels of digital economic development, with overall stable growth patterns. In contrast, Ukraine, Belarus, Brazil, Indonesia, and China, as developing countries, all show comparatively low levels of digital economic development. Among them, the United States maintains the highest level of digital economic development, while Indonesia's digital economy shows the lowest and highly unstable performance. China's digital economic development demonstrates an upward trend overall, with a significant surge after 2020, indicating that China places great emphasis on the development of its digital economy.

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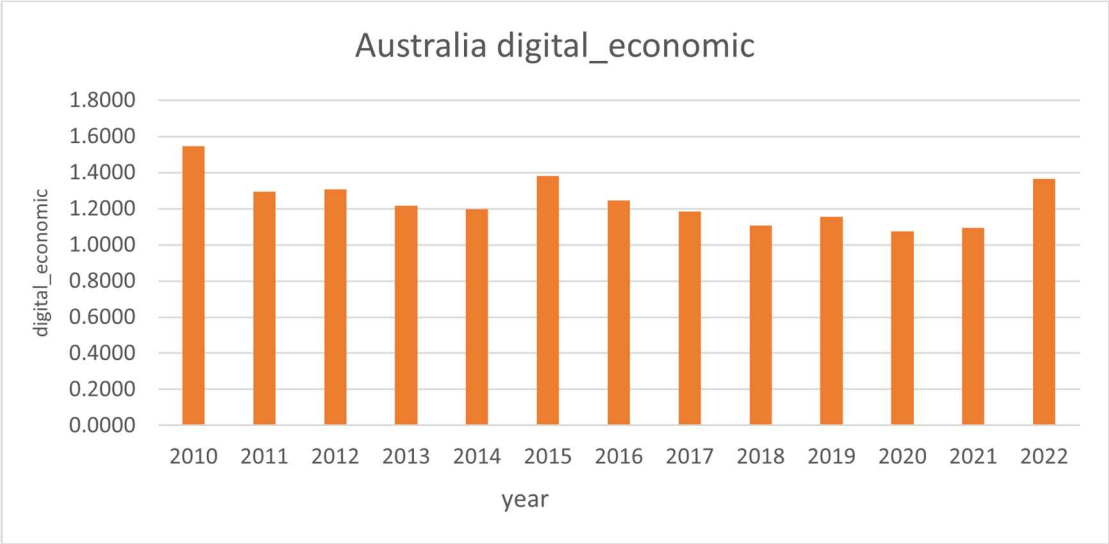


