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Research Article

Influence Effect of Internet on the Optimization of China's International Trade Structure Based on Gravity Model

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The scale and competitiveness of foreign trade are not only an important reflection of a country's economic strength, status, and influence in the international economy, but also a basic indicator to measure a trading power. At the moment, information technology, embodied by the Internet, is steadily altering the old method of international trade. This research investigates the impact of the Internet on China's international trade, based on a comprehensive review of the relevant literature. This study firstly analyzes the mechanism of network's influence on international trade structure and focuses on the influence of network on trade participants and trade services. Then, based on the gravity model, the empirical process of network's influence on international trade structure is analyzed, and the empirical research is carried out through variable analysis, stationarity and cointegration test, and pulse corresponding analysis. This paper concludes that the development of the Internet has a certain role in encouraging service commerce in China, based on an empirical analysis of the relationship between the Internet and service trade in China.

1. Introduction

With the popularization and development of Internet, the operation mode of economy has undergone great changes. Under the influence of the technical characteristics of Internet, production and consumption have undergone corresponding changes [1]. As a combination of a trading power and an Internet power, China's economic and social background and technological conditions have changed [2, 3]. Hwang and Song [4] (2017) believed that among many new factors, the influence of the Internet is the most important. The Internet and other information and communication technologies have a broad foundation, universality, and spillover, and its influence on economy and trade will be amplified with the increase of penetration rate. Zhang [5] (2015) believed that the Internet promotes a high degree of economic interconnection on a global scale, and various resources are reconfigured under the influence of the Internet. Such functions of high connectivity and configuration become new functions that affect international trade. Consulting institutions and Internet enterprises have more case studies and less theoretical analysis [6]. This study analyzes the mechanism and path of the Internet's influence on international trade and systematically and comprehensively analyzes the Internet's influence on international trade structure. Chung et al. [7] (2013) pointed out that the externality of the Internet and its integration function of economic forms have created concepts and resource allocation modes beyond traditional economic theories.

The paper arrangements are as follows: Section 2 discusses the mechanism analysis of Internet's influence on international trade structure. Section 3 defines the empirical process of the impact of the Internet on the international trade structure. Section 4 analyzes the empirical analysis of the impact of network on international trade structure. Section 5 concludes the article.

2. Mechanism Analysis of Internet's Influence on International Trade Structure

Here, we discuss the influence path and evaluate the impact on trade participants. They analyze the impact on trade services.

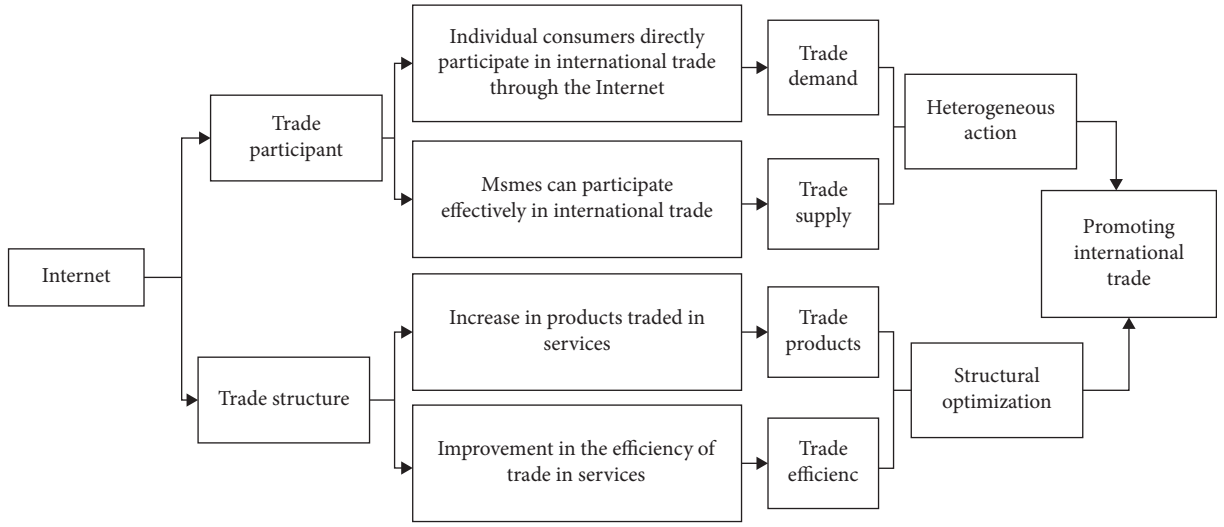

Figure 1: The path analysis of the impact of the Internet on international trade.

