

# The Application of SPSS Factor Analysis in the Evaluation of Corporate Social Responsibility

Hongming Chen

Department of Economics and Management, Changsha University of Science and Technology, Changsha, China  
Email: chmdsh@163.com

Xiaocan Xiao

Department of Economics and Management, Changsha University of Science and Technology, Changsha, China  
Email: adashaw89@gmail.com

**Abstract**—According to the basic idea and the model theory of factor analysis, this thesis explores the applicability of factor analysis in the evaluation of corporate social responsibility. With the detailed examples of the applying of SPSS factor analysis showed in this paper, it is showed the rationality of SPSS factor analysis being applied to social responsibility assessment of thermal power corporate. By essentially analyzing and evaluating the results of SPSS software running out, the most simple and suitable standard evaluation model of corporate social responsibility of thermal power is determined deservedly, and at last this thesis puts forward the prospects of solving the shortcomings of the model.

**Index Terms**—SPSS, factor analysis, corporate social responsibility

## I. INTRODUCTION

The Statistical Product and Service Solutions (SPSS), statistical software developed by SPSS Company of America, has the capabilities of basic and advanced statistics. It is well known as professional statistical software with widely applications in many fields, such as communication, medical treatment, bank, security, insurance, manufactory, commerce, market research, scientific research and education, etc. By studying the common and special reasons of variables change, factor analysis simplifies variables' structures. It is a multivariate statistical method derived from educational psychology. Recent years witnessed the booming of factor analysis in several fields, such as psychology, medical science, meteorology, and economics, etc. By analyzing the dependency of related matrixes of the source variables, factor analysis transfers variables in complex relationships into a few integrated factors in the principle of dimensionality reduction. Against the background of various evaluation mechanisms of corporate social responsibility, this thesis describes how to use SPSS to perform factor analysis on the fulfillment of corporate social responsibility, and represents the formula to calculate the standard value of common factors based on the analysis results. At last, the thesis establishes a comprehensive evaluation model of corporate social responsibility for heat-engine plants.

## II. PRINCIPLE OF SPSS FACTOR ANALYSIS MODEL

Factor analysis is a multivariate statistic method which starts from the research related to the dependence of the internal variables, and concludes the numerous complex variables into a few comprehensive factors. The basic idea of factor analysis is that through the study of the internal structure of variable correlation matrix or covariance matrix, a few random variables which are used to describe the relationship between multiple variables must be found out. Then group the variables according to the level of the relevance among them, and make sure the correlation between the variables in a same group is high and the variable between groups is low. So each type of variable actually represents a basic structure, namely common factor. These common factors are the basic structures which influence the correlation between the original variables. In social statistics, it is necessary to identify and summarize some main factors from the internal of complex realities, and the characteristics of these common factors are to help us fully grasps what as they are and find out the laws.

In the factor analysis, when the common factor is not obvious, the factor rotation method must be used to get some unrelated common factors in order to make such common factors more decentralized. That means the first common factor is representative of one part of the variables, and so does the second common factor, and so on. Such dealing makes sure that each common factor has obvious practical implications, which is conducive to analysis and interpretation. So factor analysis is a method which tries to use the minimum number of unpredictable factors in the so-called linear function of the common and special factors and to describe the original observations of each component. It divides each original variable into two parts: one consists of a few factors which are shared by all variables, namely common factor; the other part is only one variable impact, for a specific variable, namely the special factor. If the special factor is zero, then it is called the main component analysis.

