

Will Digital Financial Inclusion Boost Export Levels-- Empirical Analysis Based on Panel Data of Counties in Jiangsu Province

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Abstract. Based on the Statistical Yearbook of Jiangsu Province and the Digital financial Inclusion Index calculated by Peking University, this paper empirically analyzes the potential impact of digital financial inclusion on export growth by using panel data of nearly 90 counties in Jiangsu Province. Benchmark regression shows that the development of digital inclusive finance can effectively promote regional export growth, and regional heterogeneity shows that the promotion effect of digital inclusive finance on export is different according to the different levels of regional economic development. Finally, the paper discusses the impact of digital inclusive finance on regional exports from three perspectives: coverage breadth, depth of use and digitization degree. The research results show that all three have significant positive impact on exports, and the coverage breadth of digital inclusive finance has a more significant promoting effect on exports.

Keywords: Digital financial inclusion; export; panel data of counties.

1. Introduction

Since the beginning of the 21st century, the digital economy has become an important engine for high-quality economic development. The digital economy can drive the upgrading of production factors and the transformation of production modes, reduce the production costs of enterprises, and promote the export of enterprises. At the same time, the digital inclusive finance developed from the digital economy is more conducive to stimulate the export activities of enterprises due to its high-quality features such as wide coverage, low cost and high efficiency, and low entry threshold. By taking advantage of its digital information, digital inclusive finance can absorb financial funds in a wider range, and precisely supply these financial funds to those who lack fixed assets, so as to effectively alleviate the financing constraints of these groups, so as to be an effective supplement to traditional finance. If export trade enterprises want to win in the fierce international market competition, they must invest a lot of money in the early stage to expand the scale of production and improve the technical ability, so as to enhance their own competitiveness. Will digital financial inclusion promote export trade? Is there heterogeneity in the impact of digital financial inclusion on export trade development in different regions? Digital inclusive finance is developing rapidly in our country. It is of great experiential and theoretical significance to grasp the influence of digital inclusive finance on the development of export trade, which is of great significance for our country to promote sustained and high-quality economic development through the "double cycle". Therefore, it is necessary to deeply explore the impact of digital financial inclusion on the development of export trade. Jiangsu Province is the largest province of economy and export in the central region. The study on the influence of the development of digital inclusive finance on export will have far-reaching influence on another Jiangsu Province and even other provinceOrganization of the Text.

2. Literature Review

There are mainly two studies related to this paper: One is about digital inclusion finance, but mostly focuses on its impact on economic growth and industrial structure upgrading. For example, Chen Xiao and Sun Xiaojiao et al. [1] used provincial panel data to build a fixed-effect model to investigate the role of digital inclusion finance on regional economic growth and its internal

mechanism. And research shows that digital financial inclusion can promote regional economic growth by stimulating digital innovation; Tang Jiqiang and Li Ting et al. [2] believe that digital inclusive finance can effectively promote regional economic growth, and innovation not only plays an intermediary role between digital inclusive finance and industrial structure upgrading, but also is an important path for digital inclusive finance to promote economic growth. Yang Gang and Zhang Hengyi [3] believe that digital inclusive finance is conducive to stimulating regional economic growth, and its stimulating effect is conducted through improving the level of innovation. However, with the change of the development level of inclusive finance, the impact of innovation level on economic growth is non-linear. Xu Ziyao and Zhang Lisha et al. [4] discussed the impact of digital inclusive finance on regional innovation capacity from the perspective of the role path of household consumption and found that digital inclusive finance further boosted regional innovation capacity by promoting the increase of consumption quantity and improvement of consumption quality. Zheng Yaxin [5] suggests that digital inclusive finance can indirectly promote the output of regional innovation by improving the regional higher education level, increasing the average salary of residents, and improving infrastructure construction. Foreign scholars also drew similar conclusions. For example, Keith et al. [6] argued that scientific and technological innovation activities need the support of the financial system. Meierrieks [7] believed that the participation of financial elements in various links of scientific and technological innovation activities could not only accelerate the R&D process of innovation subjects, but also provide sufficient funds for their activities and ensure a good internal and external environment. The other one explores the influence of traditional inclusive finance on trade. Li Yunpeng [8] uses panel data of "One Belt and One Road" countries to investigate the influence of inclusive finance gap among different countries on China's export trade and finds that the inclusive finance gap between China and other countries inhibits the development of China's export trade. Fan Zhaobin and Zhang Liuqing [9] analyzed the impact of inclusive finance on regional exports by using the data of provincial manufacturing industry and found that inclusive finance promoted the development of industrial export trade. In addition, such promotion effect was more significant for industries dependent on external funds.

