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Study of the VAR-Based Correlation between China's Gold and the US Dollar Index (USDX)

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Abstract: Based on the VAR model, this paper conducts an empirical study on the correlation between the closing price of the US dollar index (USDX) and the closing price of China's gold from January 2022 to January 2024, and finds that the fluctuation of the US dollar index (USDX) drives the price of China's gold, while the fluctuation of China's gold price has a limited impact on the US dollar index (USDX), which reveals the one-way dynamic correlation between the US dollar and the price of gold in the financial market, and also provides an important perspective for investors and policymakers to analyze market trends, and make recommendations for risk management and investment decisions. This finding reveals the unidirectional dynamic correlation between the dollar and the gold price in the financial market, and also provides investors and policy makers with an important perspective to analyze the market trend, and puts forward targeted suggestions for risk management and investment decision-making.

Keywords: Dollar Index; Chinese Gold Stock Price; VAR; Correlation

1. Introduction

In the global financial market, the United States dollar index and the price of gold have always been regarded as important economic indicators and hedging tools. The dollar index, as a measure of changes in the exchange rate of the dollar against a basket of major currencies, its movement not only reflects the strength of the dollar in the international market, but also has a profound impact on the global economy and financial markets. As for China Gold (SH:600916) stock, as a leading enterprise in the domestic gold industry, its stock price fluctuation directly reflects the market's changes in expectations for the gold industry as well as the macro-economy. China's attention to and promotion of China Gold stock is conducive to enhancing the country's position and influence in the global gold market.

In recent years, with the complex and volatile international political and economic environment, the correlation between the United States dollar index and the price of gold has received increasing attention. On the one hand, the dollar as the international reserve currency and the main trading currency, its exchange rate changes directly affect the global trade and investment activities, and then on the demand for gold and other precious metals and price impact. On the other hand, as a safe-haven asset, gold is often favored by investors when economic uncertainty increases, and there is a certain correlation between its price change and the strength of the US dollar index. Therefore, an in-depth study of the correlation between the US dollar index and China's gold stocks is expected to reveal the intrinsic relationship between the two, which will help to better understand the impact of the global economic dynamics on China's financial market and the gold market, and to hold the market trend, and to make reference suggestions for investors to formulate a reasonable investment strategy and to reduce the investment risk, and secondly, to grasp the dynamic changes of the international monetary system and the gold market, and to provide a basis for the Secondly, to grasp the dynamic changes of the international monetary system and the gold market, to provide useful references for the formulation of macroeconomic policies and financial regulation, and to promote the healthy development of China's financial industry.

In recent years, academics have studied the fluctuation of the US dollar index and China's gold price. yang used the GRA model to study the factors affecting the fluctuation pattern of

the US dollar index, and applied the results of the research to the cross-cycle trading model and commodity futures composite hedging and arbitrage model, in order to guide the actual investment operation [1]; Wang used the time-series method to analyze the relationship between the US dollar exchange rate and the international gold price, and concluded that the fluctuation of the US dollar exchange rate is the main reason for the short-term price fluctuation of China's gold market. The fluctuation of the dollar exchange rate is the main reason for the short-term fluctuation of China's gold market price [2]; Liu compared the trajectory of the US dollar index and the price of gold using data spanning the last 10 years. The results indicate a somewhat negative association between the two variables. [3]; Zhu et al. used a time lag analysis method to determine the prior of the US dollar index, the gold index, and the CFETS index to the RMB exchange rate, lag or synchronous relationship, and combined with the VAR model to analyze the dynamic relationship between the indicators, empirical evidence of the results, and put forward relevant policy recommendations [4]; Liu through the classification of the international gold market, analyzed the international gold price influencing factors, the relationship between supply and demand for gold and gold production costs, and combined with the current situation of China's gold market and the existing problems, put forward measures to improve the development trend of the future and the prospect [5]. Lin constructed TVP-SV-VAR model to investigate the time-varying relationship between commodity prices, gold prices and the US dollar index. The time-varying impact coefficients of the three economic variables are not fixed, reflecting the time-varying characteristics, and the impulse responses are different at different lead times and different time points [6]; Liang et al. used the GARCH-MIDAS model, while introducing the global economic policy uncertainty GEPU index and geopolitical risk GPR index variables to test the impact of gold volatility, proving that Google Trends can significantly and substantially improve the prediction accuracy of China's gold price volatility [7]; Zhao used the VAR model to explore the relationship between the international gold price and the U.S. dollar index. Dynamic quantitative relationship. The results show that there is a long-term equilibrium relationship between the international gold price and the US dollar index; the US dollar index is mainly a negative shock to the international gold price, and the individual periods are positive shocks; the US dollar index is the Granger cause of the international gold price [8]; Zolfaghari Mehdi measures the spillover effect and looks at the impact of the US currency using the VARMA-AGARCH model in conjunction with the quartile and frequency approaches. During the post-breakout phase, the negative spillovers from the index to the steel and aluminum markets become positive. The findings demonstrate that, depending on the investment horizon and market circumstances, metals can be utilized as a safe haven to hedge against the dollar index. [9]; Aliu Florin employed wavelet coherence analysis, SVAR, and VAR. The study's conclusions are not entirely consistent, since not all studies reveal the full impact of Bitcoin across the three asset classes. All of the experiments, however, agree that Bitcoin has a major impact on gold and vice versa.Three separate experiments indicate that the positive shock of Bitcoin drives up the price of gold [10].