Figure 1. Development level of digital economy in Australia from 2010 to 2022

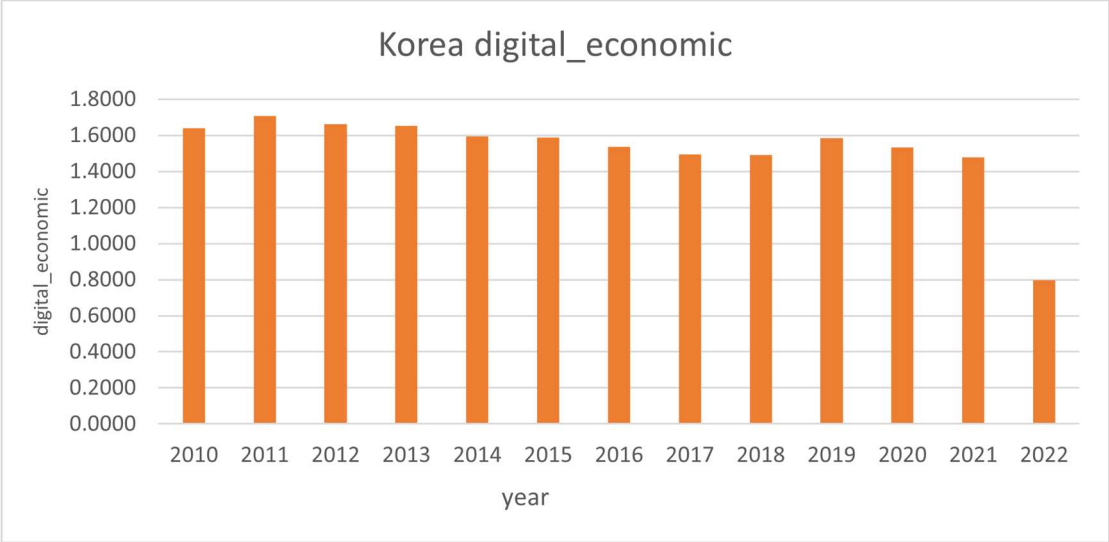


Figure 2. Development level of digital economy in South Korea from 2010 to 2022

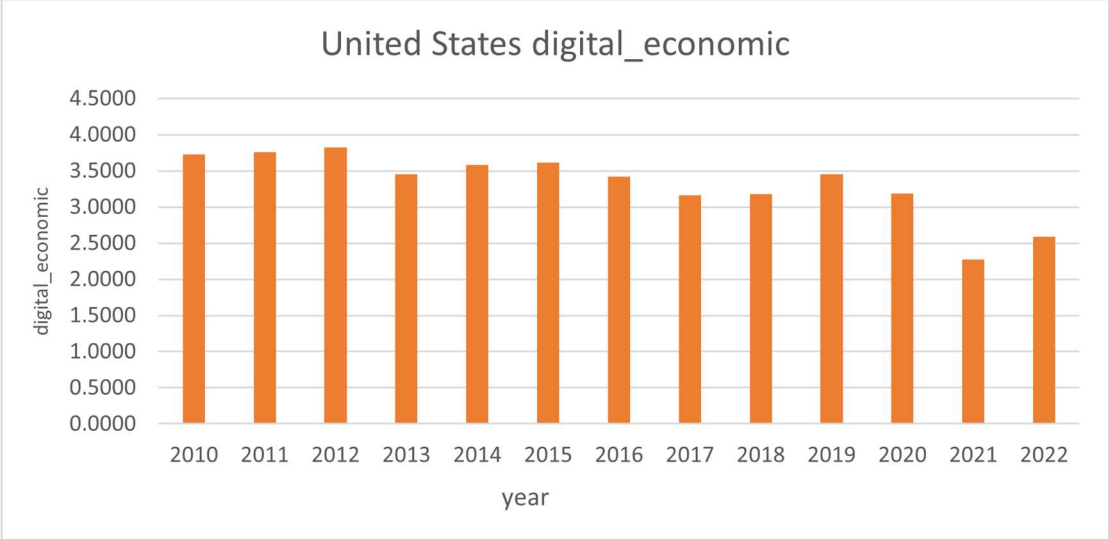


Figure 3. Development of digital economy in the United States from 2010 to 2022

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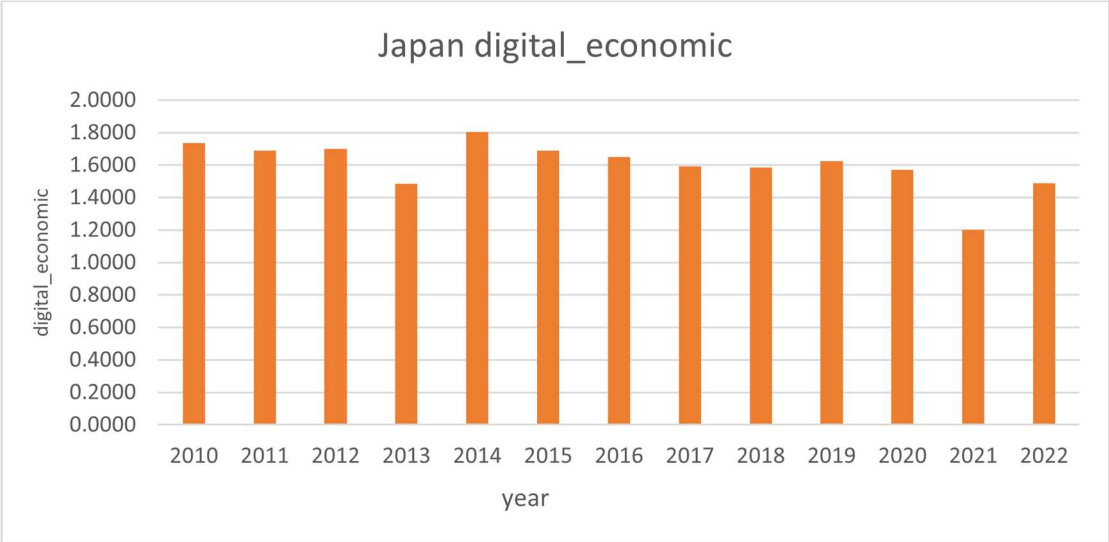


