

Evaluation and analysis of the sustainable development ability of enterprise supplementary medical insurance fund based on PSR Model -- a case study of a large state-owned enterprise in Anhui Province

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Abstract. Objective: In order to evaluate the sustainable development ability of the supplementary medical insurance fund of a large state-owned enterprise in Anhui Province, this paper puts forward the countermeasures to promote the sustainable development of the supplementary medical insurance fund of enterprises. Methods: By constructing PSR evaluation model and using entropy method to determine the index weight, the comprehensive evaluation value of sustainable development ability of supplementary medical insurance fund of a large state-owned enterprise in Anhui was calculated. Results: Horizontally, the highest comprehensive ability is the headquarters of the large state-owned enterprise, which is 0.430, and the lowest is Qingyang County, which is 0.147; Vertically, the comprehensive evaluation value of the sustainable development ability of enterprise supplementary medical insurance increased from 0.200 in 2016 to 0.239 in 2020, with an average annual increase of 4.55%. Conclusion: The influence of pressure factors on fund operation in different regions is quite different, and the development among regions is unbalanced. It is necessary to improve the management level of enterprise, enhance the fund raising ability, pay attention to overall planning and top-level design, promote regional coordinated development as a whole, continuously improve the fund investment management ability, and actively broaden the fund investment channels.

1 Introduction

The state and enterprises have always attached great importance to ensuring the medical needs of employees. The State Council issued relevant policies as early as 1998, emphasizing that in order to meet the specific needs of various levels and industries, enterprises are allowed to establish enterprise supplementary medical insurance on the basis of participating

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in basic medical insurance^[1]. In 2020, the CPC Central Committee and The State Council issued a programmatic document in the field of medical security^[2]. It emphasizes once again "improving and standardizing large medical expense subsidies for employees and enterprise supplementary medical insurance" and "strengthening the triple security functions of basic medical insurance, serious disease insurance and medical assistance", which requires enterprises to continuously take the initiative to respond, build and improve the existing enterprise supplementary medical insurance system. In particular, it puts forward new requirements for the safety, efficiency and sustainable development of the enterprise supplementary medical insurance fund.

However, on the one hand, China's enterprise supplementary medical insurance is still in the early stage of development, lacking policy constraint mechanism, slow development on the whole, and immature management ability of supplementary medical insurance^[3], which leads to a huge risk of unsustainable development of enterprise supplementary medical insurance fund.

On the other hand, through literature research, it is found that the academic research on the safety, efficiency and sustainable development of enterprise supplementary medical insurance fund is still insufficient, especially the research on the application of quantitative methods to evaluate the sustainable operation ability of enterprise supplementary medical insurance fund is almost blank. Most of them are about the positioning of supplementary medical insurance^[4], the necessity and effect of implementation^[5,6], measures and suggestions, and risk supervision^[7,8]. In 2013, Jia Hongbo and Yang Yinan studied the effects, problems and solutions of the development of Supplementary medical insurance in China, and raised problems such as difficulties in risk control in the development of supplementary medical insurance^[9]. In 2017, Shen Mengxue et al. constructed a PSR evaluation model for the sustainable development ability of basic medical insurance fund for employees, which provides theoretical and methodological reference for the sustainable development of enterprise supplementary medical insurance. However, the evaluation of the sustainable development of the enterprise supplementary medical insurance fund, the key influencing factors and the mechanism of the sustainable operation of the enterprise supplementary medical insurance fund have not been solved yet.

Based on this, this paper uses PSR model to evaluate the sustainable development ability of enterprise supplementary medical insurance system, and studies how to establish an adaptive enterprise supplementary medical insurance system and achieve sustainable development goals. Through the thinking logic of "pressure-state-response", the sustainable development index system of enterprise medical insurance fund was constructed. Taking a large state-owned enterprise in Anhui province as an example, the operation data of enterprise supplementary medical insurance fund from 2016 to 2020 were collected to comprehensively evaluate its sustainable development ability. Finally, constructive countermeasures and suggestions are put forward to promote the sustainable development of enterprise supplementary medical insurance fund.

2 Research design

2.1 Establishment of evaluation index system of sustainable development ability of enterprise supplementary medical insurance

2.1.1 PSR model

The PSR model was first proposed by David J. Rapport and Tony Friend, a Canadian statistician, in 1979 and is often used to evaluate the sustainable development ability of social

environment, also known as the stress state response model. Sustainability here emphasizes the ability of people to make long-term use of the production and use of the resource land and the physical base.

