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Do American Stock Market have Influence on Chinese Stock Market?

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Abstract: Many thougt that Chinese stock market is independent, there is no related to other stock markets.We select the daily closing price of the US Standard & Poor's 500 Indexand the Shanghai Composite Index from January 5, 2015 to March 19, 2018based onVAR model, to study the interaction between US stock market and Chinese stock market.The results show that Chinese stock market is affected by the US stock market, it has 4 days lag.

Keywords: Standard & Poor's 500 Index; Shanghai Composite Index; VAR Model

I. Introduction

In recent years, Chinese efforts in trade liberalization have greatlypromoted Chinese foreign trade and capital flows. The promulgation and implementation of the "Measures for the Management of Split Shares of Listed Companies" in 2005 enabled the market to optimize resource allocation and value discovery. After the split of equity, financial innovation became more active and the innovation space of the securities market expanded. The opening of investment and financing, the introduction and gradual improvement of QFII and QDII systems have further opened up Chinese capital account, and promoted the internationalization and standardization of Chinese securities market. Since 2015, the introduction and development of margin financing and securities lending business has increased the supply of funds and securities. Investors have hedged and arbitrage through derivatives trading, which has increased market efficiency.

In 2016, the United States completed a GDP of 18.03 trillion U.S dollars, ranking first in the Americas and the world, and it achieved a per capita GDP of 55904.30 U.S dollars, ranking fifth in the world. The development of economic globalization has made the economic and financial market fluctuations in the United States, which have a corresponding impact on Chinese economic and financial markets. As the "barometer of the national economy", the stock market intuitively reflects the economic links between the two countries.To explore the connection between the two stock markets, Chen Xiaomeng[1] studied the linkages of the stock markets of China, the United States and India from the perspective of proliferation and jump. The results show that there is a long-term equilibrium relationship among the three, and their long-term trends affect each other.Shen Hong and Xing Ying [2] analyzed the risk spillover and the size of the spillover between the US stock market and the Chinese stock market under extreme risk conditions based on the quantile regression method and the Co VaR model. It was found that when the confidence interval q changed from 0.05 to 0.01, the risk spillover effect of the Chinese stock market on the US stock market continued to rise. On the other hand, the risk spillover effect of the US stock market on the Chinese stock market also showed an upward trend, and the upward trend was more obvious. In addition, in the event of extreme events, the Chinese A-share market is also more affected than the B-shares by the US stock market.It shows that investing in the Chinese stock market under extreme risk conditions requires more attention to the risk spillover of the US stock market to the Chinese stock market.Lin Yong and Li Yanchao[3]used the POT model to measure the market risk of the three stock markets by analyzing the daily returns of the stock markets of China, Hong Kong, and the United States.And they concluded that the three stock markets have certain commonalities in the distribution of daily returns. That is, the "clustery" and "sustainability" of stock market volatility and the "big tail" in the distribution characteristics of daily returns. Zhang Weijuan's[4] research on the linkage between Chinese mainland stock market, US stock market, and Hong Kong stock market in stages.It is concluded that there is a cointegration relationship and Granger causality among the three.Among the three phases after the implementation of QFII, the linkage between the Chinese mainland stock market and the US stock market and the Hong Kong stock market has undergone significant changes compared to the pre-QFII implementation. The linkage trend has gradually become apparent and strengthened, and the interaction between the three stock markets has increased. The guiding relationship has also been significantly deepened.Liu Fengbo[5] divided the daily returns of the stock indexes of China and the United States into two parts: the opening rate of return and the current day rate of return, and conducted a Granger test on the causal relationship between the decomposed parts. He concluded that the US stock market will has a price-guiding effect on the Chinese stock market, while Chinese stock market is difficult to influence the US stock market.Ni Chuanchuan[6] used the stationarity test and cointegration test on the sample data to establish an error correction model. Through the Granger causality test. It was concluded that the US stock market affected the Chinese stock market and the Chinese stock market did not affect the US stock market.

