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Analysis of the Factors Influencing the Level of Basic Pension Insurance in China based on Factor Analysis

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Abstract: With the normalization of China's ageing population, the balanced regional development of pension insurance levels is a key concern for the Chinese government. The development process and level of each region is influenced by many factors, and there are serious differences in the level of basic pension insurance. This paper selects relevant livelihood indicators and data from provinces, municipalities directly under the Central Government and autonomous regions from 2014 to 2020, and uses factor analysis method to study and analyze the indicators that have a greater impact on the level of pension insurance, classifying all indicators into two categories: economic factors and demographic factors. The results of the study found that the economic factors accounted for a greater weight, with the coefficients in the economic factors (consumption level of residents, GDP per capita, the amount of pension insurance fund coverage, and the share of pension insurance fund) basically close to 20%, while the coefficients in the demographic factors (elderly population dependency ratio, participation rate) were closer to 10%. The weighting of the indicators affecting the importance of pension insurance are, in order of importance, the level of consumption of the population, GDP per capita, the amount of pension fund coverage, the share of pension fund, the dependency ratio of the elderly population, and the participation rate. The paper concludes that the overall level of basic pension insurance in China is low and disparate, and that disparities can be improved from both economic and demographic perspectives to promote balanced development.

Keywords: Basic Pension Insurance Level, Factor Analysis, Economic Factors, Demographic Factors

1. Introduction

Since the end of the last century (1981-1999), China had entered an aging society [1]. Chinese elderly population was facing a continuous climbing trend in both absolute and relative numbers. The population structure was gradually transitioning from a positive triangle to a spindle shape, and population aging would obviously become the basic national condition for a longer period of time in the future [2]. Along with the aging of the social population there were many more serious problems, such as labor shortage and rising cost, contradiction between supply and demand of old-

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age resources, heavy national financial pressure, etc. [3]. It was not only China, but also how to effectively cope with the aging trend had become a popular issue. As a large population country, China had a large base of elderly people. According to the data of the seventh national census, by the middle of the 21st century, there would be 380 million people aged 65 and above, accounting for 27.9% of the total population. It showed that China was gradually deepening its aging and was accelerating towards a moderate aging society, so the problem of aging needs to be solved urgently [4].

In addition, the degree of aging in China showed obvious regional differences. The aging of the population was the highest in the northeast, and the aging of the population in the north was slightly higher than that in the south, among which Liaoning was the province with the most serious aging of the population, and the proportion of the elderly population had reached 25.72% [5]. In addition, the aging of the population showed a shift from the east to the central and western parts of the country. As the core content of social security, the Chinese government had been committed to promoting the construction of a protection system. However, in the face of an aging population, the Chinese government has been constantly improving the pension system.

In the face of the serious aging of China's population, pension insurance was of great importance to protect the basic life of China's elderly residents. In the 14th Five-Year Plan and the 2035 Vision, it was proposed that China should establish a pension insurance system that was "universal, urban-rural, fair, uniform and sustainable". At present, China's basic pension insurance had initially completed comprehensive coverage. The financial situation of pension insurance was generally stable. The overall income and expenditure had achieved a steady growth trend. The information management level had been improved, and the service system had been optimized [6].

However, facing the long-term population aging trend, the sustainable development of pension insurance still faced certain pressure. Such as the uniform standards were lack in the introduction of policies implemented in various provinces in China. Also, the development of economic, social and policy factors was unbalanced between regions, resulting in uneven levels of basic pension insurance protection [7]. If appropriate and targeted measures are not taken, the disparity in basic pension levels between regions will grow for regional-level variability. This will affect the quality of life and well-being of the elderly at a micro level, and may even hinder the country's economic development at a macro level, which is contrary to China's economic building strategy. In recent years, many scholars in China had evaluated and analyzed the development of pension insurance by region. Studies have found that the current level of basic pension insurance development in China is positively and spatially autocorrelated across regions [8]. Scholars believe that regional differences in economic development are the main reason for the differences in pension insurance. Some studies have also shown that the level of pension insurance in urban areas is significantly higher than that in rural areas. When evaluating the level of pension insurance, a single indicator is currently used the pension insurance coefficient is used to evaluate the level of pension insurance [9]. Although the use of a single indicator makes it easy to calculate and collect data in practice in practice, it is easy to calculate and collect data, but it does not fully [10,11]. The fundamental measure to raise the level of pension insurance in a country or region is to develop the local economy [12].