Combing through the existing research, it is found that the research on regional export trade are mainly carried out from the perspective of traditional inclusive finance, while the influence of the integration of digital economy and traditional inclusive finance on the development of export trade is not considered, which has certain limitations. Studies that consider digital financial inclusion do not look at exports. Therefore, based on the digital inclusion finance index released by Peking University, this paper discusses the impact of digital inclusion finance on the development of China's export trade, so as to provide relevant policy suggestions for better trade development.

3. Theoretical mechanism and research design

3.1. Theoretical analysis

By far the biggest advantage of digital finance is supporting the development of inclusive finance through digital technology. On the one hand, Internet platforms adhere to tens or even hundreds of millions of mobile terminals through the establishment of some "scene" platforms such as Taobao or wechat. Digital technology, on the other hand, analyzes and evaluates big data from social media and online shopping platforms. Digital finance is to reduce customer acquisition costs and risk control costs when the two parties do not meet, to greatly improve the feasibility of inclusive finance development [10]. At present, the key technologies driving the development of finance mainly include big data, cloud computing, blockchain and artificial intelligence. The key driving technologies mainly improve the data processing capacity from the four dimensions of scale, speed, accuracy, and security, and enhance financial inclusion by reducing costs, improving risk control ability and promoting competition. Zhao Caixia and Wang Yuanyuan [11] believe that digital inclusive finance can take advantage of digital information and other advantages to absorb a large amount of idle low-cost funds in the market, expand financing channels and scale, provide more precise financial support for small,

medium and micro export enterprises, and ease the financing constraints of these emerging export subjects. Based on this, this paper proposes the following hypothesis:

H1: Digital financial inclusion can improve regional export levels.

Although Jiangsu is the largest export province and the largest economy in central China, there is also a big gap in its economic development level. In 2021, the GDP of southern Jiangsu is 6,664.791 billion yuan, while that of Central and northern Jiangsu is only 2,374.863 billion yuan and 2,673.180 billion yuan. Southern Jiangsu is the leader of Jiangsu's economy. Similarly, in terms of export, in 2021, the export volume of southern Jiangsu reaches 2,587.991 billion yuan, while that of Central and northern Jiangsu is only 383.864 billion yuan and 280.877 billion yuan, and the total export volume of Central and northern Jiangsu is less than 50% of that of southern Jiangsu, showing the regional phenomenon of unbalanced development in Jiangsu. Nanjing, Wuxi, Suzhou, Changzhou and Zhenjiang, which are located in southern Jiangsu, all have a relatively high level of digital inclusive finance development. So, this paper proposes another hypothesis:

H2: Digital financial inclusion has different effects on export promotion in regions with different levels of economic development.

3.2. Model construction

In order to verify the above research hypothesis, this paper builds the following measurement model on the basis of referring to existing studies:

$$lnex_{it} = \beta_0 + \beta_1 dif_{it} + \sum_{j=2}^5 \beta_j Z_{jit} + \psi_i + \gamma_t + \varepsilon_{it} \quad (1)$$

In Equation (1), $lnex_{it}$ is the export value of region i in period t , $ln dif_{it}$ is the development degree of digital inclusive finance in region i during the period of t , Z_{jit} represents a series of control variables, including industrial structure upgrading(is). population(lnpop). FDI level(lnfdi)And consumption power within the region(lncon). ψ_i is an unobtainable individual characteristic that does not change with time. γ_t is a time-fixed effect, ε_{it} represents the random disturbance term.

3.3. Variable selection and data description

1. Export level (lnex). In this paper, the export volume of county-level regions in Jiangsu Province during 2014-2021 was selected as the explained variable, and the data came from the Statistical Yearbook of Jiangsu Province.

2. Development level of Digital financial Inclusion (ln dif). The Digital Inclusion Finance Index constructed by Peking University is used to measure the development degree of digital inclusion finance [12]. The higher the value of the index, the higher the development degree of digital inclusion finance in a region. The data year is 2014-2021.

