How Responsive is China's Stock Market to the Monetary Polices

XinKai Chen and Dejun Xie

The development of China deeply associate with the supports for different industries from China Government, since the beginning to the middle of 2015, Central Bank of China has implement three reductions of deposit and loan interest rate and three reductions of deposit reserve rate of financial institution. These monetary policies which increase the liquidity of cash flows in the market certainly will bring positive stimulation to Chinese stock market. This study bases on these monetary policies mentioned above, utilizes Event Study Methodology and studies the response efficiency of Chinese stock market to those monetary policies issued by Central Bank. From the outcomes of the models, we find that there are varying degrees of feedback of Shanghai and Shenzhen Stock Market when the policies were enacted, and the impacts of every stimulation starts to fade out in the third trading days after the enaction dates of each monetary policy.

Keywords: Stock Market, Event study, Monetary Policy, Response Efficiency.

I. Introduction

THE development of industries in China is deeply related with the regulations and policies issued by China Government. In recent years, China's economic situation is very promising, and indeed China is experiencing a high growth stage.

However, since 2015, China's Stock Market has experienced extremely volatile times. The reasons might include diplomatic tactics and domestic regulations, but they would not be deeply discussed in this study. This study emphasizes on the monetary policies introduced in the year of 2015 by China's Central Bank.

Since the Financial Tsunami in 2008 to the middle of 2015, the Central Bank of China has issued 20 times of monetary regulations. Except for the fourth quarter of 2008, the most concentrated period of monetary policies enactions is the year of 2015. In the first half of 2015, the Central Bank of China has issued 6 times of monetary regulations. The main purposes of these monetary policies are to reduce the deposit and loan interest rate and deposit reserve rate of financial institution, no doubt those regulations would bring positive stimulation to China's stock market.

In this study, we try to find the degrees of those accommodative monetary policies affect China's stock market and the response efficiency of stock market respond to those policies. In order to discern the implications of those monetary regulations on the stock market of China, this study adopts the classic Event Study Methodology. There are hundreds of prior studies has adopted this methodology to measure the effects of an economic event. The basic idea of how an event study measures the impacts of an event is to find the abnormal return of the study firms or securities around the time of the event occurs.

This study summarizes some basic econometric models of event study methodology and adopts market model to test the effects of event. In order to precisely measure degrees and response efficiency of the event, dummy variables would be added into the classic event study market model in this study.

The outcomes of rigorous quantitative study statistically provide the evidence of the monetary policies enaction of China's Central Bank in the first half of 2015 indeed stimulated the China' stock market. Yet this study also finds some interesting phenomena which still need further researches.

The remains of this study proceeds as follows. Section II discusses how monetary regulations affect the stock market and reviews some of the prior studies about China's monetary strategy. Section III presents the prior studies and the outlines of other researches about the event study methodology. Section IV presents the adopted empirical study and the data collection in this study. Section V illustrates the empirical results in this study and discussions, and then Section VI concludes.

II. The Monetary strategies of China

Monetary policy is the process by which the monetary authority of a country controls the supply of money, often targeting an inflation rate or interest rate to ensure price stability and general trust in the currency. Further goals of a monetary policy are usually to contribute to economic growth and stability, to lower unemployment, and to maintain predictable exchange rates with other currencies.

Since the beginning of the reform and opening in 1978, the economy growth of China has not been stable, therefore China's government adopted different macroeconomic control strategies to intervene and regulate the growth. Through the years of efforts, the capacity of intervention and regulation implemented by China's government is gradually mature.

Before 1984, the functions of People's Bank of China and commercial banks were not separated. Therefore the true

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monetary regulation of China was started at the time when People's Bank of China was specialized to play the role of Central Bank of China. Since then, the monetary regulation of China could be divided into several stages.

