# Research on the Impact of Digital Economy on the International Trade Under the Double Circulation Pattern

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**Abstract.** In order to quantitatively analyze the enabling effect of digital economy on urban international trade from the city level, based on the sample data of 133 major prefecture-level cities from 2013 to 2019, the impact of digital economy on international trade is analyzed by using fixed effect model. The research shows that the digital economy can significantly promote the development of urban international trade, and the promotion effect on exports is greater than that of imports; for cities with different levels of international trade development, the digital economy shows "U" changes in the development of international trade; and the investment of human capital is conducive to the development of international trade. These empirical results provide new ideas for promoting the development of international trade: actively promotes the development of the digital economy, increase the investment in digital infrastructure and talents, pay attention to the investment and development of the digital economy of cities at different levels of development in the process of promoting the integration and development of the digital economy and international trade.

**Keywords:** Digital Economy · International Trade · Fixed Effects Models · Quantile Regression

## 1 Introduction

With the rapid development of information technology and its continuous integration with the way of economic operation, the digital economy has been regarded as a "new engine" of economic growth [12]. The level of China's digital economy shows a rapid growth pattern, the scale of which has risen from 2.6 trillion yuan in 2005 to 39.8 trillion yuan in 2020, and its proportion in GDP has risen from 14.2% in 2005 to 38.6% in 2020.Its position in the national economy has become more prominent.

Under the background of building a new development pattern with the domestic circulation as the main body and domestic and international circulation promoting each other, the digital economy empowers the real economy, and the data bonus provides a valuable database for both the supply and demand sides, and can provide accurate supply and demand relationships according to data matching; the use of the Internet as an information platform in international trade has reduced transaction costs, expanded

the scale of transactions, optimized the level of resource allocation, and thus promoted the growth of international trade [8]. Under the background of the continuous slowdown of economic globalization and the significant increase in international economic and trade frictions and games, how to adjust the development mode and structure of international trade plays a decisive role in giving play to the pulling role of trade on the national economy. Existing theoretical and empirical studies have affirmed the positive role of digital economy in reducing export costs and promoting export growth. This paper will further analyze the impact and differences of the digital economy on China's import and export trade, and explore how trade development can better cope with the challenges of the digital era in the context of double circulation, play a driving role in the digital economy, and then promote the continuous optimization and upgrading of the trade structure.

## 2 Literature Review

Since Tapscott [9] proposed the concept of digital economy, the digital economy has become one of the hot spots in academic research and has produced rich research results.

As a new growth point of international trade, the pull effect of the digital economy on the global economy is extremely obvious [12]. Among them, the development of the digital economy in importing countries can significantly reduce the loss of China's export efficiency, optimize the allocation of regional resources and improve the efficiency of export trade [6] and significantly promote the competitiveness of China's foreign trade [3]. The level of digital economy has a positive effect on the export scale and export quality of cities in the Yangtze River Delta region, and in the environment of anti-globalization, escalation of trade frictions and rising trade protectionism, the better the development of digital economy, the more it can promote the export of enterprises [10]. Shen and Yuan [7] revealed the impact of enterprise internetization on Chinese enterprise innovation and export from a microscopic perspective, and found that enterprise internetization has a significant role in promoting the export activities of Chinese enterprises. He et al. [4] found that the level of digital economy development in importing and exporting countries has a significant role in promoting value-added trade. Digital technology enhances the effectiveness of information and the matching efficiency of elements, so that the information cost between enterprises is greatly reduced or even close to zero, while commodity exchange can break through the time and space restrictions and improve trade efficiency [1, 5]. In the process of accelerating the construction of a new development pattern with the domestic cycle as the main body and the domestic and international double cycles promoting each other, the digital economy boosts the formation of a dual-cycle pattern by stimulating the momentum of domestic demand in the market, enhancing the support of domestic industries, and strengthening foreign trade ties [14].

