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Study on International Settlement of Enterprises' Export Trade Business using Risk Management

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Abstract

Objectives: This paper aims to analyze the international settlement risks of enterprise export trade businesses using the analytic hierarchy process (AHP) method. **Methods:** Firstly, the international settlement risks were divided into three levels, including 13 evaluation indicators. Then an evaluation matrix was established. After the consistency test, the indicator and hierarchical weights were calculated for analysis. **Findings:** The country risk was 0.2081, the foreign exchange risk was 0.2104, the contract risk was 0.4608, the transportation risk was 0.4422, and the credit risk was 0.4852. Among these risks in international settlement, credit risk posed the greatest risk, followed by contract and transportation risks, while foreign exchange and country risks were relatively lower. **Novelty:** When assessing international settlement risks, the AHP was used, and a judgment matrix was employed to calculate the weights for each level.

Keywords: Risk Management; Export Business; International Settlement; Analytic Hierarchy Process.

1. Introduction

In international trade business, due to the differences in language, culture, and legal system between buyers and sellers, the process of trade payment and settlement is often complicated, and it is easy to fail to settle the payment due to various risks [1]. For example, some foreign illegal enterprises seek out new export businesses in China to deceive them into signing export trade contracts. After taking the goods, they will come up with various excuses, such as the restrictions imposed by their domestic laws and regulations or their own customs and habits, to find fault with the goods. This forces these enterprises to reduce the contract amount or even claim compensation. Therefore, Chinese exporters must prioritize risk management in international settlement business to achieve sustainable development in the complex and ever-changing trade environment. Some literature on risk management has been reviewed. Aliu et al. [2] conducted a study by investigating the problems of commercial banks in Kosovo in terms of risk management. They provided a series of recommendations to help improve risk management and effectively control risks.

Nezhyva et al. [3] introduced the content of risk management plans that help to build a business risk management process and provided measures on how to deal with technical risks, management risks, business risks, and external risks. Virglerova et al. [4] collected information through a questionnaire and applied a chi-square test to assess the differences between variables. They found that international companies preferred to have a professional risk manager handle risk management compared to domestic companies. Zhang et al. [5] constructed an analytic hierarchy process (AHP) model of patent risk in international trade by combining the entropy weight method with the AHP method. They determined

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the weight and relative importance of each risk factor based on the assessment results of the AHP method and classified the risk factors as "high", "medium", and "low" according to their priority. Laryea & Heard [6] argued that export credit agencies (ECAs), which provide political risk insurance for exports and foreign direct investments, may undermine the goal of investor-state dispute settlement. The research also indicated that enhancing transparency and incorporating sustainability factors into ECA activities were crucial to more comprehensively exposing these risks and creating a more sustainable growth environment for developing countries at the lower-tier level under the umbrella of international economic law.

Liu et al. [7] combined big data with e-commerce security to conduct in-depth research on the composition of e-commerce security systems and key security strategies and technologies. The analysis results showed that the proposed credential control system based on blockchain technology could effectively resist most fraudulent behaviors, ensuring secure storage and tamper-proofing of transaction data. Lee et al. [8] proposed a blockchain-based settlement system that utilizes cross-chain atomic swaps and can be applied to central bank digital currencies (CBDCs). This model introduced an administrator's ledger into the system, eliminating settlement failures and improving market management efficiency. Mohan et al. [9] proposed a peer-to-peer market settlement mechanism aimed at reducing settlement risks. Additionally, Navas et al. [10] confirmed the appropriateness of the capital-to-risk (weighted) asset ratio (CRAR) as a measure of bank soundness. In the aforementioned studies, different researchers have utilized various methods and subjects to investigate trade risks and provide corresponding risk prevention strategies. This study primarily focuses on the international settlement risks of export enterprises, analyzing the severity of different risks in the international settlement process using the AHP method. This paper analyzed the risks that export enterprises may encounter in international settlements using the AHP method. An AHP model was constructed, and some experts were invited to establish a judgment matrix based on a nine-level scale.

The weights were calculated after consistency testing to analyze the risks of international settlement. The difficulty of this article lies in selecting the factors that affect trade settlement when constructing a hierarchical structure model. After reviewing the literature, this article divided international settlement risks into external and internal risks. By using the AHP method to construct a hierarchical structure model and then calculating the weights in the model using a judgment matrix, this article provides an effective reference for analyzing international settlement risks. The limitation of this article lies in the possibly incomplete consideration of factors that influence international settlement risk. Therefore, future research should focus on expanding the investigation of these influencing factors.