1. "Fiscal" monetary regulation from 1984 to1986 which aimed at anti-inflation.
2. "Hard landing" monetary regulation from 1987 to 1991 which aimed at anti-inflation as well.
3. "Soft landing" monetary regulation from 1992 to 1997 which aimed at both anti-inflation and equilibrium of balance of international payments.
4. Loose monetary regulation from 1998 to 2002 which aimed at anti-deflation and economy growth.
5. Steady tight monetary regulation from 2003 to 2007 which aimed at keeping the stability of economic growth.
6. Monetary regulation from 2008 to 2012 which aimed at economy recovery.
7. Steady loose monetary regulation from 2013 till now which mainly aimed at stimulate the economy.

When country adopts an accommodative monetary policy, or so called loose monetary policy, the interest rate and reserve rate will be lowered. Compared to those risk-free assets like bank deposit, investors are more willing to invest their capital to other securities like bonds or stocks, which would certainly increase the prices of the securities.

III. Event Study Methodology

A. Methodology Outline

For the purpose of discerning the implications of China's monetary policies on the stock market returns of China, this study adopts the classic event study methodology developed by Fama, Fisher, Jensen and Roll (1969).

Researchers always need to measure the effects of an economic event on the value of particular securities. It is difficult to achieve except for using an event study. By using the simple financial market data, an event study is able to statistically measure the influence of a specific event on a firm. The basic idea of how an event study measures the impacts of an event is to find the abnormal return of the study securities around the time of the event occurs.

B. Procedure of an Event Study

Even though there has been over 600 referable researches adopt event study since the event study was first introduced, the basic statistical format of event studies has not changed over time. One event study fundamental procedure includes six steps (MacKinlay, 1997).

The first step is to define the event of interest and identify the period around which the security prices of the firms involved in this event. The period of time is defined as "event window". As mentioned above, the specified event could be any matter that affects the stock market, for example, if one is looking at the stock split, the event will be the announcement of stock split, and the event window should at least include the day of the announcement. In order to capture the effects after the specified event, the time period of event window usually would be larger than the specific period of the event.

The second step is to determine the criteria to detect the effects of the particular event. The criteria should be objective, such as the stock price or market transaction volume from the exchanges, or time-distributed firm goodwill or accounting revenue from financial statements. These collected data could be cross-sectional or time series, the different data type would result in different influence on the significance test of abnormal returns in the later steps. In addition, one should notice the potential bias in choosing criteria through sampling selection.

The next step is parameter determination, which is to estimate the normal performance of the selected subjects. Except for the constant parameter, most of the parameter set for event study is also comes from market financial statistics. For example, in order to observe the stock prices changes of particular firms during the period of specified economic event occurs, the researchers would select indexes which represent the overall performance of the industry sector of the chosen firms, or the funds composited by similar firms' stocks.

The fourth step is gathering data of the selected criteria and parameters. It is noteworthy that even though the time period of the event window is narrow, sometimes only few days, the data range of criteria and parameters should be long enough. MacKinlay (1997) brings an example, in an event study which using daily data and the market model, the market model parameters could be estimated over 120 days prior to the event, while the select event period itself, as known as event window, is not included in the estimation period, which is to prevent the event from influencing the normal performance model parameter estimates. In addition, he also verifies the usability of post-event observations. And to be objective, the data selected for testing should be the historical data from reliable sources.

Then it comes to the fifth step, setting up appropriate econometric model to obtain the abnormal return. The models would be illustrated in the next part of this Section. As mentioned above, the idea of an event study measuring the impacts of an event is to find the abnormal return (AR) around the time of the event occurs, and then, what is exactly the so call abnormal return? Take stock price as an example, the basic equation could be listed as:

$$R_{i,t} = \hat{R}_{i,t} + \varepsilon_{i,t} \tag{1}$$

Where $R_{i,t}$ is the return of the stock *i* at time *t* relative of the event, $\hat{R}_{i,t}$ is the "normal" return of the stock *i* at time *t* which was predicted by various econometric models, and while, $\varepsilon_{i,t}$ is the unexpected return, or so called "abnormal return", which stands for the difference between the observed return and the predicted return:

$$\varepsilon_{i,t} = R_{i,t} - \hat{R}_{i,t} \tag{2}$$

While the abnormal return occurs during the specified event, assume that there is no other event encounter at the same time, it can be concluded that the selected event indeed causes the unusual behavior of the chosen stocks. The idea of abnormal return is still applied in other studies which utilize other criteria like market value or revenue. And it should be noticed that, the different selection of econometric model would vary the outcomes of the abnormal returns due to the

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different bias and precision of expected return measurement.

