Impact of Digital Finance on Industrial Structure with Research and Development Intensity

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Abstract. With rapid technological advancement, digital finance, facilitated by various digital technologies, has paved a novel trajectory for financial system reform and innovation, thereby playing a pivotal role in economic development. To comprehend the impact of digital finance on economic growth, this study evaluates the economic development and industrial composition of 30 Chinese regions. It constructs a regression model using the digital finance index as the independent variable. Empirical findings underscore the capacity of digital finance to propel high-quality development and emphasize the interrelation between the industry index and a moderating variable, namely Research and Development investment. Consequently, policymakers are urged to bolster digital infrastructure, encourage innovative evolution of digital finance, and position digital finance as a critical enabler of optimizing high-quality development.

Keywords: Digital Finance; Economy Development, Industrial structure, Research and Development

1 Introduction

Digital finance, encompassing services delivered through mobile devices, personal computers, the Internet, or digitally linked cards [1], holds the potential to fuel enterprise innovation by leveraging traits like sharing, convenience, affordability, and accessibility. This form of finance could drive technological innovation within businesses, evident through accurate user profiles, refined risk evaluation, and streamlined operations [3]. Extracting valuable insights from big data and applying them to enterprise credit and financing processes holds significant promise for optimizing economic structures [5,10]. Resolving real economy financing challenges, digital finance aligns with the financial accelerator theory that asserts financing constraints as determinants of economic growth [8,9]. Kapoor supports digital finance's role in economic growth by mitigating funding limitations [6].

Furthermore, digital finance diversifies financing avenues for enterprises, forming a robust foundation for bolstering technological innovation. Integrating novel scientific and technological elements can enhance labor productivity. Disparities in technological prospects across industries influence productivity variations, ultimately impacting industrial restructuring [2,4,7]. Additionally, income growth prompts shifts in consumption preferences, driving transitions from agricultural to industrial and service-oriented products, thereby propelling industrial structure upgrades [2].

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2 Data Sources

Data on digital finance originates from the China Digital Inclusive Finance Index 2011-2019, issued by Peking University's Digital Finance Research and Development Institute. Information regarding regional industrial structure, R&D intensity, and labor input derives from the China Statistical Yearbook (2011-2019) via the China National Bureau of Statistics Data Service Platform.

3 Definition of variables and empirical analysis

3.1 Variables

The model employs the logarithm of the digital finance index (encompassing coverage breadth, usage depth, and degree of digitalization service) as the independent variable. The dependent variable is the industrial structure, which gauges the sectoral arrangement of the national economy by evaluating the proportion of added value contributed by the secondary and tertiary industries. This indicator offers an intuitive reflection of a country's economic development level. The dataset, segmented by distinct regions, is scrutinized to uncover the correlation between digital finance and optimizing industrial structure. The moderating variable is the proportion of research and development (R&D) intensity, also log-transformed. Its role is to investigate whether R&D investment correlates with the performance of technological innovation and economic growth.

The rest five variables are control variables, representing five economic aspects of the different regions. GDP and disposable income per capita both directly show the city's economic and consumption levels, and both variables are measured in unit of 10,000 RMB. Foreign investment is essential for a country's economy as it stimulates capital inflows and trade/export growth, brings in technological innovation, while fixed investment helps the society in job creation and skill development, and infrastructure development, and contributes to economic stability and resilience by diversifying the sources of economic growth. Both investments are taken logarithm and measured in units of 100 million. Table 1 shows the descriptive statistics of variables.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Industrial structure	1.304	.704	.527	5.234
Digital Finance	5.143	.679	2.786	6.017
R & D intensity	1.663	1.124	.189	6.302
GDP per capita	5.129	2.567	1.602	16.178
Disposable income	2.22	1.056	.751	6.944
Fixed investment	9.427	.893	6.247	10.987
Foreign investment	5.189	1.963	-1.22	7.495
Labor input	7.595	.857	5.223	8.875

