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Effectiveness, cause and impact of price limit—Evidence from China's cross-listed stocks

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ABSTRACT

This paper examines the effectiveness, cause and impact of price limits by comparing cross-listed Chinese stocks in China (A shares), Hong Kong (H shares) and New York (N shares). Price limit is found to have some effectiveness in preventing price continuation, but is ineffective in that the findings confirm volatility spillover and trading interference hypotheses from Kim and Rhee (1997). International news and corporate level news are both found to have significant impact on the abnormal returns of the A shares during or after the price limit hits, especially for upper limit hits.

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1. Introduction

Daily price limit is often used in emerging stock markets to prevent stock prices from rising or falling too fast or too much. It usually sets a price range, within which daily prices can fluctuate, based on a certain percentage of previous day's closing prices or other specified prices. In June 2012, the SEC approved a similar proposal put forward by national stock exchanges and Financial Industry Regulatory Authority (FINRA) after the "Flash Crash" on May 6, 2010 to introduce the "limit up-limit down" mechanism to curb excessive volatility in individual securities and overall stock market index.[1] The purpose of using price limit mechanism is to serve as a circuit breaker. When new information arrives, irrational investors cannot digest information quickly enough and tend to herd after others, which will cause stock prices to overshoot. Advocates of price limit argue that price limit can moderate stock price volatility and correct overreaction in the market as investors reevaluate new information during the cooling-off period. Usually you will see price reversals, lower volatility, or thinner trading volume after price limit hits. On the other hand, critics argue that price limit mechanism cannot effectively stop the order flow after the limit hits and find evidence that price limit only delays price discovery process, causes volatility spillover, and affects liquidity of stocks in the days following price limit hits.

This paper examines China's price limit mechanism from a unique perspective, using cross-listed stocks on the Shanghai/Shenzhen Stock Exchange in China (A-share) and the Hong Kong Stock Exchange (H-share). We also include the New York Stock Exchange (N-share) in our study for comparison purpose although most results are reported using A shares and H shares due to space limitation.[2] Cross-listed stocks are shares from the same company but listed on different stock exchanges. They have the same fundamentals such as cash flows, earnings, etc., from the company. These cross-listed stocks are also from large companies that typically have less information asymmetry compared to smaller companies. Therefore, if markets are efficient, when information is released from one market, it will quickly spread to other markets and prices in these markets will respond accordingly. However, this does not always happen for Chinese cross-listed stocks. One big difference between these markets is the price limit imposed. In China's A share markets, all stocks are subject to 10% daily price limit since 1996, which means stock prices cannot increase or decrease more than 10% of previous day's closing price. Once the limit is hit, only transactions at the upper limit or lower limit will be executed. On the other hand, N share and H share markets do not have any price limits. This poses an interesting situation where we can compare the performance of the same company's stocks listed on different stock exchanges. No prior research has used cross-listed stocks to study price limit mechanism.

The literature on cross-listed stocks has either focused on whether the Law of One Price holds for cross-listed stocks (see Kato et al., 1990; Park and Tavokkol, 1994, etc.) or tried to explain why returns are different for cross-listed stocks in different markets, after controlling for factors such as exchange rates, time-zone difference, regulations, locations, etc. (see Werner and Kleidon, 1996; Grammig et al., 2005; Gagnon and Karolyi, 2010). For China's cross-listed stocks, the focus was on price premium of A shares over B shares[3] in early studies (see Chakravarty et al., 1998; Chen et al., 2000). Only recently researchers have examined the directions of information flow and volatility spillover of A share and H share or A share and N share (see Chen et al., 2010; Chelley-Steeley and Steeley, 2012). The general findings that A shares are more affected by local information while H shares and N shares are affected both by information from A shares and information from global markets help explain the direction

[1] On May 6, 2010, Dow Jones Industrial Average fell more than 600 points in 5 min, for an almost 1000-point loss on the day, only to recover most of the drop 20 min later. The limit up-limit down mechanism will be effective in February 2013 as a one-year pilot program. It sets a price band of a certain percentage above or below the average price of the security in the previous 5-min period. If the price goes outside of the band, then trading can only occur within the band; if no trading occurs within 15 s, there will be a 5-min trading pause.

[2] Results for A shares and N shares cross-listed stocks are similar with those of A shares and H shares and are available upon request.

[3] B shares are listed on China's stock exchanges, available only to foreign investors before 2001 and denominated in U.S. dollars, but opened up to domestic investors since 2001.

of information flow. The objective of this paper is not on return differentials of different shares, but rather focuses on how market behaviors might be different from a market that has a 10% price limit while the other does not. The three markets have many differences such as regulations and accounting standards, etc. (see Section 2 for more details). However, the price limit mechanism has been one big difference that has not changed over time, while other differences have become smaller over time. Therefore, using cross-listed stocks to study the effectiveness of price limit mechanism is an innovative approach even with limitations.

On the other hand, the approaches from existing literature on the price limit mechanisms are also not without debate. The difficulty with testing effectiveness of price limits lies in isolating the effect of price limits to find what would have happened if no limit had existed. One strand of research focuses on overreaction hypothesis and examines the price reversals using abnormal returns from event study. The findings often point to the direction of supporting price limit mechanism (Huang (1998) and Huang et al. (2001) in the Taiwan Stock Exchange; Karan et al. (2003) in the Istanbul Stock Exchange; Diacogiannis et al. (2005) in the Athens Stock Exchange). Kim and Rhee (1997) use a different approach. Their paper compares behavior of stocks that reach a price limit to that of stocks with prices reaching above 90% of their daily limit but still below the limit and to stocks with prices reaching between 80% and 90% of their daily limit on Tokyo Stock Exchange. They find volatility spillover, delayed price discovery and increased trading for the target group after the price limit hits compared to the control groups, therefore concluding the ineffectiveness of price limit mechanism. Following the same approach, Bildik and Gulay (2006) find generally consistent results in Turkey's Istanbul Stock Exchange and Henke and Voronkova (2005) in Warsaw Stock Exchange. Two studies on China's price limit mechanism, Chen et al. (2005b) and Kim et al. (2011), both find some evidence of volatility reduction of price limit mechanism for A shares in China. The main limitation for these two papers on China is that they both compare measures from different sub-periods within the whole sample and the difference from the sub-periods could be simply due to different economic environments in China. In our paper we test the three hypotheses in Kim and Rhee (1997) using daily data of cross-listed stocks and examine the shares of the same company stocks across different markets when price limits are hit in the A share market.

Some recent research has used intraday transaction data to study the effectiveness of price limit, such as Kim and Yang (2008), Lee and Chou (2004), Sovan Deb et al. (2013). With intra-day data, these studies are able to test the effect from different types of price limit hits. For example, Kim and Yang (2008) concludes only consecutive limit hits can possibly counter investor overreaction by reducing volatility while a closing limit hit and a single limit hit cannot. Sovan Deb et al. (2013) even provide a flexible price limit scheme based on the probability of volatility spillover and limit hits on consecutive days. Others have examined the magnet effect and find that stock prices tend to approach the limits at a faster rate with larger price variation and trading volume when price limit hits are imminent (Cho et al., 2003; Du et al., 2005; Wong et al., 2009a,b; Hsieh et al., 2009). In our paper, however, since we are unable to obtain intra-day data for those cross-listed stocks, we focus on the effectiveness of price limits, the cause and the impact of price limits in China's stock market, not the microstructure of stock market around price limit hits. Therefore, daily stock returns would be sufficient to support our arguments. In addition, we distinguish two types of limit hits: single day hits and consecutive day hits. When price limit is reached for two days or above, the impact will go beyond the first day of the price limit hit and complicate the comparisons. Therefore we exclude consecutive day hits in our main results and the consecutive day hits results are separately reported as a robustness test.

