

Bridging the Urban-Rural Gap: The Influence Mechanism of Digital Platform Development on the Urban-Rural Income Gap

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Abstract: Studying the impact of digital platform development on the urban-rural income gap can further clarify the pro-poor and inclusive nature of the digital economy, which is of great significance for bridging the urban-rural divide and promoting common prosperity. This paper uses the panel data of 274 prefecture-level cities from 2015 to 2021 to construct a two-way fixed-effect model to explore the impact and internal mechanism of digital platform development on the urban-rural income gap. The results show that the development of digital platforms can significantly reduce the income gap between urban and rural areas, and the results are robust. The mechanism analysis shows that digital platforms can narrow the income gap between urban and rural areas by promoting the upgrading of industrial structure and narrowing the gap between urban and rural capabilities. Heterogeneity analysis shows that there are still obvious regional differences in the impact of digital platform development on the reduction of urban-rural income gap, and the economically developed regions can give full play to the positive effects of digital platforms. It is proposed that the government should accelerate the construction of rural platform infrastructure and data element market, promote the upgrading of industrial structure, stimulate the supply of internal and external factors, and improve farmers' digital skills to improve farmers' income, thereby narrowing the income gap between urban and rural areas, and formulate differentiated policies to support regional cooperation and achieve high-quality development.

Keywords: Digital Divide, Digital Platform, Industrial Structure Upgrading, Urban-rural Income Gap.

1. Introduction

The imbalance between urban and rural development has always been a major problem that needs to be solved urgently in China's social development. The report of the 20th National Congress of the Communist Party of China pointed out that "the problem of unbalanced and insufficient development is still prominent..... The gap between urban and rural development and income distribution is still large." The difference in resource endowment between urban and rural areas and the difference in development policies have led to a significant income gap between urban and rural residents [1]. In addition, some studies have pointed out that the income gap between urban and rural areas in China is much higher than the international average [2]. Therefore, bridging the urban-rural divide and reducing income inequality between urban and rural residents is the key to promoting common prosperity.

Continuous progress and iteration of digital technologies are reshaping the socio-economic landscape, which has a profound impact on the income gap between urban and rural areas. The rise of the digital economy has opened up new paths for agricultural modernization, rural development, and farmers' income increase by reducing information asymmetry and breaking through geographical limitations [3]. Among them, digital platforms have become the most active new force, and the development and expansion of online markets and platform economies centered on digital platforms has many positive effects such as optimizing the efficiency of resource allocation, improving employment structure and income distribution pattern [4, 5], and is of great significance for promoting the balanced development of urban and rural economies. According to the big data monitoring of the Ministry of Commerce, in 2023, China's rural online retail sales will reach 2.49 trillion yuan, an increase of 12.1%, and

the national online retail sales of agricultural products will reach 587.03 billion yuan, an increase of 12.5%. However, the adoption of these advanced technologies in rural areas, especially when entering online markets centered on digital platforms, still faces the dual challenges of inadequate infrastructure and lack of skilled personnel, and the growing digital divide between urban and rural areas is likely to potentially widen the economic gap between urban and rural areas [6]. Therefore, it is of great significance to deeply explore the impact of digital platform development on the income gap between urban and rural areas and its internal laws to coordinate urban and rural development to achieve common prosperity.

From the perspective of existing research, the existing scholars' research on the relationship between digital technologies such as digital platforms and the urban-rural income gap is mainly carried out from two perspectives: one is to examine the impact of the overall development of the digital economy on income distribution from a macro perspective [7, 8]; The second is to study the impact of various digital technologies on income distribution from a micro perspective, and the relevant research is concentrated in developed countries [9]. On the one hand, some scholars believe that the application of digital technology has created the possibility to solve the problem of information asymmetry between urban and rural areas [12], and that digital technology can increase the income level of residents through the effect of increasing income and promoting non-farm employment [10]; On the other hand, some scholars believe that due to the objective existence of the digital divide, Internet penetration may also widen the income gap between urban and rural areas [11]. It can be noted that the existing studies either focus on the impact of the digital economy on the overall income distribution pattern, or focus on the

specific role of the Internet and other digital technological advances and applications on income distribution, and the conclusions are not uniform, and few scholars have paid attention to the important impact of the development of digital platforms in digital technology hubs [4, 5]. In general, there is a lack of systematic research on the relationship between the development of digital platforms and the urban-rural income gap, and it is urgent to clarify the impact and mechanism of the development of digital platforms on the urban-rural income gap.

In view of this, this paper synthesizes the data of 274 cities in China from 2015 to 2021 to explore the impact of the development of digital platforms at the prefecture and municipal levels on the income gap between urban and rural areas. At the same time, combined with the characteristics of macro and micro data, robustness testing techniques such as instrumental variable method are used to overcome the potential endogeneity problem, so as to enhance the reliability of the research conclusions. The purpose of this study is to explore the specific impact and internal mechanism of digital platform development on the urban-rural income gap, and to provide theoretical basis and empirical support for proposing strategies for reducing the urban-rural income gap.