And the final step of the event study is to verify the significance of the calculated abnormal returns. The test methods has been developed over decades of researching, basically a student t-test would do the job. However, it is not always the simple single abnormal return the researcher would confront, sometimes it needs to test the entire distribution of abnormal returns.

Kothari and Warner (2004) summarize the methods of two basic aggregations based on different data types. When it comes to cross-sectional data type, in order to examine the entire distribution of abnormal returns, the researchers could aggregate the abnormal returns as:

$$AR_t = \frac{1}{N}\sum_{t=1}^{N} \varepsilon_{i,t} \tag{3}$$

Where AR_t is the average abnormal returns of N securities, and $\varepsilon_{i,t}$ is the abnormal return of security i at time t. And also, other parameters of the cross-sectional distributions such as median or variance and determinants of the cross-sectional variation in abnormal returns could also be used to study. And the another aggregation is for time series data type, when the researchers have the willing to examine the significance of abnormal returns for the event window period, as Kothari and Warner addressed, they could use cumulative average residual method (CAR) and buy-and-hold method. The CAR could be defined as:

$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_t \tag{4}$$

This method algebraically average the abnormal returns of one security from t_1 to t_2, and the CAR could be tested as the entire event effects. While buy-and-hold method is basically the same, except for using geometrical average method to calculate the entire abnormal returns. Buy-and-hold method more precisely describes the entire abnormal returns because it complies with the nature of market-trade security.

Kothari and Warner (2004) also verify that it is also appropriate to treat the abnormal return of the portfolio, which composited by the subjected securities, as the entire abnormal return, some of the prior studies has adopted this method..

C. Applications of Event Study

The event study is a well-established method, which has been utilized by researchers for over forty years to investigate the behavior of stock market prices around various events. The events include not only the matters inside the stock market itself, such as stock splits (Fama et al, 1969) and earnings announcements (MacKinlay,1997), but also the happenings beyond the markets, such as regulatory (Kothari & Waner, 2007), tax fiscal or monetary policy, even president elections (Knight, 2004).

Fama, Fisher, Jensen and Roll (1969) find that there was an impressive body of empirical evidence which indicates that successive price changes in common stocks are nearly independent. However, how quickly is the speed of adjustment of prices to specific kinds of new information has seldom been tested. Therefore, they propose a new methodology called "event study" for measuring the effects of actions and events on security prices. They take the stock splits which would adjust common stock prices as an event, to examine the process of how the stock prices adjusted to new information. And after the test, the results indicates that the market realized that past stock splits have very often been associated with substantial dividend increases, and the management utilized the announcement of split to reevaluate the stream of expected income from the shares. Moreover, the results of the study provide considerable support to the conclusion that the stock market is "efficient" in the sense that stock prices adjust rapidly to new information, which essentially laid a foundation for the further research.

And MacKinlay (1997) makes a detailed summary about "event study". He specifies every step of the event study methodology process, and also classifies and defines some most common models for measuring normal performance. And for illustration, he also present an example to present how the earning announcements influent the valuation of firms. He gathers 600 event observations, includes 30 firms and 20 announcements per firm, and uses the market model and constant mean return model to test. The results of the test strongly support the hypothesis that earnings announcements do indeed convey information useful for the valuation of firms. Besides, in this study, MacKinlay also rises some possible biases which would affect the reliability of the consequences, one of them is so called "nontrading effect", which doubts if the closing price of a stock could represent the "daily" price; and the methodology used to compute the cumulative abnormal returns can induce an upward bias which comes from rebalancing the weights to equal when calculate the aggregate cumulative abnormal return.