2. International Settlement Methods and Risks

The most commonly used international settlement methods can be summarized as remittance, collection, and letter of credit [11]. Among them, remittance can be subdivided into three categories: mail transfer (M/T), telegraphic transfer (T/T), which can be divided into T/T in advance and T/T after shipment, and demand draft (D/D). Collection can be divided into two types: documents against payment (D/P) and documents against acceptance (D/A). After reviewing the literature, this paper divides the international settlement risk of enterprises' export trade business into external risk and internal risk.

2.1. External Risks

External risks can be caused by various reasons, such as changes in national policies and laws, economic policy changes, bankruptcy of the paying bank, external fraud risks, etc. For example, if there is a war or uncertainty in the trade policy of the customer's country [12], it is highly likely that the customer will be unable to pay for and collect the goods. As a result, the exporter will not be able to receive payment. There is also a possibility that the customer may invoke the "soft clause" when opening a letter of credit [13] or send a counterfeit check after receiving the goods to avoid payment. However, in the import/export business, payment for goods is made through bills of exchange. Customers can easily use counterfeit bills to deceive exporters, who only discover the fraud when they present the bills at the bank for collection. This ultimately results in both financial and merchandise losses.

2.2. Internal Risks

The internal risk in the international settlement of export trade business mainly arises from inadequate preparation by the enterprise itself or a lack of attention from relevant personnel. For example, failing to conduct a thorough investigation into a new customer's overall creditworthiness before establishing a cooperative relationship can result in an incomplete understanding of their integrity and ability to make payments, potentially leading to deliberate non-payment or an inability to take responsibility for the payment of goods. Or, before signing the sales contract, the important terms of the contract on the requirements of goods, payment time, etc. are not carefully examined, and there are some unreasonable terms in the contract, resulting in non-compliance with delivery or document opening provisions, which can prevent export enterprises from recovering payment.

3. The AHP model

To analyze the risks that an enterprise's export trade business may encounter in international settlement in a more organized manner, this paper used the AHP method [9] to quantitatively analyze the risk factors. The following are the specific steps of the AHP method.

3.1. Building a Hierarchical Structure Model

The AHP method generally consists of three levels: the goal level, the criterion level, and the indicator level. In this article, the goal level is international settlement risk; the criterion level includes four risk indicators: country risk [14, 15], foreign exchange risk [16], contract risk [17], and credit risk. The specific indicators are shown in Figure 1.

