

# Analysis of Pension Problems in Shenzhen City

Chen Huang

School of Department of Electrical Engineering, North China Electric Power University,  
Baoding 130600, China

3497483644@qq.com

## Abstract

This paper analyzes the current situation of Shenzhen City in view of the question of Shenzhen Cup for the elderly. Firstly, I select several factors related to the pension, and use the linear weight method based on the entropy value method to determine the weight value of each variable, and then carry out the linear weight to calculate the Pension level Q value in recent years. Through comparing with the existing Q value of the United States, I find out the gap between the existing and the United States. After that, the number of population and the institutions in each district of Shenzhen are configured. Based on this, the number of people and institutions in 2025, 2030 and 2035 are projected. According to the existing service standards for the elderly, various types of service personnel in each district are configured. Finally, based on the comparison with the pension system in the United States, this paper concludes the defects of Shenzhen's existing system and the improvement that should be made.

## Keywords

**Pension in Shenzhen; Entropy Method; Resource Allocation; Comparison with American System.**

## 1. Introduction

Elderly care is an important part of people's livelihood. It can be seen from the relevant data of the recent census that the aging of China's society is serious. Besides, it has gradually developed into an aging society, leading that the elderly has become the "main force" among the members of the society. In order to ensure the quality of life of the elderly, it is necessary to further improve the current old-age security system. Solving the pension problem is not only related to China's economic development, social stability, but also related to social fairness and efficiency, the construction of a harmonious socialist society and a new socialist countryside, which has an important significance. How to solve this problem properly is the top priority of the party and the government.

## 2. Analysis of Existing Pension Level Quantification

### 2.1. Analysis of Factors

Relevant data are selected to quantify the target requirements of old-age security. The relevant variables are respectively the number of nursing homes as Q1, the number of beds in nursing homes as Q2, the basic pension cost of government institutions as Q3, the basic pension cost of urban and rural residents as Q4, and the basic pension cost of enterprise workers as Q5. According to the data, the monthly data of pension expenses in 16-19 years are obtained. Based on the monthly data, the annual expenses in various aspects are calculated. Then combined with the number of nursing homes and the nursing homes beds, I put forward the total evaluation value of the pension level Q. According to the linear weight method, the values of each variable are linearly weighted:

$$Q = \sum_{i=1}^n w_i q_i$$

Where Q is the comprehensive evaluation value of the evaluated scheme,  $w_i$  represents the weight number of each individual evaluation index,  $0 \leq w_i \leq 1$  and  $\sum_{i=1}^n w_i = 1$ .  $q_i$  represents the evaluation value of each single index evaluation, and n represents the number of evaluation indexes.

Note: Data are from Social Security Data Release Column--Shenzhen Social Insurance Fund Administration.

## 2.2. Model Building

We use the linear weight method based on the entropy value method to determine the weight value. The steps are as follows:

Step1: When the measurement units of various indicators are not uniform, it is necessary to standardize the data  $X_{ij}$ . Besides, in order to avoid the nonsense of logarithm in entropy calculation, for the 0 value that appears after standardization, add 0.01 to each 0 value. The form of the positive indicator is as follows:

$$x_{ij} = \frac{X_{ij} - \min(X_{1j}, X_{2j}, \dots, X_{nj})}{\max(X_{1j}, X_{2j}, \dots, X_{nj}) - \min(X_{1j}, X_{2j}, \dots, X_{nj})}$$

Where  $X_{ij}$  is the i year sample value of the j index. Forward index values of each value are calculated according to the formula, denoted as  $x_{ij}$ .

Step2: The sample of the i year of the j index's proportion.

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^n x_{ij}}, i = 1, 2, \dots, n; j = 1, 2, \dots, n$$

Step3: Calculate the entropy of the j index.

$$E_j = -k \sum_{i=1}^n p_{ij} \ln(p_{ij})$$

Where  $k = \frac{1}{\ln n}$ , making  $0 \leq E_j \leq 1$ .

Step4: Calculate the difference coefficient of the j index.

The information utility value of a certain index depends on the difference between the information entropy  $E_j$  and 1 of the index, and its value directly affects the size of the weight. The greater the value of the information, the greater the importance of the evaluation, and the greater the weight.

$$D_j = 1 - E_j, i = 1, 2, \dots, n; j = 1, 2, \dots, m$$

where the  $D_j$  represents the information utility value of the  $j$  index.

