

# Impact of Digital Economy on China's Services Trade Competitiveness

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**Abstract:** With the global spread of the new coronavirus epidemic, international trade has been greatly hindered. However, the rapid development of the digital economy has improved the efficiency of financial services and government governance, providing new solutions and perspectives for countries to develop service trade. Therefore, this paper uses the macro panel data of 30 provinces in China from 2013 to 2020 and the system GMM model to empirically test the impact of digital economy on the competitiveness of service trade from the perspective of financial development and government governance. This paper finds that the development of the digital economy can promote the progress of financial industry and strengthen the level of government governance so as to enhance the competitiveness of service trade; that is, financial development and government governance have mediating effects. Based on the above results, the author proposes to deepen the digital transformation of government governance, deepen the digital reform of financial services and promote the process of digital legal supervision.

**Keywords:** Digital economy; Service trade competitiveness; Financial services; Government governance; system GMM; Mediating effect.

## 1. Introduction

In recent years, China's economy has entered the stage of high-quality development, and deepening the strategy of opening up to the outside world has become an important content. As a new growth pole of foreign trade, the service trade has gained significant attention from all countries. From 2010 to 2019, the total value of the world service trade was raised from \$7.8 trillion to \$11.9 trillion, with a growth rate of twice that of the trade in goods during the same period. Since 2020, the new crown epidemic and geopolitical patterns have seriously impacted the global economy and trade. The economies of all countries have suffered a heavy blow while the development of digital technology has ushered in opportunities for the development of trade in services. The active performance of trade in services has also injected vitality into China's economic transformation. However, in 2019, China's service trade was only half that of the United States, and the total amount accounted for only 14.6 per cent of total domestic trade. Obviously, the total volume and share of China's trade in services are still significantly insufficient relative to developed countries.

Small and medium-sized enterprises (SMEs) are the mainstay of the service industry, and their development is the key to improving the competitiveness of trade in services. However, domestic SMEs are currently struggling due to difficulties in financing, trade regulations, international taxes, transport costs, etc. As the digital economy flourishes, financial services and government governance are transforming to digitalisation, which, on the one hand, facilitates financial development and provides enterprises with more diversified and convenient financing channels; on the other hand, it strengthens government effectiveness, creates a fair and open business environment for SMEs. In conclusion, this paper believes that an in-depth exploration of the direct and indirect effects of the digital economy on the competitiveness of trade in services is of practical significance for deepening the strategy of opening up to the

outside world.

Existing literature has explored the digital economy and services trade competitiveness, and scholars believe that the digital economy can promote trade competitiveness. Yao Zhanqi (2022) argues that the digital economy accelerates the transformation and upgrading of traditional industries and drives the development of the information service industry. The digital economy can enhance technological competitiveness and promote the growth of export scale and quality[1]. Shan Shuangshuang (2022) argues that the digital economy has changed the forms of contract signing, communication payment and settlement, effectively avoiding trade risks[2]. Tao Aiping (2022) empirically examined with the help of fixed effects and the spatial Durbin model and found that the digital economy can promote trade in services, which is better for high-income than low-income countries. The effect is affected by the degree of development of neighbouring countries' digital economy[3].

In the field of research on the impact of the digital economy on financial services, scholars believe that the digital economy can improve the quality of financial services and inhibit financing constraints. Through empirical research, Tan Haofang (2023) found that digital infrastructure can promote the development of digital inclusive finance, promote the development of a high-quality economy, and the digital transformation of the government can strengthen the effect[4]. Wang Jingyong (2022) found that a digital economy can solve information asymmetry, reduce enterprise financing costs, strengthen innovation ability, and alleviate the financing constraints of small and medium-sized enterprises[5]. Ma Hongxia (2018), through a two-step systematic GMM model, found that financial development can optimise the export structure of trade in services and that this impact effect is long-term, and proposed the need to maintain policy consistency[6]. Li Huamin (2014) empirically found that the development of the financial sector has a spillover effect on the trade in services in the long run and that financial development promotes the optimisation of the structure of the

trade in services in a unidirectional way[7].

Scholars see the digital transformation of government governance as an adaptation to the needs of the digital age, and it creates opportunities for improving governance effectiveness. Zhao (2022) suggests that the digital economy can strengthen the signal transmission mechanism, improve the efficiency of departmental collaboration, and scientifically plan and make governance decisions. Strengthening government governance creates a suitable environment for developing trade in services[8]. Xie Danyang (2018) confirms through empirical analyses that government governance can promote overall services trade development [9]. Feng Zongxian (2018) argues that government control of corruption, improvement of regulatory quality, and strengthening of the rule of law can reduce the restrictions on trade in services, and government governance can promote the supply of trade in services[10]. Li Xiaole (2017) found through empirical tests that areas with higher levels of corruption have more service trade restrictions and lower development, and vice versa, the higher the degree of service trade development[11].

