The Drivers of the Great Bull Stock Market of 2015 in China: Evidence and Policy Implications

Guoxiang Song

Department of Accounting and Finance, Faculty of Business, University of Greenwich, Park Row, Greenwich, London

United Kingdom, SE10 9LS

Email: sg63@gre.ac.uk.

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Abstract

This paper investigates what drove the great bull stock market of 2015 in China. Multiple regression models based on the Arbitrage Pricing Theory (APT) theory are developed to describe the variation in stock returns using economic fundamentals. The results indicate that during the normal period, the Chinese stock market was sensitive to economic conditions. However, during the bull market, fundamentals could not justify the variation in the stock returns which are significantly different from the conditional predictions based on the multiple regression model which is robust for the normal period. Margin trading was the main driver of the speculative bubble during the bull market from May 2014 to June 2015. As commercial banks are becoming more exposed to the stock market, the volatility of stock prices may have the potential to increase the risk of the financial system and limit the freedom of China to use monetary policy to deal with economic fundamentals.

Keywords: Bubble, China, Fundamentals, Margin trading, Monetary policy, Stock returns.

JEL Classifications: G12, G18, E44

1. Introduction

The bull stock market in the first half of 2015 in China has been argued to be one of the world's worst investment bubbles and some people call it China's 1929 (Gold, 2015; Warner, 2015). However, the Chinese government has been trying to support this bursting bubble since the market lost a third of its value in less than a month from Mid-June to early July 2015. One of the main arguments put forward for the government intervention in the stock market is the official rhetoric which argues that the bull market reflected the improving economic fundamentals in China (The People's Daily, 2015a&b). Therefore, this paper attempts to provide empirical evidence on what drove this bull market.

The evidence on whether the Chinese stock market reflects fundamentals is very important. It has serious implications for China's economic reform and transformation of economic growth model. The development of the stock market was recognized as one strategic decision by the Chinese government in January 2004 when the State Council announced nine proposals to reform, open up and develop the capital market steadily. And these proposals were further improved and updated in 2014. In recent years, the Chinese government is developing a multi-tiered capital market (Li, 2018). China's objective is to realize the efficient utilisation of funds within the economy since the stock market is argued to provide a means for shifting resources across time and place to where they are most efficiently employed, and form an effective corporate governance for state-owned companies which have implemented mix-ownership reform to incorporate private shareholders. However, whether this efficiency can be achieved depends on whether stock prices are highly sensitive to economic conditions.

China also wants to rebalance domestic growth by increasing private consumption and improve the capital structure of state-controlled companies (Li, 2018). As residents are

encouraged to transfer more bank savings to the stock market, the rise of stock prices will increase the wealth of investors. This will help China to upgrade its economic structure and develop a consumption-driven economy. In addition, the rise in stock prices will lower the cost of capital and improve the capital structure of firms, which will increase the debt capacity of firms and reduce the financial risk of the economy. However, if the stock market is not efficient but speculative, it may have adverse implications for these objectives.

Whether stock prices reflect fundamentals also affects China's progress of opening up the stock market to international investors. China's stock market is the second largest in the world, and it was included in MSCI's emerging markets index in 2018 obliging the estimated $1.6tn of international investment funds that track the index to buy China's domestic stocks (Hughes and Bullock, 2017). However, a speculative market is not able to attract long-term international investors who may help China develop a healthy stock market. On the contrary, it may attract short-term hot money which further destabilizes the stock market since there is evidence that international institutional investors have destabilised emerging markets (Aitken, 1998).

Several ways could be applied to evaluate whether a stock market has a speculative bubble. One popular way is to use the price earnings ratio. This ratio measures how expensive a stock is. If the ratio is too high, it may indicate that the stock price does not reflect fundamentals and will decline sharply in near future. For example, in the US, when the price earnings ratio of the Standard & Poor's 500 stock index (S&P500) reached 32.6 in September 1929 before the Great Depression of the 1930s, and 30 at the height of the dot-com bubble in late 1990s and 26.9 by the end of 1999, the stock market did fall significantly in the following years (Irwin, 2015; Kashkari, 2017; Shiller, 2000). However, on 12 June 2015, when the Shanghai

Stock Exchange Composite Index (SSE Composite Index) [1] reached the peak, its average price earnings ratio was 24.92 for A shares (SSE, 2015) which was lower than the ratios occurred in the US stock market during bubbles. Therefore, it is hard to draw a definite conclusion from this measure that the Chinese stock market was a bubble. Moreover, it is argued that the price earnings ratio of the Chinese stock market should be close to that of the US because China is internationalizing its RMB and financial markets (The People's Daily, 2015a).

Based on the Arbitrage Pricing Theory (APT) (Ross, 1976), this paper applies multifactor models to evaluate the bull market of 2015 in China. The SSE Composite Index is examined to show whether the broad market rather than individual stocks is overvalued. As the broad market index diversifies firm-specific effects, macro fundamental factors such as inflation, interest rates and industrial production, are used to describe the variation of this market index.

Multifactor models are developed based on the data of the normal period of the stock market. This is because during normal periods, stock prices are less subject to huge speculative activities, and the broad market can be very sensitive to economic conditions. Then, the model robust for the normal period is tested using the data of the bull periods. If the model is still robust, it can be inferred that the bull markets reflect fundamentals. Otherwise, the bull markets contain speculative bubbles. There are two bull periods in the Chinese stock market since 2004. One is the period from February 2006 to February 2008, and the other is the recent period from May 2014 to June 2015. The model for the normal period is developed based on the period between these two bull periods.

1 The SSE Composite Index is a capitalization-weighted index which tracks the daily price performance of all A-shares and B-shares listed on the Shanghai Stock Exchange. It was developed on 19 December 1990 with a base value of 100.

The results of this paper indicate that during the normal period, China's stock market did reflect fundamentals. The RMB exchange rate and the annual growth rate of CPI, export and retail sales report a significant impact on the annual return of the stock market in each month. However, during the bull periods, this market was not sensitive to economic conditions and the model for the normal period is not robust. The money supply indicator M1 reports a significant impact on stock returns during the bull period from February 2006 to February 2008, but it may have captured the impact of a speculative bubble.

One important development in the Chinese stock market was the introduction of margin trading in 2011. Because there are arguments that margin trading has contributed to speculative bubbles in several stock markets (Seguin and Jarrell, 1993), this paper includes margin trading as one variable to explain the variation in the stock returns of the bull market of 2015 in China. Indeed, there is strong evidence that margin trading was the major contributor to this bull market.

These results suggest that China improve its measures to develop the stock market. China should stop margin trading and stock-based bank loans to return the stock market to the normal. Otherwise, the effectiveness of monetary policy to deal with fundamentals will be compromised by the financial risk created in the volatile stock market. And it will be difficult for China to develop a stable and healthy stock market for deepening economic reform and rebalancing economic growth.

This paper contributes to the literature on the market efficiency and bubbles. It is the first paper which investigates whether the recent Chinese stock market is driven by fundamentals. And it provides some new evidence related to the Efficient Markets Hypothesis (EMH) in the second largest economy in the world.

