Impact of Digital Finance on Industrial Structure with the Moderating Effect of Technological Innovation

Yue Zhang
E-mail: zydtgyx@outlook.com

Department of Mathematics, University of Bristol, Bristol, United Kingdom

https://www.bristol.ac.uk/

Abstract. The development of digital finance can contribute to the optimization of the regional industrial structure. This paper considers the impact of digital finance on regional industrial structure with the moderating effect of technological innovation. Digital finance and technological innovation are important tools to optimize the regional industrial structure. I evaluate the industrial structures of 30 provinces (excluding Tibet) in China from 2011 to 2020, and set up a regression model by combining the digital finance index of Peking University. Following empirical results, digital finance has the ability to increase investment in R&D and foreign direct investment to promote the optimization of the regional industrial structure. Therefore, the government should focus on improving the coverage and availability of digital financial services, and guiding it to become an important support for optimizing the industrial structures.

Keywords: Digital finance; Technological innovation; Industrial structure.

1 Introduction

Digital finance plays an important role in stimulating consumption, encouraging investment and creating employment. The development of digital finance can contribute to the optimisation of the regional industrial structure. Digital finance optimizes asset allocation and promotes industrial upgrading through its coverage. Digital inclusive finance can generate positive effects for industrial structure upgrading. Digital inclusive finance has a significant contribution to the optimisation of the employment structure in the eastern region.

Digital finance has an important impact on regional technological innovation. Digital finance employs technological approaches to optimize and upgrade products, which to a certain extent promotes the universality and equalization of financial services. As a developing country, the financing of Chinese enterprises encounters difficulties such as information asymmetry, adverse selection and high financing costs. Whether digital finance is able to enhance the resource allocation ability of China's financial market, to ease the financing constraints, and to promote the technological innovation is worthy of further study. The digital technology has enabled digital finance to expand its scope of services, thus providing broader and more targeted access to financial inclusion [3]. The problem of financing technological innovation for many enterprises has been alleviated, thus easing the financial constraints of the real economy and enabling it to invest more in research and development [2]. On the micro-level of executive endowments, Francis *et. al.* investigate the impact of managers' education on corporate

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governance and performance [4]. They show that companies with managers from higher education are associated with better performance [4]. Krishnan *et. al.* conclude that the enterprise innovation increases due to the deregulations are greater for financially constrained enterprise [5]. Levine and Warusawitharana show that financial frictions promote the sensitivity of productivity growth to the use of external finance [6].

I consider the impact of digital finance on regional industrial structure with technological innovation. The financial industry supports and promotes the optimisation of regional industrial structure. Technology innovation have a significant role to play in regional economic growth [7].

Technological innovation supports and promotes the optimisation of regional industrial structure in two main ways: firstly, digital finance enhances regional innovation from both the supply and demand sides. Secondly, the inclusive attributes of digital finance can provide more financial support to technology-intensive manufacturing industries [1].

The existing literature mostly focuses on certain aspects of digital finance and regional industrial structure, but there is a lack of research on the relationship between digital finance, technological innovation and regional industrial structure optimization. I provide a quantitative analysis of the relationship between digital finance and regional industrial structure with the moderating effect of technological innovation.

2 Data

The data on digital finance comes from the China Digital Inclusive Finance Index 2011-2020 published by the Digital Finance Research and Development Institute of Peking University. Province-related data on industrial structure, R&D intensity and labour input are obtained from the China National Bureau of Statistics Data Service Platform 2011-2020.

3 Definition of variables and empirical methods

This paper examines the significance of the cited variables for the study will be presented. The paper data mainly around the following six variables.

3.1 Variables

The industrial structure is the sectoral structure of the national economy, and it is the composition of the national economy among and within various industrial sectors. Digital finance comes from the digital financial Inclusion index published by the Institute of Digital Finance of Peking University. This paper selects provincial data to analyze the relationship between digital finance and regional industrial structure optimization. Research and development intensity is to prove that R&D investment is positively correlated with technological innovation performance and productivity growth. Labor input has the leading effect on production and social development. With the establishment of the market economy system, China attracts the most foreign investment. Under the conditions of open economy, especially with the deepening development of economic globalization, the introduction of foreign investment and foreign direct investment has become an important and effective way to

promote the adjustment of national industrial structure. The degree of foreign trade reflects the exchange of goods and services between a country or region and another country or region.