Step 5: Calculate the weight of the evaluation index.

Using the entropy method to estimate the weight of each index. By using the difference coefficient of the index information, the higher the difference coefficient, the greater the importance of the evaluation. Besides, the larger the weight, the greater the contribution to the evaluation results. The weight of the  $j$  index:

$$w_j = \frac{D_j}{\sum_{j=1}^m D_j}, i = 1, 2, \dots, n; j = 1, 2, \dots, m$$

If the maximum value of the index weight is to be restricted, the weight of the calculated indexes can be modified. If set the maximum value of the target is 'a' and the weight is corrected.

$$w'_j = w_j + \frac{w_j}{\sum_{j=1}^m w_j} (w_{\max} - a)$$

### 2.3. Solving and Analyzing the Model

You can come to the result by running the result by using C++ program and get the coefficients from  $q_1$  to  $q_5$  are respectively 0.902860912, 0, 0.094466545, 0.002672542, 0. Then, the normalized data value  $q_i$  is substituted into the formula, and the annual total evaluation value  $Q$  of pension level as shown in Table 1.

**Table 1.** Evaluation value of pension level

year	Q
2016	-0.64676224
2017	-0.57943095
2018	-0.24094569
2019	0.467138891

I normalized the data of the elderly population, the number of nursing homes and nursing home beds in the United States, then multiplied the corresponding data by the previous weighted value. Since the insurance value cannot be obtained from the United States, I use the total weight of the elderly population and nursing home beds to replace the total weight of the basic pension of government institutions and enterprise employees. Finally, the current international level value of  $Q$  is calculated as 1.7235854. From the conclusion, there is still a gap between the pension level of Shenzhen and the United States.

### 3. The Allocation and Forecast of Resources

#### 3.1. Population and Institutions

First, I have found the number of population and institutions in Shenzhen between 2018 and 2020 from the relevant websites, and the results are shown in Table 2:

**Table 2.** Existing population and pension institutions

	2018 year		2019 year		2020 year	
	Population	institutions	Population	institutions	Population	institutions
Futian	16.34	10	17.5	11	18.1	11
Luohu	4.61	2	4.86	2	5.04	3
Nanshan	16.4	6	17.6	6	17.8	7
Yantian	6.14	2	6.81	2	7.2	2
Baoan	9.45	6	10.5	6	10.81	7
Longgang	23.5	9	24.05	9	25.61	10
Longhua	5.51	2	5.84	2	6.3	2
Pingshan	0.76	1	0.86	1	0.94	1
Guangming	1.58	2	1.75	2	1.84	2
Dapeng new	0.83	4	0.9	5	0.97	5

Note: The population in the table is in units of ten thousand and the organization is in units of one.

Then I use the MATLAB toolkit log to interpolation and polynomial. On this basis, forecast the population and institutional allocation of the next 5, 10, and 15 years as follows in Table 3.

**Table 3.** Population and pension agency projections

	2025 year		2030 year		2035 year	
	Population	institutions	Population	institutions	Population	institutions
Futian	22.19	15	35	23	53.19	40
Luohu	6.48	4	10.22	7	14.95	15
Nanshan	22.99	15	36.25	24	44.56	36
Yantian	8.84	6	13.94	9	20.36	13
Baoan	12.69	8	20.01	13	29.27	35
Longgang	29.36	20	46.31	31	67.73	45
Longhua	7.78	5	12.28	8	17.97	13
Pingshan	1.43	1	2.26	2	3.31	4
Guangming	2.87	2	4.52	3	6.23	6
Dapeng new	1.31	6	2.07	6	3.04	7

Note: The population in the table is in units of ten thousand and the organization is in units of one. Besides, the population refers to the number of elderly people aged 60 and above.

### Result Analysis:

Through the analysis of the current situation of resource allocation of community old-age service in Shenzhen, it can be concluded that there are mainly the following problems:

First, lack of unified and systematic supporting policies. At present, there is a lack of unified planning in building community day care centers for the elderly in Shenzhen. Ten districts in Shenzhen have all issued their own measures for the construction and management of day care centers, which are different in terms of scale requirements, service objects, service contents and subsidy standards, resulting in the current situation of differences among districts.