The methodology applied in the paper to identify bubbles is also an important contribution to the debate concerning the approach used by the behaviour critique of the EMH. The introduction of margin credit in the APT model is one approach to incorporating a behavioural dimension into the asset pricing models. And this approach can help evaluate the contribution of fundamentals and mass psychology respectively to asset price movements with rigorous quantitative tools.

The remainder of the paper proceeds as follows. Section 2 provides some background information and reviews the related literature on the debate on the two bull markets in China. Section 3 describes the data, methodology and models. Section 4 reports the results. Section 5 discusses the policy implications of the results. Section 6 concludes.

Section 2 The great bull market of 2015 in China

China has experienced two bull markets since it started the reform of the stock market in 2004. The first one occurred during the period from 2006 to 2008 and the second one happened during the period from 2014 to 2015. During 2006 to 2008, the SSE Composite Index increased by 246.7% in one year from the lowest point of 1766.31 on 16 October 2006 to the highest point of 6124.04 on 16 October 2007. After that peak, the index decreased to the lowest point of 1901.5 on 16 October 2008 by 69% in one year.

(Insert Figure 1 here.)

The recent bull market showed a similar picture. The SSE Composite Index started its rally from the lowest point of 2045.96 on 12 June 2014 and increased to the highest point of 5178.19 on 12 June 2015. Although this increase of 153% in one year is less than that of the previous period, it is much greater than the increase of 20% a year experienced by Japan in

the 1980s and the US in the 1990s when both stock markets were in bull periods (Browne, 2001).

After the peak, the Chinese stock market started to decline. It decreased to the lowest point of 2850.71 on 26 August 2015 although the Chinese government announced a host of unconventional measures to rescue the market in July 2015[2]. This decrease of 44.9% in two months is much more dramatic than that of the previous period, and also one of the largest declines in the history of world stock markets being worse than the decline of a third of the Nikkei from December 1989 to December 1990 (Browne, 2001) and the decline of 23% of the S&P500 from August 2000 to December 2001 (Mishkin, 2002).

Some commentators argue that there are bubbles in both bull markets. In the case of the bull market during 2006 to 2008, the bubble is argued to be due to the excess liquidity in the financial system, which came from China's attempt to peg its currency to the US dollar to support exports that resulted in artificially low interest rates (Chancellor, 2007). In the recent bull market, the bubble is argued to be supported by the Chinese official media which claims that the rally reflected the economic reform and the record level of margin financing (The Economist, 2015a).

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2 For example, the People's Bank of China (PBOC) cut interest rates to a record low and offered direct credit support to government-backed China's Securities Finance Corporation (CSF) which announced that it would lend billions to big Chinese brokers so they could buy more stocks. And brokers committed to buy billions worth of stocks. In addition, the China Securities Regulatory Commission (CSRC) imposed a ban on short selling and initial public offerings, and a ban on sales by controlling shareholders and large shareholders with 5% or more holdings and board members for six months, and required the CSF to buy shares of mutual funds to support the liquidity of institutional investors.

However, other commentators argue that both bull markets reflected the high economic growth rates of China during each period. The bull market of 2006 to 2008 came after the successful reform of non-tradeable shares in 2005, which removed the barriers to full trading of shares seen in the Western stock markets (Song and Meeks, 2009), making it possible for the Chinese stock market to be sensitive to economic fundamentals. Therefore, the bull market could reflect the long-term stable growth rate of nearly 10% that the Chinese economy enjoyed since the turn of the 21st Century (Hu, 2007).

The bull market of 2015 is called "reform bull" and a carrier for "the China's dream" (The People's Daily, 2015a&b; CNR, 2015). The increase in stock prices is argued to reflect the investors' confidence on many new concepts arising from the new economic reform and structure adjustment measures, such as new internet, new silk-road project and free trade zone, which may increase corporate earnings. And the bull market was expected to sustain as there was enough liquidity in the stock market due to the easing of monetary policy and China's GDP being expected to keep growing at around 7%.

In addition, some commentators argue that there was no evidence of a bubble in 2015 when the price earnings ratios of blue chips of China were compared with those of the US market. For example, they argue that the price earnings ratio of the banking industry in China was lower than that of the US, and the narrowing of this difference would make more room for the Chinese stock market to improve as China was globalizing its financial system (The People's Daily, 2015a). Moreover, the Chinese government announced its reform plan to enable the general public to benefit from the dividend arising from the reform through investing in the stock market. In their view, the stock market crash did not reflect the general favourable economic conditions in China (The People's Daily, 2015a).

It is difficult to judge which argument tells the true stories of the bull markets without doing any empirical analysis. This paper attempts to contribute to this debate by investigating whether the stock returns during both bull markets reflected fundamental factors using multiple regression models. However, before the empirical analysis is conducted, it is worth noting that the introduction of margin financing and bank financing after the first bull market may have had a significant impact on the recent development of the Chinese stock market.

Margin Financing

Margin financing means the borrowing of part of the purchase price of a stock from a broker by an investor. The investor uses the stock purchased as the collateral to cover the loan from the broker. To finance these borrowings of the investors, brokers in China may use their own capital and/or borrow money from the CSF which in turn can borrow from commercial banks. In addition, brokers can borrow from commercial banks directly[3]. In 2007 when the stock market bubble burst, there was no margin financing. However, China opened equity index futures market in April 2010 and introduced margin trading in November 2011 in order to develop a healthy and stable capital market by providing more trading products, enhancing the basic infrastructures and functions of the capital market. This has made it possible for investors to make profits by manipulating both stock futures and stock prices at the same time.

The margin requirement in China was 50% for margin trading financed by brokers before it was raised to 100% on 23 November 2015 which was the same as the US market (Kashkari,

3 However, when commercial banks make stock-based loans to brokers, which mature in one year or less, brokers have to use the stocks owned as collateral and they cannot use the stocks owned by investors as collateral.

2017)[4]. The maintenance margin requirement for brokers was 30% before it was adjusted to 50% after 1 July 2015 by the CSRC. Outstanding margin financing of brokers, at 2.2 trillion yuan in earlier July 2015, was the equivalent of 12% of the value of all freely traded shares on the market, or 3.5% of China's GDP, being the highest in the history of global equity markets (The economist, 2015b). Figure 2 reports the monthly value of margin credit from brokers and shows its dramatic growth in the first half of 2015.

(Insert figure 2 here.)

There is also margin trading financed by shadow banking or grey-market (OTC) margin lenders who are not subject to specific regulations, and their margin requirements can be as low as 10%, and maintenance margin requirements vary between 4% to 50% depending on the level of the margin (Ren, 2015). Because the size of total margin financing is estimated to be around 4 trillion Yuan (Ren, 2015), it is widely accepted that margin transactions which enable investors to use leverage to invest in the Chinese stock market may be one cause of the bull market of 2015.

Bank financing

Commercial banks provide a significant source of financing for the stock market. There are several ways. First, banks offer stock-based loans to listed companies, brokers, shadow banks, enterprises and individuals. Second, banks offer finance to brokers for margin trading. Third, banks extend loans to companies and individuals who may use this money to invest in the stock market. Even though such practice is against the regulation, it is hard to monitor the

4 The margin requirement in China is defined as equity in account over loan from broker whereas in the US market it is defined as equity in account over the value of stock. Therefore, 100% margin requirement means that in China an investor can borrow up to half the value of the stock that the investor wants to buy.

usage of these loans. When the stock price declines significantly, this may trigger banks to liquidate, joining the queues of margin sellers. And banks' loans to individuals and enterprises may turn to be bad. In order to stabilize the stock market, on 9 July 2015, the China Banking Regulatory Commission (CBRC) issued a notice to ease the regulations on bank financing for stock-based loans and encourage banks to loan to listed companies which buy back their shares, and support the liquidity of the CSF.

