
Research on the Impact of International Crude Oil and International Gold Price on China's Stock Market

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Abstract: This dissertation uses the VAR model to research the dynamic relationship between the Chinese stock market, global gold prices and global oil prices. To compare the changes in the correlation between the variables before the financial crisis and the variables after the financial crisis, this dissertation divides the data into two parts, namely the data after the financial crisis and the data before the financial crisis, and then We compare the data analysis of the two parts to obtain the changes in the correlation between variables after the financial crisis. We find that there is no long-term equilibrium relationship between gold, crude oil and the CSI 300 stock index of China, either after or during the financial crisis. However, this dissertation found that during the financial crisis, the relationship between variables changed. In the conclusion part, this dissertation explained the possible reasons for the changes in the correlation between variables from several aspects. At the same time, we compared the actual situation with the theoretical analysis, and we found that after the financial crisis, the actual situation and the theoretical analysis have been different. By studying the potential connections between these variables, we can better formulate policies and give better investment recommendations.

Keywords: Stock Market Index, China, International Crude Oil, Gold Price, Correlation

1. Introduction

This research is based on the analysis of the common movement and causality between gold, international crude oil, and the stock market index. This dissertation is mainly divided into four parts. The first part is theoretical analysis, which analyzes the correlation between variables from the theoretical perspective. The second part introduces the methodology of this dissertation, which describes the econometric methods used in this dissertation and introduces each variable. The third part is the data analysis part, which carries on the quantitative analysis to the collected data with the econometric method, and then obtains the correlation data between variables. The fourth part is the conclusion, which summarizes the theoretical and quantitative analysis results mentioned above and explains the results. The data in the article comes from the Federal Reserve Economic Database and the official website of the Shanghai Stock Exchange. For comparative analysis, the data in this paper is divided into two paragraphs. These are the data for the nine years after the

outbreak of the financial crisis in 2010-2019 and the data for the nine years including the time of the financial crisis in 2005-2014. There have been many studies trying to investigate the link between the stock market and the commodity market. Bernanke (2016) found a positive correlation between stocks and oil. both are responding to potential changes in global demand [4]. Ahmed and Huo (2021) used a trivariate VAR-BEKK-GARCH model to investigate the dynamic relationship among the Chinese stock market, commodity markets, and global oil price. They found a significant unidirectional return spillover effect from the oil market to the stock market which suggested a dependence of the Chinese stock market on the international oil market. Their research results show that the impact and fluctuation of the oil market can be transmitted to China's stock market [2]. At the same time, the price of crude oil is not correlated with the stock market in some markets. Muramalla and Alqahtani (2020) have investigated the long-term correlation between oil prices and Indonesia's stock market index. in the empirical study, ARDL and Granger causality is used to determine

the long-term and short-term correlation between oil prices and the Indonesian stock market index. The results show that there is no long-term and short-term correlation between crude oil price and the Indonesian stock index [9]. In the research of the Taiwan market, the researchers found that the oil price has a two-way feedback relationship with the currency exchange rate, while the gold price has a one-way effect, which dominates the currency exchange rate and is not affected by other variables. The VAR model determined that the price of gold was independent and was least impacted. Oil prices ranked second, and the currency exchange rate was the most vulnerable [5].

2. Theoretical Analysis

2.1. Impact of Crude Oil Price Change on the Stock Market

When researching the relationship between oil and stock pricing, the traditional view holds that there is a negative correlation between them when the economic growth remains unchanged. Simply put, their relationship is as follows: as oil prices rise, stock valuations are depressed; as oil prices fell, stock valuations were pushed up. The basic assumption of this view is that when oil prices rise, energy prices rise. This leads to systemic inflation and increases the costs absorbed by enterprises in their daily business activities. In turn, profitability has been damaged. As a result, traders and investors will sell the company's shares, causing the share price to fall.

From the perspective of enterprise cost, the rise of crude oil price will push up the production costs of enterprises, including raw materials, logistics, and transportation, so it will have a negative impact on the performance of most enterprises. However, when the price of crude oil starts to rise, the domestic coal and non-ferrous metal stocks will strengthen together to drive the index upward. Before the economy overheats, a moderate rise in the price of crude oil is conducive to economic development. However, with the rise of costs, the impact of inflation on enterprise performance will be gradually revealed, and the market will fall accordingly.