2.1. Influence Path. The influence mechanism of the Internet on international trade is very complex. It has both the influence of Internet technology innovation and the influence of transaction mode innovation and change [8]. This influence mechanism can be summarized as the path analysis of the Influence of the Internet on international trade. The path analysis of the impact of the Internet on international trade is shown in Figure 1.

The popularization of the Internet and the continuous improvement of Internet network capabilities are one of the driving forces for the development and rise of information economy, new economy, platform economy, and digital economy. Whi and Yi [9] (2013) held that the new scientific and technological revolution is accelerating the change and flow of production factors. Meng [10] (2017) pointed out that the previous economy was built on warehouses and factories full of physical goods. On the cost theory of international trade, Tongsheng et al. [11] (2014) used the ingenious transaction cost function to connect the trade cost that occupies an important position and is difficult to be counted with the measurable and quantifiable trade cost and makes a quantitative analysis of the trade cost with the help of gravity mode. Zhibo et al. [12] (2012) decomposed the cost of international trade into production cost; transaction cost, environmental cost, and intergenerational cost and proposed the concept of total cost of international trade. Zhang and Zhang [13] (2013) believed that fixed and variable export costs determine the productivity threshold of an enterprise, and the relationship between the productivity level and productivity threshold determines whether an enterprise exports. Profits of firms with different productivity are shown in Figure 2.

2.2. Impact on Trade Participants. Aleksynska and Peri [14] (2012) pointed out that with the help of the Internet, consumers can directly participate in international trade through cross-border e-commerce platforms and improve their own welfare. The Internet era has formed new global

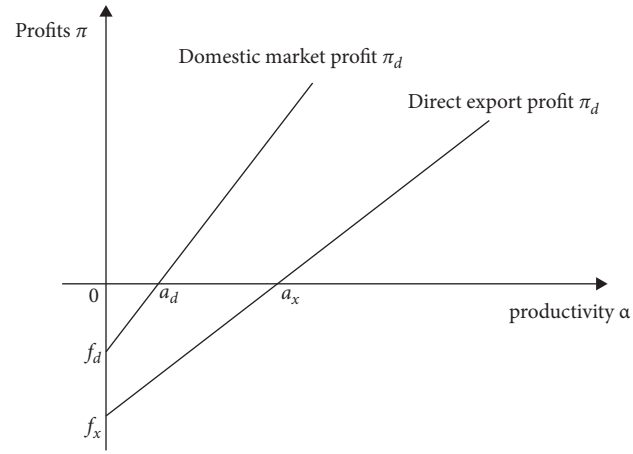

Figure 2: Profits of firms with different productivity.

trade patterns, and platformization and digitalization of international trade have made international information interchange more accessible.

2.2.1. Individual Consumers Directly Participate in International Trade through the Internet. Import and export through cross-border e-commerce platforms have enriched international trade channels, broken channel monopolies in the past, and created a reasonably flat manner of trade with the help of the Internet. Comparison between traditional trade channels and "Internet + e-commerce" trade channels is shown in Figure 3.

2.2.2. Small-, Medium-, and Microenterprises Can Successfully Participate in International Trade. Compared with traditional trade, the virtual market formed by the Internet helps small- and medium-sized enterprises to obtain scope economy in international trade and provides convenient conditions for small- and medium-sized enterprises to participate in the international market [15]. A matrix

