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Fuzzy comprehensive model of manufacturing industry transfer risk based on economic big data analysis

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Abstract. Aiming at the problems of low accuracy, low efficiency and low stability of traditional methods and recent developments in advanced technology incite the industries to be in sync with modern technology. With respect to various available techniques, this paper designs a fuzzy comprehensive evaluation model of the manufacturing industry for transferring risk based on economic big-data analytics. The big-data analysis method is utilized to obtain the data source of fuzzy evaluation of the manufacturing industry to transfer risk using data as the basis of risk evaluation. Based on the risk factors, the proposed model establishes the risk index system of the manufacturing industry and uses the expert evaluation method to design the scoring method of the evaluation index system. To ensure the accuracy of the evaluation results, the manufacturing industry's fuzzy comprehensive model is established using the entropy weight method, and the expert evaluation results are modified accordingly. The experimental results show that the highest efficiency of the proposed method is 96%, the highest accuracy of the evaluation result is 75%. The evaluation result's stability is higher than the other existing methods, which fully verifies the effectiveness and can provide a reliable theoretical basis for enterprise risk evaluation research.

Key words: economic big data; manufacturing industry; industrial transfer risk; entropy weight method; fuzzy model.

1. INTRODUCTION

With the acceleration of economic globalization and the deeper integration of various industries into the global economic cycle, the manufacturing industry must make full use of the opportunity of international industrial transfer, actively and selectively undertake industries with certain advantages according to the law of international industrial transfer, and gradually transfer some industries to the outside world, to promote the further development of the manufacturing industry [1–3]. At present, the manufacturing industry is facing a series of new problems in participating in the industrial transfer, such as changes in the consumer market, resource and factor constraints, environmental constraints, and enterprise constraints. Therefore, corresponding measures must be taken to promote the manufacturing industry to participate in the international industrial transfer faster and deeper [4–7].

In order to reduce the risk of manufacturing industry transfer and ensure the safety of industrial transfer, relevant scholars put forward the corresponding solutions. Reference [8] proposed a dynamic risk evaluation method for core manufacturers considering weight multiplier from the supply chain perspective. Combined with the risk diagnosis method with a dynamic risk evaluation model for core manufacturers in the manufacturing supply chain, the weight multiplier was proposed in a dynamic evaluation application. Based on the three-level supply chain operation model composed of a single supplier, a single manufacturer, and a single distributor, analyzes the risk factors faced by the core manufacturers in the manufacturing supply chain by using the flow chart method and diagnoses the attribute index value of the risk factors by using the FMECA analysis method. According to the algorithm steps of the C-POWA operator in multi-sequence attribute interval number information aggregation, the attribute interval index value is aggregated, and the dynamic weight of the evaluation index is determined using weight multipliers. Finally, a practical example is used to verify the above process to illustrate the feasibility and effectiveness of the evaluation model. The experimental results show that this method can accurately get the problems faced by the manufacturing industry in industrial transfer.

Still, the accuracy of risk evaluation results is low. Reference [9] puts forward a risk evaluation method of PPP project financing in characteristic towns based on the cloud model. Firstly, AHP and information entropy theory determine the combination weight value. Secondly, the cloud model theory gives the standard cloud model and comprehensive evaluation cloud chart of risk evaluation grade, and the final risk grade is judged by the similarity between the two. Finally, taking Yuanshi industrial new town project as an example, the paper tests the viability and applicability of the financing risk evaluation model of characteristic town projects under PPP mode. The experimental results show that this method can provide a more reliable basis for enterprise financing risk prediction. Still, because a lot of time is consumed in the weight calcula-