The impact of changes in crude oil prices on different countries, regions, and periods is not fixed, and it may have effects in multiple directions. High oil prices can boost employment and investment because it is economically feasible for oil companies to develop shale oil reserves with higher costs. However, high oil prices may also hit businesses and consumers with higher transportation and manufacturing costs. Although the decline in oil prices is bad for oil-related industries, it is conducive to the manufacturing industry and other industries that mainly focus on fuel costs. The decline in manufacturing costs may also make the stock market prosperous [3].

2.2. The Impact of Gold on the Stock Market

When the economy runs well and the stock market is in a medium and long-term upward trend, investors are more

willing to make profits from investing in the stock market. Many funds flow out of the gold market in pursuit of the high returns of stock investment, resulting in the decline of gold prices. When the economy is not going well and the stock market is in a bear market for a long time, some funds will flow back to the gold market, leading to the rise of gold prices. However, due to the great differences in the performance of different stock indexes, not all stock indexes have a clear correlation with the gold price. The correlation between variables in different markets may vary greatly [6].

3. Methodology

The relationship between the stock market index and crude oil and gold is not constant. In different periods, the correlation may reverse [8].

To test the correlation between variables in different periods, a VAR (2) model is utilized. The VAR model uses all current variables in the model to regress several lagged terms of all variables [11].

If some non-stationary economic time series have a trend of upward or downward changes over time, even if there is no direct correlation between these series, the t statistic of their coefficients may be significant. If some non-stationary economic time series have an upward or downward trend over time, even if there is no direct correlation between these series, the t-statistics of their coefficients may be significant. To solve this problem, this dissertation uses ADF to test the stationarity of variables. These regression coefficients have no practical significance if the data is unstable. After that, this dissertation uses the Johansen approach is used to detect whether there is a cointegration relationship between variables in this dissertation. If the results of the Johansen method show that the variables are co-integrated, the next step is to build a VECM model. If the variables are not co-integrated, then we will differentiate the variables and build a VAR model to analyze the relationship between the variables and the pulse diagram.

4. Analysis

In this research, this dissertation follows the process of the Singh and Sharma experiments to analyze the data. we first examined the properties of given data for three sub-periods using descriptive statistics and unit root tests like Augmented Dickey-Fuller (ADF). Then we used Johansen's cointegration approach to study the long-run relationship among the variables. If the variables are found to be cointegrated, they will use vector error correction models (VECM) or they will use vector autoregression (VAR) models. Finally, they conducted Granger causation, VEC Granger causation/Wald testing, and the TY version of Granger causation to analyze short-term causality in variables [10].

In this part, the unit root test of gold is carried out. When the unit root test includes trend term and intercept, the result shows that the probability of data unit root with gold is 91.04%. At the same time, when intercept and trend term is

not selected, the result in figure 1 shows that the probability of unit root is 80.91%. When only the intercept item is selected and the trend item is not selected, the probability is 58.96%. From the three results, we can conclude that at the 5% significance level, the assumption that there is a unit root in gold data is accepted whether intercept term or trend term is selected or not

Null Hypothesis: GOLDFORTEST has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=26)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	0.440514	0.8091
Test critical values:		
1% level	-2.566008	
5% level	-1.940967	
10% level	-1.616603	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GOLDFORTEST)
Method: Least Squares
Date: 09/14/21 Time: 17:10
Sample (adjusted): 8/17/2010 9/05/2016
Included observations: 2212 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GOLDFORTEST(-1)	9.48E-05	0.000215	0.440514	0.6596
R-squared	-0.000087	Mean dependent var		1.178642
Adjusted R-squared	-0.000087	S.D. dependent var		89.16864
S.E. of regression	89.17252	Akaike info criterion		11.81947
Sum squared resid	17581292	Schwarz criterion		11.82205
Log likelihood	-13071.34	Hannan-Quinn criter.		11.82042
Durbin-Watson stat	2.043175			

Figure 1. The unit root test of gold.

