Research on the Impact of Digital Economy on the Upgrading of Industrial Structure

TuoChen Li(✉) and Yue Yu

School of Economics and Management, Harbin Engineering University, Harbin, China
805321163@qq.com

Abstract. Based on panel data of three major Urban agglomerations in China from 2011 to 2019, this paper adopts the entropy weight method to measure the comprehensive level of digital economy. On this basis, this paper establishes the econometric model to conduct empirical research on the direct impact, transmission mechanism of digital economy on urban industrial structure. The results show that the development of digital economy can promote the upgrading of industrial structure, among which technological innovation plays a positive mediating role.

Keywords: Digital economy · Upgrading of industrial structure · Technological innovation · Three urban agglomerations · Mediating effect model

1 Introduction

In recent years, with the booming development and wide application of digital technologies such as the Internet, big data, cloud computing and block chain, digital economy, as a new economic form, has become the most active and important part of China's economic. In 2020, the overall scale of China's digital economy reached 39.2 trillion yuan, accounting for 38.6% of GDP and growing at 9.7%. It has become a key driving force for economic growth. At the same time, with the sustainable development of China's economy, the industrial structures have been improved but there are still many problems such as low quality of economic development and unreasonable industrial structure. The development of digital economy will trigger new industrial transformation, promote the continuous optimization of traditional industries, and bring new opportunities and challenges to industrial transformation and upgrading. As emphasized in the 14th Five-Year Plan, we will promote the deep integration of digital technology with the real economy, enable the transformation and upgrading of traditional industries, foster new industries, new forms and models of business, and strengthen new engines of economic development. At present, the economic development of three major urban agglomerations has important strategic significance for China. Therefore, this paper chooses the three most important urban agglomerations in China as research objects to study the impact of the digital economy on their industrial structure. What is the mechanism behind it? What are the differences in the impact of digital economy on industrial structure upgrading in different urban agglomerations? This paper will use fixed effect model, intermediate effect model to explore these laws.

F. Balli et al. (Eds.): ESFCT 2022, AEBMR 226, pp. 305–311, 2022.
https://doi.org/10.2991/978-94-6463-052-7_35

There have been increasing studies on the impact of digital economy on the upgrading of industrial structure. Zhang'paper [1] (2018) believed that digital economy can push the industrial structure forward to the middle and high end.

Liu (2021) [1] believed that digital economy can promote the upgrading of industrial structure by promoting factor agglomeration and increasing factor input. Li [3] (2020) found that digital economy has a positive impact on industrial structure transformation and upgrading, and there are differences in different regions. The research conducted by Yao [4] (2021) with Chinese provincial regions as samples shows that digital economy can significantly promote the upgrading of industrial structure and play an intermediary role in the process of R&D investment intensity. Yu and Cong [5] (2021) found that under the development of digital economy, human capital dividend can help promote the advancement of industrial structure. Jiao and Sun (2021) [6] found that the development of digital economy ultimately promoted the upgrading of industrial structure by promoting regional innovation, and this effect was more significant in areas with high urbanization and high human capital. Ji [7] (2022) found Digital economy can promote the upgrading of industrial structure by enabling both the production end and the demand end.

2 Model and Data

2.1 Model Building

In order to verify the direct impact of digital economy on the upgrading of industrial structure, this paper first constructs the fixed effect model as follows:

$$Ins_{it} = \alpha_0 + \alpha_1 Dig_{it} + \alpha_i X_{it} + \lambda_i + \varepsilon_{it} \tag{1}$$

In this model, ins_{it} represents the industrial structure upgrading of the i city in the t year; dig_{it} is the comprehensive development level of digital economy in the i city in the t year; X_{it} represents a series of control variables that may affect the explained variable. λ_i represents the unobstructible individual fixed effect of the city. ε_{it} refers to random interference term; α_0 represents the model intercept term. α_1 is the variable coefficient of digital economy.

