ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 10, Issue 2, February 2024

Research on the Impact of Digital Economy on Industrial Structure in the New Era

Jiaojiao Zhao[a,1], Liang Fang[a,*], Rui Chen[a]

[a] College of Mathematics and Statistics, Taishan University, Tai'an, China

[1]Email:zhaojiaojiao2017@163.com
[*]Email:fangliang3@163.com

***Abstract*—The digital economy is becoming a core force in reshaping the economic structure of various regions. For the development level of the digital economy, the entropy method is used to measure the indicator system for building the digital economy foundation, and the industrial structure upgrading index is constructed based on the Petty Clark theorem. This article selects panel data from 31 provinces and cities in China from 2013 to 2022 to establish a fixed effects model to study the impact of digital economy development on industrial structure. The results indicate that the development of digital economy has a promoting effect on the upgrading of industrial structure, both at the national and regional levels. Strengthening the development of digital economy can accelerate the upgrading of industrial structure, with the greatest impact on the industrial structure in the central region.**

***Index Terms*—Digital economy, Industrial structure, Fixed effects model.**

I. INTRODUCTION

Against the backdrop of rapid economic development in China, the current digital economy has become the main and latest driving force for upgrading China's industrial structure. Develop new quality productive forces. The upgrading of industrial structure has opened a window of opportunity for the formation of new quality productive forces.

At present, foreign scholars are paying more attention to the impact of digital technology on individuals, politics, society, and economy, as well as the indispensable role that digital economy plays in shaping the form and structure of national economy and regional clusters [1-3]. Chinese scholars have conducted more research on the impact of the digital economy on industrial structure upgrading compared to foreign countries, such as the interaction between the digital economy and the business environment, improving resource allocation efficiency, and promoting the integration of digital technology and traditional physical industries, all of which can promote industrial structure upgrading [4-5].

In the digital economy era, scholars have conducted less research on the impact of industrial structure upgrading through regional comparisons, but there are significant differences in the level of economic development among the eastern, central, and western regions of China. This article uses panel regression models to study the impact of digital economic system on industrial structure upgrading from a national and regional perspective, which has certain significance for promoting China's industrial structure upgrading.

II. INDICATOR MEASUREMENT OF DIGITAL ECONOMY AND INDUSTRIAL STRUCTURE UPGRADING

A. Indicator measurement of digital economy

This article draws on the methods of other scholars [6] in constructing digital economy indicators, and constructs an indicator system from three dimensions: digital foundation, telecommunications industry, and financial industry to measure the level of digital economy development (see Table 1 for details). This article selects panel data from 31 provinces and cities in China from the China Bureau of Statistics and Peking University Digital Inclusive Finance Index [7] from 2013 to 2022, and uses the entropy method to calculate the weights of various indicators of the digital economy, and evaluates the development level of the digital economy in each region. The entropy method is an objective weighting method that reduces the subjectivity in determining indicator weights to a certain extent.

Table 1 Digital Economy Development Indicators

Index	Variable Selection
Digital Fundamentals	Number of Internet broadband access users per 100 people
	The proportion of urban employment in information transmission, software, and information technology service industries
Telecommunications industry	Per capital telecommunications business volume
	Mobile phone penetration rate
Financial industry	Per capital e-commerce sales
	Peking University Digital Inclusive Finance Index

B. Evaluation and calculation of industrial structure upgrading level

According to the law of industrial structure evolution based on the Petty Clark theorem, as the per capita national income level increases, labor first shifts from the primary industry to the secondary industry, and then to the tertiary industry. That is, the overall upgrading of industrial structure is the transformation and upgrading of the primary industry to

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com
International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 10, Issue 2, February 2024

the secondary industry, and finally to the tertiary industry. The proportion of the tertiary industry continues to rise, the proportion of the secondary industry first increases and then decreases, and the proportion of the primary industry gradually decreases. In order to characterize the process of industrial structure upgrading using the relative changes in the proportion of output value of the three industries, drawing on the calculation method of other scholars [8], the weights of the first, second, and third industries are assigned in descending order, namely 1, 2, and 3. The industrial structure upgrading index (uis) is constructed by multiplying the proportion of output value of each industry to the total output value. [9] discussed that the time-consuming process of developing analytical models can be accelerated with the help of machine learning, which is a technique for data processing. Using machine learning, antenna designers can quickly and intelligently optimize their physical antenna designs. This is achieved by developing trained models of the designers' designs. Consequently, antenna designers can create more efficient antennas. [10] discussed about Intelligent Sensor Network for Vehicle Maintenance System. Modern automobiles are no longer mere mechanical devices; they are pervasively monitored through various sensor networks & using integrated circuits and microprocessor based design and control techniques while this transformation has driven major advancements in efficiency and safety.