3.2 Empirical models

The research hypothesis proposed is digital finance can positively impact the industrial structure. I built the following regression model:

$$Ind = \alpha_0 + \alpha_1 DF_{i,t} + \alpha_2 RDI_{i,t} + \alpha_3 DF_{i,t} RDI_{i,t} + \alpha_4 GDPc_{i,t} + \alpha_5 DI_{i,t} + \alpha_6 FIX_{i,t} + \alpha_7 FDI_{i,t} + \alpha_8 LI_{i,t} + \varepsilon_{i,t} \quad (1)$$

with digital finance as the independent variable and the change in industrial structure from 2011 to 2019 as the dependent variable. I setup a baseline model without the moderating variable R&D intensity:

$$Ind = \alpha_0 + \alpha_1 DF_{i,t} + \alpha_2 GDPc_{i,t} + \alpha_3 DI_{i,t} + \alpha_4 FIX_{i,t} + \alpha_5 FDI_{i,t} + \alpha_6 LI_{i,t} + \varepsilon_{i,t} \quad (2)$$

4 Empirical Results

This study investigates how digital finance and technological innovation influence regional industrial structure by using Eqs.(1) and (2). The outcomes of the random effect models, chosen to estimate the results, are presented in Table 2 below.

In economic studies, the significance level is at 0.1, therefore, it's reasonable to state that the correlations between digital finance, digital finance, and R&D intensity interaction term, disposable income, fixed asset investment, and labor input and the change of industrial structure are not zero. While the moderating variable, R & D intensity, and two of the control variables, GDP per capita and foreign direct investment do not have significant impacts on the industrial structure. The coefficients of variables are as follows: digital finance (0.132), disposable income per capita (0.293), fixed asset investment (-0.563), labor input (0.164) and the interaction term of digital finance and R & D intensity (0.124).

The baseline model results in Table 3 indicates that digital finance, disposable income, fixed asset investment, foreign direct investment and labor input all have significant impact on the change of industrial structure. The coefficients of variables are also different from the regression model's. It has digital finance (0.184), disposable income per capita (0.363), fixed asset investment (-0.605), foreign investment (0.046) and labor input (0.16).

Table 2. Regression Results

Ind	Coef.	p-value	95% CI		Sig
Digital finance	.132	.093	-.022	.286	*
R & D intensity	-.354	.14	-.825	.116	
DF & RDI interaction	.124	.008	.033	.215	***
GDP	-.072	.114	-.161	.017	
DI	.293	.011	.069	.518	**
FAI	-.563	0	-.748	-.379	***
FDI	-.003	.899	-.054	.047	
Labor input	.164	.061	-.008	.337	*
Constant	3.929	0	3.047	4.81	***

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

Table 3. Baseline Model Results

Ind	Coef.	p-value	95% CI		Sig
Digital finance	.184	.006	.053	.316	***
GDP	.02	.668	-.071	.111	
DI	.363	.003	.127	.599	***
FAI	-.605	0	-.804	-.407	***
FDI	.046	.075	-.005	.097	*
Labor input	.16	.091	-.025	.345	*
Constant	3.707	0	2.97	4.445	***

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

5 Conclusions

Digital finance can significantly promote economic development with the ability to positively stimulate the growth of regional industrial structure. It's also reasonable to state that R&D intensity cannot significantly impact regional industrial structure. However, their interaction term has strongly significant impact on the dependent variable. Among the five control variables, disposable income and labor input are positively correlated with regional industrial structure, while fixed asset investment has a negative impact on the regional industrial structure.

Drawing from these findings, policy recommendations aimed at fostering high-quality development in the nation through digital finance can be formulated. Firstly, advocate for the utilization of digital finance to enhance its contribution to the regional real economy. Secondly, enhance citizens' quality of life and augments disposable income. Thirdly, attracts a greater influx of migrants to amplify labor input. Lastly, institute measures to regulate and progressively curtail fixed asset investment, given its adverse effect on industrial structure.

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