

# The Forecasting Ability of the Chinese Stock Market and the U.S. Stock Market on Each Other

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## ABSTRACT

As the largest stock markets in the world, the relationship between the Chinese stock market and U.S. stock market have always been the hottest topic. If the U.S. stock market can predict and provide additional forecasting information for the Chinese stock market beyond that contained in Chinese economic variables, investors should incorporate the U.S. stock market variable into their information set to enhance the accuracy of their return forecasts. This paper mainly incorporates the data after China joined WTO because Chinese economy developed much faster than before after it joined WTO. By employing OLS and cointegration tests, this analysis presents evidence of the increasing interaction between the Chinese and the U.S. stock markets. This finding can be valuable to investors in a way that investors shall incorporate the information in the other market to make the right decision about investment in the domestic market.

**Keywords:** Chinese stock market, U.S. stock market, WTO, mutual interaction, OLS model

## 1. INTRODUCTION

With the rapid development of international capitals, the macroeconomic relations among different countries in the world have become closer, and the development of macroeconomics has also shown a significant correlation. The interconnectedness between the capitalist markets of various countries has increased as the global economy has become more integrated. With the integration of international finance, stock markets in different countries are showing a similar trend of rising or falling. The stock market in different countries have a similar trend in some specific circumstances. The fluctuations of market yields and price in different countries have a correlation which result in the stock's prices in different market following a relatively stable trend.

Investors all over the world pay more attention to the linkage of the international stock markets, especially the stock markets between China and the United States. The United States, the world's largest market, has a big influence in the world capital market. The United States and China have been the largest trading partner for many years. In addition, China's capital market has opened to the rest of the globe, and local and international economic linkages are close. China's capital market has become one of the most important part of the global capital market.

Chinese central government have attached great importance to the financial sector after 2015–2016 Chinese stock market turbulence. Public pension plans continue to shift into the stock market. Internet has penetrated many aspects of people's lives. More and more Chinese people have investment in the stock market [1]. Understanding the linkage between Chinese and U.S. stock markets is important. It can help investors to analyze investment portfolios and the structure of the securities market thereby identifying market trends and increasing investment portfolio returns. Meanwhile, it can also help listed companies to develop strategies and achieve internationalization of capital markets.

To narrow the topic down and make it more specific, this paper will focus on the years after China joined World Trade Organizations (WTO). After China joined WTO in the end of 2001, China became fully integrated into the organization over the next several years. Because US is the world's largest economy and is one of China's largest trading partners, it is reasonable to use the U.S. stock market as a proxy for global economic activity. Hence, it would be of interest to study the relationship between the two markets in the years around financial crisis.

## 2. LITERATURE REVIEW

### 2.1. U.S. stock market history

The development history of the U.S. stock market has four historical periods in the past 200 years. The first stage is from the end of the 18th century to 1886, the U.S. stock market initially developed. The first stock exchange, the Philadelphia Stock Exchange, was founded in 1790. The US stock market was rapidly developed from 1886 to 1929. The third stage is from the Great Depression in 1929 to 1954.

### 2.2. Chinese stock market history

The first off-exchange trading counter was established in Industrial and Commercial Bank of China by Shanghai International Trust & Investment Corporation on September 26, 1986. The first securities company was established in Shenzhen Special Economic Zone on September 27, 1987. On November 26, 1990, the Shanghai Stock Exchange (SSE) was formally established. Shenzhen Stock Exchange trial opened on December 1, 1990. Shenzhen Stock Exchange trial opened on December 1, 1990. After that, the first trading day of the Shanghai Stock Exchange was opened on December 19, 1990. In July 1991, the Shenzhen Stock Exchange officially opened.

### 2.3. Comparison of the correlation between Chinese and U.S. stock markets

One of the most important characteristics of the modern financial system is economic integration and financial globalization. The stock price is not only affected by domestic information, but also by spillover effects due to the transmission of international information. Many researchers studied the information linkage and relationship between Chinese and U.S. Stock Markets. Cheng and Glascock did not find the evidence of long-term relationship between the Chinese and US stock markets, but they found that the correlation between the two markets has increased after the financial crisis of 2007-2008 [2]. Qiu and Ye analyzed the data of SSE index and the S & P 500 and use multifractal detrended cross-correlation analysis (MF-DCCA) method to analyze the interaction between Chinese and U.S. stock markets [3]. It was found that the interaction between Chinese and U.S. stock markets during the financial crisis. The U.S. stock market has shown an increasing spillover effect to the Chinese stock market. Bissoondoyal-Bheenick et al., investigated the stock market volatility spillover among countries: U.S., China, and Australia. They found that there is a bilateral causality relationship between these countries at the market index level from 2007 to 2016 [4]. Zhang et al. built a time varying parameter vector auto-regression (TVP-VAR) model to investigate the

dynamic spillover effects between U.S. stock volatility and China's stock market crash risk [5]. Their results indicated that China's stock market crash risk increases as the U.S. stock volatility rises. Furthermore, China's stock market crash risk will be exacerbated by the country's improvement in financial market openness, short-term capital outflows, and RMB depreciation.