2. Research Hypothesis

2.1. Digital Platform Development and The Urban-Rural Income Gap

In the era of digital economy, digital platforms are closely connected with many institutions, markets, and technologies, and constitute a key hub for the application of digital technologies [13, 14]. As the core of the online market and platform economy, the digital platform empowers the upgrading of the industrial structure by optimizing the allocation of resources, stimulates the vitality of the rural economy, and significantly affects the income gap between urban and rural areas. First of all, the core of the digital economy lies in the application of digital technologies [15], and digital platforms bring together many digital technologies to improve production efficiency and resource allocation efficiency at multiple levels [4]. Specifically, through the platform-enabled precision agriculture, intelligent equipment, and data analysis, the allocation of agricultural resources can be optimized, the digital transformation of agriculture can be promoted [16, 17], and the yield and quality of agricultural products can be improved, thereby increasing farmers' incomes [18]. Second, the development of digital platforms has brought new development opportunities for rural e-commerce, not only providing new channels for the sale of agricultural products, but also stimulating the vitality of agriculture and the rural economy by reducing costs and enhancing financial support [19, 20]. Specifically, digital platforms have expanded the market scope of agricultural sales, allowing farmers to use e-commerce platforms and social networks to connect products directly with consumers, thereby simplifying the distribution chain and increasing the added value and market competitiveness of products. In addition, digital platforms promote business model innovation by giving full play to the network effect and scale effect of the bilateral market [21-23], accelerate the innovative application of industrial technology, improve the efficiency of resource utilization and the production efficiency of enterprises [23, 24], and promote the growth of total factor productivity through technological innovation,

thereby promoting high-quality economic development [25-27]. Through the digital platform, information exchange, resource sharing and complementary advantages between urban and rural areas have been realized, and the coordinated development of urban and rural economies has been promoted.

Based on the above analysis, this paper proposes the following hypotheses:

H1: The development of digital platforms is conducive to narrowing the income gap between urban and rural areas.

2.2. Analysis of the Mediating Mechanism of Digital Platform Development on The Urban-Rural Income Gap

Under the new pattern of economic development, the integration of digital economy and financial technology is becoming a key force to promote the adaptation of industries to the new resource allocation model [28], providing a driving force for the transformation and upgrading of the industrial structure [29], and having a decisive impact on the optimization and upgrading of the industrial structure [30], significantly promoting the dual improvement of scientific and technological progress and economic efficiency, and at the same time having a positive effect on the balanced development of the regional economy [31]. From the perspective of technology dissemination and application, technological progress is the key to promoting the rational development of industrial structure to a higher level [32, 33]. The development of digital technology has led to a wave-like upward trend in the industrial structure [34]. Relying on the low cost and high dissemination of the digital economy, regional digital platforms can quickly match supply and demand information between manufacturing sectors in the region through the network platform effect, shorten the industrial integration cycle, and accelerate the transmission of technology among various industries [35]. This process has promoted the modernization of traditional industries, promoted the overall upgrading of the regional manufacturing structure, and then affected the income distribution of urban and rural areas. From the perspective of industrial chain collaboration, the emergence of digital platforms has promoted the transformation of industrial organization from traditional geographical concentration to virtual concentration, and its wide application has overcome the geographical, spatial and climatic constraints in traditional information exchange, broken the geospatial barriers between industries, and improved the efficiency of resource allocation [4], which not only reduces the time for industrial information matching, expands the scope of the flow of production factors, but also reduces transaction costs, enhances the synergy between enterprises, and accelerates the regional manufacturing structure to a more reasonable and More advanced directions [36, 37]. Therefore, the development of digital platforms can promote the upgrading and rationalization of the industrial structure to achieve overall upgrading, and then affect the income distribution of urban and rural areas.

Based on the above analysis, the following hypotheses are proposed:

H2: The development of digital platforms reduces the income gap between urban and rural areas by promoting the upgrading of industrial structure.

Digital platform development can reduce the income gap between urban and rural areas by narrowing the "digital capability gap". The development of digital platforms plays

an important role in narrowing the "digital divide" [38], which is a prominent issue affecting the balanced development of urban and rural areas in China. Specifically, the digital divide can be understood and divided from access to digital facilities, Internet use, participation in the digital economy and benefits [39], with the advancement of the "Broadband China" strategy, the continuous improvement of digital technology facilities has effectively alleviated the access gap [40], and the improvement of technology availability has promoted the narrowing of the use gap [41, 42]. However, there are still large differences in the skills and abilities of digital technology between urban and rural micro subjects, which will lead to large differences in the return on income of informatization between urban and rural areas [12], further widening the distribution of income disparities [39]. Digital platforms have developed as a key force in bridging the rural-urban capacity gap. On the one hand, according to the learning effect theory, with the increase of the frequency of digital technology use, users' information search and processing capabilities will continue to be enhanced, and digital platforms, as the hub of digital technology, bring together new technologies and extensive information, which

can reduce the information search cost of rural residents, improve user search ability and efficiency, promote rural entrepreneurship [5], and help reduce the gap between urban and rural employment and wages. On the other hand, based on the network effect of the online market, platform enterprises have tried their best to increase their market share, and carried out online training and offline experience activities on a large scale, which promoted the accumulation of digital literacy and capacity development of rural residents [43], improved the digital benefit ability of rural residents, and narrowed the income gap between urban and rural areas.

Based on the above analysis, the following hypotheses are proposed:

H3: Digital platform development reduces the urban-rural income gap by narrowing the urban-rural digital capability gap.