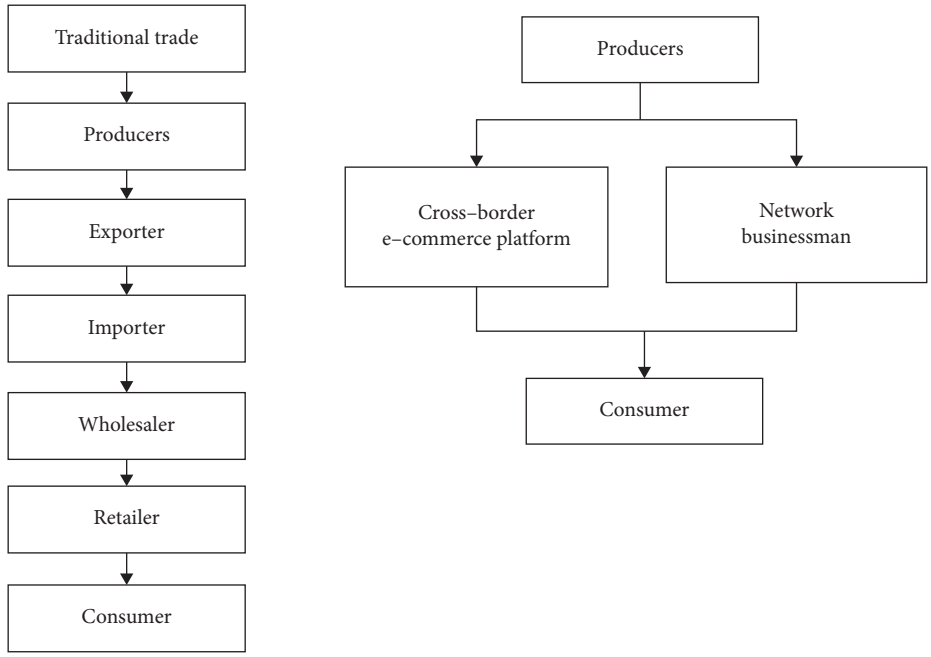

Figure 3: Comparison between traditional trade channels and "Internet + e-commerce" trade channels.

of differences in trade of goods and services under traditional commerce and Internet conditions is shown in Table 1.

2.3. Impact on Trade Services. Compared with goods trade, service trade has remarkable particularity. The Internet and information technology have completely reformed the face of service trade in the last decade and brought significant challenges to traditional economic theories [16].

Firstly, the application of the Internet overcomes many traditional restrictions on international trade in service industry and increases the content of service trade. The Internet helps to promote the development of service trade and increase the proportion of service trade in trade composition. The rising share of trade in services in the global economy is largely due to the progress of Internet technology.

Secondly, the popularity and expansion of the Internet has significantly improved the efficiency and reduced the cost of trade in services. Taking sports service industry and cultural service industry as examples, Yao et al. [17] (2016) analyzed that in cyberspace, the Internet has significantly changed the nature of low efficiency of service industry, and economies of scale, economies of scope, and long tail effect are significant.

Thirdly, the development of Internet economy leads to the transformation of transaction forms and creates new tradable service industries. The Internet's expanding penetration in social and economic life makes economic activity creation, exchange, distribution, and consumption increasingly reliant on it. In recent years, the development trend of information industry related to data mining, data analysis, and processing is remarkable. The cost of trade in digital products is shown in Figure 4.

3. Empirical Process of the Impact of the Internet on the International Trade Structure

In this section, we evaluate the model building and define the variable selection. They discuss the data sources and also analyze the empirical result.

3.1. Model Building. The first gravity model was an exact replica of Newton's law, a purely empirical formula. The gravitational attraction between two stars and their masses is equivalent in physics to the positive correlation between two countries' trade and economic aggregates [18]. Therefore, the trade flows between the two countries take the form of Newton's law of gravity:

$$X_{ij} = K\frac{Y_i^{\alpha}Y_j^{\beta}}{Y_{ij}^{\theta}}, \tag{1}$$

$$\ln X_{ij} = \ln K + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln D_{ij} + \varepsilon_{ij}.$$

The trade volume X_{ij} between the two countries is the explanatory variable, while the total GDP of the two countries and the distance between the two countries are the explanatory variables. Replace the D_{ij} of the above formula with the general trade transaction cost t_{ij}:

$$X_{ij} = K\frac{Y_i^{\alpha}Y_j^{\beta}}{t_{ij}^{\theta}}. \tag{2}$$

GDP and distance factors are general forms of gravity models and direct applications of physical concepts in the field of trade. However, the reality of the diversity of factors affecting trade exists. Add the change of population factor (POP), so the logic of adding is that the size of population is

Table 1: A matrix of differences in trade of goods and services under traditional commerce and internet conditions.