II. Research Design

2.1 Sample Selection and Data Processing

Select the daily closing price (Y) of the Shanghai Composite Index and the daily closing price (X) of the S&P 500 Index as indicators of the overall stock market trend in the US and China.The sample interval is from January 5, 2015 to March 19, 2018.To reduce errors,theinconsistenttrading days' data of the two countries were removed. All of the data in this article is copied from theGreat Wisdom Stocks software and Eviews10.0 is used as an analysis tool.

2.2 Basic ideas for model setting

In the economic field, most of the time-series observations are not generated by the stationary process, and the economic variables show strong trends.In order to reduce the volatility of data samples, the stability of time series is guaranteed.After Y and X are taken as logarithms, the difference is converted into logarithmic returns. The logarithmic returns of the Shanghai Composite Index isr_1 and the logarithmic returns of the S&P 500 Index is r_2.

$$r_1 = log(y) - log(y(-1))$$

$$r_2 = log(x) - log(x(-1))$$

In this paper, descriptive statistical studies of the two time series r_1 and r_2 are performed first, and the stationarity is tested. Then a vector autoregressive (VAR) model is established for both of them. With the Granger causality test,the Pulse Response Function and the Variancedecomposition,westudy the dynamic interaction between ther_1 and r_2.

III. Empirical Analysis

3.1 Descriptive Statistics and Stationarity Test

Perform descriptive statistics on r_1 and r_2 separately and label it as Table1.

Table1Descriptive statistics for r_1 and r_2

sequence	r_1	r_2
Mean	-0.000029	0.000390
median	0.000999	0.000397
Standard	0.016614	0.008330
Skewness	-1.238661	-0.457663
Kurtosis	9.456067	7.856313
JB	1504.2720	768.2629
Probability	0.000000	0.000000
Number of	755	755

Table1showns, the skewness of r_1 and r_2 is less than 0, and the median is slightly larger than the average, and both r_1 and r_2 are left-biased.On average, theclosing prices of the S&P 500 Indexand the Shanghai Stock Index are lower than the median closing price.At the same time r_1, r_2 kurtosis were significantly greater than 3, the data is more concentrated, in line with the peak-tailed distribution.The statistics for r_1 and r_2 show that the sequences are not normally distributed.

A unit root test is performed on the time series of r_1 and r_2.We can see the results from Table2that the t-test statistic valuesof Y and X are better than the correspondingcritical values at three significant levels of 1%, 5%, and 10%.Itindicates that the sequence has a unit root and is non-stationary. After Y and X are taken aslogarithms,and them are converted into the yield r_1 and r_2, the corresponding ADF test valuesare less than the critical value of each significant level, which is a stable time series.In the following, we will use the r_1, r_2 sequence data to select the optimal lag period to establish the VAR model, test the stability of the system, and use the Grange causality test to analyze the interconnection between the US and Chinese stock markets.

Table2Unit Root Test Results

variabl	ADF	1%	5%	10%	conclusion
Y	-2.369	-3.4388	-2.86517	-2.5687	unstable
X	-0.296	-3.4387	-2.86515	-2.5687	unstable
r_1	-25.75	-3.4387	-2.86515	-2.5687	smooth
r_2	-27.09	-3.4387	-2.86515	-2.5687	smooth

3.2 Selection of VAR Model Lag Order

Both r_1 and r_2 are stable time series, and the relationship between the two can be established by VAR model analysis.First use eviews10.0 to create VAR(2) for r_1 and r_2.From the table, we can see that LR, FPE, and AIC all point to the fourth-order lag period, the optimal number of periods given by SIC is 1, and HQ corresponds to two periods.In order to guarantee the accuracy of the model, the lag order 4 with the most "*" is selected according to most principles.

