The Empirical Research of Petroleum Enterprise's Financial Risk Assessment

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Summary
The objective and accurate evaluation of oil companies' financial risk helps them objectively recognize the deficiencies in the management of financial risk and guides them to improve the financial situation, so that the economic efficiency will be improved. This article constructs an index system of petroleum enterprises' financial risk evaluation, selecting seven oil companies as the sample enterprises, choosing gray multi-level association analysis to evaluate their financial risk.

Key words:
Oil companies,Financial risk,Gray multi-level association analysis

1. Introduction

The rapid development of economy and the changing financial environment of the oil companies complicate the financial risks faced by oil companies, and its impact is increasing. How to evaluate the financial risks effectively becomes an important element of the financial management of oil companies. For the occurrence of any enterprise' s financial risk is not instantaneous, in this process, financial risk factors directly or indirectly reflect in the different changes of some sensitive indicators. By observing the changes of these sensitive indicators, corporate will take appropriate measures to prevent and control risks [1]. Thus, using these sensitive indicators to establish a scientific, reasonable and feasible index system of financial risk evaluation, and selecting scientific and reasonable method to evaluate the oil companies' financial risks will help them effectively manage and control the financial risks to avoid their occurrence[2].

2. The Construction of the Index System of Petroleum Enterprises' Financial Risk Evaluation

Considering the various reason of the formation of enterprises' financial risk, oil enterprises' financial risk evaluation must synthetically consider all kinds of possibilities. The selected index must be comprehensive, scientific, effective, operable and adaptive. Based on that, this article constructs an index system of oil ompany's financial risk evaluation, including debt-paying ability, profitability, operational ability, growth ability and ability of obtaining cash. As following in table 1:

3. Empirical Analysis of Oil Company's Financial Risk Evaluation

3.1 Researching Methods

This article will use gray multi-level association analysis to evaluate the oil companies' financial risks. Gray multi-level association analysis is an integrated mode of gray relational analysis and analytic hierarchy process, it is a direct and multi-level financial risk evaluation method combining the analytic hierarchy process with gray relational analysis. That is, using analytic hierarchy process to determine the weight of the index of financial risk evaluation and establish a model of multi-objective decision [3-4] as the evaluation criteria according to gray correlation degree program.

3.2The Selection of Samples and the Source of Datum

The paper selects 7 petroleum companies listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange in 2011 as samples for model checking.

3.3 The Process of Empirical Analysis

(i) For author/s of only one affili

Set the optimal index set X0k=[X01,X02,⋯,X0m］, X0k（k=1,2,⋯,m） as the optimal values of the k-th index that concentrate in each of the financial index. In general, there is an optimum expectation for each of the financial indicators. For example, adaptable indicators, generally considering 2 as the optimal value of the current ratio and the optimal value of asset-liability ratio is 60%, the optimal value of the ratio of cash flow liabilities is 50% [5]. On the basis of the qualitative analysis of the object, we obtain the optimal index set of every indicator according to the datum of every indicators of the selected sample enterprises:

X0k=[2,60,1977.3;21.3664,56.0887,15.1100;48.7529,128 1.58,4.1120;100.993,12.5569,15.7670;50,1.5717]

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(ii)Using the interval value method for gray conversion

In order to facilitate the comparison, we standardize it as an indicator within the interval of [0,1]. In which, X0j is the relative optimal value among the m indicators, Xj* is the optimal value.

For positive indicators
$$\lambda_{ij} = \frac{X_{ij}}{X_{0j}} = \frac{X_{ij}}{\max X_{kj}} \quad (1)$$

For Contrary Indicators
$$\lambda_{ij} = \frac{X_{0j}}{X_{ij}} = \frac{\min X_{ij}}{X_{ij}} \quad (2)$$

For adaptable indicate
$$\lambda_{ij} = \left\{ \begin{matrix} 1 \\ 1 - \frac{|X_{ij} - X_j^*|}{\max|X_{ij} - X_j^*|} \end{matrix} \right\} \quad (3)$$

In order to facilitate the calculation, we can also use the following formula to deal with the gray conversion for the index data of petroleum enterprise's financial risk;

$$\lambda_{ij} = \frac{X_{ij} - \min(X_i)}{\max(X_{i)} - \min(X_i)} \quad (4)$$

Thereinto: max（Xi）, min（Xi）are respectively the maximum and the minimum of the i-th indicator, λi is the normalized sequence of indicator's eigenvalues[3-4].

