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Research on the Impact of Digital Inclusive Finance on the Income of China's Commercial Health Insurance

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Abstract: *Digital inclusive finance is of great significance to the future development of the insurance industry. Both the intensification of the aging population problem and the impact of the COVID-19 have stimulated residents to have a higher health awareness. As an important part of China's multi-level medical security system, commercial health insurance has huge development potential. Based on the Beijing University Digital Inclusive Finance Index and the panel data of commercial health insurance premium income of 31 provinces in China, this paper makes an empirical analysis using the double fixed effect model. The results show that the development of digital inclusive finance is conducive to improving the income of commercial health insurance in China, and the impact of digitization on health insurance income is more significant than other factors of the index. Finally, based on the research results, this paper puts forward relevant suggestions from the perspectives of insurance institutions, regulators and residents themselves.*

Keywords: *Digital inclusive finance, Commercial health insurance, Premium income, Fintech*

1. Introduction

As a part of China's multi-level medical security system, commercial health insurance and social insurance play a complementary role, which has an important contribution to the development of China's social health care. On the one hand, in recent years, the aging problem of the population in China is still getting worse, and the medical expenditure of the elderly population is increasing. It is difficult to maintain long-term demand by relying on basic medical insurance alone. On the other hand, the impact of the COVID-19 on the economy has also increased the demand for public health conscious. In recent years, the premium income of commercial health insurance has shown a continuous upward trend. In this era of rapid economic development, people's health awareness has been constantly improved with the rise of quality of life, and commercial health insurance still has high development potential.

In August 2014, China issued the new "National Ten Rules" for the insurance industry, which provided new development space for this industry at that time. In 2016, the ‘Healthy China 2030’ Planning Outline is issued by the CPC Central Committee and the State Council. It is proposed to improve the multi-level medical security system with basic medical security as the main body and other forms of supplementary insurance and commercial health insurance as the supplement, actively develop commercial health insurance, and encourage enterprises and individuals to participate in commercial health insurance and various forms of supplementary insurance. In the Health Insurance Management Measures revised by the CBRC in 2019, it was pointed out that commercial health insurance is an important part of China's multi-level medical security system, and its important position was further clarified[1].

Under the circumstances of rapid development of science and technology, how to effectively apply new technologies to practice has attracted more and more attention from all walks of life, including the insurance industry. In 2013, we ushered in the first year of Internet finance, and the diversity of Internet financial products has been greatly improved. In this context, the insurance industry has also launched new businesses relying on insurance supermarkets, portals, O2O platforms, third-party e-commerce platforms, etc. Later, with the constant updating and iteration of digital technology, the entire economic society has gradually stepped into the digital era from the Internet era. The maturity of technologies such as big data, block chain and artificial intelligence has injected fresh vitality into the financial market, and the trend of decentralized financial services has gradually emerged. In the G20 Finance Ministers and Central Bank Governors' Meeting issued on July 24, 2016, the high-level principle of digital inclusive

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finance was adopted, and digital inclusive finance was listed as an important topic for the first time at the G20 Summit. On August 9th, 2018, the SME Research Center of the Chinese Academy of Social Sciences and JD Financial Research Institute jointly released the white paper "Industry Practice of Inclusive Finance Digital Transformation", believing that digitization is the only way to develop inclusive finance. In this context, it is particularly important to adapt to the development of digital inclusive finance, effectively absorb these financial technologies, and realize the upgrading of the commercial health insurance industry[2-3].

2. Literature review

Some scholars analyzed the current situation of commercial health insurance in China from six aspects: scale, insurance density, insurance depth, proportion of medical and health expenses, market operation structure, and regional structure, and investigated the impact of commercial health insurance on the health status of Chinese residents. The results confirmed that commercial health insurance has a significant promoting effect on the health of residents today. In terms of premium income, Li Qiong (2009) conducted an empirical analysis on the influencing factors of commercial health insurance premium income in Hubei, Beijing and Shanghai at an early stage, and concluded that economic development determines insurance demand to a certain extent, while residents' income transforms potential demand for insurance into real demand, and health insurance products play a role in promoting such demand. Liu Jiayu (2014) used the national health insurance premium income data from 1999 to 2011 to empirically draw the conclusion that education and the depth of basic medical insurance will increase the health insurance premium income. Some scholars have established an optimal fitting model and concluded that the total number of permanent residents, urbanization rate, aging degree, number of people admitted to hospital, regional GDP, per capita disposable income of urban residents, number of people participating in basic medical insurance, per capita medical care expenditure of urban residents, insurance density and health insurance density will all affect the premium income of commercial health insurance to some extent. Other scholars' research results show that the rise of price index will also promote the growth of health insurance premium income in the short term, but if the price index continues to rise, it will in turn hinder the growth of health insurance premium income. Some studies also focus on the demand for commercial health insurance. For example, Liu Hong (2012) empirically analyzed the risk choice behavior of both the supply and demand sides in the commercial health insurance market using the data from the China Health and Nutrition Survey (2000-2006). The results show that urban and rural social medical security has a significant role in promoting the demand behavior of residents for commercial health insurance[4-5].

