Research on the Infrastructure Development Risk Assessment and Response Mechanism of Chinese Enterprises' Overseas Investment Under the Background of Big Data Technology

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Abstract. In order to improve the effect of corporate overseas investment risk identification, this article combines big data technology to analyze the risk assessment of Chinese enterprises' overseas investment, and builds an intelligent risk assessment system to classify and identify the risks of Chinese enterprises' overseas investment. Moreover, this paper uses Kalman filter to model the unobservable time-varying parameters in the TVP-SV-VAR model, and chooses Bayesian estimation to estimate this type of time-varying model. The core of Bayesian estimation is to obtain the joint posterior distribution of the parameters to be estimated, and to express many dynamic time series models in finance and economy in the form of state space. Through simulation research, it can be seen that the overseas investment risk assessment system for enterprises proposed in this paper has a good risk assessment effect. On this basis, several risk response mechanisms are proposed.

Keywords: big data; Chinese enterprises; overseas investment; risk assessment; response mechanism
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1 INTRODUCTION

Overseas projects themselves are exposed to the complex global market, so it is necessary to take into account the difficulty of obtaining timely information and various uncertain factors. Moreover, overseas projects are generally considered to be riskier and have a higher probability of loss and failure than domestic projects. McKinsey Global Senior Director Xu Haoxun advises local enterprises that are determined to win in cross-border mergers and acquisitions to be calmer and more sensible, and be alert to opportunities and risks. Moreover, he suggested that enterprises should prepare and analyze as much as possible to quantify and sort risks. Many enterprises look at financial performance, cost-benefit, and revenue improvement, but they don't see the many disadvantages in culture, language, and management style.

For a long time, the management of Chinese enterprises has been in an extensive form, and the sense of danger is not strong. It is still stuck in the general risk perception of "natural and man-made disasters", and there is a lack of effective identification and assessment of overseas risks. In China, many companies only know to insure their property, but they don't know that legal compensation and related consequential losses caused by negligence should also be insured, and often the losses of the latter two risks may be much higher than property losses. In countries with sound legal systems, investment companies often face various possible risks of compensation for tort liability, such as: product liability, behavioral liability, site liability, environmental liability, executive liability, infringement of intellectual property rights, liability for infringement of others' reputation, etc. The compensation for these liabilities and the high legal fees will make the operation of overseas projects miserable. In the event of natural disasters and accidents, sometimes the direct property losses caused may not be serious, but the resulting business interruption and profit reduction or additional cost increase may far exceed the loss of tangible materials. In addition, political insurance, credit insurance, M&A guarantee insurance, insurance guarantee, personnel insurance, etc. can also be fully used in overseas investment projects to provide protection for various risks faced by enterprises.

This paper combines big data technology to analyze the risk assessment of Chinese enterprises' overseas investment, builds an intelligent risk assessment system, classifies and identifies the risks of Chinese enterprises' overseas investment, and proposes corresponding response mechanisms.

By integrating big data technology and focusing on infrastructure development, this research contributes to the enhancement of risk assessment capabilities and the formulation of effective response mechanisms for Chinese enterprises' overseas investment. This enables businesses to make informed decisions, mitigate risks, and optimize their investment strategies, ultimately supporting the sustainable development of China's overseas investment endeavors.

2 RELATED WORK

Literature [1] studies the financing risks of cross-border mergers and acquisitions. It analyzes in detail the sources of financing risks in cross-border mergers and acquisitions, including: the capital structure of mergers and acquisitions, excessive corporate debt management, exchange rate fluctuation risks, tax risks, and political risks. This proposed prevention and control measures, such as: enterprise alliances, diversification of financing risks, the use of tangible assets for property rights grafting financing, and diversification of financing methods. Literature [7] believes that corporate multinational business risks involve a variety of risks, such as political risks, legal risks, cultural risks, natural risks, etc. It discusses the relatively weak quantitative analysis of market risks in corporate transnational business activities, using quantitative analysis methods and The hedging method is used to evaluate the results of enterprises' bidding decisions and investment analysis in foreign countries. Literature [2] proposes that overseas mergers and acquisitions should do all kinds of due diligence, including legal due diligence, commercial due diligence, tax due diligence, financial due diligence, welfare due diligence, etc. However, it is believed that the target company may still be found in the past after the merger. Existing tax liability defects, environmental pollution, and failure to fulfill labor responsibilities. Some issues such as the vagueness of real property rights have caused the buyer's financial losses. It is recommended to insure the "M&A Guaranteed Compensation Insurance" so that when risks occur, effective prevention and control measures can be taken to exercise the right of compensation to the insurance company, and the content of the protection has been explained. Literature [18] through some cases of overseas investment, from multiple angles and multiple levels, a detailed analysis and summary of the problems and errors in the acquisition process, pointed out that the financial risk is mainly caused by the interest generated by the capital borrowing to cause the new company The financial pressure of the company, and the operating risk is the loss of personnel, especially the loss of management. The capital market risk comes from the failure of shareholders to achieve the expected development, the shrinking of the market value of the company, and the anxiety of shareholders. The above risks will further make it more difficult for the company to achieve the expected synergy effect. , Thus entering a negative cycle. Literature [8] believes that continuous business management for the purpose of ensuring that the organization continues to operate or resume operations as soon as possible under the influence of external or internal adverse factors is a manifestation of enterprise risk management.

Literature [3] studies the risks faced by multinational corporations from the relationship and role of organizational goals, strategic interests and development models. Taking into account the different interests faced by countries and enterprises, it studies commercial risks from the perspective of social behavior, especially Political, social and cultural dimensions. Literature [9] believes that overseas investment itself is a highly professional and practical problem. In addition to the nature of investors, investment objectives, investment industries, investment methods, and even investment timing, the risks encountered may be different. Moreover, commercial risks and non-commercial risks are intertwined, so he analyzes and discusses the legal protection and risk prevention of overseas investment from the perspectives of investors and the government.

