CONSTRUCTION OF FOREWARNING RISK INDEX SYSTEMS OF VENTURE CAPITAL BASED ON ARTIFICIAL NEURAL NETWORK

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Abstract: The risk evaluation is a very important step of decision process of venture capital. This article constructs forewarning risk index systems of venture capital, and applies Artificial Neural Network (ANN) to forecast the latent risk level of venture capital. Empirical analysis indicates that this model could predict the latent risk of venture capital very well.

Key words: Artificial neural network, Forewarning risk index system, Venture capital

1. INTRODUCTION

Venture capital is a kind of equity capital that the professional venture capitalist puts into venture enterprises [1, 2]. Presently, Risk forewarning system based on neural network has been applied in many fields such as Credit risk evaluation, Project management and so on [7, 8, 6, 10]. Kuldeep Kumar, John D Hayneshave provided that the ANN is better than statistical techniques on forecasting credit risk level because risk has non-linear relationship with its affected factors[9]. None of current literatures about venture capital has constructed forewarn system based on neural network to forecast the investment risk. There are two questions: (1) How to construct forewarning risk index systems; (2) How to apply neural network to predict risk level? The evaluation target is very complicated. It is a multifactor

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comprehensive decision question [3]. This article effectively evaluates the risk constructing appropriate forewarning risk index system and effectively applying artificial neural network technology.

2. FOREWARNING RISK INDEX SYSTEM OF VENTURE CAPITAL

2.1 Contents of forewarning risk index system

The research of venture capital decision has interested people since the 1980s abroad. Tyebjee and Bruno has listed the evaluation index from qualitative angle, using questionnaire investigation and factor analytic approach to construct the U.S.A evaluation models of venture capital at first[1]. Vance H Fried and Robert D Hisrich extended this model and indicated that such as managerial ability and resistance ability of environment threaten, etc. has a great influence on expected risk of venture capital[3]. While carrying on venture capital decision, venture capitalist must consider every factor impacting on risk synthetically [2, 4]. According to the characteristic of operating venture capital, this article carries on systemic analysis on every factor which forms the risk and attempts to construct a forewarning risk index system including managerial ability, resistive ability to environmental threat, market risk, technological risk, production risk, withdraw channel, etc. 6 first class index and relevant 36 sub index.(Table.1)

Table 1. Forewarning risk index system of venture capital

Forewarning Index Systems of the Venture Enterprise (U)			
First grade index	Managerial ability	resist ability to environment threatens	Technological ability
(U_i)	(U_1)	(U_2)	(U_3)
Sub grade index	Administrator's ethical quality	National political economic environment	substitutability of Technology
(U_{ij})	Academic level	policies and regulations	Advancement of technology
	Experience of management	Change of the bank rate	Suitability of technology
	Ability of association	Investor's income of the market	Dependability of technology
	Environmental adaptive capacity	Potential rival	Intellectual property right

Forewarning Index Systems of the Venture Enterprise (U)			
First grade index	Market risk	Production risk	Withdrawing channel
(U_i)	(U_4)	(U_5)	(U_6)
Sub grade index	Market	Return on net assets	IPO
(U_{ij})	Market scale	equipment utilization degree	the way of Selling
	products competence	Producer's state	the way of Withdrawing
	Service level	Materials supplies	Liquidating
	Marketing ability	Additional investment	Payback period of investment

3. APPLYING ARTIFICIAL NEURAL NETWORK (ANN) TO FORECAST THE RISK LEVEL

3.1 Basic principle of BP neural network

Figure.1 shows a three layer BP neural topological network. Little circle means neuron unit, and the line connecting each neuron units means weight coefficient W. The neural network imports X, and exports Y after the weight coefficient W is dealt with. According to certain algorithm, ANN confirms the right weight coefficient W of each line through studying sample data. After right weight coefficient W is confirmed and the structure is steady, ANN can deal with the new data [5, 7, 8, 6, 10].

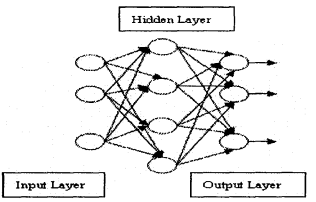

Figure 1. ANN structure

3.2 BP ANN forewarning models

(1) Input and Output. This article uses all sub index as input vector quantity X = ($u_{11}, u_{12}, u_{12}, \ldots, u_{64}$ u_{65}), and regards forewarning risk grade as output value Y. Input vector quantity includes quantitative and qualitative index. Qualitative index ought to be converted to quantitative index by that experts give grade on them. This article uses interval law to define

forewarning risk grade according to corresponding interval as table.2 shows. C is the highest forewarning risk grade; AAA is the lowest forewarning risk grade.

(2) Neural network structure. There aren't perfect methods to confirm the number of neuron units of hidden layer at present, so this article adopts experience rule. If the study samples is N, the number of neurons unit of hidden layer is $(2\sqrt{n})$ [5]. In this way, the basic structure of the three layers ANN network is a type of 30-12-1 BP ANN.