Table 1. The variables are explained in detail [Defined by author]

Variable	Measurerment
Industrial structure(Structure)	Added value of secondary / tertiary industry
Technological innovation level(Ininno)	Logarithm of patent applications
Total index of digital Inclusive Finance(Combined Index)	Total index of digital Inclusive Finance /100
Labor input(Inlabor)	Logarithm of urban unit employment
Foreign direct investment(Fdi)	Total foreign direct investmeng / log
Outward foreign direct investment(Ofdi)	Total outward foreign direct investmeng / log
Foreign trade degree(Trade)	Total foreign trade degree / log
R & D intensity(Rds)	Total R & D intensity / log
Government purchasing degree(Gov)	Total government purchasing degree / log

3.2 Empirical models

I consider the impact of the total index of financial inclusion on the industrial structure of each province as the independent variable and the change in industrial structure from 2011 to 2020 as the dependent variable. I use Stata software to run the following empirical model:

$$\text{Industrial structure} = \alpha_0 + \alpha_1 \times \text{Combined Index} + \alpha_2 \times \text{Rds} + \alpha_3 \times \text{Inlabor} + \alpha_4 \times \text{Fdi} + \alpha_5 \times \text{Controls} + \varepsilon \quad (1)$$

$$\text{Industrial structure} = \alpha_0 + \alpha_1 \times \text{Combined Index} + \alpha_2 \times \text{Ininno} + \alpha_3 \times \text{Rds} + \alpha_4 \times \text{Inlabor} + \alpha_5 \times \text{Fdi} + \alpha_6 \times \text{Controls} + \varepsilon \quad (2)$$

4Empirical results

This paper examines the impact of digital finance, technological innovation on regional industrial structure through descriptive statistics and significance tests.

Table 2 shows number of samples, mean, median, standard deviation, maximum and maximum values. Table 3 shows that direct investment and foreign trade degrees are conducive to restructuring the industrial structure to promote the upgrading of regional industrial structure. The coefficients of variables are as follows: R&D intensity (-1.20), digital financial inclusion index (10.72), labour input (-7.07), foreign direct investment (0.19), outward foreign direct investment (0.49), foreign trade degree (0.97) and government purchase degree (-4.76).

Table 2. Descriptive statistics [Calculated by author]

Variable	N	Mean	P50	Sd	Min	Max
Structure	310	2.819	0.807	5.912	0.00877	51.96
Rds	310	1.694	1.373	1.136	0.189	6.473
Combined Index	310	2.162	2.235	0.970	0.162	4.319
lnlabor	310	7.535	7.623	0.866	5.142	8.859

Fdi	310	-5.156	-5.056	1.604	-13.44	-1.095
Ofdi	302	-3.729	-3.533	1.381	-8.470	-1.032
Trade	310	-10.39	-10.58	1.314	-13.36	-6.983
Gov	310	-9.973	-10.07	1.082	-12.45	-6.985

Table 3. Significance test [Calculated by author]

	OLS Structure	Two-way Fixed Effects Structure
Rds	-1.4251***	-1.2025***
	(0.2635)	(0.3419)
Combined Index	1.2470***	10.7214***
	(0.3391)	(3.7039)
lnlabor	-3.6315***	-7.0784***
	(0.6217)	(4.5702)
Fdi	-0.3101***	0.1968***
	(0.2530)	(0.3306)
Ofdi	0.1076**	0.4925*
	(0.2703)	(0.5483)
Trade	0.6724*	0.9750
	(0.3424)	(0.7835)
Gov	-5.0489***	-4.7615***
	(0.4932)	(0.5802)
_Cons	-14.6403***	6.3390**
	(3.9192)	(31.1928)
N	302	302
r2	0.4797	0.6347
r2_a	0.4673	0.5688

5 Discussion

I study the impact of digital finance, technological innovation on regional industrial structure. R&D intensity is negatively correlated with regional industrial structure (-1.20%). Digital financial inclusion index is positively correlated with regional industrial structure (10.82%). Labour input is negatively correlated with regional industrial structure (-7.07%). Foreign direct investment is positively correlated with regional industrial structure (0.19%). Government purchase degree is negatively correlated with regional industrial structure (-4.76%).

Digital finance and technological innovation are important tools to optimize the regional industrial structure. Firstly, digital finance should be vigorously utilised to benefit the real economy in the region, by investing more financial support for scientific research. Also increase investment in R&D to promote the growth of the tertiary industry and regulate the proportion of secondary and tertiary industries, thus promoting the optimization of the regional industrial structure. The second is to increase foreign direct investment, which plays a non-negligible role in the growth of the national economy due to its good development, while the industrial structure and international trade are complementary to each other.

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