Null Hypothesis: D(OILUNITROOT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=26)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-49.85745	0.0000
Test critical values:		
1% level	-3.962083	
5% level	-3.411785	
10% level	-3.127779	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OILUNITROOT,2)
Method: Least Squares
Date: 09/13/21 Time: 16:41
Sample (adjusted): 8/18/2010 11/06/2016
Included observations: 2273 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OILUNITROOT(-1))	-1.045666	0.020973	-49.85745	0.0000
C	-0.000456	0.367959	-0.001239	0.9990
@TREND("8/16/2010")	-5.75E-05	0.000280	-0.205132	0.8375
R-squared	0.522685	Mean dependent var		-0.006113
Adjusted R-squared	0.52264	S.D. dependent var		12.67785
S.E. of regression	8.762732	Akaike info criterion		7.180211
Sum squared resid	174303.0	Schwarz criterion		7.187773
Log likelihood	-8157.310	Hannan-Quinn criter.		7.182970
F-statistic	1242.883	Durbin-Watson stat		1.997803
Prob(F-statistic)	0.000000			

Figure 2. Unit root test of first-order difference of crude oil.

Unit root test for CSI300 index: when the unit root test only selects the intercept item, the probability is 47.51%, when the intercept item and trend item are selected at the same time, the probability is 45.39%, and when the intercept item and trend item are not selected, the probability is 69.77%. According to the results, at the 5% confidence level, the CSI300 index has unit root whether intercept and trend items are selected or not.

Unit root test for oil price: when trend term and intercept are selected, the probability of unit root is 47.33%. Meanwhile, when intercept and trend term is not selected, the probability of unit root is 39.83%. When only the intercept item is selected and the trend item is not selected, the probability is 55.21%. At the 5% significance level, from the three results, whether intercept term or trend term is selected or not, the assumption of the unit root of oil price is accepted.

The next step is to make a first-order difference between the CSI 300 index, oil price, and gold. The next step is conducting a unit root test to test whether the first-order difference of the three variables is stable.

Null Hypothesis: D(MARKETFORTEST) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=25)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-34.86718	0.0000
Test critical values:		
1% level	-3.962220	
5% level	-3.411852	
10% level	-3.127819	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MARKETFORTEST,2)
Method: Least Squares
Date: 09/13/21 Time: 16:42
Sample (adjusted): 8/19/2010 8/25/2016
Included observations: 2199 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MARKETFORTEST(-1))	-1.025390	0.029408	-34.86718	0.0000
D(MARKETFORTEST(-1),2)	0.074308	0.021285	3.491109	0.0005
C	-0.282391	2.119547	-0.133232	0.8940
@TREND("8/16/2010")	0.000622	0.001667	0.373158	0.7091
R-squared	0.480117	Mean dependent var		0.006517
Adjusted R-squared	0.479407	S.D. dependent var		68.75957
S.E. of regression	49.61150	Akaike info criterion		10.64814
Sum squared resid	5402556.	Schwarz criterion		10.65850
Log likelihood	-11703.63	Hannan-Quinn criter.		10.65193
F-statistic	675.7021	Durbin-Watson stat		1.996751
Prob(F-statistic)	0.000000			

Figure 3. Unit root test of first-order difference of stock market index.

It can be seen from the tables that within the 5% confidence level, these variables are stable time series after the first-order difference.

Regression of non-stationary series may have false regression. The meaning of the cointegration test is to test whether the causal relationship described by their regression equation is false regression, that is, whether there is a stable relationship between variables. If the non-stationary time series does not have a cointegration relationship, you can build a var model. The next step is to do a cointegration test on the three variables.

Null Hypothesis: D(GOLDFORTEST) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=26)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-48.02847	0.0001
Test critical values:		
1% level	-2.566008	
5% level	-1.940967	
10% level	-1.616603	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GOLDFORTEST,2)
Method: Least Squares
Date: 09/14/21 Time: 17:12
Sample (adjusted): 8/18/2010 9/05/2016
Included observations: 2211 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GOLDFORTEST(-1))	-1.021498	0.021269	-48.02847	0.0000
R-squared	0.510708	Mean dependent var	-0.031640	
Adjusted R-squared	0.510708	S.D. dependent var	127.4857	
S.E. of regression	89.17546	Akaike info criterion	11.81954	
Sum squared resid	17574501	Schwarz criterion	11.82212	
Log likelihood	-13065.50	Hannan-Quinn criter.	11.82048	
Durbin-Watson stat	2.000958			

Figure 4. Unit root test of first-order difference of gold.

We use Johansen's Approach to test the cointegration of three variables. It is a maximum likelihood estimation-based approach to estimating a vector error correction model with several endogenous variables involving nonstationary as well as stationary variables. The procedure includes testing for and estimating multiple cointegration relationships among the variables (cointegrating vectors). The Johansen test is a procedure for testing the cointegration of several, say k , I time series. This test permits more than one cointegrating relationship so is more generally applicable than the Engle-Granger test which is based on the Dickey-Fuller (or the augmented) test for unit roots in the residuals from a single (estimated) cointegrating relationship [7].