Existing studies have analyzed the impact mechanism of the digital economy on international trade, mostly using national and provincial data to study the impact on exports, and few literature has analyzed the impact of the digital economy on the import and export trade of different cities. Based on the dynamic panel data of 133 prefecture-level cities in 31 provinces of China from 2013 to 2019, this paper analyses the impact of digital economy on international trade under the background of double circulation.

# 3 Empirical Analysis

## 3.1 Model Setting

In the formula (1), $trade_{i,t}$ is the ith city at the level of international trade development in the t period, subscript I And t Represents the sample city and year, $Dige_{i,t}$ For the ith city is The development level of digital economy in the t period is the core explanatory variable of this paper. $X_{i,t}$ denotes a series of control variables affecting the international trade of the city; $\gamma_i$ represents an urban fixed effect that does not change over time, $\theta_t$ represents a time fix effect is indicated, $\mu_{i,t}$ represents the random perturbation term.

$$trade_{i,t} = \alpha_0 + \alpha_1 Dige_{i,t} + \beta X_{i,t} + \gamma_i + \theta_t + \mu_{i,t} \tag{1}$$

## 3.2 Data Source and Data Description

In this paper, the city-level data of 133 major prefecture-level cities in 31 provinces in China from 2013 to 2019 are selected as the research sample. The data is mainly derived from: (1) China City Statistical Yearbook; (2) China Statistical Yearbook for Regional Economy; (3) China Digital Inclusive Finance Index jointly compiled by the Digital Finance Research Center of Peking University and Ant Financial Services Group. In order to reduce the influence of outliers on the regression results, the continuous variables are subjected to upper and lower 1% horizontal Winsorize indentation.

Explained variable. Combined with the characteristics of China's international trade, the per capita total import and export of goods in each city is used to indicate the level of international trade development of the city.

Explanatory variables. This paper draws lessons from relevant scholars [14], the level of digital economy development is measured from the perspectives of Internet development and digital financial inclusion. The internet development is measured from four indicators: Internet penetration rate, relevant practitioners, related output, and mobile phone penetration rate [5]. The China Digital Inclusive Finance Index jointly compiled by the Digital Finance Research Center of Peking University and Ant Financial Services Group is adopted (Guo et al. 2020).

Control variables. (1) Material capital input (MI): the ratio of government expenditure to GRP (2) Labor input density (LI): the ratio of urban employees to GRP at the end of the year. (3) Human capital input (HI): the ratio of the number of college students to the GRP.

## 3.3 Descriptive Statistical Analysis

Table 1 shows the meaning of the relevant variable indicators involved in the article and the expressive statistical analysis results. From the calculation of the standard deviation and average value of the variables in Table 1, it can be seen that the international trade and digital economy index of different cities are quite different, which infers that the level of digital economy development in different cities in China varies greatly.

**Table 1.** Descriptive statistics of variables

| Variables | mean | sd |
|-----------|--------|--------|
| trade | 7.489 | 2.008 |
| MI | 0.171 | 0.0744 |
| LI | 0.0239 | 0.0101 |
| HC | 0.109 | 0.133 |
| Dige | 0.125 | 0.0657 |
| IVG | 6.297 | 2.352 |
| EVG | 6.958 | 1.972 |

### 3.4 Empirical Results

Table 2 shows the regression results of the fixed effect model, columns (1), (2) and (3) report the results of the impact of the digital economy on total international trade, total imports and total exports, respectively. According to the analysis results, the coefficient can be obtained. Digital economy has a significant positive impact on total international trade, imports and exports at the statistical level of 1%. The coefficients are 8.601, 8.979 and 10.797 respectively, indicating that the higher the development level of digital economy in a city, the more it can improve the development of trade export, trade import and overall international trade. According to the analysis results, digital economy has a significant positive impact on international trade at the statistical level of 1%. From the perspective of control variables, Material input has a significant negative impact on the development of international trade, while labor input and human capital input are conducive to the development of international trade.

