

# A study on the development of the digital economy to international trade

Xinyun Hu

## ABSTRACT

Global trade, as a crucial link connecting production and consumption across different regions, plays a vital role in the era of the digital economy. The rise of the digital economy has injected new vitality into global trade and propelled its high-quality development. This holds significant importance and far-reaching implications for enhancing circulation efficiency, competitiveness, establishing a unified national market, and achieving the “dual circulation” new development pattern. Therefore, this paper aims to evaluate the impact of digital economic development on the high-quality development of global trade by utilizing China’s import and export volume and digital economy index from 2018 to 2022 as the dependent and independent variables, respectively, with Gross Domestic Product (GDP) serving as the intermediary variable.

**Keywords:** Digital Economy, International Trade, DEI, Total Export-import Volume.

## 1. Introduction

With the continuous advancement of Internet technology, there has been innovation in economic operations and development methods, driving the sustained prosperity of the digital economy. Digital trade has become a focal point in global market competition. Particularly, in the face of the impact of the COVID-19 pandemic, digital trade has demonstrated remarkable resilience, with its advantage of being unconstrained by time and space increasingly prominent, becoming a vital driving force for global economic recovery. In 2022, the total value of global merchandise trade reached \$24.7 trillion, a growth of 8.9% compared to 2021. The total value of service trade was approximately \$7 trillion, experiencing a growth of about 15%. Global trade reached a historic high of \$32 trillion in 2022. China’s merchandise trade surplus reached a record high of \$877.781 billion, accounting for nearly 90% of the global trade surplus. As the largest country with a trade surplus, China’s trade surplus far surpasses other countries, showcasing its strong competitiveness and resilience in global manufacturing and exports. As one of the most vibrant sectors in China’s economic development, the digital economy continues to expand its integration with various sectors of the economy and society, playing a significant role in stimulating consumption, driving investment, and creating employment opportunities. From an international perspective, the World Trade Organization released the “World Trade Report 2020,” focusing on policies that promote innovation in the digital era. The report highlights that increasing governments have adopted policies to promote economic innovation and technological progress, which has impacted trade and regulations. The COVID-19

pandemic has also accelerated the development of e-commerce and digital innovation.

Moreover, the development of global digital trade is characterized by imbalance and is currently in its early stages, with developed economies holding a dominant position. On the one hand, digital trade is a rich and nuanced new form compared to traditional trade. It relies on the development of the digital economy and differs from traditional trade without completely overturning it. Behind the competition in digital trade lies a comprehensive contest among countries regarding technology, talent, market, infrastructure, and other factors. It is crucial to address questions regarding the competitiveness of China’s digital trade and the factors that influence it to take targeted measures to promote the development of digital trade in our country.

On the other hand, the pattern of world trade development is also imbalanced, and the same applies to digital trade. Developed countries, leveraging their economic and technological advantages, occupy a superior position regarding the overall scale of digital trade and establishing rules. Developed economies, represented by the United States, were the earliest to research digital trade and have been the most proactive proponents of digital trade regulations worldwide. Conversely, developing economies generally lag in their level of digital economy and research on digital trade compared to developed economies, resulting in significant disparities between them. However, this does not mean that some developing countries will continue to lag behind developed countries in future development. Digital trade, as a new product of integrating digital technology into international trade, is still in its early stages. Developing countries still have the opportunity to seize the development of digital trade

and achieve a position of advantage. For example, despite being a developing country, India holds a leading position in fields such as computer science, surpassing many developed countries. Since computers are an essential enabler for developing digital trade, India has a significant advantage. Therefore, studying the international competitiveness of China's digital trade not only helps to understand our country's real position and situation in global digital trade development but also facilitates learning from the digital trade development experiences of other developed countries, providing valuable insights for developing countries to enhance their digital trade competitiveness.

## 2. Literature Review

### 2.1 Concept of the Digital Economy

The concept of the digital economy was formally introduced by American scholar Tapscott (1996), known as the "father of the digital economy." Since then, many scholars and research institutions have attempted to define the digital economy from various perspectives. Teo (2001) believes that the core of the digital economy lies in the digitization of information, which has become possible with the continuous development and popularization of internet technology, leading to further advancements in the digital economy[1]. Weber (2010) proposes that digital products are at the heart of digital trade, which essentially involves the commercial activities of transmitting digital products and services through electronic means such as the Internet [2]. Zhang et al. (2019) argue that humanity is undergoing the third technological revolution based on the Internet, which has a significant and far-reaching impact on efficiency and fairness. China, in particular, has greatly benefited from the Internet revolution, resulting in rapid digital economy and finance development [3]. The digital economy represents the combination and development of the economy and the Internet. As the most active sector in China's economic development, the digital economy continues to expand its breadth and depth of integration with various economic and social domains, playing a crucial role in stimulating consumption, driving investment, and creating employment opportunities[4]. Ma & Pan (2020), in examining the transformation of global trade during the pandemic, propose that modern digital trade is characterized by platformization, globalization, and personalized digitization, representing an advanced form of e-commerce development[5]. Digitalization refers to transforming information into digital form or encoding digital transmission into discrete signals or pulses. Consequently, the digital economy encompasses economic activities based on digital technology, including

e-commerce and producing and marketing electronic products and services. It enhances the efficiency and transparency of production processes and service provision [6].

