Risk Identification of Bulk Commodity Electronic Trading Based on HHM

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Abstract: There are many participants in bulk commodity electronic trading, and the trading modes are diverse. The factors that trigger risks are complex and changeable, and the risks are difficult to identify. This paper establishes a risk identification framework for bulk commodity electronic trading based on HHM, and identifies the risks of bulk commodity electronic trading from the perspective of multi-agent and system. According to the text data, risk factors are extracted based on the content analysis method. Through further statistical analysis, the trading platform, dealers, trading banks and delivery warehouse are derived as the main risk subjects. Combined with the bulk commodity electronic trading mode and business process, the risk factors of bulk commodity electronic trading are systematically extracted to provide support for the risk management of bulk commodity electronic trading.

Keywords: Bulk Commodity, Electronic Trading, HHM, Risk Identification.

1 INTRODUCTION

Bulk commodity electronic trading, also known as online spot trading or spot position trading, is a trading method that uses computer network to organize the same goods in different places, synchronous centralized bidding or one-way bidding, unified matching, unified settlement, and real-time display of price quotations. With the development trend of the bulk commodity electronic trading market, it has evolved from the simple material circulation to trade financing, financial speculation, and other directions, highlighting the characteristics of multiple agents, diverse trading models and complex and volatile risks. The continuous occurrence of risks has seriously affected the normal operation of the bulk commodity electronic trading market and damaged the interests of the trading subjects. Therefore, how to comprehensively and accurately analyse and identify various risks, and how to effectively integrate these information into a systematic and standardized risk identification framework to meet the current and future business development needs of the bulk commodity electronic trading market is particularly important.

Domestic and foreign scholars have identified and analyzed the risks of the bulk commodity electronic trading market from a macro perspective. Zhou et al. summarized and analyzed the current situation and development trend of the supervision and service technology of the bulk commodity trading market [1]. Cao et al. and Fu through their analysis of the commodity

trading market, emphasized that China's commodity market faces problems such as single and fixed model granularity and poor accuracy of market risk early warning [2-3]. Wang et al. used LDA topic model to identify risk elements of electronic trading of commodities based on news texts in the commodities domain [4]. Shi and Feng established the risk identification and classification framework of bulk commodity electronic trading market from the perspective of trading centers and traders [5]. Wang et al. and Feng et al. systematically organize the main risk involved in electronic trading centers of commodities by analysing major risk events [6-7]. More risk analysis work usually focuses on a certain type of risk factors, such as price fluctuation risk, supply risk, financial risk, etc. Bakas and Triantafyllou studied the prediction ability of macroeconomic uncertainty on the volatility of agricultural, energy, metal and other commodity markets [8]. Hu and Wu studied the relationship between international commodity price volatility and domestic financial market representative index volatility and found that there is a significant two-way spillover effect between China's financial market volatility and international commodity market volatility [9].

Domestic and foreign studies often focus on a single type of risk, lacking systematic analysis of market risk from multiple risk subjects and multiple analysis granularity. At this stage, electronic trading market risk has been characterized by cross-region, cross-platform, multi-agent and multi-mode. The market risk analysis needs to conduct effective dynamic granularity scaling according to the changes of regulatory objects and requirements. Based on this, this paper focuses on the subject risk of bulk commodity electronic trading, analyses the information of bulk commodity electronic trading market from multiple perspectives and dimensions in combination with trading mode and business process, introduces the idea and methodology of HHM(Hierarchical Holographic Model), and proposes a risk identification model of bulk commodity electronic trading market based on HHM. Based on the text data analysis of bulk electronic trading risk cases and events, using the content analysis method to iteratively extract risk elements through statistical analysis, this paper establishes a multi-agent bulk commodity electronic trading market risk identification framework system from the perspective of trading platform, dealers, trading banks and trading positions. The multi-agent risk index identification method of bulk commodity electronic trading proposed in this paper can more systematically extract and identify risks, and provide support for risk management of bulk commodity electronic trading.

2   HHM FRAMEWORK FOR BULK COMMODITY ELECTRONIC TRADING RISK

In the process of bulk commodity electronic trading, there are many subjects involved, which is a complex system engineering to identify the multi-agent risk of bulk commodity electronic trading. HHM model can study the system from multiple angles and multi-dimensions, conduct comprehensive and detailed risk identification analysis on complex multi-agent system, and finally form a relatively complete set of risks.

