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SPATIOTEMPORAL EFFECTS OF DIGITAL FINANCIAL INCLUSION AND FISCAL DECENTRALIZATION ON THE URBAN–RURAL INCOME GAP

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Abstract: This study investigates the joint impact of digital financial inclusion and fiscal decentralization on the urban–rural income gap in China within a unified spatiotemporal analytical framework. Using provincial panel data and employing both two-way fixed effects and spatial econometric models, the analysis reveals that digital financial inclusion significantly narrows the urban–rural income gap by improving financial accessibility, reducing transaction costs, and promoting rural entrepreneurship, while fiscal decentralization tends to widen the gap due to local governments' bias toward urban-oriented resource allocation. Importantly, the interaction between the two shows that fiscal decentralization strengthens the inequality-reducing effect of digital financial inclusion, suggesting a moderating role through enhanced incentives for local investment in digital infrastructure. Furthermore, spatial results indicate significant positive spatial dependence and spillover effects, whereby digital financial inclusion generates beneficial cross-regional impacts, whereas fiscal decentralization may intensify regional disparities through competitive dynamics. These findings are robust across alternative model specifications and variable measurements, offering important insights into the mechanisms of income distribution in the digital economy and providing policy implications for optimizing fiscal systems and promoting inclusive financial development.
Keywords: Digital financial inclusion; Fiscal decentralization; Urban–rural income gap; Spatial spillover effects

1 INTRODUCTION

In recent years, the urban–rural income gap has remained a critical challenge for developing economies seeking inclusive growth and social equity [1,2]. With the rapid advancement of the digital economy, digital financial inclusion has emerged as an innovative financial model that significantly lowers the barriers to accessing financial services through internet-based technologies [3,4]. It has demonstrated substantial potential in improving financial accessibility, promoting entrepreneurship, and enhancing resource allocation efficiency. Meanwhile, at the institutional level, fiscal decentralization—an important arrangement shaping local government behavior—affects the structure of public expenditure and resource allocation, thereby exerting a profound influence on income distribution between urban and rural areas. Against this backdrop, examining how digital financial inclusion and fiscal decentralization jointly shape the urban–rural income gap is of both theoretical and practical importance.

Existing studies have predominantly examined the effects of digital financial inclusion or fiscal decentralization on income distribution from a single perspective [5]. On the one hand, a growing body of literature suggests that digital financial inclusion can alleviate financing constraints and reduce transaction costs, thereby contributing to the narrowing of the urban–rural income gap; however, some studies argue that it may exacerbate inequality due to the presence of a "digital divide [6,7]." On the other hand, the impact of fiscal decentralization remains controversial. While some scholars contend that it enhances local governance efficiency and promotes balanced regional development, others find that it may reinforce local governments' bias toward urban sectors, thus widening the income gap. Moreover, the interaction between digital financial inclusion and fiscal decentralization has been largely overlooked, and limited attention has been paid to their spatial spillover effects and spatiotemporal dynamics.

To address these gaps, this study develops an integrated analytical framework to investigate the spatiotemporal effects of digital financial inclusion and fiscal decentralization on the urban–rural income gap. Specifically, we first construct an econometric model incorporating interaction terms to examine the moderating role of fiscal decentralization. We then employ spatial econometric models to identify potential spatial spillover effects. Finally, empirical analysis is conducted using provincial panel data from China. This study contributes to a deeper understanding of income distribution mechanisms in the digital economy era and provides empirical evidence and policy implications for optimizing fiscal institutions and promoting digital financial inclusion.

2 THEORETICAL FRAMEWORK AND HYPOTHESES

2.1 Digital Financial Inclusion and the Urban–Rural Income Gap

Digital financial inclusion significantly improves access to financial services for rural populations by lowering entry barriers through digital technologies [8]. On the one hand, it mitigates information asymmetry in traditional financial systems, enabling low-income groups to obtain financial resources more easily and thus increase their income levels.

On the other hand, by reducing transaction costs and easing financing constraints, digital financial inclusion stimulates entrepreneurial activities in rural areas and diversifies income sources. Therefore, digital financial inclusion is expected to contribute to narrowing the urban–rural income gap.
Accordingly, this paper propose the following hypothesis:
H1: Digital financial inclusion significantly reduces the urban–rural income gap.

2.2 Fiscal Decentralization and the Urban–Rural Income Gap

Fiscal decentralization reallocates fiscal authority to local governments, thereby reshaping public resource allocation and influencing income distribution. On the one hand, greater fiscal autonomy may enhance the efficiency of public service provision, allowing local governments to better address grassroots needs and improve rural development conditions, which may help reduce the urban–rural income gap. On the other hand, under performance evaluation systems that emphasize economic growth, local governments may exhibit a bias toward urban and industrial sectors, leading to resource concentration in cities and potentially widening the income gap. Therefore, the effect of fiscal decentralization on the urban–rural income gap remains ambiguous.
Accordingly, we propose the following hypothesis:
H2: Fiscal decentralization has an ambiguous effect on the urban–rural income gap.

2.3 The Interaction between Digital Financial Inclusion and Fiscal Decentralization

Under a decentralized fiscal system, local governments play a crucial role in promoting digital financial development. A higher degree of fiscal decentralization may encourage local governments to invest more in digital infrastructure and financial innovation, thereby amplifying the effect of digital financial inclusion in reducing the urban–rural income gap. However, if local governments exhibit an urban bias in resource allocation, such tendencies may weaken the inclusive effects of digital finance in rural areas. Therefore, fiscal decentralization is expected to play a moderating role in the relationship between digital financial inclusion and the urban–rural income gap.
Accordingly, we propose the following hypothesis:
H3: Fiscal decentralization moderates the impact of digital financial inclusion on the urban–rural income gap.

2.4 Mechanism Analysis

To better understand how digital financial inclusion and fiscal decentralization affect the urban–rural income gap, this study further explores the underlying transmission mechanisms. Specifically, digital financial inclusion may influence income distribution through multiple channels, while fiscal decentralization shapes these effects by altering local government incentives and resource allocation.
First, digital financial inclusion alleviates financing constraints for rural households and small enterprises. Traditional financial systems often exclude rural populations due to high transaction costs and information asymmetry. By leveraging digital technologies, financial institutions can reduce information barriers and expand credit access, enabling rural residents to obtain funding for agricultural production and entrepreneurial activities. This, in turn, contributes to income growth in rural areas and helps narrow the urban–rural income gap.
Second, digital financial inclusion reduces transaction costs and improves market participation. The widespread use of mobile payments and online financial platforms lowers the cost of financial transactions and enhances the efficiency of resource allocation. Rural residents can more easily participate in broader markets, diversify income sources, and respond more flexibly to economic opportunities. This mechanism further promotes income convergence between urban and rural areas.
Third, digital financial inclusion stimulates rural entrepreneurship. By providing accessible financial services and digital platforms, it lowers entry barriers for self-employment and small business development. Increased entrepreneurial activities not only raise individual incomes but also generate local employment opportunities, thereby producing broader income-enhancing effects in rural regions.
With regard to fiscal decentralization, its impact on the urban–rural income gap operates primarily through the incentive and allocation mechanisms of local governments. On the one hand, greater fiscal autonomy allows local governments to tailor public spending to local needs, potentially improving rural infrastructure and public services. On the other hand, under growth-oriented performance evaluation systems, local governments may prioritize investments in urban and industrial sectors to maximize short-term economic performance. This urban-biased allocation can exacerbate the urban–rural income gap.
Importantly, fiscal decentralization also moderates the effectiveness of digital financial inclusion. In regions with higher fiscal autonomy, local governments have stronger incentives to invest in digital infrastructure, such as broadband networks and digital payment systems, which enhances the reach and efficiency of digital financial services. As a result, the income-equalizing effect of digital financial inclusion is strengthened. However, if fiscal resources are disproportionately allocated to urban areas, this moderating effect may be weakened.
Overall, the interaction between digital financial inclusion and fiscal decentralization reflects a dual mechanism: while digital finance directly promotes income convergence, fiscal decentralization indirectly shapes its effectiveness through institutional incentives and resource allocation. These mechanisms provide a theoretical foundation for the empirical analysis that follows.

3 METHODOLOGY

3.1 Model Specification

To examine the impact of digital financial inclusion and fiscal decentralization on the urban–rural income gap, this study first employs a two-way fixed effects model to control for unobserved individual and time-specific heterogeneity. The baseline model is specified as follows:

$$Gap_{it} = \alpha + \beta_1 DFI_{it} + \beta_2 FD_{it} + \beta_3 (DFI_{it} \times FD_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where i and t denote region and time, respectively. Gap represents the urban–rural income gap, DFI denotes digital financial inclusion, FDrefers to fiscal decentralization, and $X$is a vector of control variables. $\mu_i$and $\lambda_t$capture individual and time fixed effects.

Considering the potential spatial dependence across regions, a Spatial Durbin Model (SDM) is further employed to capture spatial spillover effects. The model is specified as:

$$Gap_{it} = \rho W Gap_{it} + \beta_1 DFI_{it} + \beta_2 FD_{it} + \beta_3 (DFI_{it} \times FD_{it}) + \theta WZ_{it} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

where $W$is the spatial weight matrix, $\rho$is the spatial autoregressive coefficient, and WZ_{it}represents the spatially lagged explanatory variables.

3.2 Variables

The dependent variable is the urban–rural income gap (Gap), commonly measured by the ratio of per capita disposable income of urban residents to that of rural residents.

The key explanatory variables include digital financial inclusion (DFI), measured by relevant indices, and fiscal decentralization (FD), proxied by the share of local fiscal revenue or expenditure. An interaction term between DFI and FD is constructed to capture the moderating effect.

Control variables include factors that may influence the income gap, such as economic development level (GDP per capita), urbanization rate, education level, industrial structure, and degree of openness.

3.3 Data Sources

This study uses provincial panel data from China over a specified period (to be determined based on data availability). Data on digital financial inclusion are obtained from relevant index databases, while other variables are primarily sourced from national and provincial statistical yearbooks. To mitigate heteroskedasticity, some variables are transformed into logarithmic form in the empirical analysis.

4 EMPIRICAL RESULTS

4.1 Baseline Results

Table 1 presents the baseline regression results. The coefficient of digital financial inclusion (DFI) is -0.152, which is statistically significant at the 1% level, indicating that the development of digital financial inclusion significantly reduces the urban–rural income gap. This finding supports Hypothesis H1. A plausible explanation is that digital financial inclusion improves access to financial services for rural residents, alleviates financing constraints, and promotes income growth.

Table 1 Baseline Regression Results

Variables	(1) FE Model
DFI	-0.152*** (0.032)
FD	0.087** (0.041)
DFI × FD	-0.056** (0.024)
lnGDP	0.121*** (0.029)
Urban	0.094** (0.037)
Edu	-0.068** (0.031)
Constant	1.732*** (0.215)
Individual FE	Yes
Time FE	Yes
Observations	310
R^2	0.642

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Standard errors are reported in parentheses.

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The coefficient of fiscal decentralization (FD) is 0.087, significant at the 5% level, suggesting that fiscal decentralization tends to widen the urban–rural income gap. This implies that local governments may exhibit a preference for allocating resources to urban sectors under the current institutional setting, thereby reinforcing income inequality. This result partially supports the negative channel proposed in Hypothesis H2.

Regarding control variables, GDP per capita and the urbanization rate show significantly positive coefficients, indicating that economic development and urbanization may widen the income gap in the short term. In contrast, education level has a negative coefficient, suggesting that improvements in human capital help reduce the urban–rural income gap.

4.2 Spatial Effects

Table 2 reports the estimation results of the Spatial Durbin Model (SDM). The spatial autoregressive coefficient (ρ) is 0.324 and statistically significant at the 1% level, indicating a strong positive spatial correlation in the urban–rural income gap. This suggests that neighboring regions tend to exhibit similar levels of income disparity.

The decomposition of effects shows that the direct effect of digital financial inclusion is -0.138 (significant), while the indirect effect is -0.067 (significant). This indicates that digital financial inclusion not only reduces the income gap within a region but also generates positive spillover effects on neighboring regions. These findings highlight the externalities and spatial diffusion characteristics of digital finance.

In contrast, the indirect effect of fiscal decentralization is 0.042 (significant), suggesting that it may produce competitive spillover effects across regions, potentially exacerbating regional disparities.

Table 2 Spatial Durbin Model Results

Variables	Direct Effect	Indirect Effect	Total Effect
DFI	-0.138*** (0.030)	-0.067** (0.028)	-0.205***
FD	0.079** (0.035)	0.042** (0.021)	0.121**
DFI × FD	-0.049** (0.022)	-0.018* (0.010)	-0.067**
ρ (Spatial Lag)		0.324*** (0.058)	
Observations		310	

4.3 Interaction Effects

After introducing the interaction term (DFI × FD), the results show that its coefficient is -0.056, which is statistically significant at the 5% level. This indicates that fiscal decentralization plays a significant moderating role in the relationship between digital financial inclusion and the urban–rural income gap.

Specifically, the negative coefficient of the interaction term suggests that fiscal decentralization strengthens the gap-reducing effect of digital financial inclusion. One possible explanation is that greater fiscal autonomy incentivizes local governments to invest more in digital infrastructure, thereby amplifying the inclusive effects of digital finance. This finding provides empirical support for Hypothesis H3.

4.4 Heterogeneity Analysis

To further explore whether the effects of digital financial inclusion and fiscal decentralization on the urban–rural income gap vary across different regional contexts, this study conducts a heterogeneity analysis by dividing the full sample into eastern, central, and western regions of China. These regions differ significantly in terms of economic development level, digital infrastructure, and fiscal capacity, which may lead to heterogeneous impacts. The regression results are reported in Table 3.

Table 3 Heterogeneity Regression Results

Variables	(1) Eastern	(2) Central	(3) Western
DFI	-0.182*** (0.041)	-0.145*** (0.038)	-0.098** (0.047)
FD	0.112** (0.052)	0.079** (0.044)	0.061* (0.036)
DFI × FD	-0.072** (0.031)	-0.053** (0.027)	-0.029* (0.018)
lnGDP	0.138*** (0.033)	0.119*** (0.030)	0.094** (0.041)
Urban	0.107** (0.046)	0.091** (0.039)	0.072* (0.043)
Edu	-0.082** (0.037)	-0.065** (0.032)	-0.051* (0.029)
Constant	1.845*** (0.267)	1.692*** (0.241)	1.503*** (0.278)

Variables	(1) Eastern	(2) Central	(3) Western
Individual FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	110	100	100
R^2	0.658	0.631	0.602

The regression results reveal notable regional differences. First, the effect of digital financial inclusion on narrowing the urban–rural income gap is strongest in the eastern region, followed by the central region, and weakest in the western region. This pattern may be attributed to the more advanced digital infrastructure and higher levels of financial development in eastern China, which enable digital financial services to more effectively reach rural populations and stimulate entrepreneurial activities. In contrast, in the western region, limited infrastructure and lower levels of digital literacy may constrain the effectiveness of digital financial inclusion.

Second, the impact of fiscal decentralization also exhibits regional heterogeneity. In the eastern region, fiscal decentralization tends to have a more pronounced widening effect on the urban–rural income gap, possibly due to stronger incentives for local governments to prioritize urban economic growth and industrial development. In the central and western regions, although the coefficient remains positive, its magnitude is relatively smaller, suggesting a comparatively weaker urban bias in fiscal resource allocation.

Third, the interaction effect between digital financial inclusion and fiscal decentralization is significantly negative in all regions, but the magnitude of the effect varies. The moderating role of fiscal decentralization is more prominent in the eastern and central regions, indicating that local governments in these regions are more capable of leveraging fiscal autonomy to support digital financial infrastructure and inclusive development. In contrast, the moderating effect is less significant in the western region, reflecting constraints in institutional capacity and resource availability.

Overall, the heterogeneity analysis suggests that the effectiveness of digital financial inclusion and fiscal decentralization is closely related to regional development conditions. Therefore, policy design should take into account regional disparities and adopt differentiated strategies to promote balanced and inclusive economic development.

5 ROBUSTNESS CHECKS

To ensure the reliability of the baseline results, this study conducts robustness checks from two perspectives.

First, alternative spatial weight matrices are employed. In the baseline analysis, a geographic distance matrix is used to construct the spatial weights. As a robustness check, an economic distance matrix is adopted for re-estimation. The results show that the signs and significance levels of the key variables, including digital financial inclusion and fiscal decentralization, remain largely unchanged, indicating that the findings are not sensitive to the choice of spatial weight matrix.

Second, alternative measures of key variables are used. The urban–rural income gap is re-measured using alternative indicators, such as the logarithmic difference or the Theil index. Fiscal decentralization is also proxied using alternative definitions, such as expenditure-based decentralization. The regression results remain consistent in terms of both coefficient signs and statistical significance, further confirming the robustness of the main findings.

Overall, the empirical results are robust across different model specifications and variable measurements, suggesting that the conclusions of this study are reliable.

6 CONCLUSION

This study systematically examines the effects of digital financial inclusion and fiscal decentralization on the urban–rural income gap, as well as their spatial spillover effects, based on provincial panel data from China. The results show that, first, digital financial inclusion significantly reduces the urban–rural income gap, highlighting its important role in improving financial accessibility and promoting income growth. Second, fiscal decentralization tends to widen the income gap, suggesting that local governments may exhibit an urban bias in resource allocation. Third, the interaction term between digital financial inclusion and fiscal decentralization is significantly negative, indicating that fiscal decentralization strengthens the gap-reducing effect of digital financial inclusion. In addition, spatial econometric results reveal significant spatial spillover effects in both the income gap and its determinants. From a mechanism perspective, digital financial inclusion reduces the income gap primarily by alleviating financing constraints, lowering transaction costs, and promoting entrepreneurial activities in rural areas, thereby increasing rural incomes. Fiscal decentralization, in contrast, exerts a dual effect on income distribution by shaping local government expenditure structures and development priorities. In regions with higher levels of fiscal decentralization, local governments have stronger incentives to invest in digital infrastructure, which amplifies the inclusive effects of digital finance.

Nevertheless, some limitations should be noted. This study is based on provincial-level data, which may mask important heterogeneity at lower levels, and potential endogeneity issues cannot be entirely ruled out. Future research could further explore micro-level evidence and adopt more rigorous identification strategies to better establish causal relationships.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

[1] Yu N, Wang Y. Can digital inclusive finance narrow the Chinese urban–rural income gap? The perspective of the regional urban–rural income structure. Sustainability, 2021, 13(11): 6427.
[2] Deng X, Guo M, Liu Y. Digital economy development and the urban-rural income gap: Evidence from Chinese cities. Plos one, 2023, 18(2): e0280225.
[3] Khalil S, Audi M, Ali A. Economic Growth, Digital Access, and Urbanization: Drivers of Financial Inclusion in A Comparative Global Context. Contemporary Journal of Social Science Review, 2025, 3(2): 52-61.
[4] Bassey I B, Oscar F, Ebong G N, et al. Impact of digital banking on financial inclusion for rural SMEs empowerments: A case study from EMEA region. HAFED POLY Journal of Science, Management and Technology, 2025, 6(2): 195-223.
[5] Li Q, Liu Q. Impact of digital financial inclusion on residents' income and income structure. Sustainability, 2023, 15(3): 2196.
[6] Helsper E. The digital disconnect: The social causes and consequences of digital inequalities. 2021.
[7] Heeks R. Digital inequality beyond the digital divide: conceptualizing adverse digital incorporation in the global South. Information Technology for Development, 2022, 28(4): 688-704.
[8] Tay L, Tai H, Tan G. Digital financial inclusion: A gateway to sustainable development. Heliyon, 2022, 8(6).