In order to build the PSR evaluation model of the sustainable development ability of supplementary medical insurance fund (See Figure1), the influencing factors of the development of supplementary medical insurance fund are sorted out from three aspects: pressure, state and response. Pressure refers to a series of influences brought by social development, policy environment, fund raising, operation management and other factors on the operation of supplementary medical insurance fund. State refers to the changes of supplementary medical insurance fund under pressure in order to realize sustainable development when the fund pressure increases. Response refers to the actions taken by fund managers to improve and maintain the healthy development of supplementary medical insurance under the guidance of the concept of sustainable development in order to reduce the negative impact of external activities on the healthy operation of supplementary medical insurance.

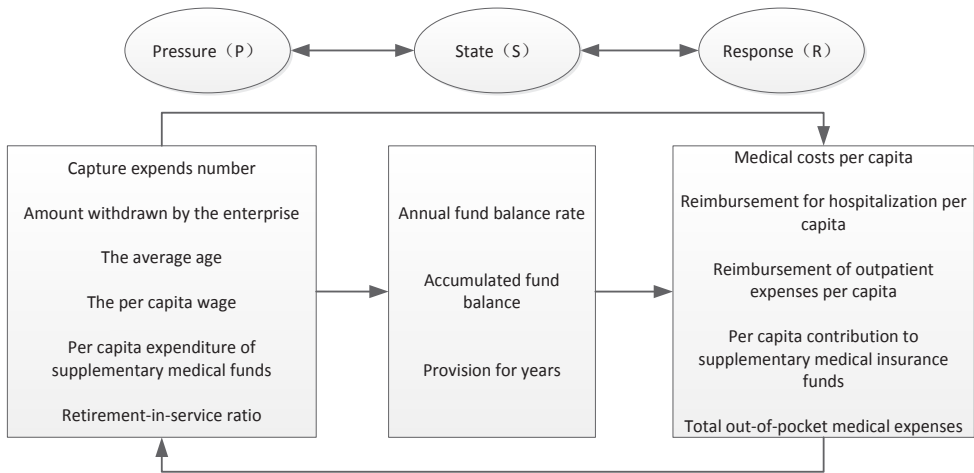


Fig. 1. Evaluation concept model of PSR model for sustainable development capability of enterprise supplementary medical insurance Fund.

2.1.2 Evaluation index system

Pressure index: In the PSR model of the sustainable development ability of the enterprise supplementary medical insurance fund, pressure (P) is the potential risk and practical problem brought by the operation of the enterprise supplementary medical insurance fund. This article selects payment number, enterprise the depreciation amount (\$one thousand), the average age, average per capita wage, supplementary medical spending per capita, retirement working than six indicators as the ability of sustainable development of the enterprise subsidiary medical insurance fund pressure indicators.

Status index: S (status) in the sustainable development capacity of enterprise supplementary medical insurance fund mainly refers to the current operating status of the fund, which is a direct reflection of the operating capacity of enterprise supplementary medical insurance fund. The fund balance rate is selected as the indicator of the sustainable development ability of the supplementary medical insurance fund of enterprises, including the annual fund balance rate, the accumulated fund balance and the number of years of reserve.

Table 1. PSR the index system construction of the model.

goal-level	index	S/N	sub-index	Index calculation method	Index unit	Index attribute
PSR Model	P (Pressure)	A ₁	Capture expends number	Number of persons enrolled in supplementary health insurance	People	positive
		A ₂	Amount withdrawn by the enterprise	The total amount of supplementary medical insurance money shall be withdrawn by the enterprise	Yuan	positive
		A ₃	Average age	Enterprise worker joins the average age that protects personnel	Age	positive
		A ₄	The per capita wage	Total wage/total number of insured employees	Yuan/person	positive
		A ₅	Per capita supplementary medical insurance expenditure	Medical expenses/total number of insured persons	Yuan/person	positive
		A ₆	Retirement-in-service ratio	Number of retired employees/total number of active employees	%	positive
	S (State)	B ₁	Annual fund balance rate	(Accumulated capital income of three years - accumulated capital expenditure of three years)/accumulated capital income of three years × 100%	%	positive
		B ₂	Accumulated fund balance	Fund balance at the end of the year	Ten thousand yuan	positive
		B ₃	Provision for years	Accumulated balance/average annual expenditure	Ten thousand yuan /year	positive
	R (Response)	C ₁	Medical costs per capita	Total medical expenses/total number of people reimbursed	Yuan/person	negative
		C ₂	Reimbursement for hospitalization per capita	Total hospitalization reimbursement/number of hospitalizations	Yuan/person	negative
		C ₃	Reimbursement of outpatient expenses per capita	Total outpatient reimbursement/number of outpatient visits	Yuan/person	negative
		C ₄	Per capita contribution to supplementary medical insurance funds	Total contribution of supplementary medical insurance fund/number of insured employees	Yuan/person	negative
		C ₅	Total out-of-pocket medical expenses	The total cost shall be borne by the individual after the reimbursement of supplementary medical insurance	Yuan	negative