2.1   HHM Model

Hierarchical Holographic Model is a comprehensive systemic thinking model to express the essence and characteristics of a system, and to identify and assess the risk of the whole system

from multiple dimensions and perspectives. The model structure can be refined through continuous cycles and iterations to identify the various risk elements in the system. The traditional mathematical identification models have limited reflection of various aspects within the system, mainly because they are mostly two-dimensional and cannot describe the whole system precisely, completely and clearly. A system contains not only elements, objectives and constraints, but also other factors. The description of risk factors cannot be completed by using only a single system model. HHM model establishes a system risk factor identification framework with a holographic multidimensional perspective, which better solves the problem of risk factor identification in large systems.

2.2   Construction of Transaction Risk HHM Framework

The bulk commodity electronic trading market is greatly affected by the upstream and downstream of the supply chain, international prices, and market fluctuations. There are many uncertain factors in the trading process, and the trading subjects present multiple correlations. There are many factors and complex scenarios that cause market systemic risk. Kaplan and Garrick gave three sets of risk definitions $R=\{(S_i, L_i, X_i)\}_C$. In the commodity electronic trading market, S_i refers to the risk subject of commodity electronic trading. L_i indicates the possibility of the risk of the third risk subject; X_i indicates the loss vector or consequence caused by the ith risk subject. C indicates that all risk entities in the system are included in the risk entity S_i. The formula proves that risk identification first needs to find the risk subject of the assessed object, and the comprehensive nature of the risk subject determines the accuracy and reliability of the risk assessment results.

In the process of bulk commodity electronic trading, the price of bulk commodities fluctuates frequently and greatly, which enables dealers to use the price law to make speculative profits or hedge, and destroy the forward transaction for the purpose of goods trading; If the applicable laws and regulations are not perfect, or the trading platform operates in violation of regulations, such as unreasonable forced closing operations, the interests of dealers will be seriously damaged. Furthermore, if the third-party depository institution lacks necessary security measures, there is a risk of misappropriation of funds. To sum up, risk subject is contained in all links of electronic commodity trading. By analysing the process of electronic commodity trading market, the subject information of electronic commodity trading in different trading modes can be mined.

The electronic transaction of bulk commodities involves various links from the preparation of goods before the transaction to the delivery and settlement after the transaction is completed. The main links include warehousing, trading, delivery, settlement, financing, etc. At present, the trading process of bulk commodity electronic trading is mainly shown in Figure 1 below.
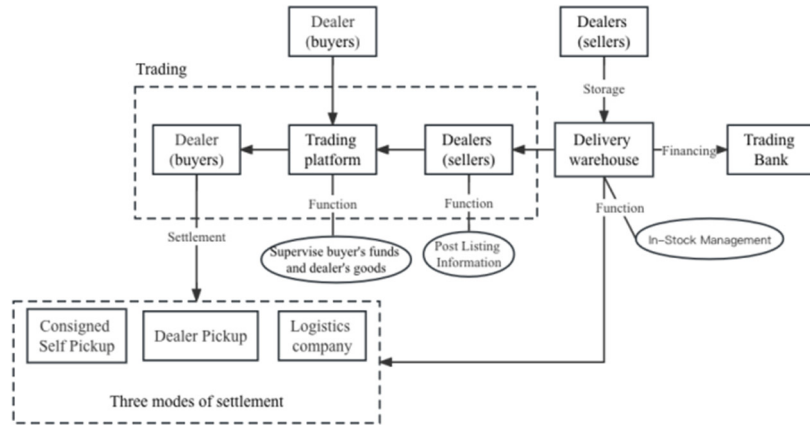
Figure 1: Business flow chart of bulk commodity electronic trading market

Through the analysis and research of several representative and large-scale bulk commodity electronic trading models in China, this paper summarizes several trading models mainly used by bulk commodity electronic trading platform, including spot trading model, listing trading model, bidding trading model, and bidding trading model.

Further, by analysing and studying the trading process of the bulk commodity electronic trading market, we can find that there are many interest entities participating in the bulk commodity electronic trading market. In order to screen the main risk subjects of commodity electronic trading, 72 cases related to commodity electronic trading risk in the past 10 years were collected through mainstream search engines, literature databases, commodity trading platforms, legal documents and other channels, and risk subjects were extracted based on risk cases. Among many risk subjects, the electronic trading platform, trading bank, Delivery warehouse and dealer have the highest frequency.