Literature [14] proposes that the host country government restricts the activities of other countries' enterprises, including matters such as national sovereignty, national interests, and national identity, and these matters are very likely to lead to political risks. Literature [13] proposed a national culture model, in which it proposed that national culture should be measured from four aspects, namely individualism, power distance, masculinity and uncertainty avoidance. Today, the national cultural model of overseas investment risk research is still the theoretical basis for many foreign scholars to study corporate cross-cultural management. In the literature [6], when studying overseas investment, the exchange rate risk that has a greater impact on the value of a company is divided into three forms: conversion risk, transaction risk, and economic risk. Generally, conversion risks and transaction risks can be effectively managed through methods such as hedging. Literature [19] conducted research on political risks, and proposed that the possibility of political risks can be measured by judging the degree of economic development of other countries and the degree of openness to other countries. The conclusion of the study is: less developed countries are more likely than developed countries, and closed countries are more likely to generate political risks than open countries. The literature [10] concluded after a lot of empirical analysis: the government policy of the host country has a direct impact on its foreign investment. It is easier to obtain foreign direct investment when the policy is looser, and it is more difficult to obtain foreign direct investment when the policy is strict. The literature [11] researched political risk is to use political stability to measure political risk, and proposed to predict political stability from the aspects of economic growth, income equality, ethnic composition, democratic tradition, and population growth/density. Literature [20] through empirical analysis of the possibility that multinational companies are exposed to exchange rate risks in overseas investment, it is proposed that the more countries the company's branches are located in, the smaller the number of countries where the company's branches are located, the more concentrated it is. The greater the possibility of exchange rate risk at the time. Literature [5] uses a qualitative analysis method to study the possible risks of investing in a developer. Considering that infrastructure construction itself has a natural monopolistic nature, and its products are not easily traded, it is different from ordinary production enterprises. Therefore, there is inevitably the existence of state control. When investing in infrastructure construction, investment enterprises are very vulnerable to the host country. The policy risk[17]. For example, the host country government sometimes fails to abide by its pre-investment commitments and nationalizes the investment enterprise after a period of time, which causes investors to suffer huge economic losses. Literature [12] empirical research pointed out: political risk = overall country risk. Financial risk, that is, the political risk faced by investment companies (not easy to measure) is equal to the overall country risk minus the financial risk (easy to measure). Literature [15] proposed through research that although the risk index cannot predict future risks3, it can clearly and intuitively reflect the changes in past and present political and economic risks. The research on the government's governance capability variables constructed in the literature [16] (including the government's executive power, political stability, legal environment, national democracy, corruption, and the effectiveness of current policies) proposes that a better way to quantify location risk is the government's governance capability . Literature [4] proposes two ways to help companies prevent government risks: (1) Participate in political activities, such as convening the masses that have an influence on political decision-making, political lobbying, and providing appropriate financial support for political decision-makers; (2) using Overseas investment subsidiaries are more dependent on the parent company, for example, in order to make the host country lose bargaining chips, transfer internal products.

3 TVP-SV-VAR model

The VAR model has many achievements in the study of macro-time series models. The fixed coefficient VAR model assumes that the estimated parameters are fixed. Therefore, if the economic system undergoes structural changes or smooth changes, the fixed-coefficient VAR model cannot detect such economic changes, and its conclusions cannot fully reflect the real shocks between economic variables, and sometimes the results may be true. However, the variable coefficient VAR model can effectively solve this problem. Therefore, combining the research results of Primiceri (2005) and Nakajima (2011), the TVPSV-VAR model is introduced. This article first starts with the basic SVAR (Structural VAR) model:

$$Ay_t = F_1 y_{t-1} + F_2 y_{t-2} + \cdots + F_s y_{t-s} + u_t, \quad \mathrm{t = s+1, \cdots, n} \tag{1}$$

In the formula, y_t represents the k×1 order column vector of k observable values, and $\mathrm{A}, F_1, \ldots, F_s$ is the k×k order matrix related to the coefficients, where A reflects the contemporaneous relationship between the variables, F_i represents the influence of the variable in the lagging period i on the current variable, and the interference term u_t represents the structural impact of k×1 order. Here, it can be assumed that $u_t \sim \mathrm{N}(0, \Sigma\Sigma)$. Among them, there are:

$$\Sigma = \begin{pmatrix} \sigma_1 & 0 & \cdots & 0 \\ 0 & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & \sigma_k \end{pmatrix} \tag{2}$$

The synchronization relationship matrix A between the variables is assumed to be a lower triangular matrix, as shown below:

$$A = \begin{pmatrix} 1 & 0 & \cdots & 0 \\ a_{21} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{k1} & \cdots & a_{k,k-1} & 1 \end{pmatrix} \tag{3}$$

Multiplying both sides of (1) by the inverse matrix A^{-1} of A, we can get:

$$y_t = B_1 y_{t-1} + B_2 y_{t-2} + \cdots + B_s y_{t-s} + A^{-1}\sum \varepsilon_t \quad \varepsilon_t \sim N\left(0, I_k\right) \tag{4}$$

Among them, $B_i = A^{-1}F_i, \mathrm{i} = 1,\ldots,\mathrm{s}$. The vector β can be obtained by stacking the row elements of $B_i^{'}s$. Then, we define $X_t = I_k \otimes \left(y_{t-1}^{'}, y_{t-2}^{'},\ldots, y_{t-s}^{'}\right)$, where $\otimes$ represents the Kronecker product, and the model (4) can be rewritten as:

$$y_t = X_t\beta + A^{-1}\sum \varepsilon_t \tag{5}$$

It can be seen that in model (5), the parameters β, A^{-1}, and Σ to be estimated do not have time-varying properties. In this paper, the time-varying properties of the parameters are assigned to the TVP-VAR model, and random fluctuations are considered in the TVP-VAR model, so that the TVP-SV-VAR model is obtained.