Although the majority of event studies have focused on "economic" events, a number of them have considered the impact of those political events. The United States presidential election of 2000 was the 54th quadrennial presidential election. The contest was between Republican candidate George W. Bush, and Democratic candidate Al Gore, the incumbent Vice President. Brian Knight (2004) utilizes a sample of 70 firms favored under Bush or Gore platforms during the election period to analyze how new information resulting from exogenous changes to political platforms can direct impact on stock prices. Because before the election result came out officially, Al Gore had more chance to win the election, the fact that Bush won the election was real an unexpected event. Knight makes use of the market model which named by MacKinlay (1997), and finds that "Bush-favored" firms enjoyed a 9 to 16 percent higher return under the Bush administration.

There is a similar case -- Michael G. Ferri (2008) analyzes changes in U.S. equity values around the 2004 presidential election. The United States presidential election of 2004 was the 55th quadrennial presidential election, Republican Party candidate and incumbent President was George W. Bush and Democratic Party candidate was John Kerry. The election was held on Tuesday, November 2nd, 2004. Ferri sets Nov. 3rd as the event window and tracks the movement of the stock prices of various industries. Because no other important event occurred in that interval, the sudden changes are creditable to only the surprising outcome of the election.

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After the statistical tests, the increasing of the stocks' daily returns, compared to the indexes' daily returns, are significant. These results indicated that some elections can substantially affect the equity value, which should not be ignored by the market participants.

And even the changing of political power could be a shock to the market. Jayachandran (2006) studies Senator James Jeffords' decision of leaving the Republican Party, which had shifted control of the US Senate to the Democratic Party in 2001. The author selects several ranges of time as the event window, to test the capitalization changes of the firms favored under different parties, and he finds that the firms with the linkage to the Republican Party had negative returns, while in the contrary, other firms linked to the Democratic Party had positive returns. In addition, Den Hartog and Monroe (2008) also study the same event, and come up with similar conclusions.

Then it comes to the regulation. There are many countries adopt smoking ban to improve environment quality and extend the citizen life expectation, which would from another aspect, in common sense, detriment the profitability of hospitality industry. However, Jonathan T. Tomlin (2008) finds that majority of over 150 studies concluded that smoking bans do not have negative effects on the hospitality industry firms' sales, profits, firm values or employment, and also, he notices some imperfection in theoretical hypothesis and statistic testing of those prior studies. To overcome the shortcomings of prior studies, he adopts event study methodology to test the influence of Indian smoking ban to the local hospitality firm. He sets a 3-day-range event window, utilizes developed event study market model to test and finally concludes that there indeed was negative abnormal stock returns to the portfolio of Indian hospitality industry firms when response to the announcement of a proposed smoking ban. And because the event study methodology avoids the primary criticisms of prior research, such as using unobjective survey data or unadjusted financial data, the results the author concludes should raise questions to the prior studies.

And there are other hundreds empirical researches done with the help of event study, and they cover various sorts of areas, include accounting (Kothai, 2001), merger and acquisition (Warren-Boulton & Dalkir, 2001), management (McWilliams & Siegel, 1997), information technology (Koh & Venkatraman, 1991) and so on, and because of the length restriction of this study, other prior literatures would be referred upon the References.

IV. Empirical Study and Data

A. Basic estimation model

This study adopts event study market model to test the impacts of the monetary policies of China in the first half of 2015 on the stock market.

In this study, several adjustments would be added in the classic event study market model for comprehensiveness and simplicity. First, dummy variables would be added in the model to more intuitively illustrate the behavior of stock market in the event window range (Karafiath, 1988). Second, in the study, we use Shanghai Stock Exchange Composite Index and Shenzhen component index to as China's stock market representations, both of them are able to illustrate the behaviors of China's stock market. In this study, the returns of Shenzhen component index represents as the dependent variable and Shanghai Stock Exchange Composite Index represents as the benchmark. The model introduced in this study could be present as:

$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \beta_n Dummy_n + \varepsilon_{i,t} \quad (7)$$

where $R_{i,t}$ is the observed daily returns of stock i at time t, $R_{m,t}$ is the daily return of the broad based market index at time t, $Dummy_n$ refers to the variable which is equal to 1 on observation n and is zero elsewhere, the number of dummies depend on how many time units is covered in the event window, and $\varepsilon_{i,t}$ is the random disturbance item for stock i at time t.