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tion, the efficiency of risk evaluation is low, and the accuracy of risk evaluation results is low. Reference [10] uses the bases of intervention factors of financial market participants, quantitative regression analysis is performed, and according to the economic game theory, big data analysis and prediction of financial risk assessment are performed through the regression analysis method. Then the big data fusion and clustering algorithms are adopted for financial risk assessment. The simulation results show that this method can provide relatively high accuracy in financial risk assessment and has fairly strong adaptive evaluation capability. Reference [11] presented a more flexible model to politico-economic factors and can yield results that are max compatible with real-life situations. Comparison between the prediction made by the proposed model and a real non-performing loan indicates little difference between them. Credit risk specialists also approve the results. The major innovation of this research is producing a table of bad customers monthly and creating a dynamic model based on the table. The latest created model is used to assess customers subsequently, so the whole process of customer assessment must not be repeated. We assert that this model is a good substitute for the static models currently in use as it can outperform traditional models, especially in the face of an economic crisis. Reference [12] established a comprehensive evaluation index system based on six domains, i.e., economy, safety, reliability, coordination, environmental protection, and automation. The evaluation of the indexes was realized through the expert scoring method. The results showed that the planning scheme had better performance in aspects such as economy and reliability. Its score was 15.39% higher than the current scheme, which verifies the effectiveness of the planning scheme and its feasible application in practical projects.

Reference [13] puts forward the risk evaluation method of intellectual property pledge financing from the perspective of the system, analyzes the influencing factors of intellectual property pledge financing risk from the perspective of the system, and constructs a risk evaluation system with 38 specific indicators in five dimensions of government and industry risk, credit risk, intellectual property own risk, operational risk, and inter-subject relationship risk. Using Vague set and TOPSIS multi-attribute decision-making method constructs Vague set evaluation matrix, establishes TOPSIS evaluation model, and sorts the alternatives according to the European closeness degree to evaluate their financing risk. It is found that credit risk and inter-subject relationship risk are the main factors leading to the emergence of intellectual property pledge financing risk. The combination of Vague set and TOPSIS can effectively evaluate the intellectual property pledge financing risk and provide a decision-making basis for optimizing financing enterprises. However, the evaluation grade obtained by this method is different from the actual risk grade, and the reliability of the evaluation result is not high.

Aiming at the problems of traditional methods, this paper designs a fuzzy comprehensive evaluation model of manufacturing industry transfer risk based on economic big data analysis. The fuzzy comprehensive evaluation method is an advanced comprehensive evaluation that can solve the system's multi-index problem. The fuzzy comprehensive evaluation model of manufacturing industry transfer risk is scientific, advanced, and operable. The evaluation results in practical application are consistent with the results of conventional analysis, which shows that the model has good reliability.

2. DATA SOURCES OF FUZZY EVALUATION OF MANUFACTURING INDUSTRY TRANSFER RISK

The risk of manufacturing industry transfer is complex, and there is generally no historical data to refer to. The application of traditional risk evaluation methods is not accurate enough. According to the characteristics of manufacturing industry transfer, the economic big data analysis method is used to analyze the data related to the operational risk of manufacturing industry transfer [14]. Let $S = \{g|s_i \geq s_j\}$ denote the linear mode of resource allocation in the manufacturing industry transfer. According to the characteristics of liabilities, the characteristic distribution of the constraints of the development of the capital market on the risk of manufacturing industry transfer meets $g \in G$, then the total asset turnover rate under the operational risk of manufacturing industry transfer is expression (1):

$$A_g = (x_1, x_2, \dots, x_n). \tag{1}$$

Among them x_n represents the probability of successful asset transfer.

Based on the economic big data analysis method, use Ed to represent the statistical source of the data of manufacturing industry transfer. Since the effect of manufacturing industry transfer is affected by multiple factors [15], these factors are integrated to obtain the integration of manufacturing industry transfer risk evaluation degree $E(s_i)$. Assuming that the scale of manufacturing industry transfer risk evaluation is w_θ, the transfer probability of manufacturing industry transfer risk evaluation is given in expression (2):

$$P = \left(\prod_{i=1}^{n} J_i \times A_g\right) E(s_i) + \sum_{i=1}^{n} w_\theta \eta_i. \tag{2}$$

Among them, n represents the data type; J_i represents the manufacturing production function of the region where the industry moves; η_i represents the production technology coefficient of the region where the industry moves.

According to the characteristics of the development of the manufacturing industry, under the joint control of the company's service capabilities and risk prevention and control capabilities, the big data fusion output results obtained from the evaluation of the manufacturing industry transfer risk are given in expression (3):

$$P_\theta = \sum_{x \in X}^{N} \sum_{x \in X}^{N} P \times \frac{p(x,y)}{p(x), p(y)}. \tag{3}$$

Among them, x represents the factors in the comment collection; X represents the comment set; $p(x)$ represents the standard score of the comment set; $p(y)$ represents the score set.