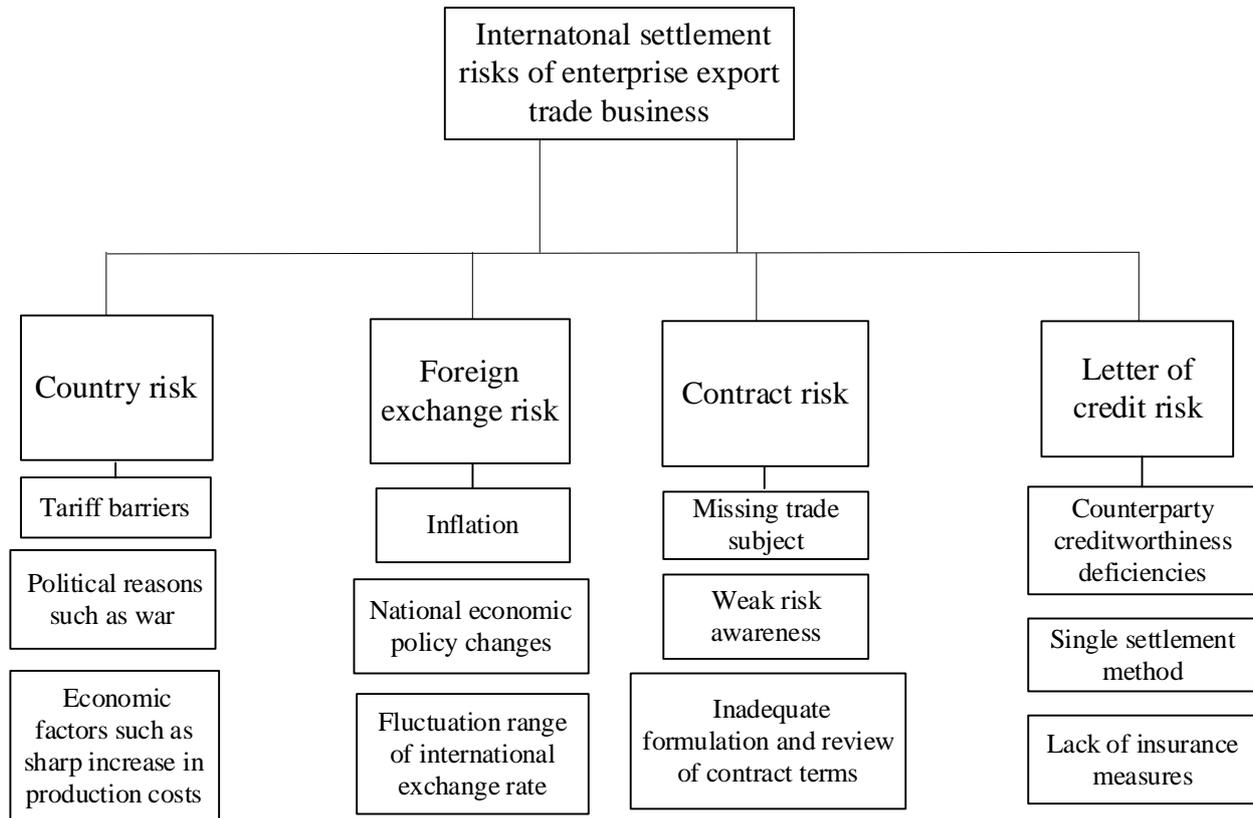


Figure 1. International settlement risk evaluation index system of enterprise export trade business

3.2. Scalar Determination and Construction of Judgment Matrix

In this paper, the survey results were summarized using the questionnaire form, and a two-by-two importance judgment matrix was constructed. The relative importance between indicators *i* and *j* was evaluated using a nine-level scale, as shown in Table 1. Table 1 presents a scale of relative importance between two indicators, using a total of nine numbers ranging from 1 to 9. The higher the number, the greater the relative importance.

Table 1. The nine-level scale method and corresponding meanings

The degree of i importer than j	Equivalent	Slightly stronger	Strong	Very strong	Absolutely strong
a_{ij}	1	3	5	7	9

2, 4, 6, and 8 were between the importance levels corresponding to 1, 3, 5, 7, and 9, respectively. Assuming that a total of *n* elements are involved in the comparison, then the matrix is:

$$A(a_{ij})_{n \times n} = \begin{bmatrix} a_{11} & \dots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \dots & a_{nn} \end{bmatrix} \tag{1}$$

where *n* is the number of indicators and a_{ij} is the relative importance between indicators *i* and *j*.

3.3. Solving the Weight of Each Layer

The weight of the constructed judgment matrix A is calculated using the geometric mean method, and weight vector W_i is obtained. The weight vector represents the relative importance of factors at the same level to factors at higher levels.

3.4. Consistency Test

The first step is to calculate maximum eigenvalue λ_{max} of judgment matrix A:

$$\lambda_{max} = \sum_i^n \frac{(AW)_i}{nw_i}, \tag{2}$$

where A represents the matrix and W is the weight.

The second step is to calculate the consistency index (CI) based on the derived λ_{max} , and its formula is defined as:

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{3}$$

where λ_{max} is the maximum eigenvalue of the matrix, and n is the number of comparison factors. CI = 0 indicates complete consistency; the larger the value of CI, the more serious the inconsistency.

The final step is to calculate the consistency ratio CR [18], and the formula is defined as follows

$$CR = \frac{CI}{RI} \tag{4}$$

The judgment matrix consistency test was established when $CR < 0.1$; otherwise, the judgment matrix was adjusted until the consistency test was established. For the value of RI in the above formula, the method of random simulation was used to obtain the corresponding average random index (RI). Table 2 provides the values of RI used for calculating the consistency ratio, which are obtained through random simulation.

Table 2. Values of average RI

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

4. Analysis of Experimental Results

This paper developed a questionnaire related to the evaluation factors in order to calculate the weights of the five different risks and their indicators in the criterion level. Ten local experts with rich experience in risk management in corporate export trade business were invited to score the evaluation factors based on the nine-level scale method. The corresponding scoring criteria are shown below. Nine points were given if the risk is very easy to occur, seven points were given if risk is easy to occur, five points were given if risk will occur, three points were given if risk is unlikely to occur, and one point was given if risk is nearly impossible to occur. The judgment matrices in Tables 3 to 8 were constructed using the scoring results from the expert questionnaire and the following paired comparison matrix formula. Table 3-8 show the importance levels of different risk indicators in international settlement processes. The values for importance levels can be found in Table 1, while the inverse of these values represents the unimportance levels. Taking Table 3 as an example, 'country risk' is more important than 'foreign exchange risk' (level 2), whereas 'foreign exchange risk' is less important than 'country risk' (level 1/2).