Just like a unit root test, there can be a constant term, a trend term, both, and neither in the model. For a general VAR(p) model:

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + e_t$$

In the VAR(p) model: c is an $n \times 1$ constant vector; A_p is an $n \times n$ matrix; e_t is the $n \times 1$ error vector, y_t is variable [1].

A set of cointegrated variables exhibits a long-run equilibrium relationship. In the short run, they may suffer disequilibrium. VECM is employed to find any such disequilibrium and the speed of correction or adjustment to put the variables back on a long-run equilibrium trajectory. The error correction mechanism allows in t period for the correction of a fraction of the disequilibrium that occurred in $t-1$.

This dissertation uses the Johansson test to test whether there is cointegration between variables firstly.

Date: 10/08/21 Time: 09:34
Sample (adjusted): 8/19/2010 5/16/2019
Included observations: 1541 after adjustments
Trend assumption: Linear deterministic trend
Series: STOCK OIL1 GOLD1
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.003355	8.146180	29.79707	0.9964
At most 1	0.001047	2.966965	15.49471	0.9684
At most 2	0.000878	1.353292	3.841466	0.2447

Trace test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.003355	5.179215	21.13162	0.9943
At most 1	0.001047	1.613673	14.26460	0.9970
At most 2	0.000878	1.353292	3.841466	0.2447

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'S11*b-l):

STOCK	OIL1	GOLD1
0.000732	0.008163	0.000188
-0.001550	-0.006428	0.000642
-0.001190	0.002114	-0.000811

Unrestricted Adjustment Coefficients (alpha):

D(STOCK)	-1.053321	0.812866	1.112112
D(OIL1)	-0.454805	0.031682	-0.092954
D(GOLD1)	-1.599472	-2.371655	1.036933

1 Cointegrating Equation(s): Log likelihood -22692.26

Normalized cointegrating coefficients (standard error in parentheses)

STOCK	OIL1	GOLD1
1.000000	11.15511	0.256910
	(5.07030)	(0.63183)

Adjustment coefficients (standard error in parentheses)

D(STOCK)	-0.000771		
	(0.00091)		
D(OIL1)	-0.000333		
	(0.00016)		
D(GOLD1)	-0.001170		
	(0.00160)		

2 Cointegrating Equation(s): Log likelihood -22691.45

Normalized cointegrating coefficients (standard error in parentheses)

STOCK	OIL1	GOLD1
1.000000	0.000000	-0.811906
		(0.79204)
0.000000	1.000000	0.095814
		(0.10061)

Adjustment coefficients (standard error in parentheses)

D(STOCK)	-0.002030	-0.013823	
	(0.00213)	(0.01292)	
D(OIL1)	-0.000382	-0.003916	
	(0.00037)	(0.00226)	
D(GOLD1)	0.002505	0.002189	
	(0.00375)	(0.02276)	

Figure 5. The result of the Johansson test.

From figure 5, what we can see is that there is no cointegration relationship between variables, we accept the null hypothesis: there is no cointegration between variables.

The next step is using the first-order difference data to establish the VAR model.

We use the variables after the first-order difference to establish the VAR model, and then use Eviews to calculate the optimal lag number.

VAR Lag Order Selection Criteria
Endogenous variables: STOCK2 OIL2 GOLD2
Exogenous variables: C
Date: 10/08/21 Time: 09:55
Sample: 8/16/2010 8/30/2019
Included observations: 1315

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-25757.06	NA	2.08e+13	39.17880	39.19062	39.18323
1	-19397.61	12680.21	1.33e+09	29.52032	29.56761	29.53805
2	-19332.17	130.1962	1.22e+09*	29.43447*	29.51722*	29.46550*
3	-19329.63	5.023679	1.23e+09	29.44431	29.56252	29.48864
4	-19319.77	19.54123*	1.23e+09	29.44299	29.59666	29.50062

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Figure 6. Lag selection of the model.

From the output of VAR lag order selection criteria in figure 6, we can see that the optimal lag number of the VAR model for first-order difference data is 2. After determining the lag order of 2, we re-establish the VAR model. Then, the test stationarity of the VAR model and the reciprocal modulus of the AR characteristic root of the VAR model are shown in the figure, which shows that the reciprocal modulus of each characteristic root is in the circle. In other words, the lag order of 2 is appropriate, and the established VAR model is stable after the stability test.