3. Study Design

3.1. Model

In order to test the hypothesis, the following econometric model is constructed:

$$Gap_{i,t} = \alpha_0 + \alpha_1 platform_{i,t} + \beta Z + \sum Year + \sum State + \mu_{i,t} \quad (1)$$

$$Gap_{i,t} = \alpha_0 + \alpha_1 platform_{i,t} + \alpha_2 IS + \beta Z + \sum Year + \sum State + \mu_{i,t} \quad (2)$$

$$Gap_{i,t} = \alpha_0 + \alpha_1 platform_{i,t} + \alpha_2 DD + \beta Z + \sum Year + \sum State + \mu_{i,t} \quad (3)$$

In the model, the lower corners of the marks *i* and *t* represent city *i* and year *t*, respectively. Gap is the explanatory variable, which refers to the income gap between urban and rural residents. platform is the core explanatory variable, which refers to the development level of digital platforms. IS refers to the upgrading of industrial structure; DD refers to the urban-rural digital capability divide; Z refers to the set of control variables; $\sum Year$ refers to the fixed effect of time; $\sum State$ refers to individual fixed effects; μ is the error term. Eq. (1) uses platform as the explanatory variable to directly test the impact of digital platform development on the urban-rural income gap, and uses a two-way fixed-effect model to verify H1. In Eq. (2), the variable Industrial Structure Upgrading IS is introduced on the basis of Eq. (1) to test the role of the intermediary mechanism of industrial structure upgrading to verify H2. Equation (3) introduces the variable urban-rural digital capability gap DD to verify whether the development of digital platforms can narrow the urban-rural income gap by narrowing the urban-rural digital divide capacity, so as to verify H3.

3.2. Variable

3.2.1. Explained Variable

Urban-rural income gap (Gap). In previous studies, indicators such as the income ratio of urban and rural residents or Theil index were mostly used to quantitatively evaluate the income gap between urban and rural areas. Drawing on the practice of Chen Binkai et al. (2013) [44], this paper measures the urban-rural income gap by calculating the ratio of the per capita disposable income of urban residents to the per capita disposable income of rural residents. At the same time, referring to the method of Wang Shaoping (2007) [45], the Urban-Rural Income Theil Index (GAPtheil) was used as a surrogate variable for the urban-rural income gap, and the regression was carried out to make the results robust. The formula is as shown in Equation (4):

$$GAPtheil_{i,t} = \sum_{j=1}^2 \frac{y_{i,t}}{y_t} \ln \left(\frac{y_{(i,j,t)}/y_{i,t}}{x_{i,j,t}/x_{i,t}} \right), j = 1, 2 \quad (4)$$

Where $J=1, 2$ represents urban or rural, $y_{i,t}$ represents the urban or rural disposable income of city *i* in *t* year, $y_{i,t}$ represents the disposable income of city *i* in *t* year, $x_{i,t}$ represents the population of urban or rural areas in city *i* in year *t*, and $x_{i,t}$ represents the total population of city *i* in year *t*.

3.2.2. Explanatory Variable

Digital platform. Drawing on the ideas of Liu Cheng (2023) [4], this study uses residents' online contact status and online retail scale to measure the development level of digital platforms in different regions. Specifically, referring to the method of estimating the penetration rate of the online market by Li Bin et al. (2021) [53], the natural logarithm of the interaction between the number of broadband Internet users in each city and the online retail sales in the province is selected as the proxy variable for the development of digital platforms.

3.2.3. Mediator Variable

Industrial Structure Upgrading (IS): It is composed of the upgrading of the industrial structure and the rationalization of the industrial structure. The upgrading of industrial structure refers to the transfer of industries from low-level to high-level, which intuitively reflects the upgrading of industrial structure, and is usually measured by the ratio of output value of the tertiary industry to the secondary industry; The rationalization of industrial structure is a dynamic evolution of the enhancement of coordination and interconnection between industries, which reflects the degree of coordination between industries and the efficiency of resource allocation, and can measure the coupling degree of factor input structure and output structure [46]. Referring to the practice of Yuan Hang (2018) [47], this paper uses the Theil index to measure the

level of industrial structure rationalization in different prefecture-level cities. The specific calculation formula is as follows: Equation (5):

$$theil_{i,t} = \sum_{m=1}^3 y_{i,m,t} \ln(y_{i,m,t}/l_{i,m,t}), m = 1,2,3 \quad (5)$$

Among them, $y_{i,m,t}$ represent the proportion of the output value of the m industry in region i to the total output value in period t ; $l_{i,m,t}$ denotes the proportion of employees in the total number of employed persons in the M industry in region i in period T . If the industrial structure rationalization Theil index is 0, it means that the industrial structure is at the equilibrium level, if it is not 0, it means that the industrial structure deviates from the equilibrium state and the industrial structure is unreasonable.

Urban-rural digital capability gap (DD): The digital capability gap mainly reflects the uneven distribution of urban and rural residents' ability to obtain, process, and use information between urban and rural areas, while the number of years of education can reflect the ability level of residents [48]. Referring to the practice of Fan Yixia (2022) [49], this paper uses the ratio of years of schooling between urban and rural residents as a surrogate indicator of the "urban-rural digital capability gap".