Table3Optimal lag period selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	4536.011	NA	1.83E-08	-12.13925	-12.12689	-12.13449
1	4551.574	31.0014	1.78E-08	-12.17021	-12.13314*	-12.15592
2	4561.253	19.22722	1.75E-08	-12.18542	-12.12362	-12.16160*
3	4564.72	6.870276	1.75E-08	-12.18399	-12.09748	-12.15065
4	4573.655	17.65413*	1.73e-08*	-12.19720*	-12.08597	-12.15434
5	4575.873	4.370093	1.74E-08	-12.19243	-12.05648	-12.14004
6	4577.347	2.897606	1.75E-08	-12.18567	-12.025	-12.12375
8	4581.672	7.559257	1.77E-08	-12.17583	-11.96573	-12.09486

3.3 Model Establishment and Inspection

By checking the stationarity of the data and determining the order of the model, a VAR(4) model is established between r_1 and r_2.Fig. 1. The stability test of the VAR(4) model is shown.All the roots of the corresponding characteristic equation fall within the unit circle. The equation passes the stationarity test and the model is valid.

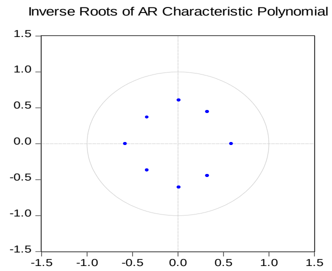

Fig. 1 Unit Root Test Results

3.4 Granger causality test

Thesequence we taken is stationary, which is satisfies the premise of the Granger test. In order to further verify the causality between the US stock market and the Chinese stock market, r_1 and r_2 are mutually tested for Granger causality.AsTable4 shows,r_2 can cause r_1 change through Granger causality test. It's corresponding probability p is 0, r_1 cannot change r_2 due to Granger causality test. The probability p is 0.2174.It can be initially assumed that the S&P 500 yield is the Granger causality of the Shanghai index's yield, but the Shanghai index's yield is not the Granger causality of the S&P 500's yield.

Table4 Granger causality test results

Depende	Exclude	Chi-sq	d	Prob
r_1	r_2	42.8373	4	0
r_2	r_1	5.76494	4	0.217

3.5 pulse corresponding function

To investigate the dynamic effects between r_1 and r_2, an impulse response plot of r_2 versus r_1 was made.

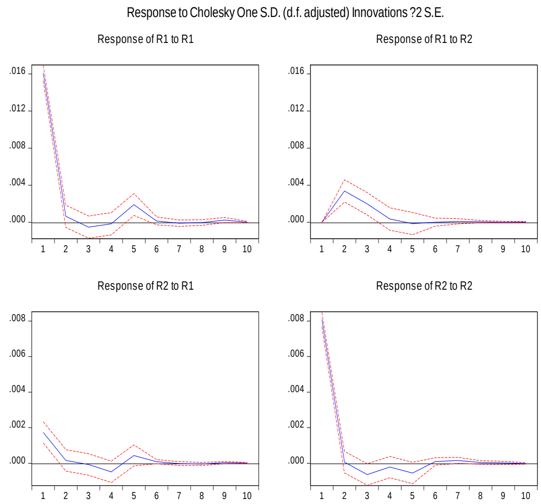

Fig. 2

As fig. 2 shows, the volatility of the S & P 500 and Shanghai index yields is more pronounced by the impact of their own lag of one period, with the increase of lag, the impact tends to zero. And it can be seen that the impact of fluctuations in the yield of the S&P 500 Index has an impact on the yield of the Shanghai Composite Index, lagging behind by one period, and the yield of the S&P 500 Index has a greater impact on the yield of the Shanghai Composite Index. It is basically near zero after 2 phases. In the three-lag period, the impact of fluctuations in the yield of the S&P 500 Index has a negative impact on the yield of the Shanghai Composite Index. After the fourth period, the impact strength remained basically unchanged, and the influence level basically went to zero. At the same time, the Shanghai yield has a weak impact on the S & P 500 yield, lagging 1, the impact of the Shanghai index on the S & P 500 index is 0, lagging 2,the Shanghai yield has a significant positive effect on the S & P 500 yield, lagging 3,the influence level basically went to zero.

3.6 variance decomposition

In order to analyze the variance of it's own perturbation term and the proportion change of the perturbation term's variance from other indicator in the total variance of r_1 and r_2, decomposite the r_1 and r_2.As **Table5** and Table6 show.