At present, the research on the impact of digital inclusive finance on the insurance industry is more theoretical than empirical. Zhao Dawei (2017) believed that the development and application of a series of new technologies and products such as the Internet, big data, cloud computing, block chain, and the Internet of Things are reshaping the entire insurance industry from multiple dimensions such as business philosophy, business model, technical means, sales channels, and internal management. Financial technology has gradually become the core element leading the upgrading and transformation of the insurance industry and optimizing the industry development environment. Some scholars also took the domestic Internet commercial health insurance business as the research object, and put forward suggestions such as combining online and offline, in-depth cooperation with third-party e-commerce platforms, and establishing data security and maintenance platforms within the industry. Hu Gaoqiao (2020) used literature analysis, qualitative analysis and empirical analysis of NPS indicators. His research believed that the application of financial technology could improve the service quality of commercial health insurance and enhance customers' sense of consumption experience. Among the current digital technologies, some scholars discussed the current situation of the application of Internet of Things technology in the health insurance industry, and pointed out that the application of Internet of Things technology may lead to technical risks, security risks, business pressures and cross-border competition shocks. Some scholars also studied the impact and application of financial technology on actuarial development from the perspective of big data and block chain. In terms of empirical research, Wang Renzeng (2021) conducted an empirical study using the survey data of China's family finance of Southwest University of Finance and Economics and the digital inclusive finance index of Peking University. The results show that the development of digital inclusive finance can significantly improve the possibility of family commercial insurance purchase. Song Chaoli (2022) also made an empirical analysis based on the digital inclusive finance index of Peking University and the relevant data of Beijing Tianjin Hebei region. The results show that digital inclusive finance has a significant role in promoting household insurance demand, and there are three intermediary effects: income effect, consumption effect

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and channel effect.

To sum up, we can see that many current empirical studies on commercial health insurance income use data from the national level or from several provinces, which may ignore the differences between different regions. On the other hand, the relevant development of digital inclusive finance is still in its early stage, and the practice of some emerging technologies is still in the exploration period. More articles analyze its impact on commercial health insurance or the entire insurance industry from a theoretical perspective, with less empirical research. In this paper, we use the Beijing University Digital Inclusive Finance Index to empirically analyze the impact of the development of digital inclusive finance on the income of commercial health insurance from the national provincial level data, so as to provide some reference for promoting the digital transformation and upgrading of the health insurance industry[6-9].

3. Theoretical analysis

On the one hand, the impact of digital inclusive finance on the commercial health insurance industry lies in its strong data collection and processing capabilities, thus providing more high-quality insurance products. In this age of big data, whether we can master more effective data and use these data efficiently has become the goal of all walks of life, especially in the commercial health insurance industry. Essentially, the operation of insurance is to collect temporarily unnecessary funds in the form of premium, and then distribute them to individuals in need through insurance compensation. In fact, it is a financing behavior. The development of insurance products can not be separated from the process of processing the data related to the insured group, and the corresponding insurance expenses need to be formulated according to the probability of occurrence of the insured group compensation event and a certain amount of compensation. Before the age of big data, due to the lack of event occurrence tendency to distinguish different policyholders, the premium can only be determined by the approximate frequency of events. In this case, compared with social insurance, commercial health insurance lacks the coverage that is compulsorily guaranteed by the latter. The policyholders' free choice of insurance and insufficient information collection will lead to people with poor health status more likely to choose insurance. Finally, the actual incidence of policyholders' events is higher than expected, resulting in losses to insurance companies, which is a common adverse selection problem in the insurance industry. In recent years, with the rapid development of intelligent devices and the popularity of wearable devices such as smart bracelets and smart watches, health insurance companies can use different channels to collect a large number of relevant health data of policyholders. With the support of cloud computing technology, some previously difficult data such as eating habits, personality and social circles can be effectively used, so that differential pricing can be made according to the health data of different policyholders, and more people can understand the corresponding products through accurate delivery[10-12].