The above literature provides valuable experience for the research of this paper, which finds that the perspectives of previous studies mainly focus on the enabling effect of the digital economy, the direct effect of the digital economy on trade in services, and the relationship between cross-border e-commerce and trade in services, and there are fewer perspectives on the indirect effect of the digital economy on the competitiveness of trade in services. There are no scholars who have discussed the impact effect of the digital economy on the competitiveness of trade in services from the perspectives of both financial services and governmental governance. Therefore, this paper discusses the indirect effect of digital economy on the competitiveness of service trade from the perspective of financial services and government governance. Therefore, this paper starts from both financial services and government governance to study the mediating effect of the digital economy on services trade competitiveness. The marginal contributions of this paper may include the following: (1) Measuring the direct and indirect effects of the digital economy on the competitiveness of trade in services from a dynamic perspective using a systematic GMM model. (2) Complementary effects of the digital economy on the competitiveness of trade in services from the financial services and government governance perspectives.

## **2. Theoretical Analysis and Research Hypotheses**

### **2.1. Direct impact of the digital economy on the competitiveness of trade in services**

The inter-temporal nature of the digital economy breaks through the traditional limitations of economic activities and creates opportunities for the development of China's service industry, and its path of influence is mainly reflected in the following aspects: Firstly, the digital economy provides SMEs with opportunities to participate in the global market. Second, improve service efficiency. Digital infrastructure empowers industry chain management, promoting information sharing, supply and demand complementarity and collaborative innovation among upstream and downstream enterprises, thus enhancing the resource allocation efficiency of the industry chain and reducing the

costs of enterprise procurement, sales and management [12] (Cao Xiaoyong, 2021). Third, reduce trade costs. As a result, this paper gets hypothesis 1:

H1: The digital economy can significantly contribute to the competitiveness of service trade.

### **2.2. Intermediation effects of financial services**

Financing is the basis for enterprises to expand their business, scale up, prepare for projects, optimise production and operation, and control risks. High-quality financial services can improve the efficiency of capital allocation, guide the flow of capital, promote technological innovation, and expand the trade of high-value-added commodities (Yang Xiaoling, 2009)[13] so as to increase the pricing ability of products and cultivate the competitive advantages of enterprises in the global market (Feng Yujing, 2022)[14], and promote the transformation of tangible trade to intangible trade transformation. Before service-oriented enterprises enter the global market, they need to invest a large amount of fixed expenses and sunk costs. Product sales will also be affected by uncertainties such as interest rates, exchange rates, trade policies, geopolitics, epidemics, etc.. Hence, the enterprises are more in need of a relatively robust and safe financing environment (Yang Lianxing, 2015)[15]. Finance is more sensitive to the national economy. It can react to the potential risks of service trade in advance, helping service-oriented enterprises resolve risks and adjust their strategies promptly.

The digital platform provides services for the Banking, Insurance and Securities Regulatory Commission (BISRC), financial industry associations, financial institutions, and the government to collaborate in supervision, which helps to establish perfect financial regulations and improve supervision so as to crack down on illegal fund-raising, manipulation of the financial market, and corruption of financial personnel, strengthen the security of the financial market, and safeguard the safety of the financial institutions' and enterprises' capital chain [16] (Zhang Mingshen, 2022). In addition, digital finance is conducive to promoting the internationalisation of the RMB and boosting the RMB as a settlement currency, thus easing international financial risks and reducing the exchange rate risks and management costs of import and export enterprises. To a certain extent, it can be. Thus, this paper proposes hypothesis H2:

H2: The financial environment has a mediating effect, and the digital economy can improve the financial environment for services trade competitiveness.

### **2.3. Mediating effects of government governance**

The path of the digital economy's impact on services trade through government governance can be summarised as the creation of a suitable development environment for the services industry, the control of rent-seeking corruption, and the transmission of positive signals (Xie Danyang, 2018)[17]. By sharing data and information resources, governments can reduce the asymmetry of government information, carry out collaborative supervision of trade behaviours such as factor flows, customs clearance and declaration, and trade settlement in the field of global economy and trade, and effectively prevent improper and unfair trade[18] (Xu Xiujun, 2022); at the same time, the proliferation of the digital economy is conducive to drawing on the advanced experience of developed countries in collaborative supervision, making

up for the deficiencies in the methods of supervisory governance and implementation, and strengthening the efficiency of governmental governance, and enhancing the efficiency of government governance. Meanwhile, the proliferation of the digital economy is conducive to drawing on the advanced experience of developed countries in co-regulation, making up for the shortcomings of regulatory governance methods and implementation, strengthening the efficiency of government governance, shaping an inclusive and open business environment, and thus helping to reduce multilateral trade conflicts, deepening cooperation in the field of trade in services, and helping domestic enterprises consolidate and strengthen their position in the global industrial chain (Liu Yunliang, 2021)[19].

Rent-seeking easily generates private information, which will motivate enterprises to use non-competitive means to obtain benefits and distort the market competition mechanism[20] (Yu et al., 2019), thus making enterprises neglect R&D and innovation, optimising production and operation, updating equipment and other competitiveness-enhancing behaviours. The development of the digital economy allows for more significant interaction between market players, with businesses, individual households, and law enforcement agencies all participating in regulating and combating rent-seeking and corrupt activities. In addition, information on digital business activities is more accessible to track, store, and transmit and more open and transparent than traditional business activities[21] (Merhi M I, Ahluwalia P, 2018).