B. Event window determination

This study regards the series of enaction of China's monetary policies in the first half of 2015 as exogenous shocks to the stock market of China, and thus any abnormal returns to the market following the series of enaction of China's monetary policies can be attributed to the impacts of the enactions.

In practice, there are three assumptions need to be identified: first, the outcomes of these monetary policies came as surprises and so their impacts were not incorporated into the stock prices before the public knew any relevant information or rumors about these policies; second, the markets are efficient so that the market's reaction to the monetary policies enactions captures the real impacts of the event on the stock market; and third, no other events occurred during the event window that might influence market's abnormal returns.

As mentioned above, the specified event studied in this study is the series of enaction of China's monetary policies in the first half of 2015; therefore, the event window should include the issue days of the monetary policies. However, the pre-event information leakage also needs to be considered, it is convinced that there would not be any leakage of the policies before the issues, for robust causes, we make one trading day before policy issuing as prevention. It is believed that the stock market of China is comparatively efficient; the shocks of one event will fade out in one week, in other words, 5 trading days. Therefore, as to every enaction of the monetary policies, the event windows are from 1 trading day before the event to 5 trading days after which included the day of enaction. Thus, the function of this study could be represented as:

$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \beta_2 D_{-1} + \beta_3 D_0 + \beta_4 D_1 + \beta_5 D_2 + \beta_6 D_3 + \beta_7 D_4 + \varepsilon_{i,t} \quad (8)$$

where D_{-1} to D_4 represents the dummy variables of 1 trading day before the event to 4 trading days after respectively and $\varepsilon_{i,t}$ is the random disturbance item for stock i in time t.

Combined with the dates of the series of enaction of China's monetary policies in the first half of 2015 and the dates of stock market close, the event windows of every event are represented as follow:

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TABLE I
THE EVENT WINDOW OF EVERY MONETARY POLICY
IN THE FIRST HALF OF 2015

Date of enaction	Main adjustment	Adjustment range	Event window
June 28.2015	Deposit and loan interest rate	-0.25%	Jun.26, Jun.29, Jun.30, Jul.1, Jul.2, Jun.3.
	Deposit reserve rate	-0.5%	
May 11.2015	Deposit and loan interest rate	-0.25%	May.08, May.11, May.12, May.13, May.14 May.15.
April 20.2015	Deposit reserve rate	-1.00%	Apr.17, Apr.20, Apr.21, Apr.22 Apr.23, Apr.24.
March 1.2015	Deposit and loan interest rate	-0.25%	Feb.27, Mar.2, Mar.3, Mar.4, Mar.5, Mar.6.
February 5.2015	Deposit reserve rate	-0.5%	Feb.4, Feb.5, Feb.6, Feb.9, Feb.10, Feb.11.

C. Data Collection

In order to examine the impacts of series of enaction of China's monetary policies in the first half of 2015 upon China's stock market, Shanghai Stock Exchange Composite Index (code: 000001) and Shenzhen component index (code: 399001) are chosen to study.

Shanghai Stock Exchange Composite Index was formally issued at July 15th 1991and base date is December 12th 1990. It was established by Shanghai Stock Exchange at 100 points. Its price was calculated by weighted combined pricing method, and up to April 2015, there are 1073 stocks included.

Shenzhen component index was formally issued at January 23rd 1995 and base date is July 20th 1994. It was established by Shenzhen Stock Exchange at 1000 the base point of 1000. At the beginning, the Shenzhen component index had only 40 component stocks, but its component stocks was expanded to 500 when it comes to 2011.

Before empirical study, many other indexes and portfolios were considered. Since the factors should have the ability to explain the behaviors of the stock market, the portfolios made by private investors and institutions were excluded. When it comes to the indexes, to better explain the behaviors of overall China's stock market, Shanghai Stock Exchange Composite Index was considered as the market benchmark because of the large coverage of industries of its stocks and longest operation period among other indexes. And to better illustrate the fluctuation of the first half of China, Shenzhen component index was selected because its prices was calculated by weighting typical stocks' prices rather than all types of stocks. And in addition, the stock coverage of Shenzhen component index is larger than other indexes such as Shanghai Stock Exchange 50 index (code: 000016), or Shanghai Stock Exchange 180 index (code: 000010). In other words, Shanghai Stock Exchange Composite Index is most qualified to simulate the behavior of overall stock market, and Shenzhen component index while guaranteeing the large coverage of the stocks of different industries, emphasizes the fluctuation of the stock market.

