The Impact of Digital Economy Development on Urban-Rural Income Gap from the Perspective of Common Prosperity: Evidence from China 2013-2020

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Abstract—Exploring the structural effects of the digital economy on the urban-rural income gap in China is conducive to exploiting the dividends of the digital economy, which is the key to promoting common prosperity and building a modern socialist country. This paper theoretically analyzes the influence mechanism of digital economy development level on the income gap between urban and rural residents. Apart from that, the paper conducts an empirical analysis based on provincial panel data of 31 provinces in China for the period 2013-2020, which aim to explore the structural effect of the digital economy on the urban-rural income gap and further explore whether there is an inflection point effect. The results show that there is an inverted U-shaped nonlinear relationship between the development of digital economy and the urban-rural income gap during 2013-2020 in China, and there is an inflection point effect on the impact of digitization on the urban-rural income gap.

Keywords- digital economy; urban-rural income gap; common prosperity

1. INTRODUCTION

China's economy is facing increasing complexity of risk. The new generation information technology such as digital economy with the Internet, Internet of Things, big data, cloud computing, artificial intelligence, blockchain and other technologies is gradually becoming the new engine of China's economic development[1]. This shows that China is currently in an important stage when the Internet economy is gradually shifting to the digital economy. In the meantime, The Fifth Plenary Session of the 19th CPC Central Committee made major strategic plans for promoting common prosperity. Common prosperity is not only about achieving "prosperity", but more important is "common"[2], which means narrowing the development gap between east and west, between urban and rural areas, finally achieving coordinated development among regions.

The digital economy has penetrated into all aspects of our life. As of 2021, industrial scale of digital economy China's digital economy exceeds RMB 45 trillion, accounting for 39.8% of the gross domestic product[3]. As the Internet penetration rate in rural areas has increased

significantly, rural areas enjoy more dividends brought by digitalization. As the digital economy continues to develop, the Internet makes information circulation between urban and rural areas more frequent, also narrowing the information gap between urban and rural areas. However, the disparity between urban and rural areas is slowly becoming bigger due to the gap in infrastructure and education conditions. How to building up the strength, quality, size of digital economy, promote the coordinated development in urban-rural areas and crack the digital divide is a vital issue problem facing China's social development.

2. LITERATURE REVIEW

Domestic and international scholars have done a lot of research on the factors influencing the urban-rural income gap. The literature has shown that different perspectives and different variable choices lead to different results. Krueger (1993), Dimaggio and Bonikowski (2008) found that the use of Internet has a significant contribution to individual income[4][5]. Cheng, Mingwang, and Zhang Jiaping (2019) studied the impact of Internet penetration on the income gap between urban and rural residents, they found an inverted U-shaped relationship between Internet penetration and the income gap between urban and rural residents[6].

A part of scholars believe that the digital economy will widen the income gap between urban and rural areas. They argue that digital technology and applied digital economy have shown an uneven development of "city preference" and created a "digital divide". Liu Huan(2020) argues that digital technology exacerbates the income gap, especially because the difference in industrial intelligence and urban-rural Internet penetration which further widens the gap in income between urban and rural areas[7]. He Zongyue et al. (2020) thinks that humanities digital economy dividend favors the highly educated groups[8]. Qiu Zeqi et al. (2016) pointed out that the regions that benefit more from the Internet dividend mainly cluster economically developed regions such as the southeast coast[9].

Another part of scholars believe that the digital economy will narrow the income gap between urban and rural areas. Zhang Xiaoyan (2016), Song (2017) argue that the rapid development of ICT brings opportunities to address the urban-rural divide[10][11]. Jonas Hjort and Jonas Poulsen (2019) use a double difference method to find that accessing to high-speed networks increases the employment rate and wages of highly skilled labor in regions such as Congo[12]. Yang Mengjie (2021), Xie Lu and Han Wenlong (2022) argue that the path of digital economy to help balanced urban-rural development is digitally empowered social reproduction link[13][14].

In addition to the elements of the digital economy, factors such as Lu M. and Chen Z. (2004) urbanization[15], Yang X. and Shi D. Qian (2019) transportation infrastructure[16], Wen T. and Wang Y. C. (2020) financial development[17], and Wang Jia X. et al. (2017) demographic structure[18] can affect the income gap between urban and rural residents. This study mainly adds two factors, information development and digital transaction development, based on Cheng Mingwang and Zhang Jiaping's (2019) study of Internet penetration on urban-rural income gap[6], and explores the impact of digital economy development on urban-rural income gap by referring to the measure of digital economy index constructed by Liu Jun (2020)[19].

3. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

The digital economy is based on information technology, which widens the market boundary and enables disadvantaged groups to participate in market transactions more conveniently. We enjoy the externalities of the digital economy, which is conducive to economic sharing, nevertheless, asymmetry in the ability to apply information technology may also produce the Matthew effect and lead to the differentiation of individual benefit gap[20].