(3) Neuron network function, error function and studying algorithm. Input layer neuron network function is f (x) = X, Function of hidden layer and output layer is Sigmoid function: f(x) =1/(1 +exp (- x)). Initialization of all the neuron units is 0. Weight coefficient $W_k = (w_{ij}^k)_{n_{k-1} \quad k}$, among them, n_k means the number of neuron units of layer k, while w_{ij} means weight coefficient between neuron unit i of layer k-1 and neuron unit j of layer k. The receiving value of neuron unit of layer k is $t_{jk} = \sum_{i}^{n_{k-1}} w_{ij} x_i$, j =1,2 ,..., n_k. The output value from layer k to layer k +1 is $y_j = f(t_{ij})$, j=1,2, ..., n_k. Error function is $E = \frac{1}{2}\sum_{1}^{n} |y_k - \hat{y}_k|^2$, among them, y_k is the expected output of layer k, $\hat{y}_k$ is the actual output of layer k.

Table 2. Forewarning risk grade

C	CC	CCC	B	BB
(0 ,0.1]	(0. 1,0. 2]	(0. 2,0. 3]	(0.3 ,0. 4]	(0. 4,0. 5]
BBB	A	AA	AAA	
(0. 5,0. 6]	(0.6 ,0. 7]	(0. 7,0. 8]	(0. 8,0. 9]	

3.3 Empiric analysis

The research object is 43 venture capital projects. At first, Initialize vector X of each venture capital project to gain the importing vector group X_i, i =1, 2, ..., 43. Then refer to table.2 and through expert's giving grade of 43 venture capital projects, get the expect exporting vector group Y_i, i =1,2,...,43. Use (X_i, Y_i) as the study samples, among them, i =1, 2, ..., 40. Use (X_j, Y_j) as the evaluation target, among them j =41, 42, 43. The purpose of the experiment is to compare the output evaluation result of ANN with the expert's evaluation conclusion, proving ANN risk evaluation is valid on venture capital.

The structure of ANN is 30 -12-1 according to the order of input layer, hidden layer and output layer. Initialization value of each neuron unit is random in [0, 1].Study precision ε =0. 005. The increment coefficient of excellent fast algorithm of dropping and seeking η =0.5. In order to prove the ANN risk evaluation model is valid, I have done the experiment for 10 times, contrasting expected output value Y_{41} =0.75, Y_{42} =0.55, Y_{43} =0.25 (Forewarning risk grade is AA, BBB, CCC) with corresponding actual output risk value $Y_j^{'}$ (j=41, 42, 43). The experimental result is shown in Table.3, Table.4 and Tab.5.

Table 3. Contrast of network output $Y_{41}^{'}$ and expected output Y_{41}

times of experiment	1	2	3	4	5
network Output	0.753	0.764	0.755	0.786	0.793
expected output	0.75	0.75	0.75	0.75	0.75
Result of evaluation	AA	AA	AA	AA	AA
Result of expectation	AA	AA	AA	AA	AA
times of experiment	6	7	8	9	10
network Output	0.731	0.722	0.684	0.773	0.729
expected output	0.75	0.75	0.75	0.75	0.75
Result of evaluation	AA	AA	A	AA	AA
Result of expectation	AA	AA	AA	AA	AA

Table 4. Contrast of network output $Y_{42}^{'}$ *and expectation output* Y_{42}

times of experiment	1	2	3	4	5
network Output	0. 534	0.533	0.554	0.620	0.589
expected output	0.55	0.55	0.55	0.55	0.55
Result of evaluation	BBB	BBB	BBB	A	BBB
Result of expectation	BBB	BBB	BBB	BBB	BBB
times of experiment	6	7	8	9	10
network Output	0.528	0.584	0.509	0.540	0.558
expected output	0.55	0.55	0.55	0.55	0.55
Result of evaluation	BBB	BBB	BBB	BBB	BBB
Result of expectation	BBB	BBB	BBB	BBB	BBB

Table 5. Contrast of network output $Y_{43}^{'}$ *and expected output* Y_{43}

times of experiment	1	2	3	4	5
network Output	0.233	0.243	0.256	0.282	0.246
expected output	0.25	0.25	0.25	0.25	0.25
Result of evaluation	CCC	CCC	CCC	CCC	CCC
Result of expectation	CCC	CCC	CCC	CCC	CCC
times of experiment	6	7	8	9	10
network Output	0.297	0.311	0.271	0.245	0.318
expected output	0.25	0.25	0.25	0.25	0.25
Result of evaluation	B	CCC	CCC	CCC	B
Result of expectation	CCC	CCC	CCC	CCC	CCC

4. CONCLUSIONS

Empiric analysis indicates that forewarning index risk system based on ANN could export comparatively accurate forewarning risk grade of venture capital. In this article the forewarning risk index system and ANN forewarning model are based on the visual angle of venture capital forms. The forewarning risk index system based on ANN has solved the problem of comprehensive evaluation of venture capital very well.

We should pay attention to that the study speed of neural network is influenced by the neuron unit number of each layer, neuron network function and study algorithm, etc[5]. We should apply ANN forewarning risk model according to the actual conditions. Because the research of risk evaluation system and risk evaluation method is beginning, here remain many problems to discuss thoroughly further. I hope this paper can play a role in casting a brick to attract jade.

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