Taking $K = \{k_1, k_2, \ldots, k_n\}$ as the statistical characteristic quantity of manufacturing industry transfer risk, a big data analysis model for risk evaluation is given in expression (4):

$$K(x) = \sum_{x=1}^{n} y_i - P_\theta(x \cdot x_i). \tag{4}$$

Among them, $K(x)$ represents the fuzzy subset of risk evaluation; y_i represents the fuzzy relationship between the comment sets; x_i represents the target evaluation score.

According to the big data analysis model, use the full-sample statistical analysis method to analyze the control variables of the manufacturing industry transfer risk, establish a database for the evaluation of the manufacturing industry transfer risk under economic growth, extract the characteristic statistical values of the manufacturing industry transfer risk, and perform information fusion processing [16, 17], the characteristic quantity of association rules of manufacturing industry transfer risk data is given in expression (5):

$$C_i = \sum_{i=1}^{n} K(x) \frac{\varphi(x_i)}{\lambda(n-1)}. \tag{5}$$

Among them, $\varphi(x_i)$ represents the statistical data of industrial transfer risk; λ represents the missing indicators in the risk evaluation.

Combining economic big data analysis methods to obtain risk fuzzy evaluation data sources provide a data basis for manufacturing industry transfer risk evaluation.

3. DESIGN OF FUZZY COMPREHENSIVE MODEL FOR MANUFACTURING INDUSTRY TRANSFER RISK

3.1. Risk evaluation index system of manufacturing industry transfer

Taking risk factors as the main basis, a comprehensive index system for manufacturing industry transfer risk evaluation is summarized, as shown in Fig. 1.

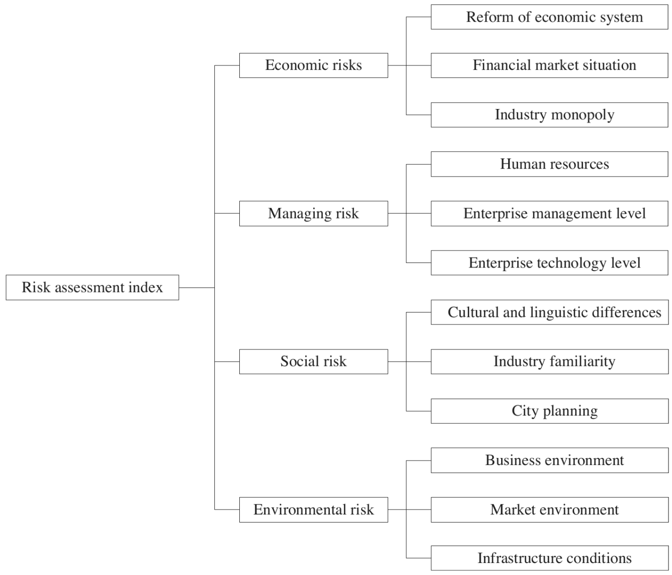

Fig. 1. The risk evaluation index system of manufacturing industry transfer

3.2. Determination of risk evaluation dimensions

According to the manufacturing industry transfer risk evaluation index system, only the level of the risk itself is considered, and the importance of the risk is directly judged, which is specifically classified according to the three measurement dimensions of risk. First, define the risk as given in expression (6):

$$R_i = [P_j, Q_j]. \tag{6}$$

Among them, P_j represents the risk value; Q_j represents the risk dimension; j represents the index evaluation value.

However, with the gradual popularization and practice of big data analysis technology, the connotation of risk has been expanded, including detectability, probability of occurrence and impact [18]. Therefore, by constructing a manufacturing industry transfer risk evaluation index system, applying expert scores to determine the weight of risk indicators, and using the entropy method [19, 20] to modify the importance of risk indicators.

Referring to the original risk measurement formula, this article explains the risk evaluation logic as follows:

Use P_f and Q_f to represent the probability of transfer failure and success respectively, that is, use P_f to represent the probability of occurrence of a risk event, and use Q_f to represent the probability of a risk event not occurring, the expression is given below:

$$Q_f = 1 - P_f. \tag{7}$$

Among them, $0 < P_f < 1$, $0 < Q_f < 1$.