On the one hand, the spread of the digital economy and the construction of related infrastructure all provide digital enablement that promote economic and social development. From the Internet capital framework, progression of the access divide narrowing and the enhanced Internet connectivity have given people more opportunities to benefit from the Internet platform. This dividend has shown the variation because of the difference in conversion size and conversion rate[9]. On the other hand, the development of economic and social differentiation is related to the development of the digital economy. The development of the "digital divide" has experienced from access opportunity differences to Internet usage differences. Disparities in the development and usage of ICT in different regions, industries, ownership system, and business size may create group differences.

Hypothesis1: The benefits of digital technology development are different, and the income benefits for urban and rural residents are differentiated.

On the other hand, the digital economy corrects factor mismatches by improving information transparency. The penetration, substitution and synergy of the digital economy[21] together with the drive of digital technologies such as big data and cloud computing have improved the transparency of market information, which also continuously expanded the traditional resource allocation boundary. The free flow of factors has led to the continuous integration of urban-rural industries, also bring about the diversification of production and organization methods. Finally, realizing the digital dividend. And the cost of information search for farmers has been reduced, and the scope of farmers' participation in market activities has been expanded[22]. As a result, the income gap between urban and rural areas began narrowing. From this, the following hypothesis is made:

Hypothesis2: Industrial digitalization has an "inflection point" effect on the income gap between urban and rural areas.

4. MODEL SETTING AND DATA SOURCES

4.1 Model construction

Based on the theoretical derivation and analysis in the previous section, the underlying econometric model is constructed as follows:

$$\text{Theil}_{it} = \alpha_0 + \alpha_1 \text{DEI}_{it} + \epsilon_{it} \qquad (1)$$

To investigate whether there is a nonlinear relationship between the digital economy and the urban-rural income gap, the following nonlinear model is constructed:

$$\text{Theil}_{it} = \alpha_0 + \alpha_1 \text{DEI}_{it} + \alpha_1 \text{DEI}_{it}^2 + \epsilon_{it} \qquad (2)$$

Theil_{it} is the explanatory variable, which denotes the urban-rural income gap in period t of province i; DEI_{it} is the core explanatory variable, which denotes the level of digital economy development in period t of province i; DEI_{it}^2 is the squared term of the level of digital economy development; and ϵ_{it} is the random disturbance term.

4.2   Variable settings

In this paper, the explained variable, urban-rural income gap, is measured by Theil index (Theil) with reference to Yu Chengxue (2009)[23]; the core explanatory variable digital economic development level (DEI) is estimated by constructing an indicator system.

1)   Urban-rural income gap (Theil). China has an obvious urban-rural dual economy structure, so the Theil index is chosen to measure the urban-rural income gap with the following formula:

$$\text{Theil}_{it} = \sum_{j=1}^{2} \left\{ \left(\left(\frac{I_{ij,t}}{I_{i,t}} \right) \ln \left[\left. \left[\frac{\left(\frac{I_{ij,t}}{I_{i,t}} \right)}{} \right] \middle/ \left(\frac{P_{ij,t}}{P_{i,t}} \right) \right] \right) \right\} \qquad (3)$$

$I_{ij,t}$ (j=1 refers to urban areas and j=2 refers to rural areas) denote the per capita disposable income of urban residents and the per capita disposable income of rural residents in period t of province i, respectively, $P_{ij,t}$ (φ=1 refers to urban areas and j=2 refers to rural areas) refer to the number of urban and rural population in period t of province i, $I_{i,t}$ refer to the total income in period t of province i, $P_{i,t}$ refers to the total population in period t of province i. The closer the Thiel index is to 0, the smaller the income gap between urban and rural residents. And vice versa, the larger it is.

2)   Digital economic development index measurement (DEI). In this paper, the explanatory variable digital economy development index refers to Liu Jun et al. (2020) to construct the digital economy evaluation index system of China's individual provinces from three perspectives: information development, Internet development and digital transaction development. The indicators at each level are shown in Table 1[24].

Table 1 Digital Economy Index Evaluation Index

Main indicators	Primary indicators	Secondary indicators	Measurement indicators
Digital economy index	Informatization development index	Informatization base	Fiber optic cable density Density of cell phone base Percentage of Informatization Employees
		Informatization impact	Total telecommunication business Software Business Income
		Fixed Internet Base	Internet Access Port Density

	Mobile Internet Base	Mobile phone penetration rate
Internet Development Indicators	Fixed Internet impact	Broadband Internet users as a percentage of the number of users
	Mobile Internet impact	Mobile Internet users as a percentage
		Percentage of enterprise websites
Digital transaction development indicators	Digital transaction Basis	Number of computers used by enterprises
		E-commerce share
	Impact of digital transactions	E-commerce sales
		Online retail sales

This paper adopts the threshold method to standardize the data, uses the principal component analysis to determine the weights of each index, and calculates the digital economy development index through the linear weighting method.