Generally, the Factor analysis model is:

$$X_1 = a_{11}F_1 + \dots + a_{1n}F_n + e_1$$

$$X_2 = a_{21}F_1 + \dots + a_{2n}F_n + e_2$$

...

$$X_m = a_{m1}F_1 + \dots + a_{mn}F_n + e_m$$

In the above formula,  $X_i$  ( $i=1, 2, \dots, m$ ) is Measured variable;  $a_{ij}$  ( $i=1,2,\dots, m; j=1, 2, \dots, n$ ) is factor loading; ( $i=1, 2, \dots, n$ ) is common factor;  $e_i$  ( $i=1, 2, \dots, m$ ) is specific factor. Factor loading is the correlation coefficient of the first  $i$  variable and the first  $j$  factor, and it reflects importance of the first  $i$  variables to the first  $j$  factor. If the load is larger, the first  $i$  variable is in the close relationship with the first  $j$  factor instead, they alienated. In the factor model, the common factor is also irrelevant, and it is also irrelevant between special factor and common factor. Thus, starting from a group of original observation variables, factor analysis that is a statistical method used to find potential factors, is about to analyze the common factors and special factors, and find out the corresponding loading matrix, and then explain the meaning of every common factor.

The first task of factor analysis is to construct a factor model with the model parameters determined, and to explain the results of factor analysis; the second task of factor analysis is to estimate the common factors, and analysis them to a further extend. Therefore, surrounding this core problem, the basic steps and solution idea of factor analysis is clear. Factor analysis often has the following basic steps:

1) Confirm whether the original variables are suitable for the factor analysis, namely inspection steps. The determination method used in this paper is mainly Bartlett Test of Sphericity and KMO (Kaiser-Meyer-Olkin). The tested statistic of Bartlett Test of Sphericity derives from related coefficient matrix. If the value is great, and the corresponding companion probability value is less than the established level of significance, there is a correlation between the original variables. Tested statistic of KMO is used to compare simple correlation and partial correlation relationship between variables, and the value is between 0-1. The more closely it is to 1, the more suitable the variables for factors analysis. And all that simple correlation squares far outweigh the partial correlation square between the variables.

2) Build factor variables, namely extraction of common factors.

Standardize the original variable data, and calculate their correlation matrix, and analyze the correlation between the variables. The number of common factor is based on a suitable proportion of the information content of the selected common factors to the original indexes to determine. The proportion of The first  $i$  common factor keeps original data information to the total amount is  $\lambda_i$ , namely the contribution rate of the first  $i$  common factor on the original data. The selection of number of common factor is according to their contribution size of common factors, when the cumulative contribution rate is greater than a predetermined standard, it is the point.

3) Make use of the rotation method to have variable factors preferably interpreted, that is rotating.

Establishing factor analysis model is designed not only to find the common factor but also to learn the meaning of each common factor that is more important, and to evaluate and analysis all private listed companies' operating results. But regardless of which method to determine the initial factor loading matrix  $A$ , is not the only, just only an initial value. If the initial factor from each can be better identified the representatives of the original indicators, we can give a reasonable economic interpretation of these factors, then take the next step analysis. But if the factor load capacity is relatively average, it is difficult to distinguish which index and factor is more closely linked, from the initial factor load matrix and get the initial factor solution to see the master factor is the typical representative of variables is not very prominent, easy to make the factors of ambiguity in the meaning, cannot find evaluation of the object on each factor scores from the original index on the reasons of the differences, it is not easy problem analysis. Then we need factor rotation, is to facilitate the interpretation of the public factor meaning, is required for the initial master factor to the linear combination, so that each variable in only one common factor on a greater load, whereas in the rest of the public factor on the load, or medium size, in order to find the common factor of the more clear economic meaning. You can create a new set of common factors following a linear combination, ..., and these factors are independent of each other, but also can well explain the relationship between the original variables.

$$F'_1 = d_{11}F_1 + d_{12}F_2 + \dots + d_{1p}F_p$$

$$F'_2 = d_{21}F_1 + d_{22}F_2 + \dots + d_{2p}F_p$$

...

$$F'_p = d_{p1}F_1 + d_{p2}F_2 + \dots + d_{pp}F_p$$

In fact the so-called "rotation" in factor analysis is the distribution of variable information once again, which is like that adjusting the focus of a microscope, in order to see the fine things. It is characterized not to increase or decrease the amount of information of things, only through the appropriate adjustment made things as they are clearer.