The development of digital inclusive finance has brought another great change to commercial health insurance, which is the marketing mode. The traditional means of product promotion in the insurance industry are more paper leaflets or face-to-face communication. Nowadays, the popularity of the Internet and even intelligent devices makes its marketing methods very convenient and diversified. Users can choose their favorite insurance products from a variety of apps, and the information barrier in the transaction process has been greatly reduced. On the one hand, this transformation saves a lot of manpower and material resources and reduces the marginal marketing cost of insurance companies. On the other hand, it also makes the previously unpopular long tail users a new profit space and expands the customer base. The application of block chain technology also brings higher data security and lower transaction costs to online transactions of insurance, and truly realizes decentralized transactions. The popularity of online marketing has strengthened the mutually beneficial and win-win relationship between different industries. Insurance companies need software support from financial technology companies. Other health related software also provides insurance companies with fragmented marketing opportunities, greatly expanding their market space.

The development of digital inclusive finance will also indirectly affect the income level of commercial health insurance through quality of life, income level, etc. After digital finance promotes the development of the overall economic level, the quality of life of residents will be improved to a certain extent, and their personal health needs will also increase accordingly. At the same time, economic development will also improve the income level of residents. When more disposable income is available, it is possible to consider financial products that have no spare power to buy. These changes have more obvious impact on the long tail group. The birth of these demands will lead to more health insurance markets, thus increasing the income of health insurance[13-14].

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4. Variable and model construction

4.1. Sample selection and data source

The Digital Inclusive Finance Index of Peking University constructed by Guo Feng in 2020 is a relatively authoritative index to measure its development level in the academic community. The index depicts the development process of digital inclusive finance in different regions from three dimensions: coverage, usage depth and digitization level. Our research selects the data of 31 provinces nationwide from 2011 to 2019 as the independent variable, and the provincial commercial health insurance premium income as the dependent variable. The data of premium income is obtained from the official website of EPSDATA to measure the development of health insurance.

4.2. Variable selection and definition

4.2.1. Dependent variable: premium income of health insurance(Y)

The premium income is the consideration income that the insurance company collects from the applicant in order to fulfill its obligations under the insurance contract. It is the main source of funds for the insurance company to fulfill its insurance responsibilities, and also the main channel of capital income. The health insurance premium income of a region is an important indicator to measure the development of health insurance in the region, which shows the market size and development level of health insurance in the region.

4.2.2. Independent variable: Peking University Digital Inclusive Finance Index (X)

This paper selects the digital inclusive finance index compiled by the Digital Finance Research Center of Peking University as the core independent variable, which can more scientifically and comprehensively measure the development of digital inclusive finance in a region. In addition, this paper also uses three secondary indicators in the index, namely, coverage, usage depth and digitization level, as independent variables to analyze whether different dimensions have different degrees of impact on the commercial health insurance industry. In terms of coverage, the index uses the number of Alipay accounts and the binding of bank cards to measure the coverage of digital financial services. The usage depth is measured by the actual use of financial services such as payments and monetary funds (number of transactions per capita, amount of transactions per capita). The digitization level is to measure the low cost and low threshold characteristics of its digital financial services by the proportion of mobile payment and deposit free payment[15-17].

4.2.3. Control variable

Referring to existing research in this field, the following control variables are used in this paper , as shown in Table 1:

Table 1: Control Variables

VARIABLE	VARIABLE NAME	CONNOTATION
control variable	Per capita disposable income (PCDI)	Income level of residents
	Gross domestic product per capita (RFDP)	Regional economic level
	Per capita healthcare expenditure (RME)	Health awareness of residents
	Per capita years of education (EDU)	Regional education level

4.3. Fixed effect model construction

This paper uses the time and regional double fixed effect regression model to conduct empirical analysis on panel data. The specific model is as follows:

$$Yit = \beta 0 + \beta 1Xit + \beta 2PCDIit + \beta 3RGDPit + \beta 4RMEit + \beta 5EDUit + \varepsilon it \quad (1)$$

Y_{it} represents the health insurance premium income of the ith region in year t. X_{it} represents the interpreted variable. PCDI, RGDP, RME and EDU are control variables. ε Is a random disturbance term.

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5. Empirical analysis

5.1.1. Data processing and descriptive statistics

Considering the time span of the Beijing University Digital Inclusive Financial Index and other variables, this paper selects the data of 31 provinces in China from 2011 to 2019 for empirical analysis. After winsorizing the data and deleting the missing samples, a total of 279 valid samples are obtained.

