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The cross-border impacts of China's official rate shocks on stock returns of Chinese concepts shares listed on U.S. market[1]

Abstract:

This paper examines a new cross-border effect of an emerging country's interest rate changes on the stock returns of its domestic firms listed overseas. First, we discover that the increase in China's official interest rate greatly affects the NYSE-listed Chinese stocks, thereby suggesting that similar to Chinese domestic investors, the institutional investors in a mature market sometimes exhibit irrational sentiment driven by an emerging economy's unexpected monetary policy shocks. Second, we highlight some novel asymmetric impacts of China's official rate changes on Chinese concepts stock prices and reveal that these effects differ from the conventional nonlinear effects of monetary policies. For instance, a bull and bear regime has no statistically significant asymmetric effect on NYSE, whereas interest

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rate rise has different cross-border impact on Nasdaq and NYSE markets. These interesting findings are mainly driven by the smart investors in the U.S. stock market who are knowledgeable about the differences between NYSE- and Nasdaq-listed stocks and carefully analyze the different impacts of China's official interest rate changes on the fundamentals of different types of Chinese concepts stocks.

Key words: China's official interest rate shocks; Cross-border impacts; Chinese concepts shares; Event study

Classification codes: E52, G14, G15

1. Introduction

Since the 2008 financial crisis, emerging financial research (e.g., see Wang & Zhu, 2013; Kim et al., 2013; Fernandez–Perez et al., 2014; Bowman et al., 2015; Edwin et al., 2016; Bernhard & Ebner, 2017; Hanisch, 2019) have begun to discuss the cross-border spillover effect of interest rate shocks on the international stock market. These studies have considered the spillover effect of U.S. federal rate shocks (Wang & Zhu, 2013; Bowman et al., 2015; Edwin et al., 2016; Hanisch, 2019) and the European monetary policy (Kim et al., 2013; Fernandez–Perez et al., 2014; Bernhard & Ebner, 2017). Given the hierarchical financial structure hypothesis which posits that a mature financial market is likely to affect an emerging financial market, only few studies have analyzed the spillover effect from emerging countries' interest rate changes to U.S. stock markets.

In addition, previous studies on cross-border spillover effects have mainly focused on how the interest rate shocks of one country (usually those of developed economies, such as the U.S.) affect the other countries' stock markets. However, no study has considered other types of cross-border effects, such as how one country's interest rate adjustments affect the stock prices of its domestic companies listed overseas. In fact, a large number of companies from many countries around the world, including China, choose to go public in the U.S. stock market. As of date, more than 200 Chinese firms are listed on the US stock market (hereinafter referred to as "Chinese concepts stocks"). Theoretically, the official interest rate changes in China will directly affect the fundamentals of Chinese concepts stocks, but the expectations of investors on the fundamental changes in the U.S. market will ultimately determine the trend of Chinese concepts stock prices. Investors in U.S. markets differ from Chinese domestic investors in several ways. For instance, institutional investors own more than 70% of the stocks of U.S. corporations in the entire market and represent a very large percentage of the U.S. trading volume (Evans, 2009), whereas retail investors in the Shanghai Stock Exchange account for 82.01% of the market trading volume in 2017[2]. Darrat et al. (2010) and Li et al. (2015) argue that Chinese local investors do not have significant information acquisition advantages over foreign institutional investors and that U.S. institutional investors are more experienced in trading skills compared with Chinese retail investors. Therefore, compared with Chinese retail investors, U.S. institutional investors should have more complete information about China's interest rate changes and should be more rational in the face of interest rate shocks.

Furthermore, current studies on cross-border effects have also failed to discuss whether the institutional investors in a developed market (e.g., U.S.) can mitigate the irrational sentiment spillover effect from an emerging market (e.g., China) on the stock return of its companies listed overseas. Therefore, to extend the literature on the spillover effect of interest rate shocks on international stock markets, the objective of this paper is to analyze a new cross-border spillover effect, that is, how the interest rate changes in an emerging country (China) affect the stock prices of its domestic companies listed overseas (U.S. stock markets). Many studies (e.g., Bernanke & Kuttner, 2005; Chen, 2007; Henry, 2009; Gregoriou et al., 2009; Kurov, 2010; Jansen & Tsai, 2010; Wang & Mayer, 2012; Fiordelisi et al., 2014; Lv et al., 2015; Chebbi, 2018, among others) reveal that interest rate shocks may have

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[2] See additional details from the Shanghai Stock Exchange Statistics Yearbook (2018; in Chinese). http://www.sse.com.cn/aboutus/publication/yearly/

nonlinear asymmetric effects on the stock market in three ways, namely, interest rate cuts and rises may produce different impacts, interest rate shocks may have asymmetric effects in bull and bear regimes, and interest rate changes may have nonlinear effects during financial crisis and non-crisis periods. These studies highlight investor sentiment as the main drivers of these asymmetric effects. Meanwhile, our cross-border effect study discusses whether global investors in U.S. markets are more rational than Chinese domestic investors when facing interest rate changes and examines whether the foreign investors' behavior can lead to some "novel" findings regarding the nonlinear effect that may challenge the conventional view. We also seek to examine how the nonlinear effects of interest rate changes on stock prices in the framework of "new cross-border effect" studies differ from classical asymmetric effects.

This paper makes the following contributions to the current literature. First, to the best of our knowledge, this is the first study to discuss the cross-border effect of emerging countries' interest rate shocks on the stock returns of their domestic firms listed in mature markets. Second, we propose that investors in mature markets cannot always stay rational to the unexpected shocks in China's interest rate and find that the price of Chinese concept shares listed on NYSE has decreased by approximately 12.5% within 5 trading days per 25-basis-point increase in China's official interest rate. Third, we highlight some novel nonlinear effects of China's official rate changes on Chinese concepts stock prices that challenge the conventional theory and provide some economic explanations in view of the U.S. investors' rational sentiment. For example, we find that China's interest rate changes have no significant asymmetric effects on NYSE-listed Chinese concepts stocks in a bull or bear market, whereas previous studies (e.g., Chen, 2007; Henry, 2009; Jansen & Tsai, 2010; Lv et al., 2015) contend that interest rate changes have a negative impact on the stock market regardless of regime, but such negative effect is greater in a bear market.

Given that China does not operate through open markets when adjusting its interest rates but directly adjusts its official rate through announcements, we follow Ricci (2015), Lv et al. (2015), and Fiordelisi et al. (2015) and adopt the event study model setting of MacKinlay (1997) to investigate the relationship between China's official rate changes and the stock returns of Chinese concept shares listed on the U.S. market. We use the market model to estimate the abnormal returns around the time of the official rate change announcement, and then apply the multiple linear regression model to estimate the nonlinear effects.

The rest of this paper is organized as follows. Section 2 reviews the literature. Section 3 describes the methodology and data used in this research. Section 4 discusses our main empirical results and robustness analysis. Section 5 presents the conclusions and policy implications.

2. Literature review

Previous studies suggest a negative correlation between interest rate and stock returns, while others point out that interest rate hikes do not necessarily cause stock prices to fall. Bernanke & Kuttner (2005) find that an unanticipated 25 basis point cut in the federal funds rate target is associated with an approximately 1% increase in the U.S. stock index. Meanwhile, Bjørnland & Leitemo (2009) reveal a strong interdependence between interest rate and real stock prices and argue that a 100-basis-point increase in federal funds rate may cause a 7% to 9% reduction in stock price. A similar significant negative relationship between interest rates and stock return has been reported in other studies. For instance, Hung & Ma (2017) investigate 10 international countries and find that most of these countries' stock prices react negatively to interest rate within 10 months. However, Ferrer et al. (2016) suggest a time-varying and country-dependent specific linkage between 10-year government bond rate and stock returns for 10 European countries. Gali & Gambetti (2015) show that after a short-run decline, stock prices increase persistently in response to an exogenous tightening monetary policy; this finding clearly contradicts the conventional view that an increase in interest rate does not reduce the size of an emerging asset price bubble.

Emerging studies in the field have mainly focused on three types of non-linear relationships between interest rate shocks and stock market. First, Bernanke & Kuttner (2005) explain that the negative impact of interest rate cuts on stock returns is greater than that of interest rate rises. However, Fiordelisi et al. (2014) show that the monetary policy interventions to interest rates cuts cannot significantly affect the stock market and that only the unchanging or increasing interest rates can produce a significant negative effect. Second, many studies reveal that the impact of interest rate changes on the stock price shows typical asymmetric characteristics in different market regimes. Chen (2007) applies the Markov switching model and finds that federal funds rates and discount rates have greater effects on stock returns in bear markets than in bull markets. Kurov (2010) attributes the nonlinear effect between bear and bull markets to investor sentiment. Similar asymmetric impacts between bull and bear market regimes have also been observed in the U.K (Henry, 2009) and China (Lv et al., 2015). Jansen & Tsai (2010) use firm-level data and find that unexpected interest rate shocks have larger negative and statistically significant impacts on the stock market in bear markets than in bull markets. Third, some studies have examined the differences in these effects between financial crisis and non-crisis periods. For instance, Gregoriou et al. (2009) reveal that the British three-month LIBOR has a significant negative impact on the stock market during a non-crisis period, but such negative impact becomes positive during a financial crisis. However, in the international comparative study of Wang & Mayer (2012), they find that the responses of the U.K. and the Euro Area stock markets to expected and unexpected rate changes become positive during crisis periods, especially during a zero-bound period, whereas those of New Zealand and Australian stock markets remain negative during a crisis period. Chebbi (2018) reveal that the impact of sovereign interest rate spreads in Germany and Italy on their stock markets increases during crisis and post-crisis years.

Other studies have analyzed the cross-border spillover effects of interest rate shocks on the international stock market yet have mostly focused on the spillover effects of U.S. federal rates changes and the European monetary policy on equity markets. First, Hanisch (2019) finds the stock markets of

European countries, including Germany, France, the Netherlands, Italy, and Spain, initially respond to the U.S. federal fund rate positively in a short term, but such effect quickly becomes negative. Wang & Zhu (2013) highlight the significant negative impacts of U.S. unexpected federal fund rates on the stock prices of more than 20 developed countries. Bowman et al. (2015) reveal that the relationship between the U.S. unconventional monetary policy announcements and the emerging markets' stock markets depends on county-specific characteristics. Edwin et al. (2016) show that the U.S. short-term interest rate does not affect Indian stock returns except during the large-scale asset purchases that took place in 2008 and the Operation Twist in 2011. Second, many studies have examined the cross-border spillover effects of the U.S. and some other advanced economies' interest rate change on international stock markets. For instance, Fernandez–Perez et al. (2014) believe that the term structure of the U.S. and Europe interest rate can help forecast the probability of a bear market regime. Meanwhile, Bernhard & Ebner (2017) reveal that an unexpected expansion in the government bond rates of US, Europe, England, and Japan can reduce the Swiss stock prices. However, Kim et al. (2013) suggest that the stock returns of the U.S. and European banking industries heterogeneously respond to the interest rates from the U.S. Federal Reserve and the European Central Bank.

