The Fluctuation Characteristics and Risk Investigation of China's Gold Future Market

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Abstract: This paper deeply explores the fluctuation characteristics and risks of China's gold futures market. Through the collection of data on macroeconomic factors, stock index interest rates, and energy futures, the paper employs multiple linear regression models and intermediary variable models to quantitatively analyze the impact of these factors on the volatility of gold futures prices. The research finds that there is a significant positive correlation between the gold futures price and the growth of the U.S. GDP and the silver futures price index, while the impact of other macroeconomic indicators such as China's gold reserves and the inflation rate is not significant. Policy support and market regulation play a key role in the healthy development of the market, and the broad participation of market participants and the innovation of financial products have driven the diversification of the market. The intermediary effect analysis shows that the impact of macroeconomic factors on the gold futures price is partially indirect through the intermediary variable of stock index interest rates.

Keywords: Gold Futures, Fluctuation Characteristics, Risk Influencing Factors.

1.   Introduction

This study establishes a rigorous research framework to analyze China's gold futures market, utilizing authoritative data sources for accuracy [1]. It applies multiple regression and intermediary variable models to quantify the influence of macroeconomic indicators, stock indices, and energy futures on gold price volatility. The model includes fixed effects and undergoes ADF testing for stationarity and cointegration tests for variable relationships [2]. Empirical analysis encompasses descriptive statistics, correlation, regression, robustness, and intermediary effect analyses to examine factor impacts comprehensively [3]. The study offers insights for investor risk management and market regulation, aiding in understanding and predicting gold futures price movements, thus providing a scientific basis for investment decisions and contributing to the market's development and regulation [4].

In recent years, the gold futures market has seen significant growth, with trading volumes rising from 42.6086 million contracts in 2019 to a new high of 52.731 million contracts in 2023 [5] shown in Table 1. The Data Source is from Securities Regulatory Commission, Huanjing Industry Research Institute compilation. Although there was a decline after reaching 52.4085 million contracts in 2020, the strong rebound in 2023 demonstrated the market's ongoing interest in gold futures. The average transaction price of gold futures also increased from 324,500 yuan per contract in 2019 to 452,200

yuan per contract in 2023, reflecting the value of gold as a safe-haven asset [6]. This growth is closely related to factors such as global economic uncertainty, loose monetary policy, and geopolitical tensions, which have driven investors' demand for gold as a hedge.

Table 1: Gold Futures Trading Volume and Average Transaction Price at the Shanghai Futures Exchange from 2019 to 2023

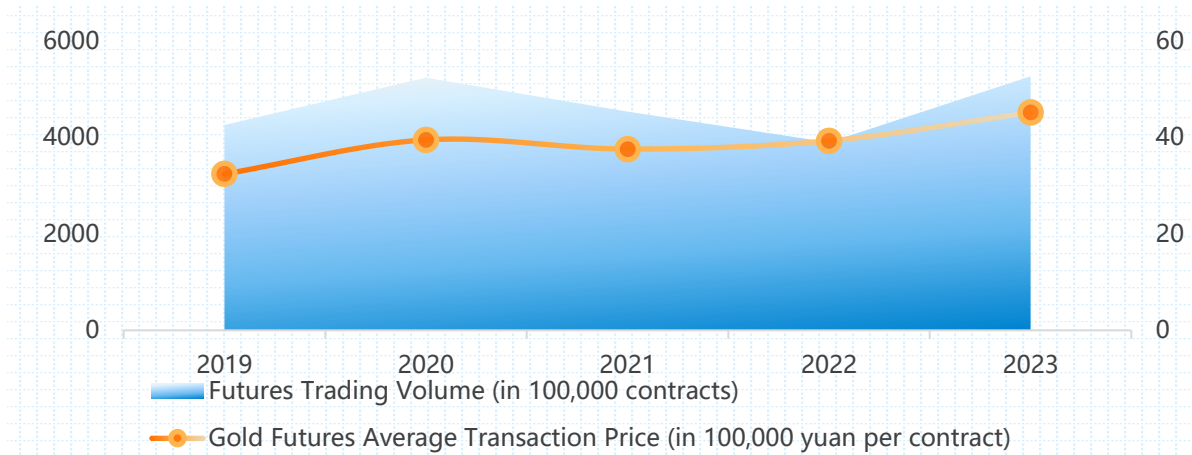| Project	2019	2020	2021	2022	2023
Futures Trading Volume (in 100,000 contracts)	4260.86	5240.85	4541.22	3901.68	5273.1
Gold Futures Average Transaction Price (in 100,000 yuan per contract)	32.45	39.53	37.62	39.34	45.22

