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Assess the Efficiency of Ping An and Ren Shou's Use of Life Insurance Business Funds–Based on the DEA Model

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Abstract: Ping An and Ren Shou have always been the two leading players in China's life insurance industry. Ping An, founded in 2002 as a private enterprise, has been continuously improving its life insurance to try to surpass Ren Shou, which was established in 1996 as a state-owned enterprise. Losing the advantage of starting capital amount and experience, the best way for Ping An to surpass Ren Shou is to enhance its capital operation efficiency. This paper takes the capital utilization efficiency of Ping An as the main study object compared to that of Ren Shou to give suggestions for the use efficiency of funds. The DEA was used to analyze the data of investment income, operating income, management expenses *etc.* of the two companies from 2006 to 2021. The operating results showed that fund-using of Ping An was less efficient than that Ren Shou. According to the results, the recommendations given are to improve pure technical efficiency, expand the size of the company, and establish a money management company.

Keywords: Ping An; Ren Shou; DEA Model; Efficiency of Fund Using

1. Introduction

Ping An life Insurance Company was established in Shekou, Shenzhen in 1988. Ping An only involved life insurance business from the beginning, but now it has developed into a personal financial life service group integrating insurance, banking and investment. Ping An is also one of the companies which obtains the most complete financial licenses in China. At present, total assets of Ping An has exceeded 10 trillion yuan, making it the world's largest insurance group with assets. In 2009, Ping An acquired Shenzhen Development Bank, which took three years to complete the acquisition and further expanded the scale of Ping An. Zhu (2022) found that this merger has made a great contribution to the improvement of the economic efficiency of Ping An in the future. In 2019, Ping An boldly followed the example of AIA Life Insurance Company in carrying out life insurance agent reform. In 2020, the company's operating profit increased 18.1% to 132.955 billion yuan, and net profit increased 36.5% to 164.365 billion yuan. Ping An has been selected in Fortune 500 for 12 consecutive years, jumping from 462nd in 2008 to 16th in 2021, with a brand value of 302,265.6 million yuan in 2021.

Ren Shou Insurance Company was established in 1996. In 2002 it achieved a premium income of 128.7 billion yuan and was selected in the Fortune 500 for the first time with this performance. 2003 was an important milestone year for Ren Shou. In that year, Ren Shou Insurance Company gradually adapted to the trend of comprehensive financial operation and began the journey of group development. According to the annual report of Ren Shou in 2020, the company achieved a premium income of 612.265 billion yuan, exceeding 600 billion yuan for the first time. At the end of 2020, the investment assets were 4.10 trillion yuan, an increase of 14.6% compared to previous year. The total investment income reached 198.6 billion yuan, an increase of 17.5% compared to previous year and the investment income reached a new high. In the first quarter of 2021, facing a complex and changeable external environment and fierce market competition, the overall business development of Ren Shou remained stable and a decent development trend. Ren Shou has been selected in Fortune 500 for 19 consecutive years, jumping from 290th in 2003 to 32nd in 2021, with a brand value of 436.672 billion yuan in 2021.

In this paper, the capital utilization efficiency of Ping An and Ren Shou is compared to give suggestions for the fund-using efficiency of Ping An. According to the common characteristics of insurance company, this paper can study the utilization efficiency of the company's funds by collecting and analyzing the data of investment income, operating income, management expenses *etc*. The specific method is to analyze the efficiency of the data of the two companies through the Deap2.1 software. The second part of the article will explain the application methods of the DEA model and the selection of related data. The third part is an empirical analysis of the data followed by the advices proposed on the results of the analysis.

2. Research Methods and Data Selection

DEA data envelopment analysis method is the basic method of analysis and evaluation of fund efficiency and an effective method for studying the quality of economic. It is based on the concept of relative efficiency according to several input and output indicators. The mathematical model is used to calculate the relative efficiency between comparative units to make a corresponding evaluation for the relative effectiveness of the same type of units or departments. Chen (2002) used the DEA method to calculate the economic benefits of companies with property insurance business in China. This is true for Wang (2021) and Wang (2022). Most of the existing literature is a specific evaluation of the overall efficiency of insurance companies using the DEA model, however, there has been less research on the efficiency of life insurance industry.

2.1. DEA Model

Data Envelopment Analysis (DEA) is a non-parametric frontier efficiency analysis method that determines the relatively efficient production frontier surface with the help of mathematical planning and statistical data, projects one or more input variables and output variables onto the production frontier surface of DEA, and evaluates its relative effectiveness by comparing the degree of deviation of the two from the DEA frontier.

