

Digital Finance and the Upgrading of Export Structure: An Analysis from the Perspective of Entrepreneurship

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Abstract: The development of digital finance will play an important role in the upgrading of export structure. Taking data of 30 provinces from 2011 to 2019, this paper applies the export proportion of capital and technology-intensive industries to measure regional export structure and study relations among digital finance, entrepreneurship, and export structure. The study finds that: on the one hand, digital finance can improve the entrepreneurship to promote the upgrading of export structure; on the other hand, compared with the spirit of startup, digital finance plays a more significant role in the entrepreneurship of innovation.

1. Problem Raising

Through literature review, it can be found that: first of all, existing studies mainly discuss the promotion of financial development to the upgrading of export structure through relieving financing constraints and improving the innovation level from the objective perspective, but neglect the significance of entrepreneurial initiative and spirit. Secondly, limited to the micro levels of enterprises and households, most foreign and domestic studies on digital finance mainly discuss its role in the capability of corporate technological innovation, the upgrading of industrial structure, and financing constraints. However, few studies are conducted from the perspective of the influence of digital finance on export structure. Finally, studies on entrepreneurship at home and abroad still focus on corporate performance, lacking study at the macro level.

Based on the above existing deficiencies in research, the study will be conducted for the following two purposes: On the one hand, from the perspective of digital finance, it will study the upgrading of export structure, and expand and innovate the study on the influence of financial system on the optimization of export trade; on the other hand, excluding objective factors, it will explore the path that intangible factors of product such as entrepreneurship influence the upgrading of export structure based on subjective factors influencing the upgrading such as entrepreneurship.

2. Hypotheses of Theoretical Analysis

Digital finance can promote the upgrading of export structure through promoting technological innovation. It can drive the development of technological innovation, and improve product structure through technological progress to promote the upgrading of export structure. Therefore, the paper puts forward the second hypothesis:

Hypothesis 1: The development of digital finance can promote the upgrading of export structure.

Digital finance provides opportunities for entrepreneurs to start up business, while the increase of venture capital will promote the improvement of technologies (Li Bijing, 2020) ^[1]. Therefore, while promoting to start up business, digital finance can also indirectly promote the innovation of technologies and improve their complexity to promote the upgrading of export structure. Therefore, the paper makes the second hypothesis:

Hypothesis 2: Digital finance can improve export structure through promoting the spirit of startup for entrepreneurs.

The development of digital finance promotes the entrepreneurship of innovation, which can benefit to other entrepreneurs through ways such as knowledge spillover, and upgrade and complicate technologies in an area, influencing export structure to a certain extent. On this basis, it can be concluded that digital finance can improve export structure through promoting the entrepreneurship of startup. Therefore, the paper puts forward the third hypothesis:

Hypothesis 3: Digital finance can improve export structure through promoting the spirit of innovation for entrepreneurs.

3. Model Design and Data Sources

3.1. Data Sources and Processing

Data in the paper is mainly from China Digital Inclusive Finance Development Database, *China Statistical Yearbook of Science and Technology*, *China Population & Employment Statistics Yearbook*, *China Statistical Yearbook.*, and provincial statistical yearbooks. Given that digital financial inclusion index was predicted and calculated from 2011, the data has been updated to 2020. However, due to the influence of COVID-19, other partial variables exist the missing of data in 2020. Therefore, the paper selects the data from 2011 to 2019.

3.2. Variable Measure

Table 1: Variable Measure

Variable Type	Variable Name	Variable Symbol	Measurement Method
Explained variable	Export structure	Export	Proportion of high-tech industry in exports (HTES) and export of technology-intensive industries (TES)
		Index	Data of digital financial inclusion from 2011 to 2020
Explanatory variable	Digital finance	Breadth	Data of digital financial inclusion from 2011 to 2020
		Depth	Data of digital financial inclusion from 2011 to 2020
		Level	Data of digital financial inclusion from 2011 to 2020
		Patent	Napierian logarithm of the number of patents granted
Intermediate variable	Entrepreneurship	Employ	Logarithm of proportion of private enterprise investors in employment
Control variable	Volume of import and export	Trade	The ratio of total volume of import and export to gross regional product
	Degree of opening to foreign investment	Open	The ratio of FDI to GDP
	Economic increment	Increase	The annual growth of GDP
	Level of green development	Pollution	The ratio of investment in industrial pollution control to GDP

3.3. Model Design

To study the influence of digital finance on the upgrading of export structure, the paper establishes Model (1):

$$export_{id,year} = a_0 + a_1 index_{id,year-1} + \sum Controls_{id,year-1} + \varepsilon \quad (1)$$

In this model, a_0 represents the constant term; a_1 represents the total effect of digital finance on the upgrading of export structure; i represents province, t represents year; Controls represents

control variable; ε represents the disturbing term.