### 2.2 Research on Global Trade Development

Multiple factors determine and influence international trade, including supply, demand, and market structure factors of supply and demand [7]. For the development of global trade, factors such as tariff barriers, transportation costs, and labor prices are all core factors affecting its development in a study on global trade tariffs. Drake (2013) focused on carbon tariffs. China's export market heavily relies on the United States and the European Union, and its export products have relatively high carbon intensity, so the imposition of carbon tariffs would significantly impact China's export trade. The study evaluates carbon tariffs' overall and sectoral impacts on China's export trade. When engaging in global trade, countries face various costs, among which transportation costs are a key factor [8].

Meanwhile, many countries prefer establishing factories in countries and regions with lower labor costs [9]. With the development of internet technology, the pattern and trends of global trade have changed. The integration of global trade and the Internet has become a reality. Wu (2000) pointed out that the proportion of e-commerce in trade will continue to increase and may even become the major mode of global trade, representing the future direction of trade development[10]. The widespread application of the Internet has become a driving force for reshaping the political, economic, and social development of both the global community and individual countries, leading to changes in economic structure, economic operation modes, and economic growth patterns[11].

Using panel data from 192 countries (regions) with trade relations with China, Wen et al. (2015) empirically demonstrated that e-commerce promotes the development of China's foreign trade. Specifically, a 1% increase in internet users between China and its trading partners leads to a 0.33% increase in mutual import and export volume, and the application of e-commerce weakens the negative impact of geographical distance on foreign trade. The current digital economy has once again brought innovation to the development model of global trade[12]. Qian et al. (2020), in their analysis of the impact of digital economic development on employment structure and quality, found that digital economic development helps optimize employment structure, further enhances labor compensation and labor protection, and promotes continuous improvement in the employment environment and increasing employment capabilities, providing new

opportunities for higher-quality employment[13].

### **2.3 The Impact of Digital Economy on Global Trade Development**

Wang et al.(2015) believe that the digital economy is a new industry that develops based on the information industry and through deep integration with traditional industries. The traditional three major industries remain the mainstay, but the difference lies in the digital economy undergoing technological upgrades and transformations, leading to significant improvements in productivity[14]. Chen (2020) incorporates the digital economy and trade openness into the theoretical analysis framework. Using panel data from 53 countries along the “Belt and Road” from 2007 to 2016, an empirical model is constructed to analyze the role of digital economy development and trade openness in economic growth. The empirical results demonstrate that the level of digital economy development has a positive impact on economic growth. Based on the logical relationship between the digital economy, technological innovation, and high-quality development[15].Song(2020) constructs a theoretical framework for analyzing the mechanism of the digital economy’s impact on high-quality development. Using 31 provincial-level administrative regions in China as research samples and collecting panel data for five consecutive years from 2014 to 2018, the results show that the digital economy (both direct and indirect effects) promotes high-quality development and technological innovation, with the direct effect being more significant than the indirect effect[16]. Xia and Ni (2021), through a systematic study of the scope estimation of digital trade and international games, find that promoting high-quality development of digital trade in China should start from cultivating a sound digital factor market system, enhancing two-way openness in the e-commerce field, actively participating in the formulation of digital trade rules, initiating the construction of a digital trade statistical system, and improving the digital trade development ecosystem[17].

## **3. Method**

### **3.1. Participants**

This paper aims to investigate the digital economy’s contribution to economic development and explore indicators for measuring the development of China’s digital economy. In the process of China’s digital economy development, the Digital Economy Index (DEI) is widely used to assess its level of development. Therefore, this study selects DEI as the indicator for measuring the development of China’s digital economy. Additionally,

China’s import and export volumes have been increasing yearly, effectively reflecting the development of China’s global trade. Hence, we choose China’s total import and export volume to measure China’s international trade.

This study will use statistical analysis methods to conduct in-depth research and analysis of the collected data to understand the relationship between China’s digital economy development and economic growth. We believe that through these research findings, we can provide valuable references and recommendations for further developing China’s digital economy.

### **3.2. Materials**

The selected explanatory and dependent variables in this study cover the period from 2018 to April 2023. The dependent variable is China’s total import and export volume, while the explanatory variable is the Digital Economy Index (DEI). In the analysis process, we consider China’s gross domestic product as a mediating variable and control for the influence of the consumer price index and the exchange rate between China and the United States.

Through the study of these variables, we hope to reveal the contribution of the digital economy to China’s economic development and examine the effectiveness of the Digital Economy Index in evaluating China’s digital economy development. At the same time, we also aim to examine the relationship between China’s international trade level and the digital economy to gain a deeper understanding of the impact of the digital economy on trade activities.

