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The Peking University Digital Financial Inclusion Index of China (2011-2018)[①]

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Contents

Abstract

Improving financial inclusion has been an important policy objective of the Chinese government in recent years. Financial inclusion means providing financial services to all social classes and groups who demand appropriate and effective financial services, at an affordable cost, and based on the principle of equal opportunity and service sustainability. In addition to efforts made by traditional financial institutions in this area, innovative digital finance, which relies on information technology, big data and cloud computing, has significantly expanded the accessibility and coverage of financial inclusion. However, discussions of financial inclusion and construction of financial inclusion indicators to date mainly focus on traditional financial products and services and fail to take into full account the advantages of digital finance – its wider coverage and greater accessibility. To fill this gap, the Institute of Digital Finance at Peking University and Ant Financial Services Group formed a joint research team (Research Team) to develop a unique index series—"The Peking University Digital Financial Inclusion Index of China (PKU-DFIIC)". PKU-DFIIC utilizes Ant Financial's massive dataset on digital financial inclusion. To date, the project has completed two phases: Stage I (2011-2015) and Stage II (2016-2018). The index covers three geographical levels—province, prefecture-level municipality and county—and updates the Stage I series from 2011-2015 to 2016-2018. In addition to the aggregate index, the PKU-DFIIC also presents disaggregated indexes, such as coverage breadth, usage depth and digitization level, as well as other subsector indexes like payment, insurance, monetary funds, credit investigation, investment, and credit. In particular, to maintain time consistency and comparability, the research team maintained continuity of the calculation methodology when preparing the Stage II indexes. Considering the progress of digital finance, the research team also added a small number of indicators to better capture the new development.

After compiling the latest PKU-DFIIC at the provincial, prefecture and county levels from 2011 to 2018, the research team also conducted some preliminary analyses.

The key findings are as follows:

1)Digital financial inclusion is an important model to realize low-cost, wide-coverage and sustainable financial inclusion.

2)The practices of digital financial inclusion over the past few years offer preliminary evidence of the feasibility and reproducibility of this model. In particular, digital financial inclusion makes it possible for economically undeveloped regions to catch up with and even surpass other regions in this area and lays a foundation to allow low-income and disadvantaged groups access to low-cost financial services.

3)The Yangtze River Delta region, especially the municipal districts of Hangzhou and Shanghai, continue to dominate the list of the top 20 in digital financial inclusion ranking at the country level.

4)Some provinces and cities in Central China have seen rapid development in digital financial inclusion, and an obvious trend of a "rising central region" is emerging. However, the figures in certain areas in the Northeast region and Western region have declined sharply. Furthermore, compared with those in Stage I (2011-2015), the PKU-DFIIC during 2016-2018 also captured significant changes. In particular, PKU-DFIIC has since shifted to reflect an increasing depth of use in recent years. This is in sharp contrast with the index in Stage I (2011-2015), which proves that China's digital financial inclusion has passed the era of extensive enclosure and is embracing a new stage characterized by deep expansion.

People from all walks of life are welcome to use this index. All the data of the index can be obtained from the research team: guofengsfi@163.com (GUO Feng). Please indicate the data source as "The Peking University Digital Financial Inclusion Index of China". At the same time, please cite our work in the following way: GUO Feng, WANG Jingyi, WANG Fang, KONG Tao, ZHANG Xun, CHENG Zhiyun, 2019, "Measuring China's Digital Financial Inclusion: Index Compilation and Spatial Characteristics", Working paper, Institute of Digital Finance, Peking University.

1. Introduction

The United Nations has defined financial inclusion as a financial system that effectively and comprehensively serves all social classes and groups (Jiao et al., 2015). The original intention of financial inclusion is to highlight the continuous improvement of the financial infrastructure and the availability of financial services to provide more convenient financial services to people from all walks of life, especially those in underdeveloped areas or categorized as low-income, at a lower cost. This concept was initially adopted by the United Nations for the International Year of Microcredit 2005 and was then vigorously promoted by the United Nations and the World Bank. According to the World Bank's Global Financial Development Report 2014: Financial Inclusion, it has joined hands with public and private partners in more than 70 countries and regions around the world on financial inclusion projects; over 50 countries and regions worldwide have established goals to improve financial inclusion (The World Bank Group, 2015).

The concept of financial inclusion was first introduced to China by the China Association of Microfinance (CAM). To promote the International Year of Microcredit 2005, Bai Chengyu, Secretary General of CAM, proposed "普惠金融体系 (*Pu Hui Jin Rong Ti Xi*)" as the Chinese translation of "financial inclusion system". In March 2006, Jiao Jinpu, Former Deputy Director of the Research Bureau of the People's Bank of China, officially used this concept at the Asia Microfinance Forum in Beijing. Afterwards, at the G20 Summit held in Mexico in June 2012, the then President of China Hu Jintao noted that financial inclusion is essentially a development issue and that all countries should strengthen communication and cooperation, better protect consumer interests, and jointly build a financial mechanism that would benefit all nations and peoples to guarantee that all consumers, particularly those in developing countries, have access to modern, secure and convenient financial services. In November 2013, the Third Plenary Session of the 18th CPC Central Committee adopted the *Decision of the Central Committee of the Communist Party of China on*

Some Major Issues Concerning Comprehensively Deepening the Reform, proposing to develop financial inclusion. At the end of 2015, the State Council clarified the definition of financial inclusion at the national level for the first time in the notice of the *Plan for Advancing Financial Inclusion Development (2016-2020)*. Financial inclusion means providing financial services to all social classes and groups with demand for appropriate and effective financial services, at an affordable cost, and based on the principle of equal opportunity and service sustainability by increasing policy guidance and support, strengthening the construction of financial systems, and improving financial infrastructure. The notice also identifies small and micro services, subsistence-level farmers, urban low-income groups, impoverished groups, those with disabilities, elderly individuals and other special groups as the focus for financial inclusion in China.

At both home and abroad, the concept, theory and practice of financial inclusion have gradually deepened: from the initial focus on the availability of banks' physical outlets and credit services to extending coverage over a variety of service areas including payments, deposits, loans, insurance, credit investigations and securities. At the practical level, financial inclusion in China has gradually expanded from public welfare microfinance at the preliminary stage to integrated financial services, including payment, credit and other services, and has embraced substantial development thanks to the extensive application of network and mobile communication technologies. Based on international experience and China's local context, Jiao et al. (2015) have summarized and divided the course of China's financial inclusion practices into four stages: public welfare microfinance, developmental microfinance, comprehensive financial inclusion and innovative Internet finance (See Table 1). The main task of financial inclusion is to provide financial services to low-income groups and small and micro services that may be excluded from traditional or formal financial institution systems.

Table 1: Major Development Stages of China's Financial Inclusion

Development Stage	Milestone	Main Characteristics
Public Welfare Microfinance (1990s)	In 1993, the Rural Development Institute under the Chinese Academy of Social Sciences established China's first microfinance institutions – the Poverty Alleviation Economic Cooperative—in Yi County, Hebei Province, to improve the economic and social status of poor households.	The main funding source of microfinance was donations by individuals or international institutions and soft loans. It aimed to mitigate poverty in rural areas and embodied the basic concept of financial inclusion.
Developmental Microfinance (2000-2005)	The People's Bank of China proposed to adopt a management approach of "one-time verification, on-demand loans, balance control, and revolving credit" to offer loans based on the credit of farmers without mortgage or guarantee and to establish farmer loan files. Microfinance for farmers entered into full swing.	Due to the demand for a large amount of funds generated by the re-employment and start-ups during this period, formal financial institutions began to engage in microfinance services, thereby forming a relatively large microfinance system and improving employment and people's livelihood.
Comprehensive Financial Inclusion (2006-2010)	In 2005, the No. 1 central document of China clearly stated that "where conditions permit, local governments can explore the establishment of microfinance organizations that are closer to the demands of farmers and rural areas and initiated by individuals or enterprises".	Microfinance organizations and rural banks emerged rapidly; the banking and financial service system gradually expanded to include small and micro enterprises into the service scope; the financial inclusion service system provided comprehensive financial services including payments, remittances, loans, and pawn services and showed a tendency towards network and mobile development.
Innovative Internet Finance (2011 till now)	New financial Internet products such as Yu'ebao provide a wide variety of financial services covering Internet payments, Internet loans, and Internet wealth management.	Internet finance embraces rapid development, presenting three major trends – "third-party payment, mobile payment replacing traditional payment, P2P credit replacing traditional deposit and loan service, and crowdfunding replacing traditional securities service".

Source: Jiao Jinpu, Huang Tingting, Wang Tiandu, Zhang Shaohua, Wang Tian, "China's Financial Inclusion Development Process and Empirical Research", PBOC Working Paper, NO.2015/2, 2015.

China's current financial inclusion practice shows a strong correlation with innovative digital finance. One of the major positions adopted by the new digital financial services represented by Internet companies offering financial services is exactly to target low-income and disadvantaged groups with its extended services, reduce the cost of financial service products and expand access to financial services through information technology and product innovation to achieve win-win results for organizations and customers. Therefore, innovative digital finance is an important driving force in the present development of financial inclusion in China. Specifically, in terms of coverage, traditional financial institutions need to build outlets to expand coverage, and the resulting high cost makes it difficult for them to penetrate into relatively impoverished regions. However, the crossover and integration of digital technology and financial services can overcome such shortcomings. In some areas, even without hardware facilities such as bank outlets and ATMs, customers still have access to desirable financial services through terminal devices such as computers and mobile phones. Compared with the traditional financial institutions that distribute most resources in densely inhabited and commercial areas, digital finance makes financial services more direct and accessible to more customers. For the social groups covered, the innovations offered by digital financial products have lowered the access threshold for customers, weakening the “nobility” attribute of financial services, and making them increasingly accessible to the public. Compared with the exclusivity of traditional financial institutions, digital finance can meet the needs of small and medium businesses and low-income groups who are generally underprivileged and unable to access financial services, thus reflecting the due meaning of financial inclusion.

This report aims to quantify China's digital financial inclusion practices in the form of indexes. Such efforts have at least two implications. First, in theory, the index will provide an important reference for the study of innovative financial inclusion and the design of statistical indicator systems in China. The existing research on financial inclusion in China mainly focuses on its concept, significance, index structure and function from the perspective of traditional financial services. A scientific and comprehensive summary of the theories and indicator systems of digital financial

inclusion from the perspective of innovative digital finance is still absent for China. Based on a consolidation of the current research on indicator systems of financial inclusion and indexes worldwide and with reference to the rapid development of innovative digital finance at the current stage in China, this report has built an indicator system for digital financial inclusion to further deepen the research on financial inclusion. Second, in practice, based on the indicator system built, this report has compiled digital financial inclusion indexes at the provincial, prefecture and county levels, which serve to display digital financial inclusion development and regional equilibrium under the current trend of innovative digital finance in China. These indexes can help policy makers and practitioners better understand the development status of digital financial inclusion in China and identify bottlenecks and obstacles to its development with the purpose of formulating corresponding policies to promote healthy and sustainable development. It should be noted to report readers, index users, and relevant conclusion quoters that due to the limited availability of data, this report and the indexes measure only the development of digital financial inclusion services provided by Internet companies; the related services of traditional financial institutions such as banks are not included.

The rest of the report is arranged as follows: Section II provides a brief overview of the related literature; Section III introduces the indicator system of digital financial inclusion; Section IV describes the calculation methods for the indexes, including a discussion on the method of weight assignment; Section V presents the digital financial inclusion indexes compiled based on the above methods, together with some preliminary toing describe the overall development trend and regional variations; and Section VI summarizes the report and proposes a direction for future research.

2. Literature Review

Financial inclusion is of great significance and value in regard to the function of finance as serving the real economy and disadvantaged groups. Kapoor (2013) argued that financial inclusion is an equalizer that contributes to economic growth and benefits all citizens. The absence of a financial inclusion system will lead to continued income inequality and the slowdown of economic growth (Beck et al., 2007). Chattopadhyay (2011) reached a similar conclusion, and further quantitative analysis proved that a lack of inclusion or even exclusion from the banking system results in a loss of 1 percent of GDP. Demirguc-Kunt and Klapper (2012) noted in the World Bank report that financial inclusion gives those living in poverty access to saving and borrowing so that they can accumulate assets and establish personal credit for a more secure future. Wang and Lu (2012) believed that the development of financial inclusion will help optimize the allocation of financial resources, improve the financing conditions of SMEs, promote financial stability and raise overall profitability. The research of Xie et al. (2018) based on the PKU-DFIIC (Stage I, 2011-2015) found that digital finance in China has significantly promoted innovation and entrepreneurship, and similar findings have been presented in other studies, such as Zhang et al. (2018). On the other hand, some studies have found that there are still some shortcomings in financial inclusion development in China (Guo and Ding, 2015).

In theory, financial inclusion is a multidimensional concept. The measurement of financial inclusion involves multiple indicators from different dimensions. Therefore, it is important to construct a scientific indicator system for financial inclusion (Zeng *et al*., 2014). After the 2008 financial crisis, the concept of financial inclusion attracted extensive attention around the world, and a number of countries, including the UK, India and Kenya, as well as institutions including the World Bank, started to research how to better understand financial inclusion and improve its development in each country. For example, the indicator system of financial inclusion proposed by the Association of Financial Inclusion (AFI) consists of two dimensions, financial

availability and the use of formal financial services, and a total of five indicators. Among them, for the availability indicators, AFI's system obtains most data from financial institutions, while the indicators for use are mainly based on surveys of the demand side or from financial institutions. The indicator system of financial inclusion established by the Global Partnership for Financial Inclusion (GPFI) at the G20 Summit in St. Petersburg, Russia, in 2013 consists of three dimensions—availability, usage and financial services—and a total of 19 indicators (GPFI, 2013). Compared with the systems above, the Global Financial Inclusion Database (also known as Global Findex, hereinafter referred to as the Findex database), colaunched by the World Bank and the Bill & Melinda Gates Foundation in 2012, is a database of financial inclusion indicators that are comparable across countries and offers ongoing monitoring. It offers high convenience for research on financial inclusion (Demirguc-Kunt and Klapper, 2012). The Findex database stands out in terms of the dimensions included and its abundant data. For statistical thinking, the Findex indicators are more focused on the actual use of financial services by users rather than simply analyzing financial coverage from the perspective of financial suppliers. For indicator design, the indicators are divided into four categories—account penetration, savings behavior, borrowing behavior, and insurance behavior—and then decomposed into a number of dimensions based on the characteristics of groups, such as gender, age, education, income, urban and rural areas. Regarding data source, Findex obtains data from sample surveys administered by third-party organizations to 150,000 adults around the world, which means that the data are relatively objective and unlikely to be affected by administrative data. In China, to meet the requirements for financial inclusion achievements proposed by documents such as State Council's *Plan for Advancing Financial Inclusion Development (2016-2020) and the G20 High Level Principles for Digital Financial Inclusion* adopted at the 2016 G20 Hangzhou Summit, at the end of 2016, the People's Bank of China (PBOC) established the China Indicator System of Financial Inclusion. For the time being, the System includes three dimensions: usage, availability, and quality, 21 categories and 51 indicators (Financial Consumer Rights Protection Bureau under PBOC, 2018).

Multidimensional indicators contain the information useful for measuring financial inclusion. The use of only a single indicator or only indicators in one specific dimension may lead to a biased interpretation of the status quo for financial inclusion. Therefore, many institutions and scholars have invested high effort and attempted to prepare financial inclusion indexes, hoping to measure financial inclusion in a holistic manner with as many indicators and comprehensive methods as possible. For example, the Indian economist Sarma (2012) drew on the United Nations Human Development Index (HDI), selected banking penetration, availability of banking services and usage of the banking system as the main indicators, and applied a linear efficacy function and Euclidean metric to measure the development of financial inclusion in different countries. Chinese researchers have also researched the compilation of financial inclusion indexes. Wang et al. (2011) measured China's financial exclusion with the 2008 data and found that among the 31 provinces in China, 3 provinces had low financial exclusion, 17 suffered severe financial exclusion, and the remaining 11 were subject to moderate financial exclusion. Wu and Xiao (2014) utilized the indicators released by the World Bank and the International Monetary Fund and a modified exponential efficacy function model to develop and analyze the financial inclusion indexes of 133 economies in the world. Jiao et al. (2015) established an indicator system of financial inclusion including three dimensions—the availability, usage and quality of financial services—and 19 indicators and applied an analytic hierarchy process (AHP) to determine the indicator weights. After collecting data at the provincial level, they calculated the financial inclusion indexes of provinces in China in 2013. Chen et al. (2015) calculated the provincial financial inclusion index from 2004 to 2013 and found a slight downward trend in China's financial inclusion.

Considering above preliminary analysis of related studies at home and abroad, largely due to limits to the availability of data, the existing research presents the following gaps. First, the financial services captured by most of the relevant studies are not diverse; they mainly focus on banking services (such as Chen *et al*., 2015) and fail to reflect the contribution of other types of financial institutions to financial inclusion. In comparison, although Jiao *et al*. (2015) include some nonbank financial

services, their coverage of innovative digital finance is still insufficient. Second, the dimensions proposed by existing indicator systems are not sufficiently comprehensive and usually fail to consider service convenience and cost. In this period of innovative digital finance, digital and mobile financial services have greatly improved the accessibility of financial services and effectively reduced their cost. At the G20 Summit held in Hangzhou, China, in September 2016, the G20 High Level Principles for Digital Financial Inclusion were formally adopted. The unique role that digital finance can play in promoting financial inclusion has been recognized by many in the industry. However, due to limited data, these increasingly important new digital financial services are still often absent from current financial inclusion indexes. When researchers do notice financial inclusion services beyond traditional financial institutions, the attention given them remains insufficient, leading to the low proportion of digital finance indicators in the indicator systems for financial inclusion as a whole (Financial Consumer Rights Protection Bureau under PBOC, 2018). For service types, financial inclusion should include not only bank-related financial services but also online investment and wealth management, online loans, Internet insurance, big data credit investigation, and other financial services. Given the shortcomings of existing research, we compiled digital financial inclusion indexes with a focus on the measurement of digital financial inclusion from the perspective of innovative digital finance to supplement to the existing indicator systems and index calculations that focus on traditional finance. Furthermore, in terms of the dimensions covered by the indicator system, financial inclusion should capture financial services' breadth of reach, depth of utilization and the extent to which customers are truly benefited and helped. Therefore, we set three dimensions—the coverage breadth of digital finance, the use depth of digital finance, and the digitization level of financial inclusion—as the foundation to compile digital financial inclusion indexes, and each of the three dimensions contains multiple indicators. Ultimately, regarding the integration of indexes at different levels and in different dimensions, the required weight setting should have a certain scientific basis and be adaptable to adjustments and changes.