2.3 Risk Identification Process of Bulk Commodity Electronic Trading

The HHM model is used to analyse and identify the risk factors of the bulk commodity electronic trading market from the multi-agent perspective, and the content analysis method, statistical analysis method and other methods are used to analyse and study the data and models of the literature research on the risk of bulk commodity electronic trading, and the analysis results of the multi-agent system risk factors are obtained, which are brought into the summarized bulk trading risk cases in recent decades for comparative verification. The iterative process of risk analysis is mainly shown in Figure 2 below:
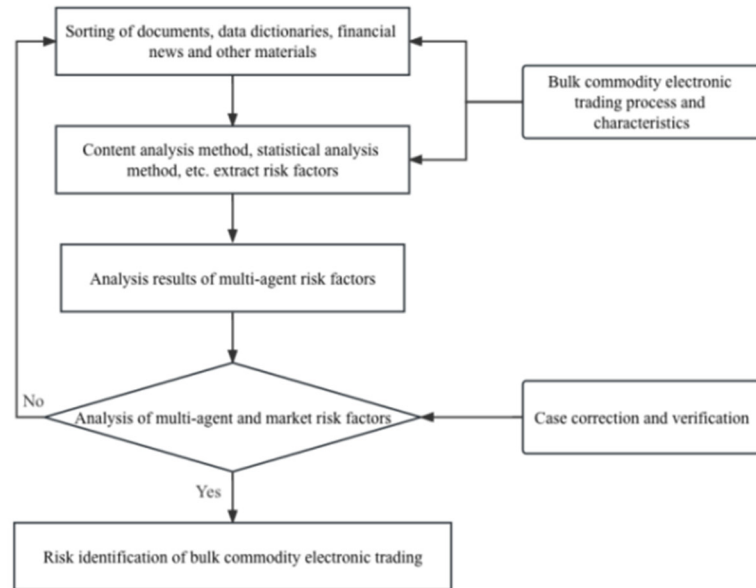
Figure 2: Risk factor analysis and identification process

Based on the analysis of the trading process of the bulk commodity electronic trading market and the mining research of case data, taking the trading platform, dealers, trading banks and delivery warehouse as the main risk subjects and combining the characteristics of the bulk commodity market, the above steps have been used to complete multiple iterative process analysis, and a relatively complete risk indicator system of the bulk commodity electronic trading market has been obtained.

3   RISK FACTORS IDENTIFICATION OF BULK COMMODITY ELECTRONIC TRADING BASED ON HHM

3.1   Trading Platform Risk

Bulk commodity electronic trading platform refers to the e-commerce platform that provides enterprises and individuals with trading, capital settlement, settlement and other related services. During the operation of the trading platform, due to changes in the external legal environment or various participants of the trading platform do not comply with relevant laws and regulations, it may cause negative legal consequences to the trading platform. In terms of trading, settlement, settlement, financing, risk control, internal management, etc., the implementation and modification of the trading platform are not in place due to the formulation of the system. At the same time, due to the internal reasons of the trading platform, there are problems in the information network system supporting the business operation and the technology and measures to ensure the continuous operation of the business,

which may cause losses to the trading platform. Based on the relevant analysis, identify the risk analysis elements of the electronic trading platform as shown in Table 1.

Table 1: Trading platform risk factors analysis.

Risk level 1	Risk level 2	Risk screening path
Qualification risk	Business license	Legal person certificate
	Enterprise credit	Legal person certificate Platform announcement
Institutional risk	Inadequate system	Platform announcement
	Inadequate system implementation	Platform data
Legal risk	Illegal activities	Legal instrument
	Violations	Administrative penalty news
Operational risk	Technical risk	Fault record
	Operational risk	Platform data

3.2   Dealer Risk

Dealers refer to enterprise users or individual users who participate in trading or other related businesses on the trading platform and receive relevant services. They are the most active factor in the operation of the bulk commodity electronic trading market. The potential risks that dealers may bring to the parties involved in the transaction and the trading platform in the process of their participation in trading activities due to their low credit rating, or their illegal and illegal behaviours. Meanwhile, the dealer fails to perform the transaction and delivery contract due to the sudden change in the price of the traded commodity, problems in its own operation and management, insufficient loan preparation, or the quality of the goods not in line with the agreement, thus damaging the interests of the observant party and causing serious interference to the market. Based on the relevant case analysis, identify the risk analysis elements of dealers as shown in Table 2. For example, in the Shanghai steel price crash, it was precisely because most of the steel trading enterprises in Shanghai fell into huge losses and the capital chain was broken, and a large number of steel traders went bankrupt, leading to the Shanghai Steel Trade Case.

Table 2: Dealer risk factors analysis.

Risk level 1	Risk level 2	Risk screening path
Credit risk	Dealer Credit	Enterprise Credit Information System
	Violations	Enterprise Credit Information System
Transaction performance risk	Non-performance risk	Platform announcement
	Loan payment risk	Platform Data
	Cargo delivery risk	Platform Data

3.3 Trading Bank Risk

The trading bank provides services for the transactions in the bulk commodity electronic trading market but is vulnerable to the impact of information asymmetry risk, the biggest impact of which is the risk of warehouse receipt pledge. Based on the relevant analysis, identify the risk analysis elements of electronic transaction banks as shown in Table 3. For example, Qingdao Decheng Mining Co., Ltd. and several warehousing companies issued warehouse receipts respectively, and then used the loophole of bank information asymmetry to repeatedly pledge to different banks to defraud loans, leading to the occurrence of risks.

