

Development Level and Growth Source of China's Digital Inclusive Finance

— An Investigation Based on Contribution Decomposition Model

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Abstract: The outbreak of COVID-19 epidemic not only highlights the solid foundation of China's digital economy, but also counterforces and accelerates its further development, which provides a potential opportunity for China's economic transformation and upgrading in the next stage. This paper uses the contribution decomposition model, examines the development level and growth sources of China's digital inclusive finance from three dimensions: the coverage, the using depth and the digitalization degree. The research shows that from 2011 to 2020, the overall level and each dimension indexes of digital inclusive finance development show a leap-forward development, but the problem of insufficient and imbalance of regional financial development is still quite obvious. The results of contribution decomposition show that, taking 2016 as the boundary, the growth source of digital inclusive finance index in the former stage lies in the coverage, and the latter stage mainly depends on the coverage and using depth of digital finance, while the emphasis on the digitalization degree of digital finance is relatively insufficient. Under the background of the complex situation and severe challenges in the post-epidemic era, efforts should be made in the top-level design and elements support, aiming at the regional and dimensional shortcomings, so as to make positive contributions to the high-quality development of China's economy.

Keywords: digital inclusive finance, growth source, contribution decomposition model

1. Introduction and Literature Review

Since the worldwide outbreak of the COVID-19 epidemic in early 2020, the course of Chinese people fighting bravely against the epidemic with fearless sacrifice has entered the third year. Over the past three years, China's economy has taken the bull by the horns, and has repeatedly become the only country in the world that has achieved positive GDP growth. This brilliant achievement has greatly benefited from China's developed digital finance and digital economy. The digital technology and financial instruments behind the products of the epidemic era, such as "big data", "health code" and "accurate credit business", have made significant contributions to alleviating the epidemic impact and ensuring China's GDP growth during the epidemic [1-3]. At the same time, the COVID-19 epidemic also accelerates and forces the vigorous development of the digital financial industry to a certain extent, and brought new opportunities for China to achieve "corner overtaking" in the downward

cycle of the world economy. The concept of "digital inclusive finance" originated from the "inclusive finance" propaganda carried out by the United Nations in 2005, and refers to the financial system that can provide services to all social strata effectively and comprehensively. Under the rapid development of China's Internet technology and user scale in the same period, the practice of inclusive finance concept has shown great correlation with innovative digital finance since it entered China, and the coverage of digital financial services has been gradually extended to the relatively backward areas where traditional financial instruments are difficult to penetrate, which has made great contributions to alleviating the major social and economic contradictions of unbalanced and insufficient regional development in China [4-5] and realizing the high-quality development of China's economy at present and for a long time to come. In the post-epidemic era, the political and economic environment at home and abroad is becoming more complicated, and the opportunities and challenges in the field of digital inclusive financial development are intertwined. Therefore, we should deeply investigate the main sources of digital inclusive finance improvement in the last stage, firmly grasp the changing trend and development direction of regional digital financial structure, and provide theoretical and practical guarantee for the systematic innovation in digital financial field in the new development stage.

The research on the growth source of digital inclusive finance mainly refers to the internal analysis of digital financial index, and judging the structural causes that affect the digital financial level according to the contribution of different parts to the whole. Specifically, the overall digital inclusive finance index is firstly decomposed according to different subdivided dimensions, and discuss the contribution of each dimension to the overall data improvement respectively. Then, consider the main indicators of different dimensions that affect the inclusive finance index, and calculate the contribution of each indicator to the overall numerical improvement. After the above two-stage decompositions, the main internal source of the overall inclusive finance index improvement is finally determined. And this paper refers to the decomposition method of Zhu Yichao [6], divides the digital inclusive finance index into three dimensions: coverage, using depth and digitalization degree, and respectively examines their contributions to the overall digital finance development.