$$y_t = X_t\beta_t + A_t^{-1}\sum_t \varepsilon_t, \quad t = s+1,\ldots,n, \tag{6}$$

The coefficient β_t, the parameters A_t and $\sum_t$ are all time-varying. There are many methods to model these time-varying parameters. According to the research of Primiceri (2005), we assume that $a_t = \left(a_{21}, a_{31}, a_{32},\ldots, a_{k,k-1}\right)$ is the $\mathrm{k(k-1)/2}$-dimensional column vector obtained by re-stacking the lower triangular matrix A_t, $h_t = \left(h_{1t},\ldots,h_{2t}\right)^{'}$, where $h_{jt} = \log\sigma_{jt}^2$, $\mathrm{j=1,\ldots k, t = s+1,\ldots,n}$. We assume that the parameters in model (6) obey the random walk process, as shown below:

$$\beta_{t+1} = \beta_t + u_{\beta t}, \quad \mathrm{t = s+1,\ldots,n} \tag{7}$$

$$\mathrm{a}_{t+1} = a_t + u_{at}, \quad \mathrm{t = s+1,\ldots,n} \tag{8}$$

$$\mathrm{h}_{t+1} = h_t + u_{ht}, \quad t = s+1,\ldots,n \tag{9}$$

$$\begin{pmatrix} \varepsilon_t \\ u_{\beta t} \\ u_{at} \\ u_{ht} \end{pmatrix} = N\left(0, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \sum_\beta & 0 & 0 \\ 0 & 0 & \sum_a & 0 \\ 0 & 0 & 0 & \sum_h \end{pmatrix} \right) \tag{10}$$

In the formula above, $\mathrm{t=s+1,\ldots,n}, \quad \beta_{s+1} \sim N\left(\mu_{\beta 0}, \Sigma_{\beta 0}\right), \quad a_{s+1} \sim N(\mu_{a0}, \sum a0)$, $\mathrm{h}_{s+1} \sim N\left(\mu_{h0}, \Sigma_{h0}\right)$.

We assume that y_t represents an observable n × 1 order vector in period t, and X_t is an unobservable state variable. Then, the state space form of y_t can be expressed by the following equation, as shown below:

$$X_t = FX_{t-1} + v_t \tag{11}$$

$$Y_t = A' + H' X_t + w_t \tag{12}$$

Among them, F, A' and H' represent r × r, n × k, and n × r-dimensional parameter matrices, and Z_t represents a predetermined variable of order k×1. Among them, formula (11) is the state equation, and formula (12) is the measurement equation. Both v_t and w_t are white noise. Among them, the mean value of v_t is zero, the variance covariance matrix is Q, the mean value of w_t is zero, and the variance covariance is R. We assume that the disturbance terms v_t and w_t are uncorrelated, that is, $E(vtw_\tau^{'}) = 0$. Based on the above state space form, as long as the initial value X_1 of the state variable X_t can be obtained, the finite observation sequence $(y_1 y_2, \ldots, y_t)$ can be modeled.

The essence of Kalman filtering is to model unobservable state variables. These state variables cannot be observed. On the one hand, we know the evolution form of this state variable (that is, equation (11) above). Therefore, it can be modeled in the form of Kalman filtering. In addition, it is also known that the state variable can be obtained through the observation equation (12) above to obtain an observation value y_t of the state variable. Therefore, the parameter estimates of the observation equation and the state equation are obtained through the MCMC algorithm. In this way, when the observation equation and the state equation are known, by inputting the initial value X_1 of the state variable, the state value of the unobservable variable at all time points can be obtained. A classic Kalman filter form is as follows:

$$X_{t+1} = FX_t + v_{t+1} \tag{13}$$

$$y_t = A^{'} Z_t + H^{'} X_t + w_t \tag{14}$$

$$\mathrm{E}\left(u_t u_t^{'}\right) = \begin{cases} Q, t = \tau \\ 0, t \neq \tau \end{cases} \tag{15}$$

$$\mathrm{E}\left(v_t v_t^{'}\right)=\begin{cases}R, t=\tau \\ 0, t\neq\tau\end{cases} \tag{16}$$

Equation (13) is the state equation, and equation (14) is the observation equation. Given the observation data $\{y_1, y_2, \ldots, y_t\}$ and $\{z_1, z_2, \ldots, z_T\}$, based on these observation data, the values of all unknown parameters in the equation are obtained, including X_t、F、A'、H'、Q、R. However, to briefly describe Kalman's technique, we assume that the parameter matrix and the covariance matrix X_t、F、$A^{'}$、$H^{'}$、Q、R, the last thing we know is the state variable X_t. In order to get the value of the state variable in all periods, the initial value $\hat{X}_{10}$ of the state variable (the unconditional predicted value of X_1) needs to be given to iterate. After assigning the initial value $\hat{X}_{10}$, it is also necessary to calculate its mean square error $P_{1|0}$, as shown below:

$$P_{1|0}=E\left\{\left[X_1-E\left(X_1\right)\right]\left[X_1-E\left(X_1\right)\right]^{'}\right\} \tag{17}$$

So far, a more comprehensive description of random variables has been carried out. After the initial values $\hat{X}_{1|0}$ and $P_{1|0}$ are given, $\hat{X}_{2|1}, P_{2|1} \cdots \hat{X}_{t|\,t-1}, P_{t|\,t-1}$ and $\hat{X}_{t+1|\,t}, P_{t+1|\,t}$。 can be deduced by analogy. At this time, y can be predicted based on the information of period t-1, as shown below:

$$y^{\wedge}_{t|\,t-1}=A^{'}Z_t+H^{'}X^{\wedge}_{t|\,t-1} \tag{18}$$

The expected error is:

$$E\left\{\left[y_t-y^{\wedge}_{t|\,t-1}\right]\left[y_t-y^{\wedge}_{t|\,t-1}\right]^{'}\right\}=H^{'}P_{t|\,t-1}H+R \tag{19}$$