### 3.5 Further Discussion

In order to distinguish whether there are differences in the impact of digital economy on urban international trade when the development level of urban international trade is different. This paper selects 10%, 25%, 50%, 75% and 90% of the five representative quantile points corresponding to cities with different levels of international trade development. It can be seen from the quantile regression results in Table 3 that the regression coefficients of digital economy shows a "U" trend, indicating that when the development level of international trade in cities is different, the impact of digital economy on international trade in cities is significantly different. For cities with a high level of international trade development, Digital economy can bring more significant enabling effect, when the city's international trade develops to a certain extent, the enabling effect of digital economy on the city's international trade will decline, but it is still a positive impact.

**Table 2.** Regression analysis results of the fixed effect model

|       | trade | EVG | IVG |
|-------|-------|-----|-----|
| Dige  | 8.601*** | 8.979*** | 10.797*** |
|       | (0.000) | (0.000) | (0.000) |
| MI    | −7.093*** | −3.421*** | −5.102*** |
|       | (0.000) | (0.000) | (0.000) |
| LI    | 19.378*** | 11.929*** | 13.030*** |
|       | (0.000) | (0.000) | (0.000) |
| HC    | 0.901*** | 1.076*** | 1.158*** |
|       | (0.000) | (0.000) | (0.000) |
| _cons | 7.068*** | 6.025*** | 5.394*** |
|       | (0.000) | (0.000) | (0.000) |
| N     | 3724 | 3724 | 3724 |
| $R^2$ | 0.180 | 0.141 | 0.155 |
| City  | yes | yes | yes |
| Year  | yes | yes | yes |

Note: The sample size is 931. ***, **, * and represent statistical significance at 1%, 5% and 10% levels, respectively

**Table 3.** Test results of the quantile regression model based on the whole sample

|       | 10% | 25% | 50% | 75% | 90% |
|-------|-----|-----|-----|-----|-----|
| Dige  | 10.389*** | 14.251*** | 16.529*** | 17.911*** | 13.532*** |
|       | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| cons  | 3.904*** | 4.573*** | 5.518*** | 6.416*** | 8.015*** |
|       | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| N     | 3724 | 3724 | 3724 | 3724 | 3724 |
| $R^2$ | 0.0395 | 0.0861 | 0.1309 | 0.1539 | 0.1379 |
| X     | yes | yes | yes | yes | yes |

## 4   Conclusions and Recommendations

### 4.1   Conclusions of the Study

Based on the sample data of 133 Prefecture-level cities in China from 2013 to 2019, this paper empirically analyzes the enabling effect of the digital economy on urban international trade, and draws the following conclusions: First, the digital economy has a significant positive impact on the development level of urban international trade, of which the promotion effect of the digital economy on trade exports is greater than

that of imports. Second, the digital economy has a "U" impact on the development of mature international trade, that is, the higher the level of international trade development, the greater the enabling effect of the digital economy, but when international trade develops to a certain level, the enabling effect of the digital economy on international trade decreases slightly.

## 4.2 Policy Implications

In order to further strengthen the enabling role of the digital economy in urban international trade, and make full use of the role of human capital and labor force in promoting urban international trade:

First of all, it is necessary to respond to relevant national policies, actively promote the development of the digital economy, and join the infrastructure and investment of digital facilities, so as to better play the role of the digital economy in promoting international trade. Secondly, the impact of the digital economy on exports is greater than that of imports, so we should pay attention to the development of the digital economy of exporting countries and better promote domestic trade exports. Finally, we should pay attention to the investment and development of the digital economy of cities at different levels of development in the process of promoting the integration and development of the digital economy and international trade, so as to give full play to the maximum enabling role of the digital economy.

There are still some deficiencies in this study, which need to be further deepened in subsequent studies. From the perspective of economic geography, coastal areas themselves have advantages in international trade, and it is necessary to distinguish coastal cities from other cities, and study the urban differences of the impact of the digital economy on international trade. Therefore, follow-up research can divide cities and analyze the differences in the impact of the digital economy on international trade.

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