From the descriptive statistical results, we can see that the province with the lowest premium income of the explained variable is only 12.88 million yuan, while the largest is 46889 million yuan, with an average of 8117 million yuan, which indicates that there is a large gap in the scale of health insurance among different provinces. The inclusive financial index of explanatory variables also has similar characteristics, with the minimum of 18.47 and the maximum of 387.5. The development level of digital inclusive finance in different provinces also has a large gap , as shown in Table 2.

Table 2: Descriptive Statistics

variable	N	mean	p50	sd	min	max
Y	279	8117	4597	9710	12.88	46889
X	279	202.2	212.4	91.37	18.47	387.5
RGDP	279	5.357	4.687	2.533	1.925	13.83
PCDI	279	22175	19905	10422	8568	64183
EDU	279	9.060	9.061	1.106	5.063	12.55
RME	279	1200	1114	560.3	152.6	3088

5.1.2. Correlation analysis

Then the correlation analysis of Y, X and other control variables is carried out. From the results, it can be seen that each variable has a significant positive correlation with the explained variable Y, which preliminarily shows that these variables have a significant positive impact on the premium income of commercial health insurance , as shown in Table 3.

Table 3: Correlation Analysis

	Y	X	PCDI	RGDP	RME	EDU
Y	1					
X	0.630***	1				
PCDI	0.474***	0.552***	1			
RGDP	0.527***	0.550***	0.597***	1		
RME	0.483***	0.632***	0.564***	0.598***	1	
EDU	0.359***	0.309***	0.544***	0.711***	0.558***	1

5.1.3. Collinearity analysis

Before regression, we conducted a collinearity analysis on each variable, and further conducted a variance inflation test on the variables. The results are shown in Table 4. It can be seen that the variance inflation factor (VIF) of all variables is less than 5, so there is no serious multicollinearity problem for the variables used in this paper.

Table 4: Collinearity Analysis

Variable	VIF	1/VIF
RGDP	2.750	0.363
EDU	2.450	0.407
RME	2.250	0.445
X	2.130	0.470
PCDI	1.920	0.520
Mean	VIF	2.300

5.1.4. Regression results

The regression results (1) show that the coefficient of the digital inclusive financial index to the health insurance premium income is significantly positive at the 10% level, and each unit of the digital inclusive financial index can increase the health insurance premium income of the province by 105.745 million yuan. This shows that the development of digital inclusive finance has a significant positive impact on the income of commercial health insurance in China from 2011 to 2019.

In order to verify the different impact of the three dimensions in the index on health insurance income,

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(2) (3) (4) are the regression results obtained by taking coverage, digitization level and usage depth as explanatory variables. From the results, we can see that the digitization level of inclusive finance has a significant positive coefficient, while the significance of coverage and usage depth is low. It shows that the digitization level of inclusive finance has a greater impact on health insurance premium income among the three. The digital degree indicator mainly measures the universality and low cost of digital financial services. It is an important indicator and can reflect its 'inclusive' nature. Finally, the three indicators are regressed together to get the result (5). It can be seen that the digitization level is still significantly positive , as shown in Table 5.