Equations (18) and (19) are based on the information of period t-1 to obtain the linear estimation and error of y_t. In fact, when the time reaches t, the real $\mathrm{t}y_t$ value can be obtained, then the prediction of X_t in period t-1 can be corrected, that is, the $X_{t|\,t}$ obtained by the real y_t value, and the $x^{\wedge}_{t|\,t-1}$ can be corrected with it. This process is a key step of Kalman filtering, and it is usually referred to as an update process. The correction formula is as follows:

$$\hat{X}_{t|\,t}=\hat{X}_{tt-1}+P_{t|\,t-1}H\left(H^{'}P_{t|\,t-1}H+R\right)^{-1}\left(Y_t-A^{'}Z_t-H^{'}\hat{X}_{t|\,t-1}\right) \tag{20}$$

$$\mathrm{P}_{t|\,t}=P_{tt-1}-P_{t|\,t-1}H\left(H^{'}P_{t|\,t-1}H+R\right)^{-1}H^{'}P_{t|\,t-1} \tag{21}$$

After obtaining the state variable $\hat{X}_{t|\,t}$ corrected based on the information of the t period, the formula (11) can be used to continue the iteration and obtain the prediction of X_{t+1} based on the information of the t period, as shown below:

$$\begin{aligned}\mathrm{X}_{t+1|\,t} &= F\hat{X}_{t|\,t} = F\hat{X}_{t|\,t-1} + F\hat{P}_{t|\,t-1}H\left(H^{'}P_{t|\,t-1}H+R\right)^{-1}\left(y_t - A^{'}Z_t - H^{'}\hat{X}_{t|\,t-1}\right)\\ &= F\hat{X}_{t|\,t-1} + K_t\left(Y_t - A^{'}Z_t - H^{'}\hat{X}_{t|\,t-1}\right)\end{aligned} \tag{22}$$

$$\mathrm{P}_{t+1|\,t} = E\left\{\left[X_{t+1} - X_{t+1|\,t}\right]\left[X_{t+1} - X_{t+1|\,t}\right]^{'}\right\} = \mathrm{F}P_{t|\,t}F^{'} + Q \tag{23}$$

Among them, $K_t = FP_{t|\,t-1}H\left(H^{'}P_{t|\,t-1}H+R\right)^{-1}$, which is the gain matrix (Kalman Gain). By repeating the above steps, the state energy values of all periods t can be obtained. The entire cycle steps can be summarized as follows:

1. The algorithm obtains a prediction of the state variable based on the information in the t-1 period, that is, $\hat{X}_{t|\,t-1}$.
2. The algorithm substitutes the initial value $\hat{X}_{t|\,t-1}$ into equation (12) to get the prediction $\hat{y}_{t|\,t-1}$ based on the information y_t in period t-1.
3. Since y_t is known, and $\hat{y}_{t|\,t-1}$ is obtained from $\hat{X}_{t|\,t-1}$, $\hat{X}_{t|\,t-1}$ can be corrected by comparing y_t and $\hat{y}_{t|\,t-1}$, and the corrected state variable value is $\hat{X}_{t|\,t^{\circ}}$.
4. The algorithm substitutes $\hat{X}_{t|\,t}$ into the state equation to get $\hat{X}_{t+1|\,t}$. In this way, the state variables for all periods are obtained.

The corresponding mean square error can be calculated for each of the above loop steps. At this point, the value of the state variable in all periods can be obtained.

Bayesian estimation combines a priori thought with data to obtain the posterior distribution of the parameter to be estimated, and then performs statistical inference based on the posterior distribution. Specifically, when estimating the model parameters, this article first adds the prior information of the parameters, and combines the prior information of the parameters with the sample data to obtain the posterior distribution of the parameters to be estimated. Then, the algorithm uses the obtained posterior distribution to make corresponding statistical inferences on the parameters.

We assume that θ is the parameter that needs to be estimated from the sample. In previous statistical analysis, the mean value and probability limit of random variables are related to the true θ, and the mean square error of random variables is usually used to measure the error of the estimator $\mathrm{E}(\hat{\theta}-\theta)(\hat{\theta}-\theta)^{'}$. However, in the Bayesian estimation method, the parameter to be estimated itself θ is regarded as a random variable. There is always some uncertainty about θ, so all the statistical inferences of the parameter θ to be estimated are expressed in the form of probability. The purpose of statistical analysis is to discuss this uncertainty in the form of probability distributions. Before the observation data is obtained, there is usually a prior density function about the parameter θ to be estimated, and $f(\theta)$ can be used to represent the prior density. $f(y|\ \theta)$ represents the conditional probability distribution of y after θ is given. We can get the joint probability density of the sample observation value and the parameter to be estimated.

$$\mathrm{f}(\mathrm{y},\theta)=\mathrm{f}(\theta)\mathrm{f}(\mathrm{y}|\ \theta) \tag{24}$$

From Bayes' theorem, the posterior probability density of the parameters given the sample information can be obtained:

$$\mathrm{f}(\theta|\ \mathrm{y})=\frac{f(y,\theta)}{f(y)} \tag{25}$$

Substituting equation (24) into equation (25), and at the same time, according to the relevant theorem of marginal distribution, Bayes' theorem can be obtained:

$$\mathrm{f}(\theta|\ \mathrm{y})=\frac{f(y|\ \theta)f(\theta)}{\int_{-\infty}^{+\infty}f(y|\ \theta)f(\theta)d\theta} \tag{26}$$

In the formula (25), f(y) is a constant that has nothing to do with the parameter θ to be estimated. Combined with formula (24), formula (25) can be written as follows:

$$\mathrm{f}(\theta|\ y)\propto\mathrm{f}(y|\ \theta)\mathrm{f}(\theta) \tag{27}$$

