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Analysis of the Mechanisms and Characteristics of High-Quality Employment Promotion through Digital Economy Development

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Abstract

In the new era, developing the livelihood economy and enhancing people's well-being have become core issues in economic work. As a key dimension of this objective, high-quality employment should encompass both a high employment rate and a high wage level. Currently, China is experiencing rapid development in the digital economy, transitioning from an internet-based economy to an artificial intelligence era. Amidst this swift advancement of the digital economy, whether and how it can promote high-quality employment—and thereby enhance people's welfare—has become a focal point of academic inquiry. This study By constructing a theoretical model, quantifing the level of digital economic development using entropy method and employing spatial autoregressive econometric models based on interprovincial panel data to conduct empirical ,analysis across various industries regarding the issue of how digital economy fosters high-quality employment. The findings reveal that the digital economy creates numerous incremental job opportunities while adjusting relative wage levels, simultaneously enhancing both employment scale and wage levels, thus facilitating the realization of high-quality employment.However, this process also exhibits significant structural biases and characteristics of spatial autocorrelation, leading to self-reinforcing effects within space. While such effects may promote spatial agglomeration of economic factors, they could potentially trigger social issues such as imbalances in income distribution.

Keywords

High-quality employment; Digital economy; Structural bias; Spatial self-reinforcement.

1. Introduction

In his report to the 20th National Congress of the Communist Party of China, Xi Jinping pointed out: Implement the employment-first strategy and promote high-quality and full employment. Develop the digital economy and promote the in-depth integration of the digital economy and the real economy. The digital economy, which uses digital knowledge and information as the key production factor, takes the modern information network as an important carrier, and uses the effective application of information and communication technology as an important driving force for efficiency improvement and economic structure optimization, is an important means to promote high-quality and full employment. The digital economy has become a driving force for China's economic growth. In 2012, the scale of China's digital economy was 11 trillion yuan, while in 2023, the scale of China's digital economy has reached 53.9 trillion yuan, accounting for 42.8% of the GDP. The application of digital technologies such as 5G technology, big data, and cloud computing has significantly

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reduced trade costs and improved market efficiency. Not only that, with the continuous emergence of new economic forms such as digital platforms, digital communities, digital finance, and digital marketing, the digital economy has created a large number of job opportunities in the fields of the Internet of Things, big data cloud computing, blockchain, and artificial intelligence, and the role of the digital economy in promoting high-quality and full employment cannot be ignored. Clarifying the mechanism of the digital economy in promoting employment and giving fuller play to the role of the digital economy in promoting the coordinated development of employment will be of greater significance.

2. Literature review

Regarding the Connotation of the Digital Economy. The digital economy refers to a series of economic activities that use digital knowledge and information as key production factors, modern information networks as important carriers, and the effective use of information and communication technologies as important driving forces for efficiency improvement and economic structure optimization. Digital technologies include emerging technologies such as big data, cloud computing, the Internet of Things, blockchain, artificial intelligence, and 5G communication. Among them, big data, cloud computing, blockchain, 5G communication, etc., have been developed in the digital market economy by reducing the transaction costs between people, and they have a relatively long development history and have become popular in the economic society. Moreover, the development of artificial intelligence, the Internet of Things, etc. is also very rapid, which can bring about foreseeable earth-shaking changes to the economic society. O'Reilly & Finegan summarized that the main values of the e-market are reflected in: search, selection, transaction execution, and promoting collaboration. Huang Hao used the matching ability to measure the search costs in the business market. Due to the higher matching ability of the e-market, the e-market has higher market efficiency. Another characteristic of the digital economy is agglomeration and scale. When analyzing the sharing economy, Zheng Liansheng believed that Internet technology has substantially expanded the usage time and geographical scope of goods. By effectively obtaining the real information of suppliers and demanders, and through collection, classification, collation, and analysis, an information system that supports the matching of supply and demand can be formed, and this system can be dynamically improved to form a credit mechanism that is binding on both the supply and demand sides. Agglomeration and scale are the basic requirements of the sharing economy and even other forms of the digital economy. The author believes that the technical characteristics of the digital economy should become the basic foothold for issues related to the digital economy, including the issue of achieving high-quality employment of the labor force in the digital economy.