In recent years, due to the rapid development of communication technology and

e-commerce and the tolerance of regulators, China's digital finance has experienced rapid development (Li, 2014). According to the Internet Finance Development Index compiled by the Institute of Digital Finance at Peking University, from January 2014 to December 2015, the Internet Finance Development Index grew by 3.8 times, almost doubling every year (Guo *et al*., 2016). The development of digital finance in China has attracted worldwide attention and high anticipation. Some scholars have defined Internet finance as a third financing model in addition to direct financing and indirect financing (Xie and Zou, 2012). Innovative digital finance eliminates the dependence on physical outlets that generally accompanies traditional finance, together with advantages including higher geographical penetration and low cost. Attention has also focused on the significance of digital finance for achieving financial inclusion. For example, the rapid development of mobile Internet has created conditions for improving financial inclusion services in underdeveloped regions (Jiao, 2014), and digital currency plays an essential role in increasing financial service coverage and penetration, reducing the cost and improving the quality of financial services. (Jiao et al., 2015) In fact, the digital financial inclusion brought by digital finance has penetrated every aspect of our lives (Chen, 2016). The practice of digital financial inclusion in China and corresponding experiences in serving the real economy are also presented in books and papers written by researchers (2017, 2018a, 2018b).

3. Indicator System of Digital Financial Inclusion

3.1 Principles of indicator design

i. Take both breadth and depth into account

An indicator system of financial inclusion should be a comprehensive summary of its meanings and characteristics. Each indicator and dimension covered by the system should capture one perspective and altogether, they should reflect financial inclusion as a whole . Therefore, compilation of the digital financial inclusion index should start by constructing a indicator system and ensure that all the dimensions and indicators work together, offer organic integrity, and reflect the substance and features of financial inclusion comprehensively, scientifically and accurately.

ii. Reflect the balance of financial inclusion services

Financial inclusion aims to establish a financial system that effectively and comprehensively serves all social classes and groups, provides opportunities and rights so that disadvantaged groups can enjoy modern financial services on an equal basis, and allows groups subject to involuntary financial exclusion to have fair and timely access to financial services and share the achievements of financial development. Therefore, an indicator system of digital financial inclusion should be designed to reflect the role of developing digital financial inclusion in mitigating the imbalance and unfairness of financial services, and an indicator of financial poverty alleviation should be set.

iii. Consider both vertical and horizontal comparability

Financial development varies across time and region. Hence, the ideal financial inclusion index should be comparable both horizontally (across regions) and vertically (across time). As a dynamic process, the development of financial inclusion is constantly changing with the development of economic society and financial systems. The financial inclusion status of the same region will change from year to year, while different regions may deliver different financial inclusion performances in the same

year due to gaps in their natural endowment, economic development and structure, policy and institutions. Therefore, the design and construction of the digital financial inclusion index must ensure vertical comparability across years and horizontal comparability across regions.

iv. Reflect the multilevel and diversity of financial services

Most of the existing research on financial inclusion is conducted from the perspective of traditional banking. However, as financial services continue to innovate and evolve, they present the characteristics of a multilevel nature and diversity. Consequently, a holistic depiction of digital financial inclusion requires that an indicator system include not only banking services (mainly credit) but also payment, investment, insurance, monetary funds, and credit investigation, among other services.

v. Emphasize Internet technology

With the constant development and innovation of Internet technology, new digital financial products represented by Yu'ebao offer a wide variety of financial services, such as payment, credit, insurance, investment, monetary funds and credit investigation. These new digital financial services have greatly lowered the threshold to access financial services and allowed groups previously subject to involuntary financial exclusion to have fair and timely access to financial services and share in the achievements of financial development, highlighting the inclusivity of Internet finance.

vi. Ensure data continuity and method integrity

The data used to calculate the financial inclusion index must come from reliable and accurate sources. In addition to the authority, accuracy and continuity of data, calculation methods must follow the basic principles of mathematics, statistics, economics, and other disciplines to ensure the relative objectivity of evaluation results.

To reflect the latest developments in digital finance, in the Stage II index (2016-2018) update, the Research Group adjusted some indicators. The level of digital support services is renamed the level of digitization, and the composition of its subindex is enriched: credit, used to measure the development of credit consumption scenarios and "credit as deposit" scenarios; convenience, used to measure the

application of offline merchant acquisition (which is currently mainly in the form of QR code payment). For the investment service, the corresponding indicators remain unchanged. However, Ant Financial made a major service adjustment: in 2015 and before, service was mainly based on products such as Zhaocaibao that were similar to fixed-income wealth management products, featuring low returns but a large principal amount; currently, Ant Fortune serves more users, and thus the investment amount of a single user may have declined significantly. Therefore, considering the index construction mechanism, the investment service index of some regions has declined, and data users are advised to notice the causes.

3.2 Indicators of digital financial inclusion

In accordance with the principles proposed above, including comprehensiveness, balance, comparability, continuity and feasibility, the indicator system of digital financial inclusion in this report adopts the following design aim: based on the traditional financial inclusion indexes proposed by existing literature and international organizations, considering the features of traditional and Internet financial services, in combination with the availability and reliability of data, to build an indicator system of digital financial inclusion considering three dimensions of financial services—breadth of coverage, depth of use and level of digitization. More precisely, on the basis of 26 specific indicators in Stage I (2011-2015), the current indicator system of digital financial inclusion has been expanded to contain a total of 33 specific indicators to reflect the development of digital financial inclusion in a more objective and comprehensive manner.

Regarding the breadth of digital financial coverage, the accessibility of traditional financial institutions is shown in the “number of outlets” and “number of service personnel”. By contrast, under the model of Internet-based new finance, because the Internet has no location restrictions by nature, the reach of Internet financial services is reflected by the number of e-accounts, etc. (such as Internet payment accounts and the bank accounts they are bound to).

In terms of the depth of digital finance usage, this report measures the actual use of Internet financial services, which are classified into payment services, monetary

fund services, credit services, insurance services, investment services and credit investigation services. The concept of usage is also broken down into the number of actual users, the number of transactions per capita and the average transaction amount per capita .

Regarding the level of digitization, convenience and cost are the main factors affecting the use of digital financial services, which truly reflects their low cost and low threshold. The more convenient (such as high mobility) and less expensive (such as low loan interest rates) digital financial services are, the higher the demand will be, while less convenience and greater expense decreases demand.

In conclusion, the index system of digital financial inclusion is shown in Figure 1, and the specific indicators are shown in Table 2.

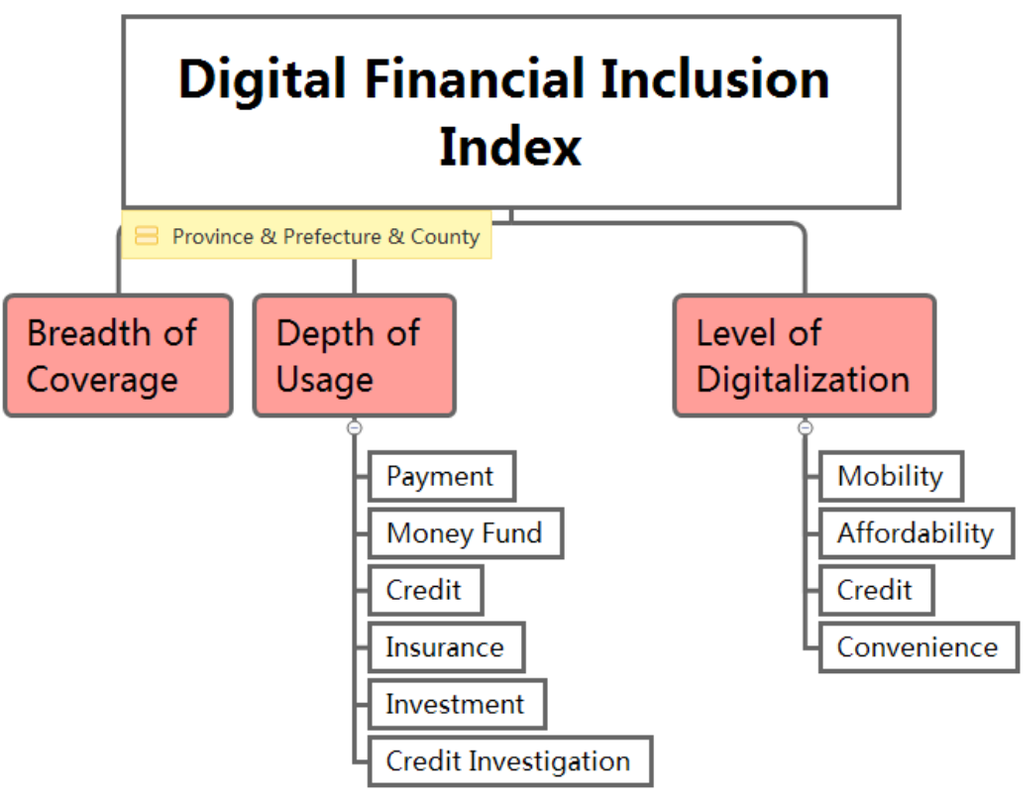

Figure 1: The Index System of Digital Financial Inclusion

Table 2: Indicators for Digital Financial Inclusion

Level 1 Dimension	Level 2 Dimension		Indicator
Breadth of Coverage	Account coverage rate		Number of Alipay accounts owned by per 10,000 people
			Proportion of Alipay users who have bank cards bound to their Alipay accounts
			Average number of bank cards bound to each Alipay account
Depth of Usage	Payment		Number of payments per capita
			Amount of payments per capita
			Proportion of number of high frequency active users (50 times or more each year) to number of users with frequency of once or more each year
	Money Funds		Number of Yu'ebao purchases per capita
			Amount of Yu'ebao purchases per capita
			Number of people who have purchased Yu'ebao per 10,000 Alipay users
	Credit	Individual User	Number of users with an Internet loan for consumption per 10,000 adult Alipay users
			Number of loans per capita
			Total Amount of loan per capita
		Small & Micro Business	Number of users with an Internet loan for small & micro businesses per 10,000 adult Alipay users
			Number of loans per small & micro business
			Average amount of loan among small & micro businesses
	Insurance		Number of insured users per 10,000 Alipay users
			Number of insurance policies per capita
			Average insurance amount per capita
	Investment		Number of people engaged in Internet investment and money management Per 10,000 Alipay users
			Number of investments per capita
			Average investment amount per capita
	Credit Investigation		Number of credit investigations by natural persons per capita
			Number of users with access to credit-based livelihood services (including finance, accommodation, mobility, social contact, etc.) per 10,000 Alipay users

Level of Digitalization	Mobility	Proportion of number of mobile payments
		Proportion of total amount of mobile payments
	Affordability	Average loan interest rate for small & micro businesses
		Average loan interest rate for individuals
	Credit	Proportion of number of Ant Check Later payments
		Proportion of total amount Ant Check Later payment
		Proportion of number of "Zhima Credit as deposit" cases (to number of full-deposit cases)
		Proportion of total amount of "Zhima Credit as deposit" (to amount of full-deposit)
	Convenience	Proportion of number of QR code payments by users
		Proportion of As above, please clarify with "Average amount" or "total amount".of QR code payment by users

4. Index Calculation Methodology

4.1 Nondimensionalization

In this section, we discuss how we consolidate the above 33 indicators of digital financial inclusion into a single digital financial inclusion index. For a comprehensive evaluation system with multiple indicators, it is necessary to nondimensionalize the indicators with different properties and units to facilitate the consolidation of specific indicators describing varied aspects of digital financial inclusion into a comprehensive index that reflects digital financial inclusion as a whole. Nondimensionalization is the removal of units from indicators so that they can be directly consolidated. To select a nondimensionalization function, the general principle is that it be strict monotonic have a clear value range, intuitive results, definite meaning, and little influence from the positive or negative forms of indicators.

In this regard, the existing literature has generally adopted efficacy functions. For a comprehensive evaluation system with multiple indicators, there are many common efficacy functions, such as linear efficacy functions (also called traditional efficacy function), exponential efficacy functions, logarithmic efficacy functions, power-function-type efficacy functions, etc., that vary in terms of form (Peng et al., 2007). At present in academic circles, the nondimensionalization of financial inclusion indicators mainly includes two methods: the linear efficacy function method and the exponential efficacy function method. Sarma (2012) made improvements to the HDI used by the United Nations Development Programme to compute a financial inclusion index. Jiao et al. (2015) nondimensionalized indicators with the linear efficacy function. Considering the shortcomings of the linear efficacy function, Wu and Xiao (2014) chose the exponential efficacy function to calculate a financial inclusion index. In this report, we have taken into account the rapid expansion of digital finance. To mitigate the impact of extreme values, avoid the excessive growth of indicators and maintain their stability, we adopted the logarithmic efficacy function method, which can effectively avoid the excessive growth of indicators brought about by rapid service

growth. Specifically, the formula of the logarithmic efficacy function is as follows:

$$d = \frac{\log x - \log x^{l}}{\log x^{h} - \log x^{l}} \times 100$$

The function has the following characteristics:

a) Monotonic

$$d' = \frac{1}{x \log \frac{x^{h}}{x^{l}}}$$

For positive indicators, $x^{h} / x^{l} > 1$, $d' > 0$, d is the monotonic increasing function about x ; for negative indicators, $x^{h} / x^{l} < 1$, $d' < 0$, d is the monotonic decreasing function about x .

b) Convexity

$$d'' = \frac{-1}{x^{2} \log \frac{x^{h}}{x^{l}}}$$

For positive indicators, $x^{h} / x^{l} > 1$, $d'' < 0$, d is the convex upward function of x ; for negative indicators, $x^{h} / x^{l} < 1$, $d'' > 0$, d is the convex downward function of x .

Regarding the determination of threshold value in the logarithmic efficacy function formula, if the maximum and minimum values of each indicator in different years are taken as upper and lower limits, when the maximum or minimum value is an extreme or abnormal value, the exponential value is very likely to be distorted, resulting in abnormality of the regional indicator. In addition, if the upper and lower limits of each indicator are set on an annual basis, it will lead to changes in the benchmarks of the indicator among regions in different years, resulting in vertical incomparability. Therefore, to ensure both horizontal and vertical comparability when measuring the development of digital financial inclusion in various regions in the future, we processed values as follows:

a) For positive indicators, take the 95% quantile of the actual indicator value in each region in 2011 as the upper limit x^{h} , and the 5% quantile as the lower limit x^{l} ;

b) For negative indicators, take the 5% quantile of the actual indicator value in each region in 2011 as the upper limit x^h and the 95% quantile as the lower limit x^l.

Furthermore, to smooth the indicator and avoid the occurrence of extreme values caused by various reasons, it is necessary to winsorize the values beyond the limits. For example, when the indicator value of the base year (2011) in a certain region is higher than the upper limit of indicator x^h, the indicator value of 2011 in the region will be set as the upper limit x^h. When the indicator value of 2011 in a certain region is lower than the lower limit of indicator x^l, the indicator value of 2011 in the region will be set as the lower limit x^l.

In this way, for the compilation of the digital financial inclusion index, each administrative region in 2011 (for county-level regions, 2014 is the benchmark year) is given an efficacy score between 0 and 100 corresponding to each indicator. The higher the score is, the higher the level of development. For data for years after 2011, the efficacy scores of the indicator may be less than 0 or more than 100, thereby reflecting a decrease or increase in the indicator value from 2011: an increase in score indicates growth, while a decrease in score indicates a drop in the financial inclusion index.

4.2 Analytic hierarchy process

For multi-indicator comprehensive evaluation, weights directly affect the results. There are many ways to determine weights. Basedon the different sources of raw data, they can be roughly divided into two categories: subjective weighting and objective weighting. Subjective weighting methods obtain results from the subjective judgments of experts, such as the Delphi method, AHP, etc., and are thus less objective. Objective weighting obtains results based on the numerical calculation of indicators. Free from the subjective judgment of human beings, they are more objective but cannot reflect the subjective requirements of decision makers. Representatives of objective weighting include principal component analysis, variance weighting, and the coefficient of variation.

Subjective weighting and objective weighting each have pros and cons. This report has combined both to determine weights, that is, the coefficient of variation weighting method and the AHP method. First, when calculating the weights of a specific indicator

on the upper rule hierarchy, we used the coefficient of variation; then, we applied AHP to calculate the weights of the indicator of rule hierarchy on the upper hierarchy targets and finally, we obtained the total index.

i. The analytic hierarchy process determines the weights of the middle hierarchy

AHP is a comprehensive evaluation method for system analysis and decision making that can quantify qualitative problems in a relatively rational manner. The main feature of AHP is that by building a hierarchical structure, judgments are converted into an importance comparison between two factors, thereby transforming a qualitative decision into a quantitative decision that is easier to handle. Its essence is a way of thinking that decomposes complex problems into multiple components and then builds these components into a hierarchical structure according to their subordination relationships. Through pairwise comparison, an overall ranking of decision-making schemes according to relative importance is obtained.

The basic principle of AHP is to decompose the factors related to the overall evaluation target into three hierarchies: the target hierarchy, the rule hierarchy, and the evaluation index hierarchy. In a constructed AHP model, a decision matrix is formed through investigation and judgment. When the decision matrix passes the consistency check, the weight of each indicator can be calculated; if the consistency check fails, the element values of the decision matrix need adjustment until it passes the consistency check. Specifically, the AHP calculation process is as follows:

Step 1: establish the hierarchical model. For the in-depth analysis on digital financial inclusion, subdivide the factors into several hierarchies according to their subordination relationship. The top is the target hierarchy, the middle is the rule hierarchy, and the specific indicators are at the bottom. The hierarchical model for this index is shown in Figure 1 above.

Step 2: build the decision matrix. According to the indicator system of digital financial inclusion constructed in this report, there are three decision matrixes: “Digital Financial Inclusion System” decision matrix, “Depth of Usage” decision matrix, and “Level of Digitalization” decision matrix.

To compare the influence of n factors $c_1, c_2 \ldots c_n$ on the factor O in the upper hierarchy, the relative importance of two factors to the factor in the upper hierarchy are compared. The relative importance is usually expressed in values of 1-9, as the weight given to each factor constitutes a decision matrix (as shown in Table 3). c_{ij} indicates the ratio of influence of c_i on c_j on O. All comparison results constitute a "pairwise comparison matrix", also called a "reciprocal matrix".

$$C = \begin{pmatrix} c_{11} & c_{12} & \cdots & c_{1n} \\ c_{21} & c_{22} & \cdots & c_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ c_{n1} & c_{n2} & \cdots & c_{nn} \end{pmatrix}$$

$$C = \left(c_{ij}\right)_{n \times n},\ c_{ij} > 0,\ c_{ji} = \frac{1}{c_{ij}},\ c_{ii} = 1$$

If the reciprocal matrix C satisfies $c_{ij} \times c_{jk} = c_{ik}$, then C is called the consistency matrix.