Figure 1: Trading Volume and Average Transaction Price of Gold Futures at the Shanghai Futures Exchange from 2019 to 2023 (Photo/Picture credit: Original).

The data shown in Figure 1 from the global trading centers indicates that the London OTC market, the U.S. futures market, and the Shanghai Gold Exchange (SGE) are the most important gold trading centers globally, accounting for over 90% of the world's trading volume [7]. The trading volume of gold futures on the Shanghai Gold Exchange saw a decline in 2020, but the trading volume of gold at the Shanghai Futures Exchange and commercial banks continued to grow [8]. This demonstrates that the trading activity in the gold futures market maintains a high level globally [9]. The scale and trading activity of the gold futures market have significantly increased over the past few years, with the market's demand and interest in gold futures continuously growing [10]. The value of gold as a safe-haven asset has been recognized and emphasized by the market [11].

2. Gold Futures Market Volatility and Risk Influencing Factor Index System Construction

2.1. Model Introduction

This paper constructs a comprehensive model system to quantitatively analyze the various factors affecting the price fluctuations in China's gold futures market. The core of the model includes a multiple linear regression model, which is used to assess the direct impact of macroeconomic indicators, stock index interest rates, and energy futures on gold futures prices. The model first ensures the stationarity of the data through the ADF unit root test to avoid spurious regression phenomena, and applies cointegration analysis to identify long-term stable relationships between variables [12]. Descriptive statistical analysis is used to examine the characteristics of the data,

correlation analysis reveals preliminary connections between variables [13], regression analysis determines the specific impact strength, robustness analysis tests the stability of the model results, and intermediary effect analysis uncovers potential indirect influence mechanisms.

2.2. Sample Selection and Data Sources

During the research on the fluctuation characteristics and risks of China's gold futures market, this paper selected a series of indicators in an attempt to fully capture the multidimensional factors affecting market volatility. Through authoritative data sources such as Wind Information and the National Bureau of Statistics, this paper collected data from 2004 to 2023 on macroeconomic factors, stock index rates, and energy futures, with specific indicators as follows shown in Table 2.

Table 2: Indicators of Volatility and Risk Influencing Factors in the Gold Futures Market

Variable Type	Indicator Type	Indicator	Variable Name
Dependent Variable	Gold Futures	Gold Futures Price	ICE
Independent Variables	Macroeconomic Factors	China Gold Reserves (in tons)	CGR(T)
		U.S. Gold Reserves (in tons)	UGR(T)
		China Inflation Rate	CN CPI
		U.S. Inflation Rate	US CPI
		China GDP	CN GDP
		U.S. GDP	US GDP
Control Variables	Stock Index Interest Rates	China 10-Year Government Bond Yield	CN 10YT
		U.S. 10-Year Government Bond Yield	US 10YT
		S&P 500 Index	S&P 500
		CSI 300 Index	CSI 300
		Dow Jones Industrial Average	DJIA
		U.S. Dollar Index	DXY
	Energy Futures	Silver Futures Price Index	SIN
		Brent Crude Oil Spot	LCO