Second, the lack of accurate resident elderly demographic data. All effective aging construction plan based on accurate data of elderly people, and Shenzhen is lack of accurate statistics of elderly people, especially for elderly population census register and disability. Not only that, different modes of pension and retirement services corresponds to the different age structure and health of the elderly. If unable to determine the number of the elderly and the geographical position, then can't predict the community institutions and personnel configuration.

Third, the number and quality of the elderly service personnel need to be promoted. The number and category of day care service personnel are detailed in the Shenzhen community day care service specification, but more institutions cannot be completed by the nearby social center, which is supported by the lack of the number of service objects or funds. In front of the city, the doctor of the center of the social community of Shenzhen city has a wide variety of daily work, less energy to complete the treatment of medical care and the lack of enthusiasm. In addition, there is a large gap in the number of service personnel in the community, and the degree of age is not reasonable.

### 3.2. Personnel Configuration

Because I have limited data on other parameters, then can't make more careful analysis. In this case, only the number of elderly institutions in each district is used, and the estimate of each parameter is generalized. According to the requirements of The daily care service specification for the elderly in Shenzhen community, we should be equipped with the staff, the doctor, the driver, the rehabilitation therapist, the worker and the psychologist, and the elderly care officer who directly serves the old man should be in the same way as the elderly old man 1:10, the semi-self-care old man 1:6, the proportion of the whole nursing old man 1:3. What's more, special care can be provided on the basis of consultation between the elderly family members and the agency. The nurse (full-time/part-time), chef, dietitian, rehabilitation teacher and driver shall have at least one person, and the social work or part-time job should be more than 2. As a result, the number of old-age institutions in each district needs to be required according to the system and the personnel of the organization. According to the above requirements, the relevant personnel of each district are shown in the following Table 4:

Among them, B1 represents the number of nursing assistants directly serving the elderly in each district; B2 represents the minimum number of nurses (full-time/part-time), cooks, nutritionists, rehabilitation teachers and drivers in each district; B3 represents the minimum number of full-time or part-time social workers in each district.

**Table 4.** Various types of staffing

	2025 year			2030 year			2035 year		
	B1	B2	B3	B1	B2	B3	B1	B2	B3
Futian	285	15	30	437	23	46	760	40	80
Luohu	76	4	8	133	7	14	285	15	30
Nanshan	285	15	30	456	24	48	684	36	72
Yantian	114	6	12	171	9	18	247	13	26
Baoan	152	8	16	247	13	26	665	35	70
Longgang	380	20	40	589	31	62	855	45	90
Longhua	95	5	10	152	8	16	247	13	26
Pingshan	19	1	2	38	2	4	76	4	8
Guangming	38	2	4	57	3	6	114	6	12
Dapeng new	114	6	12	114	6	12	133	7	14

## 4. Comparison with American

### 4.1. Comparison of Various Aspects

#### a. Project and coverage

United States: Covered 155 million workers (96% coverage) and 46.7 million retirees, dependents and survivors in 2019. With the exception of railway workers who participate in a special insurance system, as well as low-income workers and foreign workers, coverage is universal for all workers who meet certain conditions.

Shenzhen City: Endowment insurance system also includes endowment, survivors, disability insurance. In 2019, 12.1471 million people participated in the basic old-age insurance, including 11.729,800 urban workers, 407,100 retired workers and 10,200 urban residents. From this view, the coverage of the basic old-age insurance needs to be improved.

#### b. Retirement age

United States: In 2004, the age to receive full pension was 65 years and 4 months, and then the age to receive full pension was increased by 2 months for each subsequent year until 2014, when the age to receive full pension was raised to 67 years for those born in 1959 or later. Insured people can also choose to retire early at age 62 with a reduced benefit.

Shenzhen city: Legal retirement age is male worker 60 years old, female cadre 55 years old, female worker 50 years old. The number of workers engaged in special work is 55 for males and 45 for females. The workers who are completely incapacitated are 50 years old for males and 45 years old for females.

#### c. Contributions

United States: During employment, the amount an employee and his employer contribute to the system will determine the level of future treatment that employee will receive. In 2015, the social security tax rate is 12.4 percent of the employee's salary, and the employee and the employer pay 50 percent each. The self-employed pay both employer and employee contributions.