Two basic event study methodologies have been often employed in the literature to investigate the relationship between interest rate shock and stock market. The first methodology is established by Bernanke & Kuttner (2005) to detect the different impacts of unexpected and expected interest rate shocks on U.S. stock markets. In their event study model, a surprise element of interest rate must be measured by using the method proposed by Krueger & Kuttner (1996) and Kuttner (2001), and then the unexpected and expected interest rates must be added to the multiple linear model. Many other works (e.g., Gregoriou et al., 2009; Wang & Mayes, 2012; Haitsma et al., 2016; Bernhard & Ebner, 2017) have applied this event study model to investigate the effects of different countries' interest rate shocks. Meanwhile, other studies employ the classical and general event study methodology (MacKinlay, 1997) to investigate how news announcements, including macroeconomic indicators and firms' financial report releases, affect the stock market. Ricci (2015), Lv et al. (2015), and Fiordelisi et al. (2015) adopt this methodology to estimate the abnormal stock market returns caused by interest rate shocks and then perform a regression analysis to examine the impact of interest rate changes on the stock market.

However, previous studies on the relationship between interest rate and stock markets (e.g., Bernanke & Kuttner, 2005; Bjørnland & Leitemo, 2009; Gali & Gambetti, 2015; Ferrer et al., 2016; Hung & Ma, 2017, among others) have paid little attention to the impact of non-marketized official interest rate changes in developing countries on the stock market, with the exception of Lv et al. (2015), who discuss the impact of China's official interest rate on the Chinese stock market. Previous studies on the cross-border spillover effect (e.g., Kim et al. 2013; Wang & Zhu, 2013; Fernandez–Perez et al., 2014; Bowman et al., 2015; Edwin et al., 2016; Bernhard & Ebner, 2017, among others) have also failed to discuss how a home country's monetary policy affects its domestic firms listed overseas. In fact, many Chinese companies are listed on the U.S. market, and their stock prices are affected by China's monetary policy. Checking for differences between the findings for the "conventional" nonlinear effect and those for the "new cross-border effect" is also necessary given the differences in the sentiments of global investors on the U.S. market and domestic investors in local markets.

3. Data and methodology

This section describes our methodology for collecting data on China's official interest rate change, our sample of Chinese firms listed overseas, and our methodology for the event study and the subsequent regression analysis.

3.1 Sample description

We analyze the stock price reaction of Chinese firms listed overseas to China's official interest rate changes. The official interest rate is an important monetary instrument determined by the People's Bank of China (PBC) that indicates the loan and deposit rates of commercial banks. These rates are not decided by monetary market mechanisms but are instead established by administrative orders. The PBC considers the economic growth rate, inflation rate, and other macroeconomic conditions when determining its official interest rate. The non-marketized interest rate changes in China are different from the adjustments in the U.S. interest rate. Specifically, while the PBC directly changes its benchmark interest rate through announcements (in this case, China's official rate change data demonstrate discrete characteristics), the U.S. Federal Open Market Committee announces its interest rate adjustment decisions and then regulates the money supply through open market operations while maintaining the federal funds rate near the target rate.

The official interest rates of China have been changed 28 times from 2010 to 2017 with 14 rises and 14 cuts (see Tables 1 and 2). Although Chinese monetary authority gradually promoted an interest rate marketization reform and the floating limit of deposit and loan rates has been nominally cancelled, the official interest rate still plays an important role in the implementation of China's monetary policy. Therefore, we adopt one-year loan rate changes as a proxy for China's official rate changes.

As China is going through major financial transformations, many of the leading mainland-based firms list themselves overseas in order to gain access to investor capital as fast as possible. Apart from the direct investments of the mainland, Chinese concepts stocks are considered one of the purest sources of investment that contributes to the long-term economic growth of China. We mainly focus on those Chinese firms listed on the Nasdaq exchange and NYSE because these two markets are the most famous and actively traded stock exchanges in the world and have become the first choices of most Chinese companies attempting to list overseas.

The data used in this paper include the changes in the benchmark loan rate of China, the daily trading data of Chinese firms listed in Nasdaq and NYSE, and the market indices of Nasdaq and NYSE. Among these data, the daily trading data and market indices are collected from the WIND database, while the official interest rate change announcements are obtained from the website of the PBC.

3.2 Event study

We measure the stock price reaction of Chinese firms listed overseas by estimating abnormal returns (ARs), which represent the forecast errors of a specific normal return generating model. We also estimate ARs by adopting a standard market model (MacKinlay 1997), which parameters are obtained by using the daily returns of each firm and the market index, which can represent the market portfolio over a 260-day estimation period ending 10 days before the announcement of an official interest rate change. Following Aït-Sahalia et al. (2012) and Ricci (2015), we focus on the following short event windows[3]: 1-day (0,0), 2-day (0,1), 3-day (-1,1), and 5-day (-1,3),he market model for each firm can be calculated as

$$\mathrm{R}_{\mathrm{j},\tau,\mathrm{k}} = \alpha_{\mathrm{j}} + \beta_{\mathrm{j}}\mathrm{R}_{\tau,\mathrm{k}} + \varepsilon_{\mathrm{j},\tau,\mathrm{k}} \qquad \varepsilon_{\mathrm{i},\tau,\mathrm{k}} \sim \mathrm{i.i.d.N}\left(0,\sigma^2_{\varepsilon_{\mathrm{j},\tau,\mathrm{k}}}\right), \tag{1}$$

where $\mathrm{R}_{\mathrm{j},\tau,\mathrm{k}}$ and $\mathrm{R}_{\tau,\mathrm{k}}$ represent the log returns of the j-th firm and the market log returns in event k during the event date τ, respectively. Given that our samples are Chinese firms listed on Nasdaq and NYSE, we use the Nadaq and NYSE composite indices to calculate the normal returns. We then obtain the estimated market model parameters $\widehat{\alpha}_{\mathrm{j}}$ and $\widehat{\beta}_{\mathrm{j}}$ for the j-th firm during the event date τ and then compute the abnormal return as the actual return minus the normal return predicted by the market model:

$$AR_{j,\tau,k} = R_{j,\tau,k} - (\widehat{\alpha}_j + \widehat{\beta}_j R_{\tau,k}). \tag{2}$$

Afterward, we calculate the cumulative abnormal returns (CARs) as the sum of the abnormal returns over the event window (τ_1,τ_2) for the j-th firm in event k:

$$CAR_{j,k} = \sum_{\tau=\tau_1}^{\tau_2} AR_{j,\tau,k}. \tag{3}$$

We then obtain the cumulative average abnormal returns (CAARs) across all firms as follows:

$$CAAR_k(\tau_1,\tau_2) \sim N(0,\overline{\sigma^2_k}(\tau_1,\tau_2)), \tag{4}$$

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[3] We consider the time lag between China and the U.S. Given that China's official interest rate changes are usually announced at evening and just before the opening of U.S. stock markets, we set the announcement date as the event date.

where $\overline{\sigma_k^2}(\tau_1,\tau_2)$ is the variance of $CAAR_k(\tau_1,\tau_2)$, which can be expressed as

$$Var[\,CAAR_k(\tau_1,\tau_2)] = \overline{\sigma_k^2}(\tau_1,\tau_2) = \frac{1}{N^2}\sum_{j=1}^{N}\sigma_{j,k}^2(\tau_1,\tau_2), \quad (5)$$

where N is the number of the observation firms in the k-th event, and $\sigma_{j,k}^2(\tau_1,\tau_2)$ is the variance in the CAR of the j-th firm in the k-th event for event window (τ_1,τ_2). Afterward, we test our hypothesis that the market reaction is significantly different from 0 by using the following t-statistic:

$$t = \frac{CAAR_k(\tau_1,\tau_2)}{\sqrt{\overline{\sigma_k^2}(\tau_1,\tau_2)/N}} \sim N(0,1). \quad (6)$$

3.3 Regression analysis

By referring to single official interest rate change announcements, we investigate the overall reaction of the overseas listed Chinese firms' stock prices by running the following OLS regression:

$$CAR_{j,k} = \gamma_0 + \gamma_1 \Delta i_k + \epsilon_{j,k}^{\tau_1,\tau_2}, \quad (7)$$

where the dependent variable is the cumulated abnormal return (CAR) for the j-th firm to the k-th announcement over the event window (τ_1,τ_2), and Δi_k is the official interest rate change in the k-th announcement. To further examine the asymmetric effect, we run the following regressions:

$$CAR_{j,k} = \delta_0 + \delta_1 \Delta i_k + \delta_2 \Delta i_k x_{Rise,k} + \delta_3 x_{Rise,k} + \lambda_{j,k}^{\tau_1,\tau_2} \quad (8)$$

$$CAR_{j,k} = \mu_0 + \mu_1 \Delta i_k + \mu_2 \Delta i_k x_{Bull,k} + \mu_3 x_{Bear,k} + \theta_{j,k}^{\tau_1,\tau_2} \quad (9)$$

$$CAR_{j,k} = \varphi_0 + \varphi_1 \Delta i_k + \varphi_2 \Delta i_k x_{Crisis,,k} + \varphi_3 x_{Crisis,,k} + \omega_{j,k}^{\tau_1,\tau_2}, \quad (10)$$

where $x_{Rise,k}$ is a dummy variable that equals to 1 if the k-th event is the official interest rate rise announcement and equals to 0 otherwise, $x_{Bull,k}$ is a dummy variable that equals to 1 if the k-th announcement occurs during a bull market regime and equals to 0 otherwise, and $x_{Crisis,,k}$ is a dummy variable that equals to 1 if the k-th announcement occurs during a financial crisis period and equals to 0 otherwise.

4. Empirical results

This section discusses our main results. First, we present the findings from our event study analysis. Second, we show the asymmetric reactions from the second-stage regression analysis. Third, we analyze the robustness of our empirical findings.

4.1 Results of the event study analysis

Tables 1 and 2 report the results for the event study conducted on Chinese firms listed on Nasdaq and NYSE, respectively, with reference to the official interest rate change announcements in China. The Nasdaq and NYSE composite indices are selected to represent market portfolio. As shown in the tables, a large proportion of the CAARs are statistically significant at the 10% confidence level or less.