To further explore the intermediate effect of entrepreneurship, the paper establishes the following models of intermediate effect based on formula (1):

$$employid_{i,t} = b_0 + b_1 index_{i,t-1} + \sum Controls_{i,t-1} + \varepsilon \quad (2)$$

$$exportid_{i,t} = c_0 + c_1 index_{i,t-1} + c_2 employid_{i,t-1} + \sum Controls_{i,t-1} + \varepsilon \quad (3)$$

$$patentid_{i,t} = d_0 + d_1 index_{i,t-1} + \sum Controls_{i,t-1} + \varepsilon \quad (4)$$

$$exportid_{i,t} = e_0 + e_1 index_{i,t-1} + e_2 patentid_{i,t-1} + \sum Controls_{i,t-1} + \varepsilon \quad (5)$$

In those models, b_0 , c_0 , d_0 , and e_0 represent constant terms; b_1 represents the effect of digital finance on the spirit of startup in entrepreneurship; c_1 represents the direct effect of digital finance on the upgrading of export structure after the control on the spirit of startup in entrepreneurship; c_2 represents the influence degree of the spirit of startup in entrepreneurship on the upgrading of export structure after the control of digital finance.

d_1 represents the effect of digital finance on the spirit of innovation in entrepreneurship; e_1 represents the direct effect of digital finance on the upgrading of export structure after the control on the spirit of innovation in entrepreneurship; e_2 represents the influence degree of the spirit of innovation in entrepreneurship on the upgrading of export structure after the control of digital finance. ε represents the regression residual; b_1 、 c_2 、 d_1 、 e_2 represent the indirect effect of digital finance on the upgrading of export structure, namely, the intermediate effect of entrepreneurship.

4. Analysis of Empirical Results

4.1. Basic Regression Analysis

Table 2: Digital Finance and the Upgrading of Export Structure

VARIABLES	(1)	(2)
	Export	Export
Index	0.000** (2.68)	0.000*** (3.13)
Increase		0.000 (1.50)
Trade		2.234* (1.78)
Open		-0.002 (-0.33)
Pollution		-0.001 (-0.64)
Constant	0.208*** (13.68)	0.150*** (2.83)
Observations	270	270
R-squared	0.098	0.133
Number of id	30	30

The fixed effect model is applied for regression, and benchmark regression results are shown in Table 2, in which the explained variable is export structure, while the explanatory variable is digital finance index. In Table 2, no control variable is added in Column (1), while four control variables are added in Column (2) to control their influences, including the volume of import and export, the degree of opening to foreign investment, economic increment, and the level of green development. The regression results show that the development of digital finance can promote the upgrading of export structure. In Column (2), the coefficient estimation value of digital finance index a_1 is equal

to 0.0002454 and significant at the level of 1%, which indicates that the development of digital finance can promote the upgrading of export structure. Consistent with Hypothesis 1, empirical results verify the positive effect of the development of digital finance on the upgrading of export structure.

Table 3 shows regression results of the development of digital finance on the upgrading of export structure after the addition of intermediate variable — entrepreneurship. According to Column (2), the influence coefficient of entrepreneurship of innovation on export structure is 0.081 and significant at the level of 1%; meanwhile, according to Column (4), the influence coefficient of entrepreneurship of startup on export structure is 0.110 and significant at the level of 5%, which verifies the Hypothesis 2 and 3, that is, entrepreneurship plays a certain intermediate role in the relation between digital finance and the upgrading of export structure.

It shows that the development of digital finance can promote the upgrading of export structure directly or through enhancing entrepreneurship. Column (2) and (3) in Table 3 can be taken as examples to explain the influence of control variables on the upgrading of export structure, between which the volume of import and export is significant at the level of 5%, indicating that the increase in the volume of import and export can promote the improvement of export structure; the estimated coefficient of the level of green development is not significant, indicating that the control variable has no obvious effect on the upgrading of export structure.

