Evaluation of Financial Performance on Oil Industry Central Enterprises Based on Principal Component Factor Analysis

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Abstract The three major oil central enterprises of China are elected in FORTUNE 500. Their rankings are respectively 5th, 6th and 101st in 2012. However, ranking in FORTUNE 500 is based on only one indicator, which is operating income. Although the three companies have their Annual Financial Reports, we can't compare their financial performance. Therefore, we constructed a set of financial performance evaluation index system, and evaluate their financial performance with the method of principal component factor analysis.

Keywords Evaluation • Financial performance • Oil central enterprises • Principal component

Sinopec Group (SG), China National Petroleum Corporation (CNPC) and China National Offshore Oil Corporation (CNOOC) are the three oil central enterprises of China. Their rankings in FORTUNE 500 are 5th, 6th and 101st in 2012. The rank is based on business income. We try to create a set of financial performance evaluation index system, and assess the financial performance of the three oil central enterprises with the method of principal component factor analysis.

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1 Choice of Evaluation Methods and Building of Index System

1.1 Choice of Evaluation Methods

We use the method of principal component factor analysis, this method is able to calculate the composite score objectively [1].

1. The theory of principal component factor analysis

The method of principal component factor analysis aims to use the ideas of dimensionality reduction, transform the multiple indicators into a few indicators [2].

2. The model of principal component factor analysis

$$\begin{aligned} F_1 &= a_{11}ZX_1 + a_{21}ZX_2 + \ldots\ldots a_{p1}ZX_p \\ F_2 &= a_{12}ZX_1 + a_{22}ZX_2 + \ldots\ldots a_{p2}ZX_p \\ &\cdots \\ F_p &= a_{1m}ZX_1 + a_{2m}ZX_2 + \ldots\ldots a_{pm}ZX_p \end{aligned}$$

$a_{1i}, a_{2i}, \ldots\ldots a_{pi}$, $(i = 1, 2, \ldots m)$ are eigenvectors corresponding to the eigenvalue which are solution of X covariance matrix.

$ZX_1, ZX_2, \ldots\ldots ZX_p$ are the value of the normalized original variable.

1.2 The Construction of the Indicator System

According to the Central four ministries developed jointly by the <state-owned capital and performance evaluation rules >1999 and the State Council issued <central enterprise comprehensive performance evaluation of the implementation of the rules >2006, we selected 4 one-class indexes, 14 secondary indexes. Then build oil central enterprises financial performance evaluation index system (Table 1) [3].

2 Empirical Analysis

2.1 Data Collection and Processing

According to the 2011 annual financial report, we obtained 14 indicator values as in Table 2 (CNOOC annual financial report did not reflect main business income and main business cost, so we use operating income replace main business income and operating cost replace main business cost). Calculating with SPSS [4].

Table 1 Financial performance evaluation index system of oil central enterprises

The first class index	The second class index	Index code
Profitability	Rate of return on net assets	X1
	Sales profit rate	X2
	Surplus cash coverage ratio	X3
	Cost profit rate	X4
	Rate of return on capital	X5
Asset quality	Turnover of total assets	X6
	Assets cash recovery rate	X7
	Turnover of current assets	X8
Debt risk	Asset liability ratio	X9
	Quick assets ratio	X10
	Cash current liabilities ratio	X11
Business growth	Sales growth rate	X12
	Sales profit growth rate	X13
	Total assets growth rate	X14

Table 2 Financial index of three major oil central enterprises

Financial indexes	CNPC	SG	CNOOC
X1	13.95 %	15.98 %	20.40 %
X2	14.54 %	8.88 %	25.17 %
X3	1.82	1.84	0.94
X4	10.11 %	4.29 %	29.53 %
X5	49.10 %	66.15 %	64.86 %
X6	1.12	2.37	0.73
X7	16.24 %	14.29 %	20.19 %
X8	5.93	8.68	2.76
X9	43.54 %	54.91 %	36.12 %
X10	36.28 %	28.94 %	113.92 %
X11	51.81 %	35.23 %	99.73 %
X12	36.74 %	30.97 %	37.61 %
X13	0.94 %	1.68 %	16.39 %
X14	15.77 %	14.68 %	16.42 %

2.2 Select Main Components and Construct the Comprehensive Evaluation Function

Seen from Table 3, the first two factors cumulative variance contribution rate has reached 100 and feature values were 11.586 and 2.414 which are more than 1, so the two public factors as the initial factors (F1 and F2), its factor loading matrix as shown in Table 4. In Fig. 1, it tells that from the second public factor, curve gradient becomes relatively flat, so extract two main factors are more suitable. Table 5 is a rotated factor loading matrix. From the view of joint degree of factors, almost all information of 14 variables can be explained by the two public factors [5].