Trade type		Traditional business	Electronic commerce
Domestic	Service trade	Consumers receive services directly from suppliers	Receive services from domestic suppliers over the internet
	Goods trade	Consumers buy goods from retail stores	Consumers buy products from online stores
International	Service trade	The process of providing services by the four supply modes specified by GATS	GATS first and second supply models involve cross-border service supply. Online trade in services between consumers and suppliers in different countries
	Goods trade	International trading companies are engaged in import and export of bulk commodities	Consumers order products from online stores

proportional to the economic activity of goods demand, so population is an appropriate variable:

$$\ln X_{ij} = \ln K + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln D_{ij} + \alpha_4 \ln POP_i + \alpha_5 \ln POP_j + \varepsilon_{ij}. \tag{3}$$

By introducing per capita GDP into the gravity model, the equation of the gravity model becomes

$$\ln X_{ij} = \ln K + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln D_{ij} + \alpha_6 \ln\left(\frac{Y_i}{POP_i}\right) + \alpha_7 \ln\left(\frac{Y_j}{POP_j}\right) + \varepsilon_{ij}. \tag{4}$$

The equation of the gravity model with multiple dummy variables can be expressed as

$$\ln X_{ij} = \ln K + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln D_{ij} + \alpha_6 \ln\left(\frac{Y_i}{POP_i}\right) + \alpha_7 \ln\left(\frac{Y_j}{POP_j}\right) + \alpha_8 \ln(\text{Tariff}) + \alpha_9 \ln(\text{Border}) + \alpha_{10} \ln(\text{Language}) + \alpha_{11} \ln(\text{Colony}) + \varepsilon_{ij}. \tag{5}$$

In general, the regression parameters of total GDP, per capita GDP, and total population (POP) are usually positive, and sometimes there is no significant case.

3.2. Variable Selection. China's international trade structure is as follows:

(1) Primary products are SITC0-SITC4, including food and live animals, beverages and tobacco, mineral fuels, lubricants and related raw materials, and animal and plant oils, lipids, and waxes.

(2) Intermediate products correspond to SITC5-SITC6 of international trade standard classification, which are chemical finished products and related products and finished products classified by raw materials, organic and inorganic chemicals, plastics, steel, and rubber products.

(3) Capital goods are SITC7, which refers to machinery and transportation equipment, specifically divided into power machinery and equipment, special industrial machinery and equipment, office machinery and equipment, telecommunications, electric power, transportation, and other equipment [19].

(4) Consumer goods are SITC8, which is called miscellaneous products, including clothing, shoes and hats, consumer goods, equipment, furniture, etc., mainly used to meet people's consumer needs.

Based on the existing literature, this paper selects the number of Internet users in China from 2019 to 2021 as the explanatory variables of the model, and the four structural classifications of goods trade are the explained variables, respectively.

3.3. Data Sources. Considering the robustness of the model, this paper takes logarithms of variables and establishes the following basic regression model:

$$\ln S_t = \alpha_0 + \beta_1 \text{LNInternet}_t + \beta_2 \text{LNRATE}_t + \varepsilon_{ij}. \tag{6}$$

The import and export data of goods trade come from the China Customs Statistics database, which provides all the import and export data of China's import and export of goods trade from 2019 to 2021. Explanatory variable Internet Development Level comes from China Internet Network Information Center (CNNIC), and RMB exchange rate data come from the National Bureau of Statistics.

3.4. Empirical Result. With the help of Eviews8.0, the influence of Internet on the export structure of goods trade is shown in Table 2.

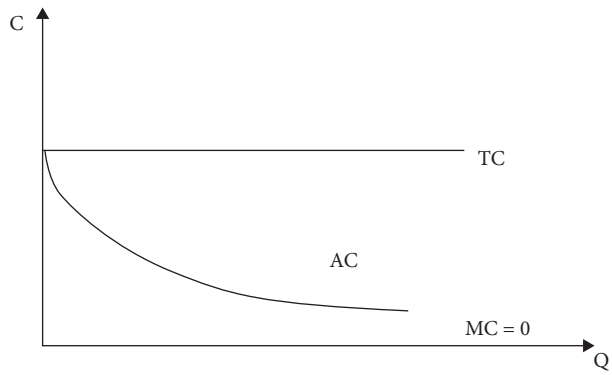

Figure 4: The cost of trade in digital products.

Table 2: The influence of Internet on the export structure of goods trade.

Type	Primary export S_1	Intermediate export S_2	Capital goods export S_3	Export of consumer goods S_4
Lnrate	0.465 (0.384)	3.365 (1.562)	4.182 (2.936)	0.869 (0.554)
LnInternet	0.582 (3.324)	1.215 (4.028)	1.429 (6.175)	0.864 (3.625)
C	9.018 (0.923)	−15.514 (−0.936)	−24.962 (−1.936)	5.845 (0.422)
Adjusted R^2	0.951	0.919	0.941	0.937
P	<0.05	<0.05	<0.05	<0.05

Table 3: The influence of Internet on the import structure of goods trade.