Quality government governance capacity can serve as a credit guarantee for exporters, and exporting countries with better government governance tend to gain the trust of manufacturers and consumers in importing countries[22] (Doidge et al., 2004); this is because the information gap between producers and consumers is objective due to the different geographic locations and social systems of each country, so only good governance can constrain the behaviour of commodity producers[23] (Xie Danyang, 2018) so that consumers and manufacturers in importing countries have more trust in the quality of products in the host country. The development of the digital economy allows information resources to be effectively integrated and processed, broadening the channels of market regulation effectively restraining producer misconduct; at the same time, it is conducive to giving full play to the competition mechanism and in order to improve the market competitiveness of enterprises, they will increase the disclosure of attributes, reduce the information gap between buyers and sellers, and boosting the consumer's confidence in consumption and willingness to access the services[24] (Liu Yaping, 2022), which is more favourable to service exports. In summary, this paper proposes hypothesis H3:

H3: Government governance has a mediating effect, and the digital economy can improve government governance for services trade competitiveness.

### 3. Research Design and Data Description

#### 3.1. Model Setting

Based on data availability, this paper mainly selects 30 provinces (excluding Tibet) in China from 2013 to 2020 as data samples. According to the above literature review and assumptions, this paper constructs the primary construction

model as follows:

$$\begin{aligned} inter_{i,t} &= a_0 + a_1 dig\_eco_{i,t} + a_2 control_{i,t} + \varepsilon_{i,t} \\ mid_{i,t} &= b_0 + b_1 dig\_eco_{i,t} + b_2 control_{i,t} + \varepsilon_{i,t} \\ inter_{i,t} &= c_0 + c_1 dig\_eco_{i,t} + c_2 mid_{i,t} + c_3 control_{i,t} + \varepsilon_{i,t} \end{aligned}$$

The first equation focuses on the total effect of the digital economy on the competitiveness of trade in services. Where  $t$  denotes time,  $i$  denotes region, and  $dig\_eco_{i,t}$  denotes the core independent variable digital economy index,  $inter_{i,t}$  denotes the dependent variable services trade competitiveness, and  $mid_{i,t}$  denotes the mediating variables (financial development and government governance), and  $control_{i,t}$  denotes the control variables that affect service trade competitiveness, the  $a_0$ 、 $a_1$ 、 $a_2$  denote the intercept term coefficient, core independent variable to dependent variable coefficient, and control variable to dependent variable coefficient, respectively. The 2nd equation mainly examines the effect of core independent variables on mediating variables.  $b_0$ 、 $b_1$ 、 $b_2$  It represents the intercept term coefficient, core independent variable to mediating variable coefficient, and control variable to mediating variable coefficient, respectively. The 3rd equation mainly examines the mediating effect of the core independent variable on the dependent variable after adding the mediating variable.  $c_0$ 、 $c_1$ 、 $c_2$ 、 $c_3$  denote the intercept term coefficient, core independent variable to dependent variable coefficient, mediator variable to dependent variable coefficient, and control variable to dependent variable coefficient, respectively, and  $\varepsilon_{i,t}$  denotes the random interference term.

### 3.2. Variables and Data Description

#### 3.2.1. Explained variables

Trade in services competitiveness ( $inter$ ). The competitiveness of trade in services is mainly reflected in the ability of an economy to sustain growth and profitability in trade in services. Michael Porter's "diamond model" theory that a country's trade competitiveness needs to be measured comprehensively, the four main factors of national industrial competitiveness, including factors of production, market demand, supportive industries, corporate strategy and competition, and two auxiliary elements of government support and opportunities. Referring to the practice of Wang Xingli(2022)[25], this paper examines the competitiveness of foreign trade from the four main factors, and obtains the index of the competitiveness of trade in services through the entropy weighting method of TOPSIS, with the data from China Statistical Yearbook and China Business Yearbook 2014-2021.

#### 3.2.2. Core explanatory variables

Digital Economy Index ( $dig$ ). This paper refers to the idea of Fan Yiman and Xu Hao (2022) [26], which is mainly considered from three perspectives, namely digital industrialisation, industrial digitisation and digital infrastructure, and this paper deals with the data in the following steps: (1) Standardise, homogenise and centrally process the raw data, and transform the different indexes into a uniform scale, so as to avoid the influence of extreme values on the regression results. (2) Use the entropy weighting method to extract the adequate information of each variable and calculate the weights occupied by each variable because the entropy weighting method still maintains objectivity in the

process of assigning weights and is more accurate compared with the principal component analysis method, logarithmic efficacy function method, coefficient of variation method and other dimensionality reduction methods. (3) Finally, this

paper adopts the TOP-SIS method to calculate TOPSIS for the weights occupied by each index of digital economy on the basis of the weights already obtained by the entropy weighting method so as to obtain the digital economy index.