Figure 4. Development level of digital economy in Japan from 2010 to 2022



Figure 5. Development level of digital economy in Ukraine from 2010 to 2022

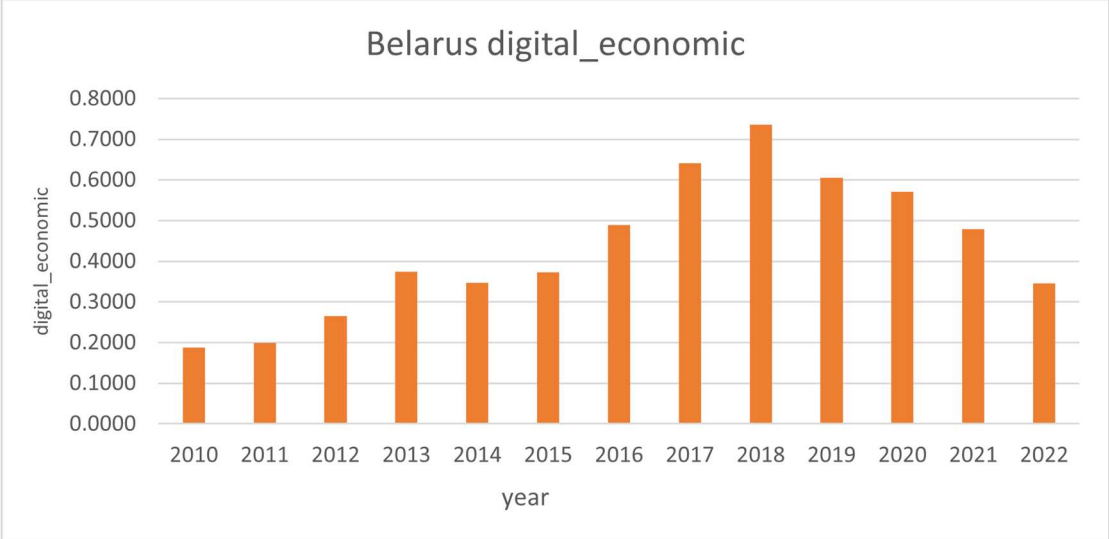


Figure 6. Development level of digital economy in Belarus from 2010 to 2022

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Figure 7. Development of digital economy in Brazil from 2010 to 2022