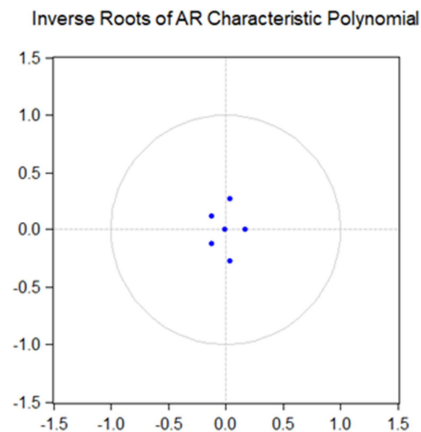


Figure 7. AR characteristic root of model.

The next step is establishing a VAR model with second-order lag. The results are shown in figure 8.

It can be seen from figure 8 that the lag of stock market changes has a significant impact on the stock market itself but has no significant impact on the changes of international crude oil and gold. This may be because China's stock market is a

policy market, not formed by free economic development because it is a speculative market, and international commodity prices are mainly affected by European and American countries. For example, the international oil price mainly depends on the futures prices in New York and London, and the international agricultural product price mainly depends on the futures price in Chicago. At the same time, we can see that the first lag t-statistic of the change of crude oil is significant, which may indicate that the price of international crude oil has an impact on China's stock market. Because many endogenous lag variables are added to VAR, it will inevitably lead to multicollinearity (so the prediction is more accurate), resulting in the failure of the parameter t-test. Therefore, the analysis of var parameters is of little significance. We mainly study the impulse response of the VAR model, that is, the impact of unit standardization change of random disturbance on endogenous variables.

Vector Autoregression Estimates
Date: 10/08/21 Time: 16:52
Sample (adjusted): 8/19/2010 5/16/2019
Included observations: 1541 after adjustments
Standard errors in () & t-statistics in []

	D(STOCK)	D(OIL1)	D(GOLD1)
D(STOCK(-1))	0.050005 (0.02492) [2.00685]	-0.001169 (0.00436) [-0.26834]	-0.029528 (0.04391) [-0.67252]
D(STOCK(-2))	-0.067457 (0.02520) [-2.67695]	-0.004000 (0.00440) [-0.90806]	0.042944 (0.04440) [0.96714]
D(OIL1(-1))	0.375778 (0.14585) [2.57649]	-0.056525 (0.02550) [-2.21706]	1.425110 (0.25700) [5.54524]
D(OIL1(-2))	0.004822 (0.14761) [0.03267]	-0.006205 (0.02580) [-0.24046]	-0.015271 (0.26010) [-0.05871]
D(GOLD1(-1))	-0.019034 (0.01465) [-1.29953]	0.001299 (0.00256) [0.50752]	-0.017553 (0.02581) [-0.68013]
D(GOLD1(-2))	0.005238 (0.01481) [0.35372]	0.003362 (0.00259) [1.29856]	0.010590 (0.02609) [0.40584]
C	0.560766 (1.24363) [0.45091]	0.101095 (0.21739) [0.46503]	-1.317840 (2.19137) [-0.60138]
R-squared	0.013096	0.005032	0.020552
Adj. R-squared	0.009236	0.001140	0.016721
Sum sq. resids	3653634.	111645.7	11344255
S.E. equation	48.80337	8.531165	85.99542
F-statistic	3.392674	1.293014	5.364725
Log likelihood	-8174.175	-5486.558	-9047.143
Akaike AIC	10.61801	7.129861	11.75100
Schwarz SC	10.64227	7.154119	11.77526
Mean dependent	0.563855	0.094849	-1.274706
S.D. dependent	49.03032	8.536033	86.72353
Determinant resid covariance (dof adj.)	1.26E+09		
Determinant resid covariance	1.24E+09		
Log likelihood	-22694.85		
Akaike information criterion	29.48196		
Schwarz criterion	29.55473		
Number of coefficients	21		

Figure 8. VAR model with second-order lag.

