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FOSTERING ECONOMIC EQUALITY: LEVERAGING DIGITAL TRANSFORMATION AND INDUSTRIAL ADVANCEMENT TO BRIDGE URBAN-RURAL INCOME GAPS

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Abstract:
China's rapid economic development has led to increasing urban-rural income disparity, highlighting the need for policies addressing this issue. The emergence of the digital economy, driven by technology and information resources, has played a pivotal role in economic growth. As the digital economy extends its reach to various sectors, including rural areas and traditional industries, it has become a catalyst for innovation and industrial upgrading, presenting new opportunities for urban and rural development. In this era of deep digitalization, the integration of digital technologies into industrial production, resource allocation, and information dissemination is gaining significance. This paper examines the impact of deepening digitalization and industrial restructuring on income disparity between urban and rural residents. It explores strategies to narrow this income gap through industrial upgrading and digital development.

Keywords: digital economy, industrial restructuring, income disparity, urban-rural divide, economic development

Introduction

While China's socialist market economy is developing vigorously, the problem of urban-rural income disparity is also becoming prominent. This is not only a reflection of the uneven and imperfect development of China's current system, but also a key task for social and economic development, and has gradually become an important direction for policy formulation.With the continuous development of the market economy and modern science and technology, a new form of economic development has gradually emerged in the form of the digital economy, which has become an important output factor through digital production science and technology and information resources, and an important information dissemination carrier through modern Internet science and technology, which has contributed to rapid economic development. As China's digital economy continues to develop, the content of the digital economy is expanding further outwards to include industry, rural areas, modern services and other traditional industries, promoting innovation and upgrading in the industrial structure and becoming a new driving force for urban and rural development. In the era of the full depth of the digital economy, the deep integration and application of digitalisation in industrial production, resource allocation and information mobilisation, and the role of digital technology in achieving the goal of common prosperity at the urban and rural income levels are receiving increasing attention (Chen,2021).[1] In the context of deepening digital development and industrial restructuring and upgrading, how else will the income disparity between urban and rural residents be affected? How to narrow the income gap between urban and rural areas by promoting industrial restructuring and upgrading deserves further exploration.

In view of this, this paper attempts to make two additions: first, by doing direct and mediated effect tests on the digital economy's influence on the urban-rural income gap respectively, in order to further analyze the differences presented by its mechanism of action, and second, by taking is industrial structure upgrading as a threshold variable to further explore the influence of industrial structure upgrading on the urban-rural income gap in the process of accelerating the construction of the digital economy, and to examine the existence of its threshold effect; this is of practical significance for an in-depth analysis of the relationship between the development of the digital economy and the urban-rural income gap, and for the application of digital construction to accelerate the process of achieving common prosperity.

1. Theoretical analysis and research hypothesis

The urban-rural income gap has long been a hot issue of concern to academics. Some scholars have argued that the development of the digital economy will lead to a gradual increase in the income gap between urban and rural residents. The development of modern technology will create a need for hightech workers, and it is more difficult for rural residents to understand and use the smart technology products and services in the digital economy than urban residents. This imbalance in the development and application of Internet applications has seriously increased the income imbalance of rural social groups(Tan,2017)[2], which in turn has had a much greater effect on the income of urban residents than on rural support for farmers' entrepreneurship, further widening the urban per capita income gap. The "digital dividend" has a distinctly urban bias, thus widening the urban-rural income gap.

Some scholars also argue that the digital economy will have a positive effect on narrowing the urbanrural income gap as the digital dividend increasingly favours rural areas. The digital economy uses information as a medium to break through traditional urban-rural spatial restrictions, reduce information inputs and intermediate transaction costs, and disseminate advanced agricultural science and technology information and production knowledge more quickly and accurately (Han,2018)[3], which can not only promote the transformation of agricultural production methods from crude to refined and intelligent (Xia,2019)[4], but also break through the information barriers of traditional agricultural markets, thus enhancing farmers' market capacity, increase the profitability of agricultural products sales, and enhance farmers' income level (Zeng,2018).[5] Research also shows that farmers can improve their agricultural income, wage income, and entrepreneurial income through the application of the Internet(Liu,2018).[6] According to the above analysis, the digital economy will widen the urban-rural income gap at the initial stage of development, while with its further development, it will effectively reduce the urban-rural income gap.Based on this, research hypothesis: H1: there is an inverted U-shaped characteristic of the impact of the digital economy on the urban-rural income gap.

