The Application of Big Data in Overseas Investment Risk Avoidance

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Abstract—Affected by the COVID-19, the international trade situation is becoming more and more complex. Because our country and the investment inward countries have the different geographical location, economic development level, political environment, diverse cultural and religious backgrounds and other factor, China's overseas investment enterprises will face many risks. In the digital economy, big data plays an important part in overseas investment risk avoidance, which can help to collect information, predict market demand, assess investment risks and evaluate investor preferences. By applying the principal component analysis, this paper analyzes 15 countries where Chinese overseas investment is more frequent during the three years from 2018 to 2020, which found that the top three risk indicators in the weight of overseas investment risk are ethnic tensions, internal conflict and religious tensions, which have a relatively large impact on overseas investment. In order to avoid overseas investment risks, big data can be used for risk identification, risk assessment, risk warning and risk disposal to avoid risks.

Keywords-big data; overseas investment risk; risk avoidance; overseas investment enterprises

1. Introduction

In the global digital wave, the use and development of big data has become an essential competitive advantage for enterprises. On the one hand, the application of big data by enterprises can improve the efficiency of innovation, better understand the environment and customer needs, and help the successful transformation of innovation results. On the other hand, the application of big data will provide opportunities for enterprises to provide innovative services and even establish new business models.

With the maturity of the "One Belt, One Road" construction and the improvement of China's international status, the scale of China's overseas investment is gradually expanding. According to statistics, in 2020, China's OFDI was $153.721 billion, up 12.3% year-on-year, ranking first in terms of volume for the first time. The stock of OFDI reached $2.58 trillion, ranking third in the world. With such a huge scale of China’s OFDI, the possible risks of overseas investment cannot be ignored. Thus, avoiding investment risks is particularly important.

Most of the studies focus on the risks of OFDI in the process of "Belt and Road" construction. Song (2010) found that political, military and socio-cultural risks of host countries are the main influencing factors, which lead to the risk of "Belt and Road" [1]. Yin et al. (2018) analyzed the current situation of overseas investment risk and its management in the context of Shanghai Pilot Free Trade Zone. Some studies focus on various aspects of the specific risks of OFDI

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process [2]. Wang and Pang (2021) explore the relationship between global value chains and political risks of OFDI and find that value chain dependence helps foreign investors to resist political risks, explaining the significant differences in the risk resistance of foreign investors depending on their nationalities and industries [3]. There are also some studies that combine industry-specific cases to analyze the causes of OFDI risk. Duan and Zhao (2021) studied the dynamic risk assessment of overseas oil and gas investment environment in the era of big data [4]. However, fewer scholars analyze overseas investment risks from the perspective of big data. This paper studies overseas investment risks classified into political, economic, social and technological risks, explores the role of big data in the process of overseas investment, analyzes how to utilize big data to avoid overseas investment risks, and brings up the role played by big data in risk identification, risk assessment, risk warning and risk treatment.

2. The role of big data in the risk of overseas investment of enterprises

2.1 Big data helps overseas information collection

The huge amount of overseas data and information needs to be analyzed by using data processing tools, and the data can be processed more efficiently and comprehensively by using big data analysis tools. Companies can establish big data overseas sharing systems and join with other overseas companies to share data and information to prevent investment risks caused by opaque information. For example, big data auditing can be used to collect data from enterprises and cross-verify and analyze with multiple data [5]. This way can more easily compensate for risk sources such as inadequate technology, lack of human monitoring and missed system defects in the process of overseas investment by enterprises. At the same time, overseas investment enterprises can use big data to conduct credit investigation of customers and partners and capture real-time hot events overseas at any time.

2.2 Big data helps predict market demand

Big data analysis helps overseas investment companies have stronger insights and more credible data-driven investment decisions. Zhou and Zhang (2020) find that both individual suppliers and manufacturers can predict demand through big data investments and share some of the big data with each other [6]. At the same time, the full development and utilization of big data helps companies perceive changes in the external environment and thus predict market demand. When making overseas investment decisions, Chinese enterprises can enhance the timeliness and accuracy of market demand forecasting by investing in acquiring the ability to collect and analyze big data on demand, and observe market changes in time before investing.

2.3 Big data helps to assess investment risks

When dealing with complex uncertainty events overseas, cloud modeling and Bayesian networks can be applied. Cloud modeling is an important tool for uncertainty analysis in the field of big data and artificial intelligence. Bayesian networks can also make good use of big data to express probabilities, deal with uncertainties and fuse multiple sources of information [7]. These two methods can be applied to predict the probability of high risk when making overseas investment decisions, thereby avoiding some of the risk.