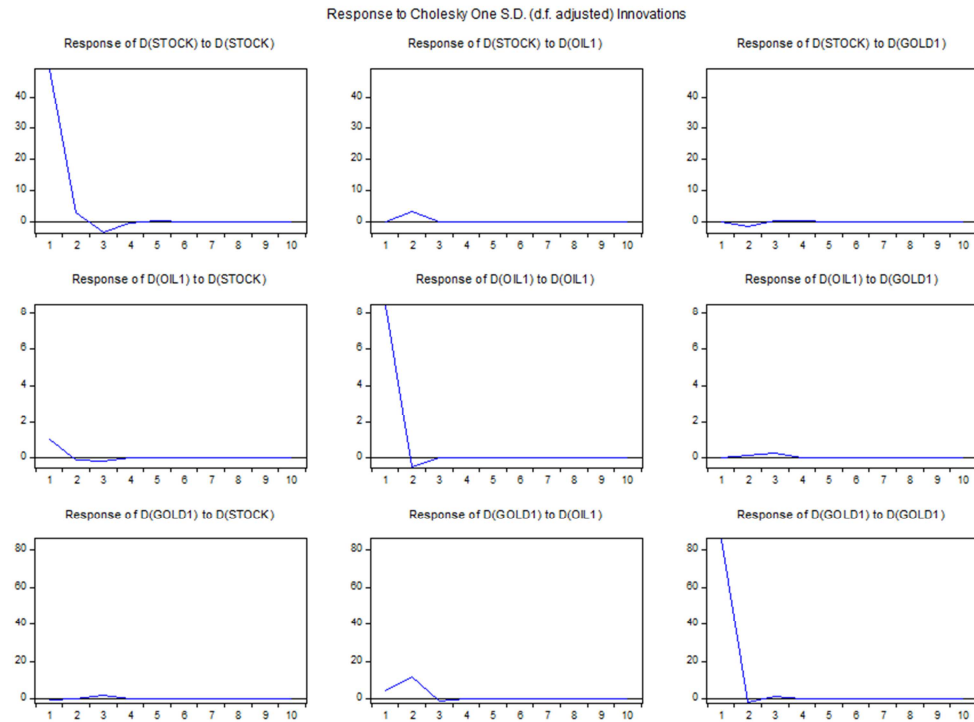


Figure 9. Pulse chart of the stock market index.

As can be seen from figure 9, from the first row, we can see that the pulse of one unit of the change of the stock market has an immediate impact on the stock market itself and a slightly positive impact on the change of international crude oil. This may be because the stock market has no significant impact on the change of gold. The pulse of a unit

of crude oil has a weak impact on the stock market, an immediate impact on itself, and a positive and weak impact on gold. The pulse of a unit of gold has no obvious effect on the change of crude oil and the change of the stock market.

Now we include the data of the financial crisis period into the research and compare it with the previous period.