This study takes the 12-year data of Ping An and Life as the decision unit, assuming that there are *n* decision unit DMU_j (j = 1, 2 ···, n) the input and output vectors of DMU_j are:

$$X_{j=}\left(x_{1j}, x_{2j} \cdots x_{3j}\right)T > 0, j = 1,2, \cdots, n \tag{1}$$

$$Y_{j=}\left(y_{1j}, y_{2j} \cdots y_{3j}\right)T > 0, j = 1,2, \cdots, n \tag{2}$$

where n is the number of input indicators and s is the number of output indicators. There are two basic models constructed:

CCR model:

$$min\theta = \theta_0 \sum_{i=1}^{n} X_j\lambda_j + s^- = \theta_{x0} \sum_{j=1}^{n} Y_j\lambda_j - s^+ = Y_0 \tag{3}$$

$$\lambda \geqslant 0, j = 1,2, \cdots, n; s^+ \geqslant 0; s^- \geqslant 0$$

BCC model：

$$min\theta = \theta_0 \sum_{i=1}^{n} X_j\lambda_j + s^- = \theta_{x0} \sum_{j=1}^{n} Y_j\lambda_j - s^+ = Y_0 \sum_{i=1}^{n} \lambda_j = 1 \tag{4}$$

$$\lambda \geqslant 0, j = 1,2, \cdots, n; s^+ \geqslant 0; s^- \geqslant 0$$

In Equation (3), assuming that the optimal solution is λ^* 、s^{*-} 、s^{*+} 、θ^*, the effectiveness of DEA can be judged. If $\theta^* = \theta^* = 1, s^{*-} = 0, s^{*+} = 0$, then the DMU_j is the DEA valid; If $\theta^* = 1$ 、$s^{*-} \neq 0$ 、$s^{*+} \neq 0$, then DMU_j is weakly effective. If $\theta^* > 1$, then the DMU_j is inactive. The latter two situations require the improvement of the decision object.

2.2. Selection of Data

The selected research objects are the data of Ping An and Ren Shou from 2006 to 2020 derived from the financial reports of Ping An and the financial reports of Ren Shou. The use of the data DEA requires the construction of input indicators and output indicators where most scholars choose benefits or profits for the output of the model and costs for the output. Based on the literatures, the input indicators selected in this study are capital input (operating expenses of insurance business) and labor cost (handling fees and commission expenses) where the output indicators are capital output (insurance business premium income, operating profit

of insurance business and income from investments in the insurance business) (Table 1). The specific data for the two companies are shown in Table 2 and Table 3.

Table 1. Input and output indicators for the DEA.

The indicator type		Content of indicators
Input indicator	Capital input	Operating expenses of insurance business
		Business and administrative expenses
	Labor input	Handling fees and commission expenses
Output indicator	Capital output	Insurance business premium income
		Operating profit of insurance business
		Income from investments in the insurance business

The first three columns in Tables 2 and Table 3 shows the input indicators and the last three as output indicators for Ping An Life Insurance business and Ren Shou Life Insurance business respectively.

Table 2. Various data of Ping An's life insurance business (Unit: Million Yuan).

Ping An	inputs			outputs		
Years	Operating expenses of insurance business	Handling fees and commission expenses	Business and administrative expenses	Insurance business premium income	Income from investments in the insurance business	Operating profit of insurance business
2009	87,469	7,049	9,592	72,073	26,743	14,212
2010	112,128	8,273	11,674	92,645	27,079	10,591
2011	137,652	10,711	13,728	118,967	29,018	13,591
2012	155,500	11,876	15,966	128,771	28,222	6,035
2013	179,401	14,802	17,227	146,090	46,833	15,602
2014	220,923	21,591	20,316	173,994	62,998	20,267
2015	289,436	33,295	31,807	208,447	107,580	36,920
2016	340,236	54,222	36,689	275,181	79,081	32,146
2017	451,034	75,0401	45,120	368,934	107,914	48,524
2018	479,583	80,371	46,475	446,884	112,756	99,976
2019	559,127	74,704	50,560	493,912	128,247	83,133
2020	580,489	59,002	44,757	476,087	185,917	102,246
2021	587,664	45,776	45,079	457,034	160,660	50,405

Data Source: Ping An's 2006~2021 financial report data.

Table 3. Various data of Ren Shou's life insurance business data (Unit: Million Yuan).