Table 3: Scale Meanings of Decision Matrix

Scale c_{ij}	Definition	Meaning
1	Equally important	The impact of c_i is the same as that of c_j
3	Slightly more important	The impact of c_i is slightly stronger than that of c_j
5	Relatively more important	The impact of c_i is stronger than that of c_j
7	More important	The impact of c_i is obviously stronger than that of c_j
9	Extremely more important	The impact of c_i is absolutely stronger than that of c_j
2, 4, 6, 8	Middle value of two adjacent scales	The impact ratio of c_i to c_j is between two adjacent scales
1/2……1/9	Comparing c_i with c_j, the unimportance of c_j	The impact ratio of c_i to c_j is the reciprocal of the α_{ij} above

For the three dimensions under the “digital financial inclusion system”, we believe that the breadth of digital financial inclusion coverage is a prerequisite, the depth of usage represents actual use, and the level of digitization can be regarded as a potential condition. The first two embody "inclusion", while the last reflects “affordability”. According to the relative importance of the three, we constructed a decision matrix, as shown in Table 4.

Table 4: Decision Matrix of Digital Financial Inclusion System

	Breadth of Coverage	Depth of Usage	Level of Digitalization
Breadth of Coverage	1	2	3
Depth of Usage	1/2	1	2
Level of Digitalization	1/3	1/2	1

Regarding the six dimensions of financial services under “depth of usage”, we selected the “threshold” (complexity and risk) and “popularity” of financial services as criteria. The higher the popularity, or the lower the threshold, the lower weight a service has, and vice versa. In this way, we obtained the following decision matrix:

Table 5: Decision Matrix of Depth of Usage

	Payment	Monetary fund	Credit investigation	Insurance	Investment	Credit
Payment	1	1/2	1/3	1/4	1/5	1/6
Monetary fund	2	1	1/2	1/3	1/4	1/5
Credit investigation	3	2	1	1/2	1/3	1/4
Insurance	4	3	2	1	1/2	1/3
Investment	5	4	3	2	1	1/2
Credit	6	5	4	3	2	1

For the four dimensions of financial services under the “level of digitalization”, the impact on real life and service maturity were chosen as criteria. The less mature a service or the less impact it has on real life, the lower weight that service will have, and vice versa. In this way, we obtain the decision matrix as follows:

Table 6: Decision Matrix of Level of Digitalization

	Credit	Convenience	Affordability	Mobility
Credit	1	1/2	1/3	1/4
Convenience	2	1	1/2	1/3
Affordability	3	2	1	1/2
Mobility	4	3	2	1

Step 3: calculate the maximum eigenvalue of the decision matrix and its eigenvector. The process of determining the weight of each indicator with a decision matrix actually aims to obtain the eigenvector of the decision matrix. By solving for the maximum eigenvalue of the reciprocal matrix, the corresponding eigenvector can be obtained and then normalized to be the weight vector.

$$CW = \lambda_{max} W$$

Step 4: conduct a consistency check. First, calculate the consistency indicator CI of the n × n decision matrix:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Second, calculate the average random consistency indicator RI. 1) Randomly select numbers from 1-9 and their reciprocals to form a n × n reciprocal matrix and calculate its maximum eigenvalue; 2) Repeat 1,000 times to obtain the maximum eigenvalues of 1,000 random reciprocal matrixes and calculate the mean value of the 1,000 max eigenvalues k ; 3) Obtain the average random consistency indicator.

$$RI = \frac{k - n}{n - 1}$$

Finally, calculate the consistency ratio CR and check consistency.

$$CR = \frac{CI}{RI}$$

When CR<0.1, the inconsistency degree of matrix A is generally considered to be within the tolerance range, and its eigenvector can be used as a weight vector. Otherwise, the decision matrix needs to be modified until CR<0.1.

Step 5: calculate weight vector. By normalizing the eigenvector corresponding to the maximum eigenvalue of the decision matrix that has passed the consistency check, the weight of the factor on the factors of the upper hierarchy can be obtained. The weight vectors corresponding to the three decision matrixes are shown in Table 7, Table 8, and Table 9.

It should be noted that the weights of "affordability" and "mobility" under the level of digitization receive manually intervention and are reallocated to maintain the same weight ratio of 1:2 as in Stage I (2011-2015) to ensure the continuity of the Index.

Table 7: Weight Vectors of Three Dimensions under Digital Financial Inclusion System

Dimension	Breadth of Coverage	Depth of Usage	Level of Digitalization
Weight	54.0%	29.7%	16.3%

Table 8: Weight Vectors of Six Service Dimensions under Depth of Usage

Dimension	Payment	Monetary fund	Credit investigation	Insurance	Investment	Credit
Weight	4.3%	6.4%	10.0%	16.0%	25.0%	38.3%

Table 9: Weight Vectors of Four Service Dimensions under Level of Digitalization

Dimension	Credit	Convenience	Adorability	Mobility
Weight	9.5%	16.0%	24.8%	49.7%

ii. The coefficient of variation determines the weight of a specific indicator

Upon determining the weight of the indicator of the middle hierarchy on its upper hierarchy as shown above, the coefficient of variation method was utilized to obtain the weight of each specific indicator of the bottom hierarchy on its upper hierarchy. The basic idea of the method is to weight each indicator based on its degree of variation in observed values. Specifically, if the coefficient of variation of an indicator is large, it means that the indicator has greater explanatory power when measuring the overall difference in the assessment target, and such indicator should be given a greater

weight. The specific process of determining indicator weight by the coefficient of variation method is as follows:

First, calculate the coefficient of variation of each indicator, which indicates the absolute degree of variation of each indicator:

$$CV_i = \frac{S_i}{\bar{x}_i}, i = 1,2,3,\ldots,n$$

where S_i is the standard deviation of each indicator and $\bar{x}_i$ is the mean value of each indicator. Then, normalize the coefficient of variation of each indicator to obtain the weight of each index:

$$q_i = \frac{CV_i}{\sum_{i=1}^{n} CV_i}, \quad i = 1,2,3,\ldots n$$

4.3 Index synthesis

In multi-indicator comprehensive evaluation, synthesis refers to the integration of the evaluation values of different indicators for different aspects of a subject through a certain formula to produce a holistic evaluation. There are a number of mathematical methods applicable to synthesis. Common synthesis models are weighted arithmetic mean, weighted geometric mean, or their combination. These three have different features and applicable occasions but no absolute difference in terms of their advantages or disadvantages. Therefore, to select an appropriate synthesis model, it is necessary to analyze the mathematical properties and characteristics of models according to the features and data properties of the subject to be evaluated.

After comprehensively comparing the three methods, we chose the weighted arithmetic mean. The main basis for determination is as follows: when calculating the score of each indicator through the logarithmic efficacy function, the comparison benchmark of each year is the upper and lower limits of the corresponding indicator in 2011, so the score upon nondimensionalization is likely to be 0 or negative. To avoid a situation in which the final weighted indicator is 0, it is most appropriate to apply the weighted arithmetic mean. The formula is as follows:

$$d = \sum_{i=1}^{n} w_i d_i$$

where d is the overall index, w_i is the normalized weight of each evaluation indicator, d_i is the evaluation score of a single indicator, and n is the number of evaluation indicators.

Specifically, synthesis follows a bottom-up layer-by-layer sequence. First, calculate the indicators on each hierarchy and then weigh and consolidate the indicators to obtain the overall index. When calculating the "depth of usage" index, since the six financial services have different start times, it is necessary to include them in the index by the time sequence. To ensure index stability, we used weighting normalization to ensure that the relative weights between services are consistent. For example, in 2012, there were only three services: payment, credit and insurance; then, the weights of the three were as follows:

Weight of Payment =4%/(4%+16%+38%)=7.3%

Weight of Insurance =16%/(4%+16%+38%)=27.3%

Weight of Credit =38%/(4%+16%+38%)=65.4%

In 2013, when Internet monetary funds (such as Yu'ebao) appear, we normalize the weights of four services: payment, credit, insurance and monetary fund. The same rule applies to the remaining services as they emerge. The following indicator system can be separately calculated by the layer-by-layer weighted arithmetic mean synthesis model. See the hierarchies in Figure 1 above.

It is worth noting that since Internet finance is a new technology and a new service, it generally expands from developed regions to underdeveloped ones. Differences between provinces or cities are relatively small, but at the county level, the gap may be large due to factors such as magnitude. To avoid distortion caused by excessive differences in county-level indexes, we made the following adjustment: for the compilation of the digital financial inclusion index at provincial and prefecture levels, data in 2011 and thereafter have been collected, while at the county level, the indicator system of digital financial inclusion is based on the data collected since 2014 and covers the counties where corresponding services have existed for at least two years since 2014.

5. Main Features of the Digital Financial Inclusion Index

Using the index preparation methods discussed above, we obtained the digital financial inclusion index for three levels of regions[①], i.e., 31 provinces (municipalities, autonomous regions, collectively referred to as "provinces"), 337 cities above the prefecture level (regions, autonomous prefectures, leagues, etc., collectively referred to as "cities"), and nearly 2,800 counties (county-level cities, banners, municipal districts, etc., collectively referred to as "counties"). The time span of the indexes at the provincial and prefectural levels is 2011-2018 and that of county-level indexes is 2014-2018. In addition to the overall index, we also compiled indexes describing the coverage breadth, use depth and digitization level of digital financial inclusion, as well as subindexes for payments, insurance, monetary funds, credit investigation, investment, credit, and more. The digital financial inclusion indexes of 31 provinces from 2011 to 2018 are shown in Table 10. This section provides an overview of some basic features of the digital financial inclusion index.

① The county-level indexes for 2014-2015 cover only counties and county-level cities, not municipal districts; the county-level indexes for 2016-2018 cover municipal districts.

Table 10: Provincial Digital Financial Inclusion Indexes 2011-2018

Province	2011	2012	2013	2014	2015	2016	2017	2018
Beijing	79.41	150.65	215.62	235.36	276.38	286.37	329.94	368.54
Tianjin	60.58	122.96	175.26	200.16	237.53	245.84	284.03	316.88
Hebei	32.42	89.32	144.98	160.76	199.53	214.36	258.17	282.77
Shanxi	33.41	92.98	144.22	167.66	206.3	224.81	259.95	283.65
Inner Mongolia	28.89	91.68	146.59	172.56	214.55	229.93	258.50	271.57
Liaoning	43.29	103.53	160.07	187.61	226.4	231.41	267.18	290.95
Jilin	24.51	87.23	138.36	165.62	208.2	217.07	254.76	276.08
Heilongjiang	33.58	87.91	141.4	167.8	209.93	221.89	256.78	274.73
Shanghai	80.19	150.77	222.14	239.53	278.11	282.22	336.65	377.73
Jiangsu	62.08	122.03	180.98	204.16	244.01	253.75	297.69	334.02
Zhejiang	77.39	146.35	205.77	224.45	264.85	268.10	318.05	357.45
Anhui	33.07	96.63	150.83	180.59	211.28	228.78	271.60	303.83
Fujian	61.76	123.21	183.1	202.59	245.21	252.67	299.28	334.44
Jiangxi	29.74	91.93	146.13	175.69	208.35	223.76	267.17	296.23
Shandong	38.55	100.35	159.3	181.88	220.66	232.57	272.06	301.13
Henan	28.4	83.68	142.08	166.65	205.34	223.12	266.92	295.76
Hubei	39.82	101.42	164.76	190.14	226.75	239.86	285.28	319.48
Hunan	32.68	93.71	147.71	167.27	206.38	217.69	261.12	286.81
Guangdong	69.48	127.06	184.78	201.53	240.95	248.00	296.17	331.92
Guangxi	33.89	89.35	141.46	166.12	207.23	223.32	261.94	289.25
Hainan	45.56	102.94	158.26	179.62	230.33	231.56	275.64	309.72
Chongqing	41.89	100.02	159.86	184.71	221.84	233.89	276.31	301.53
Sichuan	40.16	100.13	153.04	173.82	215.48	225.41	267.80	294.30
Guizhou	18.47	75.87	121.22	154.62	193.29	209.45	251.46	276.91
Yunan	24.91	84.43	137.9	164.05	203.76	217.34	256.27	285.79
Tibet	16.22	68.53	115.1	143.91	186.38	204.73	245.57	274.33
Shaanxi	40.96	98.24	148.37	178.73	216.12	229.37	266.85	295.95
Gansu	18.84	76.29	128.39	159.76	199.78	204.11	243.78	266.82
Qinghai	18.33	61.47	118.01	145.93	195.15	200.38	240.20	263.12
Ningxia	31.31	87.13	136.74	165.26	214.7	212.36	255.59	272.92
Xinjiang	20.34	82.45	143.4	163.67	205.49	208.72	248.69	271.84

Source: The PKU-DFIIC

5.1 Growth and regional differences in digital financial inclusion

i. Digital financial inclusion has stronger accessibility

Taking provincial indexes as an example, shown in Table 10 and Figure 2, the digital financial inclusion service in China saw leapfrog development from 2011 to 2018. The median of the provincial digital financial inclusion index was 33.6 in 2011, grew to 214.6 in 2015 and further rose to 294.3 in 2018. The median of the provincial digital financial inclusion index in 2018 was 8.9 times that of 2011, representing an average annual growth of 36.4%. We also observed a surge in the digital financial inclusion index in the eastern, central and western regions of China. At the prefecture level, the index rose rapidly as well, with the median of the prefecture digital financial inclusion index increasing from 46.9 in 2011 to 167.0 in 2015 and 226.6 in 2018. The median prefecture index in 2018 was 4.8 times that of 2011.

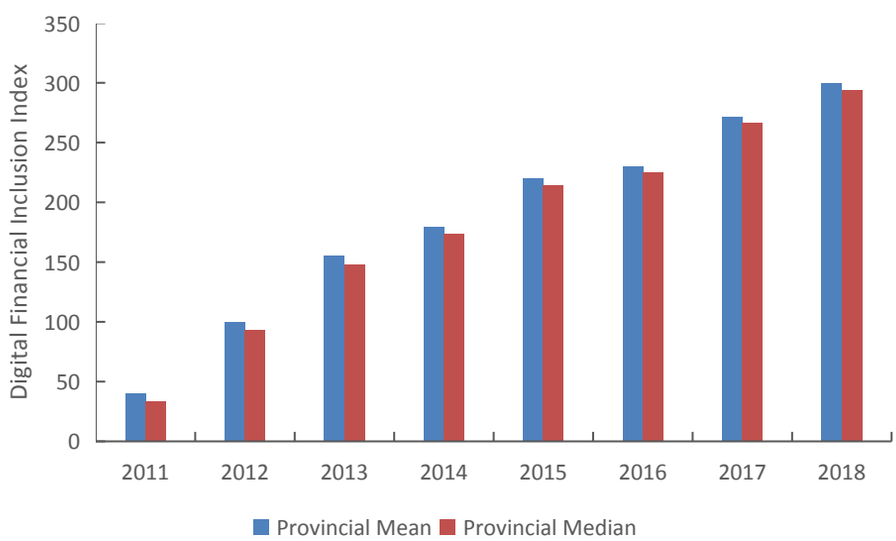

Figure 2: Provincial Mean and Median of Digital Financial Inclusion Indexes 2011-2018

Source: The PKU-DFIIC

Along with the rapid growth of digital financial inclusion, like most of China's economic characteristics, digital financial inclusion development in China displays regional differences. As shown in Figure 3, the highest digital financial inclusion index in 2018, which belonged to Shanghai, was 1.4 times that of the lowest, which was Qinghai Province. According to the traditional financial inclusion index in 2013 provided by Jiao et al. (2015), the gap between the highest and lowest index was

greater: the highest (Shanghai) was 2.8 times that of the lowest (Tibet), while the highest digital financial inclusion index in 2013 was 1.9 times that of the lowest. These results indicate that compared with traditional financial inclusion, digital financial inclusion features higher geographical penetration and has secured broader coverage.

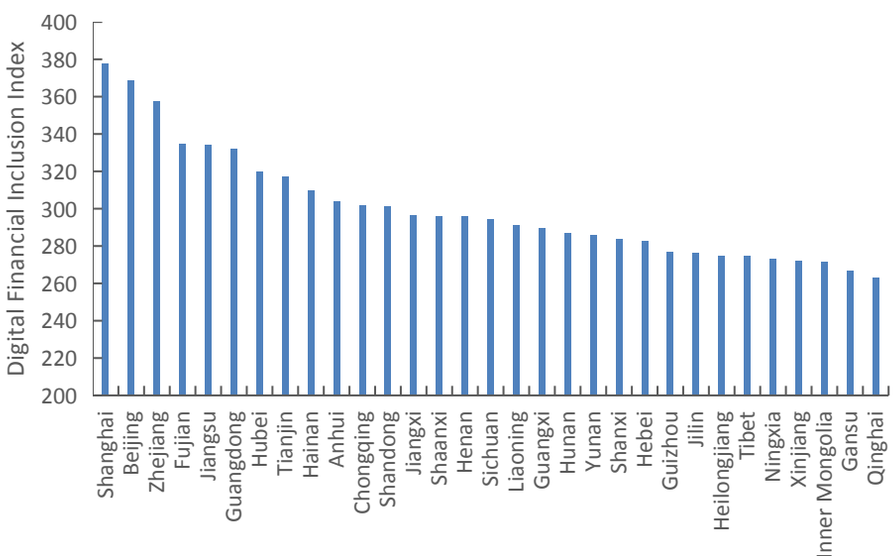

Figure 3: Digital Financial Inclusion Index by Province in 2018
Source: The PKU-DFIIC

ii. Digital financial inclusion in different dimensions presents regional differences of various degrees

If we take a look at subindexes, in Stage I (2011-2015), the dimension that grew the fastest was the level of digitalization, followed by the breadth of coverage, with the depth of usage growing the slowest. However, some changes took place during 2016-2018. Specifically, the provincial median of the usage depth of digital financial inclusion in 2018 was 1.63 times that of 2015, which is faster than the growth of coverage breadth and digitization level, which were 1.48 times and 0.97 times, respectively. In this regard, Figure 4 is another intuitive presentation. As digital financial inclusion reached a certain level in terms of coverage and digitization, the depth of usage also became a driver of index growth nationwide. However, we find that the depth of usage in 2018 has a slight downward trend compared with 2017, which is mainly due to the decline of monetary funds and investment under the influence of policy constraints and other factors, while the other depth of usage indicators are still growing.