MacKinlay (1997) addresses that to insure the reliability of the outcomes, at least 120 pre-event observations should be collected, therefore the time range of the observations is chosen from January 1st 2010 to September 11th 2015, 1380 trading days in all. This study collects the stock prices of the Shanghai Stock Exchange Composite Index and Shenzhen component index in those 1380 days from *Finance.yahoo.com.*

Through processing, the daily returns of Shanghai Stock Exchange Composite Index and Shenzhen component index from 1st 2010 to September 11th 2015 are calculated. The following table illustrates the basic statistics of these two indexes.

TABLE 2
DESCRIPTIVE STATISTICS OF RETURNS OF SHANGHAI STOCK EXCHANGE
COMPOSITE INDEX AND SHENZHEN COMPONENT INDEX
FROM JAN.1ST 2010 TO SEP. 11TH 2015.

	N	Minimum	Maximum	Average	Standard Deviation
Returns of Shanghai Stock Exchange Composite Index	1380	-.0928	.0545	-.00013	.0148
Returns of Shenzhen component index	1380	-.0898	.0538	-.00033	.0170

V. EMPIRICAL RESULTS AND DISCUSSION

This study acquires the results of entire time range by the use of current time broad base market benchmark. And the results illustrate, although in most of the days of every event windows, the market does not have significant abnormal returns. However, in most event windows, the largest positive abnormal returns occurs in the second trading day after each monetary policy enaction date, and the date when the abnormal return trend turns to positive is also the second trading day after. In addition, as we have known that in the first half of 2015, before June, the trend of the stock market index price was upwards, while after June, it changed sharply downwards. In the event window of June 26th to July 3rd, the downward trend of abnormal return was significantly change to upward at the date of July 1st, which is also the second trading day after the enaction date of June 28th. It could be concluded that the monetary regulation is more effective in a bear market situation. But if the in enaction day, the stock market was closed, such as June 28th .2015 in model 1, or March 1st 2015 in model 4, the impacts of monetary regulations fades out after the third trading day.

VI. CONCLUSION AND DISCUSSION

This study adopts event study methodology to investigate the impact of China's monetary policies in the first half of 2015 on the stock market.

As discussed above, when country adopts an accommodative monetary policy, or so called loose monetary policy, it will certainly increase the prices of the securities, or even the whole market. In this study, we assume that China's monetary policies in the first half of 2015 on the stock market would have positive impacts on the stock market. Through rigorous quantitative study, the outcomes also prove the assumption mentioned above. And more specifically, from empirical study, we found that the impacts of those monetary policies start to fade out in the third trading days after the

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enaction date of monetary policies.

However, the empirical results do not explain all the phenomena. And there are still some debates or problems need further researches. Those imperfections are mentioned as follow:

1. The selected indexes are not perfect for study. Shanghai Stock Exchange Composite Index and Shenzhen component index in this study belong to separated stock markets, although the results of empirical studies confirmed the assumption as we expected. However, there are other better choices. In further researches, it is better to select indexes or man-made portfolio which would simulate the overall China's stock market behaviors, with which the results would be more convinced.

2. The event windows of monetary policies are not perfect. We set the event window between 1 trading day before the enaction day of the monetary policies and 4 trading days after, which is 6 trading days in total. However, the issuing dates of monetary policies are always earlier than the enaction dates; although there would not be any regulations occur in the issuing day, the information of the issues might also generate the impacts on the stock market. In further researches, the impacts of the issuing of monetary policies need to be considered.

3. There are more efforts are required to investigate the monetary policies which does not generate positive abnormal returns. Although we have given some explanations to the phenomena, there are still more investigation required.

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