In order to better evaluate the level of pension insurance and enrich the connotation of the level of pension insurance, this paper considers the current situation of the pension insurance system in China and constructs a comprehensive pension insurance system. And this paper firstly constructed a comprehensive evaluation system to measure the basic pension insurance level in each province, and analyzed the current level and the differences between regions. Secondly, this paper used factor analysis to explore the important factors affecting the level of basic old-age insurance and gives corresponding suggestions. The aim was to promote the balanced development of regional pension

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insurance levels, improve the social security system, promote the improvement of the living standards and happiness index of the elderly groups, and ultimately promote the sustainable development of the country.

2. Methods

This paper selected 6 indicators of household consumption Level(yuan), insurance coverage (%), per capital GDP (wan/person), share of pension funds (%), pension fund coverage(wan/person) and dependency ratio of elderly population (%), as important factors affecting pension insurance, as shown in Table 1.

And this paper collected the data of indicators related to the level of endowment insurance in 31 provinces in China from 2014 to 2020 (data from the National Bureau of Statistics and machine calculation), and analyzes the level of endowment insurance in China.

Table 1: Factors affecting pension insurance.

Factor	Serial Number
Household Consumption Level (yuan)	X_1
Insurance Coverage (%)	X_2
Per Capital GDP (wan/person)	X_3
Share of Pension Funds (%)	X_4
Pension Fund Coverage (wan/person)	X_5
Dependency Ratio of Elderly Population (%)	X_6

The future trend of pension insurance in China was analyzed in terms of the dependency ratio of the elderly population, which, as could be seen from Figure 1, was positively correlated with the year.

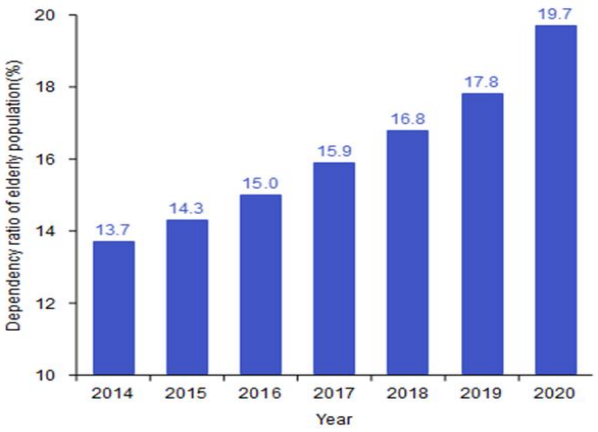

Figure 1: The proportion of the last 7 years.

Population aging had become a common phenomenon globally, but according to Figure 1, it was found that China's population aging was large-scale, deep and fast. The rising dependency ratio of the elderly population means that the burden of old-age care is increasing. In 2020, the dependency ratio of the elderly population was 19.7%, and the so-called elderly population dependency ratio refers to the ratio of the number of people aged 65 and over to the working-age population in the population, which means that the current average of 5 young people had to support an old person. Assuming that the encouragement of childbirth aroused a broad response from the whole society,

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and the fiscal expenditure reached the average level of other developed countries, according to expert forecasts, the dependency ratio of the elderly population would reach 53.2% in 2050. The severe aging form poses more challenges to the old-age security system.

For the factors of differences in pension insurance, factor analysis was used to study the influence of each indicator variable on pension insurance. First, the data of each province in 2016 was analyzed by factor. Perform the K MO and Bartlett spherical tests on the 2016 data, according to Table 2, KMO=0.572, indicating that the data was suitable for factor analysis.

Table 2: KMO and Bartlett test in 2016.

Inspection	Index	Result
KMO		0.572
Bartlett's test	The approximate chi-square	171.408
	Degree of freedom	15.000
	Significance	0.000

3. Results and Discussion

As shown in Table 3, Beijing, Tianjin and Shanghai were much higher than the other provinces in the economic factor scores, with only 11 overall positive economic factor scores, only half the number of negative scores, and a clear economic gap, with a difference of 4 between the highest and lowest scores. In the population factor scores Jiangsu and Chongqing were both greater than 1, which was slightly larger compared to the other data, proving that these cities were gradually entering a high level of ageing, while the difference in the number of positive and negative population factor scores was too large and there were differences in the population of each province.

