# The impact of the digital economy on the urban-rural income gap: Research based on the rationalization of the industrial

Jiaqi Wang [1, a]

[1]School of Business, Shandong University, China;

[a] 202000620200@mail.sdu.edu.cn

**Abstract.** The booming digital economy will affect the income gap between urban and rural areas in China. Based on the provincial data from 2011 to 2021, this paper selects a fixed-effect model to empirically test the impact of digital economy on the urban and rural income gap in China and the adjustment effect of the rationalization of industrial structure. The research shows that digital economy can significantly improve the urban-rural income gap, while the rationalization of industrial structure will expand the gap and reduce the effect of digital economy on the urban-rural income gap; Regional heterogeneity test shows that the effect of digital economy on the urban-rural income gap, and the marginal effect of digital economy on the urban-rural income gap is less than that in the central and western regions. Therefore, the government should vigorously develop the rural digital economy, pay attention to the training and introduction of rural digital technology talents, and implement the differentiated digital economy development strategy according to local conditions, so as to better realize the role of digital economy in improving the urban and rural income gap in China.

**Keywords:** digital economy; urban-rural income difference; rationalization of industrial structure; fixed-effect model.

## 1. Introduction

Since the 18th National Congress of the Communist Party of China, China has vigorously developed and popularized digital technology, issued the development strategy of digital economy and the 14th Five-Year Plan for the development of digital economy, accelerated the promotion of digital industrialization and industrial digitalization, and promoted the vigorous development of digital economy. In the past decade, China's digital economy has made remarkable achievements in development, and its overall scale has ranked second in the world for many consecutive years, playing an increasingly prominent role in leading and supporting economic and social development. The digital economy is becoming an important force leading China's economic growth and social development, laying a solid economic foundation for China's socialist modernization.

Since the reform and opening up, China's economy has developed rapidly, and the income of rural residents has increased significantly, but there is still a large gap compared with the income of urban residents. In other words, the imbalance between urban and rural development and the large income gap between urban and rural areas are still the difficult problems facing China's economic and social development. Digital economy has the characteristics of "universal benefit and sharing", so accelerating the development of digital economy and playing the enabling role of digital economy may have an impact on the urban and rural income gap. In view of this, how to follow the trend of The Times and narrow the income gap between urban and rural areas through the development of digital economy has become an issue of important theoretical and practical significance.

## 2. Literature Review

As a new driving force for China's economic growth, the digital economy has had a huge impact on the development of all walks of life. What is the impact of digital economy on the classic problem of income gap between urban and rural areas in China is also a hot issue studied by scholars at home and abroad in recent years.

Some scholars believe that the development of the digital economy can narrow the income gap between urban and rural areas. Xiong Ziyi et al. (2022) have empirically proved that the development of digital economy can significantly narrow the urban and rural income gap, and the flow of factors can strengthen the income distribution role of digital economy. Regions with high degree of marketization and high degree of factor market development are more conducive to the development of digital economy to narrow the urban and rural income gap .[1] Liu Wei et al. (2021) also proposed that the development of digital finance can narrow the gap between urban and rural areas, thus driving the high-quality development of China's economy. However, the development of digital economy brings digital dividends to residents and also leads to the emergence of "digital divide" .[2] Huang Manyu et al. (2022) believe that due to the existence of the digital divide between urban and rural areas, the development of the digital economy will expand the income gap between urban and rural areas and hinder the upgrading of the consumption structure of rural residents .[3] Yu Xiaoyan (2022) through empirical research is put forward, the internal structure of the digital economy, digital industry has a significant impact on narrow the income gap between urban and rural areas, and digital infrastructure and digital industrialization of urban and rural income gap is conducive to narrowing the income gap between urban and rural areas, the influence of the digital industry between urban and rural income gap from "digital dividend" to "digital divide" inflection point effect .[4] DengXiang et al. (2023) proposed that although digital economy can promote the improvement of urban and rural absolute income level at the same time, its positive impact on the income level of urban residents is greater than that of rural residents, leading to the widening of urban-rural income gap .[5] Some scholars believe that there is a non-linear influence of digital economy on the urban-rural income gap. Fan Yexia et al. (2022) believe that the impact of digital economy on the income gap between urban and rural residents shows a "U-shaped" trend of the first, and then rising .[6] On this basis, Chen Wen et al. (2021) proposed that increasing investment in rural infrastructure construction and accelerating the development of rural finance can reduce the widening effect of the income gap between urban and rural areas in the later period of digital economy development .[7] However, some scholars have raised different opinions. For example, Li Xiaozhong et al. (2022) believe that due to the threshold effect of the development level of digital economy on the urban-rural income gap, the impact of the development level of digital economy on the urban-rural income gap shows an "inverted U-shaped" trend of first expanding and then narrowing .[8] Zheng Guonan et al. (2022) believe that with the development of digital economy, the income gap between urban and rural areas shows a "M-type" trend of change, and the "U-type" and "inverted U-type" trends proposed by existing studies reflect different stages of the "M-type" trend .[9]