Thirdly, as investors are more likely to be concerned about the market downside risk and open to upside potential, the question is whether upper limit is necessary (Lee and Chou, 2004) and whether the lower limit does provide protection for investors who do not have short selling option to protect themselves from the downside risk (Wong et al., 2009a). The upper limits and lower limits are separately examined to see whether they have different impacts on returns, volatility and trading volume. As China's stock market is relatively new and investors are less experienced, it is often considered more irrational compared to the developed markets such as HKSE and NYSE dominated by institutional investors (Chen et al., 2007; Wang and Chin, 2004). It would be interesting to see the possible asymmetric impact.

Lastly, besides using a different approach, this paper investigates the underlying factors that cause the price limit hits, and how these factors affect abnormal stock returns after price limits hits. Among several papers that have investigated the causes of price limits hits, Kim and Limpaphayom (2000) find volatile stocks, actively traded stocks, and small market capitalization stocks hit price limits more often than other stocks; Chen et al. (2005a) add liquidity as another factor that causes stocks to hit price limits more often. Chen et al. (2005b) also confirm that those factors are correlated with price limit hits in China's A-share stock market, and this relationship is more significant under bearish market.

However, besides firms' own characteristics, which do not change much frequently, the information that investors process on daily basis is also likely to contribute to the price limit hits. One of the hypotheses proposed by Phylaktis et al. (1999) is that investors tend to overreact to the new information and that drives the share price to reach the limit. Chen (1998) also tests if traders overreact to big news under price limits on futures market. Huang et al. (2001) confirm that investors overreact to the new information and the price limit is functional to delay the overreaction. To find out what kinds of new information cause investors to overreact and lead to price limit hits, Seasholes and Wu (2007) argue that high returns, high volumes, and news coverage are the factors for upper price limit hits. Among those three factors, returns and trading volumes have been studied extensively in existing price limit research. Therefore, it would be interesting to investigate how news information causes price limit hits and what is its impact on stock abnormal returns during price limit hit events. The news effect, to our knowledge, has not been studied before. This paper uses a hand collected news dataset to study how investors' behavior around price limit hits is affected by news coverage.

There are several main findings in this paper. First, this study agrees partially with Kim and Rhee (1997) in that volatility tends to spill over to the day following the price limit hits and trading volume continues to be significantly higher several days after the upper limit hits. Second, delayed price discovery is not found in China's market either in upper limit hits or lower limit hits, different from Chen et al. (2005b) and Wong et al. (2009a), two prior studies on China that find delayed price discovery only in upper limit hits. This may possibly be due to the fact that consecutive limit hits are not excluded from these two studies and different methodologies. Third, asymmetry is, however, found in trading interference between the upper limit and lower limit hits. In the case of upper limit hits, trading volume stays higher in A share market compared to H share market several days after the hits and the interference is more significant, while in the case of lower limit hits, trading volume stays lower. This confirms the finding from Wong et al. (2009a) using intra-day data, but contradicts the no-interference conclusion from Chen et al. (2005b). Last, it is found that stocks with news arrival are more likely to hit price limits, especially in the upper limit hits. When examining the impact of news on the abnormal returns, international news is found to contribute to the stock abnormal returns on the day of price limit hits, while corporate-level news impacts the stock abnormal returns one day or several days after the hits. The news effect is more prominent in the upper limit hits cases, which is consistent with the attention-grabbing theory of Barber and Odean (2008).

The rest of the paper is organized as follows. Section 2 provides the institutional background, Section 3 develops of hypotheses. Section 4 describes the sample data. Section 5 shows empirical results. Section 6 provides robustness test results. Section 7 concludes the paper.

2. Institutional background

This paper examines three classes of shares for Chinese stocks: A shares, H shares and N shares.[4] China's A share market (the Shanghai Stock Exchange, a.k.a. SHSE, or the Shenzhen Stock Exchange, a.k.a. SZSE) only allows domestic investors to trade in local currency Chinese RMB, while on the Hong Kong Stock Exchange (HKSE) some Chinese stocks are listed and global investors can trade H shares in Hong Kong dollar. Due to stricter regulation and listing requirements, fewer Chinese stocks are

[4] China also has B shares, which are traded on the domestic stock exchanges in U.S. dollars or Hong Kong dollars, but open to foreign investors only before February 2001. After February 2001, domestic investors can also trade B shares if they have the foreign currencies required. But because the B share market has the same 10% price limit mechanism as the A share market and is much smaller, this paper does not include the B share market.

listed on New York Stock Exchange (NYSE). Same companies can have their stocks listed on different stock exchanges. For example, Sinopec Shanghai Petrochemical Co. was among the earliest to have issued A shares, H shares and N shares at around the same time in 1993. HKSE and NYSE are both regarded as developed stock markets and if a Chinese company is listed on both HKSE and NYSE, the SEC would defer to Hong Kong rules, which indicates some similarity in regulations on those two exchanges regarding Chinese stocks. However, due to Hong Kong's special relationship with mainland China, HKSE may be subject to more impact from China's stock market. Therefore both HKSE and NYSE are included to see if there is any significant difference between them when it comes to examining effectiveness of price limits.[5] Daily exchange rates of the Chinese RMB against the Hong Kong dollar or the U.S. dollar have been very stable during our sample period.[6] Robustness test is done to show minimal influence of exchange rate on stock returns or volatility, reflecting strong government control in China's exchange rates.

Gagnon and Karolyi (2010) point out that market-based barriers could impede arbitrage across markets and result in return differentials for cross-listed shares. Among them are direct restrictions such as short-sale restrictions and time zone effects, and indirect barriers such as accounting standards and legal protections for minority stockholders. Before discussing our hypotheses, it is important to understand the major market-based barriers in the three stock markets: China, Hong Kong, New York.[7] As mentioned before, the A share market has the 10% price limit while the H or N share market does not. The three markets have many differences other than price limit mechanism, such as accounting standards used, time zone, short-sale restrictions, foreign ownership restrictions, etc.

The accounting standards in these stock exchanges used to be different, with NYSE using the U.S. Generally Accepted Accounting Principles (GAAP), HKSE using the Hong Kong Financial Reporting Standards or the International Financial Report Standards (IFRS), SHSE/SZSE using the China GAAP. However, in recent years, the three exchanges have closed on the gap. China started using IFRS in 2006, HKSE has allowed the use of US GAAP and NYSE allowed the use of IFRS since 2008.[8]

There is no time-zone difference between China and Hong Kong. The trading hours of HKSE are from 9 a.m. to 4 p.m. and SHSE/SZSE open at 9 a.m. and close at 3 p.m. This paper mainly focuses on the A&H comparison group due to mostly synchronous trading in the two markets, but includes the A&N comparison group as a robustness check as well. NYSE has twelve-hour lag and therefore there is no overlapped trading hours between NYSE and the other three. Chen et al. (2010) finds that the home bias still holds in the segmented Chinese A-share market and the home market is more important in terms of price discovery and volatility spillover to NYSE. In our study, both open-to-close return and close-to-open return have been used for the A&N group for robustness check. Event study methodology used in this paper (using market model, standardized volatility and trading volume) also makes the abnormal returns, volatility and trading volume more comparable.[9]

Different from ADRs that could be exchanged to local shares at a predetermined ratio, the A shares and H or N shares in this paper are not fungible. In the last decade, China's A-share market has opened up to Qualified Foreign Institutional Investors (QFIIs), which are typically experienced large investors in the world. This alleviates the problem of segmentation of China's stock market from the rest of the world as the QFIIs can trade A shares and H or N shares at the same time. As of April 2013, there are 220 QFIIs in the Chinese stock market.[10] Still for the state-owned enterprises (SOEs) traded on the stock exchanges in China, the state has a large portion of ownership and these shares are not traded but rather stay passive. In addition, SHSE/SZSE do not allow margin trade and short sales until recent

[5] Even though we do find some differences in results for the A & N share comparison group and A & H share comparison group, there is no statistical difference in results found when N and H shares are compared. Results are available upon request.