**Table 1.** Indicator weights and measures of trade in services competitiveness

Level 1 indicators	Secondary indicators	percentage	Measurement indicators	proportion
Competitiveness of trade in services	market	20.97 %	Logarithm of GDP per capita	8.61 %
			Percentage of urban population	12.36 %
	Related and Supporting Industries	48.81 %	Value added of trade in goods/GDP	20.94 %
			Tertiary value added/GDP	27.87 %
	Corporate strategic factors	16.39 %	FDI/GDP	16.39 %
factors of production	13.83 %	Tertiary employment/total	13.83 %	

**Table 2.** Indicator weights and measures of the Digital Economy Development Index (DEDI)

Level 1 indicators	Secondary indicators	percentage	Measurement indicators	proportion
Digital Economy Index	digital industrialisation	47.51 %	Courier services per capita	7.83 %
			Patents granted per 10,000 people	6.61 %
			Per capita income from information technology services	10.13 %
			Technology market turnover per capita	13.31 %
			Software business income per capita	9.65 %
	Industrial digitisation	31.89 %	Number of Internet Top 100 companies	15.05%
			E-commerce sales as a share of GDP	4.91%
			Total telecommunication services	3%
			E-commerce purchases as a share of GDP	5.22 %
			Number of computers per 100 population	3.7%
	digital infrastructure	20.60 %	Internet penetration	2.54 %
			Internet access ports per capita	2 %
			Mobile phone base stations per capita	2.59 %
			Fibre optic cable line length	6.39 %
			Mobile phone penetration rate	7.08 %

The Digital Economy Index is a comprehensive index calculated by the TOP-SIS entropy weighting method based on the three first-level indicators listed above.

### 3.2.3. Mediating variables

Financial Environment (Fac). Drawing on the ideas of Qiu Kangquan[27] (2022), Tu Zhengge[28] (2022), and Zhang Sanbao[29] (2020), this paper examines the situation of the regional financial environment in five aspects: financial scale, financial regulation, financial risk, financial talent and financial openness. The financial scale reflects the overall level of regional financial development and the ability to provide financial support for local enterprises (Qiu Kangquan, 2022)[27]; good financial regulation can effectively maintain the order of the financial market, strengthen the financial market safeguard mechanism, regulate the market behaviour of financial subjects, reduce systemic financial risks and

safeguard the interests of market subjects. Financial risks are prone to disrupt the order of the financial market, increase market uncertainty, and affect the investment confidence of market subjects, which is not conducive to business operations. Financial talents are the hub connecting enterprises and financial institutions, and financial talents can improve the level of financial management, innovate financial products and financial services, and broaden financing channels for enterprises. Deepening financial openness is essential for high-quality financial development and an important measure for internationalising RMB, which can provide domestic enterprises with diversified financing channels. The financial environment index is obtained by using the TOPSIS entropy weighting method, and the financial environment data are from Wind database; the specific weights and indicators are selected as in Table 3:

**Table 3.** Weights and measures of the financial environment

Level 1 indicators	Secondary indicators	percentage	Measurement indicators	proportion
financial environment	Financial scale	42.24 %	Total stock market capitalisation/GDP	36.99 %
			Financial loans/deposits	5.25 %
	financial regulation	2.59 %	Expenditure on financial regulation	2.59 %
			non-performing loan ratio	3.86 %
	financial risk	3.86 %	Number of listed companies/employment	30.51 %
	financial talent	30.51 %	Financial OFDI stock/GDP	20.8 %
	financial liberalisation	20.8 %		

Government governance (Adm). The government is the organiser of fostering an open business environment. Initiatives such as reducing rent-seeking by the government, lowering the rate of government corruption, and improving fiscal transparency can effectively bring into play the market competition mechanism, motivate overseas enterprises to "come in", support domestic enterprises to "go out", and stimulate the inherent potential of service-oriented enterprises. This paper also refers Qiu Kangquan (2001), who has also referred Qiu Kangquan (2001). This paper also refers to Qiu Kangquan (2022), Tu Zhengge (2022), and Zhang Sanbao (2020) and constructs the index from the three perspectives of administrative intervention, government integrity, and fiscal budget. Although administrative intervention can protect domestic enterprises, especially infant industries, through subsidies, tax increases, and procurement, overprotection will

weaken the long-term competitiveness of enterprises and is not conducive to long-term growth. Government integrity can simplify administrative processes, reduce information asymmetry, effectively prevent industry monopolies, encourage fair market competition, and create an efficient and transparent market environment. With an abundant government budget, it can provide better public services and welfare protection for enterprises and the public, thus attracting talent, capital, technology and other high-quality elements into local enterprises and enhancing the competitiveness of service-oriented enterprises. This paper adopts the TOPSIS entropy weight method to construct the administrative environment index; the administrative environment data from the Wind database, the index's weight, and the measurement indexes are shown in Table 4.

**Table 4.** Weights and measures of the administrative environment

Level 1 indicators	Secondary indicators	percentage	Measurement indicators	proportion
Administrative environment	administrative intervention	14.62 %	Administrative fee income/fiscal revenue	7.98 %
			General budget expenditure/GDP	6.64 %
	Integrity in Government	32.14 %	Offences in office/number of persons in public office	10.92 %
			Fiscal transparency	21.22 %
	government support	53.24 %	Financial self-sufficiency rate	17.87 %
			Public administration, social security and social organisations/number of employees	16.31%
			Central subsidy income/fiscal revenue	19.06%

### 3.2.4. Control variables

This paper mainly adopts the following indicators as control variables: (1) human resources. This paper adopts regional years of education per capita to reflect the level of regional education; the higher the years of education, the better the labour force is educated, and the more competitive local trade is. Years of education of the population = (primary × 6 + junior high school × 9 + senior high school × 12 + secondary × 12 + junior college × 15 + undergraduate × 16 + postgraduate × 19) ÷ total population aged 6 years and above (2) Unemployment rate (UNE). An increase in the unemployment rate will affect regional economic development and is not conducive to enhancing the competitiveness of local trade. (3) Fixed investment. The competitiveness of regional trade comes from good productivity. Increasing fixed investment can update and upgrade enterprise equipment, plants, and infrastructure and enhance the ability of local enterprises to create new value.