3.2.4. Control Variable

In order to control the impact of other factors on the urban-rural income gap, this paper sets up the following control variables: the level of economic development (PGDP), which measures the level of economic development by the natural logarithm of GDP per capita. Government Participation (GOV), which is characterized by the ratio of local fiscal expenditure to nominal GDP; The level of economic development is characterized by GDP per capita; the level of financial development (FIN), which is characterized by the ratio of loan balances of financial institutions to nominal GDP; The level of opening up to the outside world (FDI) is characterized by the ratio of FDI to nominal GDP; Urbanization level (URB), which is characterized by the proportion of urban permanent population; The level of digital economy development (DIG) draws on the construction idea of Liu Jun et al. (2020) [52] to measure the comprehensive development level of the digital economy from two aspects: Internet development and digital inclusive finance.

3.3. Data

This study uses the data of 274 cities in China from 2015 to 2021 as the research sample, including all cities at the prefecture level and above in China, excluding Hong Kong, Macao and Taiwan, as well as autonomous prefectures and leagues, and excluding cities with serious data deficiencies. The data are mainly derived from the China Statistical Yearbook, the China Urban Statistical Yearbook, the China Rural Statistical Yearbook, and the provincial statistical yearbooks and statistical bulletins. The descriptive statistics for each variable are shown in Table 1:

Table 1. descriptive statistics

VARIA BLES	(1)	(2)	(3)	(4)	(5)
	N	mean	sd	min	max
Gap	2,041	2.257	0.411	1.207	3.580
Platform	1,957	11.66	2.211	0	16.84
IS	2,047	0.763	0.341	0.214	3.363
INF	1,974	0.0401	0.0392	0.00285	0.703
PGDP	2,026	10.87	0.518	9.304	12.29
FIN	2,058	2.790	1.331	0.910	21.30
URB	1,980	0.584	0.138	0.171	1
FDI	1,920	9.853	2.487	-10.58	18.94
GOV	2,050	0.228	0.148	0.0595	1.699
DIG	2,009	0.216	0.867	-1.870	3.413

4. Empirical Results and Analysis

4.1. Baseline Regression

In this paper, the variance expansion factor (VIF) of the regression variable is calculated, and the results show that the maximum value of the variance inflation factor is 3.87 and the mean value is 2.16, both of which are much less than the critical value of 10, so there is no serious multicollinearity problem. Table 2 shows the empirical results of the impact of digital platform development on the urban-rural income gap. Among them, regression (1) is the result of using the ordinary least squares method to control the variables that affect the income distribution gap between urban and rural areas, including all control variables such as economic development level and urbanization; Regression (2) adds individual fixed effects on the basis of regression (1), and regression (3) adds time fixed effects on the basis of regression (2), and all of them are clustered at the city level with robust standard errors, and the results show that the regression coefficients of digital platform development are all significantly negative at the level of 1%, indicating that the development of digital platforms can still significantly narrow the income distribution gap between urban and rural areas after eliminating the influence of individual and time variations.

Table 2. Baseline regression results

VARIABLES	(1)	(2)	(3)
	Gap	Gap	Gap
platform	-0.071*** (-14.05)	-0.044*** (-8.57)	-0.031*** (-2.83)
Constant	1.554*** (5.16)	3.964*** (13.94)	2.582*** (8.53)
Observations	1,790	1,790	1,790
R-squared	0.233	0.522	0.638
control	YES	YES	YES
Id FE	NO	YES	YES
Year FE	NO	NO	YES
Number of id	-	274	274

4.2. Robustness Test

In order to ensure the robustness of the above analysis results, this paper mainly considers the following aspects:

4.2.1. Replace the explanatory variable

The ratio of per capita income of urban and rural residents was replaced by the urban-rural income gap (GAPtheil) measured by the urban-rural Theil index. The regression results are shown in columns (1) and (2) in Table 3, which were tested using the individual fixed-effect model and the individual time double-fixed-effect model, respectively, and the regression coefficient of the digital platform for the urban-rural income gap (GAPtheil) was still significantly negative

at the level of 1%, indicating that the results were relatively robust.

4.2.2. Lag explanatory variables

In view of the possible time-lag impact of the development of digital platforms on the reduction of the urban-rural income gap, this study performed one and two periods of lag processing for the explanatory variables, and conducted regression analysis. Columns (3) and (4) of Table 3 show the results of the regression using the lagging variable. The results show that the regression coefficient corresponding to the development of digital platforms remains negative at the significance level of 1%, which further confirms the robustness of the research results.

4.2.3. Instrumental variable method

Furthermore, the two-stage instrumental variable method (2SLS) was used to alleviate the endogeneity problem of the model, and the research method of Liu Cheng (2023) [4] was used to select the interaction term (IV) of the online market size and topographic relief of each city as the instrumental variable of the development degree of the digital platform.

The scale of the online market is the ratio of online retail sales to total retail sales of consumer goods, and the topographic relief, as a geospatial parameter, has a significant impact on the deployment, optimization and operational efficiency of digital technology-related facilities such as optical fiber networks and communication infrastructure. In addition, the objectivity of the topographic data ensures its exogenous characteristics in the analysis.

The empirical results are shown in columns (5) and (6) of Table 3, the regression results of the first stage in column (5) show that the coefficient of instrumental variable (IV) is significant at the 1% level, and the coefficient corresponding to the digital platform in column (6) is still significantly negative at the 1% level, and the absolute value of the coefficient increases significantly, indicating that the digital platform can narrow the income gap between urban and rural areas, which further illustrates the robustness of the results. At the same time, the values of the Cragg-Donald Wald F statistic and the Kleibergen-Papp LM statistic were 32.708 and 13.180, respectively, indicating that there were no weak instrumental variables and unrecognizable problems.