$\propto$ means proportional. Equation (27) shows that after the sample information is given, the posterior probability density of the parameter to be estimated is proportional to the product of the sample likelihood function and the prior probability density. It can be seen that the parameter prior information is related to the posterior density through the prior density, so that the sample information enters the posterior density through the likelihood function, and the prior density and the sample information are combined in the joint posterior density.

$$\hat{\theta}=\frac{\sum_{i=1}^{n}\theta^{i}}{n} \tag{28}$$

In fact, when building an econometric model, the prior density $\mathrm{f}(\theta)$ has nothing to do with the data, and only contains non-data-available information about the parameters. It is the researcher's prior beliefs about the parameter distribution. The posterior density $\mathrm{f}(\theta|\ y)$ is the correction of the parameter distribution after the researcher sees the data. It combines a priori information and "current information". This method that includes a priori information provides a new idea for parameter estimation.

The full name of MCMC method is Markov Chain Monte Carlo algorithm (Markov Chain Monte Carlo). According to the foregoing, when performing Bayesian estimation, it is necessary to give the prior distribution of the parameters, and then calculate the posterior distribution of the parameters based on the known observable data. If the posterior distribution of the parameters has an analytical form, the process of calculating the parameters will be very convenient. If the posterior distribution of the parameters does not have an analytical form, the MCMC algorithm can usually be used to obtain the posterior distribution of the parameters. The MCMC algorithm improves the inefficiency of ordinary least square method and maximum likelihood estimation when estimating nonlinear models with many parameters.

An example can be used to illustrate the basic idea of Gibbs sampling. We assume that the parameter to be estimated is $\theta=\left(\theta_1,\theta_2,\ldots,\theta_p\right)$. The sample information Y^T belongs to observable data. In order to estimate the parameter θ, we must first obtain the joint posterior distribution $\mathrm{p}\left(\theta|\ Y^T\right)$ of the estimated parameter θ and the sample information Y^T, and then sample according to the joint posterior distribution to obtain the estimation result of θ. However, there are P parameters θ to be estimated, and it is very difficult to directly sample $\theta=\left(\theta_1,\theta_2,\ldots,\theta_p\right)$ from the joint posterior distribution $\mathrm{p}\left(\theta|\ Y^T\right)$. At this point, the advantages of Gibbs sampling are revealed. The posterior distribution of each parameter in θ can be calculated separately, and then the posterior distribution of these parameters can be sampled to obtain the parameter value. When performing Gibbs sampling, the first m burn-in values must be discarded in the burn-in stage to ensure the convergence of the Markov chain. Therefore, when Gibbs sampling, sufficient sampling times are required.

The specific process of Gibbs sampler sampling is as follows:

1) The algorithm first assigns arbitrary starting values $\theta^{(0)}=\left(\theta_1^{(0)},\theta_2^{(0)},\ldots,\theta_\mathrm{p}^{(0)}\right)$ to the parameters, and sets i=0.
2) The algorithm assumes $\theta^{(\mathrm{i})}=\left(\theta_1^{(\mathrm{i})},\theta_2^{(\mathrm{i})},\ldots,\theta_\mathrm{p}^{(\mathrm{i})}\right)$, and then calculates the posterior distribution of each parameter in θ and performs sampling.

a) The conditional posterior distribution $p\left(\theta_1^{(\mathrm{i}+1)}|\ \theta_2^{(\mathrm{i})},\theta_3^{(\mathrm{i})},\ldots,\theta_\mathrm{p}^{(\mathrm{i})},\mathrm{Y}^T\right)$ of $\theta_1^{(i+1)}$ is obtained.
b) The conditional posterior distribution $p\left(\theta_2^{(\mathrm{i}+1)}|\ \theta_1^{(\mathrm{i}+1)},\theta_3^{(\mathrm{i})},\ldots,\theta_\mathrm{p}^{(\mathrm{i})},\mathrm{Y}^T\right)$ of $\theta_2^{(i+1)}$ is obtained.
c) The conditional posterior distribution $p\left(\theta_3^{(\mathrm{i}+1)}|\ \theta_1^{(\mathrm{i}+1)},\theta_2^{(\mathrm{i}+1)},\theta_4^{i}\ldots,\theta_\mathrm{p}^{(\mathrm{i})},\mathrm{Y}^T\right)$ of $\theta_3^{(i+1)}$ is obtained.
d) In the same way, $\theta_4^{i+1},\theta_5^{i+1},\ldots,\theta_p^{i+1}$ is obtained.
e) The algorithm can get each sample value $\theta^{(\mathrm{i}+1)}=\left(\theta_1^{(\mathrm{i}+1)},\theta_2^{(\mathrm{i}+1)},\ldots,\theta_\mathrm{p}^{(\mathrm{i}+1)}\right)$ of the i+1-th.

3) The algorithm sets $i=i+1, i=1,2,...,N-1,N$ as the number of samples, and by repeating step (2), the algorithm can get $\theta^1=\left(\theta_1^{(1)},\theta_2^{(1)},\ldots,\theta_p^{(1)}\right),\theta^2=\left(\theta_1^{(2)},\theta_2^{(2)},\ldots,\theta_p^{(2)}\right),\ldots,\theta^N=\left(\theta_1^{(N)},\theta_2^{(N)},\ldots,\theta_p^{(N)}\right)$.
4) The algorithm deletes the first M groups (called burn-in samples, to ensure that the following sample samples are close enough to the joint allocation of $f\left(\theta_1,\theta_2,\ldots,\theta_p\right)$). Because they will be affected by the assumed initial value, the N-M group is retained for analysis. When the number of samples n is large enough, the estimated value of the parameter will be close to the actual marginal distribution.
5) We combine the sample values of θ_1 to get $\theta_1=\left(\theta_1^{(1)},\theta_1^{(2)},\ldots,\theta_1^{(N)}\right)$, then we can get the estimated value of θ_1 $\hat{\theta}_1=\frac{\sum_{i=1}^{N}\theta^i}{N-M}$. The $\theta_2,\ldots,\theta_p$ estimate is obtained in the same way.

