

# **How does reserve ratio decreasing act on market: Empirical evidence from China**

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## **Abstract**

This paper tests whether macro monetary shock will influence stock market. Employing approaches of event study and abnormal returns regression, this paper finds that reserve ratio decreasing does lead to positive abnormal returns, but it works through different channels in each event. Further analyzing shows that characteristics of the stock market of China make the differences: market overreacts to unexpected shock and underreacts to expectable event.

**JEL classification numbers:** E44 E52 G14

**Keywords:** Reserve ratio decreasing, Stock returns, Event study

## **1 Introduction**

In macro economy field, there were already numerous studies concentrated on liquidity shocks caused by monetary policy. Majority of these researches focus on macro scale factors such as GDP shocks and employment fluctuation. However, it is obvious that the impact of monetary policy must be realized through micro agents. And it still remains to be a black box for many previous macro researches. Therefore, deep understanding of how monetary policies influence economy through micro mechanism is required. At present, there are some researchers have realized this problem and trying to give their answer through micro agents. For instance, some of them explored it from credit market by investigating agent problem between banks and firms. For this reason, this paper will try to explore the mechanism of monetary policy working on capital market, taking the case of

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Some of previous studies have considered whether an expansionary monetary policy of the Central Bank leads to the fluctuation in stock market, but these discussions were in a superficial state. This study extends previous study by answering whether changes in reserve ratio have influence on security market, and, if it did, considers which hypotheses could explain this phenomenal: (1) increasing in liquidity leading to an inflation and cause asset prices increasing; (2) homogenous expectation of corporate fundamental improving leading to higher corporate stock prices.

Moreover, discussions of the efficiency of China stock market have been lasting for ages. Numerous studies have tried to answer it from different aspects. But it still remains to be an open and important question. Changes in reserve ratio are macro shock with the influence on entire market, which can reveal some characteristics of the market. Therefore, by testing previous hypothesis, this paper can also give some contribution on market efficiency discussions from a unique perspective.

## 2 Literature Review

As the introduction mentioned above, there is a gap between macro research and micro research, while only a few studies tried to fill it. The insufficiency of relate studies not only brings about gap in research, but brings about unstable and crisis in real economy. After the subprime debt crisis, some papers began reconsidering this gap by combining macro factors and market micro structures. Bunnermeir (2009) starts from bank market and finds that the liquidity can suddenly evaporate through the interaction of market liquidity and funding liquidity. And by these mechanisms, a relatively small shock, such as real estate price decrease, can cause liquidity to dry up suddenly and lead to a full-blown financial crisis and economic recession. Achary (2012) develops a theory of bank lending explaining how the seeds of a crisis could be sown when banks are flush with liquidity. He points out that when bank liquidity is sufficiently high, asset price bubbles are formed due to aggressive manner of bank managers, and the underlying macroeconomic risk is cumulated. Therefore, combining macro factors and market micro structures can give us a deeper view of how the market and economy operate.

In the aspect of equity market, there are also some studies trying making this combination. Thorbeck (1997) is the first one trying examining how stock return data responds to monetary policy shocks and revealing that monetary policy exerts large effect on ex-ante and ex-post stock returns. He then employs the theory that stock prices equal the expected present value of future net cash flows, and

conducts that expansionary monetary policy exerts real effects by increasing future cash flows or by decreasing the discount factors at which those cash flows are capitalized. But Thorbeck did not continue to explore which factor domains. Thus, mechanisms behind this phenomenal remain to be explored. Based on previous research, He (2006) investigates the sensitivity of stock prices to monetary policy and finds that stock prices can be affected by current changes, unexpected changes, or near-future changes in the cash flows and discount rates, due to different policy goals or targets in different periods. Furthermore, Kontonikas (2013) extends this field by employing macro-based VAR framework and examines whether stocks with different characteristics are affected in a different manner by unexpected monetary policy actions. However, the approach of VAR cannot effectively distinguish the causality and correlation, and consequently cannot explore deeper mechanisms hiding in those results. Therefore, this paper will employ an approach of event study to investigate how stock prices react to one of monetary policies, the reserve ratio decreasing. With the help of event study, operation mechanisms behind this phenomenal can also be discussed.

### 3 Hypotheses Development

According to discount cash flow (DCF) model, stock price is determined by discounted future cash flow.

$$P = \sum_{i=0}^{\infty} \frac{E(CF_i)}{(1+r)^i} \quad (1)$$

Therefore, there are two factors that influence stock price. One is the expectation of future cash flow, another is the discount factor. When the market is sufficient of liquidity, the firm can borrow money easily to invest positive NPV projects, which are expected to increase the future cash flow of the firm. Thus the stock price will increase. Therefore, Hypothesis 1 is obtained: reserve ratio decreasing can make market forming a homogenous expectation of future cash flow increasing, which leads to stock price increasing.