## **4 MODELING**

### **4.1 Sample Selection**

#### **4.1.1 Explained variable**

There is a close relationship between China’s global trade and its total import and export volume. The total import and export volume of China serves as an important indicator for measuring the scale and activity level of China’s international trade. With rapid economic growth and the advancement of reforms and opening up, China’s total import and export volume has shown a continuous upward trend. As one of the world’s largest trading nations, China has a significant export and import scale and plays an important role in the global market.

China’s export and import trade is crucial in developing its economy. China’s exports cover various industries, including machinery and electronic products, high-tech products, textiles, and household appliances. China’s manufacturing strength and competitiveness enable it to meet the global market demands and gain wide

recognition in the international market.

At the same time, China's import trade is also growing continuously. China's demand for raw materials, energy resources, and technological equipment has increased, and the variety of imported products has diversified. Through imports, China can obtain the necessary resources and technological support to promote developing and upgrading domestic industries. The relationship between China's global trade and total import and export volume is mutually reinforcing. China's extensive export activities bring in a substantial amount of foreign exchange income, promoting the development of domestic industries and employment growth. These foreign exchange earnings can then be used to purchase imported goods and technologies, meeting domestic demands and enhancing productivity.

Furthermore, the development of global trade also promotes economic cooperation and exchanges between China and other countries and regions. China actively participates in regional and international trade agreements, strengthening trade cooperation with other countries and promoting deepening the global value chain.

However, the uncertainty of the global trade environment and the rise of trade protectionism may have certain impacts on China's total import and export volume. The Chinese government will continue to adopt proactive policy measures to facilitate trade, expand import markets, enhance competitiveness, and address challenges and risks.

In conclusion, there is a close correlation between China's global trade and total import and export volume, with mutual promotion. As an important participant and driver of global trade, China will continue to strengthen trade cooperation and promote global trade's prosperity and sustainable development.

### **4.1.2 Explanatory variable**

The Digital Economy Index (DEI) is a key indicator that evaluates the level of digital economy development in a country or region. It incorporates various indicators and data, such as internet penetration rate, e-commerce development, digital technology application, and digital innovation capability. A higher DEI value signifies a more mature and active digital economy. This is associated with widespread adoption of digital technologies, robust digital infrastructure, and a well-developed digital ecosystem. The digital economy's development and the DEI index's improvement mutually reinforce each other. These positive impacts include economic growth, employment opportunities, social development, and international competitiveness.

The digital economy enhances productivity and innovation, leading to economic growth. It enables more

efficient commercial activities, expands market coverage, and creates new business models and opportunities. Additionally, the digital economy creates new jobs and entrepreneurial opportunities, driving the growth of emerging industries and services. It offers more choices for employment and entrepreneurial platforms. Moreover, the digital economy positively impacts various sectors of society. Increased use of digital technologies improves information acquisition and dissemination efficiency, enhances people's quality of life, and promotes development and improvement in education, healthcare, transportation, and other fields. Furthermore, the digital economy enhances a country's or region's international competitiveness by providing businesses with global market opportunities, expanding import-export scope, and strengthening their position and influence in the global economy.

### **4.1.3 Mediating variable**

*China's gross domestic product (GDP) plays a crucial role as a mediating variable in the impact of the digital economy on China's global trade.*

*Firstly, the rapid development of the digital economy directly influences China's GDP growth, indirectly affecting its global trade. A higher GDP level in China signifies a larger economic scale and higher productivity, enhancing its competitiveness in global trade. The robust growth of the digital economy drives the expansion of related industries, including e-commerce, internet finance, and technological innovation, further fueling China's GDP growth. Secondly, the rapid development of the digital economy increases the Chinese people's income levels and consumption capabilities. The increased demand for various goods and services by Chinese consumers promotes global trade growth. A higher GDP level implies that more people have the ability to purchase imported goods, further driving the expansion of international trade. The development of the digital economy positively impacts China's investment environment. The application and innovation of digital technologies attract domestic and foreign investment, fostering the development of various industries. This investment activity further stimulates China's GDP growth and strengthens global trade connections through trade interactions with other countries. The Chinese government actively promotes the development of the digital economy and has implemented a series of supportive policies. These policies encourage innovation, strengthen the development of digital infrastructure, and cultivate the digital economy industry. With the support of these policies, China's digital economy has experienced further growth, contributing to its GDP. China's GDP, as a mediating variable, reflects factors*

such as economic scale, consumption capacity, investment environment, and government policy support in the impact of the digital economy on global trade. These factors collectively play a significant role in shaping the relationship between the digital economy and global trade.