This paper uses the logarithm of fixed investment to express the indicator. (4) Technological innovation. Advanced technology can empower all aspects of enterprise research and development, production, sales, and after-sales service, improve the efficiency of enterprise resource allocation, and save production and operation costs, thus directly affecting enterprise benefits. In this paper, we refer to Jinjing[30] (2021) and use the innovation conversion rate to express technological innovation; innovation conversion rate = the number of invention grants / patent grants. (5) Demographic structure. Aging or fewer children, on the one hand, will increase the pressure of labour dependency; on the other hand, will reduce the supply of labour and reduce the level of enterprise output and this paper uses the population dependency ratio to indicate the demographic structure, population dependency ratio = the number of persons under 18 and over 65 years of age / total population. All the above indicators are from the China Statistical Yearbook 2014-2021.

**Table 5.** Descriptive statistics for each variable

variant	norm	Indicator symbols	unit (of measure)	average value	Max	Min	standard error
explanatory variable	Competitiveness of trade in services	Inter	-	0.252	0.728	0.056	0.153
	Digital Economy Development Index	dig_eco	--	0.171	0.765	0.040	0.157
intermediary variable	financial service	Fac	-	0.249	0.968	0.095	0.148
	government governance	Adm	-	0.494	0.813	0.252	0.111
control variable	teach	Edu	-	9.267	12.782	7.474	0.897
	Innovation conversion rate	Ino	%	0.159	0.431	0.046	0.071
	dependency ratio	Rai	%	0.382	0.578	0.227	0.069
	fixed assets	LnFI	-	9.655	10.990	7.767	0.773
	unemployment rate	Une	%	3.222	4.6	1.2	0.635

## 4. Regression Results

Since the impact of the digital economy on the competitiveness of trade in services is a dynamic process and the competitiveness of trade in services may have an impact on the next period, this paper introduces the explanatory variable lagged by one period as an explanatory variable. However, this may generate endogeneity problems, and given the time-series nature of potential omitted variables, this paper uses one-step and two-step systematic GMM models to measure the mediating effect of the digital economy on the competitiveness of trade in services under the role of the financial and administrative environments.

### 4.1. Financial environment intermediation effects

In this paper, the two-step and one-step system GMM models are used as instrumental variables with service trade competitiveness and technological innovation lagged by two periods and the digital economy and financial environment lagged by one period, and the regression results are shown in Table 6. Among them, (1)-(3) indicate the two-step system GMM regression results, and (4)-(6) indicate the one-step system GMM regression results. The results in Table 6 show that the values of AR2 are all greater than 0.1, indicating that

there is no second-order regression autocorrelation of the explanatory variables, and the values of the Hansen test are all greater than 0.1, indicating that there is no over-identification of the instrumental variables, which proves that the adoption of the system GMM model is correct. Columns (1) and (4) indicate that the digital economy is significantly and positively correlated with the competitiveness of trade in services under the two-step and one-step system GMM models, with effect sizes of 0.878 and 0.857, respectively, proving that hypothesis H1 is correct. Columns (2) and (5) show that the digital economy significantly promotes financial services, with coefficient sizes of 0.607 and 0.651, respectively. Columns (3) and (6) show that both the digital economy and the financial environment have a significant positive impact on the competitiveness of trade in services, with coefficients of 0.709 and 0.671 for the impact of the digital economy and coefficients of 0.646 and 0.572 for the impact of the financial environment, respectively. The above results show that an  $a_1$  coefficient is positive,  $b_1 * c_2$  coefficient is positive and in the same direction as  $a_1$ , which proves that H2 is correct. There is a partial mediation effect of the financial environment, i.e., the digital economy optimises the financial services and improves the competitiveness of Le service trade. Prove that hypothesis H3 is correct.