The normalized indicator datum of the seven oil companies are shown in table 2:

(iii) Calculating the Correlation Coefficient

Working out the difference sequence of the interval value sequence that are converted by gray, and obtain the maximum and the minimum on the basis of the difference sequence.

Difference sequence: $\varepsilon_{0i}(m) = \left|\lambda_{0m} - \lambda_{im}\right| \quad (5)$

$$\varepsilon_{0i}(m) = \frac{\delta_{\min} + \rho\delta_{\max}}{\delta_{0i}(m) + \rho\delta_{\max}} \quad (6)$$

Thereinto, p is the resolution ratio that can be factitious, it is usually valued as 0.5, δ min is the minimum difference of the two extremum, the correlation coefficient is the basis of the judgment of correlation degree [6].

The correlation coefficient of the seven oil companies calculated according to the above-mentioned formula has shown in table 3:

(iv)The synthetically single-level evaluation of the base layer indicators

C refers to the base layer indicators, A is the weight coefficient of index determined by using AHP, B is the three lines of correlation coefficient in the correlation coefficient matrix [4]. The formula is:

$$C = A \times B \quad (7)$$

For this reason, we use the analytic hierarchy process method to construct the index weight coefficient, as follows:

Each index weight of the solvency:

A1 = [0.1429,0.4286,0.4285]

Each index weight of the profitability:

A2 = [0.0683,0.2746,0.6571]

Each index weight of the operating capacity:

A3 = [0.0796,0.2648,0.6556]

Each index weight of the growth ability:

A4 = [0.1429,0.4286,0.4285]

Each index weight of the cash ability:

A5 = [0.3333,0.6667]

According to the formula(7), we use the solvency indicators, the profitability indicators, the operational capacity indicators, the indicators of the ability to grow and the cash capacity indicators for comprehensively single-level evaluation, the results are calculated as follows:

C1=A1×B1=[0.7015,0.5210,0.7348,0.4700,0.2276,0.7856, 0.8000]

C2=A2×B2=[0.5090,0.4003,0.7504,0.4320,0.5770,0.1261, 0.9408]

C3=A3×B3=[0.7012,0.9785,0.5448,0.6793,0.3879,0.7754 ,0.3729]

C4=A4×B4=[0.7817,0.7962,0.8785,0.5870,0.3171,0.7116, 0.5348]

C5=A5×B5=[0.7812,0.8325,0.9411,0.7586,0.4638,0.6156, 0.4431]

(v) Determining the Associate Degree Value of Each Indicators

Use the results of the comprehensively single-level evaluation of the base layer indicators to calculate the associate degree value of the last layer, that is, the integrated financial risk evaluation laye[7]. This value is the integrated financial risk evaluation indicator of each company, according to which, we could know each enterprise's financial situation is good or bad. The greater the associate degree, the closer relationship between the comparative sequence and the reference sequence, according to associate degrees maximum principle, we make a comprehensive evaluation of the results. The formula is as following:

$$R = P \times E \quad (8)$$

Thereinto, R is the result of the associate degree value calculated according to the last layer, that is, the integrated financial risk evaluation layer. P is the synthetical index weight coefficient calculated by AHP. E is the result of the comprehensively single-level evaluation of the base layer indicators [8].

Each of the constructed ability indicator's comprehensive weight coefficients are shown in Table 4.

According formula (8), the process of calculating is as following:

R1= （ 0.1532,0.1690,0.1278,0.2482,0.3018 ） × [0.7015,0.5090,0.7012,0.7817,0.7812]=0.7129

R2= （ 0.1532,0.1690,0.1278,0.2482,0.3018 ） × [0.5210,0.4003,0.9785,0.7962,0.8325]=0.7214

R3= （ 0.1532,0.1690,0.1278,0.2482,0.3018 ） × [0.7348,0.7504,0.5448,0.8785,0.9411]=0.8111

R4= （ 0.1532,0.1690,0.1278,0.2482,0.3018 ） × [0.4700,0.4320,0.6793,0.5870,0.7586]=0.6065
R5= （ 0.1532,0.1690,0.1278,0.2482,0.3018 ） × [0.2276,0.5770,0.3879,0.3171,0.4638]=0.4006
R6= （ 0.1532,0.1690,0.1278,0.2482,0.3018 ） × [0.7856,0.1261,0.7754,0.7116,0.6156]=0.6032
R7= （ 0.1532,0.1690,0.1278,0.2482,0.3018 ） × [0.8000,0.9408,0.3729,0.5348,0.4431]=0.5957