III. Empirical Analysis of the Impact of Digital Economy Development on Industrial Structure

A. model buildingWith the deepening understanding of the digit

To further examine the impact of digital economy development on industrial structure, an econometric model is constructed. According to previous research, taking the logarithm of all variables reduces the heteroscedasticity of the data. The specific model is as follows:

$$\mathrm{luis}_{it} = \beta_0 + \beta_1 \mathrm{ldedl}_{it} + \beta_2 \mathrm{lpatent}_{it} + \beta_3 \mathrm{lfinance}_{it} + \beta_4 \mathrm{linout}_{it} + \beta_5 lgdp_{it} + \varepsilon_{it}$$

Among them, i represents the province, and t represents the time. ldedl_{it} represents the logarithm of each index in region i in year t, and ε_{it} is a random interference term.

B. Variable Selection

In the Internet era, the digital economy is more and more closely related to the degree of industrial structure. Therefore, this article selects relevant data from 31 provinces and cities in China from the China Bureau of Statistics from 2013 to 2022 to analyze the impact of digital economy development on industrial structure. The detailed variable explanations are as follows:

(1) The dependent variable: Industrial Structure Upgrading Index (Luis): a comprehensive indicator reflecting the rationality of a region or country's economic and industrial structure, commonly used to evaluate the health of its economic development and the process of economic transformation and upgrading.

(2) Explanatory variable: Digital Economy Composite Index (LDDL): A tool used to measure the performance of a country or region in the development of the digital economy.

(3) Control variables: Industrial structure upgrading is not only related to the development of the digital economy, but also influenced by other factors. Therefore, this article chooses the following four control variables:

Technological innovation level (lpatent): per capita domestic patent application authorization volume. Technological innovation is the key to enhancing economic competitiveness. The level of technological innovation is constantly improving, breaking down technological barriers in developed countries, enhancing China's international competitiveness, and promoting industrial structure transformation and upgrading.

Degree of government intervention: The proportion of general budget expenditure of local finance in each province to GDP. The government can become one of the important factors affecting the social environment through the formulation of relevant policies, which plays a very important role in promoting the upgrading of industrial structure

Level of foreign trade (linout): The proportion of the total import and export volume of domestic destinations and sources of goods to GDP. In the context of economic globalization, the upgrading of industrial structure is not only influenced by internal economic factors in China, but also by international economic and trade factors.

Economic development level (lgdp): per capita gross domestic product. Per capita GDP objectively and directly measures the overall level and degree of development of a country's society.

C. Empirical analysis

1. Empirical analysis of the impact of national level digital economy development on industrial structure

(1) Panel unit root inspection

Although the panel data used in this article is short, for more accurate analysis, both HT and IPS tests are used for unit root testing. The test results show that all variables after the first-order difference are stationary.

(2) Regression analysis

The variables in the panel data after the first-order difference are all stable, so the Pedroni method is used for cointegration testing. The P-values corresponding to MP, PP, and ADF are all 0.000. If the test is passed, there is a long-term cointegration relationship, and the original sequence can be used for regression.

Examine the impact of digital economy development on industrial structure. The F, LM, and Hausman tests were used to determine the most suitable model for random effects, fixed effects, and mixed regression models. The fixed effects model was ultimately selected, and the regression results are shown in Table2.

According to the regression results of the fixed effects model, the core explanatory variable of digital economy

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com
International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 10, Issue 2, February 2024

development has passed the test at a significant level of 1%, indicating that digital economy development will play an important role in upgrading industrial structure. At the same time, the regression coefficient of the development of the digital economy is positive, indicating that the development of the digital economy has a positive impact on the upgrading of industrial structure. Accelerating the development of the digital economy can promote the upgrading of industrial structure.

Table2 Estimated Results

Variable	Mixed effect	Fixed effect	Random effect
	（OLSE）	（FE）	（RE）
ldedl	-0.008*	0.020***	0.019***
	(-1.86)	(8.85)	(8.20)
lpatent	0.006*	-0.008***	-0.007***
	(1.72)	(-3.87)	(-3.49)
lfinance	0.050***	0.056***	0.048***
	(9.41)	(6.95)	(6.61)
linout	0.010***	0.010***	0.013***
	(4.16)	(3.86)	(5.51)
lgdp	0.091***	0.034***	0.038***
	(10.65)	(4.21)	(4.77)
cons	-0.053	0.650***	0.600***
	(-0.57)	(7.77)	(7.18)
N	310	310	310
R^2	0.653	0.695	

2. Empirical analysis of the impact of the development level of regional digital economy on industrial structure

To further study the impact of the development level of the digital economy on industrial structure, we will analyze the role of digital economy development on industrial structure in three regions: east, west, central, and central. The estimated results of the fixed effects model are shown in Table 3.

According to the results of the fixed effects model by region, the impact of digital economy development on industrial structure in the eastern, central, and western regions has passed the test at a significance level of 1%, and all have a positive promoting effect. However, the effect shows a decreasing difference in the central, eastern, and western regions.