**4.1.4 Control variable**

Changes in exchange rates directly impact the prices of China’s exports and imports. When the exchange rate appreciates, Chinese exports become more expensive while imports become cheaper. Conversely, when the exchange rate depreciates, exports become more competitive while imports become more expensive. By controlling the exchange rate, the influence of the digital economy on China’s global trade can be separated, allowing for more accurate research. Furthermore, exchange rate fluctuations can be utilized to adjust international trade imbalances. If China has a significant trade surplus, the exchange rate can be adjusted to encourage more imports and reduce trade imbalances.

Conversely, if a large trade deficit exists, the exchange rate can be adjusted to enhance export competitiveness. Additionally, exchange rate movements also impact foreign investment in China. An appreciation in the exchange rate attracts foreign investors as they can purchase Chinese assets with less of their currency. Conversely, a depreciation in the exchange rate may hinder foreign investors as they need to pay more of their currency to acquire Chinese assets. By controlling the exchange rate, the impact of the digital economy on China’s global trade can be studied independently, without being influenced by foreign investment. In conclusion,

treating the exchange rate as a control variable helps researchers accurately analyze the effects of the digital economy on China’s global trade, eliminating the interference of exchange rate fluctuations on trade prices, trade imbalances, and foreign investment.

The Consumer Price Index (CPI) is a crucial control variable in studying the impact of the digital economy on global trade. Firstly, it reflects a country’s or region’s inflation levels by measuring consumer price fluctuations. By controlling the CPI, researchers can isolate the influence of the digital economy from inflation, allowing for a more accurate analysis of the independent impact of the digital economy on global trade. Secondly, the CPI serves as a measure of changes in consumers’ purchasing power, considering the cost variations in purchasing goods and services. As the digital economy develops, it can affect consumers’ purchasing capacity and behavior. Controlling the CPI enables researchers to eliminate disturbances caused by price fluctuations and better examine the digital economy’s impact on global trade. Lastly, the CPI can also indicate changes in consumer behavior and demand for different goods and services. With the evolving digital economy, consumer preferences and consumption patterns may shift. By controlling the CPI, researchers can conduct a more precise study on the relationship between the digital economy, the demand and supply of various goods and services, and their influence on global trade.

**4.2 Research model**

Based on the previous discussion, the research variables of this article are as follows:

**Table 4-1 Variable Interpretation**

Variable type	Variable	Symbol/Definition
Explained Variable	Current Gross Value of Import and Export	GIE
Substitution variable	Current Gross Export Value	GE
Explanatory variable	Digital economy index	DEI
Mediating variable	Gross domestic product	GDP
Control variable	Consumer price index	CPI
	Exchange rate	ER

To examine the relationship between digital transformation and China’s global trade, and to investigate the direct impact of the digital economy on China’s international trade, the regression model constructed in this paper is as follows:

$$IE_t = \beta_1 Digital_t + \sum \beta_m C_t + \beta_0 + \varepsilon_t \tag{4-1}$$

The dependent variable is China’s total import and export volume (IE<sub>t</sub> represents China’s total import and export volume in year t), the explanatory variable is the digital economy index (Digital<sub>t</sub> represents China’s digital economy index in year t), and the intermediate variable is Gross Domestic Product (GDP<sub>t</sub> represents China’s Gross

Domestic Product in year t),  $\beta_0$  is a constant term,  $\varepsilon$  The residual term,  $C_t$  is the sum of various control variables,  $\beta_M$  is the regression coefficient of the control variable.

## 5 RESULTS

This chapter tests the digital economy index (DEI) by using descriptive statistical analysis of variables, correlation analysis, regression analysis, intermediary testing, and robustness analysis; GDP (100 million yuan); CPI; Exchange rate; The correlation between variables such as the current value of total import and export value (in thousands of US dollars). Firstly, the purpose of understanding the basic characteristics of the main variables is obtained through descriptive statistical analysis of the variables. Secondly, through relevant analysis, the research hypothesis of this article is preliminarily verified. Furthermore, through regression analysis, examine the current value of total export value (in thousands of US dollars); Digital Economy Index (DEI); GDP (100 million yuan); The impact relationship between variables such as CPI exchange rate. Then, a Mesomeric effect model is established to explain the intermediary

effect of GDP (100 million yuan) between the digital economic index DEI and the current total import and export value (thousand dollars). Finally, robustness testing is conducted by replacing the core dependent variable, the current value of the total export value (in thousands of US dollars). Further, obtain the empirical research results of this article.

### 5.1 Descriptive Statistics and Analysis

This article obtained 64 current values (in thousands of US dollars) related to the total import and export value through screening; Digital Economy Index (DEI); GDP (100 million yuan); CPI; The full sample data related to exchange rate variables is analyzed through descriptive statistics using SPSS26.0 data analysis software. Descriptive statistics for various measurement indicators are mainly described from the minimum, maximum, average, standard deviation, skewness, and kurtosis of each variable to understand the significant impact relationship brought by China's digital economy. Firstly, the descriptive statistics of each variable are obtained, as shown in Table 5.1.