[6] The Chinese RMB is pegged to the U.S. dollar and the Hong Kong dollar is pegged to the U.S. dollar. Even though China has adopted a managed floating exchange rate regime since 2005, the daily movement of the RMB's value against a basket of major currencies cannot exceed 0.5% of previous day's closing value.

[7] We want to thank the anonymous referee for pointing out these important differences.

[8] Information regarding the accounting standards comes from the websites of the four stock exchanges.

[9] Even though some differences are found for the A & H comparison group and the A & N comparison group, the major findings and conclusions stay the same for the two groups. Also see footnote 6.

[10] A list of QFIIs in China is available at http://english.sse.com.cn/tradmembership/trading/qfii/qfiilist/.

years in wake of the global crisis in 2008.[11] The Chinese government wanted to prevent global panic mood to spread to the domestic markets and encouraged domestic investors to participate in equity trading. This is in contrast to the temporary ban or restriction of short-selling of financial stocks in other markets, such as the U.S., the U.K., and Australia, etc.

Due to its well established system and more open environment, HKSE (or NYSE) has attracted many institutional investors. According to a recent survey by the Hong Kong Exchanges and Clearing Limited (2013), overseas institutional investors accounted for 42.2% of the total market trading value and local institutional investors accounted for 21.3% for year 2012. The A share market on the other hand is mostly dominated by individual investors (Wang and Jiang, 2004; Wong et al., 2009a). The institutional investors tend to be more informed and considered more rational compared to individual investors. This could be an important difference for explaining our findings.

Cross-listed shares of Chinese companies provide an opportunity, but also a complex setting to examine different market mechanisms. As summarized above, even though the three markets have many differences, some of the gaps have become smaller or nonexistent in recent years.[12] Comparing stock returns, return volatility and trading volume for cross-listed stocks in these markets allows us to focus on the price limit mechanism difference, which has not changed during the whole sample period, but the paper may be subject to the limitations mentioned above.

3. Hypotheses and methodology

The first three hypotheses in this paper are in line with Kim and Rhee (1997). The paper also tests the impact of news information and how news information affects the abnormal returns.

First, delayed price discovery hypothesis (Kim and Rhee, 1997) states that hitting price limits will stop trading beyond the limits on that day and will likely cause the price to continue in the same direction next day until reaching equilibrium. This hypothesis is tested by traditional event study approach. The price limit mechanism is examined in the A share market first. All the price limit days are identified as event dates. Then market model is used to obtain abnormal returns around the event dates. If there is overreaction in the market and price limit is effective, then we may see price reversal in the market (i.e. negative abnormal return after upper limit hits and positive abnormal return after lower limit hits). If price limit is not effective, we will only see price continuation in the days after the limit hits. Both upper limits and lower limits will be examined to see if price limits have similar impact on upward or downward price movements. Since China's stock market is highly volatile due to lack of experienced institutional investors, speculation and herding are common. As a result, we expect to see price continuation after price limit (i.e. positive abnormal return after upper limit hits and negative abnormal return after lower limit hits).

However, only after we compare the degree of price continuation for the next day in the A share market with that in the other market can we provide evidence of effectiveness of price limit. Once the event dates are determined, abnormal returns in H shares or N shares can be calculated for those dates and compared with those in A shares. In HKSE or NYSE, institutional investors play a much more important role than those in China's stock markets and there may be less herding or panicking sentiment. In other words, investors are more rational and less likely to overreact to certain news in HKSE or NYSE. The abnormal returns are expected to be significantly lower than those in the A share market for upper limit hits cases, but significantly higher for lower limit hits cases.

Second, Lehmann (1989) argue that when price limit hits, price discovery process is interrupted, therefore causing volatility to increase over a long period of time rather than one-day volatility jump. This volatility spillover hypothesis is tested by comparing volatility measures for the two comparison groups, A&N comparison group and A&H comparison group, respectively. We expect that volatilities

[11] The short selling in China was initiated in February 2013 to allow a few brokerages to borrow shares of 90 blue chip companies from institutional investors. This will allow the brokerages to tap into the passive shares owned by the Chinese SOEs.

[12] The relative short history of China's stock market and limited number of cross-listed stocks do not allow us to use sub-samples in this study.

on days of limit hits may not be higher in A shares than those in H (or N) shares, possibly due to the price limits imposed on that day. However, after the limit hits, stock return volatility is expected to be higher in A shares than in H or N shares, assuming investors in HKSE and NYSE are more rational and price limit mechanism is not effective.

Third, price limit is believed to interfere with trading activity on the day when the price limit hits. Patient investors will wait for prices to reach equilibrium, therefore trading volume will increase after the limit hits (Lehmann, 1989). Trading activity around price limit hit dates will be compared between A shares and H (or N) shares. Unlike the findings of Kim and Rhee (1997) that the trading volumes of the stocks with price limits are higher than the trading volumes of those without price limits after the price limit hits, we expect that A shares' volume is higher in the upper limit hit cases and lower in the lower limit hit cases due to investor behavior (see the magnet effect from Du et al. (2005) and Wong et al. (2009a)). In the up market, China's irrational investors tend to be overly optimistic and buy stocks even after the upper limit hits. However, in the down market, those investors tend to be more hesitant to sell stocks that incur losses and wait for government's intervention to raise the stock's price.

Last, according to the efficient market hypothesis, under semi-strong form market efficiency, public information is incorporated in stock prices immediately. However, since Chinese stock market is usually regarded as less efficient market, stock prices are likely to deviate from their fundamental value when new information arrives. Therefore, we hypothesize that news arrival is one of the important factors that cause price limit hits and affect stock returns afterwards. This effect should be more profound for upper limit hits according to the attention-grabbing theory (Barber and Odean, 2008), which indicates new information that attracts investors' attention will lead them to buy stocks they have not previously owned, but the effect does not apply to net sell investors. In addition, since investors tend to overreact to the information, the news factors are likely to result in abnormal returns as well.[13]

To be more detailed on what types of news affect investors' behavior around price limit hits, after hand collecting news that has happened during our sample period, we classify our news dataset into three large categories: the international news, the domestic macro news, and the corporate level news. The international news includes the U.S. and regional (mainly Hong Kong) macro level news and international competitors' actions that are related to the firms in the sample. The domestic macro news includes monetary and fiscal policy news announced by Chinese governments or central bank. The corporate level news is further categorized into five sub-groups that represent news from earnings announcements, merger and acquisitions, capital structure, corporate governance, and corporate operations, etc.[14] We expect that the corporate level news plays a more significant role in affecting the abnormal returns of the A share stocks around price limit hits, especially in the upper limit hit cases.