In addition, the industrial structure changes will affect the role of the digital economy on the urban-rural income gap. Feng Langang et al. (2023) believe that industrial structure transformation plays a positive transmission role in narrowing urban and rural income gap through digitalization. First, in terms of industrial structure, the advanced level of industrial structure is positively correlated with urban and rural income gap, and industrial structure rationalization can improve the rationality of resource allocation structure and utilization between industries, and then narrow the urban and rural income gap; second, digitalization promotes industrial structure transformation through digital industrialization and industrial digitalization .[10]

To sum up, the existing research on the digital economy and the urban-rural income gap is still not unified, and few scholars have studied the impact of digital economy on the urban-rural income gap from the perspective of industrial rationalization. Based on this, while analyzing the impact of digital economy on the urban and rural income gap, this paper introduces the index of industrial structure rationalization, discusses the regulatory role played by the rationalization of industrial structure in it, and enriches the existing research system.

# 3. Theoretical analysis and research hypothesis

## 3.1 Income gap between the digital economy and the urban and rural areas

Digital economy is digital knowledge and information as the key factors of production, digital technology innovation as the core driving force, with modern information network as the important carrier, through the digital technology and the real economy depth fusion, constantly improve the level of traditional industry digital, intelligent, accelerate the reconstruction of economic development and government governance mode of new economic form . The development of digital economy can promote better economic development in rural areas, extend the agricultural industry chain and value chain, create new employment opportunities, release the economic value of rural land, labor force and other factors, improve the income level of rural residents, and narrow the income gap between urban and rural residents. On the one hand, due to the existence of the chase effect, for capital, technology and other elements is scarce, development is weak rural areas, the development of the digital economy for the improvement of the labor returns more significant, and for higher economic level, technology is developed urban areas, because of its own factors of production is abundant, so the influence of the development of digital economy for urban labor returns is less than the rural areas, to narrow the income gap between urban and rural areas. On the other hand, the development of digital economy breaks the information barriers between urban and rural areas, and builds a bridge for the flow of information elements between urban and rural areas. By June 2022, the Internet penetration rate in rural areas has reached 58.8%. Compared with the early stage of the 13th Five-Year Plan, the gap between urban and rural Internet penetration rate has narrowed by nearly 15 percentage points .[12] According to the new economic growth theory, the progress of technology plays a decisive role in economic growth, based on the development of digital economy will narrow the difference between urban and rural technology and human capital accumulation, and the application of rural information technology and promotion will promote the extension of the rural industry chain and upgrade, improve the efficiency and quality of agricultural production and, increase the income of rural residents, promote the rural economic growth, to narrow the income gap between urban and rural areas.

In short, digital economy has the characteristics of "universal benefit and sharing", which can break the information barrier between urban and rural areas, build a bridge for the circulation of information elements between urban and rural areas, and promote rural areas to better catch up with the development of urban areas, so as to improve the income gap between urban and rural areas. Therefore, this paper makes the following assumptions:

H1: Digital economy development tends to improve the urban-rural income gap

## 3.2 Rationalization of industrial structure and urban-rural income gap

This paper adopts shi Zhongliang (1998) to define the rationalization of industrial structure, and defines it as in a certain stage of economic development, according to consumer demand and resource conditions, straighten out the structure, so that resources are rationally allocated between industries, effective use.[13] When the industrial structure tends to be reasonable, the internal industry will be optimized and upgraded, and the capital-intensive and technology-intensive industries will develop rapidly. This means that under the rationalization of the industrial structure, the industry will develop toward technology and information technology, and will pay more attention to talent and technology, and the quality of the labor force will require a higher level. Compared with urban residents, rural residents have insufficient human capital accumulation, and they are more likely to be excluded by emerging industries, leading to the differentiation of labor force between industries and within industries and the expansion of income gap, thus aggravating the income gap between urban and rural areas. At the same time, our country policy has urban bias, for the urban rural labor force in health care, housing cost or children education and other social security system is not perfect, and some towns also protect the local talent policy, it also makes the rural labor force in

town for a long time, eventually return to the rural ,[14] lead to a widening income gap between urban and rural areas.Therefore, this paper makes the following assumptions:

H2: Rationalization of the industrial structure may widen the income gap between urban and rural areas

### 3.3 The adjustment effect of the rationalization of the industrial structure on the relationship between the digital economy and the urban-rural income gap

With the continuous progress of technology and the continuous innovation of science and technology, more and more high-tech industries have replaced labor-intensive industries. Digital technology and its new economy, new business forms and new models have provided new opportunities for the upgrading of industrial structure.[15] The rapid development of digital economy accelerates the circulation of resources among industries, promotes the formation of new models and new forms of business, promotes the development of traditional industries to intelligent and digital, realizes the optimization and upgrading of industrial structure, and accelerates the rationalization process of industrial structure.[16] Digital economy created part of the new industry, this part of the emerging industries, high technology industry to improve the requirement of labor quality, human capital accumulation is short board of rural residents may be difficult to adapt to the change, thus rejected by emerging industries, difficult to enjoy the digital economy dividends,[17] lead to the income gap between urban and rural areas. Therefore, this paper makes the following assumptions:

H3: Rationalization of the industrial structure may reduce the effect of the digital economy on improving the urban-rural income gap

### 3.4 Regional heterogeneity of the urban and rural income gap in the digital economy

The development of the digital economy is affected not only by the regional economic level, but also by the local government policies, the level of opening up and infrastructure. China has a vast territory, and the economic development is uneven among different regions. The economic level, the degree of opening up and infrastructure construction are significantly different. Therefore, there is regional heterogeneity in the development of digital economy. Because under the conditions of a market economy, Capital is profit-driven, The weak nature of agriculture leads to more capital flowing to cities and towns for high benefits , And China's long-term public policy has an urban bias, Thus, in the same region, For urban areas with higher economic level, more developed technology and more complete infrastructure construction, Local governments will provide more resources and invest in the money; conversely, In rural areas with relatively weak economic development, less developed technology and insufficient investment in infrastructure construction, Government has invested less in resources and funds , As a result, the development level of digital economy between urban and rural areas is unbalanced, The income gap between urban and rural areas is also difficult to narrow. At present, the development level of digital economy shows a trend of gradually decreasing from the eastern region to the central and western regions, and the polarization phenomenon is significant . In addition, the impact of digital economy on the income gap between urban and rural residents has a diminishing marginal effect, and for areas with relatively backward economic development, there is an advantage of backwardness due to experience for reference. The higher the development level of digital economy, the smaller the marginal utility for improving the income gap between urban and rural residents, and the greater the opposite. Therefore, this paper makes the following assumptions:

H4: There is regional heterogeneity in the impact of digital economy on urban-rural income gap. The marginal utility of digital economy on improving urban-rural income gap in the eastern region is less than that in the central and western regions.

# 4. Model setting, variable selection, and data description

If you follow the "checklist" your paper will conform to the requirements of the publisher and facilitate a problem-free publication process.