3. Empirical Analysis

3.1. Descriptive Statistics

From 2004 to 2023, gold futures prices and China's gold reserves experienced significant fluctuations, influenced by international demand, economic conditions, monetary policy, and investor sentiment. Gold, as a safe-haven asset, tends to rise in price during economic instability. China's increase in gold reserves may be related to adjustments in its foreign exchange reserve strategy. The United States' gold reserves have been stable since the 1970s when gold was removed from the monetary system and the US dollar was no longer pegged to gold. Both China and the United States have shown stable inflation rates, indicating effective price control. China's GDP growth has been remarkable, related to globalization, reforms, investments, and demographic dividends; the United States' GDP growth has been steady, reflecting a mature economic system. The stability of Treasury yield rates reflects monetary policy and economic expectations. Stock market indices are highly volatile, affected by various factors. The US dollar index is stable, related to the status of the US dollar as a global reserve

currency and the stability of economic policies. Silver and crude oil prices are highly volatile, influenced by supply and demand, geopolitical events, and the global economy. Table 3 provided descriptive statistics of main variables.

Table 3: Descriptive Statistics of Main Variables

Variable Name	Maximum Value	Minimum Value	Average	Standard Deviation	Median	Kurtosis	Skewness
ICE	1,976.17	412.58	1,245.55	458.69	1,260.32	-0.69	-0.32
CGR(T)	2,235.39	599.98	1,335.76	586.51	1,054.09	-1.69	0.02
UGR(T)	8,136.18	8,133.46	8,133.60	0.61	8,133.46	20.00	4.47
CN CPI	0.06	-0.01	0.02	0.02	0.02	0.58	0.54
US CPI	0.08	-0.00	0.03	0.02	0.02	3.94	1.37
CN GDP	17.96	1.96	9.68	5.35	10.03	-1.19	0.10
US GDP	27.37	12.22	17.98	4.18	17.20	-0.10	0.75
CN 10YT	4.41	2.74	3.49	0.48	3.49	-0.89	0.09
US 10YT	4.78	0.82	2.88	1.10	2.81	-0.75	0.13
S&P 500	4,322.67	948.52	2,144.59	1,105.78	1,798.36	-0.33	0.94
CSI 300	5,048.38	917.59	3,214.88	1,020.67	3,207.60	0.43	-0.58
DJIA	34,326.05	8,887.83	18,505.73	8,534.48	15,973.18	-0.78	0.77
DXY	35.72	6.76	18.87	7.16	17.61	0.63	0.55
SIN	1,347.08	459.45	897.23	279.95	858.75	-1.08	0.21
LCO	104.06	76.14	88.88	8.77	87.29	-1.24	0.21

3.2. Stationarity Test

To ensure the reliability of the time series model and to avoid spurious regression phenomena, it is essential to perform stationarity tests on the series first. By applying the Augmented Dickey-Fuller (ADF) test, it can be found that the original series were not stationary shown in Table 4. However, after first-differencing, the P-value dropped to 0, indicating that all series reached a first-order stationary state. Therefore, this paper used the first-differenced series for further model analysis. Through cointegration tests, it can be found that under specific conditions, the P-value was far below 0.01, which means within the 95% confidence interval, there indeed exist multiple cointegration relationships among the series, indicating that the variables maintain a long-term equilibrium state.

Table 4: ADF Unit Root Test Results

Variable	Difference Order	t	P	AIC	Critical Value 1%	5%	10%	Results
ICE	0	28.621	1	72.72	-4.223	-3.189	-2.73	Not Stationary
	1	-2.913	0.044**	142.608	-4.138	-3.155	-2.714	Stationary
CN CPI	0	1.954	0.999	-77.453	-4.223	-3.189	-2.73	Not Stationary
	1	-2.734	0.068*	-57.197	-4.332	-3.233	-2.749	Stationary
US CPI	0	-0.868	0.798	-92.303	-4.223	-3.189	-2.73	Not Stationary
	1	-6.75	0.000***	-88.125	-4.223	-3.189	-2.73	Stationary
CN GDP	0	-1.076	0.724	6.174	-3.859	-3.042	-2.661	Not Stationary

Table 4: (continued).