Specifically, 67.86% (19 out of 28 events) and 82.14% (23 out of 28 events) of the CAARs of Nasdaq- and NYSE-listed Chinese firms over the event window (-1,3) are statistically significant, respectively. The higher percentage for the NYSE-listed firms may be ascribed to the different characteristics of firms listed in the two different stock markets. Nasdaq and NYSE greatly differ in terms of their operations and traded equities. Nasdaq is a high-tech market that attracts many firms from the Internet, electronics, or biotech industries. Accordingly, the stocks traded in this exchange are highly volatile. Chinese firms listed on Nasdaq also exhibit high-tech and growth-oriented characteristics. Meanwhile, those companies listed on NYSE are less volatile. These companies mainly include blue-chip firms and traditional industries whose stocks are highly stable and established.

The percentage of statistically significant CAARs for interest rate cuts is higher than that for interest rate rises. Specifically, 71.43% (10 out of 14 interest rate cuts) and 50% (7 out of 14 interest rate cuts) of the CAARs of Nasdaq- and NYSE-listed Chinese firms over the event window (0,0) are statistically significant under loose and contractionary monetary policies, respectively. To some extent, these findings suggest that a tightening monetary policy in China may not suppress the stock prices of Chinese firms listed overseas.

The official interest rate change does not always have a negative impact on the stock returns of Chinese firms listed overseas. During the contractionary monetary policy cycle from 2004 to 2007, China's official interest rate increased 9 times and resulted in twice significant negative and twice significant positive CAARs of Chinese firms listed on NYSE. Meanwhile, during the loose monetary policy cycle from 2012 to 2015, the official interest rate was cut 8 times, which resulted in thrice significant positive and twice significant negative CAARs of Chinese firms listed on Nasdaq. Therefore, the relationship between the official interest rate change and stock returns of Chinese firms listed overseas is not governed a simple negative correlation. We further investigate this asymmetric relationship by performing a second-stage regression analysis.

4.2 Overall effect of official interest rate change on Chinese concepts stocks

As shown in Table 3, an overall significant negative relationship between excess stock return and China's official interest rate shocks is observed for those Chinese concepts shares listed overseas. This result is consistent with the contentions of traditional economic theory, which posits that an interest rate cut results in a stock price increase whereas an interest rate rise results in a stock price decline. Specifically, a 100-basis-point shock in China's official interest rate is associated with 2.14% and 2.58% immediate changes in the opposite direction in the stock returns of Chinese firms listed on Nasdaq and NYSE, respectively. At the same time, the official interest rate change has the largest and most significant impact on excess returns during the (0,0) event window (the first trading day after the announcement date). However, for the (-1,1) and (-1,3) event windows, the impact of interest rate changes on stock prices is not statistically significant.

4.3 Asymmetric effects between official interest rates cut and rise

We introduce the dummy variable $x_{\mathrm{Rise,k}}$ to capture the asymmetric effects of official interest rates cuts and rises, where $x_{\mathrm{Rise,k}}$ equals to 1 if the k-th event is the official interest rate rise announcement and equals to 0 otherwise. Table 4 reports the results of the regression model explaining the CARs registered by Chinese firms listed on Nasdaq and NYSE in line with the official interest rates change announced by the PBC. The coefficients of δ_1, which represents the effects of interest rate cuts, are all negative and statistically significant for both markets. Panel A of Table 4 shows that a 100-basis-point cut in the official interest rate is associated with an approximately 6.43% to 26.67% increase in the CARs of Chinese firms listed on Nasdaq, while Panel B of Table 4 shows that a 100-basis-point cut causes an approximately 6.01% to 9.81% increase in the stock returns of NYSE-listed Chinese firms. However, the asymmetric analysis, which can be expressed by the coefficients of δ_2, only exists for the firms listed on NYSE. Panel A of Table 4 shows that all coefficients of δ_2 are not significant, but the coefficients of δ_2 are significant in Panel B shows the opposite. Therefore, interest rate cut has a stronger negative reaction than interest rate rise in NYSE but not in Nasdaq.

By comparing Panels A and B, we find that the stock returns reaction to interest rate change is much larger in NYSE than in Nasdaq. For instance, column (d) reveals that the effect of official interest rate change on stock returns in NYSE is two times greater than that on the stock returns in Nasdaq for the event window (-1,3). Moreover, a comparison of columns (d) and (a) in Panel A reveals that in NYSE, the impact of official interest rate change increases along with the event window. The stock returns reaction to a 100-basis-point interest rate cut is 9.81% for the event window (-1,3), which is slightly larger than that for the (0,0) event window, while the stock returns reaction to a 100-basis-point interest rate hike is –49.68% for the (-1,3) event window, which is more negative and larger than that for the (0,0) event window.

Our findings on the strong spillover effects contribute to the cross-border literature by revealing that the institutional investors in a mature U.S. market not only significantly respond to the interest rate changes of an emerging economy but can also be affected by the irrational sentiment of Chinese domestic investors. For the Chinese domestic market, the most intensive period of interest rate rise is the year 2007, during which the PBC announced 6 official interest rate rises by 137 base points. During this period, the Shanghai Stock Exchange plunged from its highest point of above 6000 to around 1000, whereas the U.S. stock market, including the Chinese concepts stocks, also experienced a sharp drop due to the subprime mortgage crisis. However, apart from the drop in average market returns caused by the financial crisis, a one-point increase in official interest rate leads to a 12.5%[4] reduction in the excess returns of NYSE-listed Chinese stocks, thereby suggesting that U.S. institutional investors cannot easily maintain a rational attitude in the face of China's drastic interest rate changes. We can also speculate that the irrational sentiment of Chinese domestic investors may have been passed to the U.S. market during this period, thereby making the relatively rational institutional investors more sensitive to interest rate hikes and drastically reducing the Chinese concepts stock returns during the interest rates rise cycle.

The above results also suggest that the extent of the cross-border impact of official interest rates changes depends on stock characteristics. The rise in China's official interest rates produces a greater negative impact on the excess stock returns of NYSE-listed firms than those of Nasdaq-listed firms. The main economic explanation for this finding is that most Nasdaq-listed companies have smaller financial constraints compared with NYSE-listed ones and are relatively insensitive to interest rate shocks. Nasdaq-listed companies are coming from high-tech industries, especially software, computer, IT, and telecommunications, and face relatively light financial constraints because they mainly engage in equity financing. Therefore, interest rate changes have relatively low impact on the fundamentals of these firms, and an increase in interest rate may not be associated with an increase in these firms' financial costs. By contrast, NYSE-listed companies are mostly traditional industries facing heavy financial constraints, such as energy and finance. Interest rate rises have greatly increased the financial costs and reduced the profits of

[4] Table 1 reports that China's interest rate adjustments are around 25 basis points; therefore, the results presented in Table 4 indicate that a 100-basis-point increase in the official interest rate reduces the *CAR*s of NYSE-listed Chinese stocks by about 49.68% in the (-1,3) event window. Meanwhile, a one-point increase in the official interest rate reduces the *CAR*s of NYSE-listed Chinese stocks by 12.5%.

these firms, and therefore greatly influence the stock returns of Nasdaq-listed Chinese firms. This observation is consistent with that of Ehrmann & Fratzscher (2004), who reveal that the differences in the financial constraints of listed companies may lead to differences in the impact of interest rate shocks on the stock returns of companies listed in different markets.

4.4 Asymmetric effects between bull and bear market regimes

Following Chen (2007) and Kurov (2010), we also investigate the asymmetric effects of China's monetary policy on the stock returns of Chinese firms listed overseas in bull and bear market regimes. We employ the Markov switching model to identify a bull regime with a high mean and low variance as well as a bear regime with a low mean and high variance.[5] We use a dummy variable $x_{Bear,k}$ to detect the asymmetric effects between these regimes. $x_{Bear,k}$ equals to 1 if the k-th announcement occurred during a bear-market regime and equals to 0 otherwise. Table 5 presents the results of the regression model that explains how the $CARs$ of Nasdaq- and NYSE-listed Chinese firms react to the official interest rate change announcement in bull and bear market regimes. In Panel A of Table 5, the coefficients of $\mu_1 + \mu_2$ indicate that monetary policy has a significant and negative impact on the $CARs$ of Nasdaq-listed Chinese firms in a bear market. In other words, a 100-basis-point cut in the official interest rate leads to a 2.68% to 8.97% rise in stock returns in the bear regime. However, contrary to traditional theory, the coefficients of μ_1 do not always show a negative impact on monetary policy. Specifically, a positive effect for the (-1,1) event window is found in the bull market while a significant negative impact is detected only for the (0,0) event window. The coefficients of μ_2 in columns (c) and (d) of Panel A indicate an asymmetric effect between bear and bull markets, which is consistent with the findings of Chen (2007) and Kurov (2010).

Meanwhile, for the NYSE market, the coefficients of μ_2 in Panel B of Table 5 are statistically insignificant, thereby indicating that in contrast to Chen (2007)

[5] See Appendix A for details on the methodology and results of the Markov switching model.

and Kurov (2010), no asymmetric effect is observed between bull and bear markets. Specifically, China's monetary policy negatively affects the ARs of Chinese concept stocks regardless of whether the stock market is in a bull or bear regime. For the (0,0) event window, as can be seen from column (a) of Panel B, a 100-basis-point cut in the official interest rate is associated with a 3.73% increase in stock returns during a bear market state, while a 100-basis-point rise in official interest rate cut is associated with a 2.09% reduction in stock returns during a bull market state. Moreover, when comparing Panels A and B, the change in China's official interest rate seems to have a more lasting effect on Nasdaq than on NYSE.

The interest rate shocks produce stronger effects on the stock prices of Nasdaq-listed firms in a bear market than those in a bull market. This finding is consistent with previous studies (Chen, 2007; Kurov, 2010; Henry, 2009; Lv et al. 2015) and may be explained by the fact that Nasdaq-listed high-tech Chinese stocks are closely linked to other U.S. high-tech companies in the same market and belong to different parts of the high-tech industry global chain. The negative sentiment of investors in the bear market can be easily transmitted to Chinese Nasdaq-listed stocks, thereby greatly affecting the interest rate changes in a bear market. Meanwhile, most Chinese NYSE-listed companies are traditional industries that conduct business in the mainland and have weak relationships with the U.S. market. Therefore, the fluctuations in the U.S. stock market may not change the investor sentiment toward these stocks. Interest rate shocks tend to positively influence the stock prices of high-tech companies that face few financial constraints in a bull market and always negatively affect the stock returns of traditional industries that face great financial constraints in either a bull or bear market.