The academic community has a wide interest in the role of the digital economy in promoting high-quality employment and has achieved fruitful results at different employment levels. At the micro-enterprise level: Yan Huizhen, Li Rui, etc. believe that digital technologies can achieve an expansion of the employment scale and an optimization of the employment structure through the innovation effect, profit effect, and salary effect of enterprises. Zhan Xinyu and Zheng Jialiang explored the path of the impact of the digital economy on employment. They believe that the digital economy affects employment through three paths: factor allocation, job value, and productivity, and verified their theory through the

employment scale of micro-enterprises. Yang Renfa and Li Jiale analyzed the impact of intelligent manufacturing at the enterprise level on employment. They believe that intelligent manufacturing helps enterprises achieve high-quality employment through the channels of the substitution effect and the creation effect. At the macro-employment level: Li Hui, Deng Qiyu, etc. noticed that while there is an employment substitution effect in the digital economy, there is also an employment creation function. They believe that the development of the digital economy promotes the improvement of labor productivity and promotes employment through the price mechanism and the income mechanism. The transformation of the industrial structure driven by the development of the digital economy has accelerated the integrated development of modern information technology and the education industry, which has had an important impact on the improvement of employment quality. Lei Shangjun, He Jun, etc. believe that the digital economy has promoted economic growth, and employment growth is the result of economic growth. In particular, the digital economy has promoted the improvement of production efficiency, helped expand service employment, improved the efficiency of matching people with jobs, and thus promoted an improvement in employment quality. Obviously, while acknowledging the existence of the employment substitution effect in the digital economy, there is considerable consensus in the academic community that the digital economy in the new era can help the economic society achieve high-quality employment.

Although the research on the role of the digital economy in high-quality employment in China has achieved fruitful results, there is still much room for expansion: First, relevant theoretical discussions should be carried out on the characteristics of the digital economy. The digital economy is undoubtedly an economic growth model driven by technological progress. Different from previous technological progress, it has its own characteristics. Ignoring these characteristics when discussing high-quality employment is obviously open to further discussion in terms of the analytical logic. Second, when analyzing high-quality employment, the employment scale and salary level should be discussed in combination. After all, the increase in the wage level should be an important reference indicator for high-quality employment. This paper attempts to establish a simple decision-making model under the conditions of digital technological progress to analyze the mechanism of changes in employment and wages. At the same time, it will conduct a verification analysis by industry to study the impact of the digital economy on the number of employed people and their wage levels, so as to further improve the analytical framework of the digital economy's role in promoting high-quality employment.

3. Analysis of the Mechanism of the Digital Economy in Promoting High-quality

Employment The digital economy takes various forms, including e-commerce, platform economy, big data, and artificial intelligence. Among them, e-commerce, platform economy, big data, etc., use digital network technology to establish online connections between people. They fully exploit the advantages of digital technology, such as fast connection speed and strong computing power, enabling connections between people to greatly break through the limitations of space and time. On this basis, through further exploration of big data, more market operation rules are discovered, leading to economic breakthroughs. Undoubtedly, compared with traditional markets, the digital economy has lower transaction costs between

people and higher market efficiency. Due to the larger profit margin, manufacturers have more room for price cuts, so consumers can obtain more and cheaper goods, and the level of social welfare is also significantly improved. Obviously, this type of economic growth belongs to a total factor productivity economy, which is driven by technological progress. Furthermore, different from previous technological progress that focused more on labor-augmenting technological progress, this part of technological progress more reflects the characteristics of neutral technological progress. While artificial intelligence, which developed later, belongs to a type of labor-augmenting technological progress. However, the development of artificial intelligence is relatively late, and it has not yet had a sustained impact on the economic society.

Assumptions: (1) Under the influence of relative wages, the wage strategy of a typical manufacturer will affect the entire market; (2) The interest rate is an exogenous variable for individual manufacturers in the market, and manufacturers can only decide on investment based on the interest rate and cannot influence the interest rate.

The production function of a representative enterprise is established as:

$$Y = Af(K, L) \tag{1}$$

where Y represents output,A represents technology represented by digital technology, and K and L represent capital and labor inputs respectively. Its profit function is

$$\pi = \mathrm{PY} - \mathrm{Lw} - \mathrm{Kr} \tag{2}$$

P is the price level, w is the wage level, and r is the interest rate level. If the representative enterprise pursues profit maximization, its first-order conditions are:

$$\frac{A\partial f}{\partial L} = w \tag{3}$$

$$\frac{A\partial f}{\partial K} = r \tag{4}$$

From equation (3), it can be seen that due to the increase brought about by digital technology A, the wage level w has an upward trend. More precisely, enterprises can afford higher wages. Under the condition that the above technological level enables enterprises to afford higher wages, in order to obtain higher profits and reduce management costs, enterprises have the urge to implement higher efficiency wages, thus enabling the enterprise to have a higher relative wage in the labor market. However, at this time, only the wage levels of relevant individual enterprises increase. For the overall wage increase in the industry, the effect of labor mobility under the change of relative wages is still needed. The state of an excessively high relative wage of a typical enterprise is obviously unsustainable. When labor is fully mobile, the higher relative wage of an enterprise promotes the overall wage level increase in the industry's labor market. The result shows that neutral technological progress can increase the wage level in the industry's labor market.