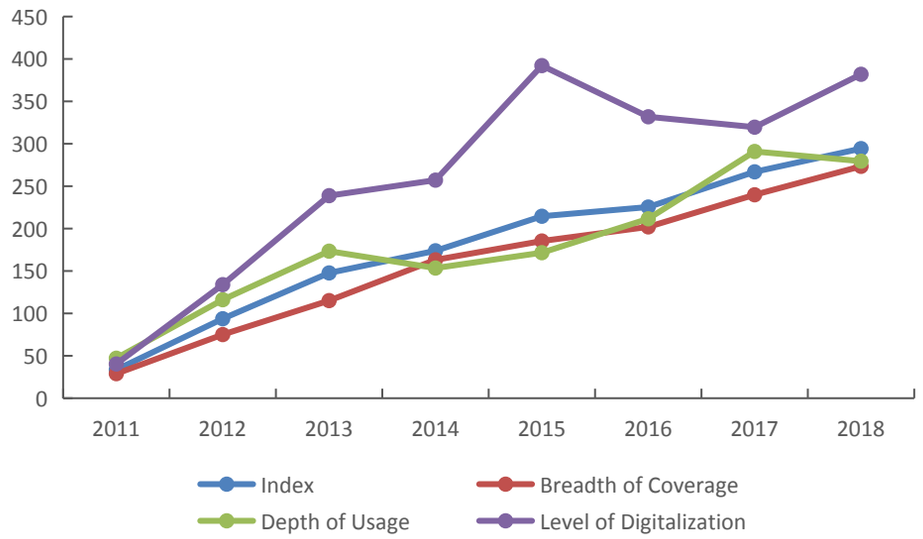

Figure 4: Provincial Median of Digital Financial Inclusion Index and Subindexes 2011-2018

Source: The PKU-DFIIC

As for the regional differences in specific subindexes, Figure 5 shows that the level of digitalization had the smallest regional difference, followed by the breadth of coverage and then the depth of usage. Concerning the three dimensions, breadth of coverage, depth of usage and level of digitalization, the ratios of the highest regional indexes to the lowest in 2018 were 1.42, 1.65 and 1.20, respectively, while the same ratios in 2011 were 50.4, 18.3 and 12.3 and in 2015 were 1.85, 2.07 and 1.21. In other words, at the preliminary stage of promoting digital financial inclusion, the index was mainly driven by breadth of coverage, i.e., covering more population, but in recent years, the depth of usage has also become a major driver of the digital financial inclusion index. In particular, we found that the index for the depth of usage still maintained large gaps among provinces during 2011-2015: at the time, our conclusion was that there was much room for undeveloped regions to catch up with counterparts in terms of their depth of usage. However, the 2018 index shows that the regional difference in usage depth was quite close to those of the other two subindexes, which is additional evidence demonstrating that digital financial inclusion is beginning to develop in depth.

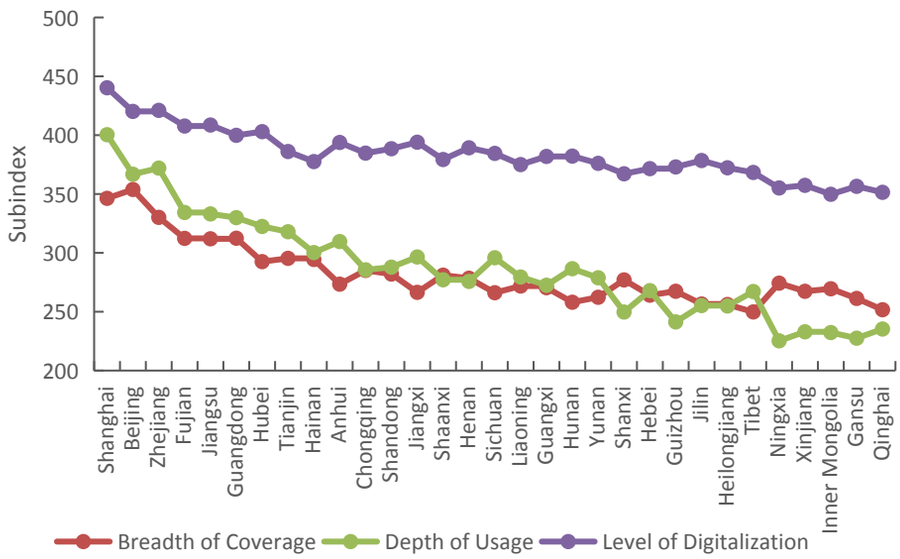

Figure 5: Subindex of Digital Financial Inclusion by Province in 2018

Source: The PKU-DFIIC

By comparing the ranking of provinces in terms of comparing their digital financial inclusion index in 2018 with that in 2015, it is found that the ranking of the top six provinces remained the same, which implies the stability of the Index. However, the remainder of the ranking shows that the speed with which digital financial inclusion develops varies greatly from region to region, as some rose by several ranks and some dropped significantly. Specifically, as shown in Table 11, the regions with obvious improvements are concentrated in Central China, such as Anhui, Jiangxi, and Henan provinces, while the regions that saw great declines are mainly located in Northeastern and Western China, such as Liaoning, Heilongjiang, Ningxia, Inner Mongolia and more. Thus, we can conclude that the convergence of digital financial inclusion nationwide is mainly driven by the rise of Central China.

Table 11: Ranking of Overall Provincial Indexes in 2018 and Changes

Province	Index in 2018	Rank in 2018	Change from 2015	Change from 2011
Shanghai	377.73	1	Unchanged	Unchanged
Beijing	368.54	2	Unchanged	Unchanged
Zhejiang	357.45	3	Unchanged	Unchanged
Fujian	334.44	4	Unchanged	Up by 2 places

Jiangsu	334.02	5	Unchanged	Unchanged
Guangdong	331.92	6	Unchanged	Down by 2 places
Hubei	319.48	7	Up by 2 places	Up by 6 places
Tianjin	316.88	8	Down by 1 place	Down by 1 place
Hainan	309.72	9	Down by 1 place	Down by 1 place
Anhui	303.83	10	Up by 7 places	Up by 8 places
Chongqing	301.53	11	Unchanged	Down by 1 place
Shandong	301.13	12	Unchanged	Up by 2 places
Jiangxi	296.23	13	Up by 6 places	Up by 9 places
Shaanxi	295.95	14	Down by 1 place	Down by 3 places
Henan	295.76	15	Up by 10 places	Up by 9 places
Sichuan	294.30	16	Down by 2 places	Down by 4 places
Liaoning	290.95	17	Down by 7 places	Down by 8 places
Guangxi	289.25	18	Up by 3 places	Down by 3 places
Hunan	286.81	19	Up by 3 places	Unchanged
Yunan	285.79	20	Up by 6 places	Up by 5 places
Shanxi	283.65	21	Up by 2 places	Down by 4 places
Hebei	282.77	22	Up by 6 places	Down by 2 places
Guizhou	276.91	23	Up by 7 places	Up by 6 places
Jilin	276.08	24	Down by 4 places	Up by 2 places
Heilongjiang	274.73	25	Down by 7 places	Down by 9 places
Tibet	274.33	26	Up by 5 places	Down by 5 places
Ningxia	272.92	27	Down by 12 places	Down by 6 places
Xinjiang	271.84	28	Down by 4 places	Down by 1 place
Inner Mongolia	271.57	29	Down by 13 places	Down by 6 places
Gansu	266.82	30	Down by 3 places	Down by 2 places
Qinghai	263.12	31	Down by 2 places	Down by 1 place

Source: The PKU-DFIIC

At the prefecture level, Table 12 shows that the top-ranking cities basically belong to the coastal provinces in the east, especially the Yangtze River Delta region, which indicates a clear sign of clustering. In terms of ranking changes, the rise of cities such as Sanya, Yangzhou, Zhenjiang, Wuhan and Nantong is prominent.

Table 12: Top 30 cities in 2018

City	Index in 2018	Rank in 2018	Change from 2015	Change from 2011
Hangzhou	302.98	1	Unchanged	Up by 1 place
Shanghai	291.44	2	Unchanged	Up by 7 places
Shenzhen	289.22	3	Up by 1 place	Unchanged
Nanjing	289.18	4	Up by 2 places	Up by 10 places
Beijing	285.41	5	Down by 1 place	Up by 5 places
Xiamen	284.91	6	Down by 2 places	Up by 6 places
Guangzhou	282.66	7	Unchanged	Down by 2 places
Suzhou	281.97	8	Up by 6 places	Up by 3 places
Wuhan	281.64	9	Up by 1 place	Up by 20 places
Changzhou	279.53	10	Up by 5 places	Up by 9 places
Zhuhai	278.25	11	Down by 2 places	Up by 10 places
Jinhua	277.19	12	Unchanged	Up by 3 places
Wuxi	276.08	13	Up by 3 places	Up by 5 places
Ningbo	274.40	14	Down by 6 places	Down by 6 places
Wenzhou	273.98	15	Down by 4 places	Down by 8 places
Zhengzhou	272.83	16	Down by11 places	Up by 19 places
Jiaxing	272.74	17	Unchanged	Down by 16 places
Fuzhou	272.67	18	Down by 5 places	Up by 6 places
Hefei	272.52	19	Up by 10 places	Up by 17 places
Huzhou	269.89	20	Up by 8 places	Up by 3 places
Sanya	269.04	21	Up by 19 places	Up by 35 places

Zhenjiang	267.95	22	Up by 15 places	Up by 12 places
Zhongshan	267.79	23	Up by 1 place	Down by 19 places
Foshan	267.49	24	Up by 8 places	Down by 18 places
Chengdu	266.77	25	Down by 6 places	Down by 12 places
Dongguan	266.35	26	Up by 8 places	Down by 6 places
Changsha	266.27	27	Down by 5 places	Down by 11 places
Nanchang	265.13	28	Up by 11 places	Up by 16 places
Nantong	264.52	29	Up by 28 places	Up by 9 places
Zhoushan	264.49	30	Unchanged	Up by 2 places

Source: The PKU-DFIIC

In Figure 6, we colored the prefectures with a relative increase (red) and those with a relative decrease (green) among the rankings of all the prefectures. Specifically, the upper part of the figure shows the change during 2011-2015, showing both increases and decreases in prefectures in different regions nationwide; the lower part shows the change during 2015-2018, showing that prefectures with an increase in ranking in recent years are mainly distributed in Eastern China, Southern China and Central China, and those with a decrease are mainly distributed in Northeast China and Southwest China; these results are consistent with the phenomenon of the rise of Central China described above and the Hu line[①] below.

[①] The Hu Line, also called Heihe-Tengchong Line, which begins at Heihe of Heilongjiang province and ends at Tengchong of Yunnan province, was proposed by Hu Huanyong, a Chinese geographer, in 1935 to describe the difference in population density between the southeast and northwest of China. The regions east of the Hu Line have plenty of population and developed economy. By contrast, the western regions are far less developed.

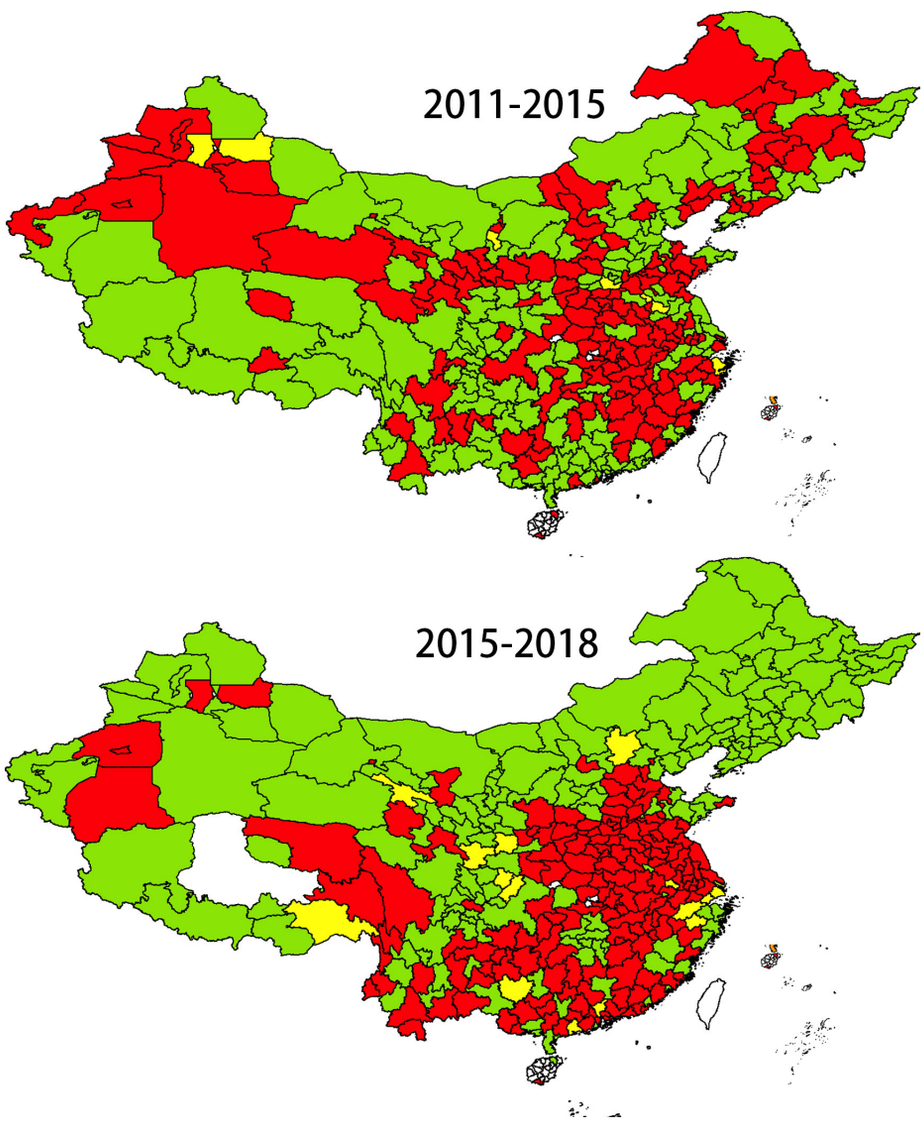

Figure 6: Prefecture-level Digital Financial Inclusion Ranking Change

Source: The PKU-DFIIC

Note: The upper part of the figure shows the change from 2011-2015 and the lower part shows 2015-2018; red indicates an increase, green, a decrease, yellow unchanged. and white indicates that relevant data are lacking, e.g., Taiwan, Hong Kong and Macao.

Furthermore, from the Stage I Index, we found that among the top 10 cities ranked according to the subindexes under depth of usage, at least half were in Zhejiang Province, except for the sector of credit investigation. In 2018, the corresponding top 10 cities under the depth of usage were no longer limited to Zhejiang Province but included other cities as well (Table 13).

Table 13: Top 10 cities with the highest subindexes under the depth of usage

Rank	Payment	Insurance	Monetary fund	Investment	Credit	Credit investigation
1	Hangzhou	Jinhua	Hangzhou	Shanghai	Hangzhou	Hangzhou
2	Jinhua	Hangzhou	Wenzhou	Beijing	Shanghai	Shenzhen
3	Shanghai	Huzhou	Shantou	Hangzhou	Jinhua	Xiamen
4	Wenzhou	Shanghai	Shanghai	Zhoushan	Shenzhen	Guangzhou
5	Wuhan	Hefei	Nanjing	Nanjing	Xiamen	Beijing
6	Shantou	Bengbo	Jieyang	Wenzhou	Wenzhou	Shanghai
7	Nanjing	Wenzhou	Jiaxing	Xiamen	Guangzhou	Zhuhai
8	Huzhou	Guangzhou	Wuhan	Changzhou	Quanzhou	Wuhan
9	Jieyang	Shantou	Jinhua	Guangzhou	Wuhan	Nanjing
10	Xiamen	Nanjing	Shaoxing	Ningbo	Fuzhou	Chengdu

Source: The PKU-DFIIC

5.2 Comprehensiveness of digital financial inclusion

i. The gap in digital financial inclusion among provinces has narrowed

The comprehensiveness of digital finance mainly lies in whether the financial services it provides are accessible to all social classes and groups. In this report, we studied the comprehensiveness of digital financial inclusion from the perspective of geography, which incorporates two meanings: first, compared with traditional financial inclusion, can digital financial inclusion deliver more comprehensive availability; and second, can regional differences in digital financial inclusion services be gradually narrowed. In fact, although financial services, as soft infrastructure, are affected by the level of economic development, the prioritized development of financial services can also provide support for economic development. If the differences in digital financial inclusion services among regions can be gradually reduced, the less developed regions are unlikely to "lose at the starting line". We concluded that, first, digital financial inclusion offers more comprehensive availability than traditional financial inclusion. This conclusion is supported by the discovery that provinces and cities presented

a smaller development gap in digital financial inclusion compared with traditional financial inclusion. As shown in Figure 3 above, the highest digital financial inclusion index in 2018, which belonged to Shanghai, was 1.4 times that of the lowest, which was scored by Qinghai (the highest was 1.5 times that of the lowest in 2015, and 4.9 times in 2011). Regarding aggregate financing to the real economy (AFRR), in 2017, the highest increase in per capita AFRR was recorded in Shanghai, which was 8.4 times that of the lowest in Jilin; the same ratio in 2015 was 3.3 times. This shows that compared with traditional financial inclusion, digital financial inclusion features higher geographical penetration and offers wider coverage of financial services, allowing undeveloped regions access to relatively more financial services.

Second, in recent years, the gap in digital financial inclusion among provinces has greatly narrowed. Overall, as time goes by and service develops, digital financial inclusion is converging among regions. As shown in Figure 7, the digital financial inclusion index varies widely from province to province in 2011, while in 2018, this difference was significantly reduced. A comparison of Figure 8, Figure 9 and Figure 10 indicates that the regional convergence of the digital financial inclusion index at the early stage could mainly be attributed to the convergence of digital finance's coverage breadth and digitalization level, but in the past two years, the convergence of usage depth has also become an important driving force. In particular, by comparing Figure 8, Figure 9 and Figure 10, we can see clearly that the depth of usage in digital financial inclusion started to gain momentum in recent years. Such a development tendency for digital finance may be of great inspiration local governments and enterprises as it concerns the development of digital finance and the strategic layout of Internet+ as a whole.