## 4.1 Model setting

In order to study the impact of the development level of digital economy on the urban and rural income gap and the role of the rationalization of industrial structure, the following fixed-effect model is constructed:

$$gap_{i,t} = \alpha_0 + \alpha_1 dig_{i,t} + \alpha_2 control_{i,t} + v_{i,t} \qquad (1)$$

$$gap_{i,t} = \beta_0 + \beta_1 dig_{i,t} + \beta_2 er_{i,t} + \beta_3 control_{i,t} + \varepsilon_{i,t} \qquad (2)$$

$$gap_{i,t} = x_0 + x_1 dig_{i,t} + x_2 er_{i,t} + x_3 diger_{i,t} + x_4 control_{i,t} + \phi_{i,t} \qquad (3)$$

Among them, i and t represent the t year of i, gap is urban-rural income gap; dig is the development level of digital economy; the adjustment variable er is the rationalization level of industrial structure; diger is the interaction item between the development level of digital economy and the rationalization level of industrial structure; control is the control variable; $v$ $\varepsilon$ $\phi$ ,, For the random disturbance term. Model (1) (2) is used to test the impact of digital economy development level (dig) and industrial structure rationalization (er) on urban and rural income gap (gap), that is, to test whether hypothesis 1 and hypothesis 2 are valid. Model (3) is on the basis of the model (1), join the industrial structure rationalization (er), digital economy development level and rationalization of industrial structure interaction terms (ger), to study the industrial structure rationalization in the digital economy of the adjustment of the urban and rural income gap, namely test hypothesis 3, if the main effect coefficient and regulation effect coefficient, the regulation effect direction is positive, if it is negative.

## 4.2 Selection and description of variables

### 4.2.1 explained variables

Urban-rural income gap ($gap_{i,t}$)。 Since the share of urban and rural population in the total population will affect the income gap between urban and rural residents, this paper refers to Wang Shaoping and Ouyang Zhigang (2007).[18] The population factor is included in the calculation process of urban-rural income gap, The specific calculation formula is as follows:

$$gap_{i,t} = \sum_{j=1}^{2} \frac{I_{ij,t}}{I_{i,t}} \ln \left( \frac{I_{ij,t}}{I_{i,t}} \middle/ \frac{P_{ij,t}}{P_{i,t}} \right) \qquad (4)$$

Among them, I represents income, P represents population, i, t and as above, j represents rural or urban areas.

### 4.2.2 Interpret variables

Development level of digital economy (dig).The measurement of the development level of digital economy usually follows the following principles: first, consider the breadth and depth of digital financial services; second, consider the vertical and horizontal comparability; and third, reflect the multi-level and diversification of digital financial services. In this paper, the digital financial inclusion index in Peking University Digital Financial inclusion Index is selected as the measure of the development level of digital economy.

4.2.3 Regulated variables

Rationalization of industrial structure (er). The rationalization of industrial structure refers to the structural transformation ability between industries and the effective utilization degree of resources, and can also measure the coordination degree between factor input and output structure. This paper refers to the practice of Binbin (2015) .[19] In order to adjust the positive and negative direction of the index and facilitate the positive and negative analysis coefficient, the reciprocal of Gan Chunhui Tell index is adopted to measure the rationalization level of industrial structure. The calculation formula is as follows:

$$er = \frac{1}{TL} = \frac{1}{\sum_{i=1}^{n} \left(\frac{Y_i}{Y}\right) \ln\left(\frac{\frac{Y_i}{L_i}}{\frac{Y}{L}}\right)} \qquad (5)$$

Among them, TL represents the Thiel index, Y, L, n, i represent the output value, the number of employment, industry sector and industry types respectively. When TL = 0, the economic system is in equilibrium state, the larger the TL value, the easier the economic development is to deviate from equilibrium state, the more unreasonable the industrial structure; and the er value is positive index, that is, the smaller the TL value, the larger the er value, which means the higher the rationalization level of industrial structure.

4.2.4 Control variables

According to the principle of data availability and consistency, refer to Chen Wen et al (2021), Wang Jun (2021) and Xiong Ziyi (2022), finally selected the following control variables: education level (lnedu), science and technology innovation expenditure level (lncx), fiscal expenditure level (cz), urbanization level (ur), the measurement method of control variables as shown in Table 1.