4.5 Asymmetric effects between financial crisis and non-crisis periods

To investigate whether the impact of China's monetary policy interventions changes during the financial crisis period, we divide our sample into the crisis and non-crisis sub-periods and then add the dummy variable $x_{Crisis,,k}$ to the regression analysis. Consistent with Aït-Sahalia et al. (2012) and Ricci (2015), we set the financial crisis period from 15/09/2008 (i.e., the day after the collapse of Lehman Brothers) to 01/05/2010 (i.e., the day before the beginning of the European sovereign debt crisis phase). $x_{Crisis,,k}$ equals to 1 if the k-th announcement occurs during the financial crisis period and equals to 0 otherwise. Table 6 reports the regression results for the impacts of China's official interest rate change on the $CARs$ of Nasdaq- and NYSE-listed Chinese firms during the financial crisis and non-crisis periods. Panels A and B show that China's monetary policy has a much larger negative impact during the financial crisis period than in the non-crisis period. Specifically, for the event window (0,0), a 100-basis-point movement in the official interest rate changes the stock returns of Nasdaq-listed Chinese firms by 8.05% in the opposite direction during a financial crisis, and this change is about 5 times greater than that recorded during a non-crisis period. Similarly, the negative impact of official interest rate change on NYSE during the financial crisis period is more than 7 times greater than that recorded in the non-crisis period. These findings are consistent with those of Wang & Mayer (2012) and Chebbi (2018).

Panels A and B also show that the coefficients of φ_1 are significantly positive for Nasdaq and statistically insignificant for NYSE in event windows (-1,1) and (-1,3). Meanwhile, the coefficients of $\varphi_1 + \varphi_2$ are all negative and statistically significant for both markets, and their absolute values increase as the event window extends for Nasdaq. Therefore, the negative impact of China's official interest rate change on the stock returns of Chinese concepts shares lasts longer during the financial crisis period.

4.6 Robustness analysis

We perform two robustness checks. First, we control for possible macroeconomic indicators, such as consumer price index (CPI), producer price index (PPI), and industrial production index (IPI), which are regularly being published by the National Bureau of Statistics (NBS) of China and may have a strong impact on the excess stock returns of Chinese firms listed overseas. We then introduce a new dummy variable $x_{Macro,k}$, which equals to 1 if CPI, PPI, or IPI indicators are published during the (-1,3) event window of the k-th official interest rate announcement and equals to 0 otherwise. We consult the "regular press release calendar"[6] published by NBS for the macroeconomic indicator release dates.

Second, we add industry dummy variables to control those problems caused by different industries facing various financial constraints. Ehrmann & Fratzscher (2004) argue that those firms facing different financial constraints respond differently to interest rate changes. In general, a tightening monetary policy has strong impacts on highly bank-dependent borrowers. Different industries also experience various credit conditions. For instance, the real estate and automobile industries are inherently more dependent on bank loans and consistently exhibit strong responses to interest rate rises. Specifically, we control for the following sectors: energy, material, manufacturing, consumer discretionary, consumer staples, healthcare, finance, IT, real estate, utilities, and telecommunications.[7] The industry classifications of all individual firms are collected from the WIND database.

The results of the robustness analysis are reported in Appendix B. After adding the macroeconomic indicators and industrial dummies, all the estimates are qualitatively and quantitatively similar to those reported in the previous sections, thereby suggesting that our conclusions are robust. Take the asymmetric analysis of interest rate cuts and rises for example. After controlling for the macroeconomic indicator releases and industries, the coefficient of δ_1 for the (0,0) event window changes from –6.43 to –6.40 for Nasdaq and from –8.68 to –9.60 for NYSE, whereas the coefficients of δ_2 indicate that the asymmetric effect is insignificant for Nasdaq. The coefficient of $\delta_1 + \delta_2$ for the (-1,1) event window changes from –43.34 to –50.15.

5 Conclusions

[6] See details on the website of NBS China. http://www.stats.gov.cn/tjsj/xxgbrc/

[7] None of the Nasdaq-listed Chinese firms are coming from the utilities or telecommunications sectors.

In this study, we investigate the cross-border effect of China's monetary policy. First, we find that the official interest rate change has a significant and strong impact on the stock returns of Chinese firms listed overseas. Specifically, a 25-basis-point interest rate rise can pull down the stock returns of NYSE-listed Chinese firms by approximately 12.5%, which may imply that mature market investors cannot always remain rational when facing continuous and drastic monetary policy shocks. Second, official interest rate cuts and rises show different asymmetric effects on the excess stock returns between Nasdaq and NYSE. The impact of interest rates cuts on Nasdaq-listed Chinese stocks is greater than that of interest rates rises, but the effect of interest rates rises on NYSE-listed Chinese stocks is greater than that of interest rates cuts. Third, the asymmetric impact of interest rate changes on stock returns in bull and bear markets is only detected in Nasdaq. In other words, official interest rate changes have great negative effects on the stock returns of Nasdaq-listed Chinese firms in a bear market but do not show any asymmetric impact on NYSE-listed Chinese stocks in bull and bear markets. Third, official interest rate change showed a stronger negative effect on the stock returns of Chinese concepts shares during 2008 financial crisis than during the non-crisis period.

These findings hold great importance for global investors. First, China's official interest rate changes produce great impacts on the stock prices of Chinese firms listed overseas. Therefore, U.S. investors need to take China's monetary policy volatility as an important indicator when predicting Chinese concepts stocks. Second, during the interest rate rise cycle, the stock price of Chinese concepts shares may dramatically decrease due to irrational sentiment spillover effects. Therefore, the proportion of Chinese concepts shocks in portfolios must be reduced. Third, given that official interest rate changes have asymmetric effects on the stock returns of Nasdaq-listed Chinese firms in a bull and bear market, investors may appropriately their proportion of the Nasdaq-listed Chinese concepts stocks during a bull market yet reduce such proportion in a bear market.

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Table 1 Cumulative average abnormal return of Chinese firms listed on Nasdaq

Event data	Interest rate change	$CAAR(0,0)$	$CAAR(0,1)$	$CAAR(-1,1)$	$CAAR(-1,3)$
20/02/2002	-0.54	0.0487*** (3.3044)	0.0334** (2.6860)	0.0426*** (3.2155)	0.0397** (2.5348)
28/10/2004	+0.27	-0.0230** (-2.1779)	-0.0260 (-0.9680)	0.0276 (0.7138)	0.0353 (1.0094)
27/04/2006	+0.29	-0.0055 (-0.5143)	0.0043 (0.3177)	-0.0016 (-0.1108)	-0.0144 (-0.5672)
18/08/2006	+0.27	-0.0030 (-0.7998)	-0.0178** (-1.9540)	-0.0075 (-0.6346)	-0.0021 (-0.1658)
17/03/2007	+0.29	0.0011 (0.1551)	-0.0234** (-2.2342)	-0.0173** (-1.8581)	-0.0106 (-0.8503)
18/05/2007	+0.18	-0.0111** (-2.1937)	0.0052 (0.5425)	0.0203** (1.9994)	0.0245 (1.1374)
20/07/2007	+0.27	-0.0104** (-1.8866)	-0.0139** (-1.8419)	0.0078 (0.8838)	-0.0341** (-1.9761)
21/08/2007	+0.18	0.0051 (0.6919)	0.0314*** (2.8820)	0.0333*** (2.8994)	0. 0399*** (2.8159)
14/09/2007	+0.27	0.0149*** (2.5388)	0.0288*** (2.6338)	0.0216** (2.0319)	0.0515** (2.2206)
20/12/2007	+0.18	-0.0047 (-0.6628)	-0.0109* (-1.5514)	-0.0119* (-1.4265)	0.0337* (1.5713)
15/09/2008	-0.27	-0.0498*** (-6.0242)	0.0192 (0.8076)	0.0352* (1.4080)	0.0597*** (3.2793)
08/10/2008	-0.27	-0.0042 (-0.2365)	-0.0531** (-0.3716)	-0.1230*** (-4.2328)	-0.1823*** (-5.6816)
29/10/2008	-0.27	0.0226*** (2.8582)	0.0433*** (3.1786)	0.0688*** (2.9855)	-0.1270*** (-3.2218)
26/11/2008	-1.08	0.0512*** (3.0366)	0.0800*** (3.9085)	0.1318*** (6.7395)	0.2300*** (7.1994)
22/12/2008	-0.27	-0.0213** (-2.1054)	-0.0114 (-0.9340)	-0.0098 (-0.5971)	-0.0183 (-1.0712)
19/10/2010	+0.25	-0.0351*** (-6,1184)	-0.0291*** (-3.4095)	-0.0246* (-1.6475)	-0.0325** (-2.2961)
25/12/2010	+0.25	-0.0093** (-2.2794)	0.0038 (0.4383)	0.0239** (2.4390)	0.0240** (1.7958)
08/02/2011	+0.25	-0.0038 (-0.4772)	-0.0071 (-0.8730)	-0.0007 (-0.0774)	-0.0224* (-1.6546)
05/04/2011	+0.25	-0.0100* (-1.5275)	0.0105* (1.4482)	0.0125* (1.4518)	0.0178* (1.3650)
06/07/2011	+0.25	0.0101 (1.1751)	0.0426*** (2.4640)	0.0471*** (2.4428)	0.0660*** (3.3568)
07/06/2012	-0.25	0.0083 (1.2957)	0.0021 (0.2896)	0.0158** (1.7053)	0.0190** (1.7235)
05/07/2012	-0.31	-0.0082** (-1.9284)	-0.0204*** (-2.4912)	-0.0108 (-0.9637)	-0.0056 (-0.4907)
21/11/2014	-0.40	0.0050* (1.3084)	0.0008 (0.1402)	0.0001 (0.0191)	-0.0075 (-0.7961)
27/02/2015	-0.25	0.0048 (1.1877)	0.0231*** (3.5827)	0.0212*** (3.1970)	0.0278*** (3.1713)
08/05/2015	-0.25	-0.0005 (-0.1283)	0.0025 (0.3436)	-0.0125* (-1.4021)	0.0234** (2.2082)
27/06/2015	-0.25	-0.0373*** (-0.9701)	-0.0392*** (-6.2608)	-0.0576*** (-8.2143)	-0.0513*** (-6.3939)
25/08/2015	-0.25	0.0289*** (4.6765)	0.0211*** (2.6768)	-0.0494*** (-4.9321)	09.0130 (-1.2284)
23/10/2015	-0.25	0.0062* (1.3462)	0.0059 (0.7169)	0.0104 (0.8710)	0.0110 (0.9299)

Notes: t-statistics are shown in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table 2 Cumulative average abnormal return of Chinese firms listed on NYSE