3. Control variables. To analyze the influence of the development level of digital inclusive finance on exports in a more comprehensive and specific way, it is also necessary to control other variables that may have an impact on exports. For reference to existing studies, details are as follows: (1). Industrial structure upgrading (is). In this paper, the output value /GDP of the tertiary industry in each region is measured. To respond to the requirements of the country to "go out" with high quality, the impact of the development of the tertiary industry on the export is self-evident. (2). Population (lnpop). In this paper, the number of registered residents at the end of each region is used to measure. Now the demographic dividend is still significant, so the demographic factor is still an important variable that cannot be ignored in regional exports. (3). FDI level (lnfdi). In this paper, the actual utilization of foreign investment in each region is used to measure the level of FDI in the region. Some scholars have found that export and investment are complementary. For example, Su Erdou and Xue Jun [13] believe that export and investment promote each other. (4) Consumption capacity within the region (lncon). This paper uses the total retail sales of consumer goods in this region to measure the regional consumption power. According to the firm heterogeneity theory of Melitz [14], only the enterprises

with the highest productivity can export, while the enterprises with low productivity can only sell domestically. Therefore, the higher the consumption power of a region, the more enterprises with high productivity in the region, the more conducive to export. The data sources of the above control variables are all Jiangsu Provincial Statistical Yearbook.

To avoid the influence of endogeneity on the estimation results and eliminate the dimensional influence, this paper takes logarithmic treatment on the export level of the explained variable, the development degree of the digital inclusive finance of the main explanatory variable, and the control variable population, FDI level and the consumption power within the region.

3.4. Descriptive statistics

The descriptive statistical results of each variable are shown in Table 1. The gap in the level of export is still quite large, with the minimum value of 0.995 million yuan and the maximum value of 457.9302 billion yuan. Similarly, the gap in the level of development of digital inclusive finance is also at a relatively high level, with the minimum value of 46.73, the maximum value of 141.261 and the standard deviation of 18.564. Moreover, there are great regional differences in population, FDI level and intra-regional consumption power.

Table 1: Descriptive statistics

variables	description	N	Average	St.d	Min	Max
<i>ex</i>	Export level	628	228.518	503.705	0.995	4579.302
<i>dif</i>	Digital financial inclusion	628	112.902	18.564	46.73	141.261
<i>is</i>	Industrial structure upgrading	628	0.509	0.146	0.314	0.998
<i>pop</i>	Population	628	82.647	37.444	13.38	211.18
<i>fdi</i>	FDI level	628	16.873	16.395	0.14	92.06
<i>con</i>	Consumption capacity	628	333.762	252.284	21.69	1625.681

4. Empirical analysis

4.1. Baseline regression result

Before baseline regression, to avoid the influence of multicollinearity, the multicollinearity test of variables was conducted in this paper based on Pearson correlation coefficient matrix analysis, as shown in Table 2. According to the criteria provided by Rockwell (1975), the correlation coefficients between variables were all less than 0.8, and the variance inflation factor test results showed that, The average VIF of variables and VIF of each variable are all less than 10 (see Table 3), indicating that the model does not have serious multicollinearity problems.

Table 2: Correlation coefficient matrix

	<i>ln dif</i>	<i>is</i>	<i>ln pop</i>	<i>ln fdi</i>	<i>ln con</i>
<i>ln dif</i>					
<i>is</i>	0.365***				
<i>ln pop</i>	-0.290***	-0.306***			
<i>ln fdi</i>	0.299***	-0.056	0.052		
<i>ln con</i>	0.458***	0.474***	0.209***	0.554***	

Note:*. **and * are significant at the levels of 10%, 5% and 1% respectively. The same as below.**

Table 3: Variance inflation factor test

Variable	VIF	1/VIF
<i>Indif</i>	1.58	0.634
<i>is</i>	2.33	0.428
<i>lnpop</i>	1.80	0.554
<i>lnfdi</i>	2.05	0.488
<i>lncon</i>	3.65	0.274
Mean VIF	2.28	

After eliminating the multicollinearity problem of the model, we adopt the region-year dual fixed effect model to carry out the benchmark regression. The first column of Table 4 shows the influence of the development degree of digital inclusive finance on exports when control variables are not added. The coefficient is positive and significant at the level of 1%. After the control variables are successively added into columns (2), (3), (4) and (5) of Table 4, the influence of the main explanatory variable, number financial inclusion development degree, on exports is still significant. Like previous studies, the upgrading of industrial structure is also conducive to the improvement of regional exports. Foreign direct investment also promotes regional export behavior at the level of 1%. Similarly, the improvement of domestic consumption power also has a significant impact on exports at the level of 1%. The influence of demographic factors on export becomes insignificant after adding regional consumption power variables. This paper speculates that it may be because when domestic consumption increases, it indicates that the consumption and income level of residents in the region are at a high level, so demographic dividend is not so important in foreign trade.