2. Analysis on the Development of China's Digital Inclusive Finance

2.1. Explanation on the Digital Inclusive Finance Indicator System

In order to fully clarify the overall level, changing trend and existing problems of China's digital inclusive finance, we adopts the data of "Peking University Digital Inclusive Finance Index (2011-2020)" developed by the research group of Institute of Digital Finance, Peking University (hereinafter referred to as "Peking University Index"), and on the basis of respecting the inherent differences of regional financial development levels and location functions, makes an in-depth investigation of the total amount and structural changes of digital finance development during 2011-2020, which lays a good foundation for further verifying the digital financial growth source by regions. On the basis of the existing literature and the traditional inclusive finance index put forward by international organizations, Peking University Index, combined with the new features of digital financial services, and taking into account the availability of data, has built the digital inclusive finance index system from three dimensions: the coverage, the using depth and the digitalization degree, so as the calculations are of high accuracy and good representation.

2.2. The Trend of China's Provincial Digital Inclusive Finance Level

After dimensionless processing of the indicators in table 1, the coefficient of variation method and analytic hierarchy process are further used to determine the indicators' composite weights of the 3 dimensions, and the composite weight vectors of coverage, using depth and digitization degree are

54.0%, 29.7% and 16.3% respectively. Then, the digital inclusive finance index of 31 regions in China from 2011 to 2020 is obtained through the arithmetic average composite model. The results are shown in table 1 below.

Table 1: Digital inclusive finance index from 2011 to 2020. Source: Peking University Digital Inclusive Finance Index (2011-2020).

Region	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Beijing	79	151	216	235	276	286	330	369	399	418
Tianjin	61	123	175	200	238	246	284	317	344	361
Hebei	32	89	145	161	200	214	258	283	305	323
Shanxi	33	93	144	168	206	225	260	284	309	326
Inner Mongolia	29	92	147	173	215	230	259	272	294	309
Liaoning	43	104	160	188	226	231	267	291	311	326
Jilin	25	87	138	166	208	217	255	276	293	308
Heilongjiang	34	88	141	168	210	222	257	275	293	306
Shanghai	80	151	222	240	278	282	337	378	410	432
Jiangsu	62	122	181	204	244	254	298	334	362	382
Zhejiang	77	146	206	224	265	268	318	357	387	407
Anhui	33	97	151	181	211	229	272	304	330	350
Fujian	62	123	183	203	245	253	299	334	361	380
Jiangxi	30	92	146	176	208	224	267	296	319	341
Shandong	39	100	159	182	221	233	272	301	327	348
Henan	28	84	142	167	205	223	267	296	322	341
Hubei	40	101	165	190	227	240	285	319	344	359
Hunan	33	94	148	167	206	218	261	287	311	332
Guangdong	69	127	185	202	241	248	296	332	361	380
Guangxi	34	89	141	166	207	223	262	289	310	325
Hainan	46	103	158	180	230	232	276	310	329	344
Chongqing	42	100	160	185	222	234	276	302	325	345
Sichuan	40	100	153	174	215	225	268	294	317	335
Guizhou	18	76	121	155	193	209	251	277	294	308
Yunnan	25	84	138	164	204	217	256	286	303	318
Tibet	16	69	115	144	186	205	246	274	294	311
Shanxi	41	98	148	179	216	229	267	296	323	342
Gansu	19	76	128	160	200	204	244	267	289	306
Qinghai	18	61	118	146	195	200	240	263	283	298
Ningxia	31	87	137	165	215	212	256	273	292	310
Xinjiang	20	82	143	164	205	209	249	272	294	308

As can be seen from the table above, from 2011 to 2020, the digital inclusive finance index of 31 regions in China showed a high-speed growth trend, with the highest level of regional development rising from 77 points in 2011 to 418 points in 2020, which shows an absolute increase of 44.3%, and reflects the regional remarkable achievements in promoting digital financial development and economic structure upgrading since China's economy entered the new normal. Specifically, areas with active digital economy such as Beijing, Shanghai and Zhejiang can be divided into the first echelon; Tibet, Ningxia, Jilin and other northwest and northeast regions are still dominated by the traditional economic development mode, and the development level of digital inclusive finance is

obviously low; And the index levels of other eastern and central provinces in the study period are between the above two echelons. It can be seen that the level of China's provincial digital inclusive finance index is obviously different not only in the eastern and western regions bounded by "Hu Line", but also in the northern and southern regions bounded by "Qinling Mountain-Huaihe River Line". This situation has also become an example and epitome of the uncoordinated regional economic development for a long time.