The consequences of the event's occurrence are also expressed by probability, D_f is the consequence utility value of failure, T_f is the degree of influence of the risk event, and P_s is the degree of influence of the risk event. According to the utility theory, it is concluded that D_f and T_f satisfy the relationship as given in expression (8):

$$D_f = 1 - T_f. \tag{8}$$

The detection degree is also expressed by probability. P_a and P_b are used to represent the ineffective value of the detection degree, Z_s is the possibility of detecting the risk, and Z_x is the degree of undetected risk. According to the utility theory, P_a and P_a satisfy the relationship as given in expression (9):

$$P_a = 1 - P_b. \tag{9}$$

Then according to formulas (7)–(9), the risk function with probability as a variable is obtained as follows: (the probability of a risk event being detected, the probability of a risk event occurring, the probability of a consequence of the risk event occurring) = 1 – risk event. The probability of not being detected × the probability of a risk event not occurring × the probability of not producing a loss.

3.3. The scoring method of the evaluation index system

After fully reviewing and analyzing the manufacturing industry transfer plan using the expert evaluation method, the experts will score the indicators [21]. The evaluation of each index is set as excellent, good, medium and poor to measure the performance of the evaluated project on the index and the size of the related risks caused by it.

3.4. Risk evaluation model of manufacturing industry transfer based on entropy method

When using the expert evaluation method to score the risk of manufacturing industry transfer, subjective thought will affect it, which leads to a certain deviation in the evaluation results. Therefore, the entropy weight method is further used to establish the risk evaluation model of manufacturing industry transfer. The weight of the evaluation index is modified to ensure the accuracy of the evaluation results [22].

The entropy method is an index weighting method based on the amount of information contained in each index value and the size of the information value to achieve an objective evaluation of system performance and effectiveness. The entropy method has strong objectivity and accuracy and can effectively evaluate the impact value of various risk factors [23,24]. In recent years, the social and economic system reform has achieved outstanding results, and the manufacturing industry transfer is also actively exploring and carrying out. Assuming that the whole process of manufacturing industry transfer risk activities is composed of M sample data, then the initialization data matrix O of the risk evaluation model can be expressed as follows:

$$O = \begin{bmatrix} o_{11} & o_{12} & \cdots & o_{1n} \\ o_{21} & o_{22} & \cdots & o_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ o_{m1} & o_{m2} & \cdots & o_{mn} \end{bmatrix}. \tag{10}$$

Normalize the index value of the risk evaluation matrix, and calculate the proportion ζ_{ij} of the j-th index evaluation value in the risk evaluation system under the i-th sample data as given in expression (11):

$$\zeta_{ij} = \frac{\varpi_{ij}}{\sum\limits_{i=1,j=1}^{n} \mu_{ij}}. \tag{11}$$

Among them, ϖ_{ij} represents the frequency of each index evaluation value corresponding to the level; μ_{ij} represents the membership degree of each factor corresponding to each level.

At this time, the entropy value I_i of the i-th influencing factor of the risk evaluation model can be expressed as given below:

$$I_i = l \sum_{i=1}^{m} \varpi_{ij} - \mu_{ij}. \tag{12}$$

Among them l represents the coefficient of the evaluation model. If the value interval of the coefficient is [0, 1], the value range of I_i is also between [0, 1]. At this time, the differential coefficient D_i of the i-th influencing factor in the risk evaluation model can be calculated as given in expression (13):

$$D_i = 1 - I_i. \tag{13}$$

Determine the risk weight u_{ij} in the process of manufacturing industry transfer based on the entropy weight method according to the difference coefficient as given in expression (14):

$$u_{ij} = \frac{D_i}{\sum\limits_{i=1,j=1}^{m} \gamma_i}. \tag{14}$$

After determining the weight ratio of each influencing factor in the risk evaluation model, combine the manufacturing industry transfer risk evaluation index system given in Section 3.1 to obtain the risk evaluation matrix. If κ_{ij} is the final evaluation result of the j-th evaluation index in the i-th evaluation unit, then the correlation risk evaluation matrix $\tau_{i\times j}$ of the evaluation index system can be expressed as given below:

$$\tau_{i\times j} = \begin{bmatrix} \tau_{11} & \tau_{12} & \cdots & \tau_{1n} \\ \tau_{21} & \tau_{22} & \cdots & \tau_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ \tau_{m1} & \tau_{m2} & \cdots & \tau_{mn} \end{bmatrix}. \tag{15}$$