Table 3: Digital Finance, Entrepreneurship, and the Upgrading of Export Structure

VARIABLES	(1) Patent	(2) Export	(3) Employ	(4) Export
Patent		0.081*** (2.95)		
Index	0.002*** (5.42)	0.000** (2.40)	0.001*** (4.09)	0.000** (2.64)
Increase	-0.000 (-1.29)	0.000** (2.42)	0.000 (0.36)	0.000 (1.00)
Trade	-6.879 (-1.56)	2.790** (2.09)	-10.590*** (-3.18)	3.397** (2.33)
Open	0.081*** (4.57)	-0.008* (-1.77)	0.024* (1.72)	-0.004 (-1.04)
Pollution	-0.011* (-2.04)	0.000 (0.13)	-0.005 (-0.87)	-0.000 (-0.36)
Employ				0.110** (2.65)
Constant	9.746*** (42.74)	-0.637** (-2.24)	-1.757*** (-10.17)	0.343*** (4.47)
Observations	270	270	270	270
R-squared	0.477	0.237	0.296	0.243
Number of id	30	30	30	30

The effects of economic increment and degree of opening to foreign investment on the upgrading of export structure are not clear. However, after the addition of variable — the entrepreneurship of innovation, the estimated coefficients of both control variables are significant, and there is a negative correlation between them; after the addition of variable — the entrepreneurship of startup, both estimated coefficients are not significant, which is likely to be related to the measurement methods of both control variables.

4.2. Robustness Test

Referring to the method of Wang Daoping et. al (2021), the paper adopts the one-stage lag processing of digital finance index to conduct the robustness test, and also takes the endogenous

problem into consideration. According to Column (1), (3) and (5), it can be concluded that the indexes of correlation are significant between digital finance, the entrepreneurship of startup, and the entrepreneurship of innovation, and the upgrading of export structure, which is consistent with the conclusion of basic regression. Among them, the index of correlation is significant at the level of 1% between digital finance and the upgrading of export structure, which verifies the robustness of core conclusion.

Table 4: Robustness Test through One-Stage Lag Processing

VARIABLES	(1) Export	(2) Patent	(3) Export	(4) Employ	(5) Export
Patent			0.062** (2.18)		
Index	0.000*** (3.10)	0.002*** (6.52)	0.000** (2.11)	0.001*** (4.68)	0.000** (2.55)
Increase	0.000*** (3.13)	0.000 (0.85)	0.000*** (2.78)	0.000 (0.91)	0.000* (1.73)
Trade	2.266* (1.79)	-2.859 (-0.78)	2.442* (1.92)	-9.306** (-2.57)	2.987** (2.13)
Open	-0.004 (-1.08)	0.066*** (5.52)	-0.008* (-1.99)	0.018 (1.42)	-0.005 (-1.57)
Pollution	-0.001 (-0.79)	-0.013*** (-3.56)	-0.000 (-0.11)	-0.005 (-0.90)	-0.001 (-0.69)
Employ					0.078* (1.89)
Constant	0.172*** (3.46)	9.771*** (59.00)	-0.431 (-1.51)	-1.752*** (-10.32)	0.308*** (3.87)
Observations	240	240	240	240	240
R-squared	0.130	0.569	0.176	0.310	0.189
Number of id	30	30	30	30	30

4.3. Heterogeneity Analysis

The development of digital finance can enhance the entrepreneurship of startup and innovation, upgrade and complicate technologies in an area, and influence export structure to a certain extent, which indirectly has a positive effect on gross regional product. The paper processes per capital gross regional products of 30 provinces to obtain the median, and divides data of those provinces between 2011 and 2019 into two groups to conduct heterogeneity analysis.

Table 9 and 10 show that first of all, in regions with a higher per capital gross regional product (GRP), the coefficient of correlation between digital finance and the upgrading of export structure is not significant, which indicates that the development of digital finance in those regions cannot directly influence export structure. However, the coefficient of correlation between the entrepreneurship of innovation and the upgrading of export structure is 0.048 and significant at the level of 10%, which shows that the development of digital finance in those regions can indirectly improve export structure through enhancing the entrepreneurship of innovation, but the effect is weak; in regions with a lower per capital GRP, the indexes of correlation are positive values and significant between digital finance, the entrepreneurship of startup, and the entrepreneurship of innovation, and the upgrading of export structure, which verifies that the three hypotheses in the paper are true in those regions. In those regions, the development of digital finance can directly improve export structure, and entrepreneurship plays an intermediate role between the two variables.

