

Study on Model of Factor Analysis Applied in the Risk Management of Electronic Commerce Enterprise

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Abstract

The electronic commerce is playing a more and more important role in the operation of the entire national economy. The electronic commerce enterprise is facing more and more risks, including the risk between the enterprise, internal risk, external risk and enterprise and three categories. It will quantify these risks for the main factors affecting the analysis of enterprise risk and constructing model, to help enterprises to more effective risk management and become a research topic of many scholars. In this paper, by using the factor analysis method combined with financial data to construct enterprise assess their risk model, in order to provide some reference for the enterprise risk management.

Keywords: *Electronic Commerce Risk; Risk Model; Evaluation Model.*

1. Introduction

Electronic Commerce (E-Commerce) is to use the network for all business e-business process, including not only the enterprise facing the external business processes, such as network marketing, electronic payment, logistics and distribution, but also including the enterprise internal business processes, such as enterprise resource planning, management information system, customer relationship management, supply chain management, human resources management, online market research, strategic management and financial management etc.[1]. The electronic commerce technology is only a means, in fact it is the modern information technology in the enterprise operation process of application. And on this basis, it will realize the business, management, and consumption activities of suppliers, customers, government and other parties involved in [2].

Generally, electronic commerce enterprise refers to the organization form of all kinds of business information activities by various modern open network and internal and external processing information technology and foreign business and marketing activities. The electronic commerce enterprise generally has the following four characteristics:

(1) The virtual production. The electronic commerce enterprise belongs to the typical characteristics of the virtual economy, its production, sales with the nature of virtual.

(2) Business cooperation. As the business activities of enterprises in e-commerce, many departments need to products, cashier, customer service and other business collaboration, such as the electronic ticket, the electronic banking so that the business collaboration is so strong.

(3) The transaction efficiency. The transaction time is very short, only need to click the mouse to select products, can be extremely efficient payment, transaction.

(4) Convenience. Customer purchasing by the use of e-commerce are very convenient, can complete remaining within doors, very convenient.

Due to the special nature of the business, e-commerce enterprises are facing multiple risks in operation. It is all e-commerce enterprises common problems to reasonable risk assessment to effective risk management.

2. Research on Electronic Commerce Risk

2.1. Risk Classification of Electronic Commerce

For the classification of the electronic commerce risk, scholars have extended outstanding division methods from own understanding and objective. The most representative are:

(1) On the basis of the field of e-commerce, the electronic commerce risk is divided into the economic risk (risk of financial risk, financial risk, and industry risk), management risk, system risk etc. (Luo Yali, 2008) [3]. This is a universal classification method. The information risk refers to losses may be brought by a false information and information lag. But Li Xiumin thought that information risk should be removed from the classification of information risk.

(2)According to the technical characteristics of e-commerce, e-commerce risk is divided into customer information disclosure risk, damage system risk, tampering and counterfeiting risk (Yao Min, 2010) [4]. Customer disclosure risk refers to the hacker or outsiders intercept and steal vendors to obtain commercial secrets through technical means in the process of electronic commerce,

(3)On the basis of e-commerce transaction process classification, the electronic commerce risk is divided into the quality control and the service risk, payment risk, legal risk etc. (Zhao Chunyan, 2010) [5]. The risk of paying online is also divided into third party payment funds exist hidden safety problems, the electronic currency standard blank, the illegal transfer of funds and assets, theft of user information.

(4)From the electronic commerce characteristic, e-commerce risk is divided into enterprise internal risk and external risk (Liu Weijiang and Wang Yong, 2005) [6]. Internal risk is divided into technological risk, strategic risk, management risk; External risk is divided into systematic risk, information risk, financial risk etc

Of course, there are some scholars such as L. Labus chagne (2000), on the basis of risk sources, technical and commercial risks are divided [7]. Zeng Xiaochun further pointed out that the direction of technology is divided into network technology, computer technology, and communication technology [8].

2.2. Evaluation of Electronic Commerce Risk Model

After we identify the electronic commerce risk, we need the specific evaluation model of e-commerce risk, summarizes the following models through the collection and collation of relevant literature.