4) Calculate the factor variable scores.

Factor score, is the score of common factor scores in every sample point. It needs to build a linear expression for common factor in its expression by some original variables, and then substitute the value of original variables into the expression, the factor score can be worked out easily. The establishment of regression equations which utilizes the common factor as the dependent variable, and the original variables as the independent variable, as follows:

$$F_j = \beta_{j1}X_1 + \beta_{j2}X_2 + \dots + \beta_{jn}X_n, j=1, 2, \dots, p$$

Under the meaning of the least square method, the estimate value of common factor  $F$  can be obtained,  $\hat{F} = A'R^{-1}X$ . In this above formula,  $A$  is the factor loading matrix,  $A'$  is the transpose of the after turn

factor loading matrix,  $R$  is the original variables correlation matrix,  $R^{-1}$  is the inverse matrix of  $R$ ,  $X$  is for the primitive variable vector.

Comprehensive evaluation score. Set  $W_i$  ( $i=1, 2, \dots, m$ ) being for the comprehensive evaluation score of sample enterprise, then the comprehensive evaluation mathematical equations of samples which is got from Weighted summary of each factor, as follows:  

$$W_i = \hat{\partial}_1 F_1 + \hat{\partial}_2 F_2 + \dots + \hat{\partial}_p F_p$$

$\hat{\partial}_i$  is for the weight of each factor which is equal to the contribution of each common factor to the total variance

contribution of  $p$  common factors, namely 
$$\hat{\partial}_i = \frac{\lambda_i}{\sum_{i=1}^p \lambda_i}$$
.

### III. EXPLORATION OF THE APPLICABILITY OF SPSS FACTOR ANALYSIS IN CORPORATE SOCIAL RESPONSIBILITY EVALUATION

In theory, factor analysis can be a good way to evaluate it with regard to the corporate social responsibility. First, because of the diversity and complexity of the performance of corporate social responsibility and the strong correlation between every aspect of its performance, it is complex and difficult to determine the evaluation index of social responsibility. Secondly, the universality of social responsibility requires that evaluation indexes must be established as much as possible, while the establishing of a large number of evaluation indexes must waste a lot of costs inevitably, which is to make the evaluation a mere formality finally. Third, the influence on evaluation results which is caused by the determination of weighing values of the indicators is of great. On the one hand, it may cause error when evaluate the object of study too high or too low, so that the final results of the evaluation cannot truly reflect the actual level; On the other hand, evaluation object will probably only pursue some index with higher weight or make use of manipulating data, and inflate some evaluation indexes. Factor analysis with its features is a good solution to the problems mentioned above, and while dealing with social responsibility problem with multiple variables indexes, factor analysis method has its own incomparable advantages:

1) The factor analysis is one of the multivariate statistical methods in social statistics, and it can solve such problems towards corporate social responsibility which is multi-dimensional, multi-variable and complexed. Through classifying the complex indexes, it will carry the find out common factor on the real diagnosis analysis and comprehensive evaluation.

2) Factor analysis method will simplify the process analysis by classifying the object. Factor analysis method can solve the complex relationship between indexes, and decrease evaluation costs which is caused by numerous index.

3) Factor analysis method can avoid defects which is caused by subjective factors determine. In the process of determining weight index, index  $W_i$  is calculated

according to certain procedures, not by subjective experience, so by using factor analysis method, the effect of subjective factor will be avoided, index weight will be determined scientifically, and the evaluation index system of corporate social responsibility will be constructed reasonably, thus the social responsibility will be evaluate objectively and scientifically.

4) The factor analysis could be processed by the computer statistical analysis software, which is strongly feasibility and operability. Using the statistical software SPSS17.0, the beforehand typed-in index data will be handled by factor analysis, such as statistically inspect, extract common factor, output data results, etc, and the calculation process is simple and convenient, easy to operate.