Event data	Interest rate change	$CAAR(0,0)$	$CAAR(0,1)$	$CAAR(-1,1)$	$CAAR(-1,3)$
20/02/2002	-0.54	0.0121 (0.7541)	0.0027 (0.1829)	0.0031 (0.2036)	0.1823 (1.0877)
28/10/2004	+0.27	-0.0080 (-1.3015)	-0.0130** (-1.8065)	-0.0228*** (-2.9675)	-0.0399*** (-3.6278)
27/04/2006	+0.29	-0.0203*** (-4.6432)	-0.0163*** (-3.2631)	-0.0148*** (-3.3371)	0.0097 (1.0374)
18/08/2006	+0.27	0.0001 (0.0212)	0.0011 (0.2760)	-0.0036 (-0.7401)	-0.0098 (-1.3211)
17/032007	+0.29	0.0033 (1.0955)	-0.0052 (-0.7709)	0.0033 (0.3976)	0.0048 (0.6107)
18/05/2007	+0.18	-0.0177*** (-3.8432)	-0.0005 (-0.0514)	0.0124 (1.0789)	0.0186 (0.8536)
20/07/2007	+0.27	0.0052** (1.7590)	0.0190*** (3.1525)	0.0249*** (3.8514)	0.0174 (1.1055)
21/08/2007	+0.18	0.0057 (1.0594)	0.0436*** (4.2007)	0.0676*** (4.8290)	0.0908*** (4.7775)
14/09/2007	+0.27	0.0275*** (7.3760)	0.0290*** (4.5706)	0.0187*** (3.2431)	0.0429*** (3.1309)
20/12/2007	+0.18	0.0006 (0.1610)	0.0200*** (2.4226)	0.0360*** (3.5138)	0.0419*** (4.2061)
15/09/2008	-0.27	-0.0359*** (-4.0599)	-0.1136*** (-9.4121)	-0.1176*** (-7.8431)	-0.0328* (-1.4449)
08/10/2008	-0.27	-0.0080 (-1.2457)	-0.0852*** (-7.5177)	-0.1474*** (-12.7085)	-0.1540*** (-7.4185)
29/10/2008	-0.27	0.0026 (0.1887)	0.0650*** (4.1468)	0.1402*** (6.8013)	0.0182 (0.7076)
26/11/2008	-1.08	0.0762*** (8.1170)	0.0676*** (3.7188)	0.0390* (1.5840)	0.0778*** (2.7594)
22/12/2008	-0.27	-0.0388*** (-8.6003)	-0.0532*** (-6.0044)	-0.0223** (-1.8290)	-0.0214 (-1.1122)
19/10/2010	+0.25	-0.0241*** (-3.6125)	-0.0192** (-2.4244)	-0.0216** (-2.4781)	-0.0002 (-0.0191)
25/12/2010	+0.25	0.0171*** (6.0276)	0.0063** (1.9184)	0.0199*** (3.5739)	0.0161** (2.2033)
08/02/2011	+0.25	-0.0271*** (-3.1611)	-0.0419*** (-3.3422)	-0.0433*** (-2.9914)	-0.0634*** (-4.5029)
05/04/2011	+0.25	-0.0009 (-0.1203)	0.0080 (0.9361)	0.0151** (1.8091)	0.0372*** (3.8462)
06/07/2011	+0.25	0.0216** (1.9225)	0.0258* (1.6703)	0.0228* (1.3513)	0.0173* (1.4040)
07/06/2012	-0.25	0.0082** (2.3562)	0.0054 (0.9614)	0.0182*** (3.1517)	0.0175*** (2.5273)
05/07/2012	-0.31	0.0058* (1.4611)	0.0020 (0.4436)	0.0047 (0.7049)	0.0233*** (2.9117)
21/11/2014	-0.40	0.0150*** (2.4281)	0.0141** (1.8609)	0.0112* (1.6626)	0.0251*** (2.7870)
27/02/2015	-0.25	0.01252** (1.9525)	0.0280*** (3.3209)	0.0401*** (4.4392)	0.0436*** (4.0839)
08/05/2015	-0.25	0.0192*** (3.6442)	0.0180*** (2.6844)	0.0320*** (4.1613)	0.0279*** (2.9676)
27/06/2015	-0.25	-0.0372*** (-9.2339)	-0.0265*** (-4.0253)	-0.0652*** (-8.5087)	-0.0488*** (-6.0446)
25/08/2015	-0.25	0.0247*** (4.2822)	0.0194*** (2.8199)	-0.0511*** (-5.5106)	-0.0049 (-0.4416)
23/10/2015	-0.25	0.0111*** (2.8827)	0.0137** (1.9157)	0.0187*** (2.8305)	0.0109* (1.3859)

Notes: t-statistics are shown in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table 3 Overall effect of official interest rate change on Chinese concepts stocks

$$CAR_{j,k} = \gamma_0 + \gamma_1 \Delta i_k + \epsilon_{j,k}^{\tau_1,\tau_2}$$

Panel A: Nasdaq				
	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
γ_0	-0.0037**	0.0018	-0.0000	0.0014
	(0.0015)	(0.0023)	(0.0029)	(0.0036)
γ	-2.1395***	-1.4525*	-0.7168	-2.8506
	(0.4944)	(0.7439)	(0.9407)	(1.1166)
N	1017	1017	1017	1017
R^2	0.0181	0.0037	0.0006	0.0059

Panel B: NYSE				
	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
γ_0	0.0003	0.0008	-0.0000	0.0061*
	(0.0015)	(0.0022)	(0.0028)	(0.0030)
γ_1	-2.5812***	-1.3381*	0.4809	-0.9448
	(0.4798)	(0.6982)	(0.8864)	(0.9406)
N	711	711	711	711
R^2	0.0392	0.0052	0.0004	0.0014

Notes: Standard errors are shown in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table 4 Asymmetric analysis between official interest rates cut and rise

$$CAR_{j,k} = \delta_0 + \delta_1 \Delta i_k + \delta_2 \Delta i_k x_{Rise,k} ++ \delta_3 x_{Rise,k} + \lambda_{j,k}^{\tau_1,\tau_2}$$

Panel A: Nasdaq

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
δ_0	-0.0188***	-0.0244***	-0.0573***	-0.0823***
	(0.0039)	(0.0059)	(0.0073)	(0.0089)
δ_1	-6.4310***	-8.8820***	-17.0400***	-26.6700***
	(1.1470)	(1.7200)	(2.1260)	(2.5950)
δ_2	5.8650	-3.1100	6.6870	-5.8790
	(8.2930)	(12.440)	(15.370)	(18.760)
δ_3	0.0145	0.0581*	0.0940**	0.1760***
	(0.0207)	(0.0311)	(0.0384)	(0.0468)
$\delta_1 + \delta_2$	-0.5700	-12.0000	-10.3600	-20.8000*
	(0.0048)	(0.9477)	(0.4629)	(3.0688)
N	1017	1017	1017	1017
R^2	0.0237	0.0237	0.0650	0.1006

Panel B: NYSE

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
δ_0	-0.0219***	-0.0232***	-0.0243***	-0.0269***
	(0.0038)	(0.0056)	(0.0071)	(0.0075)
δ_1	-8.6820***	-7.8480***	-6.0060***	-9.8060***
	(1.0640)	(1.5640)	(1.9860)	(2.0930)
δ_2	11.8800*	-15.2700	-37.3300***	-39.8700***
	(6.9680)	(10.2400)	(13.0000)	(13.7000)
δ_3	0.0130	0.0833***	0.1380***	0.1610***
	(0.0175)	(0.0257)	(0.0326)	(0.0343)
$\delta_1 + \delta_2$	3.2000	-23.1200**	-43.3400***	-49.6800***
	(0.2161)	(5.2198)	(11.3725)	(13.4590)
N	711	711	711	711
R^2	0.0881	0.0374	0.0314	0.0463

Notes: Standard errors are shown in parentheses, except for the coefficient test of $\delta_1 + \delta_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table 5 Asymmetric analysis between bull and bear market regime

$$CAR_{j,k} = \mu_0 + \mu_1 \Delta i_k + \mu_2 \Delta i_k x_{Bear,k} + \mu_3 x_{Bear,k} + \theta_{j,k}^{\tau_1,\tau_2}$$

Panel A: Nasdaq

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
μ_0	-0.0040**	-0.0014	-0.0031	0.0025
	(0.0017)	(0.0025)	(0.0031)	(0.0039)
μ_1	-1.7070***	-0.2950	2.8980**	0.8970
	(0.6260)	(0.9340)	(1.1700)	(1.4650)
μ_2	-0.9710	-1.5530	-7.7710***	-9.8690***
	(1.0570)	(1.5770)	(1.9750)	(2.4730)
μ_3	0.0019	0.0213***	0.0212***	-0.0063
	(0.0043)	(0.0065)	(0.0081)	(0.0101)
$\mu_1 + \mu_2$	-2.6780***	-1.8480	-4.8730***	-8.9720***
	(9.8975)	(2.1153)	(9.3760)	(20.2700)
N	1017	1017	1017	1017
R^2	0.0212	0.0183	0.0371	0.0198

Panel B: NYSE

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
μ_0	0.0013	0.0038	0.0012	0.0097***
	(0.0017)	(0.0024)	(0.0031)	(0.0033)
μ_1	-2.0930***	-1.7570*	0.2630	-0.9110
	(0.6060)	(0.8780)	(1.1220)	(1.1850)
μ_2	-1.6340	-0.0448	0.0797	-1.4490
	(1.0240)	(1.4820)	(1.8940)	(2.0010)
μ_3	-0.0061	-0.0175***	-0.00749	-0.0215***
	(0.0041)	(0.0060)	(0.0077)	(0.0081)
$\mu_1 + \mu_2$	-3.7270***	-1.8018	0.3427	-2.3600
	(20.4092)	(2.2741)	(0.0505)	(2.1435)
N	711	711	711	711
R^2	0.0397	0.0151	0.0021	0.0073

Notes: Standard errors are shown in parentheses, except for the coefficient test of $\mu_1 + \mu_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table 6 Asymmetric analysis between the financial crisis and non-crisis period

$$CAR_{j,k} = \varphi_0 + \varphi_1 \Delta i_k + \varphi_2 \Delta i_k x_{Crisis,,k} + \varphi_3 x_{Crisis,,k} + \omega_{j,k}^{\tau_1,\tau_2}$$