## 3. MODELING

The research focuses on the forecasting ability of the opening of stock price in Chinese stock market and the U.S stock market on each other. My hypothesis is that the opening of stock price in Chinese stock market can predict the daily return in the U.S stock market and vice versa. To test the hypothesis, some other control variables need to be included in the model. I will include interest rate and currency exchange rate in my model. Therefore, my model looks like this:

$$P_{1t} = \beta_0 + \beta_1 * P_{2t} + \beta_2 * I_t + CE_t + \mu \quad (1)$$

where P1 represents the opening stock price in one market and P2 represents the opening stock price in the other market. I represent the interest rate and CE stands for currency exchange rate. I will run two regressions: one tests the forecasting ability of the U.S. stock market on Chinese stock market and the other tests the forecasting ability of the Chinese stock market on the U.S. stock market.

The model this paper was going to use is Ordinary Least Square (OLS) model. Since the data displays time-series characteristics, it will use Dicky Fuller test to test whether the variables are unit root. To test whether there is a difference between the forecasting ability on the first Friday of each month, on which the job report get announced, it will also include a Friday dummy variable. Additionally, it will test the out-of-sample forecasting ability of the model. With the rapid development of international capitals, the macroeconomic relations among different countries in the world have become closer, and the development of macroeconomics has also shown a significant correlation. The interconnectedness between the capitalist markets of various countries has increased as the global economy has become more integrated. With the integration of international finance, stock markets in different countries are showing a similar trend of rising or falling. The stock market in different countries have a similar trend in some specific circumstances. The fluctuations of market yields and price in different countries have a correlation which result in the stock's prices in different market following a relatively stable trend.

**4. DATA**

This paper analyzed stock returns predictability of the Chinese, stock returns predictability of the Chinese stock market and the U.S. stock market from 2002 to 2012, especially after China joined WTO and after the recent financial crisis occurred. This paper used Shanghai composite index to represent the Chinese stock market. The economic reforms started in 1978 led to the rebirth of the stock markets in China. The Shanghai Stock Exchange and the Shenzhen Stock Exchange are the two major emerging capital markets in China. The Shanghai Stock Market was officially opened in 1990 and the Shenzhen Stock Market in 1991. Two types of stocks are traded in the two markets: class A and class B. Class A shares are restricted to Chinese citizens and denominated in Chinese currency yuan or Renminbi (RMB), while class B shares can be bought and sold only by foreigners and are settled in foreign currencies (US dollars for Shanghai, Hong Kong dollars for Shenzhen). By the end of 1995, there were 135 companies and 161 stocks listed on the Shenzhen Stock Exchange. Regardless of some inevitable difficulties in its infancy stage, the rapid development of China's capital markets has generated interest among academics, investors and regulators. In this research, I focus the analysis on the relationship of share A markets with four other markets. There are at least two reasons for examining class A share markets. First, the class B shares market has been losing its appeal to foreign investors while the class A share market dominates that of class B shares in terms of the number of listed companies, trade volume and market capitalization. Second, it allows us to address an interesting issue: how the volatility of a market, which is largely closed to

foreign investors, is related to the volatility of foreign markets — the U.S. market. It got the data of Shanghai composite index on Shanghai stock exchanges

This paper use Standard & Poor's 500 (S&P 500) to stand for the U.S. stock market. It is an American stock market index based on the market capitalizations of 500 large companies having common stock listed on the New York Stock Exchange or NASDAQ Stock Exchange. The S&P 500 is widely used as a measure of the general level of stock prices, as it includes both growth stocks and value stocks. It got the data of S&P 500 on Yahoo finance.

The ideal data contains all the opening price of the Shanghai Composite Index and S&P 500, interest rate and exchange rate from 2002 to 2012. However, due to different dates for holidays in China and in the U.S., some data does not match. Any data that is missing in one country will lead the whole data set containing stock return, interest rate, and currency exchange rate to be dropped. A table that describes the data is attached. The missing data will cause some breaks in the time interval. For example, for May 1st to May 7th, Chinese people are celebrating National day as holidays. Therefore, the market is closed during these days while the U.S. stock market remains open. During these days, investors in the U.S stock market react to the market without the information in the Chinese stock market. However, the breaks are relatively short compared to this time scale containing a large data set. Besides the two major variables mentioned above, it also include the exchange rate of the currencies and interest rate in each country. This paper got these data on Federal Reserve Economic Research (FRED). The basic statistics are shown in table 1:

**Table 1.** Descriptive Statistics

| Variable                  | Obs  | Mean    | Std. Dev. | Min     | Max     |
|---------------------------|------|---------|-----------|---------|---------|
| S&P 500                   | 2545 | 118.52  | 18.96     | 2622.03 | 19531.2 |
| Shanghai Composite Index  | 2545 | 2187.68 | 1004.48   | 1011.5  | 6092.06 |
| Interest Rate in the U.S. | 2545 | 4.34    | 0.85      | 2.08    | 6.79    |
| Interest Rate in China    | 2545 | 7.02    | 0.92      | 4.55    | 8.96    |
| Currency Exchange rate    | 2545 | 7.78    | 0.62      | 6.6     | 8.28    |

**5. EMPIRICAL EVIDENCE**

In our empirical application, I first analyze whether the stock price in China can predict the stock price in the U.S. before and after China joined WTO and financial crisis occurred. In the model, the independent variable is the stock price of S&P 500 and the independent variables are the stock price of Shanghai Composite Index, interest rate in the U.S. and the currency exchange rate between yuan and dollar, job report dummy.