Variable	Difference Order	t	P	AIC	Critical Value			Results
					1%	5%	10%	
	1	-5.003	0.000***	8.001	-3.859	-3.042	-2.661	Stationary
US GDP	0	-1.801	0.38	0.632	-4.223	-3.189	-2.73	Not Stationary
	1	-3.107	0.026**	7.282	-3.859	-3.042	-2.661	Stationary
CN 10YT	0	-1.99	0.291	-3.215	-4.223	-3.189	-2.73	Not Stationary
	1	-5.791	0.000***	7.323	-4.069	-3.127	-2.702	Stationary
US 10YT	0	-0.048	0.954	15.626	-3.964	-3.085	-2.682	Not Stationary
	1	-5.763	0.000***	19.533	-3.964	-3.085	-2.682	Stationary
S&P 500	0	-1.588	0.49	125.334	-4.223	-3.189	-2.73	Not Stationary
	1	-0.878	0.000***	137.182	-4.223	-3.189	-2.73	Stationary
CSI 300	0	-1.353	0.604	184.526	-3.859	-3.042	-2.661	Not Stationary
	1	-5.067	0.000***	170.493	-3.889	-3.054	-2.667	Stationary
DJIA	0	-1.057	0.732	177.827	-4.223	-3.189	-2.73	Not Stationary
	1	1.468	0.000***	184.082	-4.223	-3.189	-2.73	Stationary
DXY	0	-7.088	0.000***	36.236	-4.223	-3.189	-2.73	Stationary
SIN	0	-1.346	0.608	49.566	-4.223	-3.189	-2.73	Not Stationary
	1	-4.432	0.000***	58.942	-4.223	-3.189	-2.73	Stationary
LCO	0	-59.549	0.000***	79.461	-4.223	-3.189	-2.73	Stationary

The original series, upon inspection, were found to lack stationarity, indicating the presence of outliers or trend components. To address this issue, the paper employed a first-order differencing method, successfully transforming the series into a stationary state by applying a first difference to the raw data, with the P-value dropping to 0, meeting the requirement for stationarity. Furthermore, through co-integration tests, the paper confirmed the existence of a long-term stable relationship between the series under certain conditions, further supporting the rationality of using first-order differencing to process the data.

3.3. Correlation Analysis

The analysis from 2004 to 2023 revealed that gold futures prices are positively correlated with various factors. China's central bank has been boosting its gold reserves since November 2022, which could elevate gold prices and support the renminbi's international status. Economic growth, as reflected by U.S. GDP, drives gold demand. Gold also correlates positively with the S&P 500 and the Shanghai and Shenzhen 300, indicating it's used as a diversification tool during economic volatility. The link with the Dow Jones is weaker, and the relationship with the U.S. dollar index is intricate and multi-influenced. Gold and silver futures are positively linked, showing a market synergy. However, the correlation with U.S. gold reserves and the inflation rates of China and the U.S. is not significant shown in Table 5, suggesting a complex and fluctuating relationship with gold prices.

Table 5: Correlation Analysis of Main Variables

	ICE	CGR(T)	UGR(T)	CN CPI	US CPI	CN GDP	US GDP	CN 10YT	US 10YT	S&P 500	CSI 300	DJIA	DXY	SIN	LCO
ICE	1														
CGR(T)	0.74	1													
UGR(T)	0.00	0	0												
CN CPI	-0.17	-0.44	0	1											
US CPI	0.22	0.10	0	0.19	1										
CN GDP	0.85	0.94	0	-0.36	0.29	1									
US GDP	0.80	0.91	0	-0.37	0.40	0.96	1								
CN 10YT	-0.52	-0.70	0	0.52	-0.23	-0.61	-0.68	1							
US 10YT	-0.63	-0.57	0	0.10	0.26	-0.58	-0.37	0.26	1						
S&P 500	0.72	0.86	0	-0.37	0.47	0.93	0.97	-0.67	-0.34	1					
CSI 300	0.60	0.70	0	-0.03	0.15	0.71	0.68	-0.40	-0.46	0.69	1				
DJIA	0.73	0.88	0	-0.35	0.45	0.95	0.97	-0.65	-0.37	1.00	0.70	1			
DXY	0.44	0.87	0	-0.52	0.26	0.78	0.83	-0.75	-0.25	0.82	0.48	0.83	1		
SIN	0.80	0.27	0	0.20	0.16	0.41	0.33	-0.14	-0.49	0.25	0.28	0.25	-0.10	1	
LCO	0.27	-0.32	0	0.42	0.37	-0.06	-0.06	0.37	0.12	-0.14	-0.19	-0.14	-0.48	0.60	1