4. Data and sample

We obtain the A share and N share information from the WIND database in China and it contains daily opening price, closing price, high price, low price, turnover, volume and outstanding shares on all stocks. H share information is obtained from Bloomberg. News information comes from major news media in China, such as Hexun Financial, Tengxun Network, China Securities Daily, etc. The sample of this study consists of Chinese companies that have started listing in HKSE or NYSE at least prior to December 31, 2006 to ensure enough data points. The sample period starts with the listing dates of each company and ends May 30, 2011 (see Appendix B for listing dates). There are thirty-seven Chinese companies that have both A shares and H shares during this period of time, seven of which also have N shares listed.[15]

In our sample of China's A shares, Tsingtao Brewery Co., Ltd. was the earliest to be listed on Shanghai Stock Exchange on August 27, 1993, while Datang International Power Generation Co., Ltd. was the

[13] See, for example, Vega (2006) finds that news coverage is related with stock abnormal returns, and the more information available, the smaller the abnormal return for the stock.

[14] For details of the classifications, please see Appendix A.

[15] Please see Appendix B for a complete list of companies and their listing start date on each stock exchange.

latest to go public on December 20, 2006. In our sample of H shares, Tsingtao Brewery was again the earliest to be listed on Hong Kong Stock Exchange on July 15, 1993, while Industrial and Commercial Bank of China was the last to be listed on October 27, 2006. The earliest to be listed in New York Stock Exchange was Sinopec Shanghai Petrochemical Co., Ltd. in July 1993 and the latest listing was from Sinopec Group in October 2000.

We did two group comparisons to examine how the price limit affects stock price behavior. The first group comparison is between the A shares and the H shares; and the second group comparison is between the A shares and the N shares.[16] The data is also divided into two subgroups to see if there is any asymmetric effect from price limit hits: one with stock price hitting upper limits and the other with stock price hitting lower limits.

To consider possible different impacts of the single day limit hits and consecutive day limit hits, this paper mainly reports the results for the single day limit hits, but also include the results for consecutive day limit hits in the robustness tests in Section 6. For the A/H group, there are a total of 995 single day hits while there are only 272 consecutive day hits. For the A/N group, the sample for consecutive day hits is too small to perform any robustness test.

Since Chinese companies listed on HKSE are more than those listed on NYSE, the number of price limit hits is much more in A&H share comparison group than that in A&N share comparison group.[17] The single day hits sample has 995 hits in the A/H group, 648 of which are upper limit hits and the other 347 lower limit hits. For the A/N group, there are 143 hits, with 91 upper limit hits and 52 lower limit hits. The observation numbers in the A/N group are much smaller, but our results do not show much difference between the two groups.

5. Empirical findings

5.1. Returns and abnormal returns

Before testing any of the hypotheses, mean daily stock returns[18] for one day before and one day after stocks hit their daily price limits are shown in Table 1. Day 0 is defined as the day that stocks hit their price limit, day −1 is the day before, and day 1 is the day after the hit. More specifically, Panel A presents mean daily stock returns for A and H share stocks surrounding upper limit hits, panel B presents mean daily stock returns for A and H share stocks surrounding lower limit hits, and panels C and D shows the corresponding results of A and N share stocks.

The results show that when the A shares hit price limits on days 0 with +10% or -10% average returns, the H shares or N shares' average returns are only about half of that in the A share market. As China's stock market are relatively new and the individual investors are more likely to exhibits behavior biases such as overconfident, disposition effect, and representativeness bias (Chen et al., 2007) as opposed to institutional investors in Hong Kong or New York's market, the difference in investors' behavior and the under-developed financial market could explain the large differences in mean returns when price limits are reached. For upper limit hits, on day 1, the cross-listed stocks' mean returns in the Chinese stock markets are significantly higher than the mean returns of their corresponding shares listed both on NYSE and on HKSE.[19] For lower limit hits, the A-share mean returns are significantly lower than the N-share or H-share returns on day 0, and they continue to be less (even though insignificant) on

[16] SHSE and SZSE trading lead NYSE by about 12 h, which means after China's stock markets closes, NYSE opens and there is no overlap in trading between A shares and N shares. To consider the time zone difference between the two markets, the event study is done by using close-to-open return in N shares and close-to-close return in A shares and the results are shown in the robustness test in Section 6.

[17] We only consider the hits as our events when there are both A share & H share or A share & N share data available.

[18] Some research use median returns rather than mean returns, however, the results are generally similar according to Kim et al. (2011).

[19] Starting from day 2, there is no significant difference between the mean returns. To save space, the results after day 1 are not shown, but available upon request.

Table 1
Daily returns surrounding price limit hits for A and H shares cross-listed stocks.

Panel A: Mean daily stock returns for pre and post upper price limit hits for A and H shares

Day	A-share (N = 648)	H-share (N = 648)	Mean difference	t-Statistic for differences
−1	0.0527	0.0776	−0.0025	−0.97
0	0.1000	0.0551	0.0449***	17.00
1	0.0089	0.0044	0.0045*	1.70

Panel B: Mean daily stock returns for pre and post lower price limit hits for A and H shares

Day	A-share (N = 347)	H-share (N = 347)	Mean difference	t-Statistic for differences
−1	−0.0088	−0.0070	−0.0018	−0.43
0	−0.0999	−0.0503	−0.0496***	−17.55
1	−0.0023	−0.0018	−0.0005	−0.15

Panel C: Mean daily stock returns for pre and post upper price limit hits for A and N shares

Day	A-share (N = 91)	N-share (N = 91)	Mean difference	t-statistic for differences
−1	0.0067	0.0183	−0.0117	−1.62
0	0.1000	0.0362	0.0637***	11.58
1	0.0152	−0.0070	0.0222***	3.59

Panel D: Mean daily stock returns for pre and post lower price limit hits for A and N shares

Day	A-share (N = 52)	N-share (N = 52)	Mean difference	t-Statistic for differences
−1	−0.0160	−0.0213	0.0053	0.58
0	−0.1000	−0.0423	−0.0577***	−8.64
1	−0.0018	0.0032	−0.0050	−0.51

This table presents the mean daily stock returns pre and post stock price limit hits (consecutive hits are excluded) for cross-listed stocks on China's Shanghai/Shenzhen stock exchange (A-share) and Hong Kong stock exchange (H-share). Day 0 is the day that stocks' price hit their price limit, day −1 is the day before, day 1 is the day after the hit, day 2 is two days after the hit, etc. Stock price data was collected from August 1998 to May 2011 for A-share listed stocks and from March 2000 to May 2011 for H-share listed stocks. Asterisks (***, **, *) denote that coefficient is significant at 1%, 5%, and 10% respectively.

day 1 in both comparison groups.[20] The preliminary finding indicates that price continuation exists in both cases of upper limit hits and lower limit hits.

