

Does an Aging Population Inhibit the Digitization of Regional Finance?

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Abstract

"14th Five-Year" period, China's digital economy to deepen the application, standardize the development of a new stage. In the financial sector, digitalization has also become an important development direction. In response to the national call, banks and other financial institutions are promoting the digitalization and intelligence of risk management, and finance is moving from traditional offline to digital online, showing many benefits. As China's aging process deepens, the digital divide between the elderly and the times is further revealed, thus whether the issue of aging population will inhibit the digitization of regional finance becomes a topic worth studying. An individual fixed-effects model is used to measure the degree of financial digitization in 30 provinces in China from 2011 to 2020 to test the impact of population aging on regional financial digitization. The study shows that there is no inhibitory effect of population aging on financial digitization.

Keywords

Population Aging; Financial Digitization; Regions; Individual Fixed Effects.

1. Introduction

The Proposal of the Central Committee of the Communist Party of China on Formulating the Fourteenth Five-Year Plan for National Economic and Social Development and the Visionary Goals for 2035 states that the development of the digital economy should be accelerated to promote high-quality economic development. The digital economy drives innovation, cost reduction, efficiency and job creation in the traditional economy. In the 14th Five-Year Plan period, China's digital economy has entered a new stage of application development. Along with the rapid development and increasingly mature application of big data, blockchain, artificial intelligence and other technologies, digitalization has become an unstoppable technological trend that deeply penetrates all aspects of the economy and society. Digital inclusive finance is a new generation of financial services derived from the background of the digital era, which has injected new vitality into the development of the traditional financial industry. On the one hand, the continuous development of digital inclusive finance not only makes financial transaction costs lower, but also reduces the problem of information asymmetry. On the other hand, digital inclusive finance can make up for the shortcomings of traditional finance in terms of capital scale, risk management and financial supervision. Digital inclusive finance has significant features such as technology, inclusiveness and targeting, which can expand the coverage of financial services and better serve the development of the real economy.

Data from the seventh national census in 2020 shows that there are more than 260 million people aged 60 and above in China, accounting for 18.70% of the population, including more than 190 million people aged 65 and above, accounting for 13.50% of the population. And some experts say that along with the arrival of the era of negative population growth, China is expected to move from the current moderately aging society to a heavily aging society around

2035. Thus, it is worth studying whether the aging population will inhibit the digitization of regional finance. Some scholars argue that population aging inhibits the development of digital financial inclusion by inhibiting Internet penetration and increasing risk aversion (Zhengping Zhang, 2021). Other scholars argue that population aging has a negative impeding effect on economic growth. The demographic changes brought about by population aging, especially the increase in the elderly dependency ratio, negatively affect economic growth (Ren, Huiling, 2017). However, studies on the impact of population aging on regional financial digitization are still very limited. This paper examines this issue based on provincial panel data in China.

2. Literature Review

Finance is the core of the economy, and in order to adapt to the development of China's digital economy and accelerate the construction of a new double-cycle development pattern, China has to accelerate the digital transformation of finance (Wang Yunjia, 2021). In the new round of digital finance, digital transformation can accelerate the improvement of internal governance capacity, its own digital capacity, the capacity of inclusive financial services, and the capacity of rural revitalization services. In terms of the internal environment, the new generation of information technology continues to innovate, forming the technical conditions for the accelerated development of digital finance and giving rise to a large number of modern digital financial products and services. At the same time, the external environment tends to be mature, consumers' consumption concepts have advanced with the times and their consumption ability has been improved, which has increased the demand for digital financial products and services to match, prompting the development of digital finance to have sufficient groups to be served as a guarantee. The emergence of corresponding policy dividends and the continuous improvement of the overall credit environment will fuel the accelerated development of financial digitalization (Xu, Jie, 2022). Digital financial services play a key role in improving access to and use of services by underserved populations (FernandesCarla et al., 2021).

China has entered the aging society in 2013, but has not reached the standard of the aging society, from 2013 to 2019, the number of elderly people over 60 years old in China increased by 0.51 billion, the proportion increased by 3.2%, the number of elderly people over 65 years old increased by 0.44 billion, the proportion increased by 2.9%, the trend of population aging is very obvious (Xiang Xin et al., 2021). China's population aging has the unique characteristics of huge scale, rapid growth, aging before wealth, more women than men, regional imbalance and urban-rural inversion (Pang, National Defense et al., 2021). The growth of population aging will significantly increase the pressure on public finance spending (DanielHowdon et al., 2018). Population aging significantly inhibits the development of digital inclusive finance; at the same time, this inhibition is stronger in regions with high levels of population aging, central and western regions, and regions with large urban-rural income disparities; mechanism tests suggest that population aging inhibits the development of digital inclusive finance by inhibiting Internet penetration and enhancing risk aversion (Zhang Zhengping et al., 2021).