According to the risk evaluation matrix, the reference sequence selected in the risk evaluation process is set as given in expression (16):

$$F = \left[f_1, f_2, \ldots, f_n\right]. \tag{16}$$

Standardize the initialization index matrix in the risk evaluation system based on the reference sequence value as given in expression (17):

$$\upsilon_{ij} = \frac{f_{ik} - \min f_{ik}}{\max f_{ik} - \min f_{ik}}. \tag{17}$$

Among them, υ_{ij} represents the standardization processing result; $\min f_{ik}$ represents the large index value; $\max f_{ik}$ represents the small index value.

Based on the entropy weight correlation theory, the result of the standardized processing of the manufacturing industry transfer risk evaluation matrix is expressed in matrix form:

$$\upsilon_{ij} = (\upsilon_{ij})_{m\times n} = \begin{bmatrix} \upsilon_{11} & \upsilon_{12} & \cdots & \upsilon_{1n} \\ \upsilon_{21} & \upsilon_{22} & \cdots & \upsilon_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ \upsilon_{m1} & \upsilon_{m2} & \cdots & \upsilon_{mn} \end{bmatrix}. \tag{18}$$

Take the standardized sequence as the reference sequence for the risk evaluation of manufacturing industry transfer, solve the correlation coefficients in each index data [25, 26], and finally realize the evaluation of the risk of manufacturing industry transfer:

$$\partial = \sum_{k=1}^{n} w_k \cdot \upsilon_{ij}, \quad k = 1,2,\ldots,n. \tag{19}$$

Among them, ∂ represents the final fuzzy comprehensive evaluation value of manufacturing industry transfer risk.

4. EXPERIMENTAL RESEARCH

Simulation experiments are carried out aiming at the rationality of the research on the fuzzy comprehensive model of manufacturing industry transfer risk based on economic big data analysis. To verify the effectiveness of the proposed method, reference [8] cloud model-based characteristic town PPP project financing risk evaluation method and reference [9] the risk evaluation method of intellectual property pledge financing under the system perspective is comparative. The evaluation results of different methods are verified, and the final comparison result is obtained through specific numerical analysis.

4.1. Experimental environment settings

Data collection and processing according to the above fuzzy comprehensive evaluation model of manufacturing industry transfer risk, select the relevant data of a city in 2019 for analysis. The original data mainly comes from the statistical bulletin of the city in 2019 and the summary statistical data of the investment zone. The data needed for risk evaluation is obtained by processing the original data with MATLAB software. The industry's contribution rate and growth rate to GDP, the influence of industry association, and the sensitivity of industry association are obtained through the above calculation of the original data. For some indicators whose statistical caliber is not uniform, leading to incomplete sample data or individual missing indicators, to solve the problem, expert consultation methods are used to determine, and the evaluation results can be obtained after data collation. The following is based on the financial statements of a certain manufacturing enterprise shown in Table 1 to make a fuzzy comprehensive evaluation of the enterprise's industrial transfer risk.

Table 1
Details of some assets of the company

Index	Assets and liabilities (unit: ten thousand yuan)		
	2019	2018	2017
Total assets	891.70	499.12	357.73
Total liabilities	601.13	354.29	201.74
Current liabilities	59.63	87.63	103.45
Money funds	39.14	25.34	19.64
Accounts receivable	20.24	12.81	10.69
Other receivables	8.28	4.09	3.13
Shareholders' equity	99.5	72.68	63.17

Based on the above experimental parameter settings, to ensure the smooth progress of the simulation experiment, the experimental hardware conditions are designed. Table 2 shows the experimental hardware parameter settings.

