

The Impact of Digital Inclusive Finance on the High-Quality Development of China's Export Trade

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Abstract—In the context of financial globalization, China has put forward the policy goal of high-quality development, and the digital economy, with its advantage of information resources, is driving China's export trade to achieve high-quality development. Due to the long-standing financing constraints of small and medium-sized export enterprises, how to expand the export scale of small and medium-sized enterprises has become a major threshold for the development of China's export trade. This paper firstly adopts the hierarchical analysis method to establish the evaluation system of high-quality development of China's export trade; secondly, the panel data of 30 provinces in China from 2011 to 2018 are selected for empirical analysis to establish the impact model of digital inclusive finance on the high-quality development of China's export trade; based on the analysis of the heterogeneous enterprise trade model, a mediating effect model is established to verify the mediating role of credit constraint in the development of high-quality export trade in China. Based on the above analysis, this paper concludes that inclusive digital finance, with its unique digital and inclusive nature, alleviates the credit constraint problem among SMEs, enhances the binary marginal effect of SMEs' exports, optimizes their export scale and structure, and promotes the high-quality development of regional and even national export trade. Finally, based on the findings of this paper, we propose insights and suggestions for inclusive digital finance to promote the high-quality development of export trade.

Keywords—Digital inclusive finance, high-quality development of export trade, fixed effects, binary marginal effects.

I. INTRODUCTION

WITH the synergy of regional integration and economic globalization, the high quality of foreign trade is more dependent on the combined effect of domestic and international bilateral markets. China has entered the international trade market by exporting manufacturing products and cheap labor in large quantities, and the level of financial development and export trade competitiveness is increasing day by day. With the deepening of financial globalization and the increase of trade internationalization, the link between international trade transactions and financial support is getting closer and closer. In the face of the world trade financing gap problem, the financial exclusion and credit constraint of small and medium-sized enterprises (SMEs) need to be solved. The rapid development of inclusive finance in recent years has not only provided SMEs with more financial resources, but also promoted the growth of a country's foreign trade.

Under the digital economy, the report of the 19th Party Congress points out that China's economy has shifted from the

stage of high-speed growth to the stage of high-quality development [1], and the high-quality development of foreign trade has become the cornerstone of the all-round and sustainable development of China's foreign trade. From the Maya Declaration in 2011 [14], which first formulated national development strategies to promote the development of inclusive finance, to the GPFI report in 2016, "Global Standard-Setting Bodies and Inclusive Finance an Evolving Landscape" [15], which formally put forward the concept of digital inclusive finance, inclusive finance has stepped into a new stage driven by digital technology. The capital allocation function performed by digital inclusive finance with its digital information advantage has greatly eased the financing difficulties of the small, medium and micro enterprises and the demand for funds by exporters in the stage of expanding production scale. So the question is: How does digital inclusion affect the quality of a country's export trade? In this paper, we explore the impact of digital inclusive finance on the high-quality development of export trade by constructing an indicator system for the high-quality development of export trade in China.

II. LITERATURE REVIEW

There are relatively few studies in the existing literature on the impact of digital inclusive finance on the high-quality development of export trade, and most of the scholars' studies can be divided into the following three categories.

1. The relationship between financial development and trade scale: Shen [6] found a positive two-way causal relationship between financial development and international trade in China from 1980 to 2003. Sun Zhaobin [18] found that the optimization of China's export product structure can promote China's financial development, and there is a long-term stable equilibrium relationship between the two.
2. The relationship between inclusive finance and international economy: By analyzing the impact of inclusive finance on international trade balance and structure, [4] concluded that the promotion effect of inclusive finance is more significant for enterprises with a high dependence on external financing. Degong et al. [19] analyzed the data of 36 countries in their study and concluded that the promotion effect of both was more significant, especially in countries in the central and western regions. Mengyu [5] argues that the impact of financial inclusion on the international economy has a spillover effect, and the development of financial inclusion in one country can improve the economic level

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of neighboring countries.