Table 3 Regional Regression Results

	EAST	CENTER	WEST
ldedl	0.021***	0.033***	0.018***
	(7.93)	(6.56)	(4.19)
lpatent	-0.001	-0.012***	-0.012***
	(-0.33)	(-3.03)	(-3.32)
lfinance	0.020***	0.059**	0.037*
	(2.90)	(2.53)	(1.90)
linout	-0.006	0.013*	0.007**
	(-1.29)	(1.68)	(2.04)
lgdp	0.024***	0.013	0.026
	(3.06)	(0.70)	(1.48)
_cons	0.697***	0.906***	0.696***
	(8.67)	(4.88)	(3.92)
N	120	90	100
R^2	0.870	0.811	0.575

IV. CONCLUSION

This article uses panel regression models to study and analyze the impact of digital economy development on industrial structure using relevant data from 31 provinces and cities in China from 2013 to 2022. The results indicate that: (1) The overall analysis at the national level shows that the development of mutual digital economy has a significant effect on promoting industrial structure upgrading, and the degree of government intervention, foreign trade level, and economic development level also have a promoting effect on industrial structure upgrading. (2) Regional analysis shows that the development of digital economy has a positive effect on the upgrading of regional industrial structure; Government intervention also has a positive impact on the upgrading of industrial structure in various regions.

IV. ACKNOWLEDGMENT

This work has been supported by the Tai'an City Science and Technology Innovation Development Project (Policy Guidance) "Research on the Impact of Digital Economy System on Industrial Structure in the New Era" (2022ZC437).

REFERENCES

[1] Prainsack,B.Oil crisis:the political economy of digital data.Conclusion of thespecial issue. Policy Studies.2020;41(5):563-566.
[2] Revenko,L.S.&Revenko,N.S.Digital Transformations Tracks of Current Internati onal Economic Relations in the Context of Human Activity. Journal of Siberian Federal University,Humanities&Social Sciences.2022;15(7):1001-1011
[3] Sizova,T.,Sizova,D.&Gordeeva,J.The Conditions for Digital Economy Development as the Modern Trend of Knowledge Society Formation. International Multi disciplinary Scientific Conference on Social Sciences&Arts SGEM.2018;5:747- 754.
[4] D.He,X.M.Lin.Digital Economy,Business Environment,and Industrial Structure Upgrading.Economic System Reform, 2021 (5): 99-105.
[5] Y.X.Hong, B.P.Ren . The Connotation and Approaches of Deep Integration of Digital Economy and Real Economy . China Industrial Economy, 2023 (02): 5-16.
[6] T.Zhao, Z.Zhang, S.K.Liang. Digital Economy, Entrepreneurial Activity, and High Quality Development: Empirical Evidence from Chinese Cities. Manage the world, 2020, 36 (10): 65-76.
[7] F.Guo, J.Y.Wang, F.Wang, et al. Measuring the Development of Digital Inclusive Finance in China: Index Compilation and Spatial Characteristics . Economics (Quarterly), 2020,19 (04): 1401-1418.
[8] Y.Sun, S.H.Zhang, T.Y.Zhao , et al. The Impact and Spatial Effects of Digital Technology Innovation on Industrial Structure Upgrading: A Case Study of the Yangtze River Economic Belt. Soft Science, 2022 (7): 1-16.
[9] Christo Ananth, D. Jessintha, P. Praveen kumar, S. Jaisiva, T. Ananth kumar, "Social Service Robot using Gesture recognition technique", 4th National Conference on Communication Systems (NCOCS 2022), Journal of Physics: Conference Series, IOP Publishing, 2466(2023), 012020, DOI: 10.1088/1742-6596/2466/1/012020
[10] Christo Ananth, C.Sudalai@UtchiMahali, N.Ebenesar Jebadurai, S.Sankari@Saranya, T.Archana, "Intelligent sensor Network for Vehicle Maintenance system", International Journal of Emerging Trends in Engineering and Development (IJETED), Vol.3, Issue 4, May 2014, pp-361-369.

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 10, Issue 2, February 2024

Authors' biography with Photo

Jiaojiao Zhao is a teaching assistant at Taishan University..She obtained a master's degree from Hebei University in July 2018. In recent years, her research has focused on macroeconomics and big data statistics. email id:zhaojiaojiao2017@163.com

Rui Chen is a professor at Taishan University. She obtained her master's degree from Shandong University in December, 2009. Her research interests are in the areas of application of probability theory, and applied statistics in recent years. email id: chenruimengting@163.com

Liang Fang was born in December 1970 in Feixian County, Linyi City, Shandong province, China. He is a professor at Taishan University. He obtained his PhD from Shanghai Jiaotong University in June, 2010. His research interests are in the areas of cone optimizations, numerical analysis, and complementarity problems.