To summarize, there are fewer academic studies on the correlation between the US dollar index and China's gold stock price, so this paper conducts an empirical study on the correlation between the US dollar index and China's gold based on the VAR model.

2. Introduction to the Model

An autoregressive expression for a weakly smooth process, which represents several variables over the same sample period and can be interpreted as linear functions of their historical values, is the fundamental form of the VAR model. The following is the phrase:

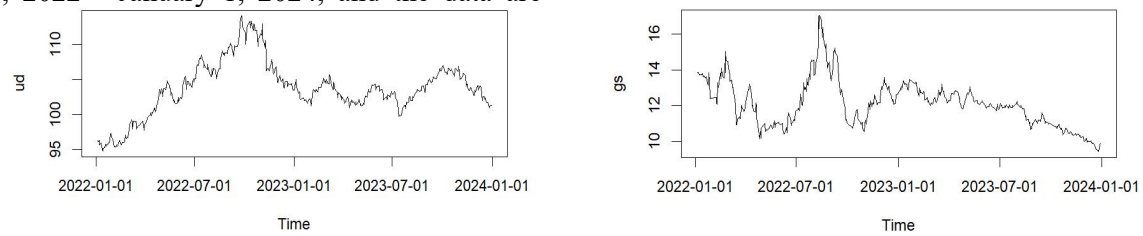
$$Y_t = \phi_0 + \phi_1 Y_{t-1} + \cdots + \phi_p Y_{t-p} + BX_t + \varepsilon_t, t = 1,2\cdots,T \quad (1)$$

Y_t is a k-dimensional column vector of endogenous variables; $Y_{t-i}, i = 1,2,\cdots,p$ is the lagged endogenous variable; X_t is a d-dimensional column vector of exogenous variables; p is the lag order; T is the number of samples.

3. Data Description

In this paper, the daily data of the closing price of the US dollar index and the closing price of

China Gold (SH:600916) are selected as the research samples for the time span of January 1, 2022 - January 1, 2024, and the data are sourced from the Yingwei Financial Intelligence website.



a. Time Series Plot of the US Dollar index b. Time Series Plot of the Closing Price of gold in China

Figure 1. Time Series Plot of the US Dollar index and the Closing Price of Gold in China

By observing the Figure 1, the US dollar index and China's gold from July 2022 to January 2024 in general have shown the first rise after the decline of the volatility trend, the price fluctuations of the dollar index before the fluctuations in China's gold prices. Segmented point of view, January 2022 to June, the dollar index fluctuation rise, China's gold from fluctuations down the trough of the two were reverse trend, July 2022 to October, the dollar index and China's gold both fluctuation rise to reach the peak, the same trend of change, October 2022, the dollar index fluctuations down to July 2023 to form a small trough, August began to rise slightly again! To reach the peak in October and then gradually down will have a certain cyclical fluctuations, China's gold is basically a downward trend.