Figure 8. Digital economy development in Indonesia from 2010 to 2022

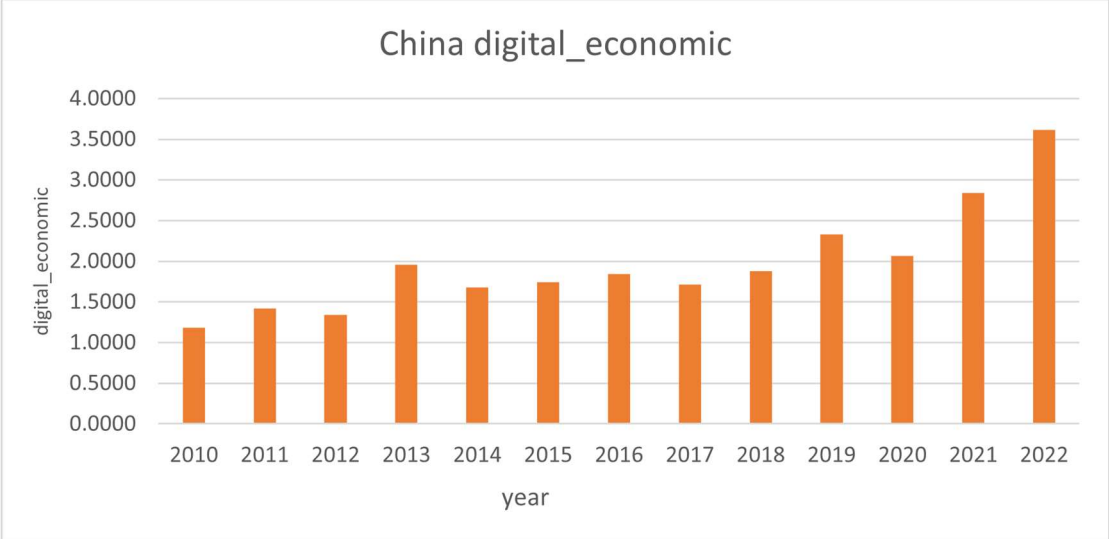


Figure 9. China's digital economy development level from 2010 to 2022

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4. Research Design

4.1. Model Setting

This paper uses the fixed effect model to investigate the impact of digital economy on the development of service trade in the economy, and constructs the following econometric model:

$$servicetrade_{it}=\alpha_1+\beta_1 \cdot Digital_{it}+\gamma_1 \cdot Z_{it}+\delta_i+\vartheta_t+\varepsilon_{it} \quad (1)$$

In equation (1), subscript i denotes the economy, and t represents the year. $servicetrade_{it}$The development level of service trade in economy i during period t is measured by this indicator, where higher values indicate greater progress in service trade development. $Digital_{it}$ This reflects the digital economy's development level in period t for economy i;Z_{it}It serves as a control variable; δ_i The individual fixed effect is represented by, ϑ_t while the year fixed effect is denoted by;εit is the random disturbance term.

4.2. Main Indicators and Data Description

1) Core explanatory variables $\boldsymbol{Digital_{it}}$

Table 1. Statistical indicators of digital economy development

	name of index	unit
1	Mobile network coverage	%
2	Fixed-line telephone penetration	%
3	Fixed broadband penetration	%
4	Secure Internet server	Per million persons
5	ICT services exports	U.S. dollar
6	Export of information and communication services	U.S. dollar
7	Ease of doing business score	/
8	Start-up convenience score	/
9	Scientific journal articles	piece
10	R&d expenditure as a percentage of GDP	%
11	Percentage of workforce in higher education	%
12	Enrolment rate in higher education	%
13	ICT frontier technology readiness	%
14	Telecom services revenue	U.S. dollar
15	Mobile Internet revenue	U.S. dollar
16	Availability of venture capital	/
17	ICT related paper publication	piece
18	Total education expenditure as a percentage of total expenditure	%
19	Mobile cellular subscriptions	Per 100 persons
20	E Participation Index	/
21	On line Service Index	/
22	Telecommunication Infrastructure Index	/

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First is the digital economy development level measured by benchmark regression. Referring to the TIMG digital economy indicator system constructed by Wang Zhe et al. (2021), and the different statistical methods used by various institutions such as Eurostat, OECD, BEA, and the China Academy of Information and Communications Technology for measuring digital economy development, we compiled data from 22 indicators to assess digital economy growth. The indicators are listed in Table 1. We performed dimensionality reduction on these 22 indicators using factorization. Through processes including data collection, correlation analysis, factor extraction, factor rotation, and factor score calculation, we ultimately derived the digital indicators.

2) The explained variable is service trade export

Service trade exports refer to the total revenue a country or region generates from providing services to other countries or regions within a specific period (typically one year). This indicator reflects a nation's service trade export capacity and serves as a crucial economic measure for assessing competitiveness and international market influence in service trade. The study primarily uses total service trade exports between two countries, with statistical calculations based on CIF values. During the benchmark regression phase, data from 121 economies covering service trade exports from 2003 to 2022 were utilized. For robustness testing, the analysis employed service trade export data from 60 economies spanning 2013 to 2022.

3) Control variables

In selecting control variables, this study incorporates value-added of service trade, gross fixed capital formation, per capita GDP, insurance and financial services, net foreign direct investment, total population, and secondary education enrollment. The data for these variables are primarily sourced from the World Bank database. Given the large magnitude of some control variables, logarithmic transformation was applied to the data for validation purposes.

4) Data description

The core explanatory variables are derived from the World Bank database, with data of 121 major economies from 2014 to 2022. The data of the dependent variable is derived from UN Comtrade, and the data of TIMG digital economy index system is derived from the Institute of Finance of Chinese Academy of Social Sciences.