3.4. Regression Analysis

Table 6: Regression Analysis of Main Variables

	Unstandardized Coefficients		Standardized Coefficients	t	P	VIF	R^2	F
	B	Standard Error	Beta					
Constant	0	0	-	-0.288	0.785	-		
CGR(T)	-0.673	0.579	-0.91	-1.162	0.298	327.489		
UGR(T)	-0.037	0.129	0	-0.288	0.785	0		
CN CPI	-2163.003	2387.05	-0.084	-0.906	0.406	4.571		
US CPI	1670.789	3069.017	0.072	0.544	0.61	9.24		
CN GDP	40.809	88.034	0.495	0.464	0.662	609.67	0.991	F=40.735 P=0.000***
US GDP	190.141	69.673	1.811	2.729	0.041**	235.323		
CN 10YT	-46.742	99.818	-0.048	-0.468	0.659	5.618		
US 10YT	-82.018	79.486	-0.208	-1.032	0.349	21.633		
S&P 500	-0.517	0.462	-1.347	-1.118	0.314	775.25		
CSI 300	0.021	0.044	0.051	0.485	0.648	5.883		

Table 6: (continued).

	Unstandardized Coefficients		Standardized Coefficients	t	P	VIF	R²	F
	B	Standard Error	Beta					
DJIA	0.015	0.039	0.296	0.38	0.72	323.706		
DXY	-4.162	11.008	-0.088	-0.378	0.721	28.87		
SIN	38.378	10.938	0.607	3.509	0.017**	16.021		
LCO	-0.609	0.572	-0.382	-1.065	0.336	68.869		

According to the analysis in Table 6, when considering the factors affecting gold futures prices, apart from the U.S. GDP and the silver futures price index, other economic indicators do not have a statistically significant impact on gold futures prices. The growth of U.S. GDP is positively correlated with gold futures prices, indicating that an increase in economic activity may be accompanied by an increased demand for gold as a safe-haven asset. Additionally, the rise in the silver futures price index has a significant positive impact on gold futures prices, which may be related to the fact that silver and gold are often viewed as similar assets in the financial market and their prices often influence each other.

These significant results may be driven by a variety of factors, including economic fundamentals, market expectations, monetary policy, and global macroeconomic conditions. Although other variables show certain trends, their relationship with gold futures prices does not reach statistical significance, suggesting that the relationship between these variables may be more complex or affected by other variables not considered.

3.5. Robustness Analysis

Table 7: Robustness Analysis with the Replacement of the Dependent Variable

	Unstandardized Coefficients		Standardized Coefficients	t	P	R²	F
	B	Standard Error	Beta				
Constant	0.019	0.006		3.26	0.001***		
ICE	0.025	0.01	-1.692	2.594	0.009***		
CGR(T)	0.002	0.003	0.037	0.835	0.404		
UGR(T)	60.727	53.893	0.149	1.127	0.26		
CN CPI	-62.641	68.665	2.136	-0.912	0.362		
US CPI	-2.208	1.843	0.92	-1.198	0.231		
CN GDP	-4.285	1.603	3.01	-2.673	0.008***	0.982	F=20.941,P=0.002***
US GDP	0.575	2.411	-0.14	0.239	0.811		
CN 10YT	0.515	2.072	-0.1	0.249	0.804		
US 10YT	0.018	0.009	-2.578	2.151	0.031**		
S&P 500	-0.001	0.001	0.082	-0.959	0.337		
CSI 300	-0.001	0.001	-0.17	-0.783	0.433		
DJIA	-0.075	0.263	0	-0.284	0.776		
DXY	0.023	0.01	-0.87	2.331	0.020**		

Table 7: (continued).