Table 3 Total variance explained

	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.586	82.757	82.757	11.586	82.757	82.757	8.332	59.514	59.514
2	−2.414	17.243	100.000	2.414	17.243	100.000	5.668	40.486	100.000
3	−7.192E-16	5.137E-15	100.000						
4	−4.071E-16	2.908E-15	100.000						
5	−2.570E-16	1.836E-15	100.000						
6	−1.716E-16	1.226E-15	100.000						
7	−8.211E-17	5.865E-16	100.000						
8	−2.591E-17	1.850E-16	100.000						
9	−6.394E-18	−4.567E-17	100.000						
10	−1.390E-16	−9.932E-16	100.000						
11	−1.963E-16	−1.402E-15	100.000						
12	−2.689E-16	−1.921E-15	100.000						
13	−4.244E-16	−3.032E-15	100.000						
14	−6.467E-16	−4.619E-15	100.000						

Extraction method: principal component analysis

Table 4 Component matrix[a]

	Component	
	1	2
X1	.801	.599
X2	1.000	−020
X3	−.952	−.305
X4	.994	.107
X5	.126	.992
X6	−.883	.469
X7	1.000	−.001
X8	−.988	.153
X9	−.951	.310
X10	.969	.249
X11	.997	.079
X12	.827	−.562
X13	.932	.363
X14	.943	−.333

Extraction method: principal component analysis
[a]Two components extracted

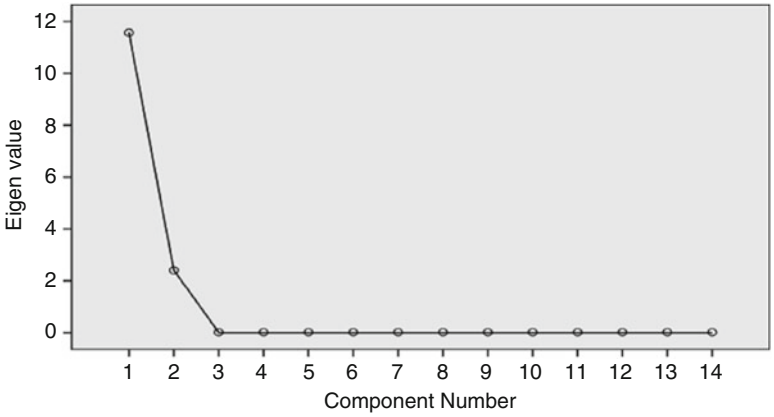

Fig. 1 Scree plot

As you can see from Table 5, X12 and X14 in public factor F1 has a larger load, so we can think F1 is reflected in business growth capacity factor; X1 and X5 in public factor F2 has a larger load, so F2 can be regarded as the profitability factor [6].

According to the Component Score Coefficient Matrix as show in Table 6, we can obtain principal component model:

Table 5 Rotated component matrix[a]

	Component	
	1	2
X1	.287	.958
X2	.815	.580
X3	−.583	−.812
X4	.735	.678
X5	−.490	.872
X6	−.989	−.149
X7	.804	.595
X8	−.885	−.466
X9	−.948	−.317
X10	.630	.777
X11	.754	.657
X12	.999	.041
X13	.532	.847
X14	.956	.294

Extraction method: principal component analysis
Rotation method: Varimax with Kaiser normalization
[a]Rotation converged in three iterations

Table 6 Component score coefficient matrix

	Component	
	1	2
X1	−.092	.240
X2	.074	.045
X3	.009	−.150
X4	.043	.087
X5	−.236	.337
X6	−.177	.111
X7	.070	.051
X8	−.106	.000
X9	−.142	.054
X10	.006	.133
X11	.050	.078
X12	.196	−.145
X13	−.025	.169
X14	.147	−.062

$$\begin{aligned} F1 = &-0.092^{*}ZX1 + 0.074^{*}ZX2 + 0.009^{*}ZX3 \\ &+ 0.043^{*}ZX4 - 0.236^{*}ZX5 - 0.177^{*}ZX6 + 0.07^{*}ZX7 \\ &- 0.106^{*}ZX8 - 0.142^{*}ZX9 + 0.006^{*}ZX10 + 0.05^{*}ZX11 \\ &+ 0.196^{*}ZX12 - 0.025^{*}ZX13 + 0.147^{*}ZX14 \end{aligned}$$

Table 7 Evaluation of financial performance

	Component score				Comprehensive score	
Enterprise	F1	Ranking	F2	Ranking	F	Ranking
CNPC	−0.8515	2	0.1246	3	−0.4563	2
SG	−1.4522	3	0.3078	2	−0.7395	3
CNOOC	−0.4405	1	0.4667	1	−0.0732	1

$$\begin{aligned} F2 = {} & 0.24^{*}ZX1 + 0.045^{*}ZX2 - 0.15^{*}ZX3 + 0.087^{*}ZX4 \\ & + 0.337^{*}ZX5 + 0.111^{*}ZX6 + 0.051^{*}ZX7 + 0^{*}ZX8 \\ & + 0.054^{*}ZX9 + 0.133^{*}ZX10 + 0.078^{*}ZX11 \\ & - 0.145^{*}ZX12 + 0.169^{*}ZX13 - 0.062^{*}ZX14 \end{aligned}$$

The variance contribution rate reflects the importance of principal components, therefore, regard the variance contribution rate (two principal component's contribution rate) as the principal components weights to carry on comprehensive evaluation, then we can build the evaluation model:

$$F = 0.5951F1 + 0.4049F2$$

By using the above evaluation model, we can obtain the financial performance evaluation of three big Petroleum central enterprises (Table 7)

3 Conclusion and Discussion

Components score Listed in Table 7 reflects financial performance status of three big Petroleum central enterprises. Generally, CNOOC's financial performance status is the best, CNPC is the second, SG is the final [7].

The result is in accordance with the financial performance realization status of the three big companies. So it proves that using the method of principal component analysis is of great value. But in the index quantification process, it only selects portion statistical data, some qualitative indexes are not properly reflected; so in the future studies, we can adopt some methods that can quantify the qualitative indexes, which makes the evaluation results more objective and comprehensive [8].

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