The digital economy is applied to the development of production informatization and the improvement of industrial structure. The digital economy is constantly acting in the modernization of industry, deeply promoting the integration and development of industry, further accelerating the transformation and upgrading of the primary industry structure in counties and rural areas, which is conducive to consolidating and adjusting the rural industrial structure, extending the industrial chain of agricultural products and enhancing the added value of products. Secondly, with the integration and exchange of digital economy and primary industries, the structural adjustment of agricultural products will gradually be guided by scientific and technological changes and led by market demand, based on characteristic agricultural products, which is conducive to cultivating new economic growth points in less developed rural areas and getting out of the dilemma of low-end, low value-added and homogeneous products that emerged in the development of traditional agricultural products. In addition, the effective mobilisation of

various factors through digital production is conducive to the gradual cultivation of multiple development models, which in turn enables multiple subjects to develop in synergy with each other, enhancing both the distribution channels and added value of products, and promoting income distribution to gain greater scope for development. The digital economy can optimise production efficiency, collaboration efficiency and innovation capacity within the industry, further realising the development of the digital economy and traditional industries, and enabling digital technology to penetrate into all stages of commodity manufacturing and circulation, promoting the transformation and upgrading of urban and rural industries, driving up the per capita income of urban and rural people, especially for traditional rural residents who have certain late-stage advantages, and further reducing the per capita income gap between urban and rural areas. Industrial structure upgrading will show a shrinking effect in the long run (Mu,2016)[7], according to which hypothesis H2: digital economy development will narrow the urban-rural income gap by promoting industrial structure upgrading.

2. Variable selection and model setting

2.1. Data selection and description

Given the late start of China's digital economy and the start date of e-commerce data calculation is 2013, this paper selects a panel data sample of 30 provinces in China from 2013 to 2020, excluding Tibetan region and Hong Kong, Macao and Taiwan regions. The main data come from the local statistical yearbooks of each Chinese province in each year, etc.

2.1.1. Urban-rural income gap

Scholars generally choose the Gini coefficient, the disposable income ratio of urban and rural residents, the consumption ratio of urban and rural residents and the Thiel index as the measures of income disparity between urban and rural residents, etc. In this paper, we choose the average disposable income ratio of urban and rural residents as a proxy index of income disparity between urban and rural residents, which is denoted as Gap.

2.1.2. Digital economy

This paper borrows the research method of existing scholars to evaluate the level of digital economy (Liu, 2020)[8], adopts the construction of a comprehensive index evaluation model to measure the results, and normalizes the raw data, and uses the entropy value method to determine the weights of each index in the evaluation system. For some of the missing values, this paper uses linear interpolation and ARIMA filling methods to fill in the missing data, and mark it as Dig.

2.1.3. Industrial structure upgrading

In this paper, the ratio of the total output of the tertiary sector to the output of the secondary sector is used as a mediating variable, which is denoted as Indus-S.

2.1.4. Control variables

In order to better test the relationship between the digital economy, industrial structure upgrading and the urban-rural income gap, this paper chose the level of transport construction, urbanisation and government investment as control variables, and record them separately as Road,Gov and City-rate, besides controlled for year fixed effects in the model.Table 1 shows the descriptive statistics of each variable.

Table 1: Descriptive Statistics of Variables

Variable	N	Mean	SD	Min	Max
Gap	240	2.554	0.362	1.845	3.555

Dig	240	0.222	0.124	0.073	0.768
Indus-S	240	28.306	63.596	2.957	360.777
Road	240	58933.25	40867.31	3560	180789
Gov	240	597.213	270.182	123.028	1339.36
City-rate	240	0.603	0.116	0.378	0.896

2.2. Model construction

To test research hypothesis H1, the following mediating effect model was constructed for the direct and indirect mechanisms of action on the development of the digital economy:

$$Gapit=\alpha 0 +\alpha 1Digit +\alpha 2Zit +\lambda i + \eta t + \varepsilon it \quad (1)$$

$$Indus\text{-}S_{it}=\alpha_3 +\alpha_4 Dig_{it} +\alpha_5 Z_{it} +\lambda_i + \eta t + \varepsilon_{it} \quad (2)$$

$$Gap_{it} =\alpha_6 +\alpha_7 Dig_{it} +\alpha_8 Indus\text{-}S_{it} +\alpha_9 Z_{it} +\lambda_i +\eta t +\varepsilon_{it} \quad (3)$$

Equation (1) reflects the direct effect, In order to discuss whether the change in industrial structure is a mediating mechanism between the two, the test steps are as follows: on the basis of the significance test of the coefficient α1 of the linear regression model (1) of the digital economy development index on the urban-rural income gap, the linear regression equation (2) of the digital economy on the mediating variable industrial structure upgrading and the regression equation (3) of the digital economy and the mediating variable industrial structure upgrading on the urban-rural income gap are constructed respectively, and the significance of the regression coefficients α6, α7 and α8 is used to determine whether their mediating effects exist.

3. Empirical test of the impact of the digital economy on the urban-rural income gap

3.1. Baseline regression analysis

The regression results of the digital economy on urban-rural income disparity are shown in Table 2 by using Stata17 software to test the data at the inter-provincial level and logarithmising the variables. In column (1), the estimated coefficient of the core explanatory variable Digital Economy Level Index (Dig) is significantly negative, indicating that the development of the digital economy can indeed reduce the urban-rural income gap. Column (2) reveals that the regression coefficient of the digital economy is significantly positive, which means that the development of the digital economy can effectively promote the upgrading of the industrial structure. The coefficient of the digital economy on the urban-rural income gap in column (3) is also higher than that in column (1), and the indicators are also significantly positive as the industry upgrades. Based on the rule of coefficient determination, it can be shown that the upgrading of industrial structure is indeed an important mechanism for the digital economy to reduce the urban-rural income gap.