Section 3 Data and methodology

3.1 Data

This paper uses monthly data to investigate whether stock prices contain a bubble or reflect fundamentals. There are several reasons: First, for many macro factors, normally monthly data are available. Second, monthly data are relatively better than quarterly data in terms of describing the short-term changes and volatility of stock prices. Third, as the recent bull period is relatively short, using monthly data rather than quarterly data can enlarge the sample size which can enhance the validity of hypothesis tests.

The macroeconomic data are collected from the website of the PBOC and the National Bureau of Statistics of China. The stock price data are collected from the website of Yahoo Finance. And the data of margin credit are collected from the CSF website.

3.2 The determination of the two bull periods

It is difficult to define a bull period for the stock market. However, there are several ways which can be used to identify whether a stock market has a bubble using statistics. First, based on the EMH, the stock price follows a random walk. It is possible to use the binominal probability distribution to estimate the probability of the number of increases in stock returns

during a normal period. If such probability of a period is very small, it may indicate that the stock market has a speculative bubble. Second, it is possible to compare the return of the market during a period with the returns of the markets which are generally identified as bubbles. Finally, it is possible to investigate whether stock returns reflect fundamental economic forces. If the increase in the stock return during a period cannot be explained by key economic indicators, the stock market may have a bubble.

(Insert Figure 3 here.)

Based on the first two ways, two bull periods are identified for the Chinese stock market since 2004. The first one is the period from February 2006 to February 2008, and the second one is the period from May 2014 to June 2015 (see Figure 3 (a)). The justifications for them can be seen in two aspects. First, over the first period, the SSE Composite Index increased by 253% in 25 months, and over the second period, it increased by 100% in 14 months. However, the Hang Seng China Enterprises Index (HSCEI) increased by only 109% over the first period whereas it decreased by 11% during the second period[5]. These changes of the SSE Composite Index are also significant increases when compared with those of other famous bull periods in the history. During the stock market bubbles of Japan in the 1980s and the US in the 1990s, the stock market increased by roughly 20% a year (Browne, 2001).

Second, the annual returns of each month were positive during both periods. Assume that the probability for the stock return of each month to be positive is 0.50 under the EMH, then for the first period, the probability for the annual returns of all months were positive is zero as there were 25 months. For the second period, the probability for the annual returns of all

5 The Hang Seng China Enterprises Index is a free-float capitalization-weighted index comprised of H-Shares which are issued by the Chinese firms listed on the Hong Kong Stock Exchange.

months were positive is 0.0061% as there were 14 months. Therefore, it could be said that during both bull periods, the behaviour of stock prices did not follow a random walk. The deviations of the SSE Composite Index from its 12-month moving average also report a similar pattern (see Figure 3 (b)). They clearly show that during both bull periods, the SSE Composite index was well above its long-term trend for many months.

3.3 Methodology

The price bubble refers to the surprisingly high prices in some periods of frenzied trading, contrasting with the reasonable prices based on fundamentals. For example, Shiller (2000) defines a speculative bubble to be "an unsustainable increase in prices brought on by investors' buying behaviour rather than by genuine, fundamental information about value" (p.5.). Therefore, to evaluate whether a bubble exists, it is also appropriate and necessary to develop a model which uses fundamental factors to describe the value of stocks. This model can be used in two ways: one way is to test the model using the data of relevant periods; the other is to examine whether the actual performance of relevant periods is consistent with the predicted values of the model for these periods.

Accordingly, this paper develops multiple regression models to investigate whether stock prices reflected fundamentals over the two bull periods. Based on the APT theory, stock prices can be explained by many factors. Some common economic factors are used in the literature for advanced economies, such as industrial production, interest rate and inflation. However, as China is in the process of liberalizing and developing its financial markets, transforming its economic structure and integrating into the global economy (Li, 2018), many related factors should also be included as explanatory variables. Exchange rate, export, industrial production and fixed assets investment should be used because China is an investment-driven and export-oriented economy which is the world's leading manufacturing

and trading nation (Marsh, 2011; Mitchell and Donnan, 2015; The Economist, 2015c). Consumer price index (CPI), money supply indicators M2 and M1, one-year deposit interest rate and interbank overnight interest rate should be used because the monetary policy in China manages and regulates both money supply and interest rates to maintain price stability, and the Chinese government bonds market is still very small. Retail sales should be included because the incentive for investors to invest in the stock market depends on their preferences for current consumption given their disposable income.

Because all these independent variables are fundamental factors, they might be closely related to each other. The correlations among them are computed for the sample period from February 2006 to June 2015: M1 and M2 have a high correlation coefficient of 84%, and one-year deposit interest rate and CPI have a high correlation coefficient of 74%. However, all other correlations are lower than 70%. Therefore, multicollinearity is not a serious problem for the regression models because their main aims are to investigate whether the stock market was driven by fundamental factors altogether.

Here the period between the two bull periods is used as the normal period for the stock market. This is because the correction of the first bull market during this period may suggest that the behaviour of market price was reflecting fundamentals. But this period, i.e. the period from March 2008 to April 2014, should be affected by the global financial crisis in 2008[6]. Using exchange rate and export as independent variables in the regression models can control for the abnormal impact of the global financial crisis in 2008 during the normal period. One main reason is that China's stock market was not affected significantly by international investors as it had less than 2% international investors before 2018 (Hughes and Bullock, 2017).

6 Thanks to an anonymous referee for this point.

The basic regression model which includes all relevant fundamental factors is estimated based on the data of the normal period. Then this model is tested using the data of the two bull periods. As the results suggest that the basic model is not robust for the bull market of 2015, two additional models are developed. One model is developed by keeping only those independent variables which are significant during the normal period. And the other model is to include margin trading as an additional independent variable in this model: there are arguments that margin trading has been one important factor for some stock market bubbles[7]. The results of these models are compared to highlight what happened during the bull period of 2015.

This paper also uses the model of the normal period to predict the stock returns of the bull markets. Then it compares the actual performance of the bull periods with the predicted values of the model for these periods. This could report a similar finding to that of the previous method.

3.4 The models

7 The link between margin, leverage, and rapid price movements is labelled as "pyramiding/de-pyramiding" by Garbade (1982). A rise in share value and an increase in shareholder wealth can start the pyramiding process where the increased wealth allows investors to buy more securities on margin leading to further price appreciation, and the process iterates. De-pyramiding is a reversal of pyramiding where a large and rapid decline in share value starts panic or forced selling by leveraged speculators who are subjected to margin calls. The forced selling of margined securities exaggerates the fall in price, leading to further price declines (Seguin and Jarrell, 1993). Luckett (1982) points out that the pyramiding of margin credit in a rising market contributed to the bubble during the summer months of 1929 U.S. stock market and margin calls in a falling market contributed to the subsequent margin sales during its crash.