Table 1 Symbol indication and indication of each variable

| type of variable | Variable name | variable symbol | Indicator instructions |
|---|---|---|---|
| explained variable | Urban-rural income gap | gap | See above for details |
| explanatory variable | The development level of the digital economy | dig | See above for details |
| regulated variable | Rationalized the industrial structure | er | See above for details |
| controlled variable | Education level | lnedu | (A 6 + b 9 + c 12 + d 16) / total population over 6 years, then take logarithm, a, b, c, d represent the population above primary, middle, high school, college degree or above, respectively |
| | Level of expenditure on scientific and technological innovation | lncx | Log of the local financial expenditure on science and technology innovation / local financial expenditure |
| | Level of fiscal expenditure | cz | Local fiscal expenditure amount / GDP |
| | Urbanization level | ur | Urban population / total population |

**4.3 Data description**

In this paper, the panel data from 31 provinces (excluding Hong Kong, Macao and Taiwan) from 2011 to 2021 are selected to study the impact of digital economy on urban-rural income gap. The original data are obtained from China Statistical Yearbook, provincial statistical Yearbook and China Economic Data Network. Descriptive statistics of related variables are shown in Table 2, where each variable is in a reasonable interval range with no outliers, and the data are relatively stable.

Table 2: Descriptive statistical results

| variable | sample capacity | mean | standard error | least value | crest value |
|---|---|---|---|---|---|
| gap | 341 | 0.092 | 0.042 | 0.018 | 0.227 |
| dig | 341 | 230.461 | 103.363 | 16.220 | 458.970 |
| er | 341 | 11.542 | 15.573 | 0.988 | 126.628 |
| lnedu | 341 | 2.207 | 0.135 | 1.440 | 2.540 |
| lncx | 341 | -4.104 | 0.677 | -5.799 | -2.695 |
| cz | 341 | 0.281 | 0.206 | 0.107 | 1.379 |
| ur | 341 | 0.580 | 0.131 | 0.227 | 0.896 |

## 5. Empirical analysis

**5.1 Benchmark regression**

Model (1) shows that the confidence interval of the development level of digital economy at 1% significantly affects the income gap between urban and rural areas, and the influence coefficient is-0.000035, which indicates that for every unit increase in the digital economy development level index, the urban-rural income gap will decrease by 0.000035 units. Hypothesis 1 is true. Digital economy is characterized by "universal benefit and sharing", which can break the information barrier between urban and rural areas, promote the two-way flow of factors and resources, and narrow the gap between urban and rural residents in information, technology and human capital, so as to narrow the income gap between urban and rural areas. Model (2) shows that the confidence interval of industrial structure rationalization at 1% significantly affects the urban and rural income gap, with the influence coefficient of 0.000176. Because this paper uses the reciprocal (er) of the GanChunhui Taier index to measure the rationalization level of industrial structure, the larger the er value, the more reasonable the industrial structure, so every unit of the industrial rationalization level, the urban-rural income gap will expand by 0.000176 units, hypothesis 2 is established. The industrial structure is rationalized, and the economic development between urban and rural areas is more unbalanced. A large number of the labor force in rural areas is transferred to cities and towns, leading to the further reduction of the income in rural areas, thus aggravating the income gap between urban and rural areas.

Table 3. Benchmark regression results

| variable | model (1) | model (2) | model (3) |
|---|---|---|---|
| dig | -0.000035*** | -0.000047*** | -0.000069*** |
| | (0.0000) | (0.0000) | (0.0000) |
| er | | 0.000176*** | -0.000585*** |
| | | (0.0001) | (0.0002) |
| diger | | | 0.000002*** |
| | | | (0.0000) |

| lnedu | 0.031848* | 0.032331* | 0.025841 |
|---|---|---|---|
| | (0.0175) | (0.0173) | (0.0170) |
| lncx | 0.001716 | 0.001275 | 0.001493 |
| | (0.0023) | (0.0023) | (0.0023) |
| cz | 0.032422** | 0.029799* | 0.042399*** |
| | (0.0158) | (0.0156) | (0.0156) |
| ur | -0.341892*** | -0.330228*** | -0.281729*** |
| | (0.0256) | (0.0256) | (0.0281) |
| constant | 0.225672*** | 0.217407*** | 0.209187*** |
| | (0.0381) | (0.0378) | (0.0370) |
| sample capacity | 341 | 341 | 341 |

Note: *, * * and * * * indicate the significance levels of 10%, 5% and 1%, respectively, and the numbers in parentheses are standard errors.