3. The relationship between digital financial inclusion and economic development: Yiqing and Maochuan [10] used a quantile model to analyze the provincial panel data of China from 2011 to 2017 and found that the synergistic effect of digital financial inclusion and economy in less developed regions was more significant. Jian and Hongmei [11] found that digital inclusive finance has a significant impact on the high-quality development of the economy, and there is a single threshold effect between them. Tang et al. [12] found that there is a bottleneck in digital inclusive finance, and after crossing the bottleneck digital inclusive finance will promote the upgrading of industrial structure, especially for the central and western regions with a significant promotion effect. Changliu and Chengtao [8] found that after crossing a certain threshold, digital financial inclusion has a non-linear promotion effect with high-quality economic development.

For the high-quality development of export trade, the academic community has defined it from various perspectives. Linjing et al. [9] argue that high-quality development of trade is built on the coordination of benign trade structure, dynamics, modalities, and environment. Chunming and Kaijun [13] argue that the high-quality development of trade is influenced by the change of comparative advantage of foreign investment and the transformation and upgrading of industrial and trade structures. Junwen and Qingya [2] explored the connotation of high-quality trade development and established an evaluation system of innovative development, effective development, coordinated development, open development, sustainable development, and shared development of trade [2]. Ying et al. [3] took the theoretical framework of sustainable development as the starting point, combined with the characteristics of the development structure of foreign trade, and constructed a comprehensive evaluation index system for sustainable development of foreign trade in terms of its scale, structure, efficiency, potential, dependence and technological progress [3].

In summary, there are limitations and shortcomings in the academic community to explore the theoretical mechanisms that influence the high-quality development of trade after the digitalization of inclusive finance. Therefore, this paper uses the digital inclusive finance index of Peking University and the panel data of 30 provinces to explore the impact of digital inclusive finance on the high-quality development of China's export trade in depth from the perspective of theoretical model and empirical analysis.

III. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

Under the pattern of high-quality development of export trade, digital inclusive finance gives full play to its advantages of financial information resources through Internet and big data technologies, optimizes resource allocation, and improves financial risk prevention and control ability while reducing transaction costs. Digital inclusive finance mainly faces SMEs and low-income groups, and commercial banks have imposed credit constraints on this group due to the lack of credit data

and collateral assets of the service recipients. The digitization of inclusive finance can further examine the growth of enterprises, help SMEs spread the high costs borne in the initial R&D stage, and ease the degree of their financing constraints. With the in-depth development of trade globalization, the export threshold of small, medium and micro enterprises has been lowered, their scale has been expanded, and their financing needs have rapidly increased. Based on the heterogeneous enterprise trade model, one of the important sources of enterprise heterogeneity is the financing constraint, which has a great impact on the export strategy decision and behavior of enterprises. To alleviate the credit discrimination faced by small, medium and micro exporters and help them obtain credit funds to produce more competitive products in the international market, digital inclusive finance takes the alleviation of financing constraints for new exporters as the starting point, and affects the total amount of exports from both the expansion margin and the intensification margin [4].

According to existing studies [4], financing constraints are mainly concentrated in enterprises with higher dependence on external financing and smaller trade scale, which are subject to stronger binary marginal effects of financial development. Reducing the fixed costs of enterprises is conducive to promoting the scale of China's exports, forming the expansion margin of exports; reducing variable costs is conducive to the growth of the number of exports of China's enterprises, i.e., the growth of the intensive margin. First, from the perspective of the expansion margin of trade, the expansion margin of exports is manifested in the increase in the variety of products imported and exported by emerging enterprises and the expansion of export markets. Usually, exporting enterprises are small in the initial stage of establishment, their export activities are risky, and they have a strong dependence on external financing. Since it is difficult for emerging enterprises to obtain external financing support, digital inclusive finance, by increasing the diversity of enterprises' export products and easing the credit constraint of SMEs' export fixed costs, expands the export scale of the whole region at the expansion margin. Secondly, from the perspective of the intensive margin of international trade, the intensive margin of exports is manifested in the expansion of the product variety of exports of existing enterprises. As SMEs are also subject to the credit constraint of variable costs in the export process, digital inclusive finance further gives credit support to their financial liquidity and expands the export scale of the whole region at an intensive margin.