(1) Delphi evaluation model. Delphi evaluation model also called expert investigation method. It is a method of expert opinion collection by non see form, is also a kind of efficient method to solve complex problems through group communication. This method has three features: anonymous between participants; statistical processing of a variety of reflect; repeated feedback opinion testing.

(2) The risk evaluation model tree. This kind of method is carried on to the risk gradually decomposition, refinement, the formation of tree structure, namely the risk tree. The risk tree can also be used for further analysis and processing. For example, it can be used to determine the probability of risk. It needs to find all the possibilities of each other and Interaction, mark the various risk probability, then the computation, forming the risk probability tree [9].

(3)The risk matrix. This method is the most direct and effective. The probability of risk and asset loss respectively is the rows and columns of the matrix. They all have five levels, respectively very high, high, medium high, low, very low, which increased from 0 to 10. So the five grades is 0, 2, 4, 6, 8. The cross of matrix express the risk level [10], matrix table is shown in Table 1.

Table1 Risk Matrix

Probability Loss degree	Higher	High	Medium	Low	Lower
Higher	10,10	10,8	10,6	10,4	10,2
High	8,10	8,8	8,6	8,4	8,2
Medium	6,10	6,8	6,6	6,4	6,2
Low	4,10	4,8	4,6	4,4	4,2
Lower	2,10	2,8	2,6	2,4	2,2

(4)The evaluation model based on factor analysis. Factor analysis is a dimensionality reduction method. It can simplify the multi variable system with correlation. A perplexing relationship variable is comprehensive to factor of several smaller number of unobservable in order to take the relationship between the reproduction of the original variables and factor.

Using the factor analysis method to evaluate the risks of e-commerce enterprises, can avoid subjective evaluation result inaccuracy identified in determining evaluation index weight for the evaluation, and provide enterprise risk mainly existing aspects and its important degree according to the public factor extracted from model and its weight in the comprehensive analysis in the model.

(5)Fuzzy evaluation model based on analytic hierarchy. The evaluation model is the comprehensive of the analytic hierarchy process (AHP) and fuzzy evaluation method. The advantages of AHP is used in the multi criteria evaluation, can judge matrix according to the relative importance of each index, calculate the synthetically importance. But the AHP weight coefficient method is too strong subjectivity, poor anti-interference ability, lack of the ability to deal with fuzzy information; but the fuzzy evaluation method can be used to deal with imprecise, vague information. So the model to combine the two can be qualitative and quantitative combined to accurately evaluate the risk [11].

(6)The evaluation model based on immune. Because the issue of e-commerce and biological risks encountered by the immune system has similarities, so Liu Tao took all kinds of risk factors as antigen, proposed quantitative calculation model of e-business risk assessment(ARN) based on antibody concentration. Strength coefficient r is firstly set up in risk model for r (or R), r (or R) value is greater, indicating that the risk of current electronic commerce is higher; secondly, according to the number of risk factors existing antibodies stimuli, estimate the risk of electronic commerce. So r and R can be defined as follows[12]:

Let n_i number for the system to detect antibodies to the risks arising from class i , β_i is the degree of risk the threat or risk factors i kind of attack, c_i is the normal state of the network system to detect antibodies to the number.

(a) Risk coefficient system from I risk threat:

$$r_i = 1 - \frac{1}{1 + \lg(|n_i - c_i| + 1)} \quad (1)$$

(b) The risk coefficient of the whole system:

$$R_Y = 1 - \frac{1}{1 + \lg\left(\sqrt{\beta_i \sum_i} |n_i - c_i| + 1\right)} \quad (2)$$

The concrete steps of calculation are: first, to determine the electronic commerce risk evaluation index set; second, to give the electronic commerce risk assessment level Third, to determine the weight of each index in the evaluation system; fourth, to determine the risk index at the time of transaction value.

2.3. Selection of the Evaluation Model and Classification of Electronic Commerce Risk Evaluation

(1) Classification of electronic commerce enterprise risk.

From the research results of many scholars and combining the characteristics of the management of e-commerce enterprise, this paper will define the risk of e-commerce into three categories:

(a) Internal risk. Internal risk is the risk related to enterprise technology level, the quality of the staff, the management level of enterprises and financial strength during internal enterprises electronic business.