2.4 Big data facilitates the assessment of consumer preferences

Under the big data model, the investment decision and risk avoidance of enterprises are related to consumer preferences. The study by Zhang and Huang (2020) shows that manufacturers should make big data investments when consumers are more sensitive to changes in the products themselves [8]. And retailers should make big data investments when consumers are more focused on offline shopping experience. In the process of overseas investment, consumer demand data is very critical. By collecting consumer preference data and conducting targeted analysis, we can not only reduce investment risk but also improve the yield of overseas investment.

3. Establishment of overseas investment risk evaluation model for overseas countries

In the process of overseas investment, since political risk is the most important and influential risk of overseas investment, we classify political risk into 12 indicators based on the political risk measure of the ICRG Country Risk Index: Government Stability (X_1), Socioeconomic Conditions (X_2), Investment Profile (X_3), Internal Conflict (X_4), External Conflict (X_5), Corruption (X_6), Military in Politics (X_7), Religious Tensions (X_8), Law & Order (X_9), Ethnic Tensions (X_{10}), Democratic Accountability (X_{11}) and Bureaucracy Quality (X_{12}) [9]. The risk of overseas investment in selected countries is measured using principal component analysis for the three-year period 2018-2020. Fifteen countries where Chinese overseas investment is frequent are selected as the subjects of the study, mainly including: the United States, Japan, India, South Korea, Singapore, the United Kingdom, France, Germany, Australia, Israel, Hong Kong, Taiwan, Thailand and Malaysia.

In order to verify whether the data are suitable for principal component analysis, this paper performs KMO test and Barlett Test of Sphericity on the data analyzed by principal components [10]. The results are shown in Table 1, the KMO is 0.696, which is greater than 0.6. Sig value is less than 0.05, indicating that the data support the principal component analysis.

Table 1 KMO and Bartlett's test

KMO		0.696
Bartlett's test of sphericity	*approximates chi-square*	501.650
	df	66
	sig	0.000

The principal components with eigenvalues greater than 1 and a cumulative variance contribution rate of about 80% were extracted. As shown in Table 2, three common factors were extracted, reflecting 78.606% of the variance, and the eigenvalues of these three principal components were all greater than one, so the selection of three main factors was reasonable.

First of all, the coefficients in the linear combination of each principal component are calculated as:

$$w_{ij} = \frac{\theta_j}{\sqrt{\lambda_i}} \quad (1)$$

In equation (1), $w_{ij}$is the coefficient in the linear combination corresponding to the principal component. θ_j is the component matrix value corresponding to each variable. $\sqrt{\lambda_i}$ is the value of the square root of the eigenvalue corresponding to the principal component. X_1,X_2,... ,X_{12} represent the above 12 indicators of measuring political risk$i$=1,2,3...12, $j = 1,2,3$. The calculation is shown in Equation (2), (3), (4) as follows.

Table 2 Explanation of total variance

Components	**Initial Eigenvalue**			**Extraction of the sum of load squares**		
	Total	*Variance %*	*Cumulative %*	*Total*	*Variance %*	*Cumulative %*
1	6.029	50.244	50.244	6.029	50.244	50.244
2	2.218	18.487	68.731	2.218	18.487	68.731
3	1.185	9.875	78.606	1.185	9.875	78.606
4	0.772	6.433	85.039			
5	0.551	4.591	89.630			
6	0.477	3.971	93.601			
7	0.264	2.198	95.799			
8	0.184	1.537	97.336			
9	0.156	1.301	98.637			
10	0.086	0.717	99.354			
11	0.053	0.440	99.794			
12	0.025	0.206	100.000			

$$F1 = 0.0181X_1 + 0.2740X_2 + 0.3546X_3 + 0.3365X_4 + 0.2056\,X_5 + 0.3489\,X_6 + 0.3216\,X_7 + 0.3735\,X_8 + 0.3337\,X_9 + 0.2474\,X_{10} + 0.0903\,X_{11} + 0.3130\,X_{12} \quad (2)$$

$$F2 = 0.4875\,X_1 + 0.2557\,X_2 + 0.0197\,X_3 + 0.1606\,X_4 + 0.1717\,X_5 - 0.0607\,X_6 - 0.1327\,X_7 + 0.0215\,X_8 - 0.2522\,X_9 + 0.4103\,X_{10} - 0.5582\,X_{11} - 0.2757\,X_{12} \quad (3)$$

$$F3 = 0.2978\,X_1 + 0.1456X_2 + 0.0127\,X_3 + 0.1948\,X_4 - 0.7127\,X_5 - 0.2213\ X_6 - 0.2916\ X_7 + 0.1798\ X_8 + 0.1976\ X_9 + 0.1866\ X_{10} + 0.3217\,X_{11} - 0.0195\ X_{12} \quad (4)$$

From equation (2), it can be seen that Principal Component1, which is mainly illustrated by religious tensions, is positively correlated with all indicators. From equation (3), it can be seen that principal component 2 is mainly explained by democratic accountability, which is negatively correlated with corruption, military in politics, law &order, democratic accountability and bureaucracy quality, and positively correlated with the rest of the indicators. Equation (4) shows that principal component 3 is mainly explained by external conflict, which has a negative relationship with external conflict, corruption, military in politics, bureaucracy quality and a positive relationship with the rest of the indicators.