The basic regression model for the normal period is as follows:

Stockreturn = a0 + a1IR1YRDP + a2M2 + a3M1 + a4CPI + a5IBONRATE + a6Indusprod + a7Fixasinvest + a8Retailsale + a9Export + a10Exchrate

Here a0 is the constant, a1, a2, a3, a4, a5, a6, a7, a8, a9 and a10 are the coefficient for each independent variable.

Two additional models for the bull market of 2015 are as follows:

(1) Stockreturn = b0 + b1CPI + b2Retailsale + b3Export + b4Exchrate

(2) Stockreturn = c0 + c1CPI + c2Retailsale + c3Export + c4Exchrate + c5Buymargin

Here b0 and c0 are the constant, b1, b2, b3, b4, c1, c2, c3, c4 and c5 are the coefficient for each independent variable.

Variables are defined as follows for each month.

Dependent variable:

Stockreturn: annual return of the SSE Composite Index. This paper examines the SSE Composite Index because it is a good representative of the broad Chinese stock market.

Independent variables:

IR1YRDP: interest rate for one-year deposits,

M2 and M1: annual growth rate of money supply indicators M2 and M1,

CPI: annual growth rate of consumer price index,

IBONRATE: interbank overnight interest rate,

Indusprod: annual growth rate of industrial production,

Fixasinvest: annual growth rate of fixed assets investment,

Retailsale: annual growth rate of retail sales,

Export: annual growth rate of export,

Exchrate: the average of the RMB vs U.S. dollar exchange rate,

Buymargin: annual growth rate of the finance for buying on margin.

Section 4 Results

4.1 The normal period

The results of the regression model for the normal period report that economic factors such as retail sales, export, CPI and exchange rate have a significant impact on stock returns at the 5% significance level (see Column (1) in Table 1). Some other factors like industrial production and fixed assets investment have a marginally significant impact at the 10% level. Overall, the model is robust and explains 79% of the variation in stock returns[8].

(Insert Table 1 here.)

8 The ordinary least squares approach (OLS) is appropriate for estimating the relationships between stock returns and macroeconomic factors if there is no significant evidence on serial correlation and heteroscedasticity in error terms. This is because if these time series are differenced to remove the unit root, it may be hard to find the basic relationships in the levels of the series (Verbeek, 2012). Therefore, the OLS approach is used for every regression model, and Breusch-Pagan / Cook-Weisberg test for heteroscedasticity and Durbin-Watson d-statistic are used to ensure that there is no significant evidence on serial correlation and heteroscedasticity in error terms. The regression model for the normal period is robust because there is no significant evidence on serial correlation and heteroscedasticity in error terms, and the F statistics is significant at the 1% level. In addition, the adjusted R-Squared is as high as 79%.

It is interesting to see that CPI, industrial production, and fixed assets investment may have a positive impact while retail sales, export, and exchange rate may have a negative impact. The increase in CPI, industrial production and fixed assets investment may have a positive impact on the profitability of listed companies, so it is favourable to the stock price. However, the increase in retail sales suggests that the funds invested in the stock market may be diverted away due to the increase in spending on current consumption. And the depreciation of the RMB against U.S. dollar and the increase in export may not support the stock price, which may be due to the long-term expectation that the RMB was undervalued and would keep its trend of appreciation (Mitchell and Donnan, 2015): the appreciation of the RMB will attract capital inflows and depress the profitability of exports in terms of the RMB.

4.2 The bull period from February 2006 to February 2008

The bull period from February 2006 to February 2008 is not well explained by the model for the normal period, although the F statistics is significant and adjusted R-Squared is 76% (see Column (3) in Table 1). This is because M1 is the only significant contributor to the increase in stock returns as it has a positive coefficient which is significant at the 5% level, and one-year deposit interest rate has a negative coefficient which is marginally significant at the 10% level. However, during the normal period, neither variable is significant.

Figure 4 reports how M1 contributes to the bull market. It is reasonable to expect that M1 may have had a significant contribution because it had been growing at an increasing rate from 12% to around 20%, and nominal interest rates were kept at a low level until mid-2007. However, the huge gap between the contribution of M1 and the stock returns suggests that the model for the normal period is not robust for this period, and M1 may have captured the impact of a speculative bubble during the period (Chancellor, 2007).

(Insert Figure 4 here.)

4.3 The bull period from May 2014 to June 2015

When the model is run for the boom period May 2014 to June 2015, none of the variables is significant (see Column (2) in Table 1). Moreover, the F statistics suggests that the model is not robust for this period although adjusted R-Squared is 82%. One possible reason in terms of statistics may be that the number of months is only 14, and some irrelevant variables may have been included in the model for this period.

(Insert Table 2 here.)

Therefore, the model is improved by keeping the variables which have a significant impact on the stock returns during the normal period at the 5% significance level, including retail sales, export, CPI and exchange rate. The results do show some improvements (see Column (1) in Table 2). For example, retail sales have a negative coefficient which is significant at the 1% level, and the F statistics suggests that the model is robust for this period although adjusted R-Squared decreases to 76%. However, overall, these results indicate that the stock market during this period was probably driven by some other factors as the estimated mean standard error (RMSE) increases to 21.75 from 12.82 of the normal period.

One important factor considered is margin trading. The stock market started to crash after it reached the peak on 12 June 2015 when the CSRC announced it would crack down on the brokers who provided services to the OTC margin lenders (CSRC, 2015). Moreover, when the margin credit decreased dramatically in the second half of 2015, the stock price also experienced a dramatic plunge (see Figure 1 & 2). This factor is not considered for the normal period as margin trading formally started in November 2011, and its size was very small during the normal period before it increased significantly in the bull period (see figure 2).

Since only the data for margin trading provided by brokers are available, they are used as one factor in the model. When margin trading is added to the model, the model is improved significantly (see Column (2) in Table 2). First, adjusted R-Squared increases to 89%, and the F statistics suggests that the model is robust. Second, the results report that buying on margin have a positive coefficient which is significant at the 1% level. As margin trading is a relevant variable, when it is added to the model, the error variance decreases. The estimated RMSE decreases from 21.75 to 14.56 which is very close to that of the model for the normal period.

(Insert Figure 5 here.)

Export also reports a positive coefficient which is significant at the 5% level[9]. However, its impact is small when compared with that of margin trading as shown in Figure 5. The contribution of margin trading is much more significant than that of export since November 2014.

Overall, the results indicate that the bull stock market was mainly driven by margin trading. This is reasonable because this factor may also have captured some important impact of the OTC margin credit. Although there are no data of the OTC margin trading as it is not regulated, the fact that the CSRC has been dealing with the serious threat created by the OTC margin credit since Mid-June 2015 confirms its important impact on the stock market bubble.

9 The reason that export may have a positive impact on the stock price in the recent bull period may be due to the fact that the RMB was no longer undervalued and there was an expectation of depreciation of the RMB (Mitchell and Donnan, 2015; Verma and Teagu, 2015). Indeed, the PBOC devalued the RMB by nearly 2% against the US dollar on 10 August 2015 and 1.6% on 11 August 2015. This was the exact opposite of what occurred during the normal period.