The main descriptive statistical analysis results of the variables and their first-order differences are shown in Table 1.

Table 1. Results of Descriptive Statistics

Statistics	UD	GS	dUD	dGS
nbr.val	482	482	481	481
min	94.790	9.420	-2.3400	-1.1899
max	114.110	17.050	1.840	1.500
range	19.320	7.630	4.180	2.689
median	103.655	12.070	0.020	-0.019
mean	103.752	12.110	0.010	-0.008
std.dev	3.793	1.309	0.545	0.294
skewness	0.077	0.680	-0.494	0.597
kurtosis	0.450	0.887	1.444	3.580

4. Empirical Research

4.1 Smoothness Test and Determination of Lag Order

In general, VAR model estimation is performed with smooth series, otherwise pseudo-regression phenomenon will occur. Therefore, firstly, the dollar index and Chinese gold data are tested for smoothness. In this study, the ADF test is chosen to test and analyze the smoothness of the time series, and the test results in Table 2:

Table 2. Results of the Stability Test

variable name	UD	GS	dUD	dGS
ADF test	-2.126	-2.643	-7.084	-7.836
	(0.525)	(0.306)	(0.01)	(0.01)
reach a verdict	non-stationary	non-stationary	smoothly	smoothly

The test results show that both the US dollar index UD and Chinese gold GS have unit root characteristics and present a non-stationary time series. The data after first-order differencing, dUD and dGS, do not have unit root characteristics, so the data after first-order differencing are smooth. To summarize, it is necessary to carry out first-order differencing on the data of the US dollar index and China's gold before building the model. For the determination of lag order, this paper applies AIC, HQ, SC and FPE criteria to evaluate, and the test results all point to the 4th order as the optimal lag order. Based on the above analysis,

the VAR model used in this paper will set the lag order as 4th order.

4.2 VAR Model Parameter Estimation

The model was built based on the presence or absence of a constant term and a trend term, and the model regression results are shown in Table 3:

Table 3. Output of Regression Results

	Model1	
	dUD	dGS
dUD.l1	0.508	0.0034**
	(0.66)	(-2.94)
dGS.l1	0.454	0.1974
	(0.75)	(-1.29)
dUD.l2	0.073.	0.5702
	(-1.79)	(0.57)
dGS.l2	0.833	0.0327*
	(0.21)	(2.14)
dUD.l3	0.120	0.5033
	(-1.56)	(0.67)
dGS.l3	0.007**	0.0115*
	(-2.71)	(2.54)
dUD.l4	0.349	0.3093
	(0.94)	(-1.02)
dGS.l4	0.255	0.0203*
	(-1.14)	(-2.33)

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

As can be seen from Table 3, this model has the same level of significance, and at this point, combined with the completeness of the estimated VAR model, it is concluded that this model is the optimal VAR model and the parameter estimation of the independent variable dUD on the dependent variable dGS is more significant, and the estimation results are as follows:

$$dUD = 0.0307dUD.l1 + 0.0644dGS.l1 - 0.0829dUD.l2 + 0.0180dGS.l2 - 0.0720dUD.l3 - 0.2321dGS.l3 + 0.0434dUD.l4 - 0.0983dGS.l4\#(1)$$

$$dGS = -0.0730dUD.l1 - 0.0595dGS.l1 + 0.0141dUD.l2 + 0.0985dGS.l2 + 0.0166dUD.l3 - 0.1166dGS.l3 - 0.0253dUD.l4 - 0.1078dGS.l4\#(2)$$

4.3 Granger Causality Test

As can be seen in Table 4, in the original hypothesis that dGS is not the Granger cause of dUD, the p-value of the test result 0.1 is greater than 0.05, so the original hypothesis can not be rejected at the 5% level, i.e. dGS is not the Granger cause of dUD. In the original hypothesis that dUD is not the Granger cause of dGS, the p-value of the test result 0.002 is less than 0.05, so the original hypothesis can be rejected at the 5% level and the alternative hypothesis is accepted, i.e. dUD is the Granger cause of dGS.