**Table 6.** Regression results of digital economy, financial environment and trade in services competitiveness

variant	Ser (1)	Fac (2)	ser (3)	Ser (4)	Fac (5)	ser (6)
l.ser	0.635*** (3.07)		0.655*** (2.70)	0.602*** (2.96)		0.631** (2.33)
dig	0.878*** (4.79)	0.607** (2.19)	0.709** (2.04)	0.857*** (5.14)	0.651** (2.38)	0.671** (2.02)
Fac			0.646** (2.47)			0.572** (2.10)
Edu	-0.075** (-1.97)	0.032 (1.23)	-0.124*** (-3.48)	-0.076** (-2.03)	0.027 (0.93)	-0.121*** (-3.28)
Rai	0.002** (2.37)	0.0003 (1.35)	0.002** (2.53)	0.002** (2.46)	0.0003* (1.75)	0.002** (2.17)
LnFI	0.008 (0.48)	-0.017* (-1.65)	0.017 (1.08)	0.006 (0.39)	-0.023** (-2.23)	0.017 (0.93)
Inno	0.371** (2.00)	0.087 (1.01)	0.304** (1.98)	0.361** (2.19)	0.114 (1.41)	0.338** (1.97)
Une	0.039* (1.68)	-0.035** (-2.02)	0.072*** (2.72)	0.039* (1.81)	-0.031** (-2.35)	0.065** (2.26)
cons	0.358 (0.96)	0.106 (0.40)	0.492* (1.69)	0.400 (1.18)	0.184 (0.71)	0.526* (1.55)
AR(1)	0.025	0.011	0.033	0.006	0.012	0.006
AR(2)	0.648	0.744	0.538	0.631	0.811	0.599
Hansen-test	0.101	0.344	0.461	0.101	0.344	0.461
control variable	yes	yes	yes	yes	yes	yes
sample size	210	240	210	210	240	210

The above table indicates t-values in parentheses, and \*\*\*, \*\*, and \* indicate that the regression results are significant at the 1 per cent, 5 per cent, and 10 per cent levels, respectively. The following regression results are identical.

### 4.2. Mediating effects of government governance

In this section, with services trade competitiveness and technological innovation lagging two periods and digital

economy and financial services lagging one period as instrumental variables, Table 7 shows the results of the mediation effect regression of government governance. Columns (1) to (3) show the two-step system GMM results, and columns (4) to (6) show the one-step system GMM results. The results show that the coefficients of the Hansen test are all greater than 0.1, which passes the over-identification test, and the coefficients of AR2 are all greater than 0.1, indicating no second-order autoregression of the explanatory variables.

Columns (1) and (4) report the significant positive effect of the digital economy on the competitiveness of trade in services. Columns (2) and (5) indicate the existence of a positive effect of digital economy on government governance, with impact coefficients of 0.786 and 0.761, respectively. Columns (3) and (6) indicate that the digital economy and government governance have a significant positive effect on the competitiveness of trade in services, with the magnitude of the digital economy impact coefficients of 0.667 and 0.616,

respectively and the magnitude of the government governance impact of 0.383 and 0.39, respectively. In summary, all coefficients are positive, and  $b_1 \times c_2$  coefficients are positive. In the same direction as  $a_1$ , proving that H2 is correct, government governance has a mediating effect, proving that hypothesis H3 is correct, that is, the digital economy improves the competitiveness of trade in services by optimising government governance.

**Table 7.** Regression results for the digital economy, government governance and services trade competitiveness

variant	Ser (1)	Adm (2)	ser (3)	Ser (4)	Adm (5)	ser (6)
l.ser	0.635*** (3.07)		0.544*** (2.70)	0.602*** (2.96)		0.538** (2.41)
dig	0.878*** (4.79)	0.786** (3.57)	0.667*** (2.66)	0.857*** (5.14)	0.761** (3.98)	0.616** (2.45)
Adm			0.383** (2.55)			0.391*** (2.76)
Edu	-0.075** (-1.97)	-0.029 (-0.72)	-0.061 (-1.61)	-0.076** (-2.03)	-0.031 (-1.00)	-0.058* (-1.82)
Rai	0.002** (2.37)	-0.0003 (-0.73)	0.002** (2.06)	0.002** (2.46)	-0.0003 (-0.93)	0.002* (1.68)
LnFI	0.008 (0.48)	0.020* (1.76)	-0.0001 (-0.01)	0.006 (0.39)	0.022** (2.10)	-0.003 (-0.19)
Inno	0.371** (2.00)	0.139 (0.79)	0.173 (0.87)	0.361** (2.19)	0.141 (0.67)	0.174 (0.88)
Une	0.039* (1.68)	0.018 (0.92)	0.041** (2.12)	0.039* (1.81)	0.013 (0.67)	0.035* (1.79)
cons	0.358 (0.96)	0.358 (1.06)	0.212 (0.76)	0.400 (1.18)	0.381 (1.60)	0.229 (0.83)
AR(1)	0.025	0.000	0.021	0.006	0.000	0.003
AR(2)	0.648	0.353	0.404	0.631	0.363	0.409
Hansen-test	0.101	0.353	0.460	0.101	0.353	0.460
sample size	210	240	210	210	240	210

## 5. Robustness Tests

In order to exclude the potential impact of extreme values on the regression results, this paper adopts the upper and lower 1% shrinkage treatment of the data and uses the two-step system GMM model for regression, and the regression results of the mediating effect of the financial environment and the administrative environment are shown in Table 8. From the regression results in Table 8, after shrinking the tail by 1%, the digital economy still has a significant positive impact on the competitiveness of trade in services, and the

digital economy significantly promotes the competitiveness of trade in services. The coefficients of the digital economy on the financial environment and government governance are positive, while the digital economy, financial environment and government governance all promote service trade competitiveness. Therefore, the mediating effects of financial services and government governance still hold after shrinking the tail by 1 per cent, and the regression results confirm that the results of the base regression are correct.