At this point, the sampling result of the parameter θ is obtained. In real applications, it is not known how big the burn-in value m is to ensure the convergence of the sample. Although there are many ways to test the convergence of Gibbs samples, these tests usually depend on the problem to be solved.
Therefore, we must pay attention to this point in real applications to ensure that the convergence requirements are not violated.

4 RISK ASSESSMENT AND RESPONSE MECHANISM OF CHINESE ENTERPRISES' OVERSEAS INVESTMENT

Chinese enterprises going abroad and making overseas investments are also one of the important strategies for maximizing corporate value by seeking growth points and participating in international market competition. Enterprises must bear risks if they want to realize the benefits of overseas investment projects. If they refuse to bear risks, they will lose opportunities for continuous development and progress. From the perspective of risk management, enterprises maximize their corporate value by minimizing risk costs. That is, the enterprise strives to maximize the return under the condition of assuming the established risk, or to minimize the risk when the return is certain. Figure 1 shows the risk cost composition.
The maximization of returns from overseas investment projects by enterprises is also reflected in the three ways of maximizing enterprise value: minimizing capital costs, maximizing cash flow, and maximizing sustainable development capabilities. From the above, we can get the correlation model between the financial risk and corporate value of overseas investment projects, as shown in Figure 2. This article is divided into "person, property, material, responsibility" from the harm caused by insurable risk. As shown in Figure 3(a), overseas project risk management is a strict and systematic management process that runs through the entire life cycle of overseas projects. It eliminates, mitigates and controls risks by identifying and analyzing risks and choosing the most effective treatment methods. Compared with domestic projects, the risk assumptions for overseas projects are more complicated, and many risks are unimaginable, so the requirements for risk management are very high. In general, the risk management process of overseas investment projects is shown in Figure 3(b).

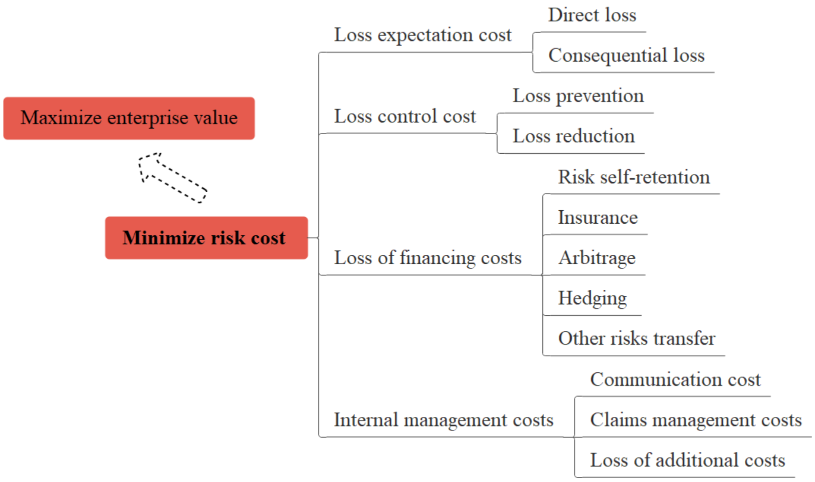


Figure 1: Risk cost composition.

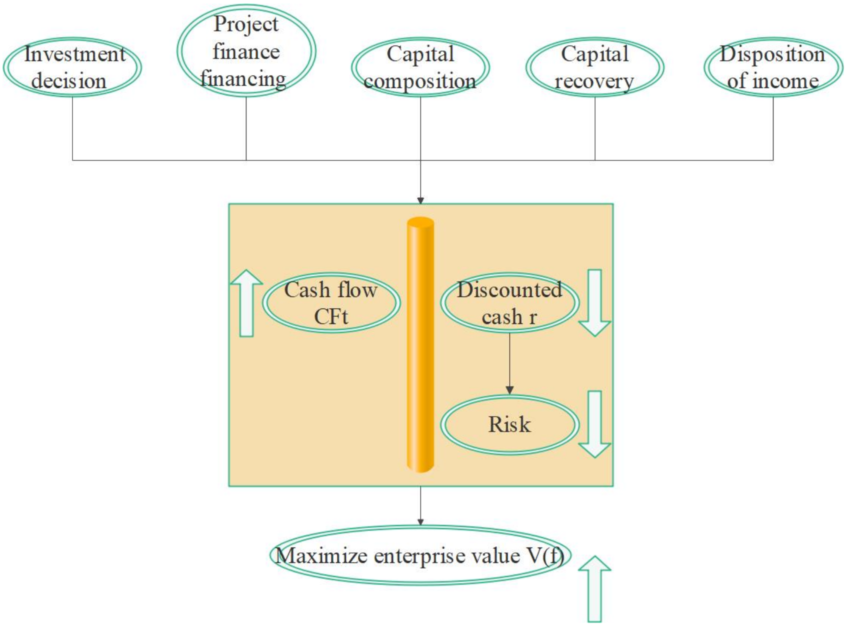
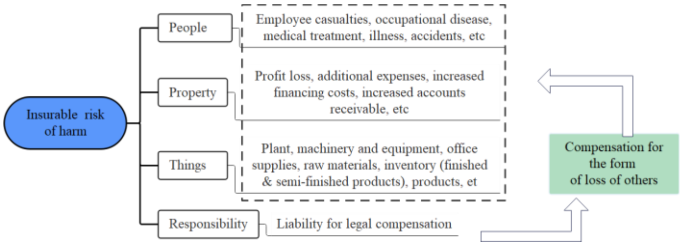
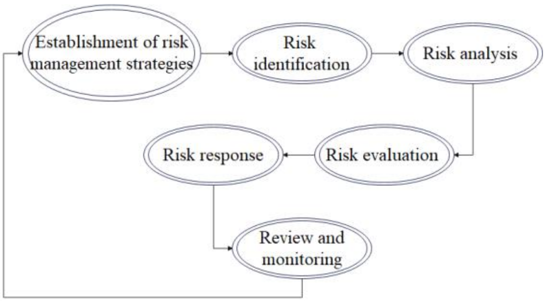


Figure 2: The relationship model between financial risk and enterprise value maximization.