Existing studies have mainly explored the relationship between population aging and inclusive economic growth from the perspective of regional differences in the East and West, but at a time when financial technology is booming, few studies have explored the impact of population aging on financial digitalization in the context of financial digitalization transformation and proposed substantive policies that can be implemented. Therefore, this research combines population aging and regional financial digital development, adopts a scientific and rigorous technical route, conducts relevant qualitative and quantitative research, examines whether population aging inhibits the development of regional financial digitalization, grasps the opportunity of the times to discuss the way to break the financial digitalization, explores a new

path for financial digital development to be stable and far-reaching, and empowers the rapid development of the real economy.

3. Analysis of Impact Mechanisms

3.1. Positive Effects of Population Aging on the Digitization of Regional Finance:

Technological progress effect. Aging will "force" firms to replace people with technology and use technological progress to mitigate the labor supply shortage effect of aging (Ma, Z. H. & Yao, 2021; Chen, Y. B., 2014; 116 Liu, Y. F. & Peng, D. D., 2016) [13, 33-34], and some studies show that aging reduces social productivity, but enhancing technological innovation capacity will effectively attenuate this negative effect (Wang, Wei et al, 2015; Oster & Hamermesh, 1998; Zhuo, Chengfeng and Deng, Feng, 2018) [32, 35-36]. Thus, an aging population will stimulate technological innovation, which will drive the digitization of regional finance.

3.2. Negative Effects of Population Aging on Regional Financial Digitization:

From the supply side: there is a labor supply effect. Aging leads to a shortage of young and strong labor supply, which is reflected in the digital service industry, where there is a demand gap for digital labor.

Demand side: It has been shown that as aging deepens, the number of elderly populations rises, which will have a significant impact on labor supply, and most of the elderly population will drop out of the labor market, leading to a significant lack of investment incentives.

Considering that there are both positive and negative effects of population aging on the development of financial digitization, and that the net effect depends on the relative magnitude of the positive and negative effects, this study establishes the following contrasting hypotheses:

Hypothesis H0: There is a positive effect of population aging on financial digitization;

Hypothesis H1: There is a dampening effect of population aging on financial digitization.

4. Variables and Data Sources

4.1. Explained Variable: Digital Club Finance (df)

In this paper, the Digital Inclusive Finance Index jointly compiled by the group of Digital Finance Research Center of Peking University and Ant Financial Services is selected as the explanatory variable. The index comprehensively measures the development of digital inclusive finance at the national, provincial, municipal and county levels from 2011 to 2020, and the index has comprehensive, balanced, comparable, continuous new and feasible characteristics.

It can be seen that the digital inclusive finance index of each province shows a fluctuating increase from 2011 to 2020. The fluctuation trend of the regional digital inclusion financial index is more consistent, but the growth rate of the western region (northeast and southwest/northwest/internal Mongolia) is relatively slow, which may be mainly due to the low digital penetration of the western region due to its geographical location and economic development.

4.2. Explanatory Variables

The explanatory variable in this paper is the population aging index, calculated as the number of people over 65 years old as a proportion of the total population, to measure the degree of population aging in the region.

4.3. Control Variables

The control variables are as follows: ① GDP per capita (lnagdp) is used to measure the level of economic development of each province ② Number of Internet users (lniu) is used to measure the construction and use of digital infrastructure in each province ③ The proportion of output value of tertiary industry (lne) and the proportion of output value of secondary industry (lnei) reflect the industrial structure of each province ④ The level of urbanization (lnc): reflects the technological innovation and human capital accumulation in each province degree.

4.4. Data Sources

This paper uses the Digital Inclusive Finance Index to measure digital finance. Since the Digital Inclusive Finance Index has been counted since 2011, this paper selects panel data of 30 provinces in China from 2011 to 2020 (some data from Hainan are missing more seriously and will not be used for reference) for empirical analysis. The data are obtained from the China Statistical Yearbook and the main data of the seventh national census published by the National Bureau of Statistics and Statistical Yearbook of each province. The descriptive statistics of the variables are shown in Table 1. The digital financial inclusion index has a small gap in the set time interval; the difference between the maximum value and the minimum value of the digital financial inclusion index is 3.282, which indicates that the sample has a large gap in the set time interval and a large gap in the degree of population aging.