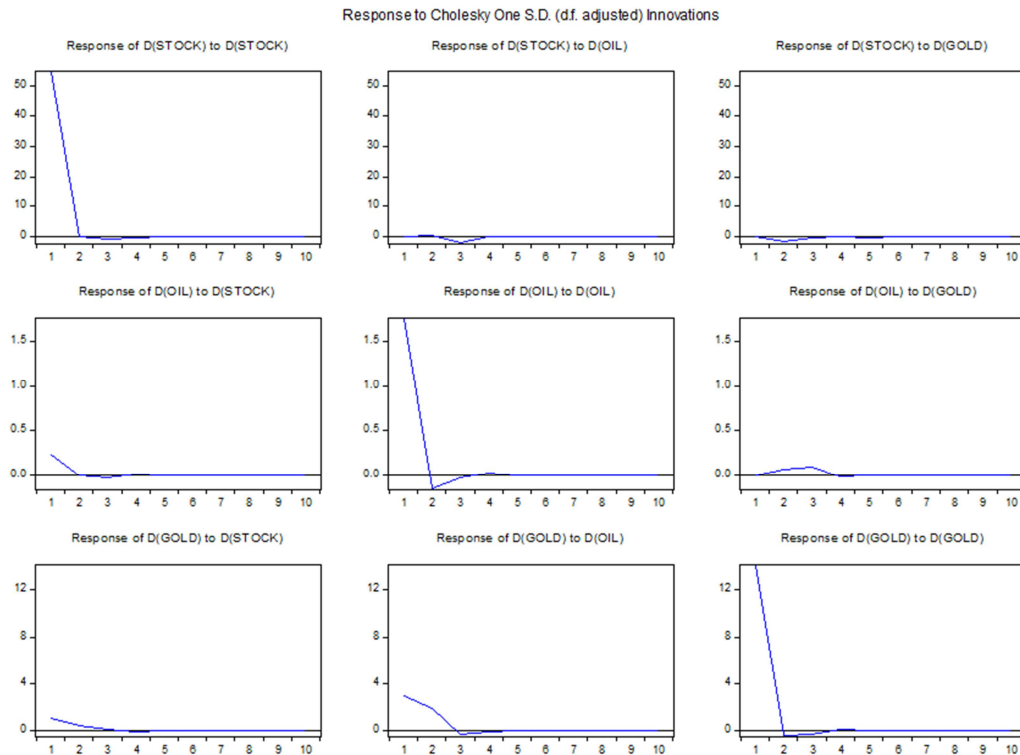


Figure 10. Pulse chart of the stock market index after first-order during the financial crisis.

From figure 10, compared with before the financial crisis, the impact of the pulse of crude oil change under the new interest rate impact of a standard deviation on itself is more significant; Compared with the uncorrelation between gold and crude oil before the financial crisis, the changes of the stock market began to have an impact on the changes of gold after the financial crisis, which may be because the hedging function of gold began to be valued by investors after the financial crisis, so the correlation between gold and the stock market increased. The impact of the change of stock market on the change of crude oil has reversed, from the original positive correlation to the negative correlation during the financial crisis, but the impact is still very weak. The effect of the change of crude oil on the change of stock market has little change, and the direction of influence remains unchanged. The impact of the stock market on gold has also changed little compared with that after the financial crisis.

5. Conclusion

According to the result, we found that before the outbreak of the financial crisis, there was no long-term equilibrium relationship between the CSI 300 index, international crude oil, and gold, but the oil price guided the stock market price. After the crisis began, this long-term equilibrium was broken by external forces. The outbreak of the financial crisis has greatly changed the relationship between gold, crude oil, and China's stock market. There may be some external forces that destroy the long-term equilibrium dynamics between these variables. Before the outbreak of the financial crisis, there is no cointegration between the three variables. At the same time, the correlation between the CSI300 index and gold is very low, and there is no causal relationship between them. After the crisis broke out, the correlation between different variables increased, and the prices of gold and crude oil were significantly positively correlated with the stock market. From the results, there is a positive correlation between the international gold price and CSI300 during the crisis. However, after the crisis broke out, the CSI 300 index was relatively independent of the international gold trend. This is inconsistent with our previous theory on the correlation between variables. This situation may be caused by many factors. China's CSI 300 index has a short establishment time, few types of financial instruments, and low market information disclosure and dissemination ability, which may lead to low market effectiveness and low correlation between CSI 300 index and gold price during the non-financial crisis period.

On the other hand, after the outbreak of the financial crisis, China implemented capital controls and restricted the free flow of capital. China's balance of payments capital account has not been fully opened. The scale of asset securitization in China's market is small and the amount of foreign exchange reserves are large. These factors make China less affected by the financial crisis than western countries. In November 2008, China's State

Council announced an investment of US \$4 trillion to stimulate domestic demand. The government's policies have led to the rapid rise of China's stock market, which may be the main reason for the positive correlation between China's stock market and international gold. During the financial crisis, financial institutions are facing a sharp decline in financial assets. These institutions need to constantly provide guarantees to solve the liquidity crisis, so they began to exchange gold for cash to solve the liquidity crisis, resulting in the decline of the gold prices with the stock market. As the Federal Reserve cut interest rates, central banks around the world followed suit. The resulting monetary easing led to a significant increase in the money supply, and people's expectations of inflation began to increase. After some time, the U.S. stock market hit the bottom, and gold, as the best tool to resist inflation, began to rise all the way. With the global economy moving from depression to prosperity, gold prices also began to rise all the way. At this time, China's policy of stimulating economic growth began to be implemented. At this time, the rise of gold and the rise of China's stock market have become a positive correlation between the two. From the results, the change of crude oil is related to the change of China's stock market, which is contrary to our previous theory that oil affects corporate profits, which is the same as Ben S. Bernanke's theory. The reason may be that when oil prices continue to fall, the oil has become a price signal. It has become an important indicator to measure whether the economy is tightening and whether it can reach the inflation level of various countries. When oil prices fall, it may mean that the economy shrinks, and the stock market begins to fall. At the same time, after the stock market fell, the market downturn and the reduction of the company's production and operation activities may reduce the demand for crude oil.

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