The composition diagram of the total cost of insurable risks is shown in Figure 4(a). The total cost of insurable risks can help enterprises choose the optimal combination of loss control and insurance purchase methods, and maximize the value of the enterprise by minimizing the total cost of insurable risks. There are five main steps to implement risk assessment activities, as shown in Figure 4(b).

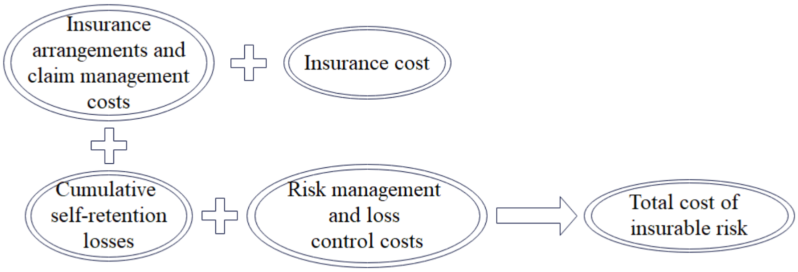


(a) Insurable risk



(b) Risk management process

Figure 3: Types and processes of risk management.



a) Total cost of insurable risk

b) Risk assessment step diagram

Figure 4: Risk assessment.

The various risk data obtained through the above risk steps will be integrated to form a comprehensive risk assessment report and a risk distribution map, which indicates the relative importance of each risk. This graphical way of summarizing corporate risks is an effective tool for communicating with company management, the board of directors, and other internal and external shareholders.

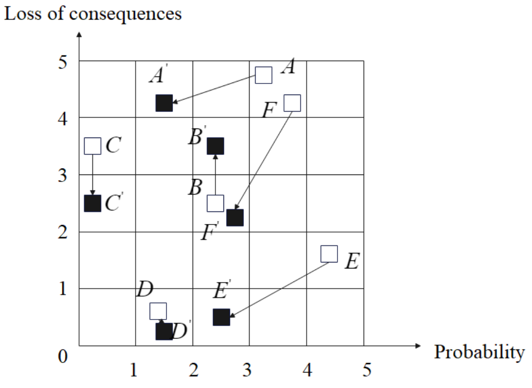


Figure 5: Risk distribution map.

In Figure 5, "o" is the original risk point after the risk assessment, and "•" is the change in the risk point after entering the risk response strategy. The schematic diagram of insurance market underwriting capacity is shown in Figure 6.

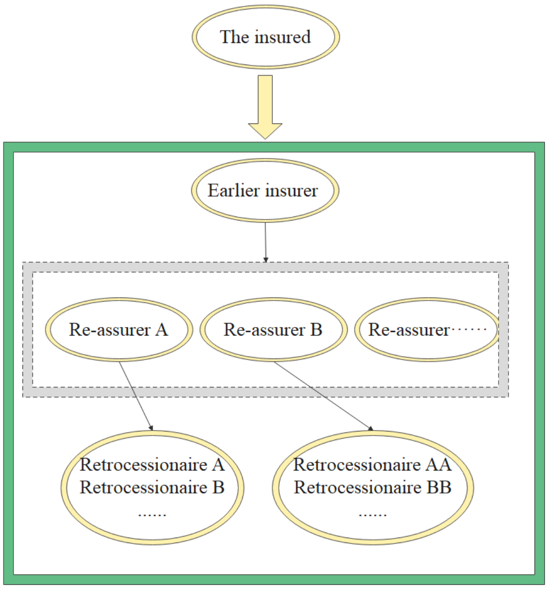


Figure 6: Schematic diagram of insurance market underwriting capacity.

The risk tolerance of overseas investment projects is mainly based on relevant financial sensitive parameters: expected income status, cash flow, maximum loss possibility, internal risk management mechanism and the risk appetite of the board of directors. The risk assessment results of the project determine the strategies for insurable risk retention and insurance transfer, as shown in Figure 7.