Table 3. Robustness test results

VARIABLES	(1) GAPtheil	(2) GAPtheil	(3) GAP	(4) GAP	(5) platform	(6) GAP
platform	-0.004*** (-9.35)	-0.003*** (-3.27)	-	-	-	-0.145*** (-2.80)
L. platform	-	-	-0.033*** (-4.29)	-	-	-
L2. platform	-	-	-	-0.023*** (-3.80)	-	-
IV	-	-	-	-	1.035*** (4.23)	-
Constant	0.258*** (10.68)	0.152*** (5.77)	2.634*** (10.79)	2.370*** (11.09)	-	-
Observations	1,790	1,790	1,520	1,310	1,760	1,760
R-squared	0.649	0.713	0.716	0.802	0.980	0.542
Number of id	274	274	274	274	271	271
control	YES	YES	YES	YES	YES	YES
state FE	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES
Cragg-Donald Wald F	-	-	-	-	-	32.708
Kleibergen-Papp rk LM	-	-	-	-	-	13.180

4.3. Heterogeneity Analysis

Regional differences, such as geographical location and economic development level, profoundly affect the access and use of digital technologies such as digital platforms [42], and the existence of the "digital access and use gap" affects the narrowing effect of digital platform development on the urban-rural income gap. Therefore, this paper groups 274 cities according to their region, economic level and digital economy development level, and then regresses the grouped subsamples based on model formula (1) to investigate the heterogeneous impact of digital platform development on the urban-rural income gap in different regions. The results of the heterogeneity analysis are shown in Table 4, in which columns (1), (2) and (3) show the impact of urban digital platform development in the eastern, central and western regions on the urban-rural income gap according to the standards of the National Bureau of Statistics, respectively. Furthermore, the 274 prefecture-level cities are divided into first- and second-tier cities, third-tier cities, and fourth-tier

cities and below according to the urban economic level, and the results in columns (4), 5, and 6 show that the reduction effect of digital platform development on the urban-rural income gap in the first- and second-tier cities is significantly stronger than that in the third- and fourth-tier cities, but not significantly in the fourth-tier cities and below. The possible reason is that cities and first- and second-tier cities located in the eastern region have relatively complete digital infrastructure and a higher level of digital economy development, so they can benefit more from the development of digital platforms, while the development level of digital economy in the central and western regions is relatively backward, and there is an obvious digital divide, and rural residents are constrained by the digital divide, making it difficult for them to benefit from the development of digital platforms. Therefore, considering the impact of the digital economy endowment of different cities, this paper draws on the practice of Xiong Qiaoqin (2023) [38] and divides cities across the country into first-tier, new first-tier and second-tier cities of the digital economy (referred to as "digital first- and

second-tier cities") according to the ranking of digital economy index scores in the Blue Book of China's Urban Digital Economy Index (2021), third- and fourth-tier cities of the digital economy ("digital third- and fourth-tier cities"), and cities that have not entered the digital classification assessment ("non-hierarchical cities"). The results show that

the narrowing effect of digital platform development on the urban-rural income gap in the first- and second-tier cities of the digital economy is significantly stronger than that of the third- and fourth-tier cities, while the results of the cities that do not enter the hierarchical evaluation are not significant.

Table 4. Heterogeneity analysis results

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Eastern	Central	Western	First- and second-tier cities	Third-tier cities	Fourth-tier and below cities	Digital first- and second-tier cities	Digital third- and fourth-tier cities	non-hierarchical cities
platform	-0.044*** (-4.14)	-0.019 (-1.32)	-0.009 (-0.32)	-0.080** (-2.26)	-0.028*** (-2.78)	-0.004 (-0.27)	-0.083** (-2.36)	-0.020* (-1.94)	0.001 (0.06)
Constant	2.658*** (8.98)	2.475*** (4.74)	3.596*** (2.72)	2.359** (2.14)	1.740*** (3.79)	2.151*** (5.38)	2.775* (1.88)	2.467*** (7.77)	1.985*** (2.94)
Observations	666	658	466	318	446	1,026	355	953	482
R-squared	0.832	0.602	0.648	0.585	0.753	0.653	0.623	0.736	0.588
Number of id	99	100	75	47	67	160	52	144	78
control	YES	YES	YES	YES	YES	YES	YES	YES	YES
state FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

4.4. Analysis of Mediation Mechanisms

In order to test the internal mechanism of the impact of digital platform development on the urban-rural income gap, based on the analysis of the mediation mechanism model shown in equations (2) and (3), this paper also conducts the Sobel test and bootstrap test to avoid possible result biases. The results of the mediation mechanism test are shown in Table 5. Regression (1) and regression (2) are the results of the mediating role of industrial structure upgrading, and the regression coefficient of digital platform development to industrial structure upgrading in regression (1) is significantly positive at the level of 1%, indicating that the development of digital platform will promote the upgrading of local industrial structure. In regression (2), the regression coefficient of industrial structure upgrading on the urban-rural income gap is significantly negative at the level of 1%, which further indicates that the industrial structure upgrading has a narrowing effect on the urban-rural income gap. Based on regression (1) and regression (2), it is not difficult to find that the development of digital platforms can improve the efficiency of resource allocation, promote the rationalization and upgrading of industrial structure, and then reduce the income gap between urban and rural areas, and this conclusion is consistent with the results of Sobel test and Bootstrap test. Regression (3) and regression (4) are the results of the mediating effect of the digital capability gap. In regression (3), the regression coefficient of digital platform development is significantly negative at the level of 1%, that is, the development of digital platform has a significant negative impact on the urban-rural digital capability gap. The regression coefficient of the digital capability gap in regression (4) is significantly positive at the level of 1%, indicating that the existence of the digital capability gap will significantly widen the income distribution gap between urban and rural areas. The results of regression (3) and regression (4) show that the digital economy can narrow the gap between urban and rural income distribution by bridging the gap between urban and rural digital capabilities, and the results pass the Sobel test and Bootstrap test. In summary, H2

and H3 are verified.