Being based on the principle and characteristics of factor analysis, it is reasonable for factor analysis to be applied to evaluating the corporate social responsibility. The factors which affect the performance of social responsibility of the enterprise is so numerous and complicated that it is not possible and unnecessary to embrace all the complicated factors. For the limitations of existing research and the difficulty acquiring of data information, this article only takes ten financial indexes to construct the evaluation model. Then choose the important influence factors and determine the sequence of impact factor through the reduced-order processing of factor analysis, and the following is using factor score model to comprehensively evaluate the samples. At the same time, according to the factor analysis, the main factors and the secondary factors will be distinguished from each other.

### IV. PRACTICAL APPLICATION OF SPSS FACTOR ANALYSIS

#### A. The computer operating process

1) Input the 3 years data of 10 indexes from the 10 sample enterprises into the table in the SPSS.

2) Click on the menu items in the sequence of Analyze Data Reduction Factor, open the Factor dialog Box.

3) In the Factor Analyze dialog box, click the variables as  $X_1 \dots X_{10}$  the analytical variables.

4) Click the Descriptives button, and select the Univariate descriptives in the Statistics option, then select Coefficients, Significance levels, KMO and Bartlett's test of sphericity in the option of Correlation Matrix, and then click on Continue to the main dialog box.

5) Click on the Extraction button, select the Principal components in Method, and select the Correlation Matrix in the Analyze option, and then select the Unrotated factor solution and Scree plot in the option of Display, click on the Continue button to return to the main dialog box.

6) Click on Rotation button in the dialog box, and then select the varimax method to do the rotation of factor loading, and select Rotated solution in Display option, then click on the Continue button to return to the dialog box.

7) Click on the Scores button in dialog box, and select Display factor score coefficient matrix, and click on Continue button to return to the main dialog box.

8) Click the OK button in the dialog box, indicate the results, which is shown in the TABLES.

TABLE I. KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.704
Bartlett's Test of Sphericity	Approx. Chi-Square	331.855
	df	45
	Sig.	.000

TABLE II. TOTAL VARIANCE EXPLAINED

Extraction sums of squared loadings			Rotation sums of squared loadings		
	variance %	cumulative %		variance %	cumulative %
total	50.265	50.265	total	43.385	43.385
1.891	18.910	69.175	2.047	20.473	63.858
1.315	13.154	82.329	1.847	18.470	82.329

TABLE III. ROTATED COMPONENT MATRIX

	component		
	1	2	3
X1	.979	-.152	-.023
X2	.970	-.146	-.008
X3	.945	-.229	-.095
X4	.932	-.229	-.039
X5	-.235	.878	.001
X6	-.114	.861	.389
X7	.557	-.610	.364
X8	.266	.062	.769
X9	-.104	.043	.730
X10	-.467	.096	.655

TABLE IV. COMPONENT SCORE COEFFICIENT MATRIX

	component		
	1	2	3
X1	.259	.103	-.004
X2	.257	.104	.004
X3	.233	.053	-.038
X4	.229	.045	-.006
X5	.108	.513	-.070
X6	.139	.495	.146
X7	.040	-.306	.249
X8	.088	.031	.420
X9	-.025	-.053	.401
X10	-.121	-.086	.357

TABLE V. 10 SAMPLE ENTERPRISES' AVERAGE F1 SCORES RANKING IN 3 YEARS

Enterprise	F1	Rank
Shenzhen energy	1.563773	1
Guangdong power A	0.454057	3

SDIC Huajing Power	0.117747	5
SP Power Development	0.243617	4
Datang Power	-0.02443	6
Anhui Power	-0.36465	7
Shenneng Stock	0.637323	2
Huadian energy	-0.94325	10
Huaneng Power International	-0.79174	8
Huadian Power International	-0.89245	9