This finding is consistent with the evidence in the US stock market that speculative bubbles are stimulated by investor leverage which is facilitated by margin trading. For example, the Brady Commission report (1988) claims that "It has long been recognized that margin requirements, through leverage, affect the volume of speculative activity. Controlling speculative behavior is one approach to inhibiting overvaluation in stocks and reducing the potential for a precipitate price decline fueled by involuntary selling" (p. 65).

4.4 Conditional prediction

Another method that can be used to determine whether there is a bubble during a period is to compare actual stock returns with the conditional prediction of the stock returns of the period using the parameters estimated for normal periods. If the actual returns are much greater than the predicted returns, then it can be concluded that there is a bubble. Here the model for the normal period is used to predict the stock returns for both bull periods based on the economic factors of each period. Then the 99.7% confidence interval for the predicted stock returns of each month is estimated using the formula: three times the RMSE of the regression model of the normal period +/- the predicted stock returns of each bull period[10]. The results are presented in Figure 6. It is very clear that during both bull periods, the actual stock returns are much greater than the upper bounds of the 99.7% confidence interval, indicating that during both bull periods, there were bubbles which were not driven by fundamental factors.

(Insert Figure 6 here.)

5. Policy implications

10 Here bubbles are defined as 3-sigma events. One reason is that some practitioners define a stock market bubble as a 2-sigma event, however, the housing market in 2007 was a three-sigma event (Wigglesworth, 2015).

The results suggest that the stock market in China did reflect fundamentals during the normal period. And money supply was one main driver of the bull market from February 2006 to February 2008. However, after margin trading was introduced, the stock market cannot be explained by fundamentals anymore, and the evidence suggests that the bull market of 2015 was mainly driven by margin trading. Therefore, the bubble deflated rapidly as investors started the process of de-pyramiding when the CSRC announced it would crack down on the OTC margin financing in Mid-June 2015. This can also be seen from the significant decline in the monthly value of margin credit from brokers in the second half of 2015 (see Figure 2).

In addition, the bubble burst because margin trading was not sustainable in terms of fundamentals. On 12 June 2015, when the SSE Composite Index reached the peak, its average price earnings ratio was 24.92 for A shares (SSE, 2015). However, such a high price earnings ratio could not be supported by the interest rate for margin financing of large brokers which is around 8.35% since March 2015 (CNSTOCK, 2015). Moreover, the average financing cost of the OTC margin financing is around 13 to 20% (Ren, 2015). Such cost of margin financing is much greater than the return from investing in the stock market which was 4.01% if the weighted average price earnings ratio of 24.92 is used to calculate the earnings yield. When the stock price stopped rising, the margin investors had to deleverage and initiate the de-pyramiding process.

This finding has important implications for the government policy. As margin trading was the main force of this recent bubble, the stock market was highly leveraged, resting on huge debt. This was repeating the history of the US stock market in 1929[11]. Because brokers,

11 In the 1929 crash, margin trading with the typical margin requirement being 10% and U.S. commercial banks' loan to speculators were important contributors to the bubble, and a coalition of bankers failed in their attempt to restore confidence by publicly purchasing blocks of shares at high prices (Richardson et al., 2013; Luckett, 1982).

commercial banks and shadow banks are the main sources of debt finance for the stock market, the risk in the stock market is now closely related to the risk of banking sector.

Due to the significant impact of margin trading on the stock market and the banking sector, the freedom of monetary policy to deal with economic growth and inflation is subject to the performance of the stock market. On one hand, because margin trading can create a huge volatility in the stock market which does not necessarily reflect economic fundamentals (Chowdhry and Nanda, 1998), changes in monetary policy to stabilize the stock market may not be justified by fundamentals. Indeed, there is evidence that the US Great Depression was mainly caused by the general tightening of credit by the US Fed in the late 1920s to early 1930s which was primarily due to the concern about the credit to brokers and investors that "was fueling a speculative wave in the stock market" (Bernanke, 2004; Miron, 1986).

On the other hand, changes in monetary policy for fundamental reasons may create huge volatility in the stock market: monetary easing which aims to stimulate the economy and prevent deflation may end up creating an unintended bubble in the stock market as the cost of margin financing decreases, and vice versa. Moreover, as it is well accepted that it is difficult for monetary policy makers to evaluate whether there is a speculative bubble in the stock market (Kashkari, 2017; Yellen, 2016), monetary policy which stimulates the economy may encourage recurring bubbles as it cannot prick the bubble due to the concern about the risk of the banking sector.

As China is liberalizing its capital account, the effectiveness of using monetary policy to manage its exchange rate will also be compromised. For example, assume that a stock market bubble emerges which is not due to fundamentals, but is triggered by the sentiment of international institutional investors (Aitken, 1998), then international capital inflow will increase, leading to the appreciation of the RMB. This may hurt export and reduce inflation

rate, making it necessary for the PBOC to cut interest rate to let the RMB depreciate to expand export and prevent deflation. However, if the PBOC cuts interest rate, this may further expand the stock market bubble, attracting more international capital flow to the stock market and offsetting the effect of monetary policy on the RMB exchange rate. And when the bubble bursts, a serious financial crisis and economic recession may occur as banks are one major source of debt finance for the stock market bubble. The lost decade of Japan in the 1990s after its stock market bubble bust is one close example: The performance of Japanese banks depends on the performance of the stock market, although Japan had enjoyed a strong economy during the stock market bubble in late 1980s (Browne, 2001). However, if the PBOC increases interest rate to cool the bubble early assuming central bankers can identify the bubble, it will also hurt the economy as the RMB will appreciate further.

Therefore, the appropriate measures to prevent the Chinese stock market from repeating the great bull market of 2015 are to stop margin trading in the stock market and stop banks from making stock-based loans. This will enable the stock market to be sensitive to economic conditions, and banks to be less vulnerable to stock market bubbles. Indeed, the fact that U.S. banks had much less exposure to the stock market than to the housing market explains why the stock market crash in 2000 had much less impact on the US economy than the burst of the housing bubble in 2007 (Mishkin, 2008; Kashkari, 2017). This indicates that if banks are not involved in financing trading activities in the stock market, monetary policy will have more freedom to deal with inflation and economic growth.

6. Conclusions

The evidence of this paper suggests that the Chinese stock market reflected fundamentals during the normal period, however, the bull market of 2015 was mainly driven by margin

trading. It explains the great meltdown of the Chinese market which started from the crackdown on the OTC margin financing by the CSRC in Mid-June 2015. It adds to the new empirical evidence supporting the bubble theory of speculative markets which argues that investor leverage can be a major force which creates a boom and bust by pyramiding and de-pyramiding.

China cannot afford to suffer from another bubble. This is because the magnitude of the Chinese stock market has increased significantly from 2006 to 2020. The number of listed firms increased from 1378 in January 2006 to 3893 in June 2020, and the total market capitalization over GDP ratio increased from about 19% to about 65% during the same period. Therefore, if stock prices are expected to serve as reliable signals to the best allocation of resources and the effective corporate governance of listed firms, it is important for China to avoid repeating historical mistakes.

To prevent a boom and bust of the stock market like that of 2015 from occurring in the future, it is necessary for China to end margin trading and stock-based loans. This will return the stock market to the normal, which will benefit China's efforts to deepen its economic reform, rebalance its growth model and attract international investors by developing a stable and healthy stock market. In addition, the exposure of banking industry to the volatile stock market will be minimized, and monetary policy changes can focus on fundament factors with no need to worry about enhancing the volatility of the stock market.