From equation (4), it can also be seen that due to the increase brought about by digital technology A, enterprises have a higher tolerance for the interest rate r. As mentioned before,

the interest rate is an exogenous variable, and the interest rate does not increase or decrease due to digital technological progress. Instead, it is the result of the interaction in the capital market outside the enterprise, and it can be considered unchanged for a single enterprise. The result is an expansion of the enterprise's profit margin. But enterprises can respond to the change in the comparison between the interest rate tolerance and the actual interest rate through changes in investment. The expansion of this investment scale comes from two aspects. One is the increase in the scale of existing enterprises, and the other is projects that originally had no investment value due to too low profit margins but have become valuable for investment after adopting new technologies and crossing the investment threshold. The increase in investment will significantly increase employment, and the latter shows that the development of the digital economy has created new job opportunities, and its effect on increasing total employment is more obvious. An important conclusion of the above analysis is that under the Internet economy with neutral technological characteristics, industries that are greatly influenced by digital technology have both increased wages and employment numbers.

When the digital economy develops to a new generation represented by artificial intelligence, the form of technological progress has undergone a fundamental change. Artificial intelligence uses AI technology, and more complex tasks that originally required human operation can be replaced by machines. AI is even more efficient and less likely to make mistakes than humans. Its technology reflects a type of labor-augmenting technological progress. Then the production function of a representative enterprise is

$$Y = g(K, AL) \tag{5}$$

where A multiplying by labor L represents that the technological progress represented by artificial intelligence has the nature of labor-augmenting. In the new situation, its profit function is:

$$\pi = PY - Lw - Kr \tag{6}$$

Its first-order conditions are:

$$\frac{PA\partial g}{\partial L} = w \tag{7}$$

$$\frac{P\partial g}{\partial K} = r \tag{8}$$

Due to A the increase of, the wage level represented by (7) will rise, indicating that manufacturers can afford higher wages. Since the technological progress at this time is labor-augmenting technological progress, workers are the result of replacing simple labor with complex labor. According to the view of efficient labor, the remuneration for efficient labor will not rise, and may even fall. The increase in the manufacturer's ability to afford wages is caused by the labor-augmenting effect brought about by technological progress, and the wage cost added to each unit of product will instead decrease to a certain extent. The marginal return of the manufacturer's investment in technological progress will be greater than the marginal return of labor, so part of the employment may be replaced.

Equation (9) represents that under the situation of pure labor-augmenting technology, the manufacturer's interest rate tolerance remains unchanged, and the manufacturer's willingness to expand investment to increase employment is not high. But in the actual

economic operation, with the emergence of artificial intelligence characterized by labor-augmenting technological progress, the investment of the whole society will still increase and employment will not decrease significantly for the following reasons:

Firstly, the emergence of these technologies means that enterprise equipment needs to be updated. Equipment updates will bring a large amount of social investment, but this increase in investment does not have a sustained and direct effect on the increase in employment. At the same time, the emergence of the artificial intelligence economy means higher efficiency, a larger profit margin, and a higher threshold for starting a business.

Secondly, the emergence of new technologies means the extension of the production chain. A longer production chain means new job opportunities and new industries. Therefore, while labor-augmenting technological progress replaces part of the employment, it will also create new job opportunities. Overall, employment will not decrease, and may even increase.

Moreover, completely labor-augmenting technological progress does not exist. When artificial intelligence shows more characteristics of labor-augmenting, it will also have certain characteristics of capital-augmenting, which will also promote the increase of investment.

4. Empirical Test

Due to the stage characteristics of the development of the digital economy and the influence degree on relevant industries, according to the above analysis, the impacts on wages and employment can be divided into four categories:

First, in the stage of digital economy development characterized mainly by e-commerce, industries that are relatively greatly influenced by digital technology. Due to the decrease in transaction costs, the increase in market efficiency, and the improvement of the overall economic efficiency of the industry, there is room for the industry to increase wages and employment numbers. Under the condition of resource competition with other industries, the overall wage level of the industry will rise. Although the specific employment forms will change, the overall employment level will also increase.

Second, in the stage of digital economy development characterized mainly by e-commerce, industries that are relatively less influenced by digital technology. Although this industry is relatively less influenced by digital technology, when labor is fully mobile, the change in the relative wage level of this industry will generate a driving force for the wage level to rise, resulting in an increase in the wage level. Under the stronger employment attractiveness of the first category of industries, the employment level of this industry has a downward trend. At the same time, digital technology still has a certain impact on this industry, so the efficiency of this industry has also expanded to some extent, and there is room for expanding employment. Overall, the employment level depends on the result of the game between the two sides, and the specific direction is difficult to determine.

Third, in the stage of digital economy development characterized mainly by artificial intelligence. Due to the increase in the marginal efficiency of labor, the wage levels of industries, whether they are greatly or less influenced by digital technology, have all increased. Also, due to the labor-augmenting characteristics of artificial intelligence, which

simultaneously have the functions of labor substitution and employment creation, the direction of change in the number of employed people is difficult to determine.

In China, although artificial intelligence has achieved considerable achievements, it is still in its infancy, and its impact on the economic society has not yet formed a sustained and extensive influence. There is currently a lack of sufficient data support for the analysis of its impact on the economic society. The empirical verification results of this paper mainly focus on the aforementioned two types.