	Unstandardized Coefficients		Standardized Coefficients	t	P	R²	F
	B	Standard Error	Beta				
LCO							

In the robustness analysis performed in Table 7, the dependent variable was replaced with SIN (the Silver Futures Price Index) to test the robustness of the model's results. The analysis reveals the extent of the impact and the statistical significance of various variables on the Silver Futures Price Index.

The significance of the constant term indicates that there is a significantly non-zero expected value for the Silver Futures Price Index even when all other explanatory variables are zero. This could reflect the model's baseline estimation of silver futures prices in the absence of any explanatory variables. Additionally, the significant impact of ICE (Gold Futures Price) on SIN suggests a certain linkage effect between the gold and silver markets, as they are often viewed as similar safe-haven assets. This positive influence may be driven by market participants' collective preference for precious metals.

Table 8: Robustness Analysis with the Dependent Variable Replaced

	Unstandardized Coefficients		Standardized Coefficients	t	P	R²	F
	B	Standard Error	Beta				
Constant	-509.613	242.71		-2.1	0.036**		
CN CPI	-2979.876	573.215	-0.115	-5.199	0.000***		
US CPI	202.681	685.087	0.009	0.296	0.767		
CN GDP	-40.65	12.431	-0.493	-3.27	0.001***		
US GDP	129.21	14.744	1.23	8.763	0.000***		
CN 10YT	-2.964	24.283	-0.003	-0.122	0.903		
US 10YT	-112.554	16.528	-0.285	-6.81	0.000***	0.98	F=24.78,P=0.000***
S&P 500	-0.16	0.066	-0.416	-2.439	0.015**		
CSI 300	0.01	0.009	0.024	1.076	0.282		
DJIA	0.01	0.009	0.206	1.168	0.243		
DXY	-3.836	2.402	-0.081	-1.597	0.11		
SIN	27.728	1.505	0.439	18.421	0.000***		
LCO	0.16	0.065	0.101	2.472	0.013**		

The robustness analysis conducted by substituting the gold reserves of China and the United States as independent variables, while also replacing the dependent variable with the gold futures price,

showed consistent results, indicating that the gold reserves have a minimal impact on the gold futures price shown in Table 8.

In summary, robustness analysis underscores the importance of considering various variables and model specifications in economic model analysis. It reveals the complex influence of different macroeconomic indicators and financial market indices on the Silver Futures Price Index, as well as the need for caution when assessing the statistical significance of these relationships.

3.6. Mediation Effect Analysis

Table 9: Mediation Effect Test

Item	Test Conclusion	c	a*b	c'	Proportion of Effect
		Total Effect	Indirect Effect	Direct Effect	
Macroeconomic Factors => Stock Index Interest Rates => Gold Futures Price	Partial Mediation	0.3	0.05	0.17	24.57%

In the mediation effect test of Table 9, the impact of macroeconomic factors on the gold futures price was partially mediated through the intermediary variable of stock index interest rates. The test results indicate that there is a significant total effect of macroeconomic factors on the gold futures price, and part of this effect is indirectly influenced through stock index interest rates, that is, the mediation effect. The direct effect refers to the immediate impact of macroeconomic factors on the gold futures price without considering the intermediary variable. The mediation effect value is 0.3, while the direct effect value is 0.17, indicating that part of the influence of macroeconomic factors on the gold futures price is realized through the intermediary variable of stock index interest rates. The effect proportion of 24.57% means that the mediation effect accounts for approximately one-quarter of the total effect, showing that stock index interest rates play a partial mediating role between macroeconomic factors and the gold futures price.

The impact of macroeconomic factors on the gold futures price is not entirely direct but is partially indirect through the intermediary variable of stock market interest rates, providing a new perspective for understanding the complex relationship between the macroeconomy and the gold market.