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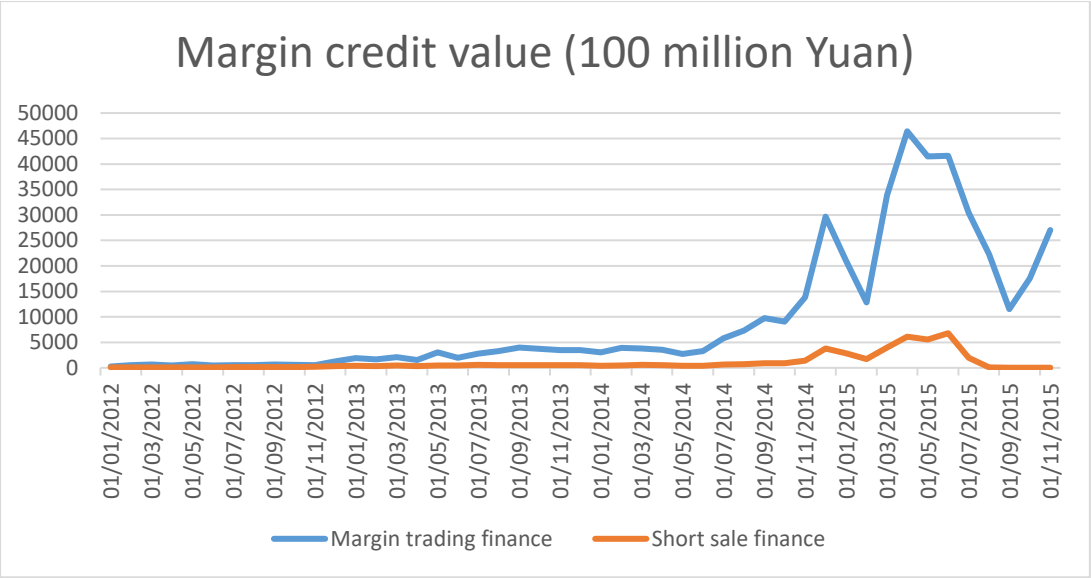
Figure 1 The Shanghai Stock Exchange Composite Index (SSE Composite Index) from 2004 to 2017

Source: Yahoo Finance

Note:

This SSE Composite Index used close price adjusted for dividends and splits.

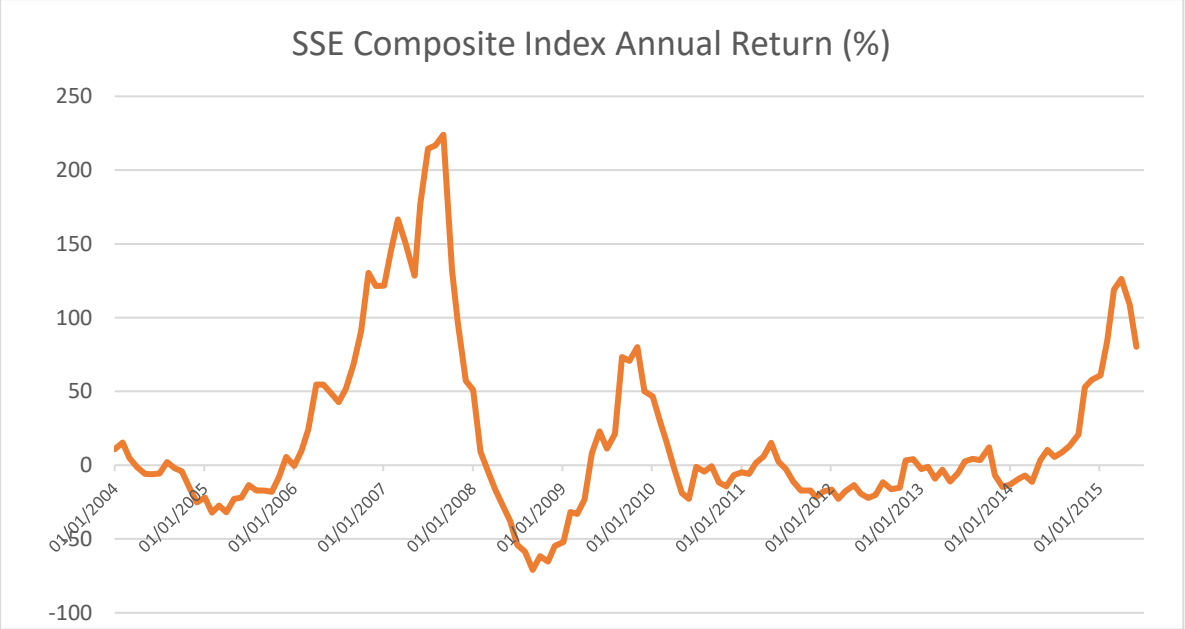
Figure 2 Margin credit from 2012 to 2015



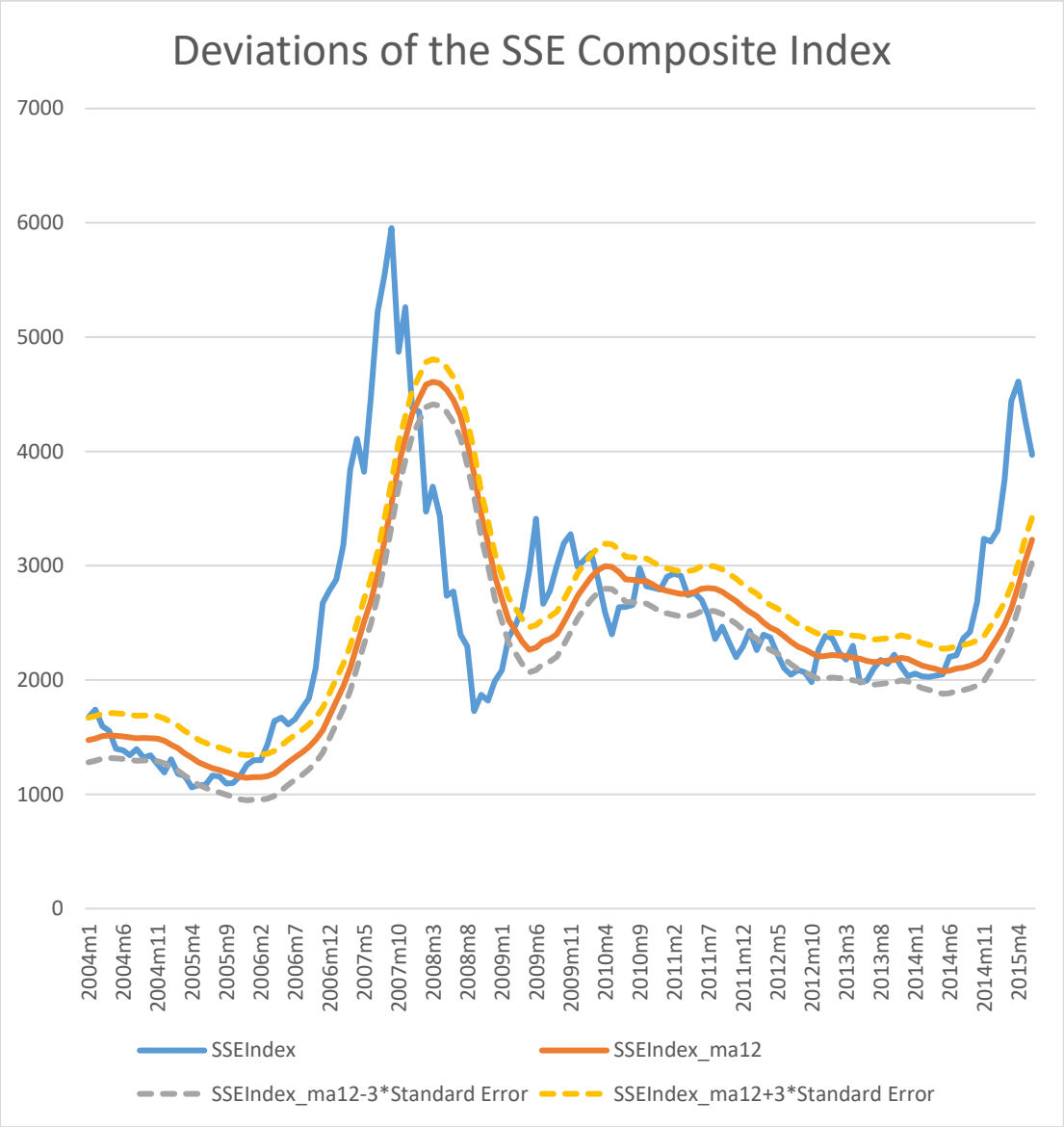
Source: China's Securities Finance Corporation (CSF).