5. Empirical analysis

(1) Benchmarking

The benchmark regression analysis examines the relationship between service trade exports and the digital economy across 121 countries from 2003 to 2022. As shown in Table 2, the regression results in column (1) demonstrate a statistically significant positive correlation, indicating that the digital economy effectively boosts service trade exports. This positive correlation is further reinforced by the inclusion of fixed effects and control variables in columns (2) and (3), where the results remain statistically significant. These findings collectively validate the digital economy's positive and substantial impact on service trade development.

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Table 2. Results of benchmark regression

Variable	(1)	(2)	(3)
	S_export1	S_export1	S_export1
Digital	0.08***	0.08***	0.02***
	(0.0018)	(0.0018)	(0.0014)
Service_Value			-0.05***
			(0.0012)
g_fixed_capital			0.09***
			(0.0018)
Per_capita_gdp			0.00***
			(0.0000)
Insur_ fina			0.00***
			(0.0001)
population			-0.00***
			(0.0000)
education_stud			0.00***
			(0.0000)
cons	-0.03***	-0.03***	-0.01***
	(0.0012)	(0.0012)	(0.0008)
R^2		0.449	0.841
fixed effect controlled variable	NO NO	YES NO	YES YES
N	2420	2420	2420

(2) Robustness test

To address endogeneity issues, this study replaced the core explanatory variable with the TIMG digital economy indicator system developed by Wang Zhe et al. (2021). As shown in Table 3, both the benchmark regression and the regression with fixed effects and control variables maintained positive significance after replacing the core explanatory variable. This confirms the digital economy's positive and significant impact on service trade exports.

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Table 3. Robustness analysis

Variable	(1)	(2)	(8)
	ln_service_export	ln_service_export	ln_service_export
TIMG指数	0.02***	0.02***	0.01***
	(0.0031)	(0.0046)	(0.0042)
lnService_Value			0.01
			(0.0121)
lng_fixed_capital			0.04**
			(0.0141)
Per_capita_gdp			0.00***
			(0.0000)
Insur_ fina			-0.02*
			(0.0127)
population			0.00**
			(0.0000)
education_stud			0.00
			(0.0000)
cons	21.74***	21.74***	20.44***
	(0.1792)	(0.2136)	(0.4079)
controlled variable	NO	NO	YES
robustness	NO	YES	YES
N	540	540	540

(3) Heterogeneity analysis

According to World Bank data, the sample countries were classified as developed and developing nations for heterogeneity analysis, with regression results shown in Table 4. The findings indicate that while control variables in column (5) showed no significant effect in developed countries, all other columns demonstrated statistical significance. This suggests that the development of the digital economy between 2003 and 2022 has boosted service trade exports in both developed and developing nations. Notably, the impact on developing countries was more pronounced than in developed ones. This disparity may stem from two factors: first, developed countries had relatively advanced digital economies during this period, which corresponded to their higher digital development levels mentioned earlier, resulting in smaller impacts; second, developing countries experienced gradual growth in their digital economies, thereby exerting greater influence on service trade exports.

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Table 4. Heterogeneity analysis

Variable	(1)developed	(2)develop	(3)developed	(4)develop	(5)developed	(6)develop
	S_export1	S_export1	S_export1	S_export1	S_export1	S_export1
Digital	0.0180***	0.0018***	0.0190***	0.0018***	0.0002	0.0004***
	(0.0011)	(0.0002)	(0.0010)	(0.0002)	(0.0013)	(0.0001)
Service_Value					-0.0009	-0.0008***
					(0.0008)	(0.0001)
g_fixed_capital					-0.0063***	0.0029***
					(0.0021)	(0.0002)
Per_capita_gdp					0.0000***	0.0000***
					(0.0000)	(0.0000)
Insur_ fina					0.0009***	-0.0000*
					(0.0001)	(0.0000)
population					0.0000***	0.0000***
					(0.0000)	(0.0000)
education_stud					0.0000***	0.0000***
					(0.0000)	(0.0000)
cons	-0.0130***	-0.0001	-0.0145***	-0.0000	-0.0036*	-0.0003***
	(0.0019)	(0.0001)	(0.0017)	(0.0001)	(0.0019)	(0.0001)
R^2			0.7276	0.0447	0.9609	0.8134
controlled variable	NO	NO	NO	NO	YES	YES
fixed effect	NO	NO	YES	YES	YES	YES
N	160	2260	160	2260	160	2260