Table 3: Trading bank risk factors analysis.

Risk level 1	Risk level 2	Risk screening path
Information asymmetry risk	Warehouse receipt pledge	data dictionary
	Fake bill	data dictionary
	Default loss rate	Data dictionary dynamic risk exposure
	Monetary interest rate	China Money Network

3.4 Delivery Warehouse Risk

The delivery warehouse is the storage place of electronic trading commodities selected by the electronic trading center. In recent years, there have been many repeated pledge events of aluminium ingot warehouse receipts in the aluminium spot market. The main risks involved include non-standard warehousing quality inspection, non-standard storage of goods, and internal and external collusion. Based on the correlation analysis, identify the risk analysis elements of trading warehouse as shown in Table 4.

Table 4: Delivery warehouse risk factors analysis.

Risk level 1	Risk level 2	Risk screening path
Regulatory pledge of goods risk	Non-standard warehousing quality inspection	Data dictionary
	Irregular preservation of goods	Data dictionary
	Internal and external collusion	Data dictionary
	Standardization of warehouse receipt elements	News Corpus
	Perfection of warehousing elements	News Corpus

3.5 Market Risk

Due to changes in the supply and demand relationship of commodities in the market, macro-control, natural disasters and other reasons, the price of relevant commodities fluctuates abnormally. This fluctuation may be transmitted to the price of trading commodities on the trading platform, which may cause the risk of loss or default of a large number of trading users. Meanwhile, when the national and industrial policies change, it may also lead to the risk that the operation of the trading platform will be greatly affected. Based on the correlation analysis, the market risk factors identified are shown in Table 5.

Table 5: Market risk factors analysis.

Risk level 1	Risk level 2	Risk screening path
Price fluctuation risk	Supply and demand changes	News Corpus
	Macro-control	News Corpus
	Natural disaster	News Corpus
	Joint operation	News Corpus
	Insider trading	News Corpus
Policy risk	Policy risk	News Corpus
	Industry Policy Changes	News Corpus

3.6 Bulk Commodity Electronic Trading Market Risk Indicator System

Based on the risk factors of various stages of bulk commodity electronic trading identified from the perspective of the above trading platform, trading customers, trading banks, delivery warehouse and market system, the risk indicator system of bulk commodity electronic trading market is constructed, as shown in Table 6.

Table 6: Bulk commodity trading market risk indicator system.

Risk subject	Risk level 1	Risk level 2
Trading platform P_1	Qualification risk R_1	Business license
		Enterprise credit
	Institutional risk R_2	Inadequate system
		Inadequate system implementation
	Legal risk R_3	Illegal activities
		Violations
	Operational risk R_4	Technical risk
Dealer P_2	Credit risk R_5	Dealer Credit
		Violations
	Transaction performance risk R_6	Non-performance risk
		Loan payment risk
		Cargo delivery risk
Trading bank P_3	Information asymmetry risk R_7	Warehouse receipt pledge
		Fake bill
		Default loss rate
		Monetary interest rate
Delivery warehouse P_4	Regulatory pledge of goods risk R_8	Non-standard warehousing quality inspection
		Irregular preservation of goods
		Internal and external collusion

		Standardization of warehouse receipt elements
		Perfection of warehousing elements
Market P_5	Price fluctuation risk R_9	Supply and demand changes
		Macro-control
		Natural disaster
		Joint operation
		Insider trading
	Policy risk R_{10}	Policy risk
		Industry Policy Changes

4   CONCLUSIONS

HHM can display the different characteristics and properties of the system from multiple angles, which is very suitable for identifying the risks of bulk commodity electronic trading. This paper constructs a framework of bulk commodity electronic trading based on HHM; Focusing on the characteristics of the trading platform, dealer, trading banks, delivery warehouses and commodity markets, starting from the analysis of the trading process and business model of the commodity electronic trading market, a risk identification model is constructed, and a list of commodity electronic trading risks based on sustainability is obtained. The HHM method overcomes the shortcomings of the traditional risk identification methods in terms of systematicness and integrity, which can comprehensively and systematically identify the risk factors of the bulk commodity electronic trading market. This study provides an important supplement to the systematic study of commodity risk indicators, builds a comprehensive and feasible risk indicator system, provides support for the risk management of commodity electronic trading, and provides index and calculation support for the subsequent quantitative analysis and early warning of commodity electronic trading market risk.

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