This paper believes that the impact of the digital economy on high-quality employment should be reflected in two aspects: the number of employed people and wages. Therefore, the following empirical test models are constructed:

$$employ_k = \alpha_0 + \alpha_1 digit_{it} + \sum \alpha_i control_{it} + U_i + V_t + \varepsilon_{it} \quad (9)$$

$$wage_k = \beta_0 + \beta_1 digit_{it} + \sum \beta_i contral_{it} + u_i + v_t + \mu_{it} \quad (10)$$

Among them, the explained variable employ represents employment. This paper attempts to analyze and discuss the impact of the digital economy on employment in different industries. The subscript k represents different industries such as total employment, manufacturing, information industry, and wholesale and retail industry respectively. The explained variable wage represents the wage levels of the above industries. The explanatory variable digit is the development level of the digital economy. The control variables, Considering that employment and wage levels are affected by the level of economic development, economic structure, and urbanization level, the control variables include the GDP growth rate, the proportion of the secondary and tertiary industries, and the proportion of the urban population in the total population, etc.

5. Variable Explanation

Regarding the development level of the digital economy. The development level of the digital economy is a complex variable, and there is still no unified understanding in the academic community on how to reasonably measure it. Following the practices of predecessors, this paper intends to measure it from three aspects: the construction of information infrastructure, the digital market, and the development level of the Internet.

Table 1: Comprehensive Evaluation Index System of the Development Level of the Digital Economy

First-level Index	Second-level Index	Third-level Index
Level of the Digital Economy	Information Infrastructure	Fiber Optic Cable Length (km)
		Mobile Phone Switching Capacity (10,000 lines)
	Digital Market	Market Express Delivery Volume (10,000 pieces)
		Number of Legal Persons in Information Transmission, Software and Information Technology Service Industries (units)

	Internet Development Level	Telephone Penetration Rate (including Mobile Phones) (units/100 people)
		Mobile Phone Penetration Rate (units/100 people)

It is necessary to assign weights to the above third-level indicators to further calculate the comprehensive measure of the development level of the digital economy. Considering that the entropy method assigns weights according to the influence of the discrete degree of hierarchical indicators on comprehensive indicators, which can relatively clearly reflect the development status of comprehensive indicators, this paper uses the entropy method to assign weights to the third-level indicators, so as to calculate the comprehensive evaluation index of the development level of the digital economy for subsequent analysis.

6. Data Source

Based on the availability of data, this paper selects data from 30 provinces and cities in China, excluding Tibet, from 2011 to 2022. The data source is the National Bureau of Statistics. To verify the impact of the development of the digital economy on employment and wages in different industries, in addition to the overall employment and wage levels, this paper selects several representative industries for verification, including the manufacturing industry, the computer and information industry, and the wholesale and retail industry.

7. Analysis Basic Model

Using the STATA software, empirical regression is carried out on the models of different industries as well as employment and average wages. The results are as follows:

Table 2: Analysis of the Impact of the Digital Economy on Employment Total Employment

	overall employment	manufacturing	information industry	holesale and retail industry
digital economy	9.831***	-5.201	1.612***	0.723***
	(1.849)	(9.870)	(0.0953)	(0.129)
GDP growth rate	-1.748	-0.863	-0.186***	-0.0332
	(1.073)	(5.771)	(0.0554)	(0.0754)
secondary industries	0.367	0.725	0.0633***	-0.00701
	(0.457)	(2.462)	(0.0236)	(0.0321)
tertiary industries	1.468***	3.337	0.0761***	0.0576
	(0.565)	(3.042)	(0.0292)	(0.0397)
urbanization rate	0.0279	0.300	-0.0114	-0.00358
	(0.162)	(0.824)	(0.00825)	(0.0110)

Significance level:* 0.10 ** 0.05 *** 0.01

It can be seen from Table 2 that the development of the digital economy has a promoting effect on the overall employment level and most industries. Among the overall employment level, manufacturing industry, information industry, and wholesale and retail industry selected in

this paper, the employment levels of the overall employment level, information industry, and wholesale and retail industry have all increased significantly, and the results have all passed the 1% significance test.

The significant promoting effect of the development of the digital economy on the overall employment level indicates that at least in this stage of digital economy development, there is no effect of technology substituting for labor and reducing the employment quantity level. On the one hand, the development stage of the digital economy discussed in this paper is more of a big data economy, and the impact of artificial intelligence on the economy is still in its initial stage, and has not had a direct impact on employment. On the other hand, even if the digital economy has a partial effect of labor-saving technology, it will not offset the overall employment level. After the emergence of this technology, more new industries will be generated, attracting and increasing employment. As mentioned in the previous view of this paper, since the Industrial Revolution, although the continuous emergence of labor-saving technologies has been a long-term norm, there has been no significant increase in large-scale unemployment. This is because while these technologies achieve benefits, they also create more new jobs, which are sufficient to offset their negative impact on employment. Overall, it is just an increase in economic efficiency and the richness of goods.