In addition, when market liquidity increases, there will be inflation in asset price and a decreasing in required return. For discount factor positively correlating to required return, it can also lead to a decrease in discount factor. When discount factor as denominator decreases, the stock price increases. Thus, Hypothesis 2 is obtained: reserve ratio decreasing can cause asset inflation and required return decreasing, which leads to discount factor of DCF decrease and stock price increase.

According to effective market hypothesis, stock price is the reflection of

expectation in efficient market, which means both H1 and H2 holds true. Therefore, testing of H1 and H2 can reveal market efficiency.

## 4 Empirical Analysis

### 4.1 Model Setup

The study includes two steps. First step is testing whether reserve ratio decreasing would lead to the stock price increasing. In order to better investigate the causality relationship, an event study is employed. If there are significant cumulated abnormal returns (CARs), either H1 or H2 will be true.

In recent year, China has experienced two periods of reserve ratio decreasing, first period started from Nov., 2011, and lasted to May, 2012, the second period begin at Feb, 2015 and continued till now. For stock price in the second period fluctuated extremely, the first period is chosen as study period. Moreover, event of reserve ratio changing contains announcement day and implement day. Because this study focuses on expectation, the announcement day is employed as the event day. In the first period, there are three times of reserve ratio decreasing. The announcement days are Nov. 30, 2011, Feb. 18, 2012 and May 12, 2012 respectively.

Event window is chosen as the first trading days after announcement. The reason is that before central bank announcement, market participants can to some degree anticipate it and take some actions. But this action is uninformed, only actions after announced can be regarded as informed and can be used to analyze market characteristics. The rest days after announcement are also not suitable for the same reason. Estimation window is chosen as 45 trading days before event day to 10 trading days before event.

For the reason that reserve ratio decreasing will affect the entire market, market return will have bias in predicting normal return. Therefore, constant mean return model is applied in normal return calculation. Brown and Warner (1980, 1985) have shown that the simple mean returns model often yields results similar to those of more sophisticated models because the variance of abnormal returns is not reduced much by choosing a more sophisticated model. In constant mean return model, normal return is calculated by the mathematical mean of estimation window return.

### 4.2 Event Analysis

Based on previous setup, benchmark model is simple mean returns model with one event day. FF-3-factors model and different event days are also employed as a supplement. The results of simple mean returns model are shown in Table 1. One event day setup is the basic model. From it we can find that the first and the second

time reserve ratio decreasing lead to a significant increase in stock returns. But the value is decreasing in each time. The reason is that the first reserve ratio change is out of expectation, and the market will therefore act intensively. In the second and the third changes, market already knows that central bank has been going to liquidity expansion path, so the decreasing in reserve ratio is partly reflect in previous trading days. Thus, the abnormal return is diminishing. Especially in third time, market has already acted on the expectation, so the abnormal return is even slightly negative in event day. When employing different event window, we can find there are overreaction in first time for out of expectation. In second time, market has expected this event but need time to act when expectation is realized. Thus, there is underreaction.

Table 1: CARs with simple mean returns model.

Event window	[0]	[-1,+1]	[-3,+5]
2011-11-30 (First time)	1.95%*** (47.22)	-5.23%*** (-53.46)	-7.22%*** (-49.05)
2012-2-18 (Second time)	0.53%*** (14.47)	2.02%*** (30.47)	9.39%*** (76.32)
2012-5-12 (Final time)	-0.18%*** (-4.23)	-0.84%*** (-10.28)	-3.07%*** (-21.79)

Notes: \*\*\*, \*\*, \* represent significance level of 1%, 5% and 10% respectively; t-test value is reported in parentheses;

FF-3-factors model is also employed as a comparison. From table 2, we can find that significance of abnormal return in each event is much lower that table 1. As disgusted above, this is for the reason that the market return is calculated by summation of each stock return. When reserve ratio decreasing, the entire market will be influenced. So is the market return. There exists abnormal return in market return. So, both FF-3-factors model and market return model become ineffective.

Table 2: CARs with FF-3-factors model

Event window	[0]	[-1,+1]	[-3,+5]
2011-11-30 (First time)	-0.08%* (-1.81)	-0.36%*** (-3.68)	0.21% (1.29)
2012-2-18 (Second time)	-0.13%*** (-3.40)	-0.14%** (-2.15)	0.014% (0.12)
2012-5-12 (Final time)	0.14%*** (3.10)	0.21%** (2.54)	0.26%* (1.91)

Notes: \*\*\*, \*\*, \* represent significance level of 1%, 5% and 10% respectively; t-test value is reported in parentheses;

In summary, event empirical analysis shows that there exist positive abnormal returns when reserve ratio decreasing. Abnormal returns diminish with the increasing of priory expectation about reserve ratio change. An over react exists when market doesn't anticipate reserve ratio decreasing and an under react exist when market predict the action of central bank.