Table 2
Experimental hardware parameter setting

Project	Setting situation
Simulation platform and version	NS2 2.35.MAC
Testing time	30 min
Transmission channel Doppler frequency	0.5
Output signal strength	24 dB
Hardware resource description	8G
Operating system	Windows 10

Integrate the above-mentioned experimental parameters and hardware environment setting results, and conduct simulation experiments. In order to ensure the accuracy of the experimental results, all experimental parameters and indicators should be kept consistent.

4.2. Analysis of experimental results

4.2.1. Efficiency of risk evaluation

Taking the efficiency of risk evaluation as the experimental index, the evaluation results of different methods are verified, and the results are shown in Fig. 2.

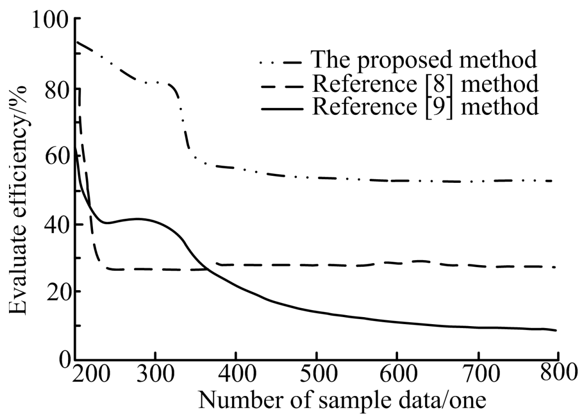

Fig. 2. Comparison of evaluation efficiency of different methods

According to the analysis of Fig. 2, with the increase of sample data, the evaluation efficiency of the three methods shows a trend of significant decline at first and then gentle. Although there are local changes, the overall trend is still a trend of decline first and then gentle. It shows that the number of samples significantly impacts the evaluation efficiency. The more samples, the lower the evaluation efficiency, i.e., the efficiency decreases with the increase in sample data. Comparing the evaluation efficiency of the proposed method with that of the traditional method, it is seen that the evaluation efficiency of the proposed method is higher than that of the traditional method for all samples. The highest evaluation efficiency of the proposed method is 96%, while the highest evaluation efficiency of the reference [8] method is 80%, and for the reference [9] method is 64%.

4.2.2. Accuracy of risk evaluation

Taking the accuracy of risk evaluation as the experimental index, the evaluation results of different methods are verified, and the results are shown in Fig. 3.

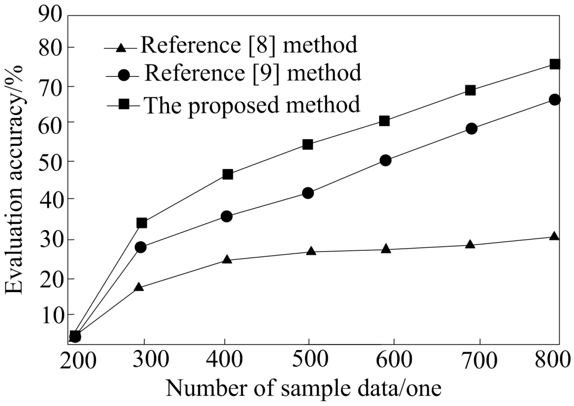

Fig. 3. Comparison of accuracy of evaluation results by different methods

It can be seen from Fig. 3 that with the increase of the number of sample data, the accuracy of evaluation results of all the methods shows continuous growth. Also, it is seen that the accuracy of the proposed method's evaluation results is higher than the other methods, and this advantage is maintained for all values of the number of samples. The highest accuracy of the proposed method is 75%, while the highest accuracy of the reference [8] method is only 29%. Although the accuracy of the reference [9] method is higher than that of reference [8], it is still far from the proposed method. The above comparison shows that the accuracy of the evaluation results of the proposed method is higher, which can provide an accurate database for manufacturing industry transfer and is conducive to ensuring the safety of industrial transfer.

4.2.3. Stability of risk evaluation

Taking the accuracy of risk evaluation as the experimental index, the evaluation results of different methods are verified, and the results are shown in Fig. 4.