Next, the coefficients in the composite score model are calculated based on the coefficients in the linear combination and the principal component variance as follows.

$$Q_i = \frac{w_{i1}*R_1+w_{i2}*R_2+w_{i3}*R_3}{R} \quad (5)$$

In equation (5), w_{i1}, w_{i2}, w_{i3} are respectively the coefficients of the i-th indicator in the linear combination of components 1,2,3.R_1,R_2,$R_3$are respectively the variance contribution of the 1st, 2nd, and 3rd principal components. $R$is the sum of R_1,R_2,R_3, resulting in a composite score model, as in Equation (6).

$$Y = 0.1636\ X_1 + 0.2536X_2 + 0.2329\,X_3 + 0.2773\,X_4 + 0.0823\ X_5 + 0.1810\,X_6 + 0.1378X_7 + 0.2664\,X_8 + 0.1788\,X_9 + 0.2780\ X_{10} - 0.0332\,X_{11} + 0.1328\,X_{12} \quad (6)$$

Finally, the indicators were normalized to calculate the weights accounted for by each factor, and then the indicators were ranked by weight from largest to smallest, and the results are shown in Table 3.

Table 3 Ranking of the weights of each indicator

Ranking	Indicator	Weight
1	*Ethnic Tensions (J)*	12.92%
2	*Internal Conflict (D)*	12.89%
3	*Religious Tensions (H)*	12.38%
4	*Socioeconomic Conditions (B)*	11.79%
5	*Investment Profile (C)*	10.83%
6	*Corruption (F)*	8.41%
7	*Law & Order (I)*	8.31%
8	*Government Stability (A)*	7.61%
9	*Military in Politics (G)*	6.40%
10	*Bureaucracy Quality (L)*	6.17%
11	*External Conflict (E)*	3.82%
12	*Democratic Accountability (K)*	-1.54%

The top three risk indicators in the weight of overseas investment risk are ethnic tensions, internal conflict and religious tensions, which have a relatively large impact on overseas investment. Firstly, In the process of overseas investment, we should pay attention to tension attributable to racial, national, or language divisions, and try our best to communicate and coordinate with opposing groups to prevent overseas investment from failing due to intolerance or unwillingness to compromise by independent groups. Secondly, overseas investment enterprises should pay attention to political violence in the investment inward country and its actual or potential impact on governance, such as the possible emergence of civil war, coup threat, terrorism, and civil disorder in that country. Finally, overseas investment enterprises should avoid religious tensions arising from the domination of society and governance by a single religious group.

4. The application scenarios of big data in enterprise overseas investment risk

The process of big data for overseas investment risk avoidance mainly includes: risk identification, risk assessment, risk warning and risk disposal. Firstly, the overseas investment key information collection is carried out in the big data information base, and the obvious, quasi-existing, potential and sudden risk sources are identified. Secondly, risk assessment is conducted through the quantitative evaluation system of big data, selecting risk-related assessment indicators, setting risk assessment indicator weights and conducting comprehensive judgment of risk situation. The Composite Risk Rating in ICRG is used to rate the risk of the investment inward country. Thirdly, the risk assessment results are used to determine whether the risk threshold is exceeded. Finally, the decision maker handles the risk alert content and disposes of the high-risk content in a timely manner. The specific process refers to Figure 1.