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Table 2: Baseline regression results

Variable	lnGap(1)	lnIs	lnGap(2)	lnGap(3)
lnDig	-0.066***	0.201***	-0.078***	-0.049***
	(-19.20)	(5.45)	(-19.47)	(-4.72)
lnIndus-S			0.062***	0.037***
			(5.22)	(3.01)
lnRoad				0.034***
				(6.94)
lnGov				-0.007
				(-0.58)
lnCity-rate				-0.043
				(-0.83)
N	240	240	240	240
cons	0.821***	2.829***	0.645***	0.355***
	(143.81)	(46.97)	(18.89)	(6.37)
R^2	0.638	0.356	0.680	0.742

(Note: ***, **, * denote significant at the 1%, 5% and 10% levels respectively; t(z) values corresponding to estimated coefficients are in parentheses. Same below.)

3.2. The non-linear effect of digital economy development on the urban-rural income gap

Firstly, the quadratic term of the level of digital economic development was added to the independent variables in the above equation (1), and the regression results, as shown in column (1) of Table 3, showed that both relationships were significantly negative, thus further demonstrating the inverted U-shaped nonlinear relationship between digital development and the difference in per capita income between cities, thus further proving the research hypothesis H1.

Second, a panel threshold regression model was used for robustness testing, and the panel threshold model was set as follows:

$$Gapit = \beta 0 + \beta 1 Digit \times I(Indus\text{-}S \leq \theta) + \beta 1 Digit \times I(Indus\text{-}S > \theta) + \beta 2 Zit + \varepsilon it \quad (4)$$

Among them, the digital economy is the core explanatory variable and the industrial structure is the threshold variable for the level of development of the digital economy.I(·) is an indicator function that takes the value of one or zero, and is one if it meets the requirements in parentheses, otherwise it is zero.Equation (4) examines the single-threshold case. By applying the boorstrap self-help method to the digital economy indicators after three hundred iterations of sampling, the conclusion indicates that a single threshold was passed, but not the double and triple threshold tests. As can be seen from the regression findings in column (3)(4) of Table 3, the equation passes only the single threshold with a threshold value of 1.5619 respectively, regardless of whether the main limiting factor is added or not. when the level of the digital economy is less than the threshold value, the regression relationship between the digital economy and the urban-rural income differential is significantly negative, indicating a reduction in the urban-rural income differential; after the threshold value is reached, the effect of the digital economy on the urban-rural income differential is also significantly The regression relationship is negative.

Table 3: Regression results of a threshold mode

Variable	Secondary item	Secondary item	Threshold variable	Threshold variable
Threshold			1.5619**	1.5619**
Dig×I ($Indus\text{-}S_{i,t} \leq q$)			-0.085***	-0.047***
			(-15.54)	(-7.84)

Dig×I (Indus-$S_{i,t}$>q)			-0.064***	-0.048***
			(-18.96)	(-0.66)
Dig×Dig	-0.033***	-0.024***		
	(-19.20)	(-4.72)		
Controlling variables	No	Yes	No	Yes
_cons	0.821***	0.355***	0.817***	0.411***
	(143.81)	(6.34)	(143.23)	(7.51)
Years	8	8	8	8
Provinces	30	30	30	30
N	240	240	240	240
R^2	0.638	0.742	0.688	0.742

4. Conclusions

Based on the fact that the digital economy empowers the urban-rural income gap in the actual situation of China's development, this paper selects Chinese provincial panel data from 2013 to 2020 for analysis, and adopts a fixed-effects model, a threshold-effects model and a heterogeneity analysis method from the perspective of the mediating influence of industrial structure upgrading, and the results show that: the development of China's digital economy effectively acts on the urban-rural The results show that the development of the digital economy in China effectively affects the urban-rural income gap, showing the nonlinear characteristics of the inverted U. Further research shows that there is a single threshold effect of the moderating factor of industrial structure upgrading, indicating that industrial structure upgrading and digital development can jointly reduce the urban-rural income gap.

The findings of this paper have the following policy implications: Firstly, in the light of the fact that the digital economy will shape the reduction of the urban-rural income gap, it is necessary to accelerate the establishment of digital infrastructure, especially by promoting the application of emerging technologies such as the Internet, virtual reality and artificial intelligence, and to strengthen the role of information technology in providing dividends to address the imbalance between cities.

On the other hand, local governments at all levels should actively explore new pillar industry construction and development models that are more suitable for the realistic production requirements and relative advantages of agriculture, so that local resource endowments and the level of information technology can be continuously integrated to promote scientific management of production, modernization of management and quality of service, and to adopt differentiated digital management strategies so as to better utilize the diffusion effect of information technology, the spillover effect of information and knowledge, and the universal utility of digital technology release.

Third, the government and enterprises should continue to strengthen the research and development of digital information technology within the industry. By researching and using digital information technology such as big data, AI, and blockchain to control the manufacturing, supply, trade, and consumption processes of the industry, a comprehensive industry-wide electronic management system will gradually be formed. The government should also coordinate the use of various public policies and measures, such as fiscal and taxation, human capital, etc., to help the industrial structure to develop in an advanced way.

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