The delayed price discovery hypothesis is formally tested by using market-model-adjusted abnormal returns.[21] Table 2 reports the daily abnormal returns surrounding price limit hit days for A/H group. When we compare the A shares with the H shares, we actually find evidence supporting the price limit mechanism. The average abnormal returns for the A shares are significantly higher than those for the H shares on the days of upper limit hits (see panel A) and slightly higher for one more day, but the mean difference is not statistically significant. For the lower limit hits (see panel B), the A shares show significantly lower returns than the H shares on the days of the hits but become slightly higher on the day after the hits. After we control the movements of the market, the abnormal returns in the A share market have not maintained the momentum to continue when compared to the H share market, which indicates some degree of effectiveness of price limit mechanism in China. It seems that price limit mechanism does cool down the market sentiment, likely as information is spread and uninformed investors have become more informed and trade more rationally after the limit hits. In order to illustrate the pattern of abnormal returns over time and to compare the A/H group with the A/N group, the differences between cumulative abnormal returns (CARs) of A shares and H shares or N shares in times of upper limit hits and lower limit hits are plotted in Charts 1 and 2, respectively. We expand the window to −5 day to +10 day around price limit hits and find the pattern of cumulative abnormal returns for A/H comparison group and A/N comparison group are very similar, both in upper limit

[20] The results are not shown after day 1, but are available upon request. There is significant difference for mean returns up to 4 days.

[21] Stock daily abnormal returns are calculated as $r_{i,t} - (\alpha_i + \beta_i \times R_{m,t})$, where $R_{m,t}$ is local market index return for day t, α_i and β_i are the coefficients estimated by the market model regression.

Table 2
Daily abnormal returns surrounding price limit hits for cross-listed stocks (Market model adjusted).

Panel A: Daily abnormal stock returns for pre and post upper price limit hits for A and H shares

Day	A-share (N = 648)	H-share (N = 648)	Mean difference	t-statistic for differences
−3	0.0051	0.0016	0.0034	1.46
−2	0.0042	0.0048	−0.0005	−0.23
−1	0.0031	0.0059	−0.0028	−1.13
0	0.0924	0.0463	0.0461***	18.69
1	0.0091	0.0053	0.0038	1.50
2	−0.0061	−0.0025	−0.0036	−1.51
3	0.0026	−0.0001	0.0027	1.17
4	0.0018	0.0047	−0.0030	−1.22
5	0.0011	0.0050	−0.0039*	−1.69

Panel B: Daily abnormal stock returns for pre and post lower price limit hits for A and H shares

Day	A-share (N = 347)	H-share (N = 347)	Mean difference	t-statistic for differences
−3	−0.0081	−0.0052	−0.0029	−0.81
−2	−0.0007	−0.0032	0.0025	0.80
−1	−0.0062	−0.0017	−0.0044	−1.20
0	−0.0884	−0.0306	−0.0578**	−25.03
1	−0.0070	−0.0117	0.0047	1.39
2	−0.0018	−0.0066	0.0048	1.44
3	−0.0052	0.0036	−0.0088**	−2.46
4	−0.0079	0.0041	−0.0120**	−3.30
5	−0.0036	−0.0006	−0.0029	−0.97

This table presents the mean daily stock returns pre and post stock price limit hits (consecutive hits are excluded) for cross-listed stocks on China's Shanghai/Shenzhen stock exchange (A-share) and Hong Kong stock exchange (H-share). Day 0 is the day that stocks price hit their price limit, day −1 is the day before, day 1 is the day after the hit, day 2 is two days after the hit, etc. Stock price data collected from August 1998 to May 2011 for A-share listed stocks and from March 2000 to May 2011 for H-share listed stocks. Asterisks (***, **, *) denote that coefficient is significant at 1%, 5%, and 10% respectively.

hits and lower limit hits. Price continuation is not found in both groups as CARs have been flat after day 0, which indicates that price limit mechanism seems to be effective in cooling down investors' sentiment on bidding stock prices up or down in China's stock market. This result is in contradiction to Kim and Rhee (1997) and other prior studies on China (Chen et al., 2005b; Wong et al., 2009a).

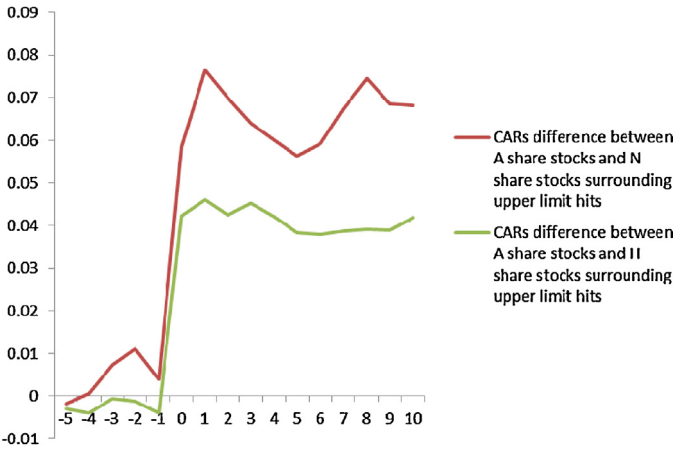

Chart 1. CARs difference between A share stocks and N or H share stocks when stock price hits upper limit.

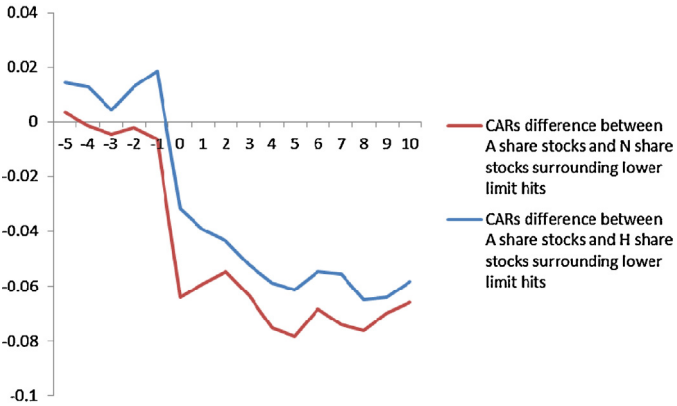

Chart 2. CARs difference between A share stocks and N or H share stocks when stock price hits lower limit.

5.2. Volatility spillover hypothesis

In order to take into account of intra-day price fluctuations and capture the transitory volatility[22], we follow Kim et al. (2011) and use Grossman (1988) measure to calculate daily volatility as the following:

$$Volatility_{i,t} = \ln\left(\frac{r_{h,i,t}}{r_{l,i,t}}\right) \quad (1)$$

where $r_{h,i,t}$ is the high price of stock i at time t and $r_{l,i,t}$ is the low price of stock i at time t. However, empirical evidence shows that in general stock returns in the Chinese stock market are more volatile than those in the U.S. stock market and are also different from those in the HK stock markets. To make the volatility measure comparable across markets, we standardize the volatility based on average volatility of day −5 to day −3 for each market. Table 3 reports the mean adjusted volatility of the A-shares, N-shares, and H-shares surrounding price limit hits.

On day 0 when price limit hits, the volatility in the A share market is higher in the lower limit hits, but not significantly higher in the upper limit hits. This phenomenon can be explained by the design of price limit. When price limit hits, prices can no longer go up or down, therefore limiting the fluctuations within the day. However, the volatility in the A share market is significantly higher on day 1 after the limit hits when compared to that in the H share market. These findings confirm the volatility spillover hypothesis and no asymmetric effect is found for upward price movement and downward price movement. Charts 3 and 4 confirm that the volatility spillover in the A/N group is similar to that of A/H group for both upper and lower limit hits, with even larger magnitude. The results indicate that the price limit in China is not effective in preventing market turbulence and reducing volatility, consistent with Kim and Rhee (1997), but in contradiction with Kim et al. (2011). This may be due to the use of different comparison groups or samples.[23]

5.3. Trading interference hypothesis

Daily average trading volume is measured by averaging number of shares traded for each share group on each day. However, due to the difference in shares outstanding among different stock

[22] Transitory volatility is defined as volatility in excess of that generated by information flow. It is induced by the difference between the observed price and the efficient fundamental price implied by weak-form market efficiency.