Response index: R (response) In the sustainable development capacity of enterprise supplementary medical insurance fund, it refers to the countermeasures and measures taken according to the current operating pressure and status of the fund. According to the actual situation of enterprises, per capita medical expenses, per capita hospitalization expenses, per

capita outpatient expenses, per capita input of supplementary medical insurance fund, and total amount of medical expenses borne by individuals after reimbursement are selected as the response indicators of the sustainable development ability of supplementary medical insurance fund of enterprises.

2.2 Data sources

Based on the field research, this study conducted an empirical analysis on the evaluation of the sustainable development ability of supplementary medical insurance fund of 20 cities and counties from 99 insured units of a large state-owned enterprise in Anhui province based on the PSR model.

2.3 Evaluation methods

For the evaluation of PSR model, entropy method can be adopted, and Ye Yun's algorithm can be used for reference to construct a judgment matrix based on information entropy to solve the weight [10], so as to overcome the influence of subjective factors in the process of index selection, so as to avoid the excessive dispersion of PSR index data.

2.4 Evaluation procedures

Evaluation method: Set the initial data matrix of n evaluation indexes of M samples as, where represents the j-th index value of the i-th evaluation object.

2.4.1 Standardized processing of initial data of indicators

Since the dimensions and orders of magnitude of each comprehensive evaluation index are different, in order to eliminate their influence on the evaluation results, it is necessary to conduct dimensionless treatment for each index. Among the 14 sub-indicators of the PSR model, 10 are positive and 4 are negative. The normalization method of the range of positive and negative effects is adopted to normalize the original data of the indicators, and the normalized data is between 0 and 1, as shown in Formula (1).

$$\text{Positive indicators: } x_{ij}^* = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} \quad (1)$$

$$\text{Negative indicators: } x_{ij}^* = \frac{\max(x_{ij}) - x_{ij}}{\max(x_{ij}) - \min(x_{ij})} \quad (2)$$

In formula (1), and represent the maximum and minimum value of the JTH indicator sample respectively.

2.4.2 The difference coefficient of each indicator was calculated according to the calculation steps of entropy method

a. Calculate the proportion of the i-th evaluation object index value of item J:

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^m x_{ij}} \tag{3}$$

b. Calculate the entropy value of item J:

$$e_j = -\frac{1}{\ln m} \sum_{i=1}^m p_{ij} \ln p_{ij} \tag{4}$$

c. Calculate the difference coefficient of item J

$$g_j = 1 - e_j \tag{5}$$

d. Calculate the weights of indicators

$$w_j = \frac{g_j}{\sum_{j=1}^n g_j} \tag{6}$$

2.4.3 Calculate the evaluation value of indicators

According to the judgment matrix, the weight is solved, which is the standardized value of each index, and finally the evaluation value of each index can be obtained.

$$B = \sum_j^n w_{ij} p_{ij} \tag{7}$$

The larger the comprehensive evaluation value B is, the stronger the sustainable development capacity of the supplementary medical insurance fund of the enterprise is, and it can better cope with the impact of the operation of the supplementary medical insurance fund of various factors.

Table 2. The weight of PSR model evaluation index of sustainable development ability of enterprise supplementary medical insurance fund.

Project	Weight	Indicators	Weight
Pressure(P)	0.3946	Capture expends number	0.1223
		Amount withdrawn by the enterprise	0.1669
		The average age of	0.0147
		The per capita wage	0.0299
		Per capita supplementary medical insurance expenditure	0.0423
		Retirement-in-service ratio	0.0185
State(S)	0.4500	Annual fund balance rate	0.0116
		Accumulated fund balance	0.3507
		Provision for years	0.0877
Response(R)	0.1554	Medical costs per capita	0.0153
		Reimbursement for hospitalization per capita	0.0184
		Reimbursement of outpatient expenses per capita	0.0173
		Per capita contribution to supplementary medical insurance funds	0.0820
		Total out-of-pocket medical expenses	0.0224

3 Research results and analysis

The specific weights of PSR indicators obtained by the entropy method are shown in Table 2. Combined with the standardized values of specific indicators, the comprehensive evaluation values of PSR of 20 county companies from 2016 to 2020 are obtained. According to the score, the sustainable development level of enterprise supplementary medical insurance fund can be evaluated. The higher the comprehensive evaluation score, the stronger the sustainable development ability of enterprise supplementary medical insurance fund. On the contrary, the sustainable development ability of enterprise supplementary medical insurance is weaker. According to the above calculation steps, the sustainable development capacity of supplementary medical insurance fund of 20 municipal and county companies of a large state-owned enterprise in Anhui province from 2016 to 2020 is calculated, and the results are shown in Table 3.