2.3. The Trend of China's Provincial Digital Inclusive Finance Structure

Based on the results of the overall development trend of digital inclusive finance, the study further investigates the changes of different dimensions of regional digital finance in the study period. Some data results are shown in table 2 below.

Table 2: Structure of provincial digital inclusive finance index from 2011 to 2020. Source: Peking University Digital inclusive finance Index (2011-2020).

Region/ index	2011			2020		
	Coverage	Using depth	Digitization degree	Coverage	Using depth	Digitization degree
Beijing	97.53	72.23	32.59	397.00	445.83	436.02
Tianjin	69.37	53.33	44.72	340.29	373.91	408.74
Hebei	18.46	44.19	57.15	304.10	318.42	391.92
Shanxi	28.94	21.61	69.57	327.29	291.37	383.04
Inner Mongolia	24.65	30.27	40.35	310.40	275.66	367.40
Liaoning	44.96	44.64	35.33	307.11	328.12	386.33
Jilin	23.75	24.04	27.86	290.78	297.63	385.29
Heilongjiang	21.12	36.28	69.83	290.48	293.69	380.09
Shanghai	98.85	86.24	7.58	395.20	488.68	450.08
Jiangsu	66.70	79.22	15.71	362.11	395.01	421.70
Zhejiang	85.53	93.52	21.22	382.07	439.25	429.98
Anhui	20.20	55.58	34.66	323.75	366.15	408.38
Fujian	63.28	68.51	44.50	359.21	401.80	409.82
Jiangxi	13.97	54.82	36.21	316.14	353.23	398.52
Shandong	33.67	47.16	39.01	331.66	343.49	409.00
Henan	13.54	38.11	59.81	331.16	321.21	408.32
Hubei	35.17	53.56	30.18	336.54	369.58	411.73
Hunan	15.33	60.73	39.02	302.28	347.44	402.30
Guangdong	63.41	80.97	68.66	356.94	404.35	409.06
Guangxi	19.98	44.06	61.33	311.98	313.24	390.41
Hainan	30.96	57.74	71.63	335.87	337.24	383.46
Chongqing	40.38	47.46	36.77	329.39	343.91	397.12
Sichuan	29.02	58.56	43.50	310.76	344.86	396.05

As can be seen from the table above, from 2011 to 2020, the three dimensions of digital inclusive finance index in 31 regions have achieved leap-forward development. By 2020, the absolute values of regional indexes have generally exceeded the 300-point mark, reflecting the balanced growth trend of digital inclusive finance structure in various places. Specifically, taking 2016 as the boundary, the growth trend of each dimension shows a periodic change. Around 2011-2015, the digitalization

degree of digital inclusive finance increased most significantly, followed by the coverage, while the using depth increased relatively slowly, indicating that in the early stage of domestic digital financial development, the related work progress mainly focused on popularizing the usage of digital finance and achieving rapid growth in the number of digital finance users, while the emphasis on its specific using depth and operation ability were relatively insufficient. Since 2016, with the coverage and digital support of digital inclusive finance gradually reaching a higher level, its further development space is limited, and the current and future development of digital finance will depend more on the using depth.

3. Investigation on the Growth Source of Digital Inclusive Finance

On the basis of understanding the evolution trend of digital finance level and structure from the perceptual level, the research adopts the contribution decomposition model, and further examines the growth source of regional digital inclusive finance development from 2011 to 2020 from the empirical level, providing test evidence for promoting the high-quality development of digital inclusive finance and innovating the policy mechanism of coordinated regional economic development in the next stage.

3.1. Contribution Decomposition Model

According to the above-mentioned two-stage decomposition process of the growth source of digital inclusive finance index, firstly, the 3 dimensions of China's digital inclusive finance index are decomposed as follows:

According to the above-mentioned two-stage decomposition process of the growth source of digital inclusive finance index, firstly, the 3 dimensions of China's digital inclusive finance index are decomposed as follows:

$$P = \sum_1^3(P_i R_i) \quad (1)$$

This formula is the derivation process of calculating the overall digital financial index by using each dimension index. Where, P is the overall digital financial index of each region in China, P_i is the i th dimension index of each region, and the R_i is the weight vector value of the i th dimension in the digital financial indicator system.