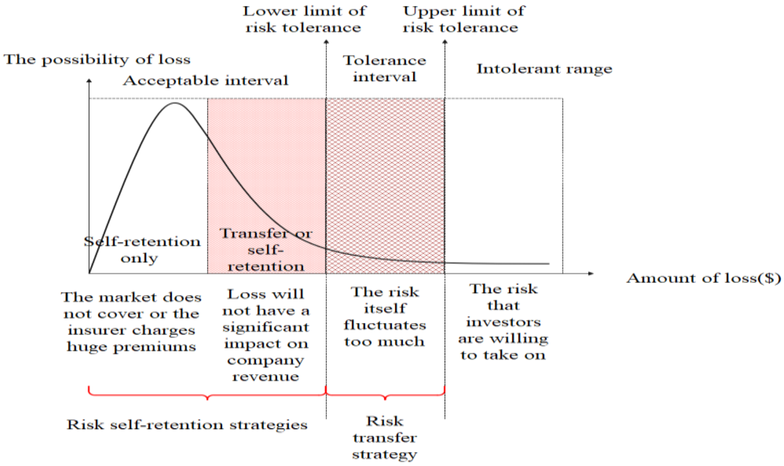
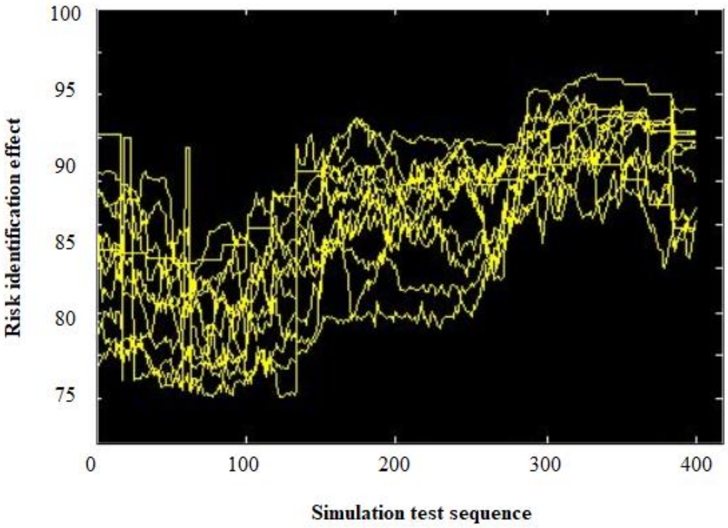
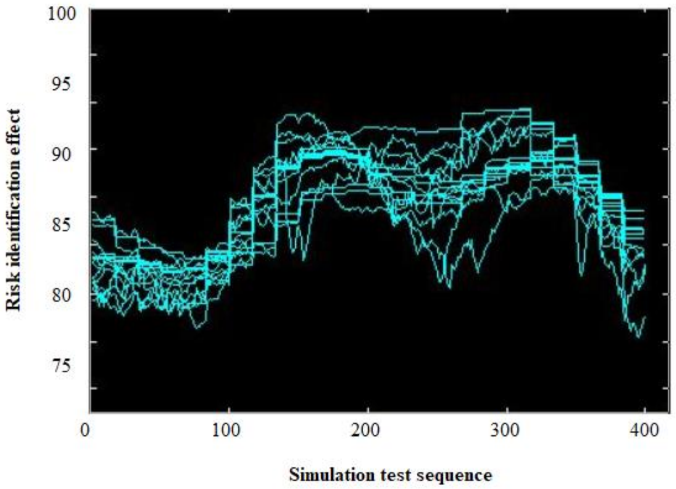


Figure 7: Insurable risk financing framework.

On the basis of the above analysis, this paper executes simulation tests and conducts risk identification on overseas investment projects acquired by the Internet. This paper simulates the time series of multiple sets of projects, and conducts simulation research on two sets of projects, and obtains the simulation results shown in Figure 8.



(a) Simulation project 1



(a) Simulation project 2

Figure 8: Evaluation of the effect of simulation risk assessment of overseas investment projects.

From the results shown in Figure 8 above, the enterprise overseas investment risk assessment system proposed in this paper has a good risk assessment effect. On this basis, this article proposes several risk response mechanisms. For overseas investment projects, Chinese enterprises should fully assess project risks, and select and formulate appropriate risk response measures on this basis, as shown in Figure 9.

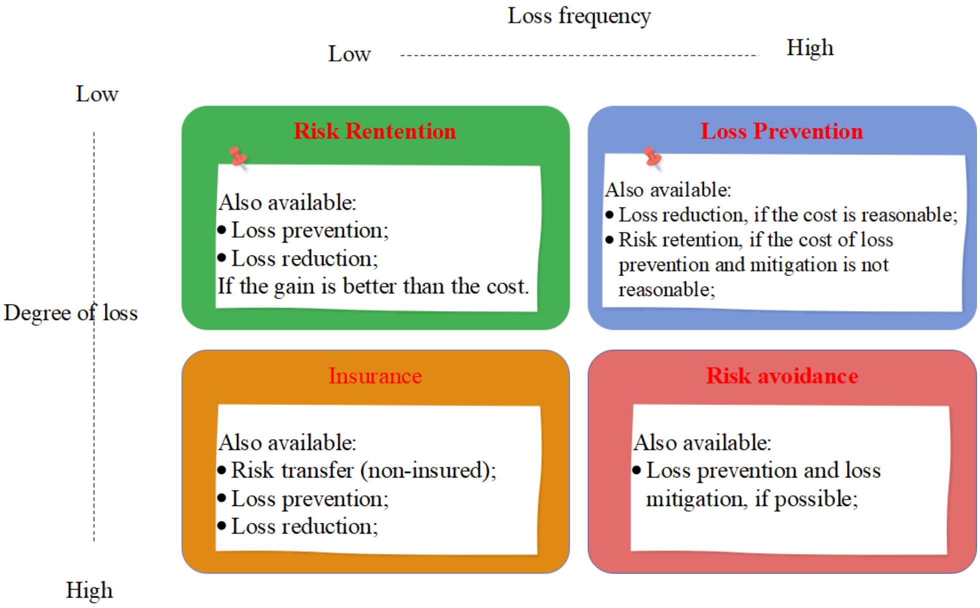


Figure 9: The response mechanism of Chinese enterprises' overseas investment risks.

5 CONCLUSION

Risks in overseas investment may come from outside the company, such as policy changes, restrictions on laws and regulations, and information asymmetry, or from inside the company, such as faults and negligence in its own operations. In short, the causes are more complicated. Under this circumstance, overseas investment of Chinese enterprises must pay attention to the identification and assessment of project risks, reduce the possibility and degree of harm of overseas project risk events, and adopt effective risk protection measures to reduce the amount of loss. Therefore, how to carry out effective risk assessment and the application of insurance schemes has important research significance for the protection of Chinese enterprises' "going out" strategy. This article combines big data technology to analyze the risk assessment of Chinese companies' overseas investment, builds an intelligent risk assessment system, classifies and identifies the risks of Chinese companies' overseas investment, and proposes corresponding response mechanisms.

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