Table 4. Results of Granger Causality Test

original hypothesis	hysteresis order (math.)	F-Test	p	reach a verdict
Granger reasons why dUD is not dGS	4	2.6	0.02	rejection
Reasons why dGS is not dUD Granger	4	2.1	0.10	acceptance

4.4 Impulse Response Analysis

Since dGS is not a Granger cause of dUD, this paper only considers the effect of dUD on dGS and the effect of dUD on itself, and the results of the impulse analysis in Figure2.

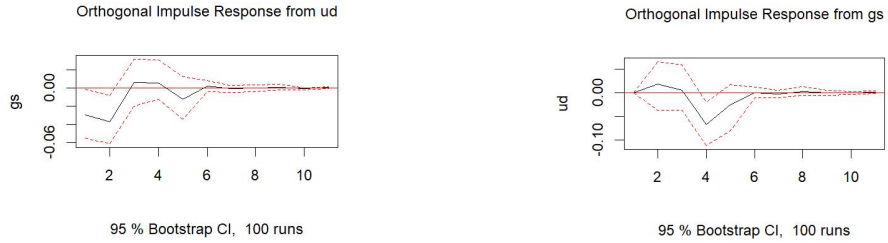


Figure 2. Impulse Response Plot between dUD and dGS

As can be seen from Figure 2, the perturbation of the US dollar index on China's gold reaches the maximum in the second period, generating negative shocks, generating positive shocks in the third period or so will gradually stabilize, and there is a small amount of negative shock perturbation in the fifth period, after which it gradually converges and stabilizes, and gradually converges to 0 in the sixth period or so; the perturbation of China's gold on the US dollar index reaches the maximum in the fourth period, generating negative shocks, and then gradually converges to 0 in the sixth period or so. The disturbance of Chinese gold to the dollar index reaches its maximum in the fourth period, generating a negative shock, and gradually converges to zero around the sixth period.

5. Conclusion

This significant finding serves a dual purpose, offering substantial value to both investors and policymakers in the financial sphere. For investors, understanding the intricate relationship between the US dollar index and China's gold market is crucial for making informed decisions in an increasingly interconnected global economy. By recognizing the Granger causality identified in the study, investors can develop more nuanced investment strategies that are responsive to the subtle shifts in market dynamics. This allows them to mitigate risks associated with market volatility and capitalize on emerging opportunities with greater agility and foresight. The insights gained from this research are particularly relevant in the current economic climate, where global economic and political factors can have profound effects on financial markets. Investors are now better equipped to navigate these complexities by considering the broader implications of the US dollar's performance on gold prices. For instance, during periods of economic uncertainty or when the US dollar is strengthening, investors might find it prudent to adjust their portfolios to include a higher allocation of gold as a hedge against currency fluctuations.

On the policymaker's side, this research offers a compelling perspective on the interplay between monetary policy and the gold market. Policymakers are now in a position to integrate this knowledge into their strategic planning, ensuring that macroeconomic policies are not only responsive to domestic economic conditions but also consider the ripple effects of international monetary movements. By doing so, they can craft policies that are more attuned to the needs of a globalized economy, promoting stability and resilience in the face of external shocks.

Moreover, the study's findings can guide financial regulatory measures that are designed to safeguard the market from excessive volatility and speculative behaviors. By understanding the correlation between the US dollar index and gold prices, regulators can implement measures that discourage destabilizing practices and foster a more transparent and orderly market environment. This is essential for maintaining investor confidence and ensuring that the financial market operates in a manner that is fair and beneficial to all participants.

In addition to macroeconomic policy and financial regulation, the study's results can also inform the development of educational initiatives aimed at enhancing public understanding of the financial markets. By disseminating knowledge about the factors that influence gold prices and the role of the US dollar index, policymakers can contribute to a more financially literate society. This, in turn, can lead to more informed investment decisions and a greater appreciation for the importance of a stable and well-regulated financial system.

In conclusion, the empirical evidence presented in this study is a valuable asset for both investors and policymakers. It not only enhances the market's decision-making capabilities but also contributes to the broader goal of fostering a stable and robust financial ecosystem. By leveraging this research, stakeholders can make more informed choices that contribute to the health and sustainability of the global economy.

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