4. Conclusions and Prospects

The Chinese gold futures market is volatile and influenced by macroeconomic factors, particularly its positive link to US GDP growth, suggesting that economic growth can increase gold demand as a hedge. The market shows a positive correlation between gold and silver futures, indicating a connected precious metals market. However, gold reserves and inflation rates do not significantly affect prices. Government policies and market regulation are key to the market's health, promoting a stable, transparent, and fair environment. Market participation and financial innovation, like gold options, support the real economy and market diversification. The growth of emerging markets boosts financial market competitiveness and global market diversification. Stock market interest rates mediate the impact of macroeconomic factors on gold futures prices, accounting for about 25% of the effect.

For the Chinese gold futures market, the following strategies are recommended to promote its healthy development and market efficiency: First, investors and analysts should construct a multidimensional economic analysis framework, continuously monitor key economic indicators such as the growth of U.S. GDP, and comprehensively consider market expectations, monetary policy, and

global macroeconomic conditions to accurately predict the trend of gold futures price fluctuations. Second, the government and regulatory authorities should promote the high-end, intelligent, and low-carbon development of the gold industry, issue normative documents such as the "Interim Measures for the Administration of Gold Lending Business," and improve the market supervision system to enhance market transparency and fairness. In addition, financial institutions and market participants should promote financial product innovation and diversification of business models, such as gold options and other derivatives, to meet market demands and promote market diversification. Finally, investors and policymakers should delve into the correlation between macroeconomic factors and stock market interest rates, construct complex economic models to understand the relationship between the macroeconomy and the gold market, thereby improving the effectiveness of investment decisions and reducing market uncertainty. Through these measures, a stable external environment can be provided for the prosperity and innovation of the gold futures market.

References

[1]   Wang, Z. C. (2024). *Study on the volatility characteristics and risks of the Chinese gold futures market [in Chinese].* Fudan University.

[2]   Liu, X. J. (2016). *Research on the volatility characteristics and risk measurement of the Chinese gold futures market [in Chinese].* Capital University of Economics and Business.

[3]   Shi, Z. B. (2024). *Analysis of the factors affecting gold futures prices. Proceedings of the Seminar on Sustainable Development of Society and Economy in the New Era [in Chinese].* Beijing Investment Promotion Service Center.

[4]   Weng, H. (2023). *Analysis of the correlation and basis impact factors of China's gold spot and futures prices [in Chinese].* Gold, 44(08), 5-9.

[5]   Sun, Z. (2023). *Gold prices may remain high after continuous rise [in Chinese].* China Economic Times, (001).

[6]   Yan, H. X. (2022). *Empirical analysis of factors affecting gold prices and suggestions [in Chinese].* Shanghai University of Finance and Economics.

[7]   Li, J. T. (2021). *Analysis of factors influencing the trend of gold prices [in Chinese].* University of International Business and Economics.

[8]   Xia, Y. (2022). *Research on price linkage and volatility spillover effects in the Sino-US soybean futures markets [in Chinese].* Zhejiang Ocean University.

[9]   Liu, Z. Q. (2021). *Study on the volatility risk of China's sugar import prices [in Chinese].* Heilongjiang University.

[10]   Yan, R. Z., Yue, D., Wu, X., & Gao, W. (2022). *Analysis and forecasting of nonlinear characteristics of liquidity and volatility trends in the Chinese stock index futures market [J] [in Chinese].* Operations Research and Management, 31(11), 200-205.

[11]   Hu, Y. N. (2021). *Volatility characteristics and risk measurement of the gold market [in Chinese].* New Finance, (02), 57-62.

[12]   Wang, Y. J. (2021). *Empirical study on the volatility and its influencing factors of the Chinese crude oil futures market [in Chinese].* Changsha University of Science & Technology.

[13]   Liu, J. (2021). *Efficiency test of the Chinese gold futures market [in Chinese].* Capital University of Economics and Business.