Table 5. Analysis of mediation mechanisms results

	(1)	(2)	(3)	(4)
VARIABLES	IS	GAP	DD	GAP
platform	0.046*** (3.15)	-0.029*** (-2.68)	-0.524*** (-2.60)	-0.029*** (-2.67)
IS	-	-0.047** (-2.13)	-	-
DD	-	-	-	0.004*** (3.83)
Sobel test	-0.002*** (-2.687)	-0.001* (-1.675)		
Bootstrap test (ind_eff)	-0.002** (-2.12)	-0.001** (-2.53)		
Bootstrap test (dir_eff)	-0.028*** (-3.27)	-0.028*** (-3.63)		
Constant	2.392*** (3.75)	2.693*** (8.77)	-19.197** (-2.25)	2.650*** (8.73)
Observations	1,794	1,790	1,794	1,790
R-squared	0.472	0.641	0.394	0.642
Number of id	274	274	274	274
control	YES	YES	YES	YES
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

5. Research Conclusions and Countermeasures

In the process of achieving common prosperity for all, it is particularly important to reduce the inequality of income distribution between urban and rural residents and promote the balanced development of urban and rural areas. Based on the panel data of 274 prefecture-level cities in China from 2015 to 2021, this paper analyzes and tests the impact

mechanism of the development of key technology hubs-digital platforms on the urban-rural income distribution gap by using empirical methods such as panel two-way fixed effect model and intermediary mechanism model. The main conclusions are as follows:

(1) On the whole, the development of digital platforms can significantly narrow the income distribution gap between urban and rural areas. (2) The development of digital platforms will reduce the income distribution gap between urban and rural areas by promoting the integration and upgrading of local industrial structure. (3) Digital platform development can narrow the urban-rural income distribution gap by narrowing the urban-rural digital capability gap. (4) Due to the different scale of regional economic development and economic growth, there is significant regional heterogeneity in the effect of digital platform development on the narrowing of the urban-rural income distribution gap, and the positive effect of digital platforms in narrowing the urban-rural gap can be more effective than that in developed regions.

Based on the above conclusions, the following suggestions are put forward: (1) It is suggested that the government and relevant institutions should closely track and grasp the evolution of the digital economy, further accelerate the construction of platform infrastructure in rural areas, cultivate a unified and efficient data element market, make full use of the resource allocation advantages of digital platforms, promote the combination of traditional agriculture and platform economy, and promote the optimization and upgrading of industrial structure to narrow the urban-rural divide; (2) In order to promote the income growth of rural residents, it is necessary to enhance their internal motivation and external resource supply at the same time. At the internal level, the government should actively cooperate with digital platforms to build and improve farmers' entrepreneurship and employment training networks, and launch diversified and targeted training programs to enhance farmers' ability to use and benefit from digital technologies, and help rural workers adapt to the emerging job market and obtain better employment opportunities. In terms of the supply of external resources, it is necessary to further strengthen policy support in terms of industry, talent, entrepreneurship policies and business environment, integrate resources, and form policy synergies to effectively improve the income level of rural households. (3) When formulating relevant policies, local governments should fully consider regional characteristics and timing, and formulate differentiated policy measures according to the development level of local digital platforms and residents' income. By giving full play to the comparative advantages of each region, introducing a mechanism for win-win cooperation in the region, and realizing mutual assistance and support within the region, it will provide a solid policy guarantee for the development of digital platforms and the narrowing of the income distribution gap between urban and rural areas.