Type	Primary import S_5	Intermediate import S_6	Capital goods import S_7	Import of consumer goods S_8
Lnrate	3.085 (1.124)	1.753 (1.502)	2.863 (2.151)	6.028 (3.514)
LnInternet	1.362 (4.075)	0.725 (4.583)	0.914 (5.014)	1.463 (6.125)
C	−14.802 (−0.631)	0.165 (0.028)	−9.561 (−0.817)	−36.384 (−2.657)
Adjusted R^2	9.351	0.963	0.952	0.936
P	<0.05	<0.05	<0.05	<0.05

The influence of Internet on the import structure of goods trade is shown in Table 3.

It can be seen from the above regression model results that the Internet has a clear positive correlation with the classification of import and export goods trade. The development level of Internet has a significant role in promoting the total import and export volume of primary goods, intermediate goods, capital goods, and consumer goods within China's goods trade.

4. An Empirical Analysis of the Impact of Network on International Trade Structure

Here, we define the variable analysis and analyze the stationarity and cointegration test. They discuss the pulse correspondence analysis.

4.1. Variable Analysis. Based on the above analysis of the mechanism of The Internet promoting foreign trade, this study constructs a VAR model to try to explain the impact of the Internet on the structure of service trade.

(1) Total volume of China's trade in services: this paper chooses the total volume of China's trade in services (TS) to represent the scale of China's service trade [20].

(2) Internet penetration rate: the number of Internet users and the total population are selected in this paper to calculate Internet penetration rate. Internet penetration rate (I) = the number of Internet users in China/the total population in China.

(3) GROSS Domestic Product (GDP): GDP reflects the size and development of a country's domestic economy, which is a factor that has a direct impact on service trade, and this refers to the view of Shi Bingzhan [21].

(4) Openness to trade in services: openness of service trade reflects the status and influence of foreign trade activities of service industry in a country or region on the national economy.

4.2. Stationarity and Cointegration Test. In order to avoid the phenomenon of "pseudoregression" in the model, the ADF test was conducted on the data in this paper, and the test results showed that the variables were 1 (2) stationary sequence of the same order. The stationarity test results of each variable are shown in Table 4.

Table 4: The stationarity test results of each variable.

Sequence	ADF test value	1% critical value	5% critical value	10% critical value	Conclusion
DDLNI	−3.9025	−2.7152	−1.9517	−1.6203	Smooth
DDLNTS	−6.1702	−2.6275	−1.9533	−1.6025	Smooth
DDLNOPEN	−7.1252	−2.4252	−1.9532	−1.6025	Smooth
DDLNGDP	−5.3624	−2.6025	−1.9532	−1.6214	Smooth

Table 5: The test results of Johansen cointegration relationship of all variables.

Null hypothesis	Trace statistic	5% critical value	Eigenvalue	*P*
	102.162	46.251	0.952	<0.05
	51.365	29.423	0.921	<0.05
	10.302	15.153	0.365	>0.05
	03.013	03.825	0.142	>0.05

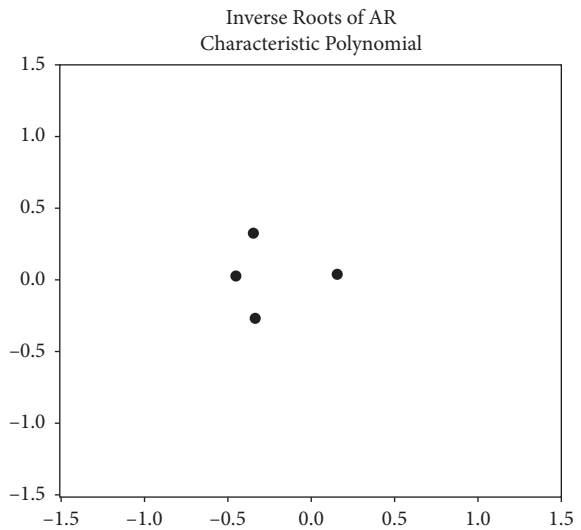

Figure 5: The modules of AR root are all less than 1.