**Table 5.1 Descriptive Statistics and Analysis**

	N	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
DEI	64	358	686	512.97	85.90	-.116	-1.050
GDP(Billion)	64	202036	335508	265256.38	36441.93	.037	-.697
GIE	64	266320173	586534153	441818442.48	76388696.98	.214	-.914
GE	64	135200630	340498780	246341301.31	48796827.77	.256	-.895
CPI	64	99	101	100.15	0.54	-.133	-.081
ER	64	6	7	6.73	0.27	-.135	-1.290

Through descriptive statistics, we can find that:

- (1) From the perspective of the digital economy index DEI, among the 64 valid samples surveyed, the minimum value of the digital economy index DEI is 358, the maximum value is 686, and the average value is 512.97. Overall, China's digital economy index DEI is at a relatively high level. The data results also fully reflect the important proportion of the digital economy index (DEI) in China's GDP growth, and China attaches great importance to transforming the digital economy.
- (2) From the perspective of GDP (100 million yuan), among the 64 valid samples surveyed, the minimum value of GDP (100 million yuan) is 202036, the maximum value is 335508, and the average value is 265256.38. Overall, China's GDP (100 million yuan) growth rate is relatively fast. The data results also fully reflect that China's economy is in a period of rapid development. It

is necessary to further explore the influencing factors of China's GDP growth (in billions of yuan).

- (3) From the perspective of the current value of total import and export value (in thousands of US dollars), among the 64 valid samples surveyed, the minimum value of the current value of total import and export value (in thousands of US dollars) is 266320173 thousand US dollars, the maximum value is 586534153 thousand US dollars, and the average value is 441818442.48. Overall, China's total import and export value (in thousands of US dollars) has grown rapidly in the current value. The data results also fully reflect that China's import and export volume accounts for a high proportion. The import and export economy plays an important role in China's economic development.
- (4) From the perspective of the current value of total export value (in thousands of US dollars), among the 64

valid samples surveyed, the minimum value of the current value of total export value (in thousands of US dollars) is 135200630 thousand US dollars, the maximum value is 340498780 thousand US dollars, and the average value is 246341301.31. Overall, the growth rate of China's current value of total export value (in thousands of US dollars) is relatively fast. The data results also fully reflect that China's export volume accounts for a high proportion. The export economy plays an important role in China's economic development.

(5) From the perspective of CPI, among the 64 valid samples surveyed, the minimum value of CPI is 99, the maximum value is 101, and the average value is 100.15. Overall, there is a certain degree of change in the price level of consumer goods and services purchased by Chinese households. Still, the amount of change is relatively small, which is related to the annual span of teaching and the impact of the epidemic in recent years.

(6) From the perspective of the exchange rate, among the 64 valid samples surveyed, the minimum value of the exchange rate is 6, the maximum value is 7, and the average value is 6.73, which is consistent with the current social situation.

### **5.2 Correlation analysis**

To empirically test the current total import and export value in thousands of US dollars among 64 valid samples; Digital Economy Index (DEI); GDP (100 million yuan); CPI; The correlation between variables such as exchange rates. This article first uses the Pearson correlation integral method to verify the correlation between various variables. In correlation analysis tests, the correlation coefficient  $r$  and significance  $p$  are usually combined to determine the correlation between two variables. According to academic regulations, when  $r > 0$ , it indicates a positive correlation between the two variables, and when  $r < 0$ , it indicates a negative correlation between the two variables.

The Pearson correlation analysis results are shown in Table 5.2. Firstly, the correlation coefficient between the digital economy index DEI and GDP (billion yuan) is -0.099 and insignificant at the  $P < 0.05$  significance level.

Therefore, there is no correlation between the digital economy index DEI and GDP (billion yuan). To further test the relationship between the digital economy index DEI and GDP (billion yuan), this article will further explore the "U" shaped relationship between the digital economy index DEI and GDP (billion yuan). Therefore, this article introduces the square of the digital economy index DEI into the equation in regression analysis. Secondly, the correlation coefficient between the digital economy index DEI and the current total import and export value (in thousands of US dollars) is -0.068. It is not significant at the  $P < 0.05$  significance level. Therefore, there is no correlation between the digital economy index DEI and the current total import and export value (in thousands of US dollars). To further test the relationship between the digital economy index DEI and the current value of total import and export value (in thousands of US dollars), This article will further explore the "U" shaped relationship between the digital economy index (DEI) and the current value of total import and export value (in thousands of US dollars). Therefore, this article introduces the square of the digital economy index DEI into the equation in regression analysis. Furthermore, the correlation coefficient between GDP (in billions of yuan) and the current value of total import and export value (in thousands of dollars) is 0.829, which is significant at the  $P < 0.01$  significance level. Therefore, there is a significant positive correlation between GDP (in billions of yuan) and the current total import and export value (in thousands of dollars).

From the above correlation analysis and research results, it can be seen that there is a significant positive correlation between GDP (in billions of yuan) and the current value of total import and export value (in thousands of US dollars). To further explore the "U" shaped relationship between the digital economy index DEI and GDP (in billions of yuan) and the current value of import and export value (in thousands of dollars), it is worth further regression analysis to verify the impact relationship between each variable.