Table 4: Baseline regression results

variables	(1) <i>lnex</i>	(2) <i>lnex</i>	(3) <i>lnex</i>	(4) <i>lnex</i>	(5) <i>lnex</i>
<i>Indif</i>	0.750*** (2.85)	0.603** (2.27)	0.735*** (2.77)	0.655** (2.56)	0.514** (2.06)
<i>is</i>		0.994*** (2.94)	1.013*** (3.02)	1.178*** (3.64)	0.408 (1.20)
<i>lnpop</i>			0.206*** (3.49)	0.171*** (2.99)	0.006 (0.09)
<i>lnfdi</i>				0.148*** (6.46)	0.131*** (5.85)
<i>lncon</i>					0.276*** (5.78)
Constant	1.097 (0.99)	1.242 (1.13)	-0.213 (-0.18)	-0.136 (-0.12)	0.137 (0.13)
Individual effect	yes	yes	yes	yes	yes
Time effect	yes	yes	yes	yes	yes
N	628	628	628	628	628
R ²	0.827	0.829	0.834	0.846	0.855

Note: The t statistic is in parentheses.

4.2. Robustness test

In order to ensure the reliability of the study, the robustness test was carried out in this paper from four aspects: replacing explained variables, replacing research methods, adding delayed terms of explained variables and shrinking tail processing:

Replace the explained variable: To better measure the export level, this paper refers to the practice of Fan Hui [15] and replaces the explained variable with the ratio of total foreign trade exports to

GDP (lnfte). The regression results are shown in column (1) of Table 5. The promotion effect of the development level of digital inclusive finance on the export level is still significant at the level of 1%.

Alternative research methods: Since panel data estimation analysis is usually confronted with problems of inter-group heteroscedasticity, inter-group covariance and intra-group autocorrelation, the robustness test of this paper uses feasible generalized least square method (FGLS), which can simultaneously eliminate inter-group heteroscedasticity, inter-group covariance and intra-group autocorrelation. The regression results are shown in column (2) of Table 5. After replacing the regression method, digital financial inclusion has an enhancement effect on exports at the level of 1%.

Add the lag term of explained variable: Since the effect of digital inclusion finance on exports may not appear in the current period, to test the robustness of this paper, the explained variable is used to regression exports that lag one period. The regression results are shown in column (3) of Table 5. Digital inclusion finance still has a significant promoting effect on exports that lag one period, which confirms the robustness of the results in this paper.

Tail reduction treatment: In order to avoid the adverse impact of outliers on the estimation results, this paper conducted 1% tail reduction treatment on explanatory variables before estimation. The regression results are shown in column (4) of Table 5.

Therefore, hypothesis 1 of this paper can be verified, that is, digital financial inclusion can improve regional export level.

Table 5: Robustness test results

	(1) <i>lnfte</i>	(2) <i>lnex</i>	(3) <i>F.lnex</i>	(4) <i>lnex</i>
<i>Indif</i>	1.810*** (3.89)	3.466*** (0.512)	0.563** (2.11)	0.618** (2.33)
Control variables	yes	yes	yes	yes
Constant	-10.439*** (-5.29)	-14.576*** (2.166)	-1.942 (-1.64)	-0.305 (-0.26)
Individual effect	yes	yes	yes	yes
Time effect	yes	yes	yes	yes
N	628	628	628	628
R ²	0.692		0.862	0.855

Note: Standard error in parentheses in column (2).

4.3. Heterogeneity analysis

In order to analyze the heterogeneity that may exist in the results of this paper, this paper discusses the sub-indexes of digital inclusive finance and the heterogeneity of different regions in Jiangsu Province.

