

On the Measurement of Regional Differences in the Development Level of Digital Inclusive Finance in China

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Abstract: In the context of the rapid development of digital inclusive finance in China, the main contradiction in today's society is the contradiction between the growing needs of the people for a better life and imbalanced and insufficient development. Therefore, the issue of differences in the allocation of digital financial resources among regions at different levels of development urgently needs to be addressed. Based on this background, this article takes the Peking University Digital Inclusive Finance Index (2011-2020) as the research object, and constructs methods such as DagumGini coefficient and Thiel index as comparative indicators to study the differences between regions at different levels of development under digital inclusive finance. The research results are used to explore the allocation of digital financial resources among regions at different levels of development. The results of this article indicate that there are significant differences in the development level among different provinces in China, and the degree of difference in development level among different regions has generally shown a decreasing trend year by year from 2011 to 2020.

Keywords: Inclusive finance; Regional differences; DagumGini coefficient; Thiel index

1. Introduction

At the same time, the report of the 20th National Congress of the Communist Party of China pointed out the need to promote the formation of a new pattern in the western development, achieve new breakthroughs in the comprehensive revitalization of Northeast China, accelerate the rise of the central region, and encourage the eastern region to accelerate modernization. Since the 18th National Congress of the Communist Party of China, the Central Committee of the Communist Party of China has placed a more important position on gradually narrowing the gap in regional development and achieving common prosperity for all people, and has made a series of major plans to promote coordinated regional development and high-quality development. Therefore, promoting the rational allocation of digital financial resources in regions with different levels of development is of great significance for promoting China's economic development. This article uses the Digital Inclusive Finance Index to further measure the differences in the allocation of digital financial resources between regions.

The development of digital inclusive finance has created more opportunities for the financial industry. Compared to traditional finance, digital finance is a new type of financial service that integrates information technology such as the Internet, linking traditional financial services with new financial services such as electronic payments and online wealth management services. With the development of digital technology, the formats of digital finance are relatively diverse, and financial services such as internet payments, online lending, digital insurance, online crowdfunding, and internet wealth management are more active. At the same time, internet merchants also utilize digital finance for innovative financial services, driving the harmonious development of the internet and financial markets. The relevant data indicates that China's digital inclusive finance is in an international leading position. With the development of the Internet, digital finance has low requirements for regional development, which can effectively alleviate the problem of information differences caused by traditional financial services, improve financial allocation efficiency, and lower transaction barriers. If digital financial resources can be fully utilized and reasonably allocated, it is bound to alleviate the problems of regional differences in development levels and resource allocation contradictions. In the

literature on the development of digital inclusive finance in the past five years, the vast majority of scholars have used Analytic Hierarchy Process to summarize China's digital inclusive finance from three dimensions: the breadth of digital finance coverage, the depth of digital finance use, and the degree of digitalization of inclusive finance.

This article uses the China Inclusive Finance Index for data analysis and processing, comprehensively analyzes and applies the empirical conclusions drawn by predecessors, establishes DagumGini coefficient and Thiel index between regions with different development levels, measures the differences in digital inclusive finance index between regions with different development levels, and quantitatively analyzes the differences in development levels between different regions in China, Establish a connection between digital inclusive finance and resource allocation issues among regions at different levels of development. And this reflects the issue of digital financial resource allocation among regions with different development levels in China, which can more accurately measure whether there are problems in resource allocation between regions with different development levels, and provide recommendations for the problems that arise. Provide academic support and data basis for the research on the distribution differences of digital financial resources among regions with different development levels.

The development momentum of digital finance in China is rapid. In recent years, research on digital inclusive finance has gradually extended to the measurement of spatial differences in digital inclusive finance. Du M.Z. and Huang J. (2023) examined the differences in the development of digital inclusive finance in China from 2011 to 2020 from both spatial and structural perspectives. The study showed that the development level of digital inclusive finance in China has significantly improved, and the development gap has been continuously narrowing. The spatial distribution is characterized by strong in the east and weak in the west, strong in the south and weak in the north, and fast in the west and slow in the east, and fast in the north and slow in the south [1]. The influencing factors of digital inclusive finance index are also actively discussed by many scholars. Wu J.W. (2019) and others used the spatial panel data model to test the influencing factors of digital inclusive finance, and believed that "Internet plus", economic development level and online consumption level all have a significant positive role in promoting the development of digital inclusive finance in all provinces [2]. Hao Y.P. (2018) found through empirical research that there is a U-shaped relationship between the economic development of a region and the digital inclusive finance index. Population density, financial awareness, and internet usage are all significantly and steadily positively correlated with digital inclusive finance. There is a significant negative correlation between urban-rural income gap and digital inclusive finance [3]. Dong S.G. et al. (2023) believe that the development of digital inclusive finance has a positive promoting effect on regional innovation levels, and the driving effect of digital inclusive finance on innovation in the East, Central, and West also has heterogeneity [4]. Kuang G.L. et al. (2023) found that the development of digital inclusive finance can significantly promote the increase in labor demand for enterprises [5]. The increase in labor demand can drive regional economic development, change the distribution method and degree of digital financial resources.