Table 3. Comprehensive evaluation value of supplementary medical insurance PSR model for 20 cities and counties of a large state-owned enterprise in Anhui in 2020.

The sample name	P	S	R	Comprehensive evaluation value	Ranking
Dingyuan County	0.040	0.063	0.067	0.171	16
Dangshan County	0.071	0.033	0.094	0.199	11
Huaiyuan County	0.064	0.010	0.085	0.160	18
A directly affiliated company	0.064	0.025	0.080	0.168	17
Luan City	0.128	0.021	0.097	0.245	5
Yi County	0.059	0.031	0.066	0.157	19
Fuyang city	0.163	0.073	0.079	0.316	4
Anqing city	0.204	0.096	0.124	0.423	3
Qingyang County	0.052	0.018	0.077	0.147	20
Jixi County	0.039	0.037	0.114	0.190	14
Wuwei city	0.083	0.026	0.087	0.196	13
Taihu County	0.050	0.041	0.081	0.172	15
Zixi County	0.087	0.049	0.081	0.218	8
Hefei city	0.296	0.055	0.079	0.430	2
Yuxi County	0.048	0.103	0.077	0.228	6
Linquan County	0.064	0.054	0.090	0.208	10
The company	0.323	0.076	0.124	0.523	1
Taihe County	0.062	0.063	0.090	0.215	9
Bozhou city	0.086	0.021	0.120	0.227	7
Huailing County	0.060	0.049	0.086	0.196	12
Comprehensive value of each city and county	0.102	0.047	0.090	0.239	

3.1 Horizontal comparative analysis

According to Table 3, in 2020, the comprehensive evaluation value of the sustainable development of supplementary medical insurance fund of enterprises in all cities and counties is 0.239, and the comprehensive evaluation value of the headquarters of this large state-owned enterprise is the highest, which is 0.523, higher than the other 20 cities and counties. The comprehensive evaluation value of each city and county is obviously different, except for the main part, Hefei has the highest value of 0.430, and Qingyang has the lowest value of 0.147. Among the 20 cities and counties, the comprehensive evaluation value of Hefei, Anqing and other urban areas is higher than other counties, while the comprehensive evaluation value of Huaiyuan, Shexian and Qingyang counties is relatively low. It can be seen that the sustainable development capacity of enterprise supplementary medical

insurance fund is uneven among different regions.

As shown in Table 4, the comprehensive evaluation value of PSR model from 2016 to 2020 varies greatly among cities and counties. The evaluation value of companies in Hefei, Anqing and other cities is higher, above 0.35. The response value is also high, above 0.3, indicating that these regions can make timely response or adjust policies to enhance the sustainable development capacity of the supplementary medical insurance fund of enterprises according to the operation status and pressure they are facing. However, the average comprehensive evaluation value of companies in Taihu, Yuexi and Dingyuan counties is below 0.2, indicating that the sustainable development ability of enterprises in these cities and counties is relatively low.

Table 4. 2016-2020 year Comprehensive evaluation value and mean value of supplementary medical insurance for 20 enterprises of a large state-owned enterprise in Anhui Province.

The sample name	2016	2017	2018	2019	2020	Comprehensive evaluation value	Ranking
Dingyuan County	0.154	0.128	0.134	0.137	0.171	0.145	20
Dangshan County	0.163	0.174	0.189	0.197	0.199	0.184	9
Huaiyuan County	0.163	0.136	0.151	0.153	0.160	0.152	14
A directly affiliated company	0.166	0.162	0.160	0.180	0.168	0.167	11
Luan City	0.212	0.216	0.230	0.235	0.245	0.228	5
Yi County	0.174	0.130	0.138	0.148	0.157	0.149	17
Fuyang City	0.260	0.264	0.270	0.271	0.316	0.276	4
Anqing City	0.302	0.355	0.361	0.374	0.423	0.363	3
Qingyang County	0.199	0.133	0.135	0.146	0.147	0.152	15
Jixi County	0.111	0.135	0.148	0.165	0.190	0.150	16
Wuwei City	0.192	0.175	0.188	0.175	0.196	0.185	8
Taihu County	0.144	0.143	0.141	0.136	0.172	0.147	18
Zixi County	0.199	0.217	0.213	0.206	0.218	0.210	7
Hefei City	0.341	0.349	0.368	0.403	0.430	0.379	2
Yuexi County	0.114	0.116	0.133	0.140	0.228	0.146	19
Linquan County	0.147	0.153	0.161	0.166	0.208	0.167	12
Company	0.439	0.454	0.759	0.478	0.523	0.530	1
Taihe County	0.134	0.141	0.153	0.155	0.215	0.159	13
Bozhou City	0.202	0.203	0.207	0.219	0.227	0.212	6
Huailing County	0.180	0.174	0.178	0.177	0.196	0.181	10
Average value of cities and counties	0.200	0.198	0.221	0.213	0.239	0.214	