TABLE VI. 10 SAMPLE ENTERPRISES' AVERAGE F2 SCORES RANKING IN 3 YEARS

Enterprise	F2	Rank
Shenzhen energy	-0.29596	7
Guangdong power A	1.645917	1
SDIC Huajing Power	-0.20985	5
SP Power Development	0.43984	4
Datang Power	-0.21498	6
Anhui Power	0.96417	2
Shenneng Stock	-1.9632	10
Huadian energy	0.60599	3
Huaneng Power International	-0.60308	9
Huadian Power International	-0.36884	8

TABLE VII. 10 SAMPLE ENTERPRISES' AVERAGE F3 SCORES RANKING IN 3 YEARS

Enterprise	F3	Rank
Shenzhen energy	0.5514	3
Guangdong power A	-0.34414	7
SDIC Huajing Power	1.73815	1
SP Power Development	0.587587	2
Datang Power	-0.15524	4
Anhui Power	-0.90722	10
Shenneng Stock	-0.37384	8
Huadian energy	-0.25067	5
Huaneng Power International	-0.30352	6
Huadian Power International	-0.54251	9

TABLE VIII. 10 SAMPLE ENTERPRISES' AVERAGE COMPREHENSIVE SCORES RANKING IN 3 YEARS

Enterprise	Comprehensive score	Rank
Shenzhen energy	0.874169	1
Guangdong power A	0.571365	2
SDIC Huajing Power	0.399807	3
SP Power Development	0.369577	4
Datang Power	-0.10116	5
Anhui Power	-0.15592	6
Shenneng Stock	-0.23621	7
Huadian energy	-0.40261	8
Huaneng Power International	-0.63529	9
Huadian Power International	-0.68373	10

TABLE IX. THE F1 SCORES RANKING OF SAMPLE ENTERPRISES IN THE SAME YEAR

Enterprise	Fiscal year	F1	rank
SDIC Huajing Power	2008	0.25534	3
Shenzhen energy	2008	0.92093	1
SP Power Development	2008	-0.34221	6
Shenzhen energy	2009	2.40115	1
Guangdong power A	2009	1.39809	2
SP Power Development	2009	0.69064	4
Shenzhen energy	2010	1.36924	1
Guangdong power A	2010	0.60804	2
SP Power Development	2010	0.38242	4

TABLE X. THE F2 SCORES RANKING OF SAMPLE ENTERPRISES IN THE SAME YEAR

Enterprise	Fiscal year	F2	rank
SDIC Huajing Power	2008	-0.04855	5
Shenzhen energy	2008	-0.29529	7
SP Power Development	2008	0.73822	4
Shenzhen energy	2009	0.02595	5
Guangdong power A	2009	1.89974	1
SP Power Development	2009	0.83322	3
Shenzhen energy	2010	-0.61854	7
Guangdong power A	2010	1.70093	1
SP Power Development	2010	-0.25192	4

TABLE XI. THE F3 SCORES RANKING OF SAMPLE ENTERPRISES IN THE SAME YEAR

Enterprise	Fiscal year	F3	rank
SDIC Huajing Power	2008	3.20559	1
Shenzhen energy	2008	0.68671	4
SP Power Development	2008	1.6434	2
Shenzhen energy	2009	0.62791	2
Guangdong power A	2009	-0.613	8
SP Power Development	2009	0.43809	3
Shenzhen energy	2010	0.33958	2
Guangdong power A	2010	-0.57178	4
SP Power Development	2010	-0.31873	3

TABLE XII. THE COMPREHENSIVE SCORES RANKING OF SAMPLE ENTERPRISES IN THE SAME YEAR

Enterprise	Fiscal year	Comp- score	rank
SDIC Huajing Power	2008	0.572524	1
Shenzhen energy	2008	0.565932	2
SP Power Development	2008	0.371927	3
Shenzhen energy	2009	1.412657	1
Guangdong power A	2009	1.071644	2
SP Power Development	2009	0.669429	3
Shenzhen energy	2010	0.643918	1
Guangdong power A	2010	0.61512	2
SP Power Development	2010	0.067373	3

## B. Process explanation

### 1) Inspection. (as table I)

The index data of social responsibility of the thermal power is processed to the factor analysis by SPSS17.0 software, and because of the different dimension of each social responsibility index, the sample data should be standardized and processed to applicability test. Being tested by KMO and Bartlett test, the data for inspection reaches the standard of factor analysis with the KMO statistical value of 0.704 and Bartlett inspection significant level value of  $0.000 < 0.005$ . Therefore, it is suitable that sample data is for factor analysis.