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References

- [1] Ge Lei, Tao Xiaoma, Wang Hong. Empirical of Local Finance, Urbanization and Urban-rural Income Gap. *China Population Resources and Environment*, 2015, 25(09): 93-99.
- [2] Yuan Y, Wang M, Zhu Y, et al. Urbanization's effects on the urban-rural income gap in China: A meta-regression analysis. *Land Use Policy*, 2020, 99: 104995.
- [3] Tang Wei, Li Yueqi, Li Chengxun, et al. (2023, December). Digital Economy and Agricultural and Rural Modernization. *Frontiers of Science and Technology of Engineering Management*. [Online] Available: <http://kns.cnki.net/kcms/detail/34.1013.N.20231228.1309.004.html>.
- [4] Liu Cheng, Xia Jiechang. Online Market, Digital Platform and Resource Allocation Efficiency: The Effect of Price Mechanism and Data Mechanism. *China Industrial Economics*, 2023, (07): 84-102.
- [5] Cheng Chouhui, Liu Yucheng, Development of platform economy and rural entrepreneurial activity. *Studies in Science of Science*, [Online]. 1-14. Available: <https://doi.org/10.16192/j.cnki.1003-2053.20230921.001>
- [6] Yin Zhichao, Jiang Jialing, Yan Yu. Does the Digital Divide Affect Household Income. *Finance & Trade Economics*, 2021, 42(09): 66-82.
- [7] Ji Fujun. The Impact of Digital Economy on Urban-Rural Income Gap: An Analysis of the Moderating Effect Based on the Upgrading of Industrial Structure. *Economic Issues*, 2023, (02): 35-41.
- [8] Fan Yixia, Xu Hao, Ma Lijun. Characteristics and Mechanism of Digital Economy Affecting the Income Gap between Urban and Rural Residents. *China Soft Science*, 2022, (06): 181-192.
- [9] Bauer J M. The Internet and income inequality: Socio-economic challenges in a hyperconnected society. *Telecommunications Policy*, 2018, 42(4): 333-343.
- [10] Liu Xiaoqian, Han Qing. The Impact of Internet Use on Income of Rural Residents and Its Mechanism: Based on China Household Panel Survey (CFPS) Data. *Journal of Agrotechnical Economics*, 2018, (09): 123-134.
- [11] Mao Yufei, Zeng Xiangquan, Hu Wenxin. Can Internet Use Reduce the Gender Wage Gap?— An Empirical Analysis Based on CFPS Data. *Journal of Finance and Economics*, 2018, 44(07): 33-45.
- [12] Tan Yanzhi, Li Yunzhong, Hu Wanjun. Digital Divide or Information Dividend: A Study on the Difference of Informatization on Urban and Rural Income Returns. *Modern Economic Research*, 2017, (10): 88-95.
- [13] Cenamor J, Parida V, Wincent J. How entrepreneurial SMEs compete through digital platforms: The roles of digital platform capability, network capability and ambidexterity. *Journal of Business Research*, 2019, 100: 196-206.
- [14] Constantinides P, Henfridsson O, Parker G. Introduction—platforms and infrastructures in the digital age. *Information Systems Research*, 2018, 29(2): 381-400.
- [15] Xu Xianchun, Zhang Meihui. A Study on the Measurement of the Scale of China's Digital Economy: From the Perspective of International Comparison. *China Industrial Economics*, 2020, (05): 23-41.
- [16] Michaël C, Marijke D, Jeroen B. Economic growth and broadband access: The European urban-rural digital divide. *Telecommunications Policy*, 2023, 47(6): 102579.
- [17] Yi Famin, Gu Feiting. Local platform business model innovation, institutional logic transformation and digital