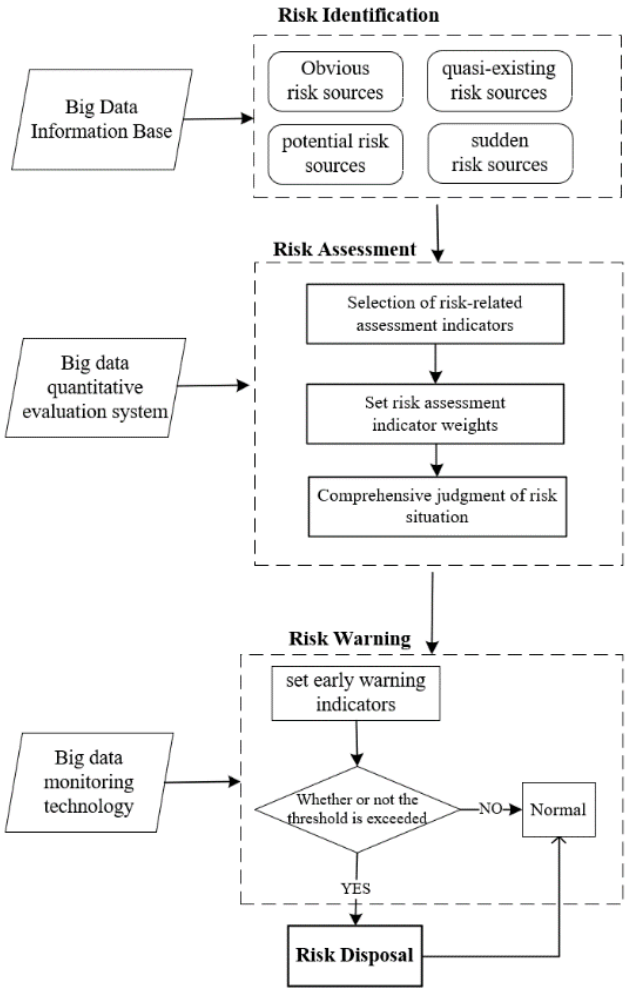

Figure 1. Overseas Investment Risk Avoidance Procedure

4.1 Risk identification

The identification of overseas investment risks refers to helping enterprises identify the obvious, quasi-existing and potential risk sources with the help of big data, and try to predict the sudden risk sources. In the process of technology research and development, enterprises can use big data to measure whether the research and development time and cost are beyond the enterprise's affordability, and whether the direction of research and development deviates from the market demand [11].

The first task before overseas investment is to use big data to determine the strategic target of investment and select the industry, location and entry method for overseas investment. In industry selection, investment should focus on manufacturing industries with excess production capacity and mature practical technology or small-scale production technology, and use big data

to monitor these target industries in real time. In location selection, big data analysis should be used to do a good job of regional positioning, with the basic orientation of consolidating and expanding overseas investment in developing countries and regions. In the entry mode selection, the main two ways are new investment and M&A. At present, most of the Chinese enterprises are greenfield investment, which makes it more necessary to do the analysis of big data before entering themarket.

4.2 Risk assessment

Overseas investment enterprises should establish a big data quantitative evaluation system,make a comprehensive assessment of the economic development status in the investment inward countries and preferential policies for inward investment before investing. Meanwhile, enterprises apply the ICRG rating system to assess the various risks that a country may face.

The assessment process is divided into three stages: firstly, the selection of risk-related assessment indicators, looking for relevant indicators that change with risk for quantitative analysis. Secondly, the setting of risk assessment indicator weights, according to the importance of risk impact factors to set the weights. Thirdly, the final step of the risk assessment is a comprehensive study of risk dynamics, which is a comprehensive study that uses big data to analyze the preferences of decision makers and integrate preferences into the risk to measure the risk of investment inflows to countries and industries [12]. From there, changes in risk dynamics are derived.

4.3 Risk warning

Overseas investment analysis process often needs to face a large amount of data, using the collected data for systematic analysis and collation. Enterprises need to set early warning indicators that are in line with international standards, and set weights according to the importance of diverse influencing factors. Once the critical threshold is exceeded, the alarm state will be started immediately to ensure that the alarm state obtained from big data analysis reflects the real risk to the greatest extent.

4.4 Risk disposal

In order to better reduce the risk of China's overseas investment, we should strengthen the communication and cooperation with the civil groups of the investment inward countries, focus on the people's foundation, use big data to collect the data information of various civil groups. Overseas investment enterprises can cooperate with each other to build a shared database, tap and seize the people's pain points, and strengthen the communication and contact with the civil groups and social people.

At the same time, use big data to do market research and investment environment analysis, select suitable target markets, build a systematic enterprise network structure, use big data to closely track the development trend of overseas technology, and reduce the possible overseas investment risk due to technology renewal.

5. Conclusion

This paper proposes a risk avoidance method using big data for the political, economic and financial risks faced by overseas investment, and constructs a principal component analysis model to deeply combine big data and overseas investment risk avoidance. The method can well determine the main indicators that affect the success of overseas investment. The results found that the top three risk indicators in the weight of overseas investment risk are ethnic tensions, internal conflict and religious tensions.

The risk avoidance system is more rigorous, complicated, and heavy workload, which requires the use of big data technology for dynamic management. Firstly, the big data information base is used to identify risks, establish a big data quantitative evaluation system to assess risks, select risk-related evaluation indicators, set the weight of risk evaluation indicators, and comprehensively study and judge the risk posture. Second, establish a quantitative evaluation system of big data for risk assessment, and also use the ICRG rating system to assess the various risks that a country may face. Thirdly, the analysis capability of big data is used to conduct risk warning, and once the threshold value is exceeded, an alarm is immediately activated. Finally, the risk assessment results are used to make appropriate risk response decisions. The above process can minimize the risk of overseas investment.

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