Because the data is time-series data, whether the stock price is unit root is tested by using augmented Dicky-Fuller test. The MacKinnon approximate p-value of S&P 500 is 0.5729 and the p-value of Shanghai Composite Index is 0.3256, indicating that unit root problem exists in the stock prices. Although the two markets' stock prices are unit root processes, there might still be a relationship between the two. The cointegration test is conducted to see whether the two variables are cointegrated. The p-value is 0.0058, indicating that there is evidence of cointegration. I also

test whether interest rates in both countries are unit root processes. According to the Dicky-Fuller test, the p-value of interest rate in the U.S. is 0.1455 and that of the interest rate in China is 0.2341. However, the cointegration tests indicate that there is a cointegration relationship between the interest rate and the stock prices in each market. Hence, the OLS regression is not a spurious regression. According to the regression result, the positive impact of Shanghai Composite Index on S&P 500 is significant.

Then, I analyzed the impact of the price of S&P 500 on Shanghai composite index. In the model, the independent variable is the stock price of Shanghai Composite Index and the independent variables are the stock price of S&P 500, interest rate in China and the currency exchange rate between yuan and dollar. The cointegration test is conducted to see whether the two variables are cointegrated. The p-value is 0.0063, so we can reject the null and conclude that there is no evidence of cointegration. According to the regression result, the positive impact of S&P 500 on Shanghai Composite

Index is significant. Hence, there is a mutual forecasting relationship between the two markets.

The RMSE of the first model, in which Shanghai Composite Index price forecasts the stock price of S&P 500, is 20.58. This is a pretty small RMSE, indicating that the out-of-sample forecasting ability is good. Similarly, the RMSE of the second model, in which the stock price of S&P 500 forecasts Shanghai Composite Index price, is 15.72.

Besides the interaction between the two stock markets, interest rate and currency exchange rate also play a significant role. According to the regression result, in the first model, the estimated coefficient of interest rate is positive and statistically significant ( $p = 0.000$ ). Whether central banks should set the short-term nominal interest rate in response to stock price fluctuations remains in debate.

The estimated coefficient of currency exchange rate is negative and statistically significant ( $p = 0.032$ ). The regression result of the first model is included in table 2:

**Table 2** The regression result

| Independent Variable   | Coef.     | Robust    |   |
|------------------------|-----------|-----------|---|
|                        |           | Std. Err. | p |
| S&P 500                | 0.0056*** | 0.0035    | 0 |
| Interest rate in China | 0.266***  | 0.0384    | 0 |
| Currency Exchange rate | 0.18***   | 0.00723   | 0 |

\*Significant at .1 level; \*\*significant at .05 level; \*\*\*significant at .01 level

The second model do the same steps. Both of them pass the Ramsey test and Pagan test, meaning that the regressions do not have the problem of autocorrelation and the functional forms are appropriate.

**6. CONCLUSION**

In this paper, by employing OLS and cointegration tests, it presents evidence of the increasing interaction between the Chinese and the U.S. stock markets, two of the largest and most important stock markets in the world currently.

Because there is no overlap of trading hours between China’s stock market and the U.S. stock market, the stock price during trading sessions in these two markets are driven by different information sets. As a result, the stock prices, which are mainly dependent on trading activities, on those two stock markets may not show significant correlations. However, this research offers new evidence of the interaction between the two markets. We show that since 2002 the stock prices in the U.S. market indexes contain important overnight information, which can forecast the opening stock price of the Chinese stock market at the next opening.

Similarly, the stock price in the Chinese market indexes can also forecast the opening stock price of the U.S. market at the next opening. This finding can be valuable to investors in a way that investors shall incorporate the information in the other market to make the right decision about investment in the domestic market.

There are limitations in this research. First of all, significant forecasting ability of the two stock markets after China joined WTO. However, due to data limitations, we do not know this effect significantly differs from the scenario before China joined WTO. If we could have included ten more years before China joined WTO, we would be able to test whether there is a significant difference. Additionally, there might be other variables that could explain the dependent variables but are not included in the model. Moreover, further research can be done to test whether the stock price in one market granger causes the stock price in the other market. To test this, we can conduct a Vector Autoregressive model, in which the lagged values of the dependent variable are included. It is hoped that these estimates provide a departure point for more refined models and data. Figures and tables should be placed

either at the top or bottom of the page and close to the text referring to them if possible.

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