### 4.3 Explanation of Abnormal Return

This part is abnormal return explanation. Through this explanation, whether H1 or H2 is true will be tested.

According to MM theory (Modigliani and Miller, 1958, 1977), firm with higher debt to total asset (leverage) has more bankruptcy cost and banks are less likely to lend them money. Thus, when market liquidity increase, higher leveraged firm is later to get money, and benefit later from this extensive monetary policy. They are in disadvantage in market competition. Therefore, their stock price will move up lower.

In addition, the pecking order theory (Myers and Majluf, 1984) points out that firms prefer internal financing than external financing such as debt and equity. Thus, firms with less free cash flow (FCFF) will suffer heavier financial restriction and improved more when market liquidity increase.

Both MM theory and pecking order theory can be employed to distinct where there is an expectation change. Specifically, if H1 is true, after control industry effect, both leverage and free cash flow should have negative significant explanatory power on CARs.

### 4.4 Hypothesis Test

The regression model is set as follow:

$$CARs_i = \beta_0 + \beta_1 Leverage_i + \beta_2 Ln\_fcff_i + \beta X_i + \varepsilon_i \quad (2)$$

We take log of the absolute value of FCFF but remain its sign (Ln\_fcff). Referring how Acharya and Schnabl (2013) handled when regressed on CARs, we includes return of asset (ROA) and total asset as control variables. We also taking log of total asset (Ln\_asset). All the data is obtained from WIND database. The summary statistics are shown in Table 3.

Table 3: Summary statistics

	Mean	Std.	Min	Max	Obs.
Event date	2011-11-30				
CARs	1.94	1.78	-4.25	10.61	1817
Leverage	0.427	0.433	0.0491	0.964	1817
Ln_fcff	-5.54	17.67	-24.79	23.35	1817
ROA	0.056	0.483	-0.463	5.374	1817
Ln_asset	21.64	1.25	16.68	28.26	1817
Event date	2012-02-18				
CARs	0.54	1.60	-5.19	11.04	1881
Leverage	0.431	0.411	0.0491	0.964	1881
Ln_fcff	-5.38	17.70	-24.79	23.35	1881
ROA	0.056	0.475	-0.463	5.374	1881
Ln_asset	21.65	1.25	16.68	28.26	1881
Event date	2012-05-12				
CARs	-0.18	1.87	-6.37	10.43	1811
Leverage	0.423	0.406	0.0067	0.929	1811
Ln_fcff	-5.32	17.70	-24.79	23.35	1811
ROA	0.058	0.484	-0.463	5.374	1811
Ln_asset	21.62	1.25	16.68	28.26	1811

Results for regress are shown in table 4. As table 4 has presented, both leverage and FCFF cannot effectively explain abnormal return in the first event. In contrast, both leverage and FCFF can significantly explain abnormal return both respectively and simultaneously in the second event. And the coefficient of them is both significantly positive, which is consistent with the prediction of H1. In the third event, they become insignificant again.

Previous event study has pointed out that there is positive abnormal return in both the first and the second events. Thus, these results indicate that in the first reserve ratio decreasing, the market stock price increase is due to inflation and required return decreasing. Namely, H2 dominates in the first reserve ratio decreasing. However, in the second reserve ratio decreasing, the firm level variables can effectively explain the positive abnormal return. It means difference future cash flow can account for the difference in abnormal returns. Therefore, H1 dominates in the second reserve ratio decreasing. In the third time, the expectation is fully reflected in the stock price, thus neither H1 nor H2 works.

Table 4: Explanation for CARs

Event date	2011-11-30			2012-02-18			2012-05-12		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Leverage	0.085 (0.097)		0.085 (0.097)	-0.20** (0.09)		-0.20** (0.09)	0.060 (0.11)		0.061 (0.11)
Ln_fcff	-	0.0017 (0.0024)	0.0017 (0.0024)	-	-0.0051** (0.0021)	-0.0050** (0.0021)		-0.00097 (0.0025)	-0.00099 (0.0025)
ROA	-0.11 (0.086)	-0.11 (0.09)	-0.107 (0.08)	-0.31*** (0.08)	-0.31*** (0.08)	-0.31*** (0.08)	-0.096 (0.091)	-0.096 (0.091)	-0.097 (0.091)
Ln_asset	0.109*** (0.034)	0.112*** (0.034)	0.108*** (0.034)	-0.106*** (0.030)	-0.115*** (0.029)	-0.106*** (0.029)	-0.0218 (0.036)	-0.0187 (0.035)	-0.0219 (0.036)
Const.	-0.363 (0.745)	-0.372 (0.744)	-0.33952 (0.745)	2.673*** (0.649)	2.757*** (0.647)	2.648*** (0.648)	-0.114 (0.787)	-0.163 (0.783)	-0.121 (0.787)
Industry	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Obs.	1817	1817	1817	1881	1881	1881	1811	1811	1811
R-sq	0.0087	0.0085	0.0089	0.023	0.024	0.027	0.0089	0.0088	0.0062
F-test	3.96***	3.89***	3.27***	11.38***	11.68***	10.32***	4.03***	3.99***	3.26***