Ren Shou	inputs			outputs		
Years	Operating expenses of insurance business	Handling fees and commission expenses	Business and administrative expenses	Insurance business premium income	Income from investments in the insurance business	Operating profit of insurance business
2009	300,164	22,936	19,238	275,077	62,807	41,745
2010	347,780	27,256	20,917	318,088	68,280	37,690
2011	364,842	27,434	22,203	318,276	64,823	20,513
2012	394,424	27,754	24,042	322,126	80,006	10,968
2013	394,710	25,690	25,602	324,813	95,911	29,451
2014	405,520	27,147	26,212	330,105	107,793	40,402
2015	465,354	35,569	28,323	363,971	145,543	45,931
2016	527,279	52,022	33,012	430,498	120,831	23,842
2017	611,313	64,789	37,685	511,966	136,164	41,671
2018	628,814	62,705	39,116	535,826	95,148	13,921
2019	685,175	81,396	42,008	567,086	162,480	59,990
2020	770,150	84,361	39,733	612,265	207,541	54,899
2021	807,524	65,744	42,967	618,327	241,814	50,981

Data Source: Ren Shou's 2006~2021 financial report data.

3. Empirical Testing

The empirical test is divided into two parts: one is to analyze the comprehensive efficiency (Crste), pure technical efficiency (Vrste) and scale efficiency (Scale) of Ping An and Ren Shou from 2006 to 2021, and the other is to analyze the input redundancy and insufficient output in the non-DEA effective years.

3.1. Comprehensive Efficiency, Pure Technical Efficiency and Scale Efficiency Analysis

Through the calculation, the technical efficiency, pure technical efficiency, and scale efficiency of Ping An and Ren Shou's capital utilization efficiency from 2006 to 2021 are shown in Table 4.

Table 4. DEA outcome.

Company	**Ping An**				**Ren Shou**			
Year	Crste	Vrste	Scale	Scale gains	Crste	Vrste	Scale	Scale gains
2009	1	1	1	-	1	1	1	-
2010	1	1	1	-	1	1	1	-
2011	1	1	1	-	0.978	0.979	0.999	drs
2012	0.973	0.988	0.986	drs	0.960	0.961	0.998	drs
2013	0.978	0.986	0.992	drs	1	1	1	-
2014	0.945	0.947	0.998	drs	1	1	1	-
2015	1	1	1	-	1	1	1	-
2016	0.898	0.899	0.998	irs	0.939	0.965	0.973	drs
2017	0.913	0.913	0.999	irs	0.954	1	0.954	drs
2018	1	1	1	-	0.931	1	0.931	drs
2019	0.998	1	0.998	drs	0.961	1	0.961	drs
2020	1	1	1	-	1	1	1	-
2021	1	1	1	-	1	1	1	-
Average	**0.900**	**0.979**	**0.998**		**0.979**	**0.993**	**0.986**	

As can be seen from Table 4:

(1) The average Comprehensive efficiency of Ping An's capital utilization is 0.900. In Ping An's 13-year data, the comprehensive efficiency (Crste), pure technical efficiency (Vrste), and scale efficiency (Scale) of capital utilization in 2009, 2010, 2015, 2020, and 2021 are all 1, reaching the effective DEA. The Crste and Scale in 2019 are both 0.998, which is non-effective DEA. Its pure technical efficiency is 1, which shows that the scale of capital input and capital output in that year is technically normal operated and only a slight increase in capital investment is required; In 2012, 2013, 2014, 2019, both the Crste and Vrste do not reach 1, the Vrste is low, but the Scale is close to 1. In those years, Ping An's utilization efficiency of funds at the technical level are not good enough. The Deap2.1 operation result suggests to reduce investment and optimize the direction of capital investment. The Vrste in 2016 and 2017 is particularly low, but the Deap2.1 operation result suggests that the investment of funds should be increased in these two years.

(2) The average Comprehensive efficiency of Ren Shou's capital utilization is 0.979. In the 13-year data of Ren Shou, the Crste, Vrste and Crste of capital utilization in 2009, 2010, 2020 and 2021 are all 1, which is effective in DEA. The Crste and Scale in 2017, 2018 and 2019 are less than 1, which is non-effective for DEA. Itts Vrste is 1, which shows that the scale of capital input and capital output in these three years is normal operated and it is necessary to focus on improving the scale of funds. In 2011, 2012, 2016, the Vrste did not reach 1, and the Scale was almost 1. According to the result of the Deap2.1 operation, it is recommended to reduce the amount of capital invested in these two years.

(3) Compared with the two companies, the Crste, Vrste and Scale of Ping An's are inferior to Ren Shou, the distant of Vrste between two company is larger, and the distant of Scale is smaller. Due to Ping An's relatively late start and the small amount of funds, it may lead to lack of experience, then lead to the utilization of funds.