Panel A: Nasdaq

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
φ_0	-0.0024	0.0022	0.0005	0.0073**
	(0.0016)	(0.0023)	(0.0029)	(0.0035)
φ_1	-1.4490**	0.7240	3.7160***	2.3090*
	(0.5830)	(0.8770)	(1.0880)	(1.2980)
φ_2	-6.6010***	-10.6200***	-20.7600***	-38.5800***
	(1.4390)	(2.164)	(2.684)	(3.204)
φ_3	-0.0334***	-0.0291***	-0.0528***	-0.169***
	(0.0072)	(0.0108)	(0.0134)	(0.0161)
$\varphi_1 + \varphi_2$	-8.0500***	-9.896***	-17.0440***	-36.2710***
	(37.4468)	(25.0311)	(48.2723)	(153.3294)
N	1017	1017	1017	1017
R^2	0.0286	0.0257	0.0622	0.1324

Panel B: NYSE

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
φ_0	0.0027*	0.0058***	0.0034	0.0113***
	(0.0015)	(0.0022)	(0.0029)	(0.0030)
φ_1	-1.604***	-1.1100	0.9400	-0.4380
	(0.5540)	(0.7960)	(1.0550)	(1.0980)
φ_2	-10.3300***	-13.2300***	-10.5700***	-14.9800***
	(1.3220)	(1.9000)	(2.5180)	(2.6210)
φ_3	-0.0554***	-0.0930***	-0.0684***	-0.1000***
	(0.0066)	(0.0095)	(0.0126)	(0.0131)
$\varphi_1 + \varphi_2$	-11.9340***	-14.3400***	-9.6300***	-15.4180***
	(98.9980)	(69.0601)	(17.7353)	(41.9609)
N	711	711	711	711
R^2	0.1298	0.1205	0.0366	0.0737

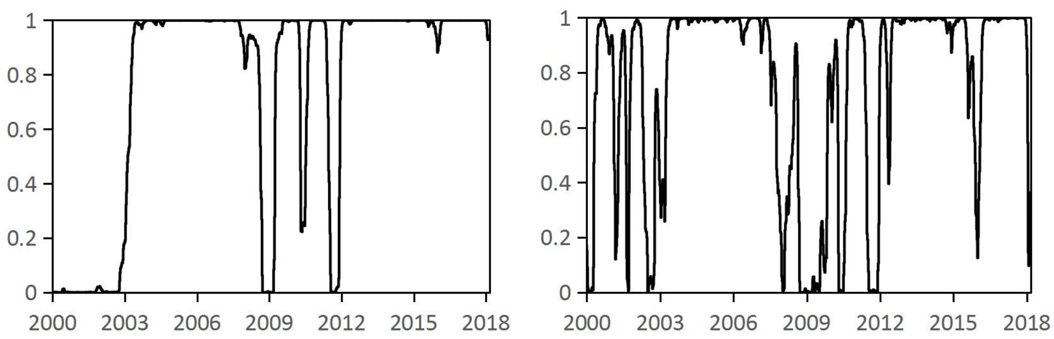
Notes: Standard errors are shown in parentheses, except for the coefficient test of $\varphi_1 + \varphi_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Appendix A Markov switching model

Using the returns on the stock price index from the beginning of January 2000 to the end of February 2018,[8] we estimate the probabilities of bull and bear markets by using a simple Markov switching model as follows:

$$R_t = \mu_{S_t} + \varepsilon_t \qquad \varepsilon_t \sim i.i.d.N\left(0,\sigma^2_{S_t}\right), \tag{A1}$$

where R_t is the weekly return on the Nasdaq or NYSE index, and S_t is an unobserved dummy variable that indicates bull or bear market. Therefore, μ_{S_t} and $\sigma^2_{S_t}$ are the state-dependent mean and variance of returns, respectively. The transition from one state to another is modeled as a Markov chain process that depends on probabilities of transition between the two regimes. The model statistically identifies a regime with a higher mean and lower variance of returns (bull market) and a regime with a lower mean and higher variance (bear market). The model parameters (e.g., means, variances, and transitional probabilities) are estimated jointly with maximum likelihood. After obtaining the parameter estimates, the conditional probabilities of bull and bear markets at each point in time are computed by using the data available at that time.[9] Fig. A1 shows the smoothed bull market probabilities for our sample period estimated by assuming fixed transitional probabilities.



(a) Smoothed probabilities of bull market for Nasdaq (b) Smoothed probabilities of bull market for NYSE

Fig A1. Smoothed probabilities of bull market from 2000M1 to 2018M3

[8] Similar Markov switching models are used in Chen (2009), Henry (2009), and Kurov (2010).

[9] See Hamilton (1994, pp. 685–688) for details on the parameter estimation and computation of regime probabilities.

Appendix B Robustness analysis

Table B1 Overall effect of official interest rate change on Chinese concepts stocks (with controls for macroeconomic indicator release)

$$CAR_{j,k} = \gamma_0 + \gamma_1 \Delta i_k + \gamma_2 x_{Macro,k} + \epsilon_{j,k}^{\tau_1,\tau_2}$$

	(a)	(b)	(c)	(d)
Panel A: Nasdaq				
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
γ_0	-0.0042	-0.0081**	-0.0203***	-0.0307***
	(0.0026)	(0.0039)	(0.0049)	(0.0060)
γ_1	-2.2094***	-2.8826	-3.6447***	-7.4906***
	(0.5804)	(0.8691)	(1.0903)	(1.3403)
γ_2	0.0008	-0.0161***	0.0329***	0.0522***
	(0.0034)	(0.0039)	(0.0064)	(0.0060)
N	1017	1017	1017	1017
R^2	0.0182	0.0134	0.0259	0.0470
Panel B: NYSE				
	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
γ_0	-0.0050**	0.0008	-0.0088**	-0.0044
	(0.0024)	(0.0036)	(0.0045)	(0.0048)
γ_1	-3.2978***	-1.3416*	-0.7051	-2.3729**
	(0.5422)	(0.7933)	(1.0026)	(1.0625)
γ_2	0.0092***	0.0004	0.0152**	0.0183***
	(0.0033)	(0.0048)	(0.0061)	(0.0065)
N	711	711	711	711
R^2	0.0497	0.0052	0.0092	0.0127

Notes: Standard errors are shown in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table B2 Asymmetric analysis between official interest rate cut and rise
(with controls for macroeconomic indicator release)

$$CAR_{j,k} = \delta_0 + \delta_1 \Delta i_k + \delta_2 \Delta i_k x_{Rise,k} + \delta_3 \Delta x_{Rise,k} + \delta_4 x_{Macro,k} + \lambda_{j,k}^{\tau_1,\tau_2}$$

Panel A: Nasdaq

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
δ_0	-0.0188***	-0.0334***	-0.0753***	-0.1110***
	(0.0044)	(0.0066)	(0.0080)	(0.0097)
δ_1	-6.4310***	-10.0500***	-19.3600***	-30.4400***
	(1.1750)	(1.7530)	(2.1500)	(2.5980)
δ_2	5.8640	-9.6640	-6.3250	-27.0400
	(8.4150)	(12.5600)	(15.4000)	(18.6100)
δ_3	0.0145	0.0726**	0.1230***	0.2230***
	(0.0209)	(0.0313)	(0.0383)	(0.0463)
δ_4	0.0000	0.0161***	0.0319***	0.0519***
	(0.0034)	(0.00514)	(0.0063)	(0.0076)
$\delta_1 + \delta_2$	-0.5670	-19.7140	-25.6850*	-57.4800***
	(0.0046)	(2.4829)	(2.8038)	(9.6103)
N	1017	1017	1017	1017
R^2	0.0321	0.0321	0.0908	0.1367

Panel B: NYSE

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
δ_0	-0.0266***	-0.0238***	-0.0342***	-0.0386***
	(0.0042)	(0.0062)	(0.0078)	(0.0082)
δ_1	-9.2730***	-7.9180***	-7.25800***	-11.2900***
	(1.0840)	(1.6000)	(2.0200)	(2.1240)
δ_2	9.2100	-15.5800	-43.0000***	-46.5700***
	(7.0130)	(10.3500)	(13.0700)	(13.7500)
δ_3	0.0191	0.0840***	0.1510***	0.1760***
	(0.0175)	(0.0259)	(0.0327)	(0.0344)
δ_4	0.0085***	0.0010	0.0180***	0.0213***
	(0.0032)	(0.0048)	(0.0061)	(0.0064)
$\delta_1 + \delta_2$	-0.0638	-23.4980**	-50.2580***	-57.8600***
	(0.0001)	(5.2160)	(14.9688)	(17.9368)
N	711	711	711	711
R^2	0.0957	0.0361	0.0421	0.0599

Notes: Standard errors are shown in parentheses, except for the coefficient test of $\delta_1 + \delta_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table B3 Asymmetric analysis between bull and bear market regime
(with controls for macroeconomic indicator release)

$$CAR_{j,k} = \mu_0 + \mu_1 \Delta i_k + \mu_2 \Delta i_k x_{Bear,k} + \mu_3 x_{Bear,k} + \mu_4 x_{Macro,k} + \theta_{j,k}^{\tau_1,\tau_2}$$

Panel A: Nasdaq

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
μ_0	-0.0044	-0.0107***	-0.0222***	-0.0287***
	(0.0027)	(0.0040)	(0.0050)	(0.0062)
μ_1	-1.7610**	-1.7280*	-0.0217	-3.8690**
	(0.7030)	(1.0450)	(1.2990)	(1.6130)
μ_2	-0.9650	-1.3830	-7.4240***	-9.3020***
	(1.0580)	(1.5720)	(1.9540)	(2.4260)
μ_3	0.0019	0.0211***	0.0207***	-0.0071
	(0.0043)	(0.0064)	(0.0080)	(0.0099)
μ_4	0.0006	0.0153***	0.0312***	0.0509***
	(0.0034)	(0.0051)	(0.0063)	(0.0078)
$\mu_1 + \mu_2$	-2.7260***	-3.1110**	-7.4457***	-13.1710***
	(9.2295)	(5.4428)	(20.1789)	(40.9598)
N	1017	1017	1017	1017
R^2	0.0261	0.0261	0.0560	0.0579

Panel B: NYSE

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
μ_0	-0.0038	0.0044	-0.00779	-0.000446
	(0.0026)	(0.0038)	(0.0048)	(0.0051)
μ_1	-2.8500***	-1.6650*	-1.0760	-2.4180*
	(0.6720)	(0.9780)	(1.2440)	(1.3140)
μ_2	-1.3220	-0.0823	0.6310	-0.8290
	(1.0270)	(1.4940)	(1.9010)	(2.0070)
μ_3	-0.0049	-0.0177***	-0.0054	-0.0191**
	(0.0042)	(0.0060)	(0.0077)	(0.0081)
μ_4	0.0085**	-0.0010	0.0151**	0.0170***
	(0.0033)	(0.0048)	(0.0062)	(0.0065)
$\mu_1 + \mu_2$	-4.1720***	-1.7473	-0.4450	-3.2470**
	(24.6812)	(2.0465)	(0.0818)	(3.9126)
N	711	711	711	711
R^2	0.0472	0.0138	0.0049	0.0154