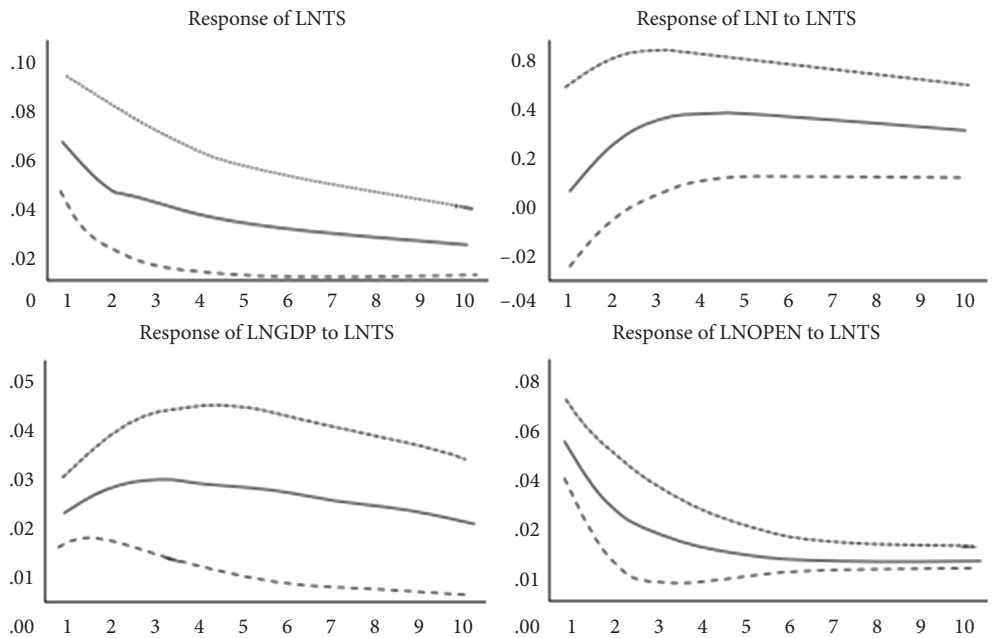

Figure 6: The influence of Internet development level on total trade in services.

In this study, the Johansen cointegration test is used to test the long-term equilibrium relationship between variables according to traditional practices. The test results of Johansen cointegration relationship of all variables are shown in Table 5.

According to the test results in the table, there is some kind of long-term equilibrium between variables.

4.3. Pulse Correspondence Analysis. The VAR model is constructed by Eviews 8.0. Subsequently, the stability test results of the VAR model show that the AR root modules of the VAR model are all less than 1, which indicates that the constructed VAR model is stable within the unit circle. The modules of AR root are all less than 1, as shown in Figure 5.

Using Eviews8.0, a positive impact on the changes of service trade and Internet development level is obtained, and the impulse response function graph of total service trade and Internet penetration is obtained. The influence of Internet development level on total trade in services is shown in Figure 6.

Figure 6 reflects the change of China's total service trade caused by the impact of Internet penetration rate. Under the positive impact of Internet penetration on service trade, service trade reached the highest point in the third period and then gradually declined. The Internet has a positive impact on service trade, which tends to be stable after the third period.

5. Conclusion

The improvement of the level of Internet use can increase the volume of China's service trade, and this impact is positive in the long run. The regression results of goods trade show that the total import and export volume of primary goods, intermediate goods, capital goods, and consumer goods increase with the improvement of the development level of the Internet. There are significant structural differences in the promotion effect, among which the Internet development level has a particularly significant promotion effect on the import of consumer goods, that is, every 1% increase in the number of Internet users, and the import amount of consumer goods will increase by 1.425%. The Internet's application and development aid in the stabilisation and structural adjustment of China's foreign commerce, providing compelling evidence for the country to push "Internet + foreign trade" integration and increase support for new forms of foreign trade.

The possible innovation of this study lies in the novelty of the theoretical view and the innovation of the empirical part. This study analyzes the characteristics of the Internet and international trade and provides a useful and systematic supplement for the influence of the Internet on foreign trade. This study carries out empirical tests on primary goods innovatively; intermediate goods, capital goods, and consumer goods, respectively, with the Internet in China's goods trade and discuss the structural effects of the Internet in the field of goods trade. Although this study is innovative in research perspective, theoretical view, and empirical part, it still has the following deficiencies. Experience summary and empirical analysis have been made on the application and influence of the Internet in the field of service trade, and how to establish a perfect theoretical model between the Internet and service trade still needs to be further expanded, which is the focus and difficulty of future research.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding the publication of this paper.

Acknowledgments

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