[23] In Kim et al. (2011), two different sample periods (before and after imposing price limit mechanism) are used to examine the impact of price limits. This method may be subject to the criticism of different information flows and economic environment for the two different periods.

Table 3
Daily volatility surrounding price limit hits for cross-listed stocks.

Panel A: Daily stock returns volatility for pre and post upper price limit hits for A and H shares

Day	A-share (N = 648)	H-share (N = 648)	Mean difference	t-Statistic for differences
−3	1.0333	1.0619	−0.0287	−1.20
−2	1.1393	1.2387	−0.0993*	−1.92
−1	1.1914	1.2528	−0.0615	−0.99
0	1.7774	1.8137	−0.0363	−0.36
1	1.5524	1.4167	0.1357**	2.22
2	1.3402	1.2600	0.0802	1.49
3	1.2701	1.2321	0.0381	0.70
4	1.2261	1.2465	−0.0204	−0.31
5	1.1833	1.3352	−0.1520*	−1.89

Panel B: Daily stock returns volatility for pre and post lower price limit hits for A and H shares

Day	A-share (N = 347)	H-share (N = 347)	Mean difference	t-statistic for differences
−3	1.0603	1.0086	0.0517*	1.72
−2	1.1040	1.0799	0.0240	0.41
−1	1.1949	1.0812	0.1137*	1.88
0	1.7074	1.4395	0.2679***	3.26
1	1.5605	1.3588	0.2017**	2.32
2	1.3277	1.2719	0.0558	0.68
3	1.2143	1.1524	0.0619	1.01
4	1.2263	1.2415	−0.0152	−0.21
5	1.0833	1.0167	0.0667	1.24

This table presents the mean daily stock returns pre and post stock price limit hits (consecutive hits are excluded) for cross-listed stocks on China's Shanghai/Shenzhen stock exchange (A-share) and Hong Kong stock exchange (H-share). Volatility is measured as $(\ln(H_t/L_t))$, where H_t is the high price and L_t is the low price on day t, and ln is the natural log operator and standardized based on volatility of day 5, the 5th day before the hit day. Day 0 is the day that stocks price hit their price limit, day −1 is the day before, day 1 is the day after the hit, and day 2 is the second days after the hit, etc. Stock price data collected from 1993 to 2011 for A-share listed stocks and from 1999 to 2011 for H-share listed stocks. Asterisks (***, **, *) denote that coefficient is significant at 1%, 5%, and 10% respectively.

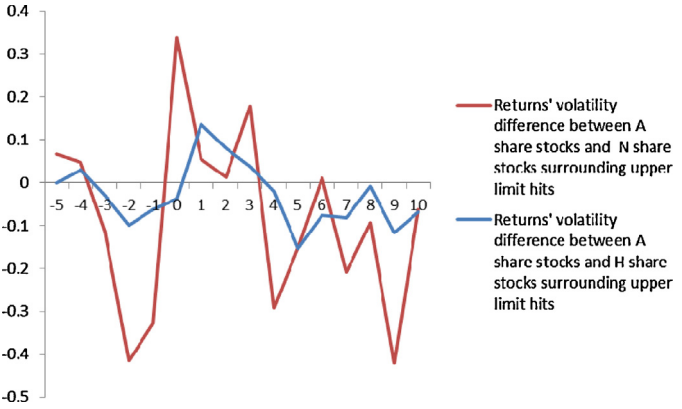

Chart 3. Returns' volatility difference between A share stocks and N or H share stocks when stock price hits upper limit.

exchanges, we again standardize the trading volume on each day by dividing it by the average trading volume from day −5 to day −3 for each market to make the trading activity among different exchanges comparable.[24] Table 4 shows comparison of daily trading activities for A/H group around price limit hits. Just by looking at A shares' trading volume, we find that it increases on day 1 after the limit hits.

[24] Since trading volume data is not as reliable as stock price data, some observations with extreme trading volume values were removed.

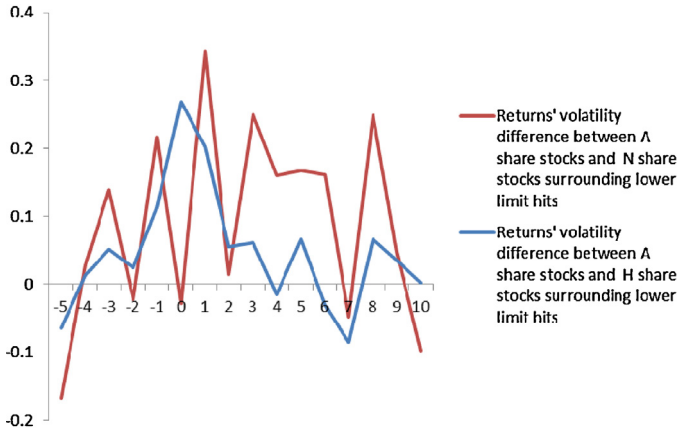

Chart 4. Returns' volatility difference between A share stocks and N or H share stocks when stock price hits lower limit.

This is consistent with the trading interference hypothesis, indicating more trading activity after price limit hits.

On day 0 when upper price limit hits, A shares' trading volume is significantly higher than H shares' (Table 4, panel A). In contrast, on day 0 when lower price limit hits, A shares' trading volume is lower than H shares' (Table 4, panel B). Since trading volume is a liquidity measure, this tells us that in a

Table 4
Daily trading volume surrounding price limit hits for cross-listed stocks.

Panel A: Daily stock trading volume for pre and post upper price limit hits for A and H shares

Day	A-share ($N = 648$)	H-share ($N = 648$)	Mean difference	t-statistic for differences
−3	1.3646	1.6030	−0.2384**	−2.08
−2	1.8142	1.8205	−0.0063	−0.03
−1	1.8038	2.0662	−0.2624	−1.06
0	4.8522	3.6111	1.2411***	2.70
1	5.6162	2.6399	2.9764***	7.26
2	3.4918	1.9408	1.5509***	4.37
3	2.9890	2.0571	0.9318***	3.33
4	2.7052	1.9410	0.7642***	3.07
5	2.3484	2.1808	0.1676	0.69

Panel B: Daily stock trading volume for pre and post lower price limit hits for A and H shares

Day	A-share ($N = 347$)	H-share ($N = 347$)	Mean difference	t-statistic for differences
−3	1.1135	1.2857	−0.1722**	−1.97
−2	1.3145	1.3333	−0.0188	−0.11
−1	1.4906	1.4677	0.0229	0.08
0	1.4183	1.7218	−0.3035	−1.45
1	1.4656	2.0721	−0.6065	−1.11
2	1.1853	1.4132	−0.2279	−1.40
3	1.1359	1.5653	−0.4295*	−1.79
4	1.0324	1.3009	−0.2685**	−2.14
5	0.9431	1.2128	−0.2697*	−1.81

This table presents the mean daily stock returns pre and post stock price limit hits (consecutive hits are excluded) for cross-listed stocks on China's Shanghai/Shenzhen stock exchange (A-share) and Hong Kong stock exchange (H-share). Daily trading volume is measured as the ratio of number of shares traded on day i to number of shares traded on day 5, the 5th day before the hit day. Day 0 is the day that stocks price hit their price limit, day −1 is the day before, day 1 is the day after the hit, and day 2 is the second days after the hit, etc. Stock price data collected from 1993 to 2011 for A-share listed stocks and from 1999 to 2011 for H-share listed stocks. Asterisks (***, **, *) denote that coefficient is significant at 1%, 5%, and 10% respectively.