4.3   Data sources.

In this paper, the panel data of 31 provinces (except Hong Kong, Macao and Taiwan) in China from 2013 to 2020 are selected. The original data of rural household disposable income (yuan), urban household disposable income (yuan), total urban population (10,000 people), total rural population (10,000 people), total urban income (yuan), and total rural income (yuan) of each region are obtained from the China Statistical Yearbook, and the Thayer indexes of 31 provinces in China from 2013 to 2020 are calculated. The original data of the indicators of digital economy development index of each region are obtained from China Statistical Yearbook, and the digital economy development index of 31 provinces in China from 2013 to 2020 is calculated.

5. EMPIRICAL ANALYSIS

There are three general forms of panel data models to choose from: mixed estimation model, fixed effect model, and random effect model. For the selection methods of panel data model forms, we use F-test to decide whether to choose POOL model or FE model, Breusch-Pagan test to decide whether to choose RE model or POOL model, and Hausman test to decide whether to choose RE model or FE model.

Table 2 Panel model selection[25]

Test type	Statistic	p-value	Conclusion
F-test	122.808	0.000***	FE model
Breusch-Pagan test	700.497	0.000***	RE model
Hausman test	-29.385	1.000	RE model

Note: ***, **, * represent 1%, 5%, 10% significance level respectively

As shown in Table 2, according to the F-test, the significance p-value is 0.000***, the level presents significance, the original hypothesis is rejected and the FE model is selected. According to the Breusch-Pagan test, the significance P-value is 0.000***, the level presents significance,

the original hypothesis is rejected, and the RE model is selected. According to the Hausman test, the significance P-value is 1.000, which does not show significance, and the original hypothesis cannot be rejected, and the RE model is chosen.

TABLE 3 RE MODE[25]

Variables	Coefficient	Standard error	t-statistic	p-value	R²	F
const	0.132	0.008	16.246	0.000***	within=0.642	F=195.073
DEI	-0.265	0.023	-11.403	0.000***	between=0.357	p=0.000***
DEI2	0.246	0.033	7.457	0.000***	overall=0.336	
			Dependent variable：Theil			

Note: ***, **, * represent 1%, 5%, 10% significance level respectively

The results of the F-test of the RE random model show that the significance p-value is 0.000***, which is significant at the level of 0.000**, and the original hypothesis is rejected, so the model is valid. Table 3 shows whether there is a non-linear relationship between the digital economy and the urban-rural income gap, and the overall relationship shows an "inverted U-shaped" relationship to verify the hypothesis. With the development of digital economy, the income gap between urban and rural areas first becomes larger and then smaller.

In the process of promoting urban and rural economic development by the digital economy, urban residents benefit more. They receive more digital economy dividends in the early stage due to infrastructure conditions and human capital. At the same time, due to the impression of inherent factors, rural areas lag behind urban development. However, with the continuous improvement and development of the overall economic level, the conditions in rural areas are continuous improving, the digital economy can break down some barriers between urban and rural areas. So that the information factors can circulate more fluent and frequency under the effect of digital information, which can also bridge the income gap between urban and rural areas.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1   Recommendations

Based on the provincial panel data of 31 provinces in China from 2013 to 2020, the paper analyzes the relationship between the development of digital economy and the urban-rural income gap in the context of common wealth. The results show that the relationship between digital economy development and urban-rural income gap in China during 2013-2020 is non-linear in an inverted U-shape.

The digital economy occupies an important position in the process of China's economic development. That's why we need to stimulate the vitality of the digital economy, enhance the efficiency of digital government, set up frameworks for digital cooperation, build strong digital security shields, and finally let digital advancement benefit people of countries. Therefore, based on the research, the paper makes the following three suggestions.

First, China should has given high priority to strengthening the construction of Internet. It is necessary to improve the construction of information network facilities in rural areas and expand the coverage of 4G, 5G communications and gigabit optical fiber networks in rural areas. Also, we should improve rural public culture service digital platform construction. Comprehensively use digital technologies such as big data, cloud computing, and blockchain to establish an urban-rural integration platform and promote the sharing of digital information resources and service resources. Second, Improving digital awareness and skills of rural residents in general. Bridging the cognitive gap and application gap of digital technology caused by the digital literacy disparity. For example, we can hire a professional information technology team to hold lectures to teach villagers with basic information skills operation and agricultural digital training. Third, encourage, support and guide digital enterprises going to the countryside. The operation of digital enterprises can effectively revitalize the development of digital economy in countryside, by which can drive the coordinated development of village-related industries and improve their ability to increase income and become rich, strengthen the county economy eventually.

6.2   Epilogue

Subject to time and ability factors, the paper fails to explore in depth how digital economy development affects the urban-rural income gap. At the same time, it failed to cover the instrumental variables in the selection of specific variables to complete the generalized moments estimation to make the study more rigorous and complete. It is hoped that in the next stage we can continue to polish and perfect the research on this topic.

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