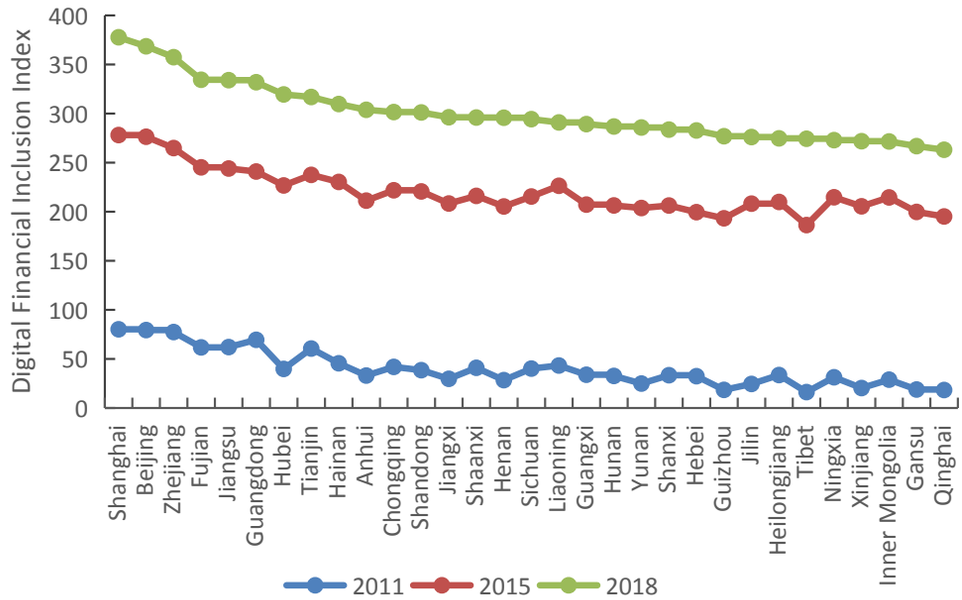

Figure 7: Provincial Digital Financial Inclusion Index in 2011, 2015 and 2018

Source: The PKU-DFIIC

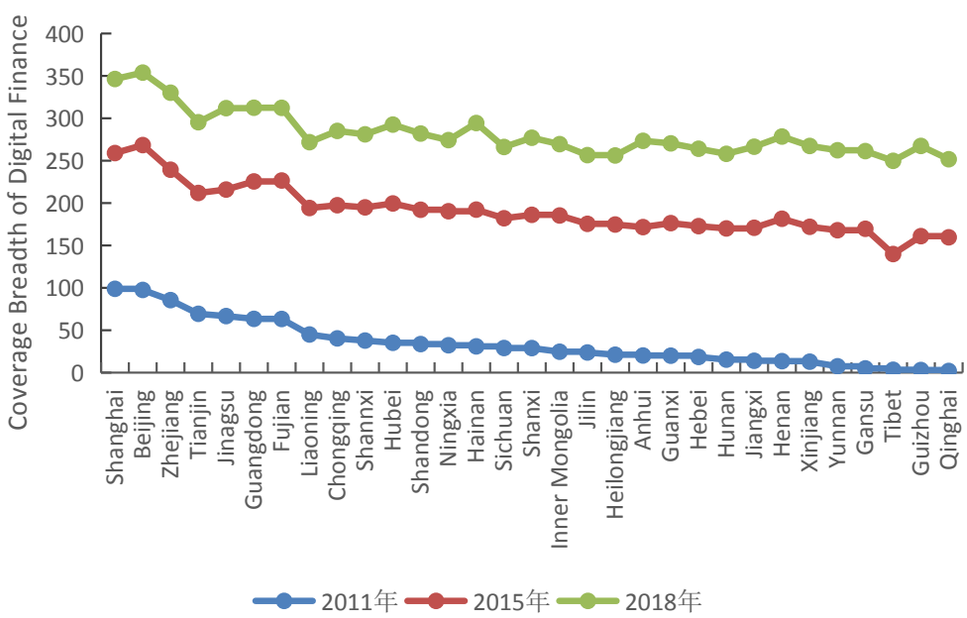

Figure 8: Provincial Index of Breadth of Coverage in 2011, 2015 and 2018

Source: The PKU-DFIIC

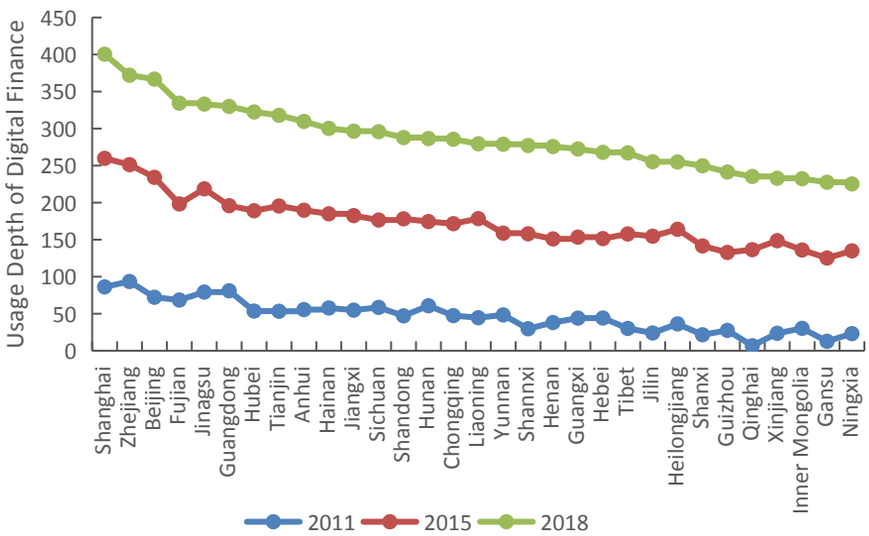

Figure 9: Provincial Index of Depth of Usage in 2011, 2015 and 2018

Source: The PKU-DFIIC

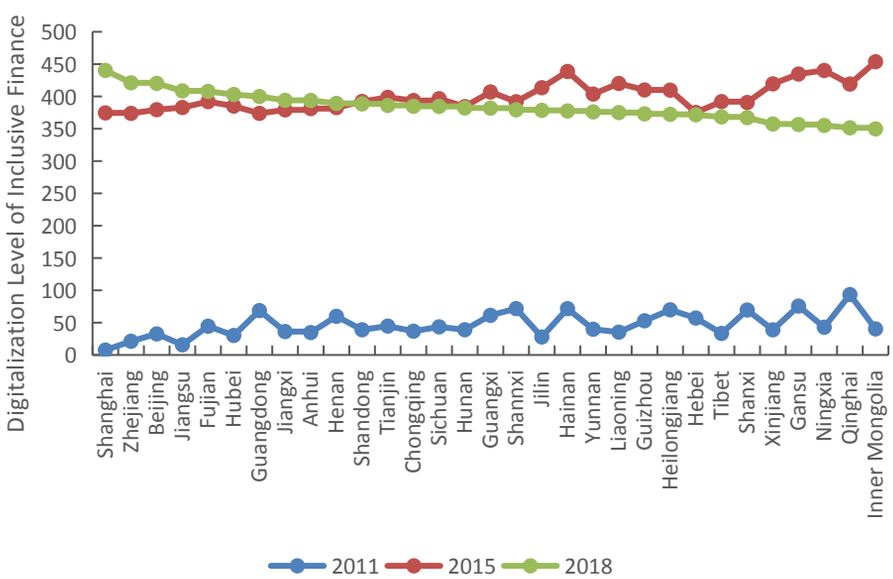

Figure 10: Provincial Index of Level of Digitalization in 2011, 2015 and 2018

Source: The PKU-DFIIC

Note: During 2016-2018, the specific indexes under the level of digitization changed greatly. In fact, compared with 2016 and 2017, the level of digitization rose in 2018.

ii. The gap in digital financial inclusion among cities has narrowed

Maps more intuitively show the relatively faster development of digital financial inclusion in remote cities, which has narrowed the gap among cities. Figure 11 displays

the rankings of cities based on the digital financial inclusion index in 2011, 2015, and 2018. The echelon classification rule is as follows: take the highest-level index of the year as the benchmark, cities with an index higher than 80% of the benchmark index are classified as the first echelon and marked in red in the figures; 70%-80% are the second echelon, marked orange; 60%-70% are the third echelon, marked yellow; and lower than 60% are the fourth echelon, marked green.

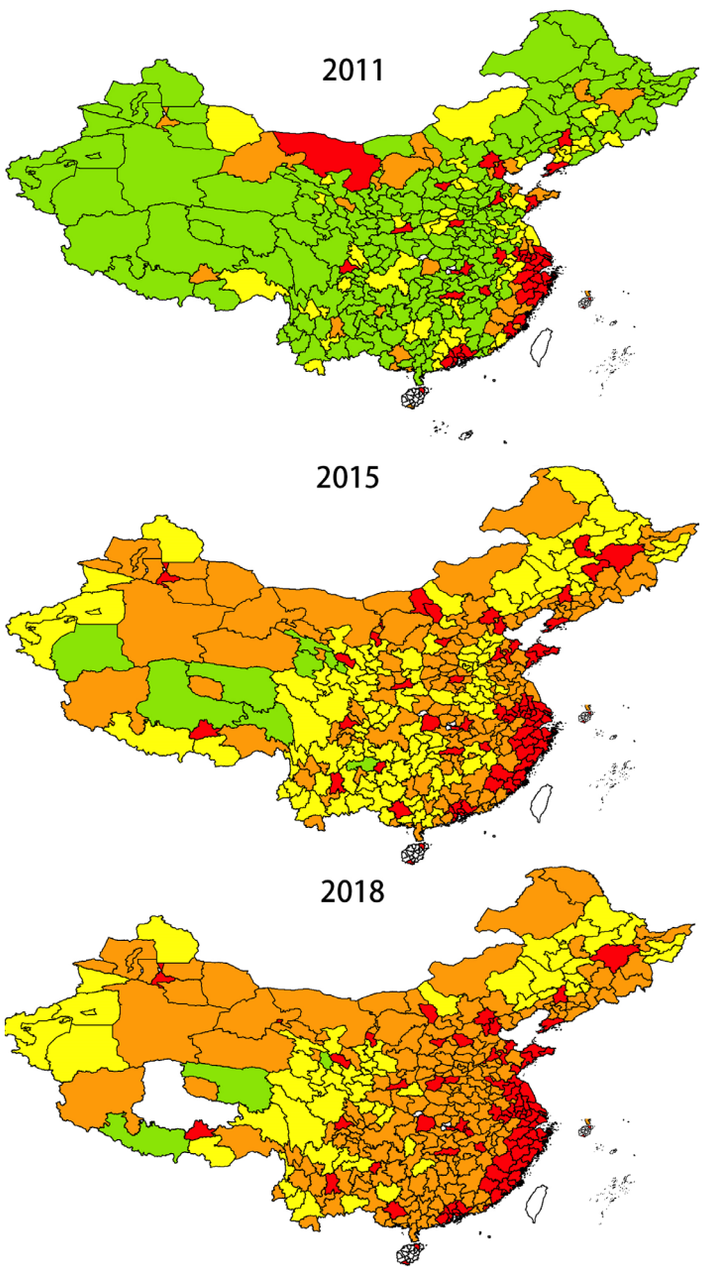

Figure 11: Relative Rankings of Cities in Terms of Overall Index in 2011, 2015 and 2018

Source: The PKU-DFIIC

Note: Due to the lack of data, Taiwan, Hong Kong, Macao and some other cities are left blank.

Figure 11 shows the distribution changes in city-level indexes over the three periods, from which we can find that in 2011, there was a large gap in development among cities, as the first echelon was concentrated in the surrounding areas of Shanghai and other large cities, the second and third echelons were few in number, and most of the cities belonged to the fourth echelon; in 2015, the first echelon reached the coastal cities in Southeast China and regional-central cities, while the second and third echelons grew and expanded; and by 2018, most of the cities were in the first and second echelons, that is, the majority of cities had a digital financial inclusion index higher than 70% of the highest-level index, implying that the gap among regions had further narrowed.

Considering the significant changes in the depth of usage, we further visualized maps on this dimension. As shown in Figure 12, the depth of usage is another perspective that can manifest the development trend identified above. Because the depth of usage is an objective depiction of the actual use of digital financial inclusion services, it is completely determined by the service application in use in reality (as for the level of digitization, the indexes also describe technical support). In 2011 and 2015, except for some fringe areas where the population is sparse (Ngari Prefecture & Shannan, Tibet), the depth of usage showed a clear stepwise trend from the southeast coast inland. The index distribution in 2015 coincides with the three steps in terms of geographical location. The first and second echelons are basically within the first step, the second step covers a mix of the third and fourth echelons, and the third step and beyond is almost completely occupied by the third echelon. In 2018, the stepwise trend diminished. However, comparing the figure with the renowned Hu Line from geoeconomics, we can still see that the first and second echelons of cities in 2018 are basically located east of the Hu Line, and those west of the line still have much room for development. Then, we can conclude that digital financial inclusion has indeed promoted the coordinated development of regions, with the original gap gradually narrowing; however, the inherent network effect is still present, and there is substantial room to grow and improve in those sparsely populated areas (regions west of the Hu Line).

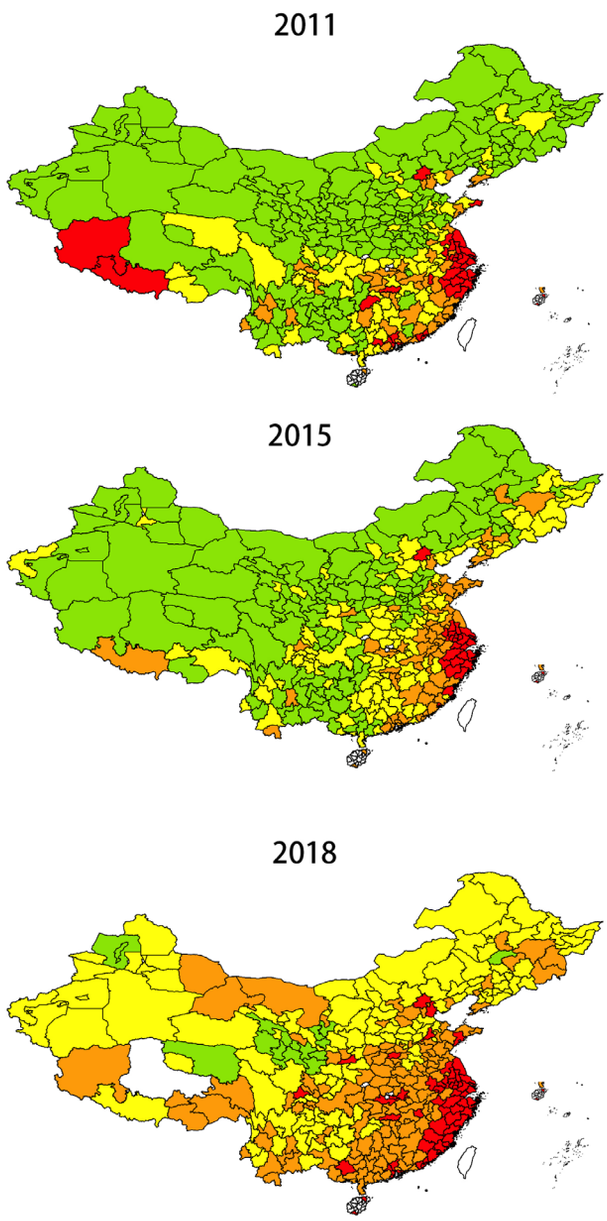

Figure 12: Relative Ranking of Cities in Terms of Depth of Usage in 2011, 2015 and 2018

Source: The PKU-DFIIC

Note: Due to the lack of data, Taiwan, Hong Kong, Macao and some other cities are left blank.

However, turning to the breadth of coverage index of digital finance in Figure 13, it can be seen that the characteristic of Hu Line is not obvious, as the breadth of coverage indexes for some cities west of the Hu Line also entered the first and second echelons in 2018. The figure demonstrates that digital finance has more extensive penetration in terms of accessibility, and Western China still has space to develop in terms of depth of usage.

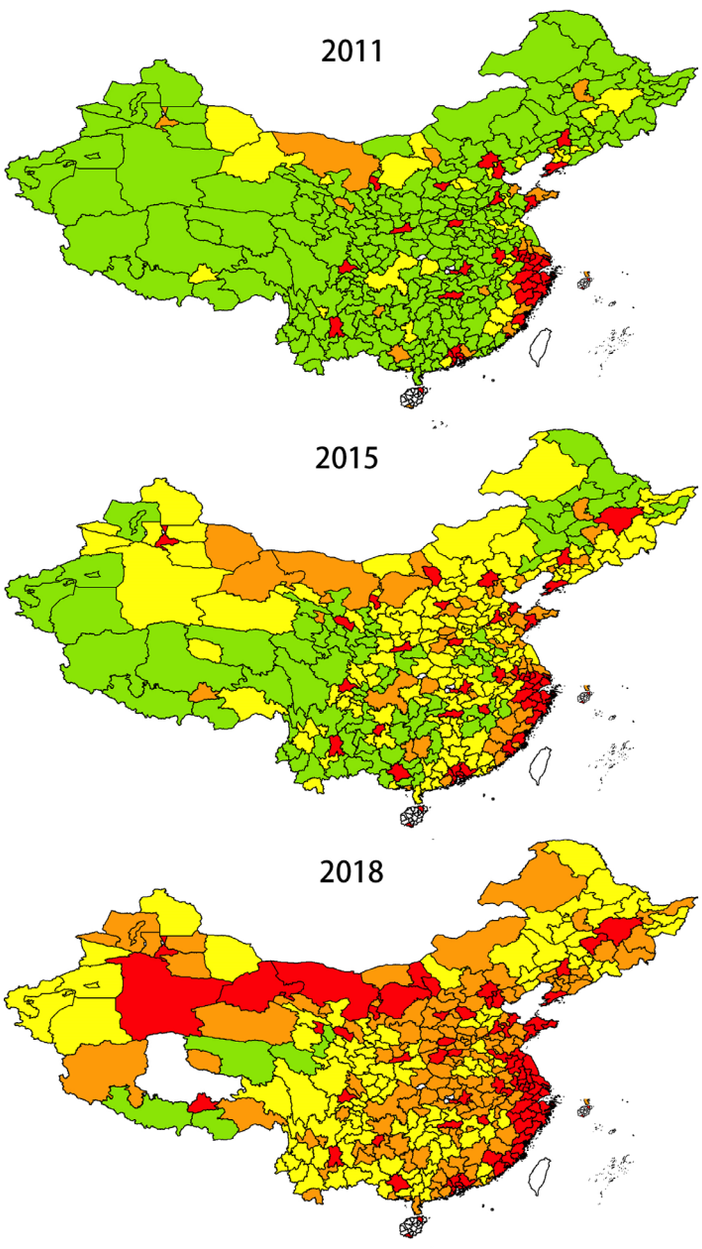

Figure 13: Relative Rankings of Cities in Terms of Breadth of Coverage in 2011, 2015 and 2018

Source: The PKU-DFIIC

Note: Due to the lack of data, Taiwan, Hong Kong, Macao and some cities and counties in Hainan are left blank.