Because the Digital financial inclusion index compiled by the Digital Finance Research Center of Peking University also includes three sub-dimensions, namely, the coverage breadth of digital financial inclusion (DIF-C), the depth of digital financial use (DIF-D) and the digitalization degree of financial inclusion (DIF-L). The three subindices are also logarithmic. The regression results are shown in columns (1), (2) and (3) of Table 6. Coverage breadth of digital inclusive finance (Indifc), depth of use of digital finance (Indifd) and digitization degree of inclusive finance (Indifl) all have significant promotion effect on export at 1% level. The coverage of digital inclusive finance has a deeper promoting effect on exports. This may be because although digital inclusive finance is developing orderly in all regions, the popularity of digital inclusive finance is only limited to enterprises or a few individuals, not to mention the depth of use and the degree of digitalization. Therefore, the regions that can promote the coverage of digital financial inclusion are self-evident in promoting exports and economic development.

As mentioned above, there is a big gap in regional development in Jiangsu province. Therefore, this paper conducts regression analysis on the influence of digital inclusive finance on export in southern Jiangsu, Northern Jiangsu and Central Jiangsu respectively. The promotion effect of digital inclusive finance on the export of southern and northern Jiangsu is significant at the level of 1%, and its impact on Central Jiangsu is also significant at the level of 5%. However, it is not difficult to see that the promotion effect of digital inclusive finance on southern Jiangsu is more obvious, which is consistent with hypothesis 2 above: The promotion effect of digital inclusive finance on export varies with regional economic development, and the higher the level of economic development, the more obvious the promotion effect of digital inclusive finance on export.

Table 6: Results of heterogeneity analysis

	(1) <i>lnex</i>	(2) <i>lnex</i>	(3) <i>lnex</i>	(4) Southern Jiangsu	(5) Central Jiangsu	(6) Northern Jiangsu
<i>ln dif</i>				4.245*** (2.61)	2.764** (2.18)	2.398*** (2.70)
<i>ln difc</i>	2.153*** (5.31)					
<i>ln difd</i>		0.811*** (2.79)				
<i>ln difl</i>			0.239*** (3.41)			
Control variables	yes	yes	yes	yes	yes	yes
Constant	- 9.252*** (3.89)	-1.163 (-0.91)	1.494*** (3.97)	-18.864*** (-2.67)	-12.544** (-2.28)	-9.435*** (-2.59)
Individual effect	yes	yes	yes	yes	yes	yes
Time effect	yes	yes	yes	yes	yes	yes
N	628	628	628	243	136	249
R ²	0.788	0.856	0.857	0.717	0.821	0.696

5. Conclusions

Based on the panel data of nearly 90 counties in Jiangsu Province, this paper empirically analyzes the potential impact of digital inclusive finance on export growth. The findings are as follows: First, the development of digital inclusive finance can effectively promote regional export growth. Second, the promotion effect of digital inclusive finance on export shows different effects due to different regional economic development levels. Thirdly, the coverage breadth, use depth and digitalization degree of digital financial inclusion have a positive promoting effect on regional exports, among which, the coverage breadth of digital financial inclusion has a more significant promoting effect on exports.

The above conclusions provide a series of theoretical evidence for digital inclusive finance to promote export growth in Jiangsu Province. Based on this, the following policy suggestions are put forward: First, continue to deepen the development of digital inclusive finance, encourage and support the deeper integration and innovative development of inclusive finance with the new generation of artificial intelligence, big data, cloud computing and other high-end emerging digital technologies, and promote the transformation and upgrading of inclusive finance industry. At the same time, the top-level design for the coordinated development of digital inclusive finance should be perfected, the efficient and transparent organization and management system and coordination and communication

mechanism should be accelerated, and efforts should be made from the three dimensions of digital inclusive finance in order to promote the export growth of Jiangsu Province from multiple dimensions. Second, accelerate digital technology to empower other industries and build a modern industrial system. Further integrate digital technology with traditional manufacturing, service and other industries in a deep way, rationally allocate factor resources, realize the penetration, integration, co-construction and sharing of data factors and traditional production factors, and improve total factor productivity. Finally, it is necessary to strengthen policy support and continue to give full play to the inclusive nature of digital finance. The development plan of regional digital finance can be explored to ensure the development of regional real economy and technology research and development. We can explore the formulation of moderately favorable policies for digital finance, which can be moderately favorable to central and northern Jiangsu in the region and moderately favorable to technology research and development enterprises in the industry type, so as to provide them with more financial support and promote technological innovation with digital finance, so as to achieve regional export growth.

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