Figure 3

(a) Annual return of the SSE Composite Index from 2004 to 2015.



(b) Deviations of the SSE Composite Index from its 12-month moving average

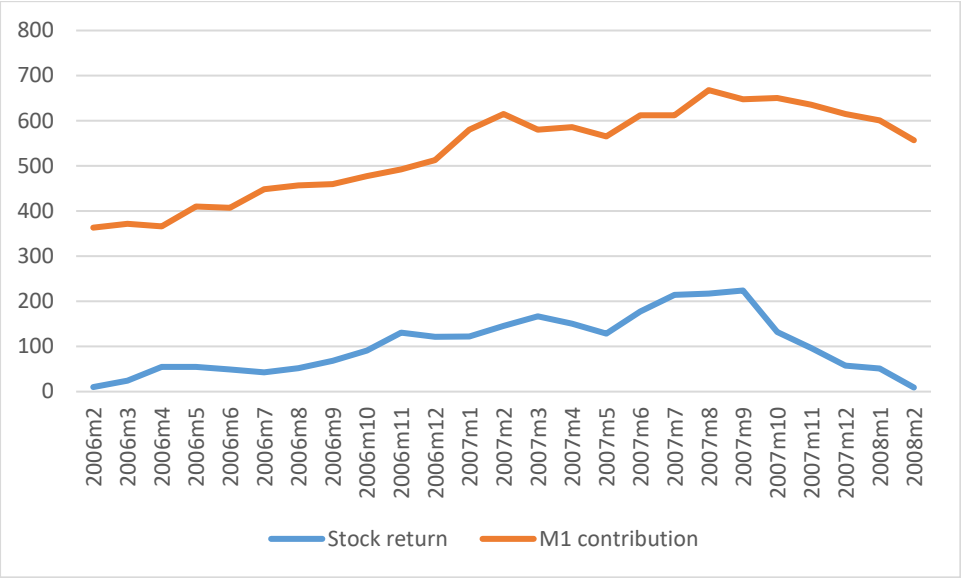


Source: own calculation.

Notes:

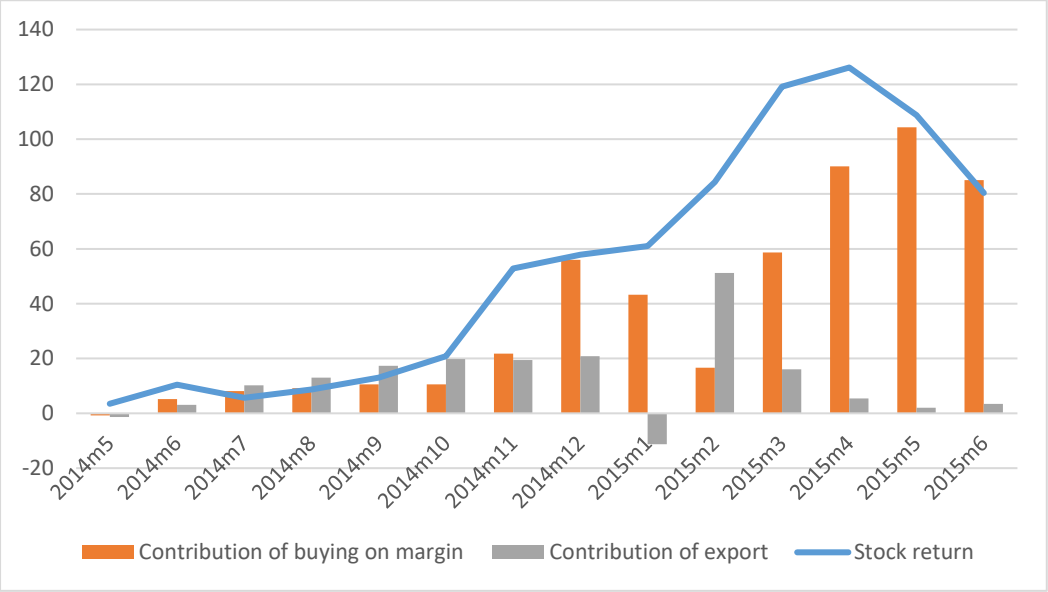
SSEIndex is the SSE Composite Index. SSEIndex_ma12 is the 12-month moving average of the SSE Composite Index. The deviation of each month is the difference between the SSE Composite Index and its 12-month moving average, and the standard error is of the mean of these deviations.

Figure 4 Contribution of M1 to annual stock returns in the period Feb 2006 to Feb 2008 (%)