$$A = \begin{bmatrix} C1/C1 & \dots & Cn/C1 \\ \vdots & \ddots & \vdots \\ Cn/C1 & \dots & Cn/Cn \end{bmatrix} \tag{3}$$

Table 3. International settlement risk judgment matrix for export business

	Country risk	Foreign exchange risk	Contract risk	Transportation risk	Credit risk
Country risk	1	2	1/2	3	1/3
Foreign exchange risk	1/2	1	1/3	1/3	1/3
Contract risk	2	3	1	3	1/2
Transportation risk	1/3	3	1/3	1	1/2
Credit risk	3	3	2	2	1

Table 4. Country risk judgment matrix

	Tariff barriers	Political reasons such as war	Social reasons such as strikes
Tariff barriers	1	1/3	2/3
Political reasons such as war	3	1	2
Social reasons such as strikes	3/2	1/2	1

Table 5. Foreign exchange risk judgment matrix

	Inflation	National economic policy changes	Large fluctuations in exchange rates
Inflation	1	2	2
National economic policy changes	1/2	1	1
Large fluctuations in exchange rates	1/2	1	1

Table 6. Contract risk judgment matrix

	Missing contract terms	Careless contract review
Missing contract terms	1	1
Careless contract review	1	1

Table 7. Transportation risk judgment matrix

	Damage to cargo in transit	Collusion between the other party and the freight forwarder
Damage to cargo in transit	1	2
Collusion between the other party and the freight forwarder	1/2	1

Table 8. Credit risk judgment matrix

	Counterfeit stamps	Malicious refusal to pay	Multiple extensions of payment deadlines
Counterfeit stamps	1	2	4
Malicious refusal to pay	1/2	1	2
Multiple extensions of payment deadlines	1/4	2	1

After obtaining the above judgment matrices based on the statistics of experts' evaluation, the values of the judgment matrices were used to calculate the CR and weight of each index in the AHP model. Then, the indicators were ranked. The specific research results are shown in Table 9. Table 9 presents the weights of each indicator in the hierarchical structure, which were calculated using the judgment matrix discussed earlier. Additionally, all indicator weights have undergone consistency testing.

Table 9. International settlement risk analysis model for enterprise export trade business

Target layer	Criterion layer	CR	Weight	Indicator layer	Weight	CR	Ranking	
International settlement risk of enterprises' export foreign trade business	Country risk	0.2081	0.2081	Tariff barriers	0.3439	0.0467	6	
				Political reasons such as war	0.1083		13	
				Social reasons such as strikes	0.1416		11	
	Foreign exchange risk	0.2104	0.2104	0.2104	Inflation	0.1354	0.0422	12
					National economic policy changes	0.1819		8
					Large fluctuations in exchange rates	0.2708		7
	Contract risk	0.0326	0.4608	0.4608	Missing contract terms	0.4233	0.0377	3
					Careless contract review	0.4179		5
	Transportation risk	0.4422	0.4422	0.4422	Damage to cargo in transit	0.5214	0.0419	2
					Collusion between the other party and the freight forwarder	0.1476		10
	Credit risk	0.4852	0.4852	0.4852	Counterfeit stamps	0.1665	0.0385	9
					Malicious refusal to pay	0.4203		4
Multiple extensions of payment deadlines					0.6724	1		

As shown in Table 9, the judgment matrix composed of country risk, foreign exchange risk, contract risk, transportation risk, and credit risk at the criterion level had a CR of 0.0326, which was less than 0.1. This indicated that the matrix passed the consistency test and that the weights calculated by the judgment matrix were credible. The CR for "country risk" was 0.0467, the CR for "foreign exchange risk" was 0.0422, the CR for "contract risk" was 0.0377, the CR for "transportation risk" was 0.4422, and the CR for "credit risk" was 0.4852, indicating that all of them passed the consistency test, i.e., the weights calculated by the judgment matrix were effective.

The weights of the five evaluation criteria were as follows: "country risk" had a weight of 0.2081, "foreign exchange risk" had a weight of 0.2104, "contract risk" had a weight of 0.4608, "transportation risk" had a weight of 0.4422, and "credit risk" had a weight of 0.4852. It was obvious that credit risk had the largest weight, followed by contract risk and transportation risk, and the weight of foreign exchange risk and country risk was relatively small.