6. Summary and Recommendations

(1) Summary

This paper uses the digital economy development level and service trade export data of 121 countries from 2003 to 2022 to verify the promoting effect of digital economy on the development of service trade. The model is verified from different aspects such as benchmark regression, robust test and heterogeneity analysis, and the results are consistent.

(2) Recommendation

1) Strengthen the construction of digital infrastructure and enhance the support capacity for service trade.

Continuous investment should be made in new digital infrastructure such as 5G, cloud computing, and industrial internet to improve network coverage quality and data processing capabilities. In particular, in central and western regions, efforts should be made to promote balanced distribution of digital infrastructure in line with the "Digital China" strategy, thereby narrowing the regional digital divide. Additionally, emphasis should be placed on human capital accumulation by optimizing higher education and vocational education systems to cultivate high-quality talents with digital skills, providing intellectual support for digital service trade.

2) Enhance digital governance and regulatory frameworks to facilitate orderly opening of service trade.

In the face of intensifying global competition in digital rule-making, China should actively engage in international digital governance dialogues to establish fair and transparent trade rules. Domestically, it should optimize the management of cross-border service trade negative lists, develop secure regulatory mechanisms for data flows across borders, and balance innovation-driven openness with national security. Meanwhile, by drawing on international

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best practices, China can refine digital service taxation policies to strengthen effective oversight and protect rights in digital transactions.

3) Promote international cooperation and regional integration to expand the market for digital trade in services

We should leverage multilateral agreement platforms such as RCEP and CPTPP to promote mutual recognition of standards and market integration in digital service trade. By hosting international exchange platforms like the China International Fair for Trade in Services (CIFTIS), we will strengthen cooperation with developing countries in the field of digital services, sharing China's mature experiences in e-commerce, mobile payments, and other areas. Meanwhile, we will support enterprises in "going global" to participate in the global digital service value chain, thereby enhancing the international competitiveness and rule-making influence of China's digital service trade.

References

[1] BAREFOOT K, CURTIS D, JOLLIFF W, et al. Defining and measuring the digital economy [J]. US Department of Commerce Bureau of Economic Analysis, Washington, DC, 2018, 15(2).

[2] GOLDFARB A, TUCKER C. Digital economics [J]. Journal of economic literature, 2019, 57(1): 3-43.

[3] BULTURBAYEVICH M B, JURAYEVICH M B. The impact of the digital economy on economic growth [J]. International Journal of Business, Law, and Education, 2020, 1(1): 4-7.

[4] SHU Z, PENG S, HUANG X. How does service trade openness promote the green transformation of manufacturing firms? Evidence from China [J]. Energy Economics, 2025, 144: 108347-.

[5] EBERECHUKWU O C, CHINYERE I M, IHIENCHUKWUKWU E D. Interative effects of trade openness and foreign direct investment on economic growth in Nigeria [J]. World Journal of Advanced Research and Reviews, 2024, 21(2): 633-46.

[6] BARKAT K, ALSAMARA M, AL KWIFI O S, et al. Does trade openness mitigate environmental degradation in Organisation for Economic Co-operation and Development (OECD) countries? Implications for achieving sustainable development; proceedings of the Natural resources forum, F, 2025 [C]. Wiley Online Library.

[7] Huang Xue. Analysis of innovative mode of opening cross-border service trade from the perspective of Hainan Customs -- Taking Sanya as an example [J]. ER, 2024, 1(2).

[8] DI C, TANG D, XU Y. Impact of digital economy on the high-quality development of china's service trade [J]. Sustainability, 2023, 15(15): 11865.

[9] LI B, ZHANG S. Research on the development path of China's digital trade under the background of the digital economy [J]. Journal of Internet and Digital Economics, 2022, 2(1): 1-14.

[10] SOSE A, TASCON N, VIEMOSE A. Digital economy [J]. 2023.