To measure the relative gap in digital financial inclusion among regions in a more scientific manner, we also calculated the coefficients of variation [①] of the provincial indexes across the country, as well as the coefficient of variation within each province.

[①] The coefficient of variation is the ratio of the raw data standard deviation to the raw data mean. The coefficient of variation is dimensionless and measures the data dispersion of variables.

Figure 14 shows that from 2011 to 2018, the coefficients of variation of the provincial digital financial inclusion indexes saw a sharp decline, indicating the convergence of digital financial inclusion among regions.

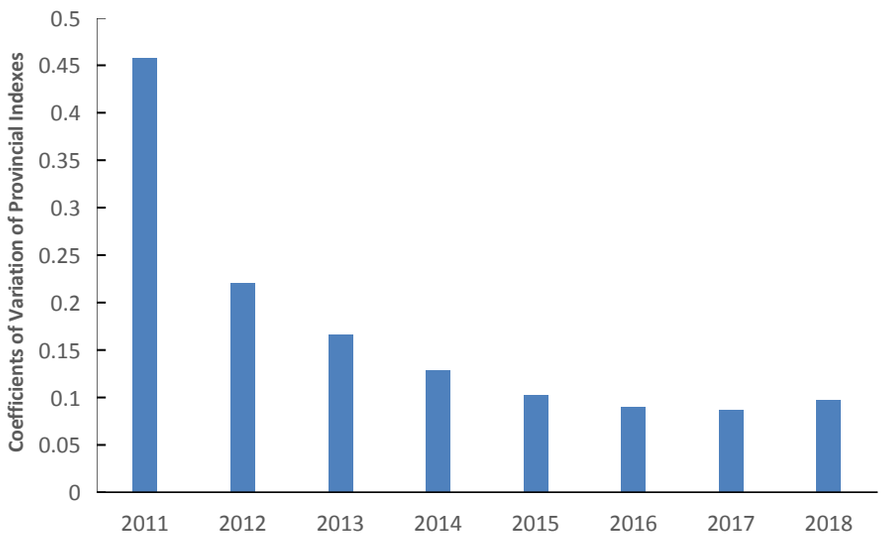

Figure 14: Coefficients of Variation of Provincial Digital Financial Inclusion Indexes across China 2011-2018

Source: The PKU-DFIIC

As shown in Figure 15, the coefficients of variation of the prefecture-level digital financial inclusion indexes within each province presented the following characteristics: first, in 2011, the variations in remote provinces were significantly greater than those in the eastern coastal provinces. Second, from 2011 to 2018, all provinces had reduced the differences to varying degrees, and the differences among provinces were even smaller in 2018. Figure 15 provides additional strong evidence showing that digital financial inclusion is stronger in terms of accessibility for remote areas.

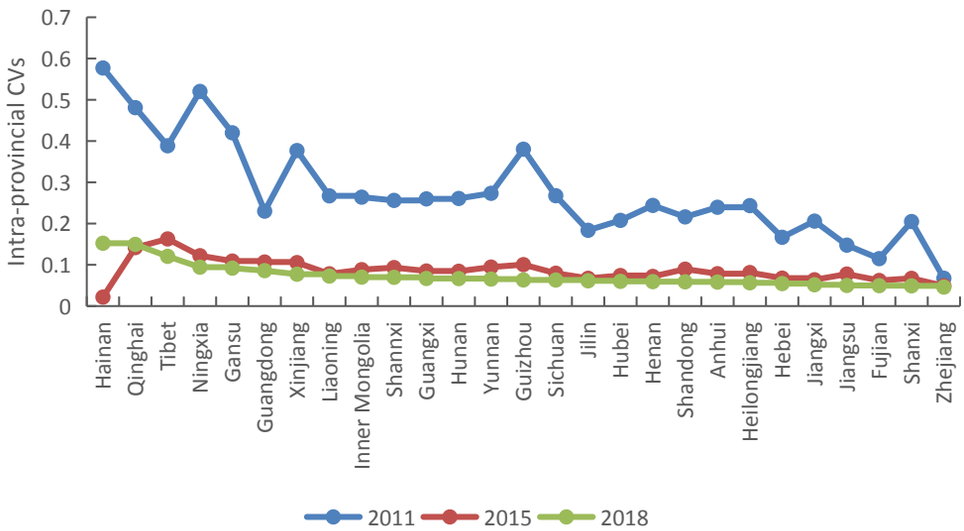

Figure 15: Coefficients of Variation of Digital Financial Inclusion Indexes of Prefecture-level Cities within Provinces in 2011, 2015 and 2018

Source: The PKU-DFIIC

5.3 Effectiveness of digital financial inclusion

i. The digital financial inclusion index and traditional financial inclusion index

The relationship between digital finance and traditional finance has always been a controversial topic (Guo and Wang, 2019). As shown in Figure 16, there exists a prominent positive relationship between digital financial inclusion and traditional financial inclusion. For example, the correlation coefficient between the digital financial inclusion index and the traditional financial inclusion index compiled by Jiao et al. (2015) reaches as high as 0.74. Therefore, areas with more developed traditional financial inclusion are prone to deliver better performance in digital financial inclusion development. For another example, the depth of traditional finance as measured by traditional financial institutions' loan balance/GDP (2013 value) and the digital financial inclusion index (2018value) also show an apparent positive correlation (Figure 17). These results indicate that the development of digital financial inclusion is inseparable from that of traditional financial inclusion, and the two both promote and supplement each other.

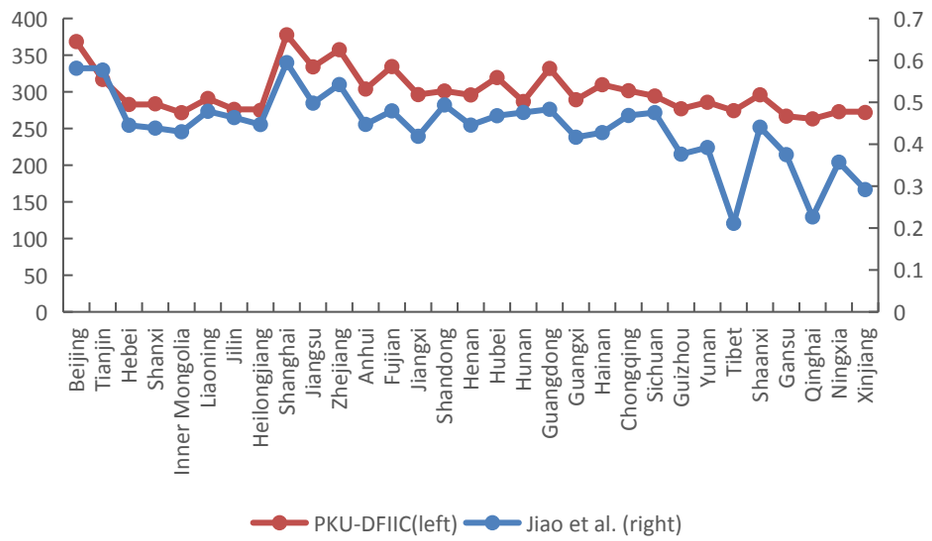

Figure 16: The Traditional/Digital Financial Inclusion Index

Source: The PKU-DFIIC and Jiao et al. (2015)

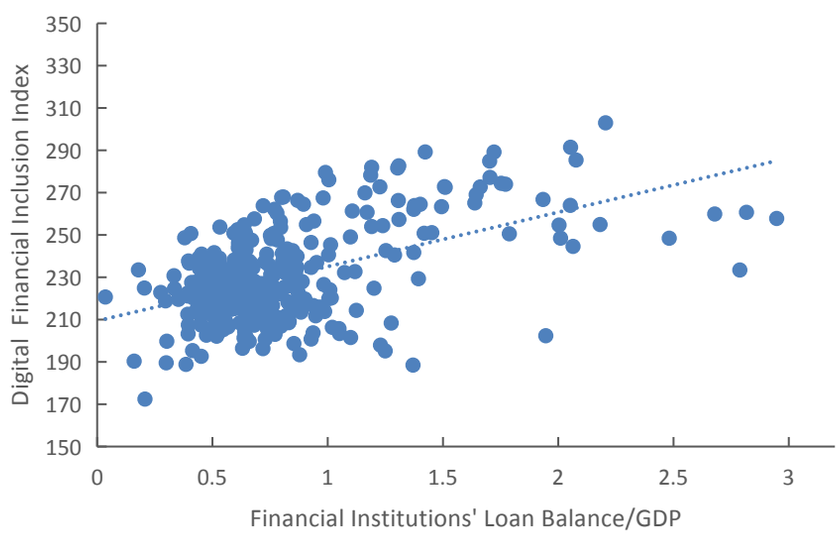

Figure 17: Financial Institutions' Loan Balance/GDP and the Digital Financial Inclusion Index

Source: The PKU-DFIIC, China Statistical Yearbook for Regional Economy

ii. Digital financial inclusion and economic development

The charts visualized above show that eastern regions with relatively developed economies have relatively higher digital financial inclusion indexes. Now, we will further analyze the direct relationship between the digital financial inclusion index and economic development. According to Figure 18, the regions with better performance in terms of economic development are more developed in digital financial inclusion.

However, there do exist some cities—mainly resource-based cities—that have high GDP per capita but a low digital financial inclusion index. The positive correlation between the digital financial inclusion index and economic development is mainly attributed to the breadth of coverage and the depth of usage for digital financial inclusion (Figures 19 and 20), while the level of digitization is more weakly correlated with economic development (Figure 21). However, we merely present the direct correlation between digital financial inclusion and traditional financial inclusion, or economic development, at an absolute level rather than a causal relation. Rigorous conclusions would require a more in-depth analysis.

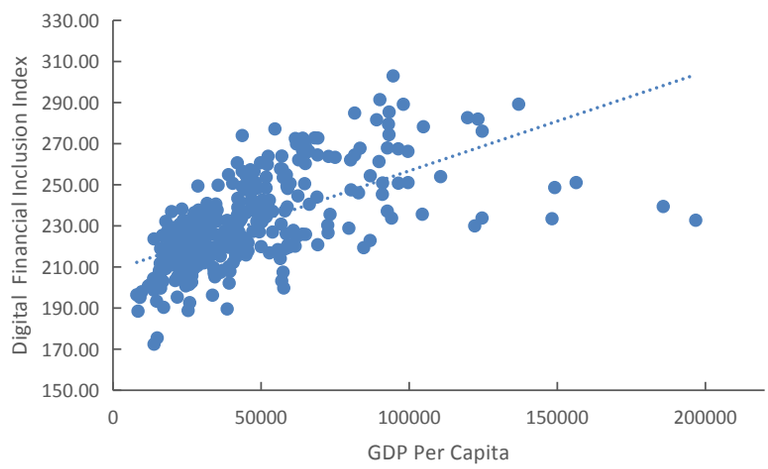

Figure 18: GDP Per Capita and the Digital Financial Inclusion Index

Source: The PKU-DFIIC, China Statistical Yearbook for Regional Economy

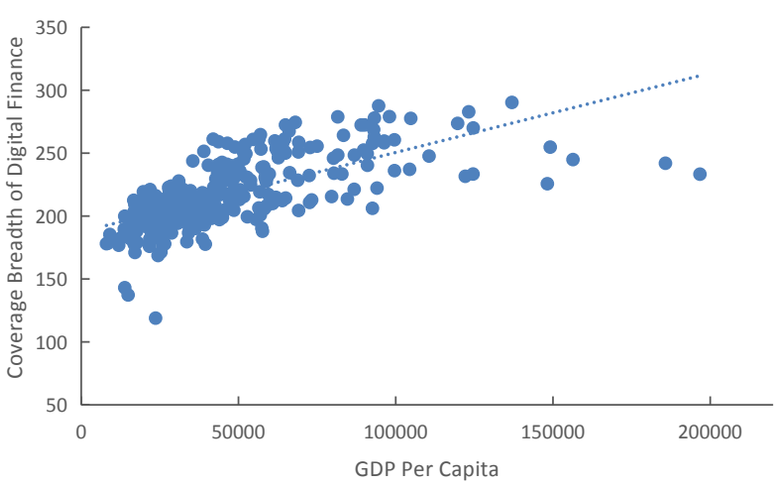

Figure 19: GDP Per Capita and Coverage Breadth of Digital Financial Inclusion

Source: The PKU-DFIIC, China Statistical Yearbook for Regional Economy

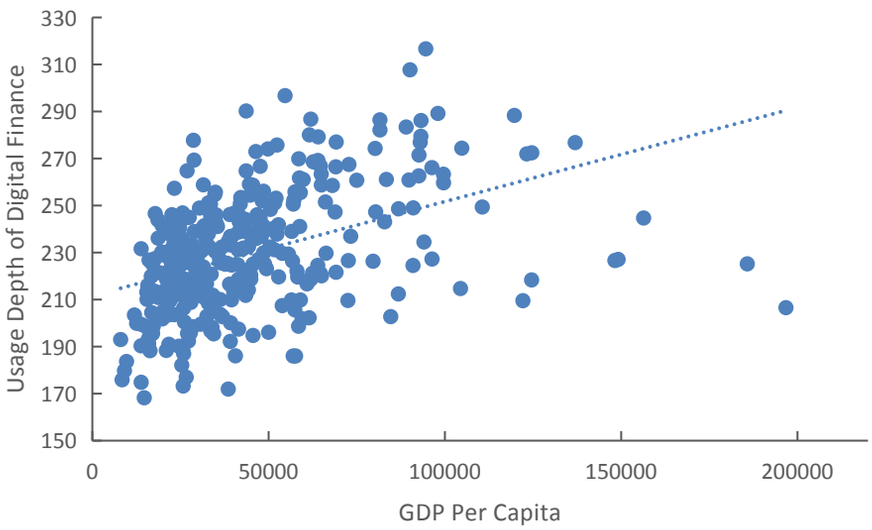

Figure 20: GDP Per Capita and Usage Depth of Digital Financial Inclusion
Source: The PKU-DFIIC, China Statistical Yearbook for Regional Economy

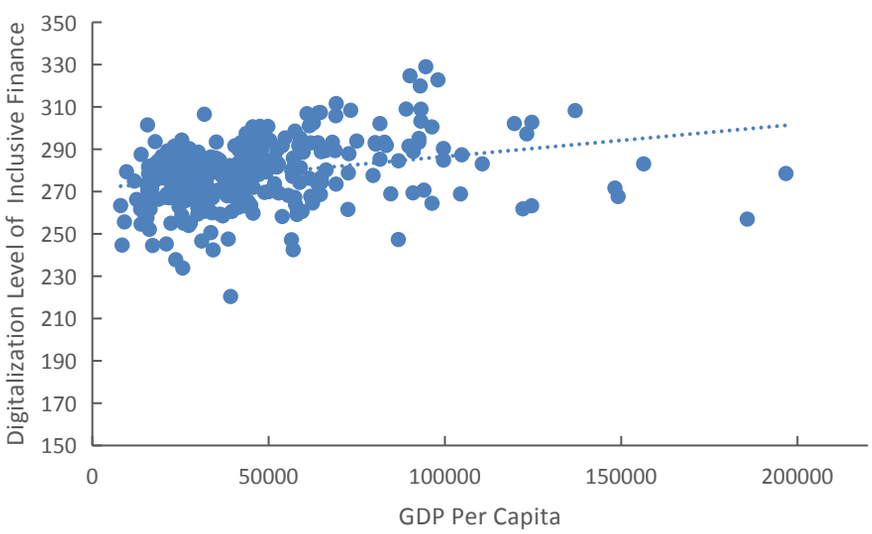

Figure 21: GDP Per Capita and Digitalization Level of Financial Inclusion
Source: The PKU-DFIIC, China Statistical Yearbook for Regional Economy

5.4 The top 20 countries are mainly distributed in Hangzhou and Shanghai

While compiling the digital financial inclusion index at the county level, in addition to the counties/banners and county-level cities that were previously included, we also incorporated municipal districts for unified index compilation and ranking. As shown in Table 14, based on the digital financial inclusion index at the county level, the counties ranking at the top were mostly from eastern China, especially the

municipal districts of Hangzhou and Shanghai. There were 4 municipal districts of Hangzhou in the top 5 list, and among the top 10, municipal districts in Hangzhou occupied 7 places. For the top 11-20 counties, 6 out of 10 were municipal districts of Shanghai. These results further confirm that although at the macro level, digital financial inclusion does have the feature that it goes beyond geographical location, those areas close to the institutions that served as our data source, such as Hangzhou and Shanghai, still scored higher in the digital financial inclusion index. This issue has been discussed in detail in an academic paper by our Research Team, and we are not going to elaborate it here (Guo et al., 2017).

Table 14: Top 30 Regions with the Highest County-level Digital Financial Inclusion Index

Rank	County	City	Index	Breadth of Coverage	Depth of Usage	Level of Digitalization
1	Binjiang	Hangzhou	146.87	119.68	200.22	139.72
2	Xihu	Hangzhou	142.58	114.32	195.82	139.15
3	Jinggan	Shanghai	139.96	116.21	185.75	135.21
4	Hangan	Hangzhou	139.65	118.09	187.12	124.61
5	Gongshu	Hangzhou	139.53	115.33	191.91	124.25
6	Xiacheng	Shanghai	138.01	112.13	189.75	129.43
7	Yuhang	Hangzhou	135.67	113.42	181.87	125.18
8	Shangcheng	Hangzhou	135.24	110.22	187.27	123.30
9	Hongshan	Wuhan	134.53	115.48	172.15	129.09
10	Haishu	Ningbo	133.87	111.32	177.67	128.76
11	Xuhui	Shanghai	133.58	108.11	185.33	123.68
12	Minhang	Shanghai	133.25	107.36	181.21	131.58
13	Changning	Shanghai	132.99	108.41	188.04	114.15
14	Kuncheng	Wenzhou	132.98	110.78	178.78	123.02
15	Putuo	Shanghai	132.94	106.55	184.61	126.17
16	Tianhe	Guangzhou	131.72	111.60	176.01	117.71
17	Huangpu	Shanghai	131.46	106.69	180.07	124.94
18	Nanshan	Shenzhen	131.26	111.86	172.12	121.04
19	Jianyi	Nanjing	131.20	108.33	175.65	125.94
20	Pudong	Shanghai	131.11	107.11	178.42	124.41

21	Siming	Xiamen	131.03	107.91	177.27	123.36
22	Jianghan	Wuhan	130.88	109.54	171.95	126.73
23	Hongkou	Shanghai	130.88	106.12	182.44	118.94
24	Chaoyang	Beijing	130.59	110.24	171.80	122.93
25	Yuhuatai	Nanjing	130.39	109.69	172.38	122.46
26	Wuchang	Wuhan	130.38	107.97	172.69	127.50
27	Futian	Shenzhen	130.31	110.27	174.14	116.83
28	Hanyang	Wuhan	130.20	109.63	170.45	124.98
29	Wuzhong	Suzhou	130.16	112.93	166.01	121.92
30	Xuanwu	Nanjing	130.10	106.27	172.60	131.60

Source: The PKU-DFIIC

Figure 22 shows the rise of the digital financial inclusion indexes of municipal districts, county-level cities and counties/banners in 2018 compared with 2016, but there was still a certain gap among them. According to Figure 23, the gap among counties/banners and municipal districts in digital financial inclusion primarily reflected the depth of usage, then breadth of coverage, and the variation in terms of digitalization level was the smallest. A comparison of the data of 2016 and 2018 shows that the gap in the digital financial inclusion index among counties and municipal districts had widened.