### 2) Extraction of common factor. (as table II)

The total variance explained table containing the characteristic value comes after the extraction of common factor by princomp method. Which is determined by corresponding to the standard of characteristic root value greater than 1, the first three principal component have enough description to most of the indexes information. And in the table the variance contribution rate of the first three main components are 43.385%, 20.473% and 18.470% respectively, and the total variance contribution rate respectively are 43.385%, 63.858%, 82.329%, namely that the social responsibility of thermal power could be explained effectively by the three principal component.

### 3) Rotation. (as table III)

For the got common factors being explained more easily, the principal component matrix must be conducted by the process of variance maximizing rotation, then the variance components matrix would be formed. The economic significance of the factors respectively are named after the size of the variables load on the common factors. From the statistics given in the table, the load of main factors F1 on the four indexes X1, X2, X3 and X4 are all more than 90%, being maximum among them. These indexes demonstrate comprehensively the economy responsibility of enterprises, or it is that being responsible for shareholders and creditors, and explain the financial performance responsibility of the enterprise and the ability to create value, naturally name it economic responsibility factor. On the three indexes X5, X6 and X7, the main factor F2 is showed with the maximum factor loading. On account of the close connection between these indicators and the condition of the internal environment, resources and employees, so name it the internal environment responsibility factor. In X8, X9 and X10, the main factor F3 is on the maximum load. And name it external environment responsibility factor, because of involving the society and resources pollution of the external of enterprise and the outside Stakeholders, such as the government and the public.

### 4) Score. (as table IV)

The score of each main factor of the each sample enterprise is got by the regression analysis process, and the weight is assigned by the proportion of the variance contribution of each principal to the cumulative variance contribution of the three main factors, then naturally get the comprehensive scoring function,

$W = 0.43385F_1 + 0.20473F_2 + 0.18470F_3 / 0.82329$  would weighted score those factors, and rank them on the basis of the comprehensive got scores.

As table 4, the factor score model of this thesis sample is

$$F_1 = 0.259X_1 + 0.257X_2 + 0.233X_3 + 0.229X_4 + 0.108X_5 + 0.139X_6 + 0.040X_7 + 0.088X_8 - 0.025X_9 - 0.121X_{10}$$

$$F_2 = 0.103X_1 + 0.104X_2 + 0.053X_3 + 0.045X_4 + 0.513X_5 + 0.495X_6 - 0.306X_7 + 0.031X_8 - 0.053X_9 - 0.086X_{10}$$

$$F_3 = -0.004X_1 + 0.004X_2 - 0.038X_3 - 0.006X_4 - 0.070X_5 + 0.146X_6 + 0.249X_7 + 0.420X_8 + 0.401X_9 + 0.357X_{10}$$

As table 2 and 4, the comprehensive scoring model is:

$$W = 0.43385F_1 + 0.20473F_2 + 0.18470F_3 / 0.82329$$

Form the size of coefficient before each factor in the function, when comprehensively evaluate their social responsibility of the sample companies, F1 (economic responsibility factor) is the main influence factor, and F2 (internal environment responsibility factor) and F3 (external environment responsibility factor) also play important roles in comprehensive score. According to each factor score and the comprehensive factor score function, The comprehensive rank of the 10 thermal power sample enterprises is listed in the following table, so as to compare the corporate social responsibility performance of such sample companies by the year 2008 to 2010.