Table 5: Regression Results

VARIABLES	(1) Y	(2) Y	(3) Y	(4) Y	(5) Y
X	105.745*				
	(1.71)				
coverage		74.421			79.036
		(1.03)			(1.09)
digitization			34.768*		38.080*
			(1.73)		(1.82)
depth				0.044	-18.469
				(0.00)	(-0.58)
PCDI	0.398**	0.411**	0.382**	0.396**	0.400**
	(2.13)	(2.19)	(2.05)	(2.11)	(2.14)
RGDP	1,746.034***	2,175.574***	1,799.598***	2,302.462***	1,765.606***
	(2.70)	(3.79)	(2.86)	(3.75)	(2.66)
RME	1.851	2.265	1.127	1.858	1.549
	(1.01)	(1.20)	(0.60)	(1.00)	(0.80)
EDU	-3,959.443*	-4,081.794*	-3,279.344	-4,020.901*	-3,141.074
	(-1.88)	(-1.93)	(-1.53)	(-1.89)	(-1.44)
2.time	-6,206.214	-3,333.867	-3,193.940	-107.050	-5,701.277
	(-1.60)	(-0.96)	(-1.36)	(-0.04)	(-1.38)
3.time	-13,431.723*	-8,083.513	-7,867.152**	-1,667.114	-13,139.293*
	(-1.91)	(-1.27)	(-2.04)	(-0.43)	(-1.73)
4.time	-15,562.202*	-11,330.940	-8,348.159*	-1,396.779	-17,807.065*
	(-1.84)	(-1.16)	(-1.92)	(-0.41)	(-1.68)
5.time	-19,744.225*	-13,238.877	-12,669.684*	-1,457.729	-24,223.948*
	(-1.82)	(-1.14)	(-1.88)	(-0.38)	(-1.82)
6.time	-17,914.244	-11,572.001	-7,712.522	1,276.204	-19,458.874
	(-1.57)	(-0.92)	(-1.38)	(0.25)	(-1.41)
7.time	-22,628.903	-15,200.848	-7,130.934	730.923	-20,741.611
	(-1.63)	(-0.97)	(-1.38)	(0.10)	(-1.23)
8.time	-23,409.178	-15,679.145	-7,592.514	2,694.720	-24,195.779
	(-1.51)	(-0.87)	(-1.16)	(0.38)	(-1.26)
9.time	-24,453.753	-16,668.941	-6,219.755	3,880.874	-24,740.146
	(-1.45)	(-0.83)	(-0.94)	(0.50)	(-1.16)
Constant	18,136.528	18,622.133	15,436.382	20,753.582	11,678.733
	(0.99)	(1.01)	(0.83)	(1.12)	(0.62)
Observations	279	279	279	279	279
Number of pro	31	31	31	31	31
R-squared	0.643	0.640	0.643	0.638	0.645
Company FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
F test	0	0	0	0	0
r2_a	0.578	0.574	0.578	0.572	0.577
F	32.54	32.15	32.56	31.92	28.24

Note: The values in the table are regression coefficients of variables; The value in brackets is t value, and the regression adopts robust standard error; ***, ** And * represent 1%, 5% and 10% significance levels respectively

6. Conclusion

Based on the digital inclusive financial index and commercial health insurance income of Peking University in 31 provinces nationwide from 2011 to 2019, this paper constructs a double fixed effect

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model for empirical research and draws the following two conclusions: (1) The development of digital inclusive finance has a significant positive impact on the premium income of commercial health insurance in China. (2) Among the three secondary indicators, the digitization level indicator in the digital inclusive financial index has a more significant positive impact on health insurance premium income. In the modern society with rapid social and economic development, residents' health awareness is getting higher and higher. The development of commercial health insurance is an important part of their healthy life. In view of the above conclusions, this paper puts forward the following suggestions:

Insurance institutions should seize the opportunity of digital transformation, strengthen cooperation with financial technology companies, actively and effectively use various emerging financial technologies, optimize their service structures and marketing models, and make them more responsive to the digital era. In the service process, insurance institutions can use AI technology to simplify the service process of business, improve service efficiency and reduce labor costs. When formulating health insurance products, use big data and cloud computing technology to achieve efficient processing of health data. At the same time, consider the economic and educational level of residents in different regions, and provide high-quality health insurance products with accurate matching for different populations. With the help of the cloud computing platform, various insurance companies can share data to provide more comprehensive customer health. With the popularization of various intelligent devices, insurance companies should optimize their online trading platforms, improve their digital level, cover their business scope to the long tail group, and expand their customer base. Finally, we should also strengthen cooperation with other relevant companies, provide corresponding insurance purchase channels in their apps, online outlets, etc., and achieve fragmented marketing.

For regulators, the vigorous development of digital finance will also bring about corresponding regulatory risks. While encouraging the digital transformation and upgrading of insurance institutions, regulators should also comply with the development trend, correspondingly strengthen their digital regulatory capabilities, improve regulatory efficiency and improve the new regulatory system. In the age of big data, data security is naturally an important aspect of supervision that regulators should pay attention to. Regulators should strictly control the user's data use authorization channels, and use the anonymous nature of block chain technology to enhance data security. On the other hand, regulators should also pay attention to the differences in education and income levels in different regions, and implement differentiated management for different regions. In addition, we should also pay attention to the interests of vulnerable people and popularize the relevant knowledge of digital finance in underdeveloped areas[18].

With the rapid development of digital inclusive finance, local residents should also follow the trend of the times and improve their ability to accept new things and technologies. It is suggested that residents can reasonably allocate funds according to their own economic and health conditions, and purchase insurance products suitable for them at different stages. At the same time, it is also necessary to improve the awareness of digital risk prevention, avoid the disclosure of their own relevant data, identify the compliance of different digital financial products, enjoy the convenience of the digital era and protect their own personal interests.

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