Model (1) represents the direct impact of digital economy on industrial structure upgrading. In order to verify the possible indirect transmission mechanism of digital economy on industrial structure upgrading, a mediating effect model is established with technological innovation as the mediating variable. The specific testing steps are as follows: after the regression coefficient α_1 in model (1) passes the significance test, construct a linear regression equation for the impact of the digital economy on technological innovation, and construct a regression equation for the impact of the digital economy and technological innovation on industrial structure upgrading. The significance of the coefficients β_1, γ_1 and γ_2 can be used to judge whether there is a mediating effect. The specific mediation effect model can be expressed as:

$$Inv_{it} = \beta_0 + \beta_1 Dig_{it} + \beta_i X_{it} + \lambda_i + \varepsilon_{it} \tag{2}$$

$$Ins_{it} = \gamma_0 + \gamma_1 Dig_{it} + \gamma_2 Inv_{it+}\gamma_i X_{it} + \lambda_i + \varepsilon_{it} \tag{3}$$

2.2 Variable Explanation and Description

(1) Explained variables. Industrial structure upgrading (Ins) refers to the economic development process in which a country's economic focus shifts from the traditional primary and secondary industries to the tertiary industries. In this paper, it is measured by the ratio of the added value of the tertiary industry to the added value of the secondary industry. (2) Explanatory variables. Digital economy (Dig). Based on ZHAO's article [7], this paper adopts entropy weight method to measure the digital economic development index, which contains five indicators including telecom revenue, the number of information transmission computer services and software employees, the number of broadband Internet access users, the number of mobile phone users, and Financial inclusion index. (3) Intermediary variables. Technological innovation (Inv). This paper uses the number of patents granted in a city, which best represents the innovation level of a city. (4) Control variables. Government support (Gov). This paper adopts the proportion of government financial expenditure in GDP in this region. Opening to the outside world (Fdi). The proportion of foreign direct investment in GDP is used as the expression. Infrastructure development (Inf). Per capita road area is used to represent the level of infrastructure construction. Level of urbanization (Urb). The urbanization rate of resident population is selected to represent the level of urbanization development.

2.3 Source of Data

This paper selects panel data of three urban agglomerations from 2011 to 2019, which from China Urban Statistical Yearbook and some data from public data of government departments. In order to ensure data integrity, linear interpolation method is used to supplement some missing data.

3 Empirical Analysis

3.1 Analysis of Direct Effect Results

The estimated results of the impact of digital economy on the upgrading of industrial structure are shown in Table 1. In Model (1), the estimated coefficient of the core explanatory variable digital economy is 0.4519, which passes the significance test, indicating that the development of digital economy can significantly promote the upgrading of industrial structure. Digital economy and industry has brought technology, talents, capital and other advanced elements to the industry, driving the development of Chinese industry. For control variables, the government support coefficient is significantly positive, and the government can adopt policies, investment and other ways to lead the development of local industries. The coefficient of foreign direct investment is negative but not significant. The reason may be that foreign investors invest more in labor-intensive industries, which has a certain structural bias. The coefficient of infrastructure construction is significantly positive, indicating that urban infrastructure is the foundation of digital economy development, and the more perfect the infrastructure is, the more conducive to industrial development. The level of urbanization is positive but not significant, which may be due

Table 1. Digital economy affects the estimated result of industrial structure upgrading

Variable	General regression	Beijing-Tianjin-Hebei Urban agglomeration	Yangtze River Delta Urban agglomeration	Pearl River Delta Urban agglomeration
Dig	0.4519*** (8.41)	0.6865** (2.34)	0.4215*** (9.46)	0.2517*** (2.92)
Gov	1.3161*** (4.57)	1.1539** (2.07)	1.4191*** (3.08)	1.7206*** (2.66)
Fdi	-0.4822 (-0.67)	0.5541 (0.2)	-1.1836** (-1.97)	-0.6732 (-0.65)
Inf	0.0057* (1.78)	0.0043 (0.30)	0.0115** (2.57)	0.0065** (2.32)
Urb	0.3939 (1.06)	0.0869 (0.05)	-0.0845 (-0.31)	1.1293 (0.82)
Constant	0.3915* (1.66)	0.7472 (0.76)	0.5431*** (3.08)	-0.3393 (-0.31)
Obs	432	117	234	81
R^2	0.1070	0.0576	0.0795	0.1016

Note: value is in parentheses; ***, ** and * represent significance levels of 1%, 5% and 10%, respectively

to the fact that the current urbanization does not effectively improve human capital, and thus does not have an effective impact on the upgrading of industrial structure.

As the endowment conditions and development stage of the three urban agglomerations are quite different, their digital economy development level and industrial development status are different. Therefore, this paper carries out regression on the three urban agglomerations respectively, and tests the law of different urban agglomerations. It can be seen from Table 1 that digital economy can significantly promote the upgrading of regional industrial structure in the three major urban agglomerations. Among them, the Beijing-Tianjin-Hebei has the largest coefficient of 0.6865, followed by the Yangtze River Delta economic group with a coefficient of 0.4215, and finally the Pearl River Delta with a coefficient of 0.2517. After calculation, the comprehensive level of digital economy in Beijing-Tianjin-Hebei region is higher than that in the Yangtze River Delta and pearl River Delta. It can be seen that the improvement of digital economy level can significantly promote the upgrading of industrial structure, and there are significant differences in different regions. The promotion effect of digital economy level on the upgrading of industrial structure is more obvious.

