Digital Economy and the Urban-Rural Income Gap: Theoretical Mechanism and Empirical Study

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Abstract. At present, China has won a comprehensive victory in the battle against poverty, but the unbalanced development of city and countryside and regional development, and the large gap between the urban and rural income distribution have become significant obstacles for high quality economic development, which is urgent to be narrowed. This paper theoretically analyzes the impact mechanism of digital economy development on the income gap, and conducts an empirical study with 8 years provincial data of 30 provinces from 2013 in China. The result shows that the development of digital economy can narrow this gap. And this paper puts forward some countermeasures, including that the government ought to strengthen the construction of digital infrastructure in countryside, pay attention to cultivate more rural relevant talents, and accelerate the integration of traditional agriculture and digital economy, hoping this paper can provide some useful ideas to improve the China's urban-rural income gap.

Key words: Income gap; Digital economy; Fixed effect model

1 Background introduction

Since reform and opening up, accompanied by a number of manpower, material resources and capital poured into the city, China's economy developed rapidly, but the problem of income gap between urban and rural region has also emerged. Compared with downtown residents, the countryside residents' income is still at a lower level. Gini coefficient of Chinese income reached 0.465 in 2019, exceeding the international warning line. The income ratio of urban and rural residents was 2.56 in 2020, which shows a significant gap. If the current situation cannot be properly resolved, it will restrict the harmonious development between economy and society.

Many scholars have studied urban-rural income gap for a long time, which has been a hotspot in academic research, and the discussion of its influencing factors is an enduring research topic in academic circles. With the development of the times, informatization has ushered in the third wave of vigorous development, and new technologies, like 5G, big data and artificial intelligence have begun to integrate into economic and social development. Gradually, digital economy has become an indispensable part during the economic development process, and an important way to figure out the problem of urban-rural dualization in China.

2 Literature review

With digital technology development, many domestic and foreign scholars have researched the relationship between developmental level of digital economy and the gap of urban-rural areas income from the aspects of e-commerce, Internet and infrastructure. There are two types of viewpoints as follows.

One of the views is that digital economy can widen the income gap of the two kinds of areas. Tan Yanzhi et al. (2017) [1] found that the application of the Internet can bring information dividends to residents' income. But due to the unbalanced areas development and the different ability between downtown and countryside areas in using the Internet, the urban income return rate from using the Internet is greater than that in rural area. Zhang Lei and Han Lei (2017) [2] believed that e-commerce has the ability to boost both urban and rural regions residents' income growth. However, the improvement effect is unbalanced, which can widen the income gap instead. Ward and Zheng (2016) [3] believed that the better construction of digital infrastructure districts have, the greater improvement of regional economic development districts will make. And the more economically developed regions are, the more affect those residents will have.

The other view is that digital economy can decrease the income gap of the two kinds of areas. Song Xiaoling (2017) [4] used Theil to measure this gap in various Chinaese provinces and found that, along with the application of digital technology, the inclusive finance development can facilitate families, in rural, to start businesses actively, which significantly improves the rural income level, and then narrows the gap. On this basis, Zhang Xun et al. (2021) [5] combined digital divide with digital finance and found that digital finance can help restrain the negative impact of digital divide, thus promoting economic growth and raising residents' income level. It can especially increase the income of households without access to the Internet, but has little effect on the improvement of households that frequently use the Internet. Therefore, digital finance has the ability in closing the income gap of urban and rural residents.

3 Influence mechanism

3.1 Employment effect

Firstly, the upward trend of the digital economy using can generate new jobs and create more job opportunities, which can directly promote non-agricultural employment to rural residents. Secondly, it can also indirectly promote the employment of rural residents. As the digital economy breaks the traditional restrictions on information transmission, the information asymmetry between urban and rural labor forces has been improved, which can not only reduce the cost of job searching for rural residents, but also enable them to obtain employment information faster and find jobs that match them. Finally, the rural human capital will gradually have a substantial increase, after learning and strengthening new skills through the Internet, which can reduce the human capital gap.