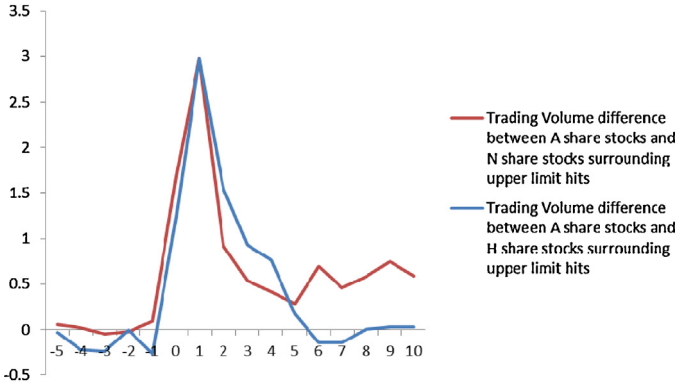

Chart 5. Trading volume difference between A share stocks and N or H share stocks when stock price hits upper limit.

down market, the A share market is less liquid than H share market while in an up market, the opposite occurs. This could be attributed to government intervention in Chinese stock markets. Investors tend to be overly optimistic with confidence in government support and buy more frequently in the up market. However, they tend to be more patient in a down market waiting for government intervention (see Mei et al., 2009; Tan et al., 2008). After the upper limit hits, A shares' volume increases on day 1 while H shares' volume decreases. A shares' volume stays higher for up to 4 days at 1% significance level when compared to H shares. In the lower limit hit cases, A shares' volume remains lower than H shares' volume for up to 5 days, but only significant for days 3–5. The trading interference hypothesis is supported in the upper limit hits, but the fact that trading volume is lower during and after the lower limit hits is inconsistent with the trading interference hypothesis. We also confirm the asymmetry in the upper limit hit and lower limit hit cases from Charts 5 and 6. We can see that after the lower limit hits, the trading volume in A share market continues to be lower than that in H share or N share market, while in upper limit hits cases, the trading volume in A share market continues to be higher. Our results are consistent with Kim and Rhee (1997) in the case of upper limit hits but consistent with the findings in Wong et al. (2009a) in the case of lower limit hits. The price limit mechanism appears to be effective in slowing down market activities only in the down market.

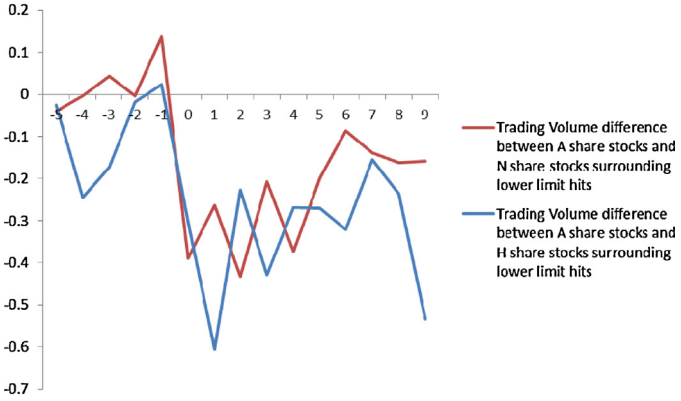

Chart 6. Trading volume difference between A share stocks and N or H share stocks when stock price hits lower limit.

5.4. Causes of price limit hits

Most research on price limit hits up to date focuses on price, trading volume, and return volatilities after price limit hits. However, very few have studied the causes of price limit hits, especially at market level.[25] We hypothesize that besides firms' own characteristics, stocks that have more news events arriving at the market are more likely to hit limits. The news events are classified as international, domestic or corporate level news[26], which might have a significant impact on overall stock markets or individual stocks.

To perform this analysis, we define the price limit hits as a binary dependent variable that takes the value of 0 if there is no price limit hit for stock i on day t and 1 if there is a price limit hit. However, to validate the results, we need to control fundamental variables that affect stock price changes. The firm level control variables that have been documented in previous studies include lagged abnormal return (Phylaktis et al., 1999; Shen and Wang, 1998), trading volume, and return volatility[27] (Chen et al., 2005a,b). Empirical studies also predict that macroeconomic variables could also affect stock returns, and there are significant stock return spillovers among regional and international markets (Griffin and Stulz, 2001; Chiang and Zheng, 2010; Chiang et al., 2007). Therefore, the following variables should be included in the model as well: the interest rate spread in China and HK, the exchange rate change for Chinese Yuan on USD, and lagged stock market index returns in China, HK and the US. Specifically, we estimate the following logistic regression model:

$$\ln\left(\frac{\%Hit_{i,t}}{(1-\%Hit_{i,t})}\right) = \alpha + \beta_j News_{j,t} + \beta_k \sum_{k=1}^{3} Control_{firm,k,t} + \beta_l \sum_{l=1}^{4} Control_{macro,l,t} + e_i \quad (2)$$

where $\%Hit_{i,t}$ represents the frequency of stock i hitting a price limit at time t, $Control_{firm,k,t}$ represents the three firm level control variables on price limit hits days, and $Control_{macro,l,t}$ represents the four domestic and international macro variables on price limit hits days.

Table 5 presents the regression results. For both A-H share cross-listed stocks, the coefficients of news events are positive and significant even after we control the whole set of firm level and market level variables, and the news effect is stronger for upper limit hits compared with lower limit hits. That means stocks with news arrival are more likely to have price limit hits, especially in upward price movements. This is consistent with the attention- grabbing theory (Barber and Odean, 2008) that investors with new information tend to buy stocks not previously owned rather than sell already-owned stocks. These results are in support of our hypothesis that news event is an important factor that drives stock price to hit the limit. In addition, stocks that have higher volatility are more likely to hit price limits. We also find that stocks with higher trading volume are more likely to hit upper price limits. At the market level, lagged market returns and term spreads affect upper and lower limits hit to a similar extent.

5.5. Impact of news on stock abnormal returns

Now that we know what news factors may cause the price limit hits, we continue to test our hypothesis of the impact of news on stock returns, and we propose a simple model as the following:

$$AR_{i,t} = \alpha + \beta_j \sum_{j=1}^{7} News_{j,t} + e_i \quad (3)$$

where $AR_{i,t}$ is the abnormal return for stock i in the A-share market on price limit hit days. The abnormal return is A share's daily market–model-adjusted return. In order to test if different types of news impact stock abnormal returns differently, news variable are divided into seven classes. $News_{j,t}$ Stands for international news, domestic news, and five types of corporate news.[28] Same as in last

[25] Kim and Limpaphayom (2000) and Chen et al. (2005a) find that stocks with wider spreads, more residual risk, and smaller market capitalizations hit price limits more often.
[26] Please see Appendix A for detailed news classifications.
[27] For trading volume and return volatility variables' definition, please check the details in the data description part.
[28] For detailed information, please check Appendix A.

Table 5
News effect on price limit hits.