3.4 The analysis of the evaluation results

We could know from the analysis of above data that the associate degrees of the seven oil companies are ranked as following: the COOEC>China Petrochemical>China Petroleum>COSL>Tongyuan oil>Yueyang Xingchang>Taishan Petroleum. Thereinto, when a correlation degree value is below 0.6, the corporate' finance stays at a poor level; when it is between 0.6-0.7, the financial level is qualified; when it is between 0.7-0.8 , the financial level is moderate; only when it is between 0.8-0.9, the financial level is good. So among these seven companies, the COOEC' financial level is fine, Sinopec and China National Petroleum' financial level is moderate, and the financial level of COSL and Tongyuan oil is qualified, while the financial level of Taishan Petroleum and Yueyang Xingchang is poor.

COOEC who has a well financial level analyzes the performance report as: during the reporting period, with the scientific management, actively coordinating various resources and improving the working efficiency, because of which the smooth operation of the various projects was ensured, the completion of the workload continues to grow, which ensure the operating performance steadily.

China Petrochemical who has a moderate financial level analyzes the causes of the results of the report as following: tax reform of the domestic refined oil price, a gradual improvement in domestic refining business[9], the scale advantage, the cost advantage, as well as the incorporate and management advantages of China petrochemical' refining business took effect.

COSL who has a qualified financial level analyzes the reasons as: the amount of work for each of the segments of the enterprise have varying degrees of growth, at the same time, the price of services also have different levels of growth,which make the performance increased [10].

Taishan Petroleum who has a poor financial level analyzes the reasons as: effected by the market,the current selling price decline; especially because of the national implementation of the new refined oil pricing mechanism, the gap between buying price and selling price declines and the gross profit margin dropped significantly.

Yueyang Xingchang who has a a poor financial level analyzes the reasons as: downtime resulting in reduced production of the main business products; lacking of demand, and so the prices decline; Yueyang Xingchang the Finance level of difference, performance reporting: before the year there is a big amount of gains on disposal of assets and decrease in value and it is going to switch back.

As for the China Petroleum who has a moderate financial level and the Tongyuan oil who has a qualified financial level, there is no explanation for their performance reports, so there is no analysis about them.

In other words, the value of the correlation degree reflect the financial situation of the oil companies well, but also highlights the level of financial risk. Using Gray multi-level association analysis and evaluation model for the assessment of oil companies' financial risk, and the results of which is more credible. Meanwhile, we can determine the level of financial risk according to the range of values of business related degree.

That is, when $R \leq 0.5$, corporation's financial risk is high; when $0.5 < R \leq 0.6$, corporation's financial risk is higher; when $0.6 < R \leq 0.7$, corporation's financial risk is acceptable; when $0.7 < R \leq 0.8$, corporation's financial risk is common; when $0.8 < R \leq 0.9$, corporation's financial risk is low; $R > 0.9$, enterprise financial risk is very low.

4. Conclusion

The correct evaluation of the oil companies' financial risk may help oil companies improve economic efficiency and achieve its sustainable and stable growth targets. This paper constructs the index system of evaluation of the petroleum companies' financial risk and uses the gray multi-level association analysis to evaluate the financial risks of the oil companies, and it selects the seven oil companies as sample for empirical analysis. The analysis shows that the gray multi-level association analysis not only can evaluate the risk of the subsystem of complex system, but also can comprehensively evaluate on the basis of the risk assessment of subsystem, and it enhance the validity and accuracy of the financial risk evaluation. The value of related degree reflects the financial risk situation of the oil companies and provides a new way of thinking and methods for the evaluation of multi-level complex system.