Notes: \*\*\*, \*\*, \* represent 1%, 5%, and 10% significance, respectively; (1) to (3) is the first reserve ratio decreasing, (4) to (6) is the second reserve ratio decreasing and (7) to (9) is the last one.

Additionally, previous event study finds that there is an overreaction in the first reserve ratio decreasing and an underreaction in the second reserve ratio decreasing. Combining above results, we can obtain the whole picture. The first reserve ratio decreasing is out of expectation. Once it is announced, investors quickly act on this information without deep analysis. In their superficial analysis, only changes in discount factor, the required return, is captured. So, there is an overreaction, and the stock price increasing is due to inflation rather than expectation change. In the following reserve ratio decreasing, market participants already expect central bank is in a liquidity easing path. Some investors have sufficient time to make plans. Thus, when expectation is realized, those well prepared investors carry out their plans and only invest most valuable asset. Those unprepared investors follow them. Therefore, there is an underreaction in market. Thus, firm leverage and FCFE can explain abnormal return to some degree. In the third time, all investors have anticipated this monetary policy and have already relocated their assets accordingly, so there is no reaction in the market.



## 5 Robust Test

If our analyses about market behavior and hypotheses tests are robust, we might observe the coefficient becomes continuously significant in few days after the event. Therefore, in this part, we use CARs of two post-event windows in the first and the second event as the dependent variable. We employ both leverage and FCFF as independent variables. Other control variables are also included. Results are shown in table 5.

Table 5: Robust regress.

Event date	2011-11-30		2012-02-18	
	[0,2]	[3,5]	[0,2]	[3,5]
Event window	[0,2]	[3,5]	[0,2]	[3,5]
Leverage	0.22 (0.22)	-0.93*** (0.17)	-1.23*** (0.17)	-0.057 (0.16)
Ln_fcff	0.0014 (0.0054)	-0.0040 (0.0042)	-0.0096** (0.004)	0.0015 (0.0037)
ROA	-0.20 (0.21)	-0.24 (0.15)	-0.41*** (0.15)	0.18 (0.14)
Ln_asset	0.661*** (0.077)	0.039 (0.060)	-0.464*** (0.058)	0.206*** (0.054)
Const.	-17.81*** (1.69)	-0.83 (1.32)	14.192*** (1.28)	-1.865 (1.19)
Industry	Fixed	Fixed	Fixed	Fixed
Obs.	1817	1817	1881	1881
R-sq	0.048	0.022	0.087	0.0083
F-test	18.11***	8.00***	35.51***	3.15***

Notes: Each regress is different in event time or event window; Standard deviation is reported in bracket; \*\*\*, \*\*, \* represent 1%, 5%, and 10% significance, respectively.

As results shown in table 5, in the first reserve ratio decreasing, we can find the coefficient of leverage becomes significantly negative when choosing 3 days after event to 5 days after event. The sign of FCFF also becomes negative. It is because that stock price of high leverage firm will decrease more when market return to rational. These results are consistent with previous theory and support our previous analyses. In the second reserve ratio decreasing, the coefficient of leverage and FCFF continue being significant and being consistent with previous tests. It shows that when market behavior returns to ration from underreaction, price of firm with higher leverage ratio or firm with more FCFF increasing slighter. It also validates our previous analyses.

## 6 Conclusion

Through previous study, this paper finds that reserve ratio decreasing does lead to a positive abnormal return. But in each event, the channel is different. In the first reserve ratio decreasing, increasing in market liquidity cause asset price inflation and discount factor decreasing, leading to entire market price increase. In the second reserve ratio decreasing, increasing in market liquidity changes the expectation of future cash flow of firm, and cause benefitted firm's stock price increase.

Combined with each event, investors also behave irrationally in China stock market. When the event is out of expectation, namely the first reserve ratio decreasing, there is an overreaction. However, when event is expected, namely the following reserve ratio decreasing, there is an underreaction. Robust analysis validates this conclusion. As a result, we can conclude that China stock market is weakly efficient. Information cannot be gotten nor well understood by every investor. There are still spaces for market reform and efficient improving.

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