Table 1. Results of descriptive statistics of variables

Variable	Mean	Sd	Min	Max
year	2,016	2.877	2,011	2,020
ln df	5.210	0.678	2.786	6.068
ap	0.105	0.0266	0.0482	0.188
lnagdp	10.83	0.443	9.706	12.01
lniu	7.976	0.853	5.090	9.565
lnc	4.036	0.237	3.127	4.495
lne	3.834	0.193	3.391	4.430
ei	43.58	8.080	15.80	59
id	15.50	8.670	1	30
lnei	3.754	0.218	2.760	4.078

5. Empirical Analysis

5.1. Baseline Regression Results

To test the effect of population aging on the digital development of regional finance, this study designed the regression equation of equation (1):

$$df_{it} = \alpha_0 + \alpha_1 ap_{it} + \alpha_2 agdp_{it} + \alpha_3 iu_{it} + \alpha_4 c_{it} + \alpha_5 e_{it} + \alpha_6 ei_{it} + \lambda_i + \varepsilon_{it} \quad (1)$$

where i denotes province ($i = 1, 2, 3, \dots, 30$) and t denotes time ($t = 1, 2, 3, \dots$). df denotes digital financial inclusion index, which measures the degree of regional financial digital development; ap denotes population aging index; $lnagdp$ denotes GDP per capita, which measures the level of economic development of each province $lniu$ denotes the number of Internet users, which is used to measure the construction and use of digital infrastructure in each province; lne and $lnei$ denote the proportion of output value of tertiary industry and secondary industry respectively, reflecting the industrial structure of each province; lnc denotes the level of urbanization: reflecting the degree of technological innovation and human capital accumulation in each province. λ_i denotes province fixed effects, and ε_{it} is a random disturbance term.

The estimated results through fixed effects regressions are shown in Table 2. Column (1) shows the empirical results of population aging on regional financial digitization without adding control variables, and its coefficient is significantly positive, indicating that there is no inhibitory effect of population aging on financial digitization, i.e., the positive effect of population aging on financial digitization is greater than the negative effect. Column (2) is the regression result of adding economic development to column (1), population aging still shows a significant positive effect on financial digitalization, and its influence is greater, while population aging does not regional financial digitalization development. Columns (3), (4), (5), and (6) all add a control variable to the previous column, and the results show that population aging does not inhibit the development of regional financial digitalization.

Table 2. Regression results between population aging and regional financial digitization

	(1)	(2)	(3)	(4)	(5)	(6)
	ln df	ln df	ln df	ln df	ln df	ln df
ap	26.166*** (13.24)	6.966** (2.41)	3.422*** (8.77)	2.810*** (6.17)	2.204*** (5.29)	1.309** (2.73)
lnagdp		2.214*** (13.08)	0.395*** (3.93)	0.300*** (3.24)	0.310*** (3.68)	0.369*** (5.09)
lniu			0.704*** (8.48)	0.551*** (5.60)	0.468*** (4.81)	0.399*** (4.18)
lnc				0.948*** (4.16)	0.795*** (3.48)	0.714** (2.44)
lne					0.415*** (3.70)	0.311*** (3.35)
lnei						-0.386*** (-3.15)
Constant	2.454*** (11.78)	-19.505*** (-11.92)	-4.754*** (-8.56)	-6.289*** (-8.27)	-6.667*** (-10.33)	-4.500*** (-4.70)
Observations	300	300	210	210	210	210
R-squared	0.442	0.710	0.918	0.930	0.938	0.946
Number of id	30	30	30	30	30	30
F test	0	0	0	0	0	0
r ² _a	0.440	0.708	0.917	0.929	0.936	0.944
F	175.3	214.7	724.8	455.3	408.8	408.3

5.2. Analysis of Results

One, financial digitalization is mainly a supply-side reform, and population aging, as a demand-side problem, has a weaker impact on the supply side. The issue of population aging is currently reflected in the digital finance field mainly in the audience of digital financial products accounted for a relatively large proportion of older people, that is, there is a certain digital divide in the use of the demand side, while the digitalization of finance is mainly a reform of the supply side, and the demand has less impact on the supply. The main force of financial digitization is financial institutions, financial practitioners build indicator systems and models to promote the transformation of finance from the traditional model to digital. For example, the Industrial and Commercial Bank of China (ICBC), as the main body of supply, actively researches the application of technologies such as blockchain, adopts distributed bookkeeping methods and applies them to green credit and other aspects, and tries to play a role in digital technology empowerment when achieving financial supply innovation drive. Thus, supply-side

reform is the main force in the development of financial digitalization, and the audience of digital products and services is divided into two parts: individuals and enterprises, and the elderly are only a small part of the individuals and have a weak impact on the overall trend.