According to neoclassical trade theory, regions with high levels of digital inclusive finance development have a comparative advantage in firms with high dependence on external financing, while regions with low levels of digital inclusive finance development have a comparative advantage in firms with low dependence on external financing [3]. Similarly, according to Robertsinsky's theorem [16], regions with high levels of digital inclusive finance development drive their comparative advantage as their level of digital inclusive finance development increases, thus promoting the export

growth of firms with high dependence on external financing; conversely, regions with low levels of digital inclusion financial development will stagnate their comparative advantage as their level of digital inclusion financial development decreases, inhibiting the export levels of firms with low reliance on external financing [3].

The expansion of export scale driven by digital inclusive finance will also promote high-quality development of export trade. The unique integration and innovation of digital inclusive finance have become a new driving force to optimize China's export trade structure, innovate economic growth and promote sustainable trade development. On the one hand, the inclusive nature of digital finance helps SMEs cross the threshold of credit constraint, and the symmetry of capital demand has a positive impact on the export scale and risk tolerance of SMEs, which makes the relative position of SMEs in export trade stronger and the quality development of China's export trade more diversified. On the other hand, the rise of "digital trade" has broken the information asymmetry barrier, lowered the exchange cost and trade threshold, and relied on big data, cloud computing and other emerging Internet technologies. Digital inclusive finance can more accurately and efficiently determine the changes in demand in the international trade market, improve the competitiveness of China's exports, and promote the high-quality development of foreign trade.

In summary, digital inclusive finance has a more obvious pulling effect on relatively disadvantaged SMEs, and the promotion utility of digital inclusive finance for SMEs' export trade can promote the high-quality development of a country's export trade. Therefore, this paper puts forward the following hypothesis: digital inclusive finance, with its unique digital and inclusive nature, can alleviate the credit constraint problem among SMEs, optimize their export scale and structure by enhancing the binary marginal effect of SMEs' exports, and promote the high-quality development of regional and even national export trade.

IV. DATA SOURCES AND VARIABLE MEASUREMENTS

A. Data Sources

This paper selects 30 provincial panel data in China from 2011 to 2018 to conduct an empirical analysis on the impact of digital inclusive finance on the high-quality development of export trade. To measure the level of high-quality development of export trade, three primary indicators and seven secondary indicators are selected to construct the evaluation system of high-quality development of export trade in China, and the data are obtained from the National Bureau of Statistics and Guotaian database. The data on digital inclusive finance are obtained from the Digital Inclusive Finance Index of Peking University (2011-2018). In addition, the data of relevant control variables such as local fiscal general budget expenditure, per capita disposable income, year-end resident population and fixed asset investment price index are obtained from the National Bureau of Statistics and Guotaian database.

B. Measurement of Export Trade Quality Development

Indicators

For the question of how to measure the level of quality development of our trade, this paper evaluates seven indicators from three dimensions: the level of foreign investment, the level of basic industries and the level of research and development, and the specific index system is constructed.

TABLE I
 EVALUATION INDEX SYSTEM OF HIGH-QUALITY DEVELOPMENT OF CHINA'S EXPORT TRADE

Primary indicators	Secondary indicators	Eigenvectors	Weight values
China's export trade quality development index system	Percentage of foreign exports	0.006	0.063%
	Foreign investment level	3.157	31.567%
	Percentage of foreign investment	0.010	0.096%
	R&D expenditure/GDP	0.020	0.203%
	Basic industry level	0.022	0.221%
	Development of new products expenses/GDP	1.694	16.937%
	The number of valid invention patents of industrial enterprises above the scale (pieces)	3.501	35.006%
Research and development level	Gross regional product (billion yuan)	0.024	0.239%
	Export/Import Value-added of tertiary industry (billion yuan)	1.523	15.228%
	Academic qualifications	0.044	0.440%

The hierarchical analysis is a multi-objective decision-making method, which can decompose a complex system into levels of objectives, criteria and programs, and then subjective judgments are made to calculate the relative importance degree of programs.

Firstly, the hierarchical analysis structure is constructed, and the hierarchical analysis structure of the foreign trade quality development level of 30 provinces in China is established according to the foreign trade quality development index system. Secondly, the judgment matrix is constructed and tested for consistency, and the judgment matrix C is constructed by comparing the importance degree of each factor. The maximum eigenvalue of the judgment matrix is λ_{\max} , which is normalized and recorded as W . The weight vector of the elements of the criterion layer for the relative importance of the target layer has $CW = \lambda_{\max} W$. On this basis, the matrix is tested for consistency.