The development of the digital economy mainly affects economic efficiency by reducing market transaction costs and promoting the improvement of market efficiency. Obviously, the impact on the wholesale and retail industry is understandable. The improvement of market efficiency means the expansion of the profit margin of the wholesale and retail industry, so providing more job opportunities is the rational choice of industry enterprises. Of course, the development of the digital economy is mainly beneficial to online trading activities. For offline trading activities, due to the decrease in relative efficiency, their profit margins will inevitably be compressed, resulting in a reduction of job positions. However, the increase in online job opportunities is greater than the decrease in offline job opportunities, showing an increase in the overall employment level.

For the information industry, the increase in the employment level may be more due to the improvement of its technological level, which promotes the vigorous development of the industry and enables it to create more job opportunities for the market. Not only does the information industry promote the development of the digital economy, but conversely, the development of the digital economy also promotes the faster development of the information industry, forming a complementary effect.

For the manufacturing industry, it presents a different scene. On the one hand, the development of the digital economy and the improvement of market efficiency help to increase the employment level of the manufacturing industry. On the other hand, although the digital economy technology in this stage does not take labor-saving as its main feature, the comprehensive development of the digital economy still has a certain degree of labor substitution effect, which has a reducing effect on the number of employed people in the manufacturing industry. Overall, it is difficult to determine the final result of the impact of the digital economy on the number of employed people in the manufacturing industry. This is mainly because the number of employed people in the manufacturing industry is affected by more factors. In addition to the market efficiency at the demand side, factors such as the technical ability at the production side, internal management ability, and the labor market all

have a considerable impact on the employment in the manufacturing industry. The low significance level of the impact of the digital economy on manufacturing employment in Table 2 is related to the above complex situation.

Table 3: Analysis of the Impact of the Digital Economy on the Average Wages of Industries

	Total Average Wage	manufacturing	information industry	holesale and retail industry
digital economy	18.19*** (2.372)	12.20*** (2.134)	44.05*** (3.907)	17.93*** (2.380)
GDP growth rate	-2.309 (1.505)	-1.667 (1.387)	-3.337 (2.424)	-1.990 (1.473)
secondary industries	0.380 (0.646)	0.109 (0.596)	0.406 (1.040)	0.445 (0.632)
tertiary industries	-1.482* (0.796)	-1.698** (0.734)	-0.682 (1.282)	-1.020 (0.779)
urbanization rate	1.512*** (0.138)	1.145*** (0.116)	2.586*** (0.244)	1.514*** (0.150)

Significance level:* 0.10 ** 0.05 *** 0.01

Table 3 describes the impact of the digital economy on the average wages of industries. Different from its impact on the number of employed people, the digital economy has a boosting effect on the wages of all industries. Except that the increase range in the information industry is relatively large, the impact ranges on other industries are relatively small, and all of them have passed the 1% significance level, which fully reflects that the impact of the digital economy on the entire economic society is comprehensive. The greatest contribution of digital technology to the economy at this stage lies in the improvement of market efficiency, and this improvement effect exists for all industries. Although the final effect of the digital economy on the employment in the manufacturing industry is not significant due to multiple factors, due to the mobility of labor, the unfavorable position of relative wages will reduce the competitive advantage of the labor market in the manufacturing industry, and increasing the average wage level is an inevitable choice for manufacturing enterprises in the competition of the labor market.

Considering that there may be spatial correlation among variables, in order to explore the deeper relationship between the employment quantity, wage level and the development level of the digital economy, a relevant spatial econometric model should be established for further analysis.

This paper first establishes a spatial weight matrix characterized by spatial adjacency. It is defined that for provinces adjacent in geographical space, the corresponding elements in the spatial weight matrix are 1, and otherwise they are 0. Then, row normalization processing is carried out on it.

Using the above spatial weight matrix, the spatial Moran's I indices of employment and wages for the overall situation, the manufacturing industry, the information industry, and the wholesale and retail industry are calculated, and two-sided tests for positive and negative spatial autocorrelation are carried out. The results are as follows:

Table 4: Spatial Moran's I Indices of Each Industry

time	overall employment	manufacturing	information industry	holesale and retail industry	Total Average Wage	manufacturing	information industry	holesale and retail industry
2011	0.009	0.175*	-0.099	0.098	0.214**	0.158*	0.350***	0.191*
2012	0.031	0.197**	-0.064	0.107	0.204**	0.195**	0.342***	0.147*
2013	-0.021	0.006	-0.062	0.080	0.219**	0.252***	0.392***	0.187*
2014	0.002	0.019	-0.052	0.060	0.203**	0.222**	0.350***	0.222**
2015	0.004	0.022	-0.052	0.065	0.215**	0.235**	0.388***	0.235***
2016	-0.001	0.021	-0.076	0.031	0.215**	0.216**	0.386***	0.257***
2017	-0.005	0.021	-0.075	0.013	0.227**	0.216**	0.364***	0.262***
2018	0.010	0.031	-0.064	0.038	0.198**	0.190**	0.295***	0.234***
2019	-0.009	0.012	-0.070	0.082	0.204**	0.179**	0.273***	0.230**
2020	-0.023	0.011	-0.077	0.099	0.186**	0.172**	0.285***	0.231***
2021	-0.026	0.012	-0.053	0.096	0.203**	0.180**	0.318***	0.244***
2022	-0.028	0.018	-0.060	0.089	0.188**	0.145*	0.291***	0.259***