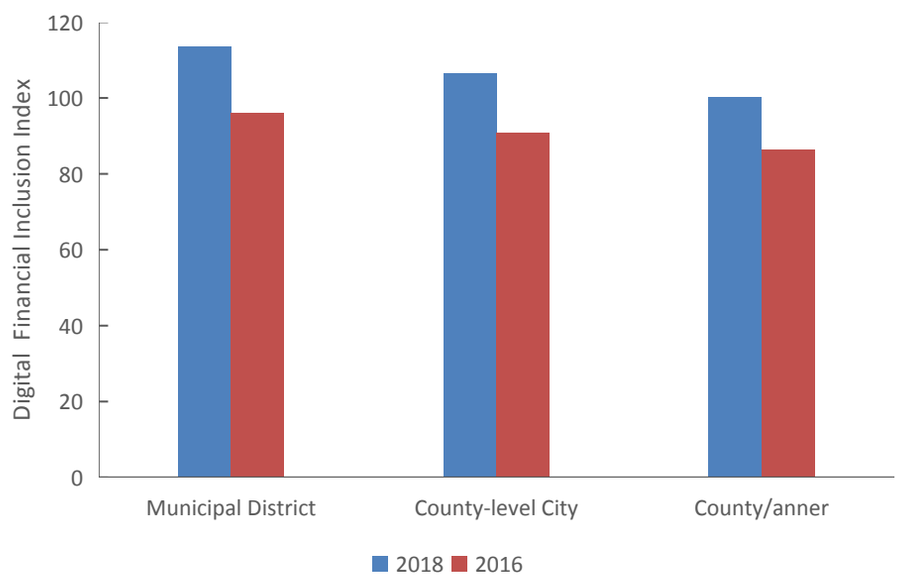

Figure 22: Digital Financial Inclusion Indexes of Municipal Districts, County-level Cities and Counties/Banners in 2018

Source: The PKU-DFIIC

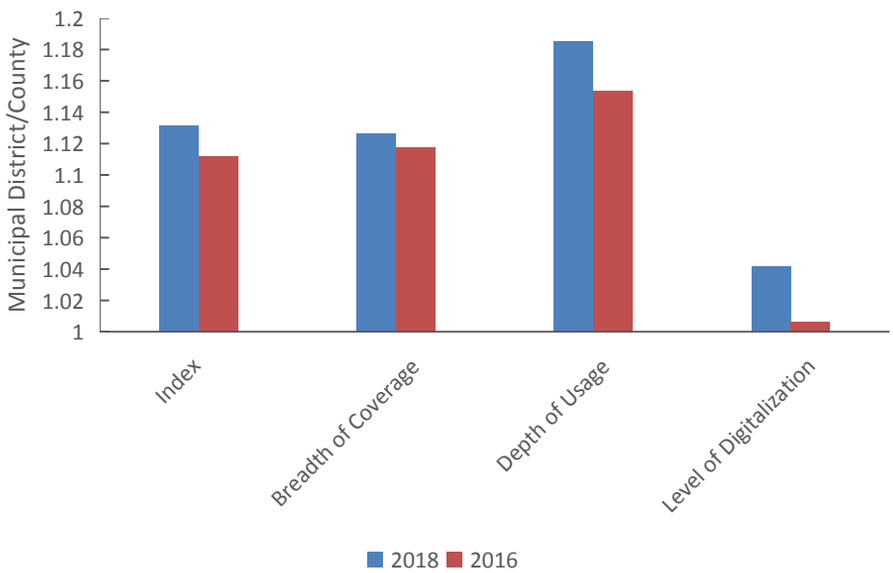

Figure 23: Difference in Digital Financial Inclusion Indexes of Municipal Districts and Counties/Banners between 2016 and 2018

Source: The PKU-DFIIC

Finally, it should be noted that the great value of the digital financial inclusion index, especially at the prefecture and county levels, lies in it combination with other economic and social data sources for deeper academic analysis with the aim of exploring and observing regional differences, influencing factors, etc. of digital financial inclusion in China. For now, our discussion ends here, and we encourage people from all walks of life to request these data from us and utilize them for more in-depth research.

6. Conclusions

To compile this Index, we have referred to the existing literature, especially the literature on the compilation of traditional financial inclusion indexes, while taking into account the characteristics of digital financial inclusion and utilizing the massive dataset of Ant Financial on financial inclusion. Based on the 2011-2015 digital financial inclusion indexes at the provincial, prefecture and county levels prepared in 2016, this report has updated the relevant indexes for 2016-2018. The compilation of the Stage II Index has continued the basic structure of the Stage I Index, guaranteeing the continuity of indexes, while also making some innovations, especially expanding and improving the subindexes of digital finance, the level of digitalization, and incorporating municipal districts into the county-level indexes.

Based on the above index preparation methods and major data results, this report has drawn the following basic conclusions: digital financial inclusion is an important model for realizing low-cost, broad coverage and sustainable financial inclusion. The practices of digital financial inclusion over the past few years offer preliminary proof of the feasibility and reproducibility of this model. In particular, digital financial inclusion provides possibilities for economically undeveloped areas to catch up with and surpass other areas in the sector of financial inclusion and lays a foundation for low-income and disadvantaged groups to have access to low-cost financial services. Furthermore, compared with the indexes for 2011-2015, the digital financial inclusion indexes for 2016-2018 have undergone significant changes. In particular, the growth of the digital financial inclusion indexes has shifted to the depth of usage in recent years, which proves that China's digital financial inclusion has passed the era of extensive enclosure and is embracing a new stage and a new era characterized by deep expansion.

Although we have made improvements to the methods from preparing the Stage I Index that were developed in 2016, especially the measurement of the level of digitization, which is now more comprehensive and complete, it must be

acknowledged that there is still room for improvement in this research. For example, restricted by the availability of data and the compatibility of data from different organizations, this report has selected the Ant Financial Services Group as the sole data source, so it cannot depict the development landscape of China's digital financial inclusion in a comprehensive manner. Taking Guangdong as an example, the province with the highest GDP in the country only ranked No. 6 in this Index due to its long distance from Hangzhou, among other reasons. However, considering the absence of the measurement of cross-regional development in digital financial inclusion, this Index provides a rough measurement of the development of digital financial inclusion in various regions for people from all walks of life and for reference by researchers, regulators and industry insiders.

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Appendix 1: The Provincial PKU-DFIIC 2011-2018

Table A1: The Provincial Digital Financial Inclusion Index and Sub-indexes of 2011

Province	Index	Breadth of Coverage	Depth of Usage	Payment	Insurance	Credit	Level of Digitalization
Beijing	79.41	97.53	72.23	79.4	59.48	76.75	32.59
Tianjin	60.58	69.37	53.33	55.52	75.74	43.73	44.72
Hebei	32.42	18.46	44.19	24.36	24.83	54.49	57.15
Shanxi	33.41	28.94	21.61	19.48	20.25	22.42	69.57
Inner Mongolia	28.89	24.65	30.27	27.51	49.83	22.42	40.35
Liaoning	43.29	44.96	44.64	49.24	48.98	42.31	35.33
Jilin	24.51	23.75	24.04	23.89	23.85	24.13	27.86
Heilongjiang	33.58	21.12	36.28	33.74	39.37	35.28	69.83
Shanghai	80.19	98.85	86.24	100	72.82	90.3	7.58
Jiangsu	62.08	66.7	79.22	80.77	78.49	79.35	15.71
Zhejiang	77.39	85.53	93.52	96.52	100	90.48	21.22
Anhui	33.07	20.2	55.58	49.04	40.63	62.54	34.66
Fujian	61.76	63.28	68.51	77.26	46.12	76.87	44.5
Jiangxi	29.74	13.97	54.82	56.7	46.6	58.04	36.21
Shandong	38.55	33.67	47.16	44.24	9.07	63.38	39.01
Henan	28.4	13.54	38.11	38.37	0.25	53.88	59.81
Hubei	39.82	35.17	53.56	69.15	44.82	55.47	30.18
Hunan	32.68	15.33	60.73	53.36	51.76	65.29	39.02
Guangdong	69.48	63.41	80.97	59.96	50.69	95.96	68.66
Guangxi	33.89	19.98	44.06	52.17	42.03	44	61.33
Hainan	45.56	30.96	57.74	60.56	61.02	56.06	71.63
Chongqing	41.89	40.38	47.46	59.24	57.04	42.14	36.77
Sichuan	40.16	29.02	58.56	45.49	73.61	53.74	43.5
Guizhou	18.47	3.06	27.51	49.21	47.38	16.79	52.92
Yunan	24.91	7.47	48.39	55.11	82.08	33.58	39.81
Tibet	16.22	3.37	30.16	0	66.3	18.46	33.33
Shaanxi	40.96	37.81	29.74	34.44	26.16	30.71	71.74
Gansu	18.84	4.99	12.76	10.82	6.48	15.59	75.61
Qinghai	18.33	1.96	6.76	0	21.99	1.16	93.42
Ningxia	31.31	32.27	23.16	15.68	41.09	16.51	42.96
Xinjiang	20.34	12.92	23.6	21.47	51.84	12.05	38.92

Table A2：The Provincial Digital Financial Inclusion Index and Sub-indexes of 2012

Province	Index	Breadth of Coverage	Depth of Usage	Payment	Insurance	Credit	Level of Digitalization
Beijing	150.65	155.56	159.42	110.02	216.68	141.07	118.47
Tianjin	122.96	110.61	135.77	74.34	212.58	110.61	140.44
Hebei	89.32	65.46	108.15	43.52	132.99	105.02	133.9
Shanxi	92.98	75.2	86.48	37.43	143.54	68.17	163.5
Inner Mongolia	91.68	75.03	95.44	45.63	158.4	74.75	139.78
Liaoning	103.53	89.01	120.36	69.54	187.08	98.21	120.91
Jilin	87.23	69.43	93.83	44.98	127.45	85.27	133.99
Heilongjiang	87.91	66.48	100.46	56.37	153.19	83.4	135.89
Shanghai	150.77	149.35	174.72	136.14	227.7	156.94	111.94
Jiangsu	122.03	106.69	156.55	98.32	228.07	133.23	109.94
Zhejiang	146.35	128.5	200.42	130.89	324.29	156.52	107.07
Anhui	96.63	66.06	138.06	67.84	215.71	113.52	122.31
Fujian	123.21	112.74	140.25	100.51	169.52	132.49	126.79
Jiangxi	91.93	59.82	132.68	75.05	207.3	108	123.92
Shandong	100.35	80.15	127.53	61.65	176.43	114.51	117.68
Henan	83.68	61.93	98.07	61.8	104.06	99.63	129.37
Hubei	101.42	82.06	125.84	90.83	173.75	109.77	121
Hunan	93.71	63.39	132.38	75.16	204.99	108.49	123.56
Guangdong	127.06	111.37	149.38	81.73	153.26	155.34	138.31
Guangxi	89.35	66.47	104.58	69.07	142.54	92.72	137.25
Hainan	102.94	79.51	120.72	87.09	169.69	104.05	147.98
Chongqing	100.02	85.39	116.14	89.6	180.84	92.12	119.05
Sichuan	100.13	74.36	126.5	78.66	179.64	109.68	137.31
Guizhou	75.87	49.87	89.92	79.69	155.99	63.49	136.21
Yunan	84.43	52.78	111.96	75.43	177.58	88.67	138.91
Tibet	68.53	32.86	71.07	16.85	164.95	37.98	181.65
Shaanxi	98.24	83.62	98.61	58.38	141.46	85.23	145.88
Gansu	76.29	54.72	68.98	36.32	117.06	52.57	160.79
Qinghai	61.47	47.12	51.85	16.33	136.35	20.57	126.3
Ningxia	87.13	76.78	90.34	40.51	158.36	67.53	115.46
Xinjiang	82.45	60.88	85.14	46.28	159.44	58.5	148.76

Table A3：The Provincial Digital Financial Inclusion Index and Sub-indexes of 2013

Province	Index	Breadth of Coverage	Depth of Usage	Payment	Insurance	Monetary fund	Credit	Level of Digitalization
Beijing	215.62	193.86	247.5	136.53	617.63	94.21	131.17	229.57
Tianjin	175.26	146.54	197.52	110.17	511.81	53.85	100.24	229.67
Hebei	144.98	105.66	162.85	64.92	422.49	24.22	88.71	242.35
Shanxi	144.22	115.4	139.08	61.87	422.74	14.73	50.21	248.75
Inner Mongolia	146.59	116.37	138.84	73.66	369.88	4.22	72.3	260.45
Liaoning	160.07	126.67	181.54	93.89	485.17	27.93	90.42	231.33
Jilin	138.36	106.85	147.95	72.92	396.34	8.92	76.01	224.97
Heilongjiang	141.4	104.49	152.58	80.25	418.82	13.87	72.84	242.97
Shanghai	222.14	187.31	280.93	169.95	680.74	100	156.87	230.3
Jiangsu	180.98	144.68	223.09	128.77	543.88	70.02	125.46	224.3
Zhejiang	205.77	167.96	265.48	166.23	649.99	95.21	144.69	222.12
Anhui	150.83	106.51	190.86	95.33	493.54	37.52	100.96	224.45
Fujian	183.1	157.43	194.12	130.14	436.21	60.94	122.6	247.85
Jiangxi	146.13	99.81	183.73	102.46	478.45	43.19	93.4	230.78
Shandong	159.3	122.01	189.07	89.87	483.75	45.87	101.22	228.32
Henan	142.08	105.06	155.23	87.45	395.02	31.51	83.51	240.42
Hubei	164.76	123.74	197.04	111.2	511.31	53.97	99.5	241.51
Hunan	147.71	103.46	175	100.22	454.11	34.87	90.4	244.25
Guangdong	184.78	153.33	208.44	106.47	466.62	59.28	137.12	245.61
Guangxi	141.46	106.97	153.84	99.06	417	20.3	72.55	232.82
Hainan	158.26	121.75	173.37	110.76	468.48	32.71	80.81	251.39
Chongqing	159.86	125.27	178.2	113.4	471.66	35.23	86.97	240.74
Sichuan	153.04	114.03	176.71	102.38	445.78	35.62	96.41	238.82
Guizhou	121.22	89.59	125.46	100.53	384.99	0	41	217.93
Yunan	137.9	95.59	153.55	97.13	413.08	26.56	72.86	249.15
Tibet	115.1	74.09	112.84	63.75	363.27	21.4	29.17	254.65
Shaanxi	148.37	123.6	145.94	78.61	399.93	23.61	68	234.55
Gansu	128.39	96.77	114.2	69.51	357.1	3.33	36.43	258.6
Qinghai	118.01	88.18	113.42	63.67	389.3	3.26	22.35	224.82
Ningxia	136.74	115.08	129.02	44.5	399.35	3.37	46.74	222.32
Xinjiang	143.4	101.44	146.39	76.03	422.5	24.01	59.57	276.48

Table A4：The Provincial Digital Financial Inclusion Index and Sub-indexes of 2014

Province	Index	Breadth of Coverage	Depth of Usage	Payment	Insurance	Monetary fund	Investment	Credit	Level of Digitalization
Beijing	235.36	243.92	219.89	196.25	663.95	209.83	94.93	120.76	235.22
Tianjin	200.16	193.86	180.28	165.52	576.75	166.06	59.55	97.95	257.11
Hebei	160.76	149.97	131.34	114.97	423.99	126.08	27.5	79.94	249.86
Shanxi	167.66	163.16	124.78	117.06	462.67	122.03	20.44	53.43	260.43
Inner Mongolia	172.56	165.46	114.88	117.47	428.7	111.48	9.2	53.41	300.84
Liaoning	187.61	175.49	162.89	143.45	550.31	139.88	40.66	87.32	272.53
Jilin	165.62	154.91	136.01	118.63	462.03	119.15	30.66	73.74	254.75
Heilongjiang	167.8	152.48	142.48	127.57	484.01	129.53	32.27	75.98	264.41
Shanghai	239.53	237.02	242.78	225.1	725.26	220.53	96.62	142.88	241.88
Jiangsu	204.16	193.18	201.09	184.42	611.07	182.13	72.09	119.53	246.02
Zhejiang	224.45	217.48	233.67	224.06	687.54	206.83	96.58	139.65	230.71
Anhui	180.59	156.56	173.84	151.5	547.03	151.28	59.96	98.99	272.22
Fujian	202.59	204.22	164.85	181.25	457.02	161.83	37.59	124.93	265.76
Jiangxi	175.69	148.73	167.19	154.14	535.69	148.08	44.25	98.59	280.18
Shandong	181.88	169.89	161.19	142.07	511.64	151.85	49.31	91.92	259.08
Henan	166.65	157.52	132.24	137.08	415.49	136.22	23.47	84.05	259.31
Hubei	190.14	176.61	175.7	165.88	548.79	162.44	59.01	99.75	261.07
Hunan	167.27	150.42	153.46	148.44	479.47	139.81	40.84	94.02	247.99
Guangdong	201.53	199.63	175.04	156.69	485.07	159.13	56.45	128.04	255.98
Guangxi	166.12	154.29	139.98	139.02	449.06	115.7	36.92	82.67	252.66
Hainan	179.62	170.99	153.8	157.71	529.76	136.61	42.99	71.93	255.03
Chongqing	184.71	175.57	157.88	158.33	514.01	141.85	34.8	92.5	263.63
Sichuan	173.82	162.58	159.82	149.32	499.44	140.04	46.33	96.92	236.39
Guizhou	154.62	139.9	114.08	126.53	421.51	95.77	10.18	55.52	276.9
Yunan	164.05	147.22	144.3	134.42	475.79	123.72	35.1	82.03	255.54
Tibet	143.91	126.67	108.76	113.51	450.07	126.67	19.73	21.11	264.7
Shaanxi	178.73	173.25	139	122.05	472.64	131.49	32.45	72.71	269
Gansu	159.76	148.1	107.29	111.91	426.42	110.28	11.49	35.84	293.6
Qinghai	145.93	139.24	108.4	109.16	443.05	111.57	22.21	24.58	236.23
Ningxia	165.26	167.18	114.28	111.45	446.04	111.85	14.42	41.97	251.55
Xinjiang	163.67	151.28	134.87	133.48	487.16	134.97	39.1	50.72	256.91