## 5.2 Analysis of the regulation effect of industrial structure

This paper further adds the interactive item between the development level of digital economy and the rationalization of industrial structure to the model (2), in order to investigate the regulating effect of the rationalization of industrial structure in the development level of digital economy on the urban and rural income gap of people. Results As shown in model (3), the interaction term of the rationalization of industrial structure and the development level of digital economy significantly affects the urban-rural income gap at the confidence interval of 1%, and the influence coefficient is 0.000002, while the correlation coefficient between the development level of digital economy and the income gap between urban and rural residents is significant at the level of 1%, -0.000069. Obviously, the rationalization of industrial structure has played a significant reverse adjustment role in the impact of the development level of digital economy on the urban-rural income gap. Hypothesis 3 is true. This shows that the rationalization of industrial structure can not only directly have a significant widening effect on the urban and rural income gap, but also reduce the development level of the digital economy on improving the urban and rural income gap. With the rationalization of industrial structure, traditional industries are gradually replaced by emerging industries, making it difficult for rural residents who lack skills and education to enjoy the dividends brought by the digital economy, thus aggravating the income gap between urban and rural areas.

## 5.3 Robustness test

In this paper, the explanatory variables were replaced with the ratio of per capita disposable of urban and rural residents to test the robustness of the model. The relationship between the development level of digital economy, the rationalization of industrial structure and the urban and rural income gap obtained by regression is shown in Table 4. The development level of digital economy can significantly improve the income gap between urban and rural areas, while the rationalization of industrial structure will expand the income gap between urban and rural areas, and the rationalization of industrial structure can reduce the improvement effect of digital economy development level on the urban and rural income gap, which is basically consistent with the previous conclusion.

Table 4. Results of the robustness test

| variable | model (4) | model (5) | model (6) |
|---|---|---|---|
| dig | -0.0006*** | -0.0007*** | -0.0010*** |
|  | (0.0001) | (0.0002) | (0.0002) |
| er |  | 0.0021** | -0.0076*** |
|  |  | (0.0008) | (0.0029) |
| diger |  |  | 0.0000*** |
|  |  |  | (0.0000) |
| lnedu | 0.1815 | 0.1871 | 0.1047 |
|  | (0.2384) | (0.2363) | (0.2331) |
| lncx | 0.0199 | 0.0147 | 0.0174 |
|  | (0.0317) | (0.0314) | (0.0309) |
| cz | 0.3890* | 0.3581* | 0.5183** |
|  | (0.2150) | (0.2134) | (0.2143) |
| ur | -2.6834*** | -2.5461*** | -1.9297*** |
|  | (0.3491) | (0.3501) | (0.3855) |
| constant | 3.8679*** | 3.7706*** | 3.6661*** |
|  | (0.5195) | (0.5163) | (0.5077) |
| sample capacity | 341 | 341 | 341 |

Note: *, * * and * * * indicate the significance levels of 10%, 5% and 1%, respectively, and the numbers in parentheses are standard errors.

## 5.4 Regional heterogeneity

Since the development level of digital economy in the eastern coastal areas of China is ahead of that in the central and western regions, and the development level of digital economy in the central and western regions is not different, this paper will make fixed effect regression of the eastern coastal areas and the comparative analysis of the central and western regions respectively, and the results are shown in Table 5. The regression results of the models (7) and model (8) in the Table indicate that, The level of digital economy development in the eastern coastal areas and the central and western regions in improving the urban-rural income gap is significant at 5% and 1%, respectively, And the regression coefficients were-0.00003 and-0.00010, This shows that for every unit increase in the development level of the digital economy, The urban-rural income gap in the eastern coastal areas will narrow by 0.00003 units, The urban-rural income gap between the central and western regions will narrow by 0.00010 units, That is, the impact of the development level of digital economy on the urban-rural income gap follows the law of diminishing margin, The presence of regional heterogeneity, Hypothesis 4 holds true.

Table 5. Test of heterogeneity

| variable | eastern coastal areas | Midwest |
|---|---|---|
|  | model (7) | model (8) |
| dig | -0.00003** | -0.00010*** |
|  | (0.0000) | (0.0000) |
| lnedu | 0.04904 | 0.03379 |

|  | (0.0299) | (0.0212) |
|---|---|---|
| lncx | -0.00240 | 0.00427 |
|  | (0.0028) | (0.0030) |
| cz | 0.01226 | 0.04554** |
|  | (0.0245) | (0.0197) |
| ur | -0.28781*** | -0.23296*** |
|  | (0.0248) | (0.0473) |
| constant | 0.14136** | 0.18309*** |
|  | (0.0697) | (0.0465) |
| sample capacity | 121 | 220 |

Note: *, * * and * * * indicate the significance levels of 10%, 5% and 1%, respectively, and the numbers in parentheses are standard errors.