**Table 5.2 Correlation variable analysis results**

Variable	(1)	(2)	(3)	(4)	(5)	(6)
DEI	1					
GDP	0.091	1				
CPI	-0.090	-0.095	1			
ER	.356**	0.047	-0.045	1		
GIE	-0.099	.829**	-0.097	-0.203	1	
GE	-0.068	.850**	-0.074	-0.146	.987**	1

**5.3 Regression result analysis**

Based on the data analysis software SPSS26.0, this article constructs a regression model for the collected 64 valid data, thereby organizing the impact relationship between China’s digital economy index (DEI), GDP (in billions of yuan), and the current value of import and export value (in

thousands of dollars).

**5.3.1 Regression Analysis of Digital Economy Index DEI and Current Value of Import and Export Value**

The regression analysis results of the digital economy index DEI and the current value of total import and export value are shown in Table 5.3:

**Table 5.3 Regression Analysis Results of Digital Economy Index DEI and Current Value of Import and Export Value**

Variable	Dependent variable The current value of the total import value					
	Model 1		Model 2		Model 3	
	Beta	T	Beta	T	Beta	T
DEI			3.741*	2.484	4.749**	3.143
DEI <sup>2</sup>			-3.852*	-2.558	-4.774**	-3.180
CPI	-.106	-.849			-.147	-1.243
ER	-.208	-1.665			-.287*	-2.230
Observations	64		64		64	
Adj R <sup>2</sup>	0.021		0.076		0.137	
F	1.686		3.604*		3.510*	

Note: 1. \* \* \*, \* \* and \* respectively represent significance levels of 1%, 5%, and 10%;

(1) Model 1 is a regression test result using CPI and exchange rate as independent variables and the current total import and export value as the dependent variable. The data results show that neither CPI nor exchange rate significantly impact the current value of total import and export value.

(2) Model 2 is a regression test result using the digital economy index DEI and the square term of the digital economy index DEI as independent variables and the current import and export value as the dependent variable. The results show that: firstly, based on the results of the F-test (F=3.604; P=0.033 < 0.05), it fully shows that the model built in this paper is generally significant and effective. Secondly, through R<sup>2</sup>=0.076, it can be seen that the digital economy index DEI and the square term of the digital economy index DEI explain the degree of variation of 7.6% in the current total import and export value. Finally, through the influence coefficient and significance, it can be seen that the influence coefficient of the digital economy index DEI on the current value of total import and export value is 3.741, which is significant at the P<0.05 significance level. The influence coefficient of the square term of the digital economy index DEI on the current value of total import and export value is -3.852, which is significant at the P<0.05 significance

level. Therefore, the digital economy index DEI has a significant inverted U-shaped relationship with the current total import and export value.

(3) Model 3 is a regression test result that takes CPI and exchange rate as control variables, the digital economy index DEI and the square term of the digital economy index DEI as independent variables, and the current value of import and export value as the dependent variable. The results show that: firstly, based on the results of the F-test (F=3.510; P=0.012 < 0.05), it fully shows that the model built in this paper is generally significant and effective. Secondly, through R<sup>2</sup>=0.137, it can be seen that CPI; Exchange rate, The digital economy index DEI and the square term of the digital economy index DEI explain the degree of variation of 13.7% in the current value of the total import and export value. Finally, through the influence coefficient and significance, it can be seen that the influence coefficient of the digital economy index DEI on the current value of total import and export value is 4.749, which is significant at the P<0.05 significance level. The influence coefficient of the digital economy index DEI’s square term on the current total import and export value is -4.774, which is significant at the P<0.05 significance level. Therefore, the digital economy index DEI has a significant inverted U-shaped relationship with



the current total import and export value. The coefficient of influence of the exchange rate on the current total import and export value is -0.287, which is significant at the P<0.05 significance level. Therefore, the exchange rate has a significant negative impact on the current value

of total import and export value.

**5.3.2 Regression Analysis of Digital Economy Index DEI and GDP**

The regression analysis results of the digital economy index DEI and GDP are shown in Table 5.4

**Table 5.4 Regression Analysis Results of Digital Economy Index DEI and GDP**

Variable	Dependent variable The current value of the total import value					
	Model 4		Model 5		Model 6	
	Beta	T	Beta	T	Beta	T
DEI			4.410**	2.968	4.770**	3.076
DEI <sup>2</sup>			-4.333**	-2.917	-4.678**	-3.037
CPI	-.094	-.734			-.125	-1.031
ER	.042	.333			-.076	-.575
Observations	64		64		64	
Adj R <sup>2</sup>	-0.022		0.101		0.091	
F	0.337		4.541*		2.584*	

Note: 1. \* \* \*, \* \* and \* respectively represent significance levels of 1%, 5%, and 10%;

(1) Model 4 is a regression test result with CPI and exchange rate as independent variables and GDP as dependent variables. The data results show that neither CPI nor exchange rate has a significant impact on GDP.