3.2. Analysis of Input Redundancy and Insufficient Output

The analysis of input and output slackness in non-DEA effective years can more accurately analyze the capital input indicators and input directions, which can help to make targeted optimization countermeasures. Output-oriented refers to the insufficient state of output under the fixed input (Tables 5 and 6). As shown in Table 5, in the output-oriented indicators, there are varying degrees of input slackness and output deficiencies in 2012, 2013, 2014, 2016 and 2017. Only 2012 appears excessive operating expenses. In 2016 and 2017, there are excessive fee and commission expenses. In 2012, 2013, 2014, 2016, 2017, there are excessive operating overheads. Most of the problems in the indicators of insufficient output occur in the output of operating income. In 2012, there is an output deficit in both investment income and operating expenses. Ping An has been non-DEA for five years, while Ren Shou is only non-DEA for three years. More problem of Ping An is in I_3 (Business and administrative expenses), in other words, Ping An needs to better manage their expenses on business and administrative.

Table 5. Output-oriented Ping An company input slacks and output slack.

Year	input slackness			output slackness		
	I_1	I_2	I_3	O_1	O_2	O_3
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	0	0	0	0	0	0
2012	-4,797.576	0	-1,328.816	0	4,613.640	8,623.612
2013	0	0	-1,010.079	0	0	5,833.018
2014	0	0	-1,737.896	0	0	14,684.209
2015	0	0	0	0	0	0
2016	0	-9,774.355	-7,506.059	0	0	28,160.754
2017	0	-15,234.155	-7,216.982	0	0	32,749.399
2018	0	0	0	0	0	0
2019	0	0	0	0	0	0
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
Average	**-369.044**	**-1,923.731**	**-1,446.1409**	**0**	**354.895**	**6,926.999**

Table 6. Output-oriented Ren Shou company input slacks and output slack.

Year	input slackness			output slackness		
	I_1	I_2	I_3	O_1	O_2	O_3
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	-9,573.695	-572.393	-463.252	0	8,417.702	15,757.082
2012	-23,900.862	-1,077.999	-933.821	0	1,341.590	23,041.671
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	-18,667.426	-1,841.751	-1,168.734	0	0	20,640.438
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
2019	0	0	0	0	0	0
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
Average	**-4,010.922**	**-268.626**	**-197.370**	**0**	**750.715**	**4,572.245**

4. Suggestions

(1) Improve pure technical efficiency

The change of pure technical efficiency is affected by investment ability and management ability, and the stronger the investment ability and management ability, the greater the pure technical efficiency. As far as Ren Shou, foreign management personnel account for a very high proportion of the company's senior executives. The company can fully absorb the advanced management concepts of foreign insurance companies so the pure technical efficiency of Ren Shou is relatively high in the industry. Therefore, Ping An can improve pure technical efficiency by increasing the number of foreign managers.

(2) Cultivate professional talents in the use of funds

From the DEA operation results, we can see that Ping An's pure technical efficiency is not as good as Ren Shou for five years, that is, improving the pure technical efficiency of Ping An may be the key for Ping An to catch up with Ren Shou. Under the background of the rapid development of the insurance industry in our country, life insurance funds using scale and methods are constantly expanding, life insurance funds can invest in more and more industries, therefore, the required talents should also have a wider and wider range of knowledge, this requires the company to constantly introduce high-end external talents while also to cultivate internal high-quality internal talents, mining the potential of the internal staff, make it have investment management experience and investment decision-making vision.

(3) Choosing a better channel for the use of funds

Since China's life insurance funds are indirectly allowed to enter China's stock market, Ping An's life insurance funds have been developed rapidly in the stock market. Which means the use efficiency of life insurance funds has a great correlation with the use channel of life insurance funds, the channel not only needs to have a greater profitability, better stability, but also low risk and other characteristics. Thus, if Ping An want to improve the efficiency of life insurance funds, it should be good at choosing the channels of the use of life insurance funds.

(4) Expanding the size of the company also affects efficiency

Ping An can further expand company scale with care since the economies of scale in the industry can only be realized within a certain range. Therefore, along with investment increment, actively innovating the use of funds and optimizing the asset allocation plan is fully required.

(5) Establishment of asset management companies

Apparently, there are not many insurance companies that have set up asset management companies. The establishment of an asset management company helps insurance companies to develop asset allocation plans that are in line with diversified risks, returns and solvency, thereby improving the efficiency of capital utilization of insurance companies.

(6) Cooperate with the national insurance reform system arrangement

In September 2021, regulators reformed the use of insurance funds, that is, the insurance private equity fund will be changed from the registration system to the registration system. Although the registration system is more time-consuming than the registration system, but in the actual operation it is found that the efficiency of product distribution has been improved, which means the company's capital turnover rate has increased. Therefore, it is suggested that insurance companies should actively cooperate with the national insurance reform and change the company to the registration system.

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