It can be obtained from the above formula:

$$\Delta P_{(t-j)} = \sum_1^3(P_{it}R_{it} - P_{ij}R_{ij}) \quad (2)$$

Where, $\Delta P_{(t-j)}$ is the increase amounts of the regional overall digital inclusive financial index in the t th year compared with the j th year; P_{it} , P_{ij} is the index of the i th dimension in the t th year and j th year; R_{it} , R_{ij} is the composite weight of the i th dimension in the t th year and j th year.

Divide both sides of the above equation by $\Delta P_{(t-j)}$ to get the contribution decomposition model of each dimension to the overall digital financial index improvement, namely

$$\frac{\sum_{i=1}^3(P_{it}R_{it} - P_{ij}R_{ij})}{\Delta P_{(t-j)}} = 1 \quad (3)$$

As can be seen from the above formula, $(P_{it}R_{it} - P_{ij}R_{ij})$ is the contribution of the i th dimension to the overall index. On the basis of formula (3), it is only necessary to further calculate the contribution of each dimension index in $(P_{it}R_{it} - P_{ij}R_{ij})$ to measure the contribution of each dimension index to the overall digital financial index. The contribution decomposition method of each dimension index proportion in $(P_{it}R_{it} - P_{ij}R_{ij})$ is as follows:

$$\delta_{p_i} = \frac{\ln(1+p_i)}{\ln(1+p_i)+\ln(1+r_i)} \quad (4)$$

$$\delta_{r_i} = \frac{\ln(1+r_i)}{\ln(1+p_i)+\ln(1+r_i)} \quad (5)$$

Where, δ_{p_i} is the contribution of the i th dimension index in $(P_{it}R_{it} - P_{ij}R_{ij})$, δ_{r_i} is the contribution of the i th dimension weight proportion in $(P_{it}R_{it} - P_{ij}R_{ij})$; p_i is the growth rate of the i th dimension index, and r_i is the growth rate of the i th dimension weight proportion.

From the above calculation process, we can get the contribution decomposition formula of the index changes of each dimension to the overall digital financial index improvement, namely:

$$\Delta P = \sum_1^3 \frac{(P_{it}R_{it}-P_{ij}R_{ij}) \ln(1+p_i)}{\ln(1+p_i)+(1+r_i)} + \sum_1^3 \frac{(P_{it}R_{it}-P_{ij}R_{ij}) \ln(1+r_i)}{\ln(1+p_i)+(1+r_i)} \quad (6)$$

Where, ΔP is the increase of the overall digital financial index in each region, while in the two sub items on the right side of the equation, the former represents the contribution of the 3 dimension index change to the overall index improvement, and the latter represents the contribution of the weight changes of the 3 dimension index to the overall index improvement.

3.2. Calculation and Analysis of the Growth Source of Digital Inclusive Finance

Because the composite weight of each dimension in the digital financial index system don't change with time, the calculation results of the model's first stage can just reflect the real situation of the contribution of each dimension to the overall digital inclusive finance index. Therefore, taking 2016 as the boundary, we focuses on the evolution trend of regional digital finance development sources in two periods, around 2011-2015 and 2016-2020. According to the decomposition formula, the contribution of the three dimensions of each region to the improvement of the overall digital inclusive financial index is shown in table 3 below:

Table 3: Provincial contribution of three dimensions to the improvement of overall digital finance level from 2011 to 2020. Source: Calculated by Peking University Digital Inclusive Finance Index (2011-2020).

Region/indicator	2011-2015			2016-2020		
	Coverage	Using depth	Digitization degree	Coverage	Using depth	Digitization degree
Beijing	0.49	0.27	0.23	0.46	0.41	0.13
Tianjin	0.45	0.29	0.26	0.54	0.37	0.10
Hebei	0.51	0.25	0.24	0.56	0.33	0.11
Shanxi	0.50	0.26	0.24	0.65	0.30	0.05
Inner Mongolia	0.48	0.23	0.29	0.74	0.34	-0.08
Liaoning	0.47	0.28	0.26	0.57	0.34	0.10
Jilin	0.47	0.28	0.25	0.59	0.30	0.11
Heilongjiang	0.49	0.27	0.24	0.64	0.31	0.06
Shanghai	0.47	0.29	0.24	0.44	0.41	0.15
Jiangsu	0.47	0.27	0.26	0.54	0.33	0.13
Zhejiang	0.48	0.28	0.25	0.50	0.36	0.14
Anhui	0.48	0.26	0.25	0.57	0.33	0.09
Fujian	0.50	0.27	0.22	0.50	0.37	0.13
Jiangxi	0.49	0.26	0.26	0.59	0.33	0.08
Shandong	0.49	0.26	0.25	0.57	0.32	0.11

Table 3: (continued).