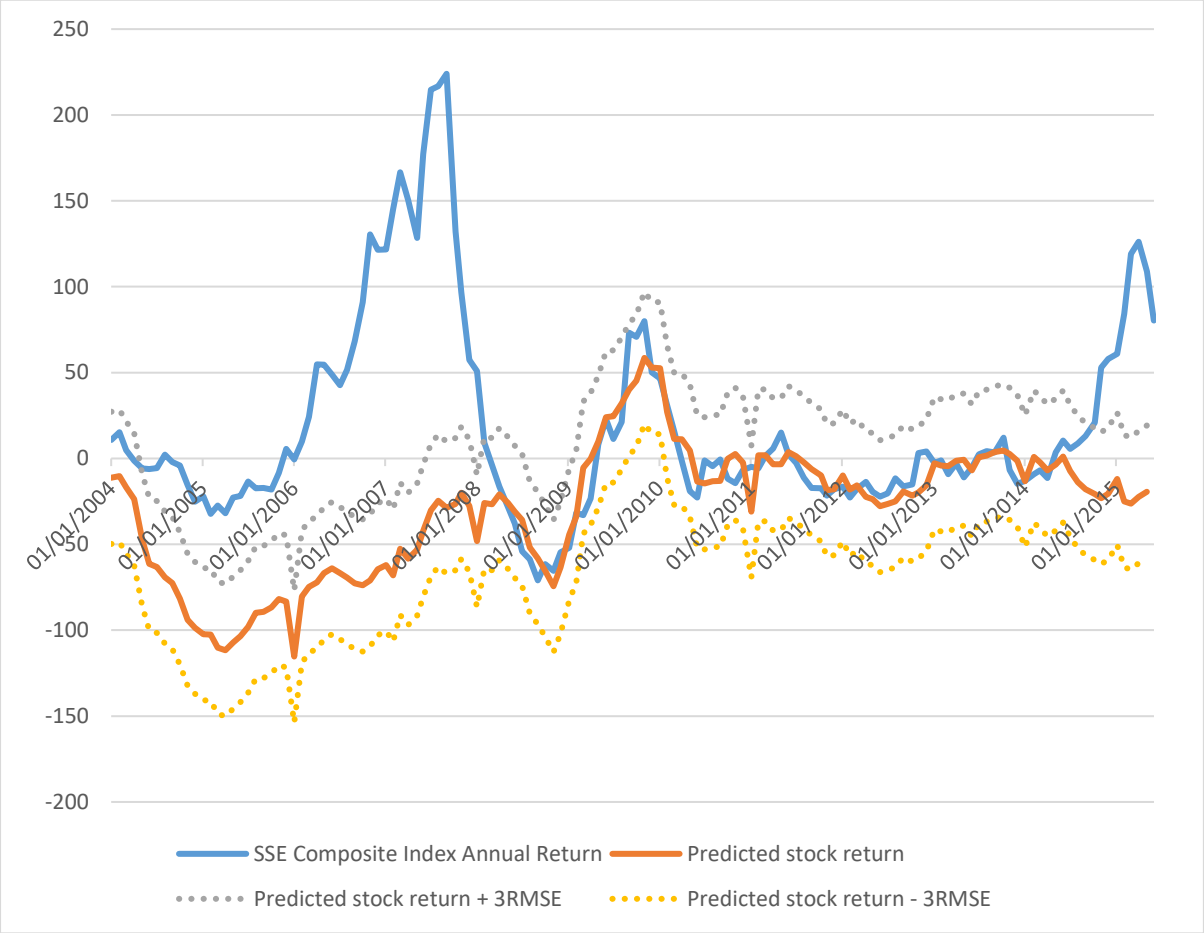
Source: own calculation.

Figure 5 Contribution of margin trading and export to annual stock returns in the period May 2014 to June 2015 (%)



Source: own calculation.

Figure 6 Conditional prediction for the stock return



Source: own calculation. RMSE is using the result of the regression model of the normal period (see Column (1) in Table 1).

Table 1

The effect of economic factors on stock returns (Feb 2006 to June 2015)

	(1)	(2)	(3)
	Mar 08-Apr 14	May 14-Jun 15	Feb 06-Feb 08
	Stockreturn	Stockreturn	Stockreturn
IR1YRDP	-8.588	-134.229	-97.808*
	(0.108)	(0.698)	(0.093)
M2	1.857	11.279	5.809
	(0.346)	(0.550)	(0.725)
M1	1.409	-5.884	29.295**
	(0.114)	(0.505)	(0.027)
CPI	6.647***	-20.820	29.345
	(0.000)	(0.819)	(0.240)
IBONRATE	-1.716	5.315	19.728
	(0.532)	(0.913)	(0.365)
Indusprod	2.309*	-56.385	-10.250
	(0.097)	(0.666)	(0.717)
Fixasinvest	2.080*	7.693	-1.116
	(0.065)	(0.871)	(0.921)
Retailsale	-4.904**	25.680	-4.408
	(0.013)	(0.880)	(0.851)
Export	-0.693***	-0.827	-1.974
	(0.010)	(0.832)	(0.612)
Exchrate	-58.745**	214.491	251.718
	(0.011)	(0.938)	(0.536)
_cons	341.940***	-942.189	-2011.767
	(0.006)	(0.953)	(0.561)

N	74.000	13.000	25.000
r2	0.820	0.971	0.861
r2_a	0.791	0.824	0.761
F	28.652	6.617	8.655
Prob > F	0.000	0.138	0.000
RMSE	12.821	19.15	31.59
chi2(1)	3.29	0.76	0.44
Prob > chi2	0.070	0.384	0.505
DW	1.189	2.320	1.612
DW(DL,DU)	(1.170,1.819)	(0.111,3.438)	(0.348,2.517)

Source: own calculation.

Notes:

p-values in parentheses

* p<0.10, ** p<0.05, *** p<0.01

RMSE: Mean square error.

chi2(1) is obtained from Breusch-Pagan / Cook-Weisberg test for heteroscedasticity.

DW: Durbin-Watson d-statistic

DW(D_L,D_U): Durbin-Watson d-statistic lower critical value (D_L) and upper critical value(D_U)

Variables are defined as follows for each month. Stockreturn: annual return of SSE Composite Index;IR1YRDP: interest rate for one-year deposits;M2 and M1: annual growth rate of money supply indicator M2 and M1;CPI: annual growth rate of consumer price index; IBONRATE: interbank overnight interest rate; Indusprod: annual growth rate of industrial production; Fixasinvest: annual growth rate of fixed assets investment; Retailsale: annual growth rate of retail sales; Export: annual growth rate for export; Exchrate: the average of the RMB vs U.S. dollar exchange rate.

Table 2

The effect of margin trading on stock returns (May 2014 to June 2015)

	(1)	(2)
	Stockreturn	Stockreturn
CPI	-3.777	-19.490
	(0.864)	(0.230)
Retailsale	-44.822***	-21.790*
	(0.003)	(0.060)
Export	1.427	3.412**
	(0.344)	(0.016)
Exchrate	-337.182	984.326
	(0.577)	(0.108)
Buymargin		0.074***
		(0.008)
_cons	2636.154	-5758.839
	(0.473)	(0.126)
N	14.000	14.000
r2	0.835	0.934
r2_a	0.761	0.893
F	11.359	22.700
Prob > F	0.001	0.000
RMSE	21.753	14.561
chi2(1)	2.37	0.03
Prob > chi2	0.1235	0.8623
DW	1.574	.867
DW(DL,DU)	(0.505, 2.296)	(0.257,2.354)

Source: own calculation.

Notes:

p-values in parentheses

* p<0.10, ** p<0.05, *** p<0.01

RMSE: Mean square error.

chi2(1)is obtained from Breusch-Pagan / Cook-Weisberg test for heteroscedasticity.

DW: Durbin-Watson d-statistic

DW(D_L,D_U): Durbin-Watson d-statistic lower critical value (D_L) and upper critical value(D_U)

Variables are defined as follows for each month. Stockreturn: annual return of SSE Composite Index; CPI: annual growth rate of consumer price index; Retailsale: annual growth rate of retail sales; Export: annual growth rate for export; Exchrate: the average of the RMB vs U.S. dollar exchange rate; Buymargin: annual growth rate of the finance for buying on margin.