Notes: Standard errors are shown in parentheses, except for the coefficient test of $\mu_1 + \mu_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table B4 Asymmetric analysis between the financial crisis and non-crisis period (with controls for macroeconomic indicator release)

$$CAR_{j,k} = \varphi_0 + \varphi_1 \Delta i_k + \varphi_2 \Delta i_k x_{Crisis,,k} + \varphi_3 x_{Crisis,,k} + \varphi_4 x_{Macro,k} + \omega_{j,k}^{\tau_1,\tau_2}$$

Panel A: Nasdaq

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
φ_0	-0.0013	-0.0058	-0.0160***	-0.0169***
	(0.0027)	(0.0040)	(0.0049)	(0.0058)
φ_1	-1.2730*	-0.5240	1.1190	-1.5010
	(0.6730)	(1.0100)	(1.2450)	(1.4800)
φ_2	-6.7180***	-9.7840***	-19.0200***	-36.0300***
	(1.4570)	(2.1840)	(2.6950)	(3.2030)
φ_3	-0.0338***	-0.0256**	-0.0456***	-0.1580***
	(0.0073)	(0.0109)	(0.0135)	(0.0160)
φ_4	-0.0018	0.0127**	0.0264***	0.0387***
	(0.0034)	(0.0051)	(0.0063)	(0.0075)
$\varphi_1 + \varphi_2$	-7.9910***	-10.3080***	-17.9010***	-37.5310***
	(36.6209)	(27.1051)	(53.7317)	(167.1087)
N	1017	1017	1017	1017
R^2	0.0306	0.0306	0.0744	0.1537

Panel B: NYSE

	(a)	(b)	(c)	(d)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
φ_0	-0.0007	0.0085**	-0.0035	0.0035
	(0.0024)	(0.0034)	(0.0045)	(0.0047)
φ_1	-2.1120***	-0.7100	-0.0692	-1.5820
	(0.6160)	(0.8870)	(1.1730)	(1.2200)
φ_2	-10.020***	-13.4700***	-9.9530***	-14.2800***
	(1.3290)	(1.9150)	(2.5330)	(2.6350)
φ_3	-0.0541***	-0.0940***	-0.0657***	-0.0970***
	(0.0066)	(0.0095)	(0.0126)	(0.0131)
φ_4	0.0060*	-0.0047	0.0118*	0.0134**
	(0.0032)	(0.0046)	(0.0060)	(0.0063)
$\varphi_1 + \varphi_2$	-12.1320***	-14.1800***	-10.0222***	-15.8620***
	(101.8883)	(67.0444)	(19.1432)	(44.3027)
N	711	711	711	711
R^2	0.1329	0.1205	0.0404	0.0783

Notes: Standard errors are shown in parentheses, except for the coefficient test of $\varphi_1 + \varphi_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table B5 Overall effect of official interest rate change on Chinese concepts stocks (with controls for industries and macroeconomic indicator release)

$CAR_{j,k} = \gamma_0 + \gamma_1 \Delta i_k + \gamma_2 x_{Macro,k} + \sum d_m Ind_{m,j} + \epsilon_{j,k}^{\tau_1,\tau_2}$								
	Nasdaq				NYSE			
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
γ_0	-0.0309*	-0.0194	-0.0470	-0.0664*	-0.0060	-0.0019	-0.0105	-0.0170
	(0.0166)	(0.0249)	(0.0312)	(0.0384)	(0.0064)	(0.0093)	(0.0117)	(0.0125)
γ_1	-2.2620***	-2.8943***	-3.7665***	-7.5746***	-3.2350***	-0.9937	-0.7887	-2.3920**
	(0.5823)	(0.8732)	(1.0946)	(1.3464)	(0.5550)	(0.8087)	(1.0224)	(1.0841)
γ_2	0.0009	0.0161***	0.0332***	0.0523***	0.0092***	-0.0007	0.0154**	0.0184***
	(0.0034)	(0.0051)	(0.0064)	(0.0079)	(0.0033)	(0.0048)	(0.0061)	(0.0065)
d_1	0.0194	-0.0045	0.0096	0.0190	0.0015	-0.0010	0.0024	0.0116
	(0.0190)	(0.0284)	(0.0357)	(0.0439)	(0.0071)	(0.0103)	(0.0131)	(0.0139)
d_2	0.0325*	0.0088	0.0189	0.0286	-0.0049	0.0014	0.0046	0.0223
	(0.0173)	(0.0259)	(0.0325)	(0.0399)	(0.0088)	(0.0127)	(0.0161)	(0.0171)
d_3	0.0282*	0.0081	0.0263	0.0329	-0.0004	0.0004	0.0030	0.0178
	(0.0168)	(0.025)	(0.0317)	(0.0390)	(0.0069)	(0.0101)	(0.0128)	(0.0135)
d_4	0.0257	0.0141	0.0250	0.0404	0.0032	0.0125	-0.0027	0.0098
	(0.0168)	(0.025)	(0.0315)	(0.0387)	(0.0073)	(0.0107)	(0.0135)	(0.0143)
d_5	0.0200	0.0056	0.0156	0.0224	0.0212	0.0465**	0.0627**	0.0607**
	(0.0176)	(0.0264)	(0.0331)	(0.0407)	(0.0143)	(0.0209)	(0.0264)	(0.0280)
d_6	0.0249	0.0130	0.0209	0.0302	-0.0038	0.0088	0.0004	0.0134
	(0.0175)	(0.0262)	(0.0329)	(0.0404)	(0.0103)	(0.0150)	(0.0189)	(0.0201)
d_7	0.0364*	0.0286	0.0423	0.0552	0.0043	0.0126	0.0160	0.0302*
	(0.0197)	(0.0296)	(0.0371)	(0.0456)	(0.0090)	(0.0131)	(0.0166)	(0.0176)
d_8	0.0268	0.0125	0.0315	0.0387	0.0006	0.0032	-0.0063	0.0064
	(0.0166)	(0.0249)	(0.0312)	(0.0384)	(0.0071)	(0.0103)	(0.0130)	(0.0138)
d_9					0.0016	-0.0013	-0.0006	0.0068
					(0.0074)	(0.0108)	(0.0137)	(0.0145)
d_{10}					0.0038	-0.0016	0.0041	0.0090
					(0.0095)	(0.0139)	(0.0175)	(0.0186)
N	1017	1017	1017	1017	711	711	711	711
R^2	0.0246	0.0171	0.0310	0.0510	0.0559	0.0199	0.0231	0.0257

Notes: Standard errors are shown in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table B6 Asymmetric analysis between official interest rate cut and rise
(with controls for industries and macroeconomic indicator release)

$CAR_{j,k} = \delta_0 + \delta_1 \Delta i_k + \delta_2 \Delta i_k x_{Rise,k} + \delta_3 x_{Rise,k} + \delta_4 x_{Macro,k} + \sum d_m Ind_{m,j} + \lambda_{j,k}^{\tau_1,\tau_2}$								
	Nasdaq				NYSE			
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
δ_0	-0.0420**	-0.0393	-0.0895***	-0.130***	-0.0322***	-0.0322***	-0.0374***	-0.0542***
	(0.0167)	(0.0250)	(0.0306)	(0.0370)	(0.0106)	(0.0106)	(0.0134)	(0.0141)
δ_1	-6.4000***	-10.1100***	-19.3200***	-30.5600***	-9.5950***	-8.6920***	-7.4030***	-11.6200***
	(1.1780)	(1.7610)	(2.1590)	(2.6090)	(1.0940)	(1.6050)	(2.0390)	(2.1430)
δ_2	5.5480	-9.6900	-6.5020	-27.2500	9.5970	-14.6900	-42.7500***	-45.9900***
	(8.426)	(12.59)	(15.44)	(18.65)	(7.0180)	(10.2900)	(13.0700)	(13.7400)
δ_3	0.0148	0.0731**	0.123***	0.224***	0.0222	0.0913***	0.1520***	0.1790***
	(0.0210)	(0.0313)	(0.0384)	(0.0464)	(0.0176)	(0.0258)	(0.0328)	(0.0345)
δ_4	0.0001	0.0160***	0.0320***	0.0517***	0.0081**	-0.0003	0.0178***	0.0207***
	(0.0035)	(0.0052)	(0.0063)	(0.0076)	(0.0033)	(0.0048)	(0.0061)	(0.0064)
d_1	0.01720	-0.0081	0.0017	0.0074	0.0002	-0.0026	0.0009	0.0096
	(0.0188)	(0.0281)	(0.0345)	(0.0417)	(0.0069)	(0.0101)	(0.0128)	(0.0135)
d_2	0.0293*	0.0033	0.0071	0.0111	-0.0044	0.0019	0.0051	0.0230
	(0.0172)	(0.0256)	(0.0314)	(0.0380)	(0.00849)	(0.0125)	(0.0158)	(0.0166)
d_3	0.0249	0.00237	0.0139	0.0145	-0.00148	-0.0011	0.0016	0.0159
	(0.0167)	(0.0250)	(0.0307)	(0.0371)	(0.0067)	(0.0099)	(0.0125)	(0.0132)
d_4	0.0232	0.0097	0.0157	0.0265	0.0079	0.0183*	0.00230	0.0168
	(0.0166)	(0.0249)	(0.0305)	(0.0368)	(0.0072)	(0.0105)	(0.0133)	(0.0140)
d_5	0.0174	0.0006	0.0052	0.0067	0.0272*	0.0538***	0.0692***	0.0696**
	(0.0175)	(0.0261)	(0.0320)	(0.0387)	(0.0139)	(0.0204)	(0.0260)	(0.0273)
d_6	0.0223	0.00831	0.0108	0.01510	0.000197	0.0138	0.00496	0.0196
	(0.0174)	(0.0260)	(0.0318)	(0.0385)	(0.0100)	(0.0147)	(0.0186)	(0.0196)
d_7	0.0349*	0.0261	0.0369	0.0472	0.00552	0.0137	0.0166	0.0312*
	(0.0196)	(0.0293)	(0.0359)	(0.0434)	(0.0088)	(0.0128)	(0.0163)	(0.0171)
d_8	0.0231	0.00587	0.0173	0.0176	0.00523	0.0088	-0.0014	0.0132
	(0.0165)	(0.0246)	(0.0302)	(0.0365)	(0.0069)	(0.0101)	(0.0128)	(0.0135)
d_9					0.0005	-0.0027	-0.00197	0.00494
					(0.0072)	(0.0106)	(0.0134)	(0.0141)
d_{10}					0.00261	-0.0032	0.0027	0.0070
					(0.0093)	(0.0136)	(0.0172)	(0.0181)
$\delta_1 + \delta_2$	-0.8520	-19.8000	-25.8220	-57.8100***	0.0020	-23.3820	-50.1530***	-57.6100***
	(0.0103)	(2.4929)	(2.8194)	(9.6848)	(0.0000)	(5.2313)	(14.9134)	(17.8042)
N	1017	1017	1017	1017	711	711	711	711
R^2	0.0287	0.0284	0.0835	0.1338	0.0951	0.0483	0.0426	0.0614