Henan	0.52	0.25	0.24	0.60	0.31	0.09
Hubei	0.49	0.27	0.25	0.55	0.34	0.11
Hunan	0.50	0.26	0.25	0.55	0.33	0.12
Guangdong	0.53	0.26	0.21	0.48	0.38	0.14
Guangxi	0.49	0.25	0.26	0.63	0.32	0.05
Hainan	0.52	0.26	0.22	0.60	0.31	0.09
Chongqing	0.49	0.25	0.26	0.56	0.35	0.08
Sichuan	0.49	0.25	0.26	0.56	0.35	0.09
Guizhou	0.50	0.24	0.26	0.73	0.23	0.05
Yunnan	0.50	0.24	0.26	0.63	0.31	0.06
Tibet	0.47	0.27	0.26	0.63	0.33	0.04
Shanxi	0.50	0.27	0.23	0.57	0.34	0.09
Gansu	0.54	0.26	0.21	0.64	0.27	0.09
Qinghai	0.52	0.29	0.19	0.63	0.25	0.12
Ningxia	0.52	0.26	0.23	0.63	0.25	0.11
Xinjiang	0.51	0.26	0.23	0.65	0.25	0.10

It can be seen from the table above that 31 regions in China have certain commonalities in the structural evolution trend of digital finance improvement source, that is, during the "12th Five-Year Plan" period, the regional development of digital finance mainly depends on the improvement of digital financial coverage, while the contribution of the using depth and digitalization degree are roughly equal, reflecting the remarkable achievements of China's economy in vigorously developing digital technology and expanding digital financial fundamentals in the early stage of entering the new normal; During the "13th Five-Year Plan" period, the contribution of the 3 dimensions of digital finance showed an obvious stratification phenomenon, and the contribution of digitalization degree dropped sharply, and showed negative values in some areas, which indicated that with all kinds of economic entities paying too much attention to the coverage and neglecting the digital degree for a long time, some unstable and uncoordinated phenomena began to appear in the digital finance development system, which might lead to the potential risks of the long-term development, so as to verify the conclusions of previous theoretical analysis and realistic investigation, and provides an empirical basis for adjusting and improving the growth structure of regional digital finance in the next stage.

4. Conclusions and Policy Recommendations

4.1. Research Conclusions

This paper uses the contribution decomposition model, examines the development level and growth sources of China's digital inclusive finance from three dimensions: the coverage, the using depth and the digitalization degree. The research shows that from 2011 to 2020, the overall level and each dimension indexes of digital inclusive finance development show a leap-forward development, but the problem of insufficient and imbalance of regional financial development is still quite obvious. The results of contribution decomposition show that, taking 2016 as the boundary, the growth source of digital inclusive finance index in the former stage lies in the coverage, and the latter stage mainly depends on the coverage and using depth of digital finance, while the emphasis on the digitalization degree of digital finance is relatively insufficient.

4.2. Policy Recommendations

Based on the research conclusions, this paper tries to put forward some reference suggestions for the higher development of China's digital finance from the regional level and the dimension level. From the regional point of view, parts of western and northern China should be brought into the key areas to promote the digital finance development in the next stage, five more preferential policies and measures, and provide more source channels in terms of capital, land, talents, technology and other elements, so as to provide full support and guarantee for digital financial superior resources to benefit more regions and more people. From the perspective of index dimension, on the one hand, we should deepen the reform of system and mechanism in related fields, and explore the stock space of the coverage and using depth; On the other hand, we should increase the support for the promotion and application of advanced digital information technology, and provide incremental space for the overall improvement of digital inclusive finance with a high level digitalization.

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