## 6. Main conclusions and policy recommendations

As a new driving force for China's economic development, the digital economy has also become an effective driving force to narrow the urban-rural income gap. Based on the above analysis, this paper draws the following conclusions: digital economy development can improve urban and rural income gap; the rationalization of industrial structure will expand the urban and rural income gap, and reduce the improvement effect of digital economy development level; the influence of digital economy development level on urban and rural income gap and there is regional heterogeneity, and the marginal impact on the central and western regions is greater than that of the eastern region. Based on the above studies, the following suggestions are made:

### 6.1 Vigorously develop the rural digital economy

First of all, the construction of rural digital infrastructure should be strengthened. The rural digital infrastructure lags behind cities and towns is one of the important factors affecting the large gap between urban and rural digital economy in China. Therefore, the government should increase the investment in rural digital infrastructure, promote the development of rural digital infrastructure, narrow the gap between urban and rural digital hardware, so as to lay a foundation for the development of rural digital economy. Specifically, it is necessary to strengthen the construction of 5G Internet and communication facilities in rural areas, improve the coverage and use depth of rural Internet, and reduce the difficulty of obtaining information acquisition for rural residents; strengthen the digitalization and intelligence of traditional infrastructure, such as the construction of smart water conservancy facilities, smart meteorological facilities, smart power facilities and smart transportation facilities, solve the problems of rural residents, promote the circulation of goods between urban and rural areas, and facilitate the rural residents to enter the market, and increase farmers' income. Secondly, we should promote the digital development of rural industries. At present, rural industries are not attractive enough, and a large number of labor force transfers from rural areas to urban areas, leading to a decline in the income level in rural areas and aggravating the income gap between urban and rural areas. Therefore, the government should guide the integrated development of digital technology and rural industries, and promote the transformation and upgrading of rural industries. We should plan the direction of the digital transformation of rural industries, promote the implementation of the demonstration projects for the application of digital technology in key industries, increase the subsidies for the digital transformation of rural enterprises, and carry out intelligent transformation of rural industries with the help of digital technology. At the

same time, we should accelerate the development of emerging industries such as rural ecotourism to help the development of rural digital economy.

**6.2 Pay attention to the training and introduction of rural digital technical personnel**

First, to improve the digital literacy and skill levels of rural residents, By offering an "online + offline" digital technology training course, To organize and implement the demonstration project for the digital literacy and skill level of rural residents, Strengthen the ability of some rural residents to apply digital technology and related facilities, Give full play to the role of "role model" and "benchmark"; Relevant departments can publish simple guidelines for the application of digital technologies, For the reference of the vast number of rural residents, At the same time, we can cooperate with local universities and scientific research institutions to open government training institutions, rural "night universities" and other training institutions, Meet the needs of more rural residents for digital technology training; The government can build a dedicated platform for digital technology exchange, To enable the exchange of experiences among rural residents, We will accelerate the improvement of the digital literacy and skills of rural residents. Secondly, we should make full use of the talent advantages and technical strength of local universities, scientific research institutions, enterprises and institutions to introduce digital technical talents and boost the development of local rural digital economy. Finally, a reasonable digital talent incentive mechanism should be established to commend and reward the units and individuals who enhance the digital literacy and skills of rural residents and use digital technology to bring wealth to rural areas.

**6.3 Implementing differentiated digital economy development strategies**

Following the law of marginal diminishing of digital economy on the difference between urban and rural income, different regions should implement the development strategy of regional differentiated digital economy to promote the coordinated development of the eastern coastal areas and the central and western regions.one side, Eastern coastal areas with improved infrastructure, high level of economic development and wide application of digital technology, The development of the digital economy has good industrial conditions, Therefore, focus on the region's digital innovation capabilities, Strengthen the cultivation and optimization of the innovation environment of the digital economy, Vigorously support enterprises in their digital technology innovation, To further construct the digital economy development strategy centered on digital enterprises, Ensuring that the digital economy releases strong momentum; on the other hand, The overall economic development level of the central and western regions lags behind the eastern coastal areas, The digital economy is developing relatively backward, Therefore, attention should be paid to the construction of digital infrastructure, We will accelerate the development of traditional infrastructure to intelligence, At the same time, we should increase the policy subsidies for the construction of rural digital industry, To strengthen the weak links of rural digital economy development, Promote the further development of the local digital economy.