Table 3: Factor scores for indicators by province in 2016.

Regions	F_1	F_2	Regions	F_1	F_2
Beijing	3.115	-0.558	Hunan	-0.553	0.762
Tianjin	1.312	-0.167	Guangdong	0.918	-0.211
Hebei	-0.685	0.534	Guangxi	-0.800	0.008
Shanxi	-0.578	-0.387	Hainan	-0.357	-0.239
Liaoning	0.482	0.736	Chongqin	0.106	1.283
Jilin	-0.360	0.250	Sichuang	-0.300	0.820
Heilongjiang	-0.137	0.465	Guizhou	-1.049	0.425
Shanghai	2.841	-0.500	Yunnan	-0.896	-0.463
Jiangsu	0.988	1.002	Shaanxi	-0.458	0.313
Zhejiang	0.991	0.276	Gansu	-1.029	-0.006
Anhui	-0.750	0.633	Qinghai	-0.384	-1.024
Fujian	0.095	0.340	Inner Mongolia	0.025	-0.234
Jiangxi	-0.556	0.401	Tibet	-0.746	-4.290
Shandong	0.082	0.616	Ningxia	-0.205	-0.630
Heinan	-0.662	0.661	Xinjiang	-0.237	-1.371
Hubei	-0.213	0.555	-	-	-

Similar to the 2016 data, factor analysis was performed on the other years' data and KMO values greater than 0.5 were obtained from the KMO and Bartlett's spherical tests for all seven years, indicating that each year was suitable for factor analysis. Factor analysis was conducted for each

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year to obtain the characteristic roots and variance contribution rates, which showed that the cumulative contribution of the first two characteristic roots reached more than 75% for each year, therefore two factors were extracted for each year affecting the pension insurance factors.

Table 4 showed that the coefficients of the economic factors (consumption level of the population, GDP per capita, the amount of pension insurance fund coverage and the share of pension insurance fund) were basically close to 20%, while the coefficients of the demographic factors (dependency ratio of the elderly population and participation rate) were closer to 10%. The coefficients of the indicators had not fluctuated much over the past seven years, indicating that the weight of the factors affecting the difference in the level of pension insurance had remained relatively stable since the implementation of the social pension insurance system for urban and rural residents.

Table 4: Indicator weighting factors for 2014-2020 (unit: %).

Indicators	2014	2015	2016	2017	2018	2019	2020
X_1	19.50	10.67	18.96	18.62	18.93	18.62	17.78
X_2	19.61	18.58	18.87	18.91	19.43	19.90	20.01
X_3	19.68	17.21	18.24	17.79	17.30	17.05	16.74
X_4	19.40	16.20	18.87	14.78	15.13	15.46	17.21
X_5	9.83	20.94	11.21	17.34	18.12	17.78	17.32
X_6	11.99	16.39	13.85	12.56	11.09	11.18	10.93

In Table 5 shows factor analysis total variance interpretation in 2016, selecting two eigen roots greater than 1, the cumulative contribution rate reached more than 79%, two common factors could be selected.

Table 5: Total Variance Explained in 2016.

Initial Eigenvalue		
Total	Percentage of variance	Accumulation (%)
3.348	55.803	55.803
1.419	23.647	79.450
0.733	12.218	91.668
0.422	7.033	98.702
0.056	0.928	99.630
0.022	0.370	100.000
Extraction Sums of Squared Loading		
Total	Percentage of variance	Accumulation (%)
3.348	55.803	55.803
1.419	23.647	77.450
Rotation Sums of Squared Loading		
Total	Percentage of variance	Accumulation (%)
3.031	50.523	50.523
1.736	28.928	79.450

These two factors were rotated to obtain the component matrix as shown in Table 6.

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Table 6: Component matrix in 2016 (The exclusion coefficient is less than 0.5).

Factor	Ingredient	
	1	2
Household Consumption Level (yuan)	0.930	-
Insurance Coverage (%)	0.930	-

Table 6: (continued).