Table 5: Per Capital Gross Regional Product (GRP) Higher than the Median

VARIABLES	(1) Patent	(2) Export	(3) Employ	(4) Export
Patent		0.048*		
		(1.74)		
Index	0.000	0.000	0.000	0.000
	(1.04)	(0.85)	(0.15)	(1.02)
Increase	-0.000	0.000	0.000	0.000
	(-1.52)	(0.95)	(0.31)	(0.34)
Trade	-13.113***	0.846	-13.439***	1.453
	(-4.87)	(0.96)	(-5.13)	(0.99)
Open	0.079***	-0.004	0.042**	-0.004
	(7.63)	(-0.91)	(2.58)	(-1.16)
Pollution	-0.031***	-0.001	-0.016***	-0.001
	(-9.46)	(-1.05)	(-3.43)	(-0.69)
Employ 2				0.092
				(1.30)
Constant	11.192***	-0.231	-1.058***	0.406***
	(73.78)	(-0.73)	(-5.28)	(5.75)
Observations	135	135	135	135
R-squared	0.680	0.068	0.544	0.124
Number of id	26	26	26	26

Table 6: Per Capital Gross Regional Product (GRP) Lower than the Median

VARIABLES	(1) Patent	(2) Export	(3) Employ	(4) Export
Patent		0.098***		
		(3.09)		
Index	0.002***	0.000*	0.001***	0.000**
	(4.85)	(2.03)	(4.03)	(2.69)
Increase	-0.000	0.000	0.000	-0.000
	(-1.57)	(0.23)	(0.36)	(-0.64)
Trade	-34.878*	11.668***	-1.360	8.395**
	(-2.00)	(3.76)	(-0.06)	(2.08)
Open	0.078	-0.000	0.028	0.004
	(0.68)	(-0.07)	(0.54)	(0.58)
Pollution	-0.001	-0.000	-0.006	0.000
	(-0.20)	(-0.45)	(-1.23)	(0.12)
Employ 2				0.095*
				(1.76)
Constant	9.295***	-0.870***	-2.336***	0.259***
	(26.28)	(-2.84)	(-6.27)	(2.91)
Observations	135	135	135	135
R-squared	0.419	0.396	0.222	0.337
Number of id	23	23	23	23

Given that problems such as financing difficulty and the misallocation of financial assets often emerge in regions with a lower per capital GRP, the development of digital finance is favorable to relieve financing constraints in those regions, and promote enterprises in those provinces to speed up innovation and entrepreneurship and improve the complexity of product technology. Therefore, through the heterogeneity test, it can also be concluded that digital finance can promote the improvement of export structure in those areas with relatively backward economic development.

5. Conclusions and Suggestions for Policy Making

Based on data of China Digital Inclusive Finance Development Database between 2011 and 2019, this paper verifies the influence of digital finance on the upgrading of export structure and the intermediate effect of entrepreneurship between both them. The study finds that: (1) On the whole, digital finance can enhance entrepreneurship and improve the complexity of export technology to promote the upgrading of export structure. Furthermore, through the test with the one-stage lag measurement method, the core conclusion is still robust; (2) benchmark and robustness studies show that compared with the spirit of startup, digital finance has a more significant effect on the entrepreneurship of innovation; (3) the heterogeneity test finds that the promotion of digital finance to the upgrading of export structure is not significant in regions with a higher per capital GRP, which is opposite in those with a lower per capital GRP.

Based on the above conclusions, the paper puts forward the following suggestions for policy making. First of all, given that the development of digital finance can promote the upgrading of export structure, policy makers should pay attention to the development of digital finance and the degree of inclusion in all provinces, fully consider regional differences in the development of digital finance. Secondly, they should continue to carry out the policy of innovation, and implement the development strategy of “mass entrepreneurship and innovation” to continuously infuse the vitality of innovation into all provinces and improve the complexity of product technology so as to improve China’s export structure and speed up its upgrading. Finally, they should also pay attention to the development of digital finance in regions with a lower per capital GRP. Given the significant effect of digital finance on the upgrading of export structure in those regions, it should be ensured that they can fully enjoy the dividend of digital finance.

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