## References

[1] Xiong Ziyi, Zhang Ke, He Yiqing. Digital economy development and urban-rural income gap:Empirical analysis based on the perspective of factor flow [J]. World Agriculture, 2022, No.522(10):111-123.

[2] Liu Wei, Dai Bingqing, Liu Weizhen. Can digital finance drive high-quality economic development?: Empirical analysis based on provincial panel data in China from 2011 to 2017 [J]. Comparison of economic and social systems, 2021, No.218(06):63-75.

[3] Huang Manyu, Dou Xueleng. Will the digital divide between urban and rural areas hinder the upgrading of rural residents' consumption structure?: Analysis based on the China Family Tracking Survey (CFPS) data [J]. Economic Issues Exploration, 2022, No.482(09):47-64.

[4] Yu Xiaoyan. Digital economy and the income gap between urban and rural areas: the "digital dividend" or the "digital divide" [J]. Business Research, 2022, No.535(05):123-131.

[5] DengX ,GuoM ,LiuY(2023)Digital economy development and the urban-rural income gap :Evidence from Chinese cities.PLoSONE18(2):e0280225.

[6] Fan Yixia, Xu Hao, Ma Lijun. Characteristics and mechanisms of digital economy affecting the income gap between urban and rural residents [J]. China Soft Science, 2022, No.378(06):181-192.

[7] Chen Wen, Wu Ying. The development of the digital economy, the digital divide and the income gap between urban and rural residents [J]. Southern Economy, 2021, No.386(11):1-17.

[8] Li Xiaozhong, Li Junyu. Study on the influence of digital economy development on urban-rural income gap [J]. Agricultural Technical Economics, 2022, No.322(02):77-93.

[9] Zheng Guonan, Li Changzhi. Does the digital divide affect the balanced distribution of digital dividends:Based on the empirical test of the provincial urban-rural income gap in China [J]. Macroeconomic Research, 2022, No.286(09):33-50.

[10] Cheng Li. Whether the rationalization and upgrading of the industrial structure will narrow the income gap between urban and rural areas:Empirical analysis of Chinese provincial panel data based on it from 1985 to 2011 [J]. Modern Finance, 2014,34 (11): 82-92.

[11] The White Paper on China's Digital Economy Development (2017) issued by China Communications Institute

[12] China Digital Rural Development Report (2022) issued by Information Development Bureau of Cyberspace Administration

[13] Shi Zhongliang, et al. Industrial economics [M]. Beijing: Economic Management Press, 1998.

[14] Dai Jinhui, Xu Yue. Research on the impact of the income gap between urban and rural residents:Based on industrial structure upgrading and labor mobility [J]. Journal of Shandong Industry and Business College, 2023,37 (02): 64-74.

[15] Li Jingbo, Tian Lu. Analysis on the restriction of agricultural weak quality on rural financial development [J]. Anhui Agricultural Science, 2011,39 (27): 17027-17029.

[16] Lu Yu. Public policy and issues of "agriculture, Rural areas and farmers" issues [J]. Social Sciences Forum (Academic Research volume), 2009, No.184(02):69-72.

[17] Where, Zhao Xuanzhuo, Qi Qi. Research on the development level measurement, spatial and temporal pattern and regional difference of Digital Economy in China [J]. Industrial technology and Economy, 2023,42 (03): 54-62.

[18] Wang Shaoping, Ouyang Zhigang. Measurement of urban and rural income gap and its effect on economic growth in China [J]. Economic Research, 2007,42 (10): 44-55.

[19] Yu Bin Bin. Economic growth effect of industrial structure adjustment and productivity improvement:Based on the analysis of Chinese urban dynamic space panel model [J]. China Industrial Economy, 2015, No.333(12):83-98.