Table 2. Mediation model regression results

Variable	Model (2)	Model (3)
Dig	0.4900*** (8.61)	0.2896*** (5.26)
Inv		0.3313*** (7.29)
Gov	0.6557** (2.15)	1.0999*** (4.04)
Fdi	-0.4601 (-0.61)	-0.3298 (-0.49)
Inf	-0.0051 (-1.48)	0.0073** (2.45)
Urb	-1.1052*** (-2.82)	0.7601** (2.17)
Constant	0.7988*** (3.20)	0.1269 (0.57)
Obs	432	432
R^2	0.0759	0.3959

3.2 Analysis of Mediating Effect Results

Model (2) and Model (3) are the empirical results of mediation model testing. It can be seen from Model (2) that the influence coefficient of digital economy on technological innovation is significantly positive.It bring technological innovation capital, high-quality talent, information technology services, improve the efficiency of the allocation of resources, and promote the development of the regional innovation. After technological innovation is added into model (3), its influence coefficient on industrial structure upgrading is significantly positive, while the coefficient of digital economy decreases significantly. Specifically, for every 1% increase in the digital economy, the upgrading of the industrial structure will directly increase by 0.2896%, and at the same time, the technological innovation will increase by 0.4900% which will indirectly lead to an increase of 0.1623% in the upgrading of the industrial structure. The total effect is 0.4519, and the indirect effect accounts for 35.92% of the total effect (Table 2).

4 Conclusion and Advice

4.1 Conclusion

By studying the impact of digital economy on the upgrading of industrial structure, the main conclusions are as follows: First, the development of digital economy can effectively promote the upgrading of urban industrial structure. The comprehensive development level of digital economy can effectively promote the upgrading of urban

industrial structure. Second, the promoting effect of digital economy on industrial structure upgrading has obvious regional heterogeneity. The Beijing-Tianjin-Hebei region has the best effect, followed by the Yangtze River Delta region, and finally the Pearl River Delta region. Third, digital economy can indirectly promote industrial structure upgrading by promoting technological innovation.

4.2 Advice

By studying the impact of digital economy on the upgrading of industrial structure, the main advice are as follows: First, improve the comprehensive development level of the digital economy. The government should continue to promote the development of the digital economy, thereby promoting the upgrading of the urban industrial structure. Second, strengthen technological innovation. The government should continuously optimize urban software and hardware facilities, create an excellent environment for industrial development, increase investment in science and technology, and promote the upgrading of industrial structure by improving the level of regional technological innovation. Third, upgrade the industrial structure based on the actual situation. The government should upgrade the industrial structure according to the actual situation of the city itself, give priority to optimizing the leading industries, expand the advantages of the leading industries and then drive the development of other industries.

References

1. Zhang Yuzhe. The development of digital economy and its Main tasks [J]. Economic Outlook, 2018 (09): 85-91.
2. Liu Xuan. Correlation analysis of digital economy development and global value chain Division of Labor status [J]. Business Economics Research, 2021 (13)
3. Li Xiaozhong, Wu Jiaxuan. Regional differences in industrial structure Transformation and Upgrading driven by digital economy [J]. International Economic Cooperation, 2020, (4)
4. Yao Weihan, Yao Zhanqi. Journal of Xi'an Jiaotong University (Social Science Edition), 201, 41(5).
5. Yu Boyang, Cong Yi. Digital economy, human capital dividend and advanced industrial structure [J]. Financial Theory & Practice, 201, 42(3).
6. Jiao Shuaitao, SUN Qiubi. Research on the influence of Digital economy development on industrial structure upgrading in China [J]. Industrial Technical Economics, 201, 40(5).
7. Ji Yuanyuan, Zhu Pingfang. Digital Economy Enabling Industrial Structure Upgrading: Demand Traction and Supply Optimization [J]. Academic Monthly, 202, 54 (04)
8. Zhao Tao, Zhang Zhi, LIANG Shangkun. Digital economy, entrepreneurial activity and quality development: Empirical evidence from Chinese cities [J]. Management world, 2020, 36