By calculating the weights of the 13 evaluation indicators at the indicator level and ranking them according to their weights, it was seen that the greatest weight was assigned to "multiple extensions of payment deadlines", followed by "damage to cargo in transit". However, there was no significant difference in the weights of "missing contract terms", "malicious refusal to pay", and "careless contract review", which showed that these five evaluation indicators were relatively important. At the same time, it also confirmed the importance of credit risk, contract risk, and transportation risk among the five risks at the criterion level. The indicator with the lowest weight was "political reasons such as war" because exporters consider the overall environment of the buyer's country before negotiating with both sides and will not enter into contractual transactions with companies in countries where there is a war. Therefore, this evaluation indicator had minimal impact on the international settlement risk of an enterprise's export foreign trade business.

5. Discussion

The rapid development of economic integration has led to an increase in international business cooperation. In the context of international trade settlements, avoiding risks and ensuring secure payment settlements have become important challenges for export enterprises. There have been numerous studies on the risk of trade settlement. In previous literature reviews, some researchers have examined risk management from the perspective of bank activity management. Other researchers have conducted questionnaire surveys to investigate the factors that influence trade settlement risks. Additionally, some researchers have utilized the AHP method to analyze the hierarchical structure of trade settlement risks and employed the entropy weight method to calculate weights for indicators within this hierarchical structure. Compared to the aforementioned research content, this article took a perspective from international trade settlement and utilized the AHP method to categorize settlement risks into different structures. Subsequently, a judgment matrix was constructed using a nine-level scale method, and after completing consistency testing, the weights of structural indicators were calculated in order to analyze the risk factors that impact international trade settlement. The paper used the AHP method to analyze the specific forms of international settlement risks in export foreign trade business. It divided the risks of international settlement into three levels and 13 evaluation indexes, established judgment matrices using a nine-level scale, and calculated the weights after consistency testing to analyze the risks of international settlement. The results of the study showed that, according to the ranking of the weights assigned to the 13 evaluation criteria, "multiple extensions of payment deadlines" received the highest weight, followed by "damage to cargo in transit"; the weights of "missing contract terms", "malicious refusal to pay", and "careless contract review" were not much different; the indicator with the lowest weight was "political reasons such as war". Therefore, according to the above findings, the following recommendations are made on how to reduce the risk of international settlement:

- 1) To address the risk factors of "multiple extensions of payment deadlines" and "malicious refusal to pay", a customer information management system can be established [19]. For new customers, their creditworthiness is checked and entered into the system before establishing a cooperative relationship, minimizing the risk of subsequent international settlements. For old users, the integrity management information of their previous trade business can be added to the system to facilitate subsequent inquiries. In this way, the seller can avoid cooperation with customers who have low integrity in export-trade cooperation. If cooperation is required, the seller can also adopt an international settlement method that is self-beneficial to reduce the risk of international settlement business.
- 2) The terms of sales contracts can be improved by strengthening the management of professionals in the enterprise [20]. Risk factors such as "missing contract terms" and "careless contract review" can be avoided as much as possible. When signing a contract with a buyer, the seller should specify the payment method, letter of credit opening time, latest delivery deadline for goods, advance payment percentage, payment timeframe, scope of contractual items, performance and supervision methods during project or trade execution, as well as claims division and management. It is also possible to stipulate in the contract that a portion of the advance payment be paid upfront to recover potential losses in case of non-performance according to the contract.
- 3) Considering the risk factor of "damage to cargo in transit", the seller can assign dedicated personnel to monitor the export goods in real-time and dynamically. When choosing a freight shipping company, the seller can choose one with whom they usually cooperate, ensuring safe cargo transportation. Once transportation begins, exporting enterprises will assign specialized personnel to closely track the movement and arrival time of goods, enabling timely reminders for buyers regarding pickup and payment settlement.

6. Conclusion

The article analyzed the international settlement risks of export foreign trade business using the AHP method and calculated the weights of the hierarchy structure using a judgment matrix constructed by the nine-level scale method. The final results indicated that in international settlements, credit risk had a weight of 0.4852, contract risk had a weight of 0.4608, transportation risk had a weight of 0.4422, foreign exchange risk had a weight of 0.2104, and country risk had a weight of 0.2081. Credit risk is identified as the highest risk in international settlements, followed by contract and transportation risks, whereas foreign exchange and country risks are relatively lower.

7. Declarations

7.1. Data Availability Statement

The data presented in this study are available in the article.

7.2. Funding

The author received no financial support for the research, authorship, and/or publication of this article.

7.3. Institutional Review Board Statement

Not applicable.

7.4. Informed Consent Statement

Not applicable.

7.5. Declaration of Competing Interest

The author declares that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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