3.2 Production efficiency

Digital economy development can break the restrictions of information dissemination. Also, it can enable the latest agricultural technology information and farming experience to be

disseminated to the countryside in a timely manner, so that farmers can choose suitable production methods and make the best production decisions. Moreover, after having higher human capital, there will be spillover effect of human capital. In the process of communication, experience shared with other farmers, human capital can flow between regions, enhance the overall enthusiasm of agricultural production, and thus improve agricultural productivity and income level.

3.3 Market participation

The digital economy development has promoted the marketing model of agricultural products. E-commerce, as an important crystallization in the deep fusion with real economy and digital economy, has brought about profound changes in the flow pattern and consumption pattern of commodities. Farmers can know the price changes of agricultural products in a timely manner, through some relevant websites, so as to speculate the supply and demand information of the market and choose the best production mode. They can also sell online through the online sales platform. The widening of sales channels can increase the sales volume of agricultural products and bring more income to farmers.

Combined with the above analysis, this paper proposes a hypothesis, which is that the digital economy development can lessen the income gap between urban and rural areas residents.

4 Research design

4.1 Model setup

According to the above analysis, the model and letter meanings are as follows:

$$Theil_{i,t} = \alpha_i + \alpha_1 lnDe_{i,t} + \beta X_{i,t} + \varepsilon_{i,t} \tag{1}$$

$Theil_{i,t}$ represents the urban-rural income gap and it is the explained variable; lnDe represents the development level of digital economy and it is the core explanatory variable; X represents a group of control variables; i represents the provinces in China (i=1,2,... ,30) and t represents the year (t=2013,2014,... ,2020), α_i is the constant term, α_1, β are some coefficients, $\varepsilon_{i,t}$ is the random error term.

4.2 Variables selection and measurement

4.2.1 Explained variable

The paper adopts Thiel Index as the urban-rural income gap measurement method.

$$Theil_{i,t} = \sum_{j=1}^{2} (\frac{I_{ij,t}}{I_{i,t}}) \ln (\frac{I_{ij,t}}{I_{i,t}} / \frac{P_{ij,t}}{P_{i,t}}) \tag{2}$$

When j=1, it represents China's downtown area; when j=2, it represents China's countryside area. i represents provinces; t represents years; I and P represent per capita disposable income and population respectively.

4.2.2 Core explanatory variable

Digital economy's connotation of is in a good digital economy governance environment and digital economy innovation environment, with the digital infrastructure construction as the "ballast", the development of digital industry as support, the integration of industrial digitalization as the focus, and then constantly expand the depth and breadth development of digital economy[6]. According to the practice of Ge Heping and Wu Fuxiang (2021)[7], this paper builds a digital economy indicator system, that includes 4 first-level indicators and 7 second-level indicators in Table 1.

Table 1. Digital economy indicator system

First-level indicators	First-level indicators weights	Second-level indicators	Units	Secondary indicator weights
Digital infrastructure	21.29%	Number of broadband Internet access ports	Ten thousand	11.04%
		Number of mobile phone base stations	Ten thousand	10.25%
Digital industrialization	39.69%	Total telecom business	Billion yuan	15.45%
		Software business revenue size	Billion yuan	24.24%
Industrial digitization	33.03%	Digital financial inclusion index	/	5.75%
		E-commerce transaction volume	Billion yuan	27.28%
Digital economy development environment	5.99%	Number of government affairs tweets per 10000 people	/	5.99%

4.2.3 Control variables

Combined with related research[8], some other factors will also have the ability to influence on the urban-rural areas income gap. To avoid those factors impact on the results, the following 4 variables will be taken as control variables.

(1) Level of economic development. Economically developed areas have more job opportunities, so rural residents are more likely to engage in non-agricultural industries to obtain higher labor remuneration, thereby reducing the income gap. This variable is calculated as the logarithm of GDP per capita, recorded as lnGDPp.

(2) Urbanization level. Urbanization will enable the expansion and upgrading of secondary and tertiary industries, then provide more urban job opportunities for rural residents, and downsize the gap. It is calculated by the formula urbanization level=Urban population / total population, denoted as urban.