Shenzhen: From May to December 2019, it will be 300% (19,014 yuan) of the average monthly salary of the provincial full-time urban employees in the previous year. The minimum payment limit is the monthly minimum wage of the city (2,200 yuan), and the actual average monthly wage is 3,708 yuan, with the contribution ratio of 13% for units and 8% for individuals.

#### d. Fund pattern, fund status and dependency ratio

United States: The social security system is pay-as-you-go system, endowment insurance benefits are paid monthly and adjusted annually with the change of the living price index. In 2003, revenue from the Social Security Fund amounted to US \$632 billion, while expenditure amounted to US \$471 billion, leaving a surplus of US \$161 billion, nearly US \$1 trillion rolled over the years. The ratio of the number of people paying fees to the number of people receiving benefits dropped from 5.1 in 1960 to 3.3 in 2003.

Shenzhen: In 2019, the income of various social security funds (excluding medical and maternity insurance funds) in the city totaled 140.4554 billion yuan, and the expenditure totaled 722.831 billion yuan, with the current balance of 681.723 billion yuan. By the end of the year, the fund roll-over balance amounted to 592.1648 billion yuan. The dependency ratio was 27.4:1.

#### e. Substitution rate and remuneration

The United States: A regressive compensation calculation method is adopted. Although the absolute amount of compensation obtained by high payers is higher than that of low payers, the wage replacement rate obtained by low payers is higher than that of high payers. If you retire early at 62, you will receive a monthly reduction of 5/9 of the salary you would receive as you retired at 65, up to a maximum reduction of 20%. The total pension replacement rate for 2019 is 51 percent.

Shenzhen City: In 2019, the adjusted monthly person basic pension for enterprise insured retirees nationwide will reach 2,645 yuan, 1.4 times the Shenzhen pension level and much higher than the 58-60% target replacement rate designed by the state system.

## 4.2. Comparison and Analysis of Endowment Insurance Systems

Compared with the United States, Shenzhen's endowment insurance system has five deficiencies:

- (1) Small coverage of endowment insurance.
- (2) The retirement age is low.
- (3) The endowment insurance accumulation fund is small.
- (4) The ratio of in-service personnel to retirees, namely, the dependency ratio, has declined too fast.
- (5) The wage replacement rate for pensions is higher.

## 4.3. Suggestions to Improve the Endowment Insurance System

First, according to the development condition of our country's social economy and one's ability, gradually sub-area expands endowment insurance coverage.

Second, slowly harmonize the retirement age by introducing a flexible retirement scheme.

Third, the establishment of minimum pension, maximum pension limits. While ensuring basic living standards, we should reflect the principle of fairness and reduce polarization.

Fourth, establish the minimum line of pay endowment insurance premium. The person that salary does not reach minimum line does not attend endowment insurance temporarily, and the endowment insurance premium of unit place pay does not calculate its individual account.

Moreover, the actuarial function of social insurance needs to be strengthened. In this way, correct decisions can be made on the number of people who need to be expanded every year, the minimum contribution proportion, the minimum contribution wage, the minimum and the maximum pension standard, and the annual adjustment of the range of pension, to ensure the benign operation of the fund.

Finally, social insurance should be widely spread to enhance the people's awareness of hardship. Greater publicity of social insurance policies is needed through various channels.

## 5. Conclusion

Through the establishment of the model, the annual pension level value  $Q$  of Shenzhen city is obtained. As can be seen from the results, the pension level of Shenzhen is increasing year by year. Then, through entropy weight method, the weight values of each variable are respectively 0.902860912, 0, 0.094466545, 0.002672542, 0. Based on the existing data, the number of staff and nursing institutions in each district can be predicted in the next 5, 10 and 15 years. Then, according to the current service standards, get the allocation of various types of personnel, to make full preparations for the assignment of work. Finally, through the comparison with the pension system in the United States, it is found that Shenzhen should improve the coverage, retirement age, contribution, fund and replacement rate in different degrees.

## References

- [1] Si Shoukui, Sun Zhaoliang. Mathematical Modeling Algorithms and Applications.
- [2] <http://hrss.sz.gov.cn/szsi/zxbs/zdyw/sbsjfbzl/index.html>.
- [3] Comparison of Chinese and American Social Endowment Insurance System [J]. Economic Herald, 2011, (08):8-9.
- [4] Liu yujin. Evaluation of the layout of community pension facilities - the annual meeting of the Chinese city planning in Shenzhen.