Per Capital GDP (wan/person)	0.895	-
Share of Pension Funds (%)	0.673	-
Pension Fund Coverage (wan/person)	-	0.770
Dependency Ratio of Elderly Population (%)	0.571	-0.667

The first public factor had a large load on the variables of pension fund share, per capita GDP, pension fund security, and household consumption level, indicating that the four variables had a strong correlation, were classified into one category, and are all related to the economy, so they are named economic factors. The second common factor had a large load on the two variables of enrollment rate and elderly population support, and both were related to population, so it was named population factor. It showed that these two factors are the main factors causing the difference in the level of pension insurance in various provinces. It could be seen from Table 5: 50.523% > 28.928%, indicating that the first public factor, that was, the economic factor, had a greater impact on the level of pension insurance.

Table 7: Component score coefficient matrix.

Factor	Ingredient	
	1	2
Household Consumption Level (yuan)	0.339	-0.078
Insurance Coverage (%)	-0.034	0.499
Per Capital GDP (wan/person)	-0.079	0.317
Share of Pension Funds (%)	0.316	-0.027
Pension Fund Coverage (wan/person)	0.340	-0.108
Dependency Ratio of Elderly Population (%)	0.166	-0.520

The economic factor was represented by F_1, the population factor is represented by F_2, and the 2016 factor score coefficient matrix is shown as Table 7 listed.

From the scoring coefficient matrix, it could be seen that the score expression of the two factors were:

$$\&F_1 = O.339X_1^* - 0.34X_2^* + 0.079X_3^* + 0.316X_4^* - 0.340X_5^* - 0.166X_6^* \quad (1)$$

$$F_2 = -0.078X_1^* + 0.499X_2^* + 0.317X_3^* - 0.027X_4^* - 0.108X_5^* - 0.520X_6^* \quad (2)$$

(X_1^*~X_6^* were the standardized data of X_1~X_6, respectively)

The coefficients of the economic factors (consumption level of the population, GDP per capita, the amount of pension insurance fund coverage and the share of pension insurance fund) were basically close to 20%, while the coefficients of the demographic factors (dependency ratio of the elderly population and participation rate) were closer to 10%. This meant that the impact of the economy was about twice as large as the impact of the demographic factor. The coefficients of the

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indicators did not fluctuate much over the seven consecutive years, indicating that the weight of the factors affecting the difference in the level of old-age insurance was relatively stable after the implementation of the social old-age insurance system for urban and rural residents.

The average share of the amount of pension insurance fund coverage was approximately the same, with a trend towards a more constant ratio, which indicated that the impact of these indicators on the level of pension insurance did not fluctuate much. The average participation rate was 0.104, which showed a decreasing trend, indicating that the impact of the participation rate on the level of pension insurance was gradually decreasing. The average dependency ratio of the elderly population was approximately 0.133, which was increasing and was likely to increase in the future, indicating that the ageing of the population was an inevitable trend and that the impact on the level of old-age insurance is gradually increasing. The importance of pension insurance was therefore influenced by: the level of consumption of the population, GDP per capita, the amount of pension insurance fund coverage, the share of pension insurance funds, the dependency ratio of the elderly population and the participation rate, in that order.

4. Conclusion

The paper selected a number of national indicators and data from the National Bureau of Statistics of China for the period 2014 to 2020 and used factor analysis to examine and analyze which indicators have a greater impact on the level of basic pension insurance in China. Pension insurance levels are more likely to be influenced by regional differences as well as by policy, so we first categorize regions and explore the differentiated levels across regions, and then proceed step by step. In this article, six indicators are selected as factors influencing the level of pension insurance: the level of consumption of the population, GDP per capita, the amount of pension insurance fund coverage, the share of pension insurance fund, the dependency ratio of the elderly population and the participation rate, and then the weights were calculated and analyzed for these six indicators.

The level of pension insurance in a city depends to a large extent on the local government's expenditure on social pension insurance, which in turn was closely related to the local economic development. It can be seen from the composite score that regions that score high do not necessarily score high in all aspects. Therefore, in order to improve the level of social pension insurance in a country or region, the most fundamental means is to strengthen the local economy, and economic development is the fundamental guarantee for the improvement of its social pension insurance level. The level of social pension insurance in each region should take into account the balance with other regions. Because of the differences in the comprehensive development level of each region, there are certain differences between regions in terms of pension insurance contribution standards, contribution methods, benefit standards and account management, but this is unfair to a certain extent. Therefore, we should consider the balance between regions and the design of the pension insurance policy development system should co-ordinate the overall situation.

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