News effect on price limit hits (for A and H share cross-listed stocks)			
Independent variable	Whole sample	Upper limit hits	Lower limit hits
Intercept	−5.8681*** (4869.67)	−5.4272*** (1813.61)	−6.3576*** (2266.81)
$News_0$	0.8796*** (204.96)	0.9449*** (114.94)	0.8488*** (81.21)
$R_{i,t-1}$	3.2251*** (23.07)	5.3969*** (28.11)	1.1769 (1.07)
$TV_{i,0}$	0.0000*** (6.97)	0.0000*** (8.48)	0.0000 (0.10)
$Vol_{i,0}$	34.8272*** (1652.69)	37.6701*** (828.73)	33.5353*** (651.19)
$Spread_{CHN,0}$	−0.1652*** (39.62)	−0.3883*** (65.74)	−0.0225 (0.42)
$Spread_{US,0}$	−0.1289*** (36.16)	−0.1633*** (28.09)	−0.1019*** (8.79)
$Spread_{HK,0}$	−0.1676*** (12.45)	−0.2062*** (8.04)	−0.0905* (1.88)
$\Delta Exchange_0$	18.1519 (0.24)	−131.0000*** (4.26)	117.6000*** (7.15)
$China\_index_{t-1}$	−2.1956 (0.90)	8.3203*** (7.43)	−18.2633*** (25.38)
US_index_{t-1}	0.6731 (0.10)	6.7475*** (4.98)	−9.7837*** (9.63)
HK_index_{t-1}	−0.4572 (0.02)	−13.9694*** (10.60)	15.3859*** (10.15)
R^2 Max	0.1985	0.2281	0.1946

This table shows the logistic regression results of news effect on stock price limit hits. Sample stocks are those cross listed on China's Shanghai/Shenzhen stock exchange (A-share) and Hong Kong stock exchange (H-share). Panel A presents the results for the A-share and N-share cross-listed stocks and panel B presents the results for the A-share and H-share cross-listed stocks. The dependent variable takes the value of 0 if no price limit hit for stock i on day t and 1 if there is a price limit hit. $News_0$ is the news variables.[a] The subscript 0 means the news event happened at the price limit day. $TV_{i,0}$ is the trading volume at price limit hit day, which is measured as the ratio of number of shares traded on day i to number of mean shares traded on day −5 to −3, the 5th day to the 3rd day before the hit day. $Vol_{i,0}$ is the return volatility at price limit hit day which is measured as $(\ln(H_t/L_t))$, where H_t is the high price and L_t is the low price on day t, and ln is the natural log operator and standardized based on the mean volatility of day −5 to −3, the 5th day to the 3rd day before the hit day. $Spread_0$ is the interest spread for China (CHN), the U.S. (US) and Hong Kong (HK) at price limit hit day, which is calculated as the difference between the long-term government bond rate and the short term government bond rate. $\Delta Exchange_0$ is the change of exchange rate of Chinese Yuan for each $100 at the price limit hit days. $China\_index_{t-1}$ is the lagged daily return of China stock index, US_index_{t-1} is the lagged daily return of US stock index and HK_index_{t-1} is the lagged daily return for Hong Kong stock index. Day 0 is the day that stocks's price hit their price limit, day 1 is the day after the hit, and days 2–5 is the second day to the fifth day after the hit, etc. Stock prices data collected from 1993 to 2011 for A-share listed stocks and from 1999 to 2011 for N-share and H-share listed stocks. χ^2-stats are in parentheses. Asterisks (***, **, *) denotes that coefficient is significant at 1%, 5%, and 10% respectively.
[a] For detailed information, please check Appendix A.

section, to validate our results we also include a set of control variables and establish the complete model as the following[29]:

$$AR_{i,t} = \alpha + \beta_j \sum_{j=1}^{7} News_{j,t} + \beta_k \sum_{k=1}^{3} Control_{firm,k,t} + \beta_l \sum_{l=1}^{4} Control_{macro,l,t} + e_i \quad (4)$$

where $AR_{i,t}$ and $News_{j,t}$ have the same definitions as above, and the whole set of control variables are defined in Eq. (2). This equation tests which type of news affects stock abnormal returns on price limit days.

To further test the long run impact of news on price limit hit days, we shall change the dependent variable $AR_{i,t}$ to $AR_{i,t+1}$ (abnormal return on day 1) or $CAR_{i,t+2\text{-}t+5}$ (cumulative abnormal return from day 2 to day 5). If β_j $(i = 1, 2, \ldots, 7) = 0$, then the price limit hits are not caused by Chinese A-share investors' overreaction to the news, but mostly by firms' own characteristics or other macro variables. However, the rejection of the null will be consistent with our hypothesis and it can be concluded that investors' reaction to news is a significant factor that drives price limit hits and in determining abnormal stock returns on or after price limit hits days. Specifically, if news has an incremental power in explaining excess stock returns on or after price limit hits days, one or more of β_j should be statistically significant. Additionally, if the test statistics reject the null: $\beta_l = 0$ $(l = 1, 2, 3, 4)$, then the macroeconomic (China and international) factors also possess significant power in explaining excess stock returns on or after price limit hits days.

[29] To address the econometric issues, we use general least square regressions to control firm level fixed effect.

The empirical results from the simple equation (3) and the complete equation (4) are shown in Table 6. The signs and significance level of news coefficients from the two set of equations in panels A–C are quite consistent, which indicates that including firm level and macro level control variables cannot mitigate news effect on abnormal returns around price limit hits.[30]

The international news seems to have a significant impact on the abnormal returns on the days of price limit hits, but only in the upper limit hits cases (panel B). On average the abnormal returns on the days of upper limit hits increase by about 0.5% when international news arrives. However, there is no significant leftover effect for day 1 and after. This suggests that positive international news has very short-lived but significant impact on the abnormal returns of cross-listed A shares in China. In the case of lower limit hits, international news seems to have no significant impact on the abnormal returns of A share stocks.

The macroeconomic news from China domestically does not seem to have any significant impact, either in the short run or in the long run, whether it is upper limit hit or lower limit hit. It is possible that China macro-economic news effect is explained by term spread, lagged stock index and exchange rate changes in China.

As for the corporate level news, none of the news has a significant impact on the abnormal returns on day 0, except for marginally significant impact from other corporate news category. One possible reason is that stock prices on day 0 are censored by price limits, which could skew the returns and the relationship. Another possible reason could be the lagged effect. Some of the news could be available to public after the market closes. On day 1, the news impact seems more evident. Capital structure news has the most statistically and economically significant impact on the abnormal returns. For the upper limit hits cases, the capital structure news on average increases the abnormal returns by more than 1.7% on day 1, while corporate governance news on average increases the abnormal returns by about 1.5% (panel B). This may have to do with China's reform of state-owned enterprises. The division between the state-owned shares and outstanding shares allows participation of shareholders in residual claims of the companies, therefore increasing shareholders' interest in these stocks. For the lower limit hits cases, none of the news coverage has much impact on the abnormal returns on day 0 and day 1. The results are consistent with Seasholes and Wu (2007) that indicates only under upper limit hits, investors are more attracted by news coverage, but not under lower limit hits. The corporate level news appears to have a long lasting impact (2–5 days after price limit hits) on the abnormal returns, namely the earnings news and other corporate news in the case of upper limit hits and the earnings news and merger and acquisition news in the case of lower limit hits. Notably, firms that