2. Research Design

2.1. Research Methods

Scholars have conducted systematic clustering analysis on the differences in the development of China's provincial economy based on the sum of squares of deviations. This article uses its classification results to divide 31 provinces in China into three categories: the first category is Beijing and Shanghai, which belong to areas with rapid economic development; The second category is Tianjin, Zhejiang, Jiangsu, Shandong, Guangdong, and Fujian, which belong to areas with moderate economic development; The third category is other provinces, belonging to areas with slow economic development. Overall, the development of China's provincial economy is extremely uneven. Beijing and Shanghai lead the national economic development, while the level of economic development in the eastern coastal provinces is relatively high. There is a significant gap in economic development between the eastern, central, and western regions. This classification is basically in line with the regional current situation presented by different levels of economic development in China [6]. For the measurement of regional differences, most scholars choose methods such as Gini coefficient, coefficient of variation, and dispersion to explore. Some scholars also use entropy method to measure the development level of digital economy in various cities, and use the Thiel index to reveal the regional differences in digital economy development. Although the Thiel index can further decompose

the differences within and between regions, it cannot decompose the contribution of each region to the overall gap in the region. Although the traditional Gini coefficient can measure the differences in the allocation of digital financial resources between regions, it cannot further decompose the differences in regional fine molecular sets [7-9]. Therefore, this article establishes DagumGini coefficient and Thiel index as calculation methods, and there is a certain degree of complementarity between the Thiel entropy index and DagumGini coefficient.

(1) DagumGini coefficient decomposition. The DagumGini coefficient compensates for the shortcomings of other methods used to measure regional disparities, which cannot solve the problem of overlapping observation data, and can better identify the sources of regional disparities. In recent years, many scholars have also conducted regional difference analysis based on DagumGini coefficient. This article uses DagumGini coefficient to study the differences in digital financial resource allocation between regions with different development levels.

(2) Thale exponent decomposition. The Thiel index includes two indicators, namely the Thiel T index and the Thiel L index. The difference between the two is that the T index calculates weighted weights based on income data, while the L index calculates weighted weights based on population. The Tal T index shows significant changes in upper income levels, while the Tal L index is sensitive to changes in lower income levels. The data conclusions of the two can complement each other.

2.2. Indicator Selection

This article uses the Peking University Digital Inclusive Finance Index (2011-2020) compiled by the Peking University Digital Finance Research Center to measure the degree of differences in the development of digital inclusive finance among regions at different levels of development in China. This index measures the digital inclusive finance index at the provincial, municipal, and county levels from three dimensions: the breadth of digital finance coverage, the depth of digital finance use, and the degree of digital inclusive finance digitization.

2.3. Data Source

This article uses a provincial-level digital inclusive finance index, mainly sourced from the "Peking University Digital Inclusive Finance Index (2011-2020)", and analyzes 31 provinces in China into three categories based on their different levels of development.

3. Empirical Results and Analysis

3.1. Decomposition of DagumGini coefficient

This article uses the DagumGini coefficient and its subgroup decomposition method to calculate the DagumGini coefficients of three different development levels in China from 2011 to 2020. The results are shown in Table 1.

Table 1: Difference Decomposition Results of DagumGini Coefficient

Year	Overall Gini coefficient	Gini coefficient within the group			Gini coefficient between groups		
		Medium	Slow	Fast	Medium & Slow	Medium & Fast	Fast & Slow
2011	0.248	0.1	0.156	0.002	0.335	0.128	0.442
2012	0.118	0.055	0.066	0	0.163	0.099	0.257
2013	0.089	0.04	0.049	0.007	0.119	0.093	0.21
2014	0.069	0.031	0.038	0.004	0.091	0.08	0.169
2015	0.055	0.028	0.028	0.002	0.074	0.067	0.14
2016	0.048	0.023	0.026	0.004	0.063	0.064	0.126
2017	0.046	0.026	0.023	0.005	0.061	0.062	0.122
2018	0.052	0.028	0.028	0.006	0.071	0.062	0.132
2019	0.054	0.028	0.029	0.007	0.074	0.063	0.136
2020	0.054	0.026	0.029	0.008	0.074	0.061	0.134