Secondly, although the aging population accounts for 14% of the population, the majority of the elderly can use smartphones, and the elderly can also accept smart operations. New media technology has been increasingly integrated into all aspects of people's lives, and in this digital wave, new media represented by the Internet and smartphones are gradually penetrating into the elderly population. Although the proportion of the aging population is large, the proportion of those who do not know how to use smart devices at all is relatively small. According to the latest 47th Statistical Report on the Development Status of China's Internet by China Internet Network Information Center (CNNIC), the proportion of Internet users aged 60 and above increased to 11.2% as of December 2020. ①The Report on Mobile Internet for Elderly Users shows that on average, one in five elderly people use cell phones to access the Internet. ②The popularity of smartphones has become an important turning point for seniors to create a connection with digital technology, and a new set of characteristics have emerged in the lives of these silver-haired surfers as a result. The "2020 Internet Life Report for the Elderly" shows that smartphones have become the main tool for the elderly to access the Internet, accounting for more than 95.6% of the elderly, and more than half of them think smartphones have an important role in their lives, while the most frequent behavior of the elderly in Internet use is browsing news and information (those who choose "often" in this option). The highest frequency of Internet use among the elderly is browsing news and information (71.6% of elderly Internet users chose "often" in this option), followed by learning knowledge and understanding new things (52.7%), watching short videos and live streaming (44.8%), interacting with friends (42.6%), playing games (40.2%) and so on. It can be seen that the elderly group is more optimistic about the acceptance of digitalization.

Third, the popularity of financial services and the Internet, to a certain extent, bridges the digital divide of the aging population, thus reducing the inhibiting effect on financial digitization. The problem of difficulties in using cell phones for the elderly is mainly concentrated in less developed areas, but with the speed of renewal in the overall social infrastructure, economic and cultural development, the rapid increase in Internet penetration, along with the improvement in the availability of financial services in poor areas, their education development level has also achieved an unprecedented increase, bridging the digital divide to a certain extent. For example, commercial banks have taken the practical needs of the elderly and the difficulties in applying smart technology as the starting point, and have made a variety of educational programs for the elderly by producing teaching materials, opening "citizen classes" in branches, sharing "health lectures" online, reaching out to the community and the public, and linking social resources and forces. We will help the elderly to improve their ability to apply smart technology and financial security awareness through a variety of public service activities for the elderly, such as producing teaching materials, opening "citizen classes" in our branches, sharing "health lectures" online, reaching out to the community and linking social resources and forces, helping the elderly to bridge the "digital divide." To help the elderly to bridge the digital divide and enhance their sense of well-being and security in the construction of smart cities.

In summary, the aging population will not inhibit the trend of regional financial digitization.

6. Conclusion and Policy Recommendations

At the national policy level, we combine the national strategy of actively coping with population aging with the national development strategy of digital power, and provide top-level design of digital accurate empowerment of aging. According to the guidance of the 14th Five-Year Plan

and the 2035 Vision Plan, we will conduct in-depth research on the core needs, main features and application scenarios of the elderly population. We should highlight the problem-oriented approach to solve the pain points of the elderly in digital life, and at the same time establish the long-term thinking of balancing technical efficiency and social benefits.

At the enterprise R&D level, we should encourage and guide relevant enterprises and platforms to carry out hardware and software R&D design and technological innovation for the ageing era, and use technology to support the effective integration of the elderly into digital life. Enterprises and platforms should highlight the application innovation orientation of "digital technology for aging" and "intelligent scene service", pay attention to the needs and feelings of elderly users, and strengthen the diversified technical support of public service platforms, so as to solve the common problems faced by the elderly in order to solve the problem of lack of digital usage ability faced by the elderly. At the same time, for the key demand scenes that frequently occur in the daily life of the elderly, the system platform function integration of high-frequency affairs and services can be realized with the help of big data technology, so that the intelligence level of services in the scenes involving the elderly can be improved continuously and the accessibility and universality of the digital life of the elderly can be solved actively.

At the level of social participation, the government, community, family and other multiple entities should cooperate and make efforts to improve the adaptability of the elderly to digital technology. On the one hand, it should standardize the regulation of platform services for the elderly, legalize network information security, strictly punish illegal acts such as network fraud, and effectively protect the information privacy security and legitimate rights of the elderly. On the other hand, families should be mobilized to carry out intergenerational digital feedbacks, and with the help of different forces such as communities, public welfare organizations, senior citizen institutions and senior citizen universities, we should continuously improve the digital information access ability and online digital literacy level of the elderly by holding regular training seminars and other forms, so that more elderly people can integrate and enjoy the good life in the digital era.

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