**Table 8.** Regression results of shrinkage treatment

Variables	Ser (1)	Fac (2)	Ser (3)	Ser (4)	Adm (5)	Ser (6)
l.ser	0.595*** (2.82)		0.502** (2.09)	0.595*** (2.82)		0.517** (2.30)
dig	0.852*** (4.75)	0.609** (2.30)	0.720** (1.97)	0.852*** (4.75)	0.769*** (4.18)	0.622** (2.43)
Fac			0.661** (2.54)			
Adm						0.388** (2.63)
AR(1)	0.023	0.011	0.028	0.023	0.000	0.003
AR(2)	0.684	0.674	0.428	0.684	0.342	0.417
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
sample size	210	240	210	210	240	210

## 6. Conclusions and Policy Recommendations

### 6.1. Conclusion

This paper analyses the effect of the digital economy on the competitiveness of trade in services under dynamic conditions and explores the transmission paths of financial development and government governance by adopting a systematic GMM model and selecting the macroeconomic data of 30 provinces in China from 2013 to 2020. Through the above empirical tests, this paper obtains the following conclusions: first, at the level of direct effect, the development of digital economy does significantly improve the competitiveness of service trade. Second, through the test of the mediating effect on financial services, it is found that the digital economy improves financial services and significantly enhances the competitiveness of trade in services; third, through the test of the mediating effect on government governance, it is found that the digital economy improves the effectiveness of government governance and promotes the competitiveness of trade in services, which indicates that the digital economy accelerates the transformation of government governance, which does help to improve the competitiveness of service enterprises. Thus, this paper argues that the digital economy should be developed vigorously to release the full potential of digital technology, improve the efficiency of financial services and government governance, and help service-oriented enterprises to "go out" and "come in".

### 6.2. Policy recommendations

#### 6.2.1. Deepening the digital transformation of government governance

First, to promote the circulation of data, formulate rules and regulations for data market transactions, cultivate a standardised market system and market players, clarify the operational system, reduce the information cost of enterprises, and help them to formulate optimal plans. Second, it should continue to improve the performance of the integrated digital government platform, promote the integration of network and physical government, flexibly apply digital technologies and data elements, promote the level of government innovation, and reduce non-essential administrative processes for enterprises. Thirdly, the government should update digital infrastructure, promote the application of digital sharing equipment, and provide SMEs with services such as technical guidance, policy publicity, and declaration of incentives and subsidies so as to help service-oriented enterprises accelerate their digital transformation and cultivate their competitive advantages.

#### 6.2.2. Deepening the digitalisation of financial services

Financial talents are the core of promoting financial reform. Financial institutions can cooperate with universities or scientific research institutions, target the cultivation of talents by universities or scientific research institutions, and promote the transformation of industry, academia and research through research topics or projects; at the same time, the government should improve the treatment, incentives and welfare protection of digital financial talents. Secondly, the application of digital infrastructure in the financial field should be strengthened, investment education for enterprises and investors should be strengthened with the help of the

Internet, financial products should be innovated for service-oriented enterprises, and the quality of financial services should be upgraded to broaden financing channels for enterprises. Finally, it should improve the ability of wind control. With the help of digital technology to develop enterprise credit self-certification, reduce the burden of corporate secured financing, and strengthen digital financial supervision, especially in the algorithms, user privacy, transaction records and other aspects of the supervision, to ensure that the security of corporate financing at the minimum cost.

#### 6.2.3. Facilitating the process of digital law regulation

The legal system is a guarantee to promote the development of the digital economy, and digital laws should not be absent or out of place to create a fair and orderly market environment for service enterprises. First, based on the technical characteristics and potential risks of algorithms, prevent others from taking advantage of the loopholes in the rules to seize undue benefits; second, improve the regulations of Internet platforms, strengthen the mechanism of rights protection, reduce the threshold of market access, encourage small and medium-sized enterprises to move into the platforms. Secondly, the government should improve Internet platform regulations, incredibly clarifying property rights and data security, strengthening the rights protection mechanism, lowering the market access threshold, encouraging small and medium-sized enterprises to move into the platform. Thirdly, the government should consider the interests of enterprises and consumers open a multi-channel interconnection and interoperability regulatory mechanism to comprehensively safeguard the interests of individual users and enterprises to create a favourable environment for the convergence of the digital economy and trade in services.

## References

- [1] Yao Zhanqi. The multiple impacts of digital economy on China's foreign trade competitiveness[J]. Research on Financial Issues,2022(01):110-119.
- [2] Shan Shuangshuang, Dai Yundi. The development path and optimisation strategy of export trade transformation under the background of digital economy[J]. Business and Economic Research,2022(10):150-153.
- [3] TAO Aiping, ZHANG Zhen. The impact of digital economy on the development of trade in services--an empirical study based on country-level panel data [J]. East China Economic Management, 2022, 36(05):1-14.
- [4] Tan Haofang, Zhang Shoufu. Digital new infrastructure, financial resource allocation and economic high-quality development[J/OL]. Journal of Yunnan University for Nationalities (Philosophy and Social Science Edition):1-9[2022-12-31].
- [5] WANG Jingyong, SUN Tong, LI Pei, GONG Yuxuan. Digital transformation and corporate financing constraints - Empirical evidence based on listed SMEs [J]. Science Decision, 2022 (11): 1-23.
- [6] Ma Hongxia, Zhang Guanglei. The impact of the level of financial development on the export structure of trade in services[J]. Hunan Forum,2016,29(06):68-75.
- [7] LI Huamin, HUANG Juan, LIU Hui. Spillover effects of financial development on the export structure of services trade--an empirical study based on the export complexity algorithm[J]. Economy and Management,2014,28(01):84-89.