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

If the stochastic consistency ratio is close to 0, the judgment matrix has a more satisfactory consistency and the stochastic consistency index is introduced RI :

$$RI = \frac{CI_1 + CI_2 + \dots + CI_n}{n}$$

Finally, the test coefficient CR is calculated:

$$CR = \frac{CI}{RI}$$

In general, if the sum of the relative importance index weights of the target layer is not greater than 0.1, the hierarchical ranking is considered to have a more satisfactory consistency.

C. Variable Measurement

Explained variables: In this paper, we construct the index system of high-quality development of China's export trade, get the comprehensive score of the level of high-quality development of export trade in 30 provinces in China, and take the logarithm of the score of each province from 2011-2018 as the explanatory variable. The larger the value, the higher the level of high-quality development of export trade.

Core explanatory variables: The Digital Inclusive Finance Index released by the Center for Internet Finance Research of Peking University [17] measures the degree of digital inclusive finance penetration in each province from three dimensions: breadth, depth, and digitalization of digital inclusive finance, and more than 20 indicators such as insurance, payment, money fund, credit, and investment.

Control variables: The increase in local fiscal general government budget ($\ln fin$) spending will benefit the total retail sales of consumer goods. The resident population at the end of the year was expressed as ($\ln pop$). China's investment situation using the fixed asset investment price index ($\ln inv$) indicates that the domestic optimistic market investment situation can revitalize the real economy and promote high-quality development of export trade.

V. EMPIRICAL ESTIMATION AND ANALYSIS OF RESULTS

A. Model Setting

This paper focuses on the impact of digital inclusive finance on the high-quality development of China's export trade, and constructs an empirical model as following:

$$\ln y_{it} = \beta_0 + \beta_1 \ln index_{it} + \beta_2 \ln pop_{it} + \beta_3 \ln inv_{it} + \beta_4 \ln fin_{it} + \varepsilon_{it}$$

To reduce the heteroskedasticity of the variables, all variables are logarithmically treated in this paper where $\ln y$ represents China's export trade quality development index, $\ln index$ represents digital inclusive finance, $\ln pop$ represents number of laborers, $\ln inv$ represents investment level, $\ln fin$ represents financial subsidy strength. The subscript i represents the province, t represents the year, ε represents the error term.

TABLE II
DESCRIPTIVE STATISTICS OF THE SAMPLE

Variable name	Observed value	Mean value	Standard error	Minimum value	Maximum value
lny	240	13.91526	1.024796	11.21997	16.54286
lnindex	240	5.072954	0.6699073	2.908539	5.93419
lnpop	240	8.202032	0.7413239	6.342122	9.421249
lninv	240	4.625118	0.029534	4.566221	4.685459
lnfin	240	8.295046	0.5680176	6.559488	9.663278
lninc	240	10.23568	0.2901246	9.61505	11.12776
lnm	240	10.01587	0.8295592	7.71378	12.68308

Table II gives the results of descriptive statistics based on the overall sample, after taking logarithms of each variable. Among them, the standard deviation of export trade quality development index of each region after taking the logarithm is large, which indicates that the gap in the export trade level in different regions is obvious.

B. Analysis of Empirical Results

TABLE III
BASE REGRESSION RESULTS

lny	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnindex	0.118	0.018	6.59	0	0.083	0.154	***
lnpop	1.221	0.25	4.89	0	0.729	1.713	***
lninv	1.683	0.178	9.44	0	1.331	2.034	***
lnfin	0.547	0.055	10.02	0	0.439	0.654	***
Constant	-9.017	2.095	-4.30	0	-13.148	-4.886	***
Mean dependent var			13.915		SD dependent var		1.025
R-squared			0.925		Number of obs		240
F-test			639.550		Prob > F		0.000
Akaike crit. (AIC)			-652.791		Bayesian crit. (BIC)		-635.388

*** $p < .01$, ** $p < .05$, * $p < .1$

The results of F-test and Hausman test indicate that the fixed effects are better than the first two. Analyzing the regression results of the fixed-effects model, the goodness-of-fit of the model is 0.9967, and the linear fit of the model is high, while the model passes the p-value test, indicating that the model is valid. Based on each regression coefficient, it can be concluded that the digital inclusive finance index, local fiscal general budget expenditure, year-end resident population and fixed asset investment price index all have significant positive effects on the high-quality development of China's export trade.