From 2011 to 2020, the overall Gini coefficient of China's digital inclusive finance showed a downward trend, with a relatively gentle decline from 2013 to 2017 and a significant decrease in 2012, a year-on-year decrease of 52.42% compared to 2011. In 2017, the Gini coefficient reached 0.046, which is the lowest level in 2011 to 2020. The overall Gini coefficient of China's digital inclusive

finance is on the rise from 2017 to 2020, but the growth rate is relatively small. Overall, the overall trend of the Gini coefficient of digital inclusive finance in China is decreasing. The decrease in the Gini coefficient of digital inclusive finance means that the regional differences in the allocation of digital financial resources are decreasing. This is mainly due to China's implementation of regional assistance policies such as the "Western Development, the rise of the central region, and the revitalization of the old industrial base in Northeast China", Reduced the distribution differences of digital financial resources among regions at different levels of development.

The Gini coefficient within the group of moderately developed regions and slowly developing regions shows a general downward trend, and the degree of difference in the allocation of digital financial resources within the region ranges from slow developing regions to moderately developed regions and rapidly developing regions. The Gini coefficient and overall Gini coefficient in moderately developed and slowly developing regions are similar, with a general trend of first significant decrease and then slight increase. 2011 was the year with the largest difference in the Gini coefficient within the group, with a Gini coefficient of 0.16 in areas with slow development, 0.10 in areas with moderate development, and 0.02 in areas with rapid development. The rapidly developing regions showed a "v" trend from 2013 to 2017, and in recent years, there has been an upward trend in the distribution of digital financial resources within the rapidly developing regions. Overall, between 2011 and 2020, there was a relatively small difference in the distribution of digital financial resources in rapidly developing regions. In recent years, the degree of difference in the distribution of digital financial resources in regions with moderate and slow development has been decreasing year by year. In 2012, the State Council issued several opinions on vigorously implementing the strategy of promoting the rise of the central region, which promoted the distribution of digital financial resources within the region. As a result, the difference in the distribution of digital financial resources within each region significantly decreased in 2012.

From 2011 to 2020, the difference in digital financial resource allocation between rapidly developing regions and slow-moving regions was the most significant, but overall, the difference in digital financial resource allocation among the three regions has been decreasing year by year. By 2020, the difference in digital financial resource allocation between rapidly developing regions and slow-moving regions remains the most significant. The difference in digital financial resource allocation between moderately developed regions and rapidly developing regions is relatively similar to the difference in digital financial resource allocation between moderately developed regions and slow-moving regions. Except for 2015-2017, the distribution gap of digital financial resources among regions with different levels of development ranges from high to low, including areas with fast and slow development, areas with moderate and slow development, and areas with fast and moderate development.

3.2. Decomposition of regional differences using the Taylor T index

Calculate the regional differences in the development level of digital inclusive finance in China using the Thiel T index, as shown in Table 2.

Table 2: Taylor T index decomposition

Year	TWR	TBR	Thiel index(T)
2011	0.1985	0.0894	0.2879
2012	0.2012	0.0464	0.2476
2013	0.2051	0.0422	0.2473
2014	0.2137	0.0397	0.2533
2015	0.2264	0.0388	0.2652
2016	0.2196	0.0394	0.2591
2017	0.2197	0.0401	0.2598
2018	0.2188	0.0405	0.2593
2019	0.2162	0.041	0.2572
2020	0.2153	0.0415	0.2567

From the perspective of the regional differences in the development level of digital inclusive finance in China, the Taier T index shows a downward trend from 2011 to 2020, with a slight growth trend from 2012 to 2015, a significant decline from 2011 to 2012, and a relatively stable period from 2016 to 2020. This means that the differences in digital finance development between China's 31 provinces are constantly narrowing. In 2011, the Theil T index reached its maximum value of 0.2879, indicating significant differences among the 31 provinces in China.

The difference in the distribution of digital financial resources within 31 provinces is generally on the rise, indicating an increase in the uneven distribution of digital financial resources within the region. The regional differences showed a "v" trend from 2011 to 2015, reaching a minimum of 0.2476 in 2012. This conclusion is consistent with the analysis results of DagumGini coefficient. From the Tale T index of digital economy development between regions, it shows a downward trend from 2011 to 2020, indicating a decreasing trend in the overall differences in digital finance development between regions. Among them, in 2011, the Tal T index value between regions was the highest, with a value of 0.0894. The regional differences after 2012 are decreasing year by year, and the regional differences in the development of digital finance in China are gradually decreasing.