Significance level:* 0.10 ** 0.05 *** 0.01

It can be seen from the above table that most of the dependent variables have spatial correlation, and it is recommended to use a spatial econometric model for analysis.

A spatial autoregressive model is established, and the above model becomes

$$y = \rho Wy + X\beta + \varepsilon \tag{11}$$

Where W is the spatial weight matrix composed of the adjacency matrix. The original matrix is composed of 0 and 1. If provinces are adjacent, the corresponding elements are 1, and if not, they are 0, thus forming a symmetric matrix. Considering the size of the calculation amount, row standardization of this symmetric matrix is carried out to form the spatial weight matrix of this paper. ρ is the spatial autoregressive coefficient.

Considering the problem of the correlation between the individual error term and the independent variable, to select between the fixed effects model and the random effects model, a Hausman test is carried out, and the test results all suggest selecting the random effects model.

According to the results of the Hausman test, the random effects model is selected. According to the analysis steps of the corresponding ordinary model described above, the model of the impact of the digital economy on the employment rate is first regressed, and the results are as follows:

Table 5: Analysis of the Impact of the Digital Economy on Employment in Each Industry under the Spatial Autocorrelation Model

	overall employment	manufacturing	information industry	holesale and retail industry
digital economy	8.947*** (1.646)	-1.281 (0.864)	1.614*** (0.0911)	0.696*** (0.114)
GDP growth rate	-1.926** (0.946)	-0.183 (0.494)	-0.203*** (0.0525)	-0.058 (0.066)
secondary industries	0.533 (0.406)	0.093 (211.0)	0.0673*** (0.0224)	0.006 (0.028)
tertiary industries	1.304*** (0.498)	0.247 (0.260)	0.078*** (0.028)	0.041 (0.035)
urbanization rate	-136.7 (153.2)	-53.24 (79.15)	-25.72*** (8.964)	-28.61*** (10.72)
ρ	0.192*** (0.0514)	0.0992* (0.0515)	0.0832* (0.0458)	0.279*** (0.0540)
lgt_theta	-2.751*** (0.145)	-2.629*** (0.146)	-2.400*** (0.157)	-2.606*** (0.150)
sigma2_e	6.110*** (0.478)	1.664*** (0.130)	0.019*** (0.001)	0.029*** (0.0021)
direct effects				
digital economy	9.090*** (1.708)	-1.252 (0.889)	1.621*** (0.094)	0.713*** (0.119)
GDP growth rate	-1.981** (0.921)	-0.203 (0.477)	-0.205*** (0.051)	-0.062 (0.064)
secondary industries	0.569 (0.395)	0.109 (0.204)	0.069*** (0.022)	0.008 (0.028)
tertiary industries	1.326*** (0.485)	0.253 (0.252)	0.079*** (0.027)	0.043 (0.034)
urbanization rate	-0.134 (0.157)	-0.051 (0.081)	-0.026*** (0.009)	-0.029*** (0.011)
indirect effects				
digital economy	2.124** (0.834)	-0.131 (0.130)	0.148* (0.087)	0.264*** (0.085)
GDP growth rate	-0.460*	-0.021	-0.019	-0.023

	(0.271)	(0.063)	(0.012)	(0.025)
secondary industries	0.134 (0.109)	0.013 (0.028)	0.006 (0.004)	0.003 (0.011)
tertiary industries	0.306** (0.150)	0.026 (0.036)	0.007 (0.005)	0.015 (0.013)
urbanization rate	-0.032 (0.042)	-0.005 (0.011)	-0.002 (0.002)	-0.012** (0.005)
total effects				
digital economy	11.213*** (2.266)	-1.383 (0.979)	1.769*** (0.131)	0.977*** (0.182)
GDP growth rate	-2.441** (1.148)	-0.225 (0.533)	-0.224*** (0.057)	-0.084 (0.089)
secondary industries	0.703 (0.494)	0.122 (0.228)	0.076*** (0.024)	0.011 (0.038)
tertiary industries	1.632*** (0.600)	0.279 (0.279)	0.086*** (0.030)	0.059 (0.046)
urbanization rate	-0.166 (0.196)	-0.056 (0.090)	-0.028*** (0.010)	-0.040** (0.016)

Significance level:* 0.10 ** 0.05 *** 0.01

It can be seen from the above table that in the spatial autoregressive model for analyzing the impact of the digital economy on the employment rate by industry, the autoregressive coefficients ρ are all significantly positive at the 1% level, indicating that the employment rate in adjacent regions has a positive impact on the employment rate in the local region. The development of the digital economy within the adjacent spatial scope is mutually dependent, self-reinforcing, and has the efficiency of spatial self-circulation aggregation. Among different industries, the impact on the retail industry is relatively greater.