Analysis of the estimated results in Table III shows that the development of digital inclusive finance plays a significant positive role in promoting the high-quality development of China's export trade, with a 1% increase in the digital inclusive finance index and a 0.0900% increase in the high-quality development of export trade, indicating that the better the level of digital inclusive finance development, the higher the quality of export trade development in the regions, i.e., digital inclusive finance can promote the high-quality development of export trade in all regions. further improve the quality and scale of China's export trade, which can verify the hypothesis of this paper. This result can be explained by the fact that the digital transformation of traditional inclusive finance improves the efficiency of resource allocation of funds

in export trade enterprises, provides multiple financing channels for small and medium-sized export enterprises, alleviates the credit constraints on SMEs, and thus promotes the high-quality and sustainable development of export trade in a region or even a country.

The high-quality development of China's export trade is also closely related to the general budget expenditure of local finance, year-end resident population and fixed asset investment price index. The estimated results in Table III show that the higher the level of local general budget expenditure, the more favorable it is to the high-quality development of export trade, i.e., the government's financial support to export trade enterprises can supplement the demand for credit by SMEs, which in turn expands the scale of regional export trade. The increase in year-end resident population can also promote the high-quality development of export trade, because the increase in labor growth rate can promote the transformation and upgrading of export trade industries, especially for labor-intensive industries; there is another explanation for the influence of labor force level on export trade in academia; export trade shows labor cost sensitivity, and the rise of labor force number will bring about higher labor cost, and the number of export trade decreases accordingly. The reason why investment is significantly and positively correlated with the level of high-quality development of export trade is that regions with higher capital investment have higher access to financial resources, and financial resources guarantee the operation of small and medium-sized export trade enterprises, expand the scale of enterprise exports, and further expand the scale of regional export trade; the positive correlation between traffic mileage per capita and high-quality development of export trade can reflect that a region's good trade flow, transportation can promote the turnover and operation of its export trade.

VI. ROBUSTNESS TEST

Due to the limitation of data availability, this paper may omit other important variables that affect the impact of digital inclusive finance on the high-quality development of export trade. In addition, while digital inclusive finance promotes the high-quality development of China's export trade, in turn, the growth of China's export trade will drive the synergistic development of digital inclusive finance in various regions. In order to examine the previous empirical results, this paper employs a robustness test of the estimated results of the model by replacing the main research variables, i.e., using the gross regional product (billion yuan) to replace the export trade quality development index as the explanatory variable.

Table IV shows the regression results for the robustness test of the model. After replacing the explanatory variables and regressing the new model, the sign and significance level of the coefficients of the explanatory variables of the new model did not change significantly, and the regression coefficients of the core explanatory variables were still significantly positive, which shows that the regional economic level is influenced by the development of digital inclusive finance. The above regression results indicate that the original column model has

controlled the factors affecting the variables more effectively, and the hypothesis of this paper still holds, which can verify the reliability of the research results of this paper.

TABLE IV
ROBUSTNESS TEST REGRESSION RESULTS

ln gdp	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]	Sig
ln index	0.138	0.014	10.11	0	0.111	0.165 ***
ln pop	1.34	0.19	7.07	0	0.966	1.714 ***
ln inv	1.428	0.135	10.55	0	1.161	1.695 ***
ln fin	0.408	0.041	9.85	0	0.326	0.49 ***
Constant	-11.971	1.592	-7.52	0	-15.11	-8.833 ***
Mean dependent var			9.706		SD dependent var	0.873
R-squared			0.947		Number of obs	240
F-test			920.654		Prob > F	0.000
Akaike crit. (AIC)			-784.732		Bayesian crit. (BIC)	-767.328

*** $p < .01$, ** $p < .05$, * $p < .1$

VII. INTERMEDIATION EFFECT TEST

Based on the analysis of the heterogeneous enterprise trade model, digital inclusive finance takes the alleviation of SME financing constraints as the starting point, and enhances the binary marginal effect of enterprise export trade by reducing the fixed costs of enterprises to form the export expansion margin and reducing the variable costs to expand the intensive margin. Therefore, this paper draws the inference that the development of digital inclusive finance will alleviate the credit constraint problem of SMEs, expand the financing channel as an intermediary channel, and promote the high-quality development of China's export trade.