(2) Model 5 is a regression test result using the digital economy index DEI and the square term of the digital economy index DEI as independent variables and GDP as the dependent variable. The results show that: firstly, based on the results of the F-test (F=4.541; P=0.015 < 0.05), it fully shows that the model built in this paper is generally significant and effective. Secondly, through R2=0.101, it can be seen that the digital economy index DEI and the square term of the digital economy index DEI explain the degree of variation of GDP by 0.1%. Finally, through the influence coefficient and significance, it can be seen that the impact coefficient of the digital economy index DEI on GDP is 4.410, which is significant at the P<0.05 significance level. The impact coefficient of the square term of the digital economy index DEI on GDP is -4.333, which is significant at the P<0.05 significance level. Therefore, the digital economy index DEI has a significant inverted U-shaped relationship with GDP.

(3) Model 6 is a regression test result using CPI and

exchange rate as control variables, the digital economy index DEI and the square term of the digital economy index DEI as independent variables, and GDP as the dependent variable. The results show that: first, based on the F-test results (F=0.091; P=0.046 < 0.05), it fully shows that the model built in this paper is generally significant and effective. Secondly, through R2=0.091, it can be seen that CPI; Exchange rate, The digital economy index (DEI), and the square term of the digital economy index (DEI) explain the degree of variation of 9.1% in GDP. Finally, the influence coefficient and significance show that the influence coefficient of the digital economy index DEI on GDP is 4.770, which is significant at the P<0.05 significance level. The influence coefficient of the square term of the digital economy index DEI on GDP is -4.678, which is significant at the P<0.05 significance level. Therefore, the digital economy index DEI has a significant inverted U-shaped relationship with GDP.

**5.3.3 Regression Analysis of GDP and Current Value of Import and Export Value**

The regression analysis results of GDP to the current value of total import and export value are shown in Table 5.5:

**Table 5.5 Regression Analysis Results of GDP and Current Value of Import and Export Value**

Variable	Dependent variable	
	The current value of the total import value	
	Model 7	
	Beta	T
GDP	.838***	12.843
CPI	-.028	-.422
ER	-.243***	-3.741
Observations	64	
R <sup>2</sup>	0.735	
F	59.125***	

Note: 1. \*\*\*, \*\* and \* respectively represent significance levels of 1%, 5%, and 10%.

**5.4 Robust Test**

To test the robustness and reliability of the regression results, another similar variable measuring the current value of total import and export value, the current value of total export value, is used to replace the current value of total import and export value in the original model for

robustness testing, to determine whether the conclusion of the impact of the digital economy index DEI on the current value of total import and export value is robust. Robust regression analysis was conducted on Model 1 to Model 3, and the results obtained are shown in Tables 5.7 and 5.8:

**Table 5.7 Robustness Test Results of Regression Analysis between Digital Economy Index DEI and Current Value of Export Value**

Variable	Dependent variable					
	The current value of the total import value					
	Model 1		Model 2		Model 3	
	Beta	T	Beta	T	Beta	T
DEI			3.600*	2.372	4.399**	2.833
DEI <sup>2</sup>			-3.680*	-2.425	-4.411**	-2.859
CPI	-.081	-.643			-.118	-.972
ER	-.150	-1.186			-.227	-1.717
Observations	64		64		64	
Adj R <sup>2</sup>	-0.004		0.062		0.089	
F	0.877		3.095*		2.537*	

Note: 1. \*\*\*, \*\* and \* respectively represent significance levels of 1%, 5%, and 10%;

(1) Model 1 is a regression test result using CPI and exchange rate as independent variables and the current total export value as the dependent variable. The data results show that neither CPI nor exchange rate has a significant impact on the current value of total export value.

(2) Model 2 is a regression test result using the digital economy index DEI and the square term of the digital economy index DEI as independent variables and the current export value as the dependent variable. The results

show that: first, based on the F-test results (F=3.095; P=0.048 < 0.05), it fully shows that the model built in this paper is generally significant and effective. Secondly, through R<sup>2</sup>=0.062, it can be seen that the digital economy index (DEI) and the square term of the digital economy index (DEI) explain the degree of variation of 6.2% in the current value of total export value. Finally, through the coefficient of influence and significance, it can be seen that the coefficient of influence of the digital economy index DEI on the current value of total export value is

3.600, which is significant at the  $P < 0.05$  significance level. The coefficient of influence of the digital economy index DEI's square term on the current total export value is -3.680, which is significant at the  $P < 0.05$  significance level. Therefore, the digital economy index DEI has a significant inverted U-shaped relationship with the current total export value.