As for the impact of the development of the digital economy on the employment rate, the conclusion is similar to that of the ordinary model. The development of the digital economy has a significant impact on the overall employment, as well as the employment in the information industry and the retail industry, indicating that the development of digital technology has not shown the so-called labor substitution effect. Instead, with its characteristic of reducing transaction costs, it can significantly promote the increase of market economic efficiency, thereby increasing employment. The impact on the employment in the manufacturing industry is relatively more complex. In the spatial autoregressive model, similar to the ordinary control model, it did not pass the significance test.

The spatial autoregressive model also provides more information about the impact. In particular, the spatial direct effect of the impact of the digital economy on the employment rate is significantly higher than the indirect effect. One possibility is that due to the rapid development of the digital economy, its direct impact on the employment rate is significantly higher than the indirect effect brought about by the interaction between regions. Another possibility is that the development practice of the digital economy in China is relatively short, and the interaction between regions has not been more fully manifested.

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Regarding the impact of the digital economy on the wages of industries, the model is similar to that of employment. After the Hausman test, it is recommended to use the random effects model. According to the setting of the model, the regression results of the spatial autoregressive model of the impact of the digital economy on the wages of industries are as follows:

Table 6: Analysis of the Impact of the Digital Economy on Wages in Each Industry under the Spatial Autocorrelation Model

	Total Average Wage	manufacturing	information industry	holesale and retail industry
digital economy	6.933***	3.562***	28.722***	58.308***
	(1.397)	(1.246)	(3.115)	(1.522)
GDP growth rate	-2.021***	-1.193*	-1.961	-1.954**
	(0.778)	(0.706)	(1.759)	(0.843)
secondary industries	0.857***	0.504*	0.791	0.754**
	(0.330)	(0.300)	(0.748)	(0.358)
tertiary industries	0.317	0.082	0.206	0.292
	(0.411)	(0.373)	(0.924)	(0.444)
urbanization rate	0.160	0.258*	0.991***	0.063
	(0.163)	(0.134)	(0.298)	(0.166)
ρ	0.840***	0.837***	0.626***	0.840***
	(0.0310)	(0.0299)	(0.0420)	(0.0327)
lgt_theta	-1.910***	-1.551***	-1.337***	-2.009***
	(0.189)	(0.201)	(0.198)	(0.181)
sigma2_e	412.009***	339.334***	2113.983***	483.784***
	(36.184)	(29.537)	(174.576)	(42.401)
direct effects				
digital economy	9.632***	4.945***	32.581***	8.121***
	(1.895)	(1.714)	(3.422)	(2.075)
GDP growth rate	-2.841***	-1.68*	-2.296	-2.754**
	(1.054)	(0.945)	(1.919)	(1.142)
secondary industries	1.221***	0.725*	0.958	1.081**
	(0.449)	(0.402)	(0.819)	(0.485)
tertiary industries	0.454	0.127	0.259	0.420
	(0.554)	(0.499)	(1.011)	(0.599)
urbanization rate	0.223	0.357**	1.128***	0.090
	(0.220)	(0.176)	(0.323)	(0.230)
indirect effects				
digital economy	34.812***	17.448**	44.901***	29.434***
	(9.807)	(6.79)	(7.948)	(9.816)
GDP growth rate	-10.391**	-6.039	-3.162	-10.138**
	(4.729)	(3.770)	(2.759)	(5.103)
secondary industries	4.462**	2.600	1.328	3.975*
	(2.017)	(1.610)	(1.190)	(2.124)

tertiary industries	1.696 (2.180)	0.493 (1.869)	0.366 (1.438)	1.572 (2366)
urbanization rate	0.721 (0.758)	1.215** (0.567)	1.528*** (0.406)	0.239 (0.861)
total effects				
digital economy	44.444*** (11.197)	22.393*** (8.307)	77.482*** (9.980)	37.555*** (11.435)
GDP growth rate	-13.232** (5.691)	-7.720* (4.671)	-5.458 (4.647)	-12.893** (6.147)
secondary industries	5.682** (2.426)	3.325* (1.993)	2.286 (1.996)	5.056** (2.573)
tertiary industries	2.150 (2.721)	0.620 (2.360)	0.624 (2.440)	1.992 (2.950)
urbanization rate	0.944 (0.973)	1.572** (0.734)	2.656*** (0.700)	0.329 (1.086)

Significance level:* 0.10 ** 0.05 *** 0.01

It can be seen from the above table that the autoregressive coefficients ρ are all significantly positive at the 1% level, indicating that in the impact of the digital economy on industry wages, similar to its impact on the employment rate, the development of the digital economy within the adjacent spatial scope is mutually dependent, self-reinforcing, and has the efficiency of spatial self-circulation aggregation.