Analyzing Fig. 4, it can be seen that when using different methods to perform fuzzy comprehensive evaluation on the transfer risk of manufacturing industries, with the increase of sample data, the stability of the evaluation results of various methods shows a continuous decreasing trend. However, in comparison, the stability of the proposed method is higher, indicating that the application of the proposed method can provide more stable data for the risk evaluation of manufacturing industry transfer, which is conducive to improving the reliability of the evaluation results.

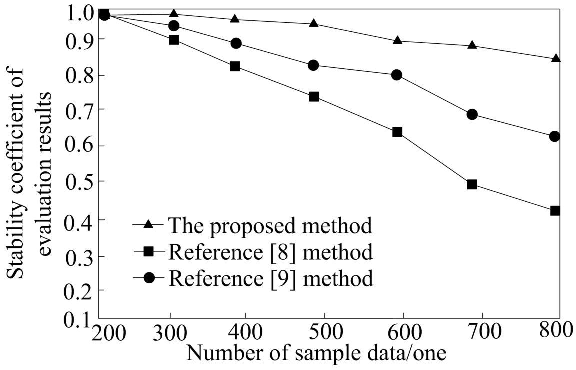

Fig. 4. Comparison of accuracy of evaluation results by different methods

5. DISCUSSION

1. Use big data analysis methods to analyze the risk factors of manufacturing industry transfer, find out the hierarchical relationship between the risk factors, and clarify the difference in the degree of influence of each factor. Based on the above analysis results, countermeasures, and suggestions for the transfer of manufacturing industries are proposed:
   First of all, should do a good job in environmental construction, improve policies and regulations, maintain a stable political environment and economic system, keep opening to the outside world, and increase exchanges with other countries. Secondly, one should ensure good economic development, deepen the reform of the financial system, speed up the construction of a sound capital market system, and provide a good capital market environment for the entry of foreign capital. Thirdly, should improve the laws and regulations to protect intellectual property rights, formulate the anti-monopoly law, and constantly improve the education and training mechanism to cultivate multi-level talents. Finally, to speed up the construction of the manufacturing industry base and the scaling process, to form a good market environment, the enterprises should continue to improve their technology and management level to ensure the smooth progress of manufacturing industry transfer.
2. Based on the construction of a fuzzy comprehensive evaluation model of manufacturing industry transfer risk based on the entropy method and correlation theory, specific measures to reduce the industry transfer risk are given:
   First of all, it is necessary to clarify the role of government departments in industrial transfer. Based on respecting the laws of economic development and ensuring that all partners are equal in law, achieve a win-win situation between government departments and enterprises. In the traditional process of industrial transfer, the role of the government and its relevant authorities is not clear, both managers and participants, which is unfair to other participants. Under the new risk evaluation system of industrial transfer, the most important point is that the participants of industrial transfer should cooperate under an equal condition and clarify their respective responsibilities and obligations in the process of industrial transfer.

6. CONCLUSION

As the pillar industry of economic development, the manufacturing industry plays a fundamental and leading role in promoting the development of the whole national economy. However, in recent years, the market environment of the manufacturing industry has deteriorated significantly. Although the state has actively carried out policy regulation, consumers have a strong wait-and-see mood, which indicates that the development of the manufacturing industry has reached an inflexion point. The manufacturing market bid farewell to the golden age of rapid development and entered the silver age. Although there is a certain foundation for manufacturing industry transfer risk research, these studies are still focused on the theoretical research level. The research of manufacturing market development status is rare, and there is no satisfactory system for manufacturing industry transfer risk management. Based on the above two aspects, it is of great significance to systematically analyze and evaluate the risk of manufacturing industry transfer. Therefore, this paper designs a fuzzy comprehensive manufacturing industry transfer risk model based on economic big data analysis.

1. Through the big data analysis method, the data source of fuzzy evaluation of manufacturing industry transfer risk is obtained, which provides a data source for risk evaluation.
2. Establish the risk index system of manufacturing industry transfer and use the expert evaluation method to design the scoring method of the evaluation index system.
3. The fuzzy comprehensive manufacturing industry transfer risk model is established based on the entropy weight method. The evaluation results obtained by the expert evaluation method are modified to ensure the accuracy of the evaluation results.
4. Finally, the model is verified by experiments, and the simulation results show that the proposed method is scientific and effective as the evaluation efficiency of the proposed method is 96%.

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