Table A5：The Provincial Digital Financial Inclusion Index and Sub-indexes of 2015

Province	Index	Breadth of Coverage	Depth of Usage	Payment	Insurance	Monetary fund	Investment	Credit	Credit investigation	Level of Digitalization
Beijing	276.38	268.39	234.17	243.23	469.42	239.07	230.65	173.81	92.32	379.48
Tianjin	237.53	211.89	195.46	206.76	427.33	193.62	183.24	143.47	52.11	398.62
Hebei	199.53	172.78	151.45	161.59	306.8	162.76	144.95	127.69	0	375.2
Shanxi	206.3	186.14	141.52	159.41	337.67	156.65	124.49	97.75	21.99	390.57
Inner Mongolia	214.55	185.34	136.04	154.71	332.6	136.78	111.59	100.99	10.04	453.66
Liaoning	226.4	194.17	178.41	181.6	398.6	168.45	166.5	132.75	37.34	420.06
Jilin	208.2	175.49	154.68	166.01	343.1	152.29	149.57	113.84	20.53	413.47
Heilongjiang	209.93	174.68	164.06	170.1	363.16	163.96	168.8	111.5	33.75	409.72
Shanghai	278.11	258.98	259.81	268.49	521.32	252.66	246.52	201.7	99.92	374.54
Jiangsu	244.01	215.94	218.62	227.43	441.96	216.8	196.83	173.28	88.44	382.84
Zhejiang	264.85	239.33	251.29	270.92	518.33	243.83	233.82	196.9	74.43	373.77
Anhui	211.28	171.65	189.78	196.92	396.7	188.13	175.28	149.57	48.54	381.23
Fujian	245.21	226.6	198.23	230.19	396.13	198.59	140.07	185.79	62.59	392.01
Jiangxi	208.35	170.86	182.48	194.78	397.91	182.27	144.49	151.45	48.25	379.14
Shandong	220.66	192.11	178.15	186.17	372.83	187.49	165.04	141.22	33.02	392.16
Henan	205.34	181.5	151.05	174.98	307.69	171.16	127.15	130.9	15.71	382.73
Hubei	226.75	199.53	189.08	210.98	396.45	196.58	168.41	146.92	57.81	385.07
Hunan	206.38	170.07	174.47	186.49	371.97	171.84	150.14	143.89	34.65	384.24
Guangdong	240.95	225.52	195.87	207.36	365.29	194.22	155.49	187.62	55.21	373.79
Guangxi	207.23	176.33	153.46	177.23	341.68	145.27	108.67	133.25	38.33	406.94
Hainan	230.33	192.26	184.91	195.59	438.8	164.35	163.58	128.84	57.04	438.59
Chongqing	221.84	197.46	171.58	191.7	395.35	168.62	137.05	132.4	44.92	393.65
Sichuan	215.48	182.08	176.54	190.6	378.83	168.17	152.43	141.43	48.59	396.51
Guizhou	193.29	160.98	132.74	155.83	345.19	119.99	99.82	95.4	17.94	410.01
Yunan	203.76	167.96	158.79	168.47	383.48	144.2	126.27	122.14	27.86	403.67
Tibet	186.38	139.87	157.75	168.77	447.65	160.9	131.77	87.66	22.33	391.97
Shaanxi	216.12	194.92	157.95	162.76	355.33	161.98	142.39	116.87	35.15	391.85
Gansu	199.78	169.67	125.25	142.62	319.06	130.5	107.17	84.74	6.12	434.64
Qinghai	195.15	159.59	136.5	143.26	357.89	135.74	125.92	85.05	4.95	419.14
Ningxia	214.7	190.35	134.87	149.39	364.97	135.96	104.12	90.12	9.68	440.18
Xinjiang	205.49	172.01	148.6	165.46	397.95	155.11	125.97	92.83	10.14	419.4

Table A6：The Provincial Digital Financial Inclusion Index and Sub-indexes of 2016

Province	Index	Breadth of Coverage	Depth of Usage	Payment	Insurance	Monetary fund	Investment	Credit	Credit investigation	Level of Digitalization
Beijing	286.37	285.65	263.74	286.87	566.47	262.63	210.94	172.79	251.61	329.90
Tianjin	245.84	225.41	231.61	247.13	541.83	226.72	159.76	155.95	202.60	339.15
Hebei	214.36	191.55	196.87	214.64	434.79	213.26	125.48	145.45	174.72	321.46
Shanxi	224.81	205.51	189.38	206.37	451.07	201.16	101.35	134.39	187.73	352.96
Inner Mongolia	229.93	202.00	184.89	195.22	466.55	176.23	99.44	125.88	176.30	404.00
Liaoning	231.41	207.74	220.06	219.02	523.97	205.06	142.03	152.90	197.61	330.21
Jilin	217.07	191.94	204.14	209.46	482.14	195.40	124.46	144.93	189.90	323.59
Heilongjiang	221.89	191.24	206.54	214.35	496.97	204.83	122.77	142.58	195.35	350.97
Shanghai	282.22	274.25	281.48	309.09	615.25	278.98	222.35	190.79	233.86	309.94
Jiangsu	253.75	233.22	253.08	279.69	560.71	255.34	172.07	174.22	253.81	322.80
Zhejiang	268.10	254.44	270.62	316.53	608.21	279.39	192.47	189.77	212.02	308.66
Anhui	228.78	194.89	229.95	248.77	524.77	234.42	148.09	161.80	214.37	338.54
Fujian	252.67	240.47	245.12	287.16	566.68	249.60	137.36	180.46	228.43	306.70
Jiangxi	223.76	188.79	222.74	242.01	533.27	226.68	129.04	157.10	202.21	341.08
Shandong	232.57	209.80	217.81	235.54	488.04	228.83	145.30	154.33	196.47	334.58
Henan	223.12	200.65	199.22	226.02	446.66	219.76	113.26	146.68	195.95	340.80
Hubei	239.86	215.55	233.41	264.87	530.70	241.57	158.89	159.41	210.13	331.83
Hunan	217.69	186.13	219.80	233.88	517.19	216.16	130.90	158.56	198.54	318.07
Guangdong	248.00	240.07	236.50	266.79	516.88	238.18	143.89	181.38	217.88	295.07
Guangxi	223.32	193.51	202.21	227.42	476.80	200.46	101.20	149.01	210.69	360.15
Hainan	231.56	210.09	220.35	232.99	562.52	203.50	140.08	134.72	208.30	322.83
Chongqing	233.89	214.03	211.54	236.07	508.19	209.84	120.02	147.53	202.76	340.10
Sichuan	225.41	197.00	216.54	237.79	492.85	213.79	135.37	154.36	209.48	335.38
Guizhou	209.45	180.70	182.70	190.36	479.22	168.13	74.26	131.03	184.71	353.03
Yunan	217.34	185.37	203.17	206.68	501.83	186.39	116.03	141.41	190.33	348.65
Tibet	204.73	167.21	202.53	210.12	537.69	197.95	141.09	113.15	163.39	332.66
Shaanxi	229.37	211.17	202.87	213.12	471.15	203.41	128.32	140.55	195.17	337.60
Gansu	204.11	189.28	172.66	182.10	434.02	172.07	99.70	111.11	170.03	310.24
Qinghai	200.38	177.73	182.26	181.72	457.67	173.70	112.73	118.71	165.84	308.11
Ningxia	212.36	205.92	179.62	191.98	461.68	174.42	91.80	118.95	179.54	293.12
Xinjiang	208.72	190.32	190.11	197.22	490.82	189.52	130.24	112.29	155.41	303.31

Table A7：The Provincial Digital Financial Inclusion Index and Sub-indexes of 2017

Province	Index	Breadth of Coverage	Depth of Usage	Payment	Insurance	Monetary fund	Investment	Credit	Credit investigation	Level of Digitalization
Beijing	329.94	316.12	357.24	303.12	717.79	274.60	388.93	210.41	340.35	326.02
Tianjin	284.03	257.90	310.13	257.20	666.47	245.04	312.83	188.37	265.14	322.91
Hebei	258.17	232.89	273.45	226.55	572.54	222.53	263.34	170.23	269.07	313.87
Shanxi	259.95	243.02	254.98	216.39	553.60	220.15	234.64	159.25	234.50	324.92
Inner Mongolia	258.50	238.92	249.20	196.40	563.67	190.60	240.18	141.03	243.89	340.10
Liaoning	267.18	239.87	291.27	224.18	630.04	218.81	282.88	182.83	261.75	313.57
Jilin	254.76	227.45	273.62	210.33	593.75	209.98	262.23	170.99	251.91	310.72
Heilongjiang	256.78	226.00	275.86	214.68	593.53	217.39	261.07	173.30	262.03	323.77
Shanghai	336.65	305.89	396.05	333.43	785.39	294.74	398.99	231.81	486.77	330.31
Jiangsu	297.69	272.32	328.93	298.29	688.84	276.23	318.37	205.11	301.74	324.69
Zhejiang	318.05	290.06	366.40	343.86	768.73	303.17	344.68	224.29	372.47	322.66
Anhui	271.60	234.70	309.55	271.32	662.72	260.40	282.60	188.94	322.57	324.48
Fujian	299.28	275.40	334.33	309.03	704.80	292.68	300.31	210.30	340.23	314.47
Jiangxi	267.17	228.52	305.92	261.96	672.55	257.50	272.23	182.36	327.53	324.38
Shandong	272.06	247.19	290.92	248.98	619.98	244.43	282.61	180.27	257.85	319.92
Henan	266.92	241.45	279.56	247.49	584.25	242.81	258.81	170.34	300.21	328.09
Hubei	285.28	253.63	317.58	290.35	652.84	269.86	311.25	192.90	317.58	331.10
Hunan	261.12	223.47	297.70	248.52	641.34	246.38	280.06	181.95	290.21	318.96
Guangdong	296.17	275.91	328.17	288.57	676.58	267.20	297.05	209.91	358.26	304.92
Guangxi	261.94	232.73	279.52	244.56	601.91	230.97	247.06	174.67	293.37	326.44
Hainan	275.64	253.39	297.53	247.67	656.86	237.26	292.47	171.45	279.20	309.34
Chongqing	276.31	249.50	301.21	246.62	621.74	233.38	285.95	179.45	360.08	319.57
Sichuan	267.80	231.87	301.54	245.24	620.25	237.72	298.90	181.94	321.86	325.14
Guizhou	251.46	227.77	258.44	207.60	594.73	201.57	226.99	157.08	246.54	316.99
Yunan	256.27	223.54	282.85	217.82	604.28	211.19	296.57	164.67	261.55	316.08
Tibet	245.57	209.29	273.79	219.80	596.15	226.33	297.58	146.69	239.68	314.10
Shaanxi	266.85	246.48	276.00	226.87	586.20	221.87	276.76	166.68	253.10	317.47
Gansu	243.78	227.38	240.39	196.94	526.80	191.33	243.43	132.77	237.38	304.10
Qinghai	240.20	215.67	251.09	189.51	534.91	195.47	278.41	135.86	232.68	301.42
Ningxia	255.59	242.42	252.21	189.87	552.15	185.65	239.44	138.21	310.56	305.24
Xinjiang	248.69	228.82	249.10	196.68	539.02	203.00	279.76	131.99	209.86	313.56

Table A8：The Provincial Digital Financial Inclusion Index and Sub-indexes of 2018

Province	Index	Breadth of Coverage	Depth of Usage	Payment	Insurance	Monetary fund	Investment	Credit	Credit investigation	Level of Digitalization
Beijing	368.54	353.87	366.78	317.54	747.90	229.24	405.88	216.26	345.81	420.19
Tianjin	316.88	295.35	317.94	278.23	717.91	201.49	294.27	191.02	316.05	386.10
Hebei	282.77	264.06	267.92	238.96	608.74	178.16	229.24	166.12	280.18	371.55
Shanxi	283.65	277.03	249.73	243.58	560.07	183.78	192.97	163.01	273.11	367.19
Inner Mongolia	271.57	269.49	232.31	205.87	561.44	138.36	178.88	141.03	261.41	349.76
Liaoning	290.95	271.81	279.48	237.75	647.87	165.28	241.64	169.26	298.84	375.01
Jilin	276.08	256.55	255.23	216.84	584.77	154.24	214.50	159.50	278.48	378.46
Heilongjiang	274.73	256.12	254.88	220.17	571.27	167.34	213.10	160.68	285.72	372.28
Shanghai	377.73	346.33	400.40	356.14	849.62	261.16	419.90	243.08	344.98	440.26
Jiangsu	334.02	311.95	333.09	313.48	732.70	234.92	302.17	208.82	319.52	408.62
Zhejiang	357.45	330.17	372.01	379.51	838.08	256.93	337.91	229.70	328.80	421.07
Anhui	303.83	273.41	309.62	286.38	726.16	220.86	254.70	191.80	299.98	393.79
Fujian	334.44	312.31	334.30	324.73	748.45	233.93	282.49	215.68	325.32	407.76
Jiangxi	296.23	266.46	296.52	273.50	688.64	209.01	240.49	186.82	296.59	394.00
Shandong	301.13	281.99	287.85	263.14	653.12	200.62	245.07	179.46	293.13	388.48
Henan	295.76	278.46	275.74	269.68	627.45	205.03	217.08	178.31	281.95	389.27
Hubei	319.48	292.56	322.44	307.65	705.24	226.21	298.14	199.53	310.68	402.99
Hunan	286.81	258.07	286.55	248.24	653.41	192.38	246.43	178.89	290.13	382.19
Guangdong	331.92	312.44	329.93	305.54	733.02	215.65	282.15	214.14	332.90	399.86
Guangxi	289.25	270.41	272.49	258.82	629.05	176.50	206.85	177.77	297.43	381.93
Hainan	309.72	294.40	300.23	265.85	683.33	183.76	268.65	184.31	300.74	377.54
Chongqing	301.53	285.11	285.60	261.95	622.31	181.26	255.20	178.41	311.21	384.74
Sichuan	294.30	266.15	295.83	256.25	656.64	188.36	275.92	177.18	309.53	384.51
Guizhou	276.91	267.39	241.33	220.88	575.72	144.55	163.71	161.93	276.39	373.01
Yunan	285.79	262.29	278.84	228.89	622.58	161.74	266.65	166.04	288.61	376.06
Tibet	274.33	249.82	267.16	234.36	582.08	190.52	262.27	152.56	278.34	368.33
Shaanxi	295.95	281.05	277.15	253.23	609.53	181.85	243.87	173.95	295.99	379.31
Gansu	266.82	261.29	227.52	207.77	511.72	145.81	189.66	142.63	254.10	356.54
Qinghai	263.12	251.69	235.31	194.60	505.29	148.52	226.63	141.36	258.52	351.43
Ningxia	272.92	274.25	225.27	207.53	522.09	133.39	168.32	144.76	268.43	355.14
Xinjiang	271.84	267.35	232.94	209.70	491.33	157.37	231.08	135.86	254.82	357.37

Appendix 2: Profile of the Institute of Digital Finance at Peking University

Approved by the Presidential Office Meeting of Peking University, the Institute of Digital Finance at Peking University (IDF) was established in October 2015. IDF is committed to conducting academic, policy and industrial research in the fields of digital finance, financial inclusion, financial reforms, etc., providing authoritative results from scientific research for the public, theoretical guidance for the development of relevant industries and scientific reference for the decision-making process of the government. Prof. Li Qiang, Director of the Institute of Social Science Survey at PKU (ISSS), is the Chairman of the IDF Council; Prof. Huang Yiping, Deputy Dean of National School of Development (NSD) at PKU, is the Director of IDF; Wang Haiming, Executive President of Shanghai Finance Institute (SFI), is the Executive Deputy Director of IDF; and Prof. Huang Zhuo and Prof. Shen Yan from NSD are the Deputy Directors. IDF now has 25 full-time and part-time researchers.

Since its inception, IDF has scored fruitful research results, with research brands such as the Peking University Digital Finance Index Series and the "New Finance Book Series of the Institute of Digital Finance at Peking University". The Digital Finance Index Series, independently or jointly developed and released by IDF researchers, consist of the Peking University Internet Finance Development Index of China, the Peking University Digital Financial Inclusion Index of China, the Peking University Internet Finance Sentiment Index of China and the Peking University Commercial Bank Internet Transformation Index of China. The New Finance Book Series of the Institute of Digital Finance of Peking University is an authoritative brand with theory, practice and policy value. To date, 12 Lectures on Digital Finance, Chinese Practices of Digital Financial Inclusion, Financial Technology in China: 12 Lectures on Digital Finance, Ant Finance: From Alipay to the New Finance Ecosystem, Technology Empowerment: The Business Practices of Digital Finance in China, and Digital Finance: Enhancing the Real Economy, among other works, have been published. In addition, IDF has carried out a number of studies on topics including the support of

the real economy by digital finance, the promotion of financial inclusion practices by digital technology, constructing personal credit investigation systems, strategies for commercial banks addressing Internet finance transformation, risks of P2P lending platforms, big data finance, etc. It also organizes academic annual conferences in collaboration with authoritative journals in economics and finance sectors to promote academic exchange in the field of digital finance. From 2016 to 2018, it joined hands with China Economic Journal, China Economic Quarterly and Journal of Financial Research.

IDF regularly holds activities such as policy seminars and the Peking University Digital Finance Forum, which provide a platform for communication among academics, industry practitioners and policy makers. The annual academic conference of IDF each November attracts the research team of IDF, officials from PBOC, CSRC and CBIRC, university scholars and industry representatives, making it one of the most influential events in the sector of digital finance. IDF also delivers digital finance lectures at Peking University to share the latest issues on digital finance.

As a vital and dynamic think tank, the researchers of IDF, based on massive corporate research datasets, also actively participate in policy study and consultation focused on Internet finance and systemic risks, the regulation of P2P lending and agendas promoting financial inclusion with digital finance as advocated by the PBOC under the G20 framework. Multiple achievements have received attention and instructions from leaders at the decision-making level. In 2018, IDF, together with 24 Chinese universities and research institutes, launched the China Digital Finance Research Alliance, with the aim of enhancing exchange and cooperation on academic research and personnel development in the fields of digital finance, financial technology, Internet finance, and financial big data analysis in China's academic circles.

Furthermore, IDF has organized a number of international exchange activities, including visits co-organized with SFI to developed or emerging economies in Europe and the US for research on the development status and path of the financial technology industry, annual international conferences co-organized with SFI and IMF, and

international academic seminars co-organized with international institutions such as the Graduate Institute, Geneva, and the University of Nottingham.