- [8] ZHAO Jianhua, DU Chuanhua. Analysis of the mechanism, dilemma and way out of the digital economy to promote the change of government governance[J]. Theory Exploration, 2022 (02): 154-158.
- [9] Xie Danyang, Yan Chao, Shen Qin. The level of government governance and trade in services-Evidence from cross-country panel data[J]. Comparison of Economic and Social Systems, 2018 (06): 86-95.
- [10] FENG Zongxian, LU Huixin, GUO Genlong. Services trade policy and manufacturing productivity: The role of government governance [J]. Contemporary Finance and Economics, 2018 (07): 90-98.
- [11] Li, Shiao-Le. Anti-corruption, contracting and service industry development[J]. Industrial Economics Review, 2017, 8(03): 96-108.
- [12] Cao Xiaoyong, Li Siru. Research on Opportunities, Challenges and Paths of Transformation of Service Industry Driven by Digital Economy--Based on the Perspective of New Development Pattern of Domestic and International Double Cycle[J]. Journal of Hebei University of Economics and Trade, 2021, 42(05): 101-109.
- [13] Yang, S.. An empirical study on the relationship between financial development and trade in services in China: 1982-2007[J]. Financial Development Research, 2009(05): 12-16.
- [14] Feng Yujing, Zhai Liangliang, Li Fumin. Reform of security interest system, financing constraints and domestic value-added rate of exports of manufacturing enterprises[J]. International Trade Issues, 2022(04): 125-141.
- [15] YANG Lianxing, ZHANG Jie, JIN Qun. Financial development, financing constraints and the ternary margin of corporate exports[J]. International Trade Issues, 2015(04): 95-105.
- [16] Zhang Mingxin, Xie Shenxiang, Qiang Haofan, Zheng Lekai. Digital inclusive finance and micro and small enterprise exports: A gift in the snow or icing on the cake[J]. World Economy, 2022, 45(01): 30-56.
- [17] Xie Danyang, Yan Chao, Shen Qin. The level of government governance and trade in services-Evidence from cross-country panel data[J]. Comparison of Economic and Social Systems, 2018 (06): 86-95.
- [18] XU Xiujun, LIN Kaiwen. Global economic governance change and China's strategy in the digital era[J]. International Studies, 2022(02): 85-101+156.
- [19] Liu Yunliang. Legal ways to optimise business environment in free trade port with Chinese characteristics[J]. Social Science Journal, 2021(01): 189-194.
- [20] YU Wenchao, LIANG Pinghan. Uncertainty, business environment and private enterprise business vitality[J]. China Industrial Economy, 2019(11): 136-154.
- [21] Merhi M I, Ahluwalia P. Digital Economy and Corruption Perceptions: A Cross-Country Analysis [J]. International Journal of Digital Accounting Research, 2018, 18.
- [22] Doidge C, Karolyi G A, Stulz R M. Why are foreign firms listed in the US worth more?[J]. Journal of financial economics, 2004, 71(2): 205-238.
- [23] Zhang Mingxin, Xie Shenxiang, Qiang Haofan, Zheng Lekai. Digital inclusive finance and micro and small enterprise exports: A gift in the snow or icing on the cake[J]. World Economy, 2022, 45(01): 30-56.
- [24] Liu Yaping, Li Xue. Digital regulatory capacity: concept definition, path analysis and practice evolution[J]. Journal of Sun Yat-sen University (Social Science Edition), 2022, 62(06): 176-188.
- [25] Wang Xingli. An empirical study on the international competitiveness of China's trade in services--Based on the comparison between China and the United States[J/OL]. Price Monthly: 1-11 [2022-12-31].
- [26] Fan Yiman, Xu Hao. Can China's digital economy development lead to economic greening? --Empirical evidence from China's inter-provincial panel data[J]. Exploration of Economic Issues, 2021 (09): 15-29.
- [27] Qiu Kangquan, Chen Jing, Lv Yanqin. Measurement, Regional Differences and Dynamic Evolution of China's Comprehensive Development Level of Business Environment[J]. Research on Quantitative and Technical Economics, 2022, 39(02): 121-143.
- [28] Tu Zhengge, Cheng Long, Zhang Mu. A study on regional differences and spatial and temporal evolution characteristics of China's business environment[J]. Research on Quantitative and Technical Economics, 2022, 39(07): 3-25.
- [29] Zhang Sanbao, Kang Bicheng, Zhang Zhixue. Evaluation of business environment in Chinese provinces: index system and quantitative analysis [J]. Economic Management, 2020, 42 (04): 5-19.
- [30] Jin Jing. Research on the impact of technological innovation on industrial energy efficiency in China[D]. Wuhan University of Science and Technology, 2021.