3.2 Longitudinal comparative analysis

Based on Table 5, it can be seen that the sustainable development capacity of supplementary medical insurance fund showed an overall growth from 2016 to 2020, and the comprehensive evaluation value increased from 0.200 in 2016 to 0.239 in 2020, with an average annual increase of 4.55%. From 2016 to 2017, the comprehensive evaluation value was basically flat, while from 2018 to 2019, the comprehensive evaluation value decreased slightly, and from 2019 to 2020, the comprehensive evaluation value increased. From the change of the

evaluation value of each index, the average annual increase of pressure value is 3.76%, from 0.088 to 0.102; The annual average increase of status value was 23.8%, from 0.020 to 0.047. The response value experienced a transition from 0.092 in 2016 to 0.085 in 2017, but gradually recovered from 0.087 to 0.090 in 2018-2020, with an overall annual average increase of -0.5%, slightly lower than that in 2016. Reason may be that the enterprise in dealing with the complicated influence of the social economic environment to make measures to adjust the effect is not obvious, but per capita medical expenses, such as total out-of-pocket expenses will be brought under effective control, v-shape development trend on the whole. It can be seen that the sustainable development ability of the supplementary medical insurance fund of this large state-owned enterprise in Anhui province is on the rise.

Table 5. Sustainable development level of PSR from 2016 to 2020.

Year	P	S	R	Comprehensive evaluation value
2016	0.088	0.020	0.092	0.200
2017	0.091	0.022	0.085	0.198
2018	0.095	0.038	0.087	0.221
2019	0.100	0.025	0.088	0.213
2020	0.102	0.047	0.090	0.239

4 Discussion and suggestions

4.1 Improve the company's operating level and fund financing capacity

From the differences of pressure value, status value, response value and comprehensive evaluation value of units in different cities, it can be seen that the sustainable development ability of supplementary medical insurance fund is correlated with the business development level and fund financing ability of enterprises. The comprehensive evaluation value ranking of cities in the province in 2020 reflects that the sustainable development ability of supplementary medical insurance fund is closely related to the regional economic development level. The higher the level of economic development of the region, the higher the income level of workers, increased the amount of fund withdrawal. At the same time, economically developed areas are more likely to attract high-quality talents, expanding the number of payment. Therefore, to enhance the sustainable development capacity of the fund, the key is to continuously deepen the reform of the three systems of state-owned enterprises, promote the high-quality development of enterprises, improve the wage income of employees, and provide a solid economic foundation for fund financing and effective operation of the system.

4.2 Pay attention to overall planning and top-level design, and promote coordinated regional development

The evaluation results show that the comprehensive evaluation value of different regions varies greatly, indicating that the companies in different counties are not balanced in promoting the sustainable development ability of the fund. From the perspective of the comprehensive evaluation value of the sustainable development ability of the supplementary medical insurance fund in each region from 2016 to 2020, provincial companies need to strengthen the overall development plan, do a good job in the overall thinking and strategic deployment of development, construct the top-level design framework of the enterprise supplementary medical insurance fund for long-term development according to local conditions, and constantly improve the sustainable development ability of the fund.

4.3 Improve the fund investment management ability, and actively expand the fund investment channels

In terms of the weight of each specific index of the sustainable development of the supplementary medical insurance fund of enterprises, the weight of the number of contributors, the amount of enterprise withdrawal, the accumulated saving balance of the fund and the number of years of reserve payment are relatively high, indicating that the current balance of income and expenditure and investment situation of the fund have a great impact on the sustainable development of the fund. It can be clearly seen from Table 2 that the weight of the fund's accumulated saving balance is the largest, which indicates that there are problems such as low fund utilization rate and lack of scientific and advanced investment methods. Therefore, on the one hand, Anhui companies should choose the appropriate fund management mode, do a good job in the fund budget, and constantly improve the fund income and expenditure management ability. On the other hand, we can broaden the different channels of fund investment, ensure the safe and healthy operation of the fund, and at the same time, make diversified investment, constantly improve the profit of fund investment, and enhance the sustainable development capacity of supplementary medical insurance fund.

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