Table5 Variance Decomposition of r_1:

Period	S.E.	r_1	r_2
1	0.016111	100.0000	0.000000
2	0.016475	95.78362	4.216383
3	0.016605	94.39257	5.607434
4	0.016609	94.34808	5.651915
5	0.016720	94.41601	5.583989
6	0.016721	94.41634	5.583656
7	0.016721	94.41216	5.587845
8	0.016722	94.41049	5.589513
9	0.016723	94.41156	5.588436
10	0.016723	94.41122	5.588776

For the variance of r_1 (the yield rate of the Shanghai Stock Exchange Index), when the lag period is 1, 100% comes from its own rate of return. As the lag period increases, the total variance from its own part shows a downward trend. Finally, it tended to be stable after the fourth stage of lag, which was about 94.42%.When the lag period was 1,it was 0,and gradually increasing with the lag period from the part of r_2 (S & P 500 index yield). Eventually, it led to a significant increase which tends to 5.58%and improved notably.

Table6 Variance Decomposition of r_2:

Peri	S.E.	r_1	r_2
1	0.008273	4.407813	95.59219
2	0.008275	4.440620	95.55938
3	0.008300	4.421450	95.57855
4	0.008317	4.749101	95.25090
5	0.008347	4.989132	95.01087
6	0.008348	4.999198	95.00080
7	0.008349	4.998089	95.00191
8	0.008349	5.000691	94.99931
9	0.008349	5.002245	94.99775
10	0.008350	5.002331	94.99767

For the variance of r_2 (S&P 500 index yield), when the lag period is 1, 95% comes from its own rate of return, after the fourth period, the part of the total variance from its own tends to 95 %, from r1 (the return rate of the Shanghai Stock Exchange Index), with a lag period of 1.4% for the first quarter and a final increase of 4.99%.The lag behind the 9th phase was basically stable, at 0.0088349.

Therefore, both short-term and long-term $r_1$and r_2 are greatly affected by themselves. In the long-term, their role is partially weakened. The extent of r_1 affected by r_2 is improved notably as the lag period increase, and after 4 period ,the incidences tends to be stable. The extent of r_2 affected by r_1 was slightly increased in lag 1 to 4 phases, and lag 5 began to stabilize.It can be considered that r_1 is significantly affected by r_2 fluctuations, while r_1 fluctuations have a weak influence on r_2.

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3.7 Residual analysis

From Fig.3, the established VAR(4) model, we know that the residual is white noise, which is in line with the basic assumptions of the VAR model.

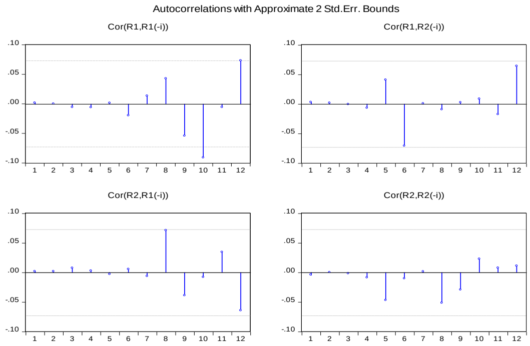

Fig.3

IV. Conclusions and Recommendations

Based on the above empirical test results, we found that:

(1) The US stock market has a significant positive impact on the Chinese stock market, while the Chinese stock market has a smaller impact on the US stock market.

(2) The impact of the US stock market on Chinese stock market has obvious lag, lagging behind by approximately 4 phases.

Since changes in the US stock market are ahead of changes in the Chinese stock market, investors can forecast the trend of the Chinese stock market by analyzing the trend of the US stock market, diversify investment, and optimize investmentstrategies.The acceleratingprocess of economic globalization and financial market integration has made the connection between Chinese economy and the world economy increasingly close. Chinese policy makers need to formulate reasonable policies to prevent the impact of the turmoil in the international financial market on Chinese securities market and maintain the stability of Chinese stock market.Regulators can avoid the financial risks such as asset bubbles in mainland China by studying other stock markets.

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