Different from the individual case where the impact of the digital economy on employment has a not significant influence in the manufacturing industry, the impact on wages is significantly positive at the 1% significance level. This shows that under the condition of high labor mobility, relative wages tend to be consistent. Stimulated by the improvement of technological levels through digital technology and the enhancement of market efficiency, there is a trend of an increase in wage levels across all industries. The development of the digital economy has generally improved the welfare status of workers.

Except for the information industry, the direct effects of the digital economy on wages are all significantly smaller than the indirect effects. This paper believes that the direct effect of the impact on the information industry is close to the indirect effect, which benefits from its strong correlation with digital economy technologies. The larger indirect effects generated by the interaction between regions indicate that the changes in relative wages caused by the development of the digital economy are greater than its direct technical impact on industry wages.

In real economic life, the development of the digital economy generally has a certain correlation with the level of regional economic development, and this correlation is often the root cause of the endogeneity problem in the model. The possible endogeneity problem makes the credibility of the model results questionable. In order to verify the robustness of the model, this paper intends to re-estimate the model using the instrumental variable method. Considering that the length of long-distance optical cable lines and the length of optical cables are highly correlated, the length of long-distance optical cable lines is a good instrumental

variable for the length of optical cable lines. According to the above original calculation method of the digital economy development index, the development level of the digital economy is recalculated. The newly calculated development level of the digital economy is used as the instrumental variable of the original development level of the digital economy, and it is then substituted into the model for regression respectively. there are certain differences between the new model and the original model. However, these differences do not change the overall characteristics of the impact of the development level of the digital economy on the regional employment quantity and wage level, indicating that the model has good robustness.

8. Conclusions

The digital economy not only achieves high-speed economic growth but also plays an important role in high-quality employment. The role of the digital economy in promoting high-speed macroeconomic growth has been confirmed by a lot of practice and theory, and there is no need to elaborate on it here. The research of this paper confirms that the digital economy can also achieve high-quality employment in the economic society, including an increase in the quantity of employment and an upward trend in the overall wage level. The actual data results show that under the condition of the development of China's digital economy, both the total employment and the total average wage level have increased significantly. Different from the perception that the total employment volume should decline because many jobs are replaced by the Internet, the reason is that while the progress of Internet technology replaces some jobs, it also creates more job positions. It not only offsets the replaced jobs but also increases the total employment volume. At the same time, the progress of Internet technology has brought about an improvement in market efficiency, increased the marginal efficiency of capital and labor, and thus created more social wealth, and the remuneration income of workers has also increased accordingly. This is the general trend of technological progress. After all, since the Industrial Revolution, the economic society has been facing various rapid technological advancements, but there have been very few economic recessions caused by large-scale unemployment due to technological progress. It can be predicted that in the era of artificial intelligence that China is about to rapidly enter, similar effects will also be produced. While a large number of job positions are replaced by artificial intelligence, a large number of new job opportunities will also be created, and at least the employment volume will not decline significantly.

Secondly, in the process of promoting high-quality employment, the digital economy has a certain degree of structural deviation. In the model of this paper, while the total employment volume, the employment volume in the information industry and the retail industry have increased significantly, the employment volume in the manufacturing sector is decreasing. Although it has not passed the significance test, it still cannot hide the structural deviation in the increase of employment quantity. That is, the employment volume in some industries expands, while in other industries, it may face a decline. In fact, this structural deviation is not only manifested between different industries but also may be manifested within the same industry. This phenomenon is a reality noticed by many economic observers, that is, while the digital economy is developing rapidly, the business environment of some industries is deteriorating, such as the operation of physical stores. The digital economy under Internet technology is an economic development brought about by general-purpose technology. While

promoting the overall economic progress, it has also greatly changed the economic behavior patterns and the profit models of various industry sectors. The profit models that were very good in the past will encounter operational difficulties due to their inadaptability to the new economic environment, while the business models that were not adopted in the past may be highly favored by people due to their adaptability to the new economic environment. While understanding that any technological progress will cause similar structural deviations, policymakers should also pay attention to the possible social problems caused by the changes in the direction of wealth distribution brought about by such structural deviations.

Moreover, in promoting high-quality employment, the digital economy shows certain characteristics of spatial correlation. Whether it is the employment quantity or the wage level, the wage level is positively correlated with the adjacent space (in the above empirical test, the employment volume in the manufacturing industry shows a negative correlation, but it has not passed the significance test), that is, the development of the digital economy in adjacent regions will drive the increase in the employment quantity and wage level in the local region. The development of the digital economy is likely to contribute to the formation and development of local industrial clusters. For policymakers who attempt to use economic agglomeration effects such as industrial clusters to promote regional economic development, actively promoting the construction of digital economy infrastructure in the local region has practical significance for the long-term economic development of regional industrial clusters.

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