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Table 1 The Index system of Oil Company's Financial Risk Evaluation

Primary Index	Secondary Index	Variable	Index Property
Debt-Paying Ability	Liquidity Ratio	X_1	Moderate Index
	Asset-Liability Ratio	X_2	Moderate Index
	Interest Cover ratio	X_3	Positive Index
Profitability	Net Interest of Marketing	X_4	Positive Index
	Rate of Return on Total Assets	X_5	Positive Index
	Rate of Return on Net Assets	X_6	Positive Index
Operational Ability	Turnover Rate of Inventory	X_7	Positive Index
	Turnover Rate of Accounts Receivable	X_8	Positive Index
	Turnover Rate of Total Assets	X_9	Positive Index
Growth Ability	Growth Rate of Net Profit	X_{10}	Positive Index
	Growth Rate of Net Assets	X_{11}	Positive Index
	Growth Rate of Net Total Assets	X_{12}	Positive Index
Ability of Obtaining Cash	The Ratio of Cash Flowing Liabilities	X_{13}	Moderate Index
	The Ratio of the Net Flow of Operating Cash to Net Profit	X_{14}	Reverse Index

Table 2 The normalized indicator datum

	CNPC	Sinopec	COOEC	COSL	Sinopec Shandong Taishan PetroleumCo.,Ltd.	Tong Oil Tools Co., Ltd.	YueYangXingChang Petro-Chemical Co.Ltd
X_1	0.0000	0.0136	0.0201	0.2130	0.9488	0.1348	1.0000
X_2	0.7498	0.9742	0.8657	1.0000	0.0000	0.7698	0.0895
X_3	1.0000	0.8879	0.3583	0.8244	0.6772	0.4006	0.0000
X_4	0.3336	0.1339	0.1080	1.0000	0.0000	0.1183	0.1092
X_5	0.1515	1.0000	0.0000	0.3692	0.0612	0.5180	0.6803
X_6	0.8685	1.0000	0.0625	0.9346	0.0000	0.1336	0.4321
X_7	0.0261	0.0908	0.0000	0.1754	0.5120	0.3062	1.0000
X_8	0.0300	0.0368	0.0011	0.0023	2.6686	0.0000	1.0000
X_9	0.1938	0.5301	0.0000	0.0292	1.0000	0.0496	0.6010
X_{10}	0.0000	0.0300	1.0000	0.0092	0.2973	0.2664	0.1739
X_{11}	0.5320	1.0000	0.3053	0.8831	0.0000	0.1381	0.5669
X_{12}	1.0000	0.9379	0.3742	0.2247	0.0000	0.0146	0.2431

X_{13}	0.1715	0.0690	0.1194	0.0000	0.7825	0.2715	1.0000
X_{14}	0.0317	0.0301	1.0000	0.0000	0.2950	0.8230	0.0182

Table 3 The distribution of the related coefficient of the sample companies

	CNPC	Sinopec	COOEC	COSL	SinopecShandongTaishanPetroleumCo.,Ltd.	Tong Oil Tools Co., Ltd.	YueYangXingChang Petro-Chemical Co.Ltd
X_1	0.2234	0.2169	0.0240	0.7118	0.1022	0.7630	0.0136
X_2	0.1005	0.2090	0.0747	0.0747	0.3049	0.9852	0.9742
X_3	0.2953	0.2343	0.2318	0.0846	0.1920	0.5926	0.8879
X_4	0.1237	0.1496	0.7424	0.2576	0.1393	0.1484	0.1339
X_5	0.6028	0.3972	0.0280	0.3360	0.1208	0.2831	1.0000
X_6	0.5098	0.4277	0.4444	0.4902	0.3566	0.0581	1.0000
X_7	0.2107	0.3015	0.1261	0.2105	0.0047	0.6985	0.0908
X_8	0.4928	0.5285	0.5273	0.1390	0.5296	0.4704	0.0368
X_9	0.6735	0.1434	0.1142	0.1434	0.1930	0.7444	0.5301
X_{10}	0.2238	0.7462	0.2446	0.0435	0.0126	0.0799	0.0300
X_{11}	0.5107	0.1840	0.3938	0.4893	0.3512	0.0776	1.0000
X_{12}	0.5387	0.0250	0.1745	0.3992	0.3846	0.1561	0.9379
X_{13}	0.2758	0.2254	0.3448	0.4377	0.0733	0.6552	0.0690
X_{14}	0.2839	0.6860	0.3140	0.0190	0.5090	0.2958	0.0301

Table 4 The distribution of comprehensive weight coefficients of the sample companies' financial risk evaluation indicators

Solvency	profitability	operating capacity	growth ability	cash ability	gross
0.1532	0.1690	0.1278	0.2482	0.3018	1