- transformation of agriculture. *China Rural Survey*, 2023(05):2-23.
- [18] Li Yi, Ke Jiesheng. Level 3 Digital Divide: Income Growth and Income Distribution Effects of the Rural Digital Economy. *Journal of Agrotechnical Economics*, 2021(08):119-132.
- [19] Luo Qianfeng, Hu Wen, Zhao Qifeng. How E-commerce Operation Promotes Rural Households' Income Increase: Based on the Data of China Rural Revitalization Survey (CRRS). *Economics and Management*, 2023, 37(05): 1-8.
- [20] Wang Ruifeng. Evaluation of the impact of agriculture-related e-commerce platforms on the development of China's agricultural economy: A case study of rural Taobao. *China Business and Market*, 2020, 34(11): 68-77.
- [21] LU Minfeng. Digital technology empowers the high-quality development of the real economy: integrating advantages, operating mechanisms and practical paths. *Journal of Xinjiang Normal University (Edition of Philosophy and Social Sciences)*, 2023, 44(01): 136-144.
- [22] Ji Yuanyuan, Zhang Meixing, Feng Shuhui. Research on the Impact of Platform Economy on Industrial Structure Upgrading: From the Perspective of Consumption Platform. *Systems Engineering - Theory & Practice*, 2022, 42(06):1579-1590.
- [23] Huang Qunhui, Yu Yongze, Zhang Songlin. Internet Development and Manufacturing Productivity Improvement: Internal Mechanisms and China's Experience. *China Industrial Economics*, 2019, (08):5-23
- [24] Yu Wentao, Wu Shiwei. Internet Platform Economy and the Easing Market Distortions. *Finance & Trade Economics*, 2020, 41(05):146-160.
- [25] Jing Wenjun, Sun Baowen. Digital Economy Promotes High-quality Economic Development: A Theoretical Analytical Framework. *Economist*, 2019, (02):66-73.
- [26] Wang Mengfei, Zhang Xinwei. Research on the Influence Mechanism of Technological Change on Production Process in the Era of Digital Economy. *Economist*, 2020(01):52-58.
- [27] Zhao Tao, Zhang Zhi, Liang Shangkun. Digital Economy, Entrepreneurial Activity and High-quality Development: Empirical Evidence from Chinese Cities. *Management World*, 2020, 36(10):65-76.
- [28] Zhou Jianming, Wang Peng. Pressures and countermeasures for upgrading China's industrial structure under the new development pattern. *Economic Review*, 2021, (06):94-99.
- [29] Liao Shanshan, Lu Zhaoyang, Li Ruiqin. An Empirical Study on the Development of Digital Economy to Promote the Transformation and Upgrading of Industrial Structure. *Statistics and Decision*, 2024, 40(02):29-34.
- [30] Li Zhen, Wang Xiuzhi. The Impact of Fiscal Science and Technology Expenditure Efficiency on the Upgrading of Local Industrial Structure: An Empirical Analysis Based on China's Provincial Panel Data. *Reform of Economic System*, 2022, (01):143-149.
- [31] Feng Tao, Wu Maoguang, Zhang Meisha. Financial Development, Industrial Structure and Urban-Rural Income Gap: An Analysis Based on the Perspective of "Shifting from Real to Virtual" in Finance. *Inquiry Into Economic Issues*, 2020, (10):170-181.
- [32] Guo Kaiming. Development of Artificial Intelligence, Transformation and Upgrading of Industrial Structure and Changes in Labor Income Share. *Management World*, 2019, 35(07):60-77+202-203.
- [33] Xue Bai. Transformation of Economic Growth Mode Based on Industrial Structure Optimization: Mechanism and Measurement. *Journal of Management Science*, 2009, 22(05):112-120.
- [34] Shi Ai, Ji Liangyu, Cheng Zhonghua. An Empirical Study on the Impact of "Internet+" on the Transformation and Upgrading of China's Manufacturing Industry: A Test of Provincial Panel Data in China from 2003 to 2014. *Science & Technology Progress and Policy*, 2017, 34(22): 64-71.
- [35] Sutherland W, Jarrahi M H. The sharing economy and digital platforms: A review and research agenda. *International Journal of Information Management*, 2018, 43: 328-341.
- [36] Xu Ye, Wang Zhichao. (2024, March). Market-oriented construction of data elements and digital transformation of enterprises—a quasi-natural experiment based on data trading platform. *Soft Science*, [Online]. 1-13. Available: <http://kns.cnki.net/kcms/detail/51.1268.G3.20240129.0952.002.html>.
- [37] Yuan Chun, Xiao Tusheng, Geng Chunxiao et al. Digital Transformation and Enterprise Division of Labor: Specialization or Vertical Integration. *China Industrial Economics*, 2021(09): 137-155.
- [38] Xiong Qiaoqin, Tang Ke, Zhang Fengyu. Can Third-party Digital Platforms Help Micro, Small and Medium-sized Enterprises Improve Operating Income?—Evidence from Big Data of Millions of Merchants. *China Economic Quarterly*, 2023, 23(05):1704-1722.
- [39] Guo Han, Feng Xingyuan. The Multiple Digital Divide and Household Income Disparities: Theoretical and Empirical Evidence. *Economic Review*, 2024, (02):79-90.
- [40] [40] Liu Chengjie, Feng Ting, Li Yong. Network Infrastructure Construction, Digital Inclusive Finance and Digital Divide: An Analysis of Policy Effects Based on the Creation of "Broadband China" Demonstration Cities. *Finance & Economics*, 2022, (12):103-116.
- [41] Adam I O, Dzang Alhassan M. Bridging the global digital divide through digital inclusion: the role of ICT access and ICT use. *Transforming Government People Process and Policy*, 2021, 15(4): 580-596.
- [42] Song Z, Wang C, Bergmann L. China's prefectural digital divide: Spatial analysis and multivariate determinants of ICT diffusion. *International journal of information management*, 2020, 52: 102072.
- [43] Munthali N, Leeuwis C, van Paassen A, et al. Innovation intermediation in a digital age: Comparing public and private new-ICT platforms for agricultural extension in Ghana. *NJAS-Wageningen Journal of Life Sciences*, 2018, 86-87: 64-76.
- [44] Chen Binkai, Lin Yifu. Development Strategies, Urbanization and China's Urban-Rural Income Gap. *Social Sciences in China*, 2013, (04): 81-102+206.
- [45] Wang Shaoping, Ouyang Zhigang. The measurement of the urban-rural income gap in China and its effect on economic growth. *Economic Research Journal*, 2007, 42(10): 44-55.
- [46] Gan Chunhui, Zheng Ruogu, Yu Fan. The impact of changes in China's industrial structure on economic growth and volatility. *Economic Research Journal*, 2011, 46(05): 4-16+31.
- [47] Yuan Hang, Zhu Chengliang. Has the National High-tech Zone Promoted the Transformation and Upgrading of China's Industrial Structure. *China Industrial Economics*, 2018, (08): 60-77.
- [48] Shen Hongli. The Impact of Digital Finance on High-quality Development from the Perspective of Digital Divide. *Journal of Statistics and Information*, 2023, 38(04): 103-113.
- [49] Fan Yixia, Xu Hao, Ma Lijun. The characteristics and mechanisms of the digital economy affecting the income gap between urban and rural residents. *China Soft Science*, 2022, (06): 181-192.

- [50] WANG Qin, LI Jing, DING Keke, et al. Digital Infrastructure, Factor Allocation Efficiency and Urban-Rural Income Gap. *Statistics & Decision*, 2023, 39(09): 29-34.
- [51] Bai Xu. Research on the Common Prosperity Effect of Digital Economy: Based on the Perspective of Urban-Rural Income Distribution Gap. *Economic Review*, 2023, (12): 84-94.
- [52] Liu Jun, Yang Yuanjun, Zhang Sanfeng. Research on the Measurement and Driving Factors of China's Digital Economy. *Shanghai Economic Research Journal*, 2020, (06):81-96.
- [53] Li Bin, Huang Shaoqing. Internet Market Penetration and Firms' Market Influence: Micro Evidence from Chinese Manufacturing Firms. *Economic Research Journal*, 2021, 56(11):84-99.