5) Result Analysis. (as table V-XII)

From the finally scores of table 5, there are only four companies whose the average of comprehensive scores in three years of the social responsibility performance of the sample companies are positive, and less than 50% of all of the sample quantity. It can be concluded that the social responsibility performance of the whole thermal power industry was not enough good with a big difference among those samples. From the rank listed in table 6, it obviously shows that all the three years of both Shenzhen Energy and SP Power Development were actual comprehensively scored in the top three, and the comprehensive score of Guangdong Power A was in the top three in 2009 and 2010 two years. It explains that the above indexes of the three companies interpreted the social responsibility performance being taking some well. Because of the strongest explanatory power of F1 in this evaluation system and the load of F1 on X1 (EVA) reaching 0.979 as the highest, it expresses that the EVA rate greatly contributes to the intensity of a good explanation of social responsibility with the analysis to the three companies also being ranked top from the original data of index X1, which is also reflected the rationality of the evaluation index system of the thermal power enterprise society responsibility involved EVA into. Beyond that, the score ranking of single factor have some great influence on the comprehensive score ranking of enterprise in a greater positive correlation between them. Especially F1, the comprehensive ranking of the enterprises is generally consistent with it. However, the differences caused by the ranking of F2 and F3 also do

not ignore, such as SDIC Huajing Power, Shenzhen Energy and Huadian Energy in table 5. It is showed that the social responsibility of thermal power enterprise is largely displayed in its economic responsibility, and in other words, is whether the enterprise took the burden of the responsibility of the shareholders and creditors well or not. The most important among them is economic responsibility, and it is interpreted by the performance on profitability and debt paying ability, so it is the key point to focus on profitability and debt paying ability for improving the overall social responsibility performance. Thus that enhancing the independent R&D (research and development) on the efficient resources utilization and improving the technology innovation level is essential for thermal power enterprises to create more value with the support of national policy and increasing investment in R&D.

In addition, the influence of F2 and F3 on the overall performance of Corporate Social Responsibility society is a force to be reckoned with, and shows that it is significant that the thermal power enterprise should lay emphasis on every internal aspect of their own management and control, improve the efficiency of resource utilization and guarantee the staff's healthy growth and development, and still should establish some harmonious and friendly relationship with the external stakeholders, such as the government and the society, and with the ecological environment also. Specifically, the enterprises could observe the relevant code of conduct and the law, pay tax in accordance with law, provide internal staff with the healthy and safe working environment, distribute the shares of the pay to employees, offer employees some beneficial trainings, undertake more the contribution of public welfare; On the other hand, Pursuit the coordinated development with environment, abide by relevant laws and regulations of environmental protection and resource conservation, establish and improve the environmental management system, stick to energy conservation and emission reduction, continuously refine environmental protection and energy saving work, actively respond to and avoid environmental risk, Gradually realize the clean development of the power etc. The electric power enterprise, as the important state-owned enterprise, both for the development of the economy and society and for its establishment of modern enterprise system and realization of the sustainable development, should undertake social responsibility, and it is very important and urgent.

V. CONCLUSION

Through factor analysis theory and examples of SPSS software, it is certain that factor analysis should be widely used in the evaluation of corporate social responsibility. Factor analysis method not only effectively resolve problem of determining the index weight in the corporate social responsibility evaluation, but also can make the weights of evaluation indexes setting fast and objective. In the process of social responsibility evaluation, it is acceptable to classify and

simplify evaluation indexes by factor analysis , and extract common factors, and then synthetically rank objects according to their got scores calculated by comprehensive score model. Thus , the cost of the evaluation process of corporate social responsibility will be greatly cut, and avoid causing the waste of human, financial and material.