To verify the mediating role of credit constraint between digital inclusive finance and the high-quality development of China's export trade, this paper establishes a mediating effect model from the perspective of loan funds given to enterprises by banking financial institutions as follows:

$$\ln y_{it} = \beta_0 + \beta_1 \ln index_{it} + \varepsilon_{it} \quad (1)$$

$$\ln m_{it} = \beta_0 + \beta_1 \ln index_{it} + \varepsilon_{it} \quad (2)$$

$$\ln y_{it} = \beta_0 + \beta_1 \ln index_{it} + \beta_2 \ln m_{it} + \varepsilon_{it} \quad (3)$$

If the development of digital inclusive finance does affect the quality development of export trade by relaxing the credit constraints of enterprises and thus, the coefficients of β_1 and β_2 in models (1)-(3) should be significant on the one hand, and the coefficient of β_1 in model (3) will decrease accordingly compared to (2) on the other hand. If the above conditions are satisfied, it means that there is a mediating effect.

In Table V, column (1) and column (3) use China's export trade quality development index ($\ln y$) as the explanatory variable, and the empirical results show that the coefficient of digital financial inclusion ($\ln index$) is greater than 0 and

passes the significance test at the 1% confidence level. Further, the results in column (2), with various loans (lnm) from banking financial institutions as the explanatory variable, show that digital inclusive finance can significantly alleviate the credit constraints of enterprises and has a larger value of β_1 compared to column (3). In summary, we can prove the existence of the mediating effect, i.e., digital inclusive finance promotes the high-quality development of China's export trade by reducing the financing constraints of enterprises.

TABLE V
REGRESSION RESULTS OF INTERMEDIATE EFFECTS

Variables	(1) lny	(2) lnm	(3) lny
lnindex	0.207 (0.03)	0.408 (0.061)	0.115 (0.038)
lnm			0.226 (0.072)
Cons	3.637 (0.138)	8.101 (0.311)	1.804 (0.594)

Note: "****" is the 1% confidence level, and the figures in parentheses are standard errors.

VIII. INSIGHTS

Based on the panel data of 30 provinces and cities in China from 2011 to 2018, the article investigates the impact effect of digital inclusive finance on the high-quality development of China's export trade based on the measurement of China's export trade high-quality development index. According to the study, it can be concluded that digital inclusive finance in China further promotes the high-quality development of China's export trade comprehensively by alleviating enterprises' credit constraints, expanding their binary marginal costs, promoting the expansion of enterprises' exports, and pulling the scale of regional and even a country's export trade. Based on the findings of this paper, the following policy recommendations are proposed:

First, China needs to deeply understand the role of digital inclusive finance in promoting export trade. Driven by digital technology, we should optimize the top-level design of inclusive finance around the world, increase the support for digital technology innovation, and raise the proportion of high-tech products in the new foreign trade model. Based on coordination and complementarity with traditional finance, we will expand the depth and breadth of digital inclusive finance in China, break the "digital divide" that restricts the high-quality development of export trade, and smoothly realize the digital transformation of inclusive finance.

Second, the government should increase financial subsidies for the less developed areas of digital inclusion finance. We should improve the tax relief system for digital financial products, Internet technology in rural areas and microcredit for SMEs, and increase the support of government funds to ease the financing constraints on inclusive financial entities and fully support the high-quality development of China's foreign trade.

Third, financial institutions should improve the regulatory system of digital inclusive finance. Due to the instability of the

credit of digital inclusive finance subjects, it is necessary to raise the entry threshold of lending enterprises and improve the industry risk disclosure mechanism. In China's mixed industry and digital market environment, we should implement information transparency regulation, increase talent training and innovate the regulatory system to prevent and minimize the credit risks faced by digital inclusive finance.

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