(b) Enterprise external risks. The Enterprise external risks refer to the implementation of e-commerce and business environment in which domestic and foreign operations are directly related to risk. Enterprise external risks can be roughly summarized into five risks: cyber-crime risks; fiscal and financial risks; legal risks; credit risks; patent risk.

(c) The risk between enterprises. The risk between enterprises refers to the risks caused by the relationship between the electronic commerce operations processes involved in the enterprise. Mainly include the following three aspects: operation risks; competition risks. The risk depends on other enterprises[13].

(2) Selection of method of factor analysis. The basic principle of factor analysis is that most of the variation attributed to a few public factors based of the correlation, from the covariance or correlation matrix, the remaining variation is called special factor. Thus, each class variables actually represents a common factor, factor analysis is used to find and identify these models of the basic features.

When the inner system of the problem is lack of understanding, can make use of factor analysis to the observed variables into a few common factors, one dimension of each common factor representation space. If after orthogonal or oblique rotation, it is not related to between the various dimensions. The use of these dimensions can clearly delineate the system structure of the object of study. Generally, it is believed that the accumulated variance contribution rate is greater than 85%, it is ensured that does not lose too much important information.

From the above comprehensive evaluation model, combined with the classification of the risks of e-commerce enterprises, due to the data availability and the actual operation, the final

risk factor analysis method is selected to evaluate the risk of enterprise electronic commerce. The main steps of factor analysis method to evaluate the risk of electronic commerce are:

Combined with the existing theoretical system and practical data, select P index of the evaluation index system; To calculate the correlation coefficient matrix of each index $(R_{ij})_{p \times p}$, and determine; whether suitable for factor analysis.

(3) On the basis of the statistical significant correlation coefficient matrix $(R_{ij})_{p \times p}$, calculate the first m eigenvalues of $R \lambda_1 \geq \lambda_2 \geq \lambda_3 \geq \dots \geq \lambda_m$, and the corresponding eigenvector of the $T_1, T_2, T_3, \dots, T_m$, and the feature vectors orthonormal. There are two kinds of method for determining M: according to the characteristics of value, and take more than 1 characteristic value; can also use the accumulated variance contribution rate (Q) for the determination of M, Q is defined as:

$$Q = \frac{\sum_{i=1}^m \lambda_i}{\sum_{i=1}^p \lambda_i} \quad (3)$$

(4) To calculate the rotation matrix A of common factor.

(5) To calculate the score of F_i of common factor.

(6) To calculate the comprehensive index value [14].

$$Y = \frac{\lambda_1}{\sum_{i=1}^m \lambda_i} F_1 + \frac{\lambda_2}{\sum_{i=1}^m \lambda_i} F_2 + \dots + \frac{\lambda_m}{\sum_{i=1}^m \lambda_i} F_m \quad (4)$$

3. The Empirical Analysis

On the basis of the reason of availability and authenticity of data, this paper selects four e-commerce platform class enterprises, six software developers companies in order to draw general risk evaluation model for providing some reference for electric enterprises.

(1) The selection of indicators and data sources

According to 2012 annual report of company and the risk classification, select earnings per share, return on net assets, assets and liabilities rate, profit rate, the rate of return on investment, management fee rate, accounts receivable rate, technical personnel ratio, the main customer income ratio, main customer expenditure proportion and R & D cost rate etc eleven indicators to construct the evaluation system. Data come from the giant network.

(2) The calculation process

(a) Calculate the correlation coefficient

It is found that earnings per share and each index is low when calculating correlation coefficient, and it can be replaced by the remaining indicators, it will be removed. For the remaining 10 correlation coefficients, the correlation coefficients were higher, and the test of KMO and Bartlett are significantly. It indicates that the remaining 10 indicators are suitable for factor analysis.