In this example, because of Each factor only reflecting some certain aspects of the performance of thermal power enterprise social responsibility, therefore, in this paper, the weight is assigned by the proportion of the variance contribution of each principal to the cumulative variance contribution of the three main factors, the mathematical model are as follows:  $F = (0.43385 * F_1 + 0.20473 * F_2 + 0.18470 * F_3) / 0.82329$ . The confirmation of the weighing values is based on the analysis on the original data through SPSS processing with some surely objectivity, and it synthesizes many indexes into a few basically uncorrelated comprehensive factors, so the purpose of dimensional reduction and reducing the superposition and redundancy of information among the evaluation indexes is possible definitely. Through the calculation of comprehensive factor score , the analysis of thermal power enterprise social responsibility in three aspects is clear, namely, the economic responsibility, the internal environment responsibility and the external environment responsibility. And with the specific to the problems represented in the score of the model, the improvement of its social responsibility is accessible.

This model illustrates the some certain rationality of the built evaluation system of the thermal power enterprise's social responsibility based on the ten selected indexes through the factor analysis, but it may not integrate all indices, which can explain the performance of social responsibility, into the model and quantify them because of the limitations of the model itself. And in addition, the influence of qualitative index other than some quantitative indexes is also very important, such as the quality of social responsibility management, the credibility of financial statements, the technical level of pollution control, the establishment of sustainable development policies with relevant, the employee benefits and the security situation and so on. Thus , the fitting some qualitative indexes valued scientifically into the model is necessary as far as possible in the future research, so as to fully consider the performance status of thermal power social responsibility.

Of course, the practical application of SPSS software factor analysis method requires a profound understanding of the actual problems and the basic ideas of the method, and a deep-going realization and a reasonable explanation of the output ,in addition with the according support to decisions , so that ,the combination of scientific theory knowledge and computer hardware and software technology will better and powerfully support to solve practical problems.

## REFERENCES

- [1] Gao Taishan. The Factor Analysis and Evaluation of State-owned Enterprise Economic Benefit [J]. Business Management. 2008, (4)J.
- [2] Li Liqing. The Evaluation Theory and Empirical Research on Enterprise Social Responsibility: Take Hunan Province as An Example [J]. Southern Economic Journal , 2006,1.
- [3] Li Xiaolong, Luo Liyan. On the Core Concept of Corporate Social Responsibility[J]. Jiangsu Commercial Forum, 2005,(8).
- [4] Yin Yumin , Liu Wenchang . The Application of Factor Analysis in the Evaluation of Enterprise Competitive Power [J]. Mathematical Statistics and Management, 2004,
- [5] Guo Zongyi , Huang Yi . The Thinking of Constructing China's Green Financial Evaluation System [J]. Friends of Accounting, 2004, (4).
- [6] Xue Wei. Statistical Analysis and SPSS Application [M]. China Renmin University Press, 2001.
- [7] Sandra A. Wad dock & Samuel B. Graves. Green Paper: Promoting a European Framework for Corporate Social Responsibility, 2006.



**Hongming Chen**, is a professor in the School of Economics and Management, Changsha University of Science and Technology, Changsha city, P.R. China. He received BS, MSc, PhD in Information System and Management from Hunan University.

His major research interests include accounting information system, business administration. His papers appeared in many journals and International Conferences, such as Accounting Research, International Forum on Computer Science-Technology and Applications, IFCSTA. Professor Chen had written several books, for instance Computer accounting theory and application(Hunan science and technology Press), Visual FoxPro 6.0 Design and accounting computerization model(Hainan Publishing house).

Professor Chen is the member of Accounting Society of China, and the trustee of Accounting Society of Hunan Province and Accounting Society of Changsha city. application(Hunan science and technology Press), Visual FoxPro 6.0 Design and accounting computerization model(Hainan Publishing house).

Professor Chen is the member of Accounting Society of China, and the trustee of Accounting Society of Hunan Province and Accounting Society of Changsha city.



**Xiaocan Xiao**, received a bachelor degree of administration from Hunan university in 2010. She interests in the research of such field which mixes computer or software and company management together. She has published a paper in quality journal.