Notes: Standard errors are shown in parentheses, except for the coefficient test of $\delta_1 + \delta_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table B7 Asymmetric analysis between bull and bear market regime
(with controls for industries and macroeconomic indicator release)

$$CAR_{j,k} = \mu_0 + \mu_1 \Delta i_k + \mu_2 \Delta i_k x_{Bear,k} + \mu_3 x_{Bear,k} + \mu_4 x_{Macro,k} + \sum d_m Ind_{m,j} + \theta_{j,k}^{\tau_1,\tau_2}$$

	Nasdaq				NYSE			
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
μ_0	-0.0297*	-0.0157	-0.0362	-0.0557	-0.0049	0.0017	-0.0092	-0.0127
	(0.0167)	(0.0248)	(0.0308)	(0.0382)	(0.0064)	(0.0093)	(0.0119)	(0.0125)
μ_1	-1.8640***	-1.6760	-0.1350	-3.9140**	-2.6880***	-1.1270	-1.3420	-2.6540*
	(0.7120)	(1.0600)	(1.3180)	(1.6360)	(0.7120)	(1.0330)	(1.3130)	(1.3870)
μ_2	-0.8330	-1.4460	0.0312***	-9.2490***	-1.5020	-0.7170	0.8270	-0.6340
	(1.0700)	(1.5930)	(0.0063)	(2.4580)	(1.0620)	(1.5410)	(1.9580)	(2.0680)
μ_3	0.0018	0.0214***	0.0034	-0.0068	-0.0048	-0.0171***	-0.0068	-0.0205**
	(0.0043)	(0.0065)	(0.0351)	(0.0100)	(0.0042)	(0.0061)	(0.0077)	(0.0082)
μ_4	0.0007	0.0152***	0.00601	0.0508***	0.0084**	-0.0017	0.0154**	0.0172***
	(0.0034)	(0.0051)	(0.0320)	(0.0079)	(0.0034)	(0.0049)	(0.0062)	(0.0065)
d_1	0.0188	-0.00792	0.0142	0.0154	0.0013	-0.0002	0.0030	0.0125
	(0.0190)	(0.0282)	(0.0312)	(0.0436)	(0.0071)	(0.0103)	(0.0131)	(0.0138)
d_2	0.0311*	0.00213	0.0155	0.0200	-0.0048	0.0016	0.0047	0.0226
	(0.0173)	(0.0258)	(0.0310)	(0.0398)	(0.0088)	(0.0127)	(0.0161)	(0.0170)
d_3	0.0270	0.00223	0.00546	0.0242	-0.0006	0.0013	0.0037	0.0190
	(0.0169)	(0.0251)	(0.0326)	(0.0388)	(0.0069)	(0.0101)	(0.0128)	(0.0135)
d_4	0.0247	0.00919	0.0108	0.0340	0.0036	0.0107	-0.0042	0.0075
	(0.0168)	(0.0250)	(0.0324)	(0.0385)	(0.0074)	(0.0107)	(0.0136)	(0.0143)
d_5	0.0190	0.0000	0.0369	0.0163	0.0226	0.0452**	0.0608**	0.0589**
	(0.0176)	(0.0262)	(0.0365)	(0.0405)	(0.0144)	(0.0209)	(0.0265)	(0.0280)
d_6	0.0239	0.00771	0.0160	0.0237	-0.0030	0.0074	-0.0012	0.0114
	(0.0175)	(0.0261)	(0.0308)	(0.0402)	(0.0103)	(0.0150)	(0.0190)	(0.0201)
d_7	0.0358*	0.0259	-7.2680***	0.0515	0.0044	0.0125	0.0160	0.0302*
	(0.0197)	(0.0294)	(1.980)	(0.0453)	(0.0090)	(0.0131)	(0.0166)	(0.0175)
d_8	0.0252	0.00483	0.0208***	0.0279	0.0010	0.0013	-0.0079	0.0040
	(0.0167)	(0.0248)	(0.0080)	(0.0382)	(0.0071)	(0.0103)	(0.0131)	(0.0138)
d_9					0.0014	-0.0005	0.0001	0.0078
					(0.0074)	(0.0108)	(0.0137)	(0.0145)
d_{10}					0.0037	-0.0009	0.0048	0.0099
					(0.0095)	(0.0138)	(0.0176)	(0.0186)
$\mu_1 + \mu_2$	-2.6970***	-3.1220	-0.1038***	-13.1630***	-4.1900***	-1.8440	-0.5150	-3.2880
	(8.9818)	(5.4379)	(19.7776)	(40.5744)	(23.6417)	(2.2674)	(0.1093)	(4.0027)
N	1017	1017	1017	1017	711	711	711	711
R^2	0.0142	0.0222	0.0517	0.0539	0.0402	0.0119	0.0055	0.0157

Notes: Standard errors are shown in parentheses, except for the coefficient test of $\mu_1 + \mu_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

Table B8 Asymmetric analysis between the financial crisis and non-crisis period
(with controls for industries and macroeconomic indicator release)

$$CAR_{j,k} = \varphi_0 + \varphi_1 \Delta i_k + \varphi_2 \Delta i_k x_{Crisis,k} + \varphi_3 x_{Crisis,k} + \varphi_4 x_{Macro,k} + \sum d_m Ind_{m,j} + \omega_{j,k}^{\tau_1,\tau_2}$$

	Nasdaq				NYSE			
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$	$CAR(0,0)$	$CAR(0,1)$	$CAR(-1,1)$	$CAR(-1,3)$
φ_0	-0.0275*	-0.0115	-0.0314	-0.0449	-0.0022	0.0050	-0.0054	-0.0096
	(0.0165)	(0.0247)	(0.0305)	(0.0362)	(0.0061)	(0.0088)	(0.0116)	(0.0120)
φ_1	-1.3830**	-0.4950	0.9840	-1.6270	-1.9830***	-0.2560	-0.4110	-1.9140
	(0.6800)	(1.0200)	(1.2590)	(1.4960)	(0.6530)	(0.9380)	(1.2390)	(1.2890)
φ_2	-6.6120***	-9.8120***	-18.9000***	-35.9100***	-10.1600***	-13.9200***	-9.5980***	-13.9400***
	(1.4600)	(2.1920)	(2.7050)	(3.2130)	(1.3510)	(1.9400)	(2.5630)	(2.6670)
φ_3	-0.0343***	-0.0255**	-0.0462***	-0.1590***	-0.0540***	-0.0930***	-0.0667***	-0.0982***
	(0.0073)	(0.0110)	(0.0135)	(0.0161)	(0.0067)	(0.0096)	(0.0127)	(0.0132)
φ_4	-0.0017	0.0126**	0.02650***	0.0388***	0.0059*	-0.0052	0.0123**	0.0138**
	(0.0034)	(0.0051)	(0.0064)	(0.0075)	(0.0032)	(0.0046)	(0.0061)	(0.0063)
d_1	0.0184	-0.0080	0.0027	0.0113	0.0018	0.0007	0.0036	0.0135
	(0.0188)	(0.0282)	(0.0348)	(0.0413)	(0.0068)	(0.0097)	(0.0128)	(0.0134)
d_2	0.0322*	0.00343	0.00807	0.0220	-0.0048	0.0017	0.0049	0.0227
	(0.0171)	(0.0257)	(0.0317)	(0.0377)	(0.0083)	(0.0120)	(0.0158)	(0.0165)
d_3	0.0275*	0.00250	0.0149	0.0240	0.0001	0.0023	0.0046	0.0201
	(0.0167)	(0.0251)	(0.0309)	(0.0367)	(0.0066)	(0.0095)	(0.0125)	(0.0131)
d_4	0.0251	0.00950	0.0158	0.0333	0.0041	0.0115	-0.0037	0.0082
	(0.0166)	(0.0249)	(0.0307)	(0.0365)	(0.0070)	(0.0101)	(0.0133)	(0.0139)
d_5	0.0196	0.0009	0.0062	0.0158	0.0217	0.0433**	0.0600**	0.0564**
	(0.0174)	(0.0262)	(0.0323)	(0.0384)	(0.0137)	(0.0197)	(0.0260)	(0.0271)
d_6	0.0243	0.00824	0.0112	0.0228	-0.0041	0.0054	-0.0023	0.00912
	(0.0173)	(0.0260)	(0.0321)	(0.0381)	(0.0098)	(0.0141)	(0.0187)	(0.0194)
d_7	0.0355*	0.0255	0.0362	0.0485	0.0050	0.0135	0.0167	0.0312*
	(0.0195)	(0.0293)	(0.0362)	(0.0430)	(0.0086)	(0.0123)	(0.0163)	(0.0170)
d_8	0.0266	0.00602	0.0183	0.0309	0.0012	0.0016	-0.0077	0.0042
	(0.0165)	(0.0247)	(0.0305)	(0.0362)	(0.0068)	(0.0097)	(0.0129)	(0.0134)
d_9					0.0019	0.0004	0.0008	0.0089
					(0.0071)	(0.0102)	(0.0134)	(0.0140)
d_{10}					0.00420	0.0000	0.0055	0.0110
					(0.0091)	(0.0131)	(0.0172)	(0.0179)
$\varphi_1 + \varphi_2$	-7.9950***	-10.3070***	-17.9160***	-37.5370***	-12.1430***	-14.1760***	-10.0090***	-15.8540***
	(36.6129)	(26.9893)	(53.5846)	(166.5986)	(101.2633)	(66.9183)	(19.1163)	(44.2864)
N	1017	1017	1017	1017	711	711	711	711
R^2	0.0366	0.0267	0.0704	0.1507	0.1272	0.1194	0.0416	0.0794

Notes: Standard errors are shown in parentheses, except for the coefficient test of $\varphi_1 + \varphi_2$ which report F-statistics in parentheses. *, ** and *** represent significance at the 1%, 5% and 10% level, respectively.

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