(b) Principal component extraction

Table 2. Explained Total Variance

Ingredients	Initial eigenvalue			Rotating square and load		
	total	Variance%	Cumulative%	total	Variance%	Cumulative%
1	3.02	30.20	30.20	2.33	23.38	23.38
2	2.47	24.72	54.93	2.171	21.71	45.09
3	2.02	20.28	75.21	2.115	21.15	66.25
4	1.08	10.88	86.09	1.985	19.85	86.10
5	.69	6.913	93.01			
6	.44	4.40	97.41			
7	.20	2.04	99.45			
8	.04	.45	99.89			
9	.01	.11	100.0			

From table 2 we can see accumulated variance contribution rate extracted from process of four public factor is 86.10%, four public factor can reflect about 85% information of the original 10 indicators. It can be considered to be effective that four public factors are used to replace the original 10 variables.

(c) Rotated factor loading matrix. In order to further explain three common factors from the economy, we use variance maximization to rotate loading matrix of factor, the rotated factor loading matrix A is shown in table 3.

Table 3. Rotating Component Matrices

	element			
	1	2	3	4
X ₁	0.086	-0.608	0.115	0.244
X ₂	-0.117	-0.280	-0.778	0.100
X ₃	0.059	0.762	0.115	0.222
X ₄	0.182	0.204	0.869	0.112
X ₅	-0.818	0.177	-0.245	0.296
X ₆	-0.191	0.162	0.227	0.846
X ₇	-0.781	0.067	-0.022	-0.281
X ₈	0.819	0.162	-0.176	-0.285
X ₉	-0.042	0.104	0.112	0.908

As can be seen from Table 3, the first principal component is decided by accounts receivable rate X5, major customers proportion of income ratio X7, major customers expenditure ratio X8, mainly reflect the risk between enterprises. The second principal components is decided by the X1 rate of return on net assets, X3rate of profit, X10 rate investment income, mainly reflect the company's operating results, reflect the external economic environment, can be used to describe the economic risk. The third principal

component is mainly composed of X2 asset liability ratio, X4 management expense ratio, t mainly reflect the enterprise risk management. The fourth principal component is decided by X6 proportion of technical personnel, X9 R & D expense ratio, mainly reflects the enterprise technology and scientific research level, indirectly reflect the technical aspects of risk enterprises.

(d) Component score coefficient matrix

Table 4. Component Score Coefficient Matrix

	element			
	1	2	3	4
X_1	0.094	-0.455	-0.099	0.117
X_2	-0.111	-0.027	-0.584	0.056
X_3	0.085	0.734	-0.078	0.184
X_4	0.036	0.004	0.733	-0.084
X_5	-0.624	0.113	-0.215	0.193
X_6	-0.040	0.109	-0.063	0.746
X_7	-0.428	0.028	-0.050	-0.139
X_8	0.325	0.052	-0.099	-0.004
X_9	-0.058	-0.101	0.089	-0.668

Approximate score of each principal component from table 4 to is calculated as follows:

$$F1 = -0.624X_5 - 0.428X_7 + 0.325X_8$$

$$F2 = -0.455X_1 + 0.734X_3 + 0.641X_{10}$$

$$F3 = -0.584X_2 + 0.733X_4$$

$$F4 = 0.746X_6 - 0.668X_9$$

From equation (4) we can get the comprehensive enterprise risk calculation formula is:

$$Y = 0.2338F1 + 0.2171F2 + 0.2115F3 + 0.1985F4$$

4. Conclusion

Risk of electronic commerce enterprise is mainly composed of three parts: internal risk, business risk and external risk. In this paper, according to the data, equation for calculating the comprehensive evaluation of enterprise risk and equation about all kinds of risk are constructed. The enterprise can calculate each risk level according to the equation, and longitudinally contrast to detect changes of all kinds of risk enterprises and actively cope with and control. And can be compared with similar companies to find their own strengths and weaknesses. The advantages and disadvantages of the model:

Advantages: The factor analysis method is introduced into the process of risk management of e-commerce enterprise, give weight to the enterprise risk management index system by the use of factor analysis. Weight is objective and scientific, avoids the defects of the subjective weighting;

Disadvantages: (1)Because of limitations of the method, external legal risk is not quantified into the model, the model cannot describe the risks faced by enterprises; (2) because of data limitations, enterprise data quantity is less, it can not cover all types of electronic commerce enterprises, the conclusion may apply only to some enterprises.

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