(3) Educational level. At present, the per capita education level in urban is generally higher than it in rural areas. The improvement of educational level may lead to widen the residents' income gap. However, education can provide low-income groups with better employment opportunities, which is conducive to decreasing this gap. In this paper, the average years of schooling are used to measure the level of Education, which is measured by the formula: (number of illiterates×0 + number of primary school education×6 + number of junior high school education×9 + number of senior high school education×12 + number of secondary vocational education×12 + number

of college education or above×16 + number of postgraduate students×19)/ the total number of people over 6 years old, recorded as education.

(4) Population density. In areas with high population density, goods and services can flow quickly among the urban and rural areas, and those residents who live in the countryside can participate in talent market, thus getting more income and minish the income gap. Population Density=total population of a region/area of a region is used to calculate population density, which is recorded as density.

4.3 Data sources

All above data is from China Fiscal Yearbook and China Statistical Yearbook. According to the scientificity and availability of data, this paper excluded the data from Tibet, Hong Kong, Macao and Taiwan, which means the paper only selects 30 provinces data in China from 2013 to 2020 as samples for research, and uses mean value method to fill in all missing data.

5 Empirical analysis

This paper conducts fixed-effect model regression using the panel data of 30 provinces, from 2013 to 2020. The regression results obtained by Stata14.0 are shown in Table 2.

Table 2. Benchmark regression

Variables	Theil
lnDe	-0.007***
	(0.005)
lnGDPp	0.007
	(0.007)
Urban	-0.196***
	(0.047)
Education	-0.006***
	(0.002)
Density	-0.366
	(0.619)
Constant	0.216**
	(0.079)
N	240
R^2	0.848

Note: *, ** and *** are respectively significant at 10%, 5% and 1% levels.

The results show the development of digital economy has a significantly negative effect on the rural-urban income gap within a 1% confidence interval, with a coefficient of -0.007, which has no difference with the analysis of the influence mechanism mentioned above and confirms hypothesis. Through the Internet, rural residents can learn knowledge, learn technology and find jobs more conveniently, which narrows the gap in human capital and job-searching costs between the two areas residents. The digital economy development also enables farmers to better understand the market conditions and increase their participation in the market, which

promotes the integration between urban and rural markets. All in all, the digital economy can close the gap in human capital, information access cost, market participation and other aspects.

The coefficient of economic development level is positive, which indicates that with the economic development, the residents' income gap will increase, but the influence is not significant. The possible reason is that there is an obvious dual economic structure in China, and the overall improvement of economic development level will not close this gap, so that both economic development levels will continue to expand, and then enlarge the income gap. However, both urbanization level and educational level are negatively correlated with this gap, and the result passes the 1% significance level test. On the one hand, urbanization can provide more job opportunities for rural residents and solve the problem of large manpower surplus in the countryside. In addition, saturated factor resources in cities will be transferred to countryside during the process of urbanization, which will increase the efficiency of agricultural production and provide higher marginal labor remuneration for rural residents, who still engage in agricultural production. Education can upgrade the quality of labor force and the situation of human capital, enhance the competitiveness of employment, then improve the vulnerable position of farmers in the job market. Population density is inversely correlated with the income gap, but not significantly.

6 Conclusions and suggestions

According to the 30 provinces data from 2013 to 2020, a fixed effect model is constructed for empirical analysis, and analyzes the relationship between digital economy development level and urban and rural income gap. The result shows that the development of digital economy can narrow this income gap.

Combined with the above study conclusion, the paper puts forward following countermeasures: Firstly, the government is supposed to strengthen the construction of rural digital infrastructure and reduce digital divide. Focus on areas with imperfect rural infrastructure construction, increase social investment, speed up the digitization process of agriculture, and provide strong support to its development. Secondly, the government should establish a digital talents training system and actively guide digital talents into the countryside, effectively push forward the development of human capital, and close the residents' income gap. Thirdly, the government should advance the integration of traditional agriculture and digital economy. Making full use of technologies, like Internet and big data, can not only change the marketing model of agricultural products, but understand the market situation in a timely manner to help farmers make their favorable production decisions.

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