(3) Model 3 is a regression test result that takes CPI and exchange rate as control variables, the digital economy index DEI and the square term of the digital economy index DEI as independent variables, and the current value of export value as the dependent variable. The results show that: first, based on the F-test results ( $F=2.537$ ;  $P=0.049 < 0.05$ ), it fully shows that the model built in this paper is generally significant and effective. Secondly, through  $R^2=0.089$ , it can be seen that CPI; Exchange rate, The digital economy index DEI

and the square term of the digital economy index DEI explain the degree of variation of 8.9% in the current value of total export value. Finally, through the influence coefficient and significance, it can be seen that the influence coefficient of the digital economy index DEI on the current value of total export value is 4.399, which is significant at the  $P < 0.05$  significance level. The influence coefficient of the digital economy index DEI's square term on the current total export value is -4.411, which is significant at the  $P < 0.05$  significance level. Therefore, the digital economy index DEI has a significant inverted U-shaped relationship with the current total export value. The coefficient of influence of the exchange rate on the current total export value is -0.227, which is not significant at the  $P < 0.05$  significance level. Therefore, the exchange rate's negative impact on the current total export value is not significant.

**Table 5.8 Robustness test results of the mediating effect of GDP between the digital economy index DEI and the current value of export value**

Variable	Dependent variable The current value of the total import value					
	Model 3		Model 6		Model 8	
	Beta	T	Beta	T	Beta	T
DEI	4.399**	2.833	4.770**	3.076	.332	.375
DEI <sup>2</sup>	-4.411**	-2.859	-4.678**	-3.037	-.422	-.481
GDP					.853***	12.373
CPI	-.118	-.972	-.125	-1.031	-.011	-.177
ER	-.227	-1.717	-.076	-.575	-.162*	-2.315
Observations	64		64		64	
Adj R <sup>2</sup>	0.089		0.091		0.745	
F	2.537*		2.584*		37.881	

Note: 1. \*\*\*, \*\* and \* respectively represent significance levels of 1%, 5%, and 10%;

(1) Both Model 3 and Model 6 have been further explained in the previous text.

(2) Model 8 is a regression test result using CPI and exchange rate as control variables, digital economy index DEI and the square term of digital economy index DEI and GDP as independent variables, and the current value of export value as the dependent variable. The results show that: first, based on the F-test results ( $F=37.881$ ;  $P=0.000 < 0.001$ ), it fully shows that the overall significance of the model built in this paper is within an acceptable range, and the model is effective. Secondly, through  $R^2=0.745$ , it can be seen that CPI; Exchange rate; The digital economy index (DEI), and the square term of the digital economy index (DEI) and GDP explain a

variation of 74.5% in the current value of total export value. In contrast, the independent variable to some extent explains the dependent variable. Finally, through the coefficient of influence and significance, it can be seen that after adding GDP as an intermediary variable, the impact of GDP on the current value of total export value is still significant at the  $P < 0.001$  significance level, indicating that GDP plays a mediating role between the digital economy index DEI and the current value of total export value. And the impact coefficient of the digital economy index DEI on the current value of total export value has decreased from 4.399 in model 3 to 0.332, so GDP plays a complete mediating role between the digital economy index DEI and the current value of total export

value.

## 6 Conclusion

Through the comparison of pre and post-test results, it can be seen that: firstly, the main effect test results found that the digital economy index (DEI) has an inverted U-shaped relationship with the current value of export value; And GDP plays a complete mediating role between the digital economy index (DEI) and the current value of total export value. There is no significant slight difference in the exchange rate's negative impact on the current total export value. Overall, there is little difference between all test results and the previous research results, and the data has passed the robustness test.

Firstly, digital transformation injects new vitality into China's economy. China has made great progress in information technology, e-commerce, and the Internet, enabling Chinese businesses to better adapt to the demands of the digital age. Through digital technology, Chinese enterprises can organize production processes more efficiently, improve productivity, and reduce costs. Furthermore, digital transformation promotes the vigorous development of innovation and entrepreneurship, driving the emergence of new industries such as artificial intelligence, big data, and the Internet of Things. These emerging industries inject new growth momentum into China's economy and promote the upgrading and transformation of the economic structure.

Secondly, digital transformation is of great significance to China's international trade. China is one of the largest trading nations globally, and digital transformation provides Chinese export enterprises with a broader market and more efficient trading methods. Through e-commerce platforms, Chinese businesses can directly communicate and trade with global consumers, breaking traditional trade barriers and facilitating and accelerating cross-border trade. Additionally, digital transformation strengthens the visualization and collaborative management of supply chains, improving the efficiency and reliability of trade. The development of cross-border e-commerce and digital payment services in China has significantly contributed to the convenience and fluidity of global trade.

Finally, China's digital transformation also positively impacts the global trade system. China's leading position in the digital economy has driven the global development of the digital economy. China actively participates in the formulation and promotion of international digital trade rules, promoting the liberalization and facilitation of digital trade. China has also strengthened digital cooperation with other countries, promoting the interconnectivity of digital infrastructure and cross-border data flows. These efforts

promote the digitization and interconnection of global trade, creating more opportunities for global economic growth and development.

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