3.3. Decomposition of Regional Differences using the Thiel L Index

Calculate the regional differences in the development level of digital inclusive finance in China using the Thiel L index, as shown in Table 3.

Table 3: Taylor L-index decomposition

Year	TWR	TBR	Thiel index(L)
2011	0.1718	0.0604	0.2322
2012	0.1646	0.0343	0.199
2013	0.1631	0.0336	0.1968
2014	0.1686	0.0337	0.2022
2015	0.1745	0.0343	0.2088
2016	0.1695	0.0357	0.2052
2017	0.1683	0.0365	0.2048
2018	0.1677	0.0365	0.2042
2019	0.1663	0.0368	0.2031
2020	0.1658	0.0374	0.2032

From the perspective of the regional differences in the development level of digital inclusive finance in China, the Thiel L index shows a downward trend from 2011 to 2020, with a slight growth trend from 2012 to 2016, a significant decline from 2011 to 2012, and a relatively stable period from 2017 to 2020. This means that the differences in digital finance development between China's 31 provinces are constantly narrowing. In 2011, the Thiel L index reached a maximum value of 0.2322, indicating significant differences among the 31 provinces in China.

The distribution differences of digital financial resources within 31 provinces are generally relatively stable, indicating that the degree of regional distribution differences in digital financial resources has not changed significantly in the past decade. The regional differences showed an "inverted v" trend from 2012 to 2017, reaching a maximum of 0.1745 in 2015. From the Thiel L index of digital economy development between regions, it can be seen that there was a general downward trend from 2011 to 2020, indicating a decreasing trend in the overall differences in digital finance development between regions. Among them, in 2011, the Thiel L index value between regions was the highest, with a value of 0.0604. After 2012, the regional differences have slightly increased year by year. Overall, the regional differences in the development of digital finance in China have gradually decreased in the past decade.

4. Suggestions

Introducing digital technology into traditional finance for innovation is beneficial for reducing costs and providing financial services to more consumers in a more convenient way. The goal of financial services for the real economy includes both inclusivity and precision, and digital finance promotes the achievement of this goal. Promoting fair distribution of digital finance can reduce regional differences in development levels and further promote economic development. Based on the above research conclusions, this article proposes the following suggestions:

Firstly, improve the relevant systems of digital finance and achieve balanced development of digital finance. Faced with the unequal distribution of digital finance in China, the government should take measures to develop digital finance according to the specific situation of each region and adapt to local conditions. For example, certain policies that benefit the people can be implemented in the eastern region, and the coverage and depth of digital finance can be increased in the central and western regions. Popularize knowledge related to digital finance and improve its utilization rate. Overall, China should improve the development system and system of digital finance, encourage the development of

digital finance, and then promote the transformation of income distribution towards equilibrium, exerting the functional effect of digital finance development to promote the balanced development of digital finance among different regions.

Second, encourage digital Financial innovation and promote cooperation between digital finance and traditional finance. The current popularity of digital finance is broad but not deep, and most people's understanding of digital finance is only limited to electronic payments. New digital financial services such as internet investment and insurance are still not the focus of public choice. Digital financial institutions can collaborate with traditional financial institutions to strengthen innovation. Traditional financial institutions have national support, are large and stable in scale, and have high consumer trust. Digital financial institutions, relying on emerging technologies such as artificial intelligence, have technological advantages and rich experience in controlling digital financial risks. Both have their own advantages and disadvantages. If the two can be effectively combined, it can promote better development of the Chinese economy and reduce regional differences in digital finance distribution.

Thirdly, continue to promote the overall regional development strategy of "Western Development, Central Rise, Northeast Revitalization, and Eastern Leading". The imbalance of regional development is a long-standing problem in China's development, and it is also a problem that must be solved in the process of building a moderately prosperous society in all respects and achieving socialist modernization. We should always prioritize the development of the western region, continue to adopt special support policies, and strive to enhance the self-development capacity of the western region. Accelerate the implementation of policies to revitalize old industrial bases such as the Northeast region, eliminate outdated production capacity with greater efforts, and promote the optimization and upgrading of industrial structure. Vigorously promote the rise of the central region, accelerate the development of key regions, and orderly undertake industrial transfer. Actively supporting the leading economic development in the eastern region and leading the country in transformation and upgrading. Especially, we must firmly implement the planning of the main functional areas, delineate ecological protection red lines, establish a warning mechanism for resource and environmental carrying capacity, guide the rational layout of productive forces in the national space based on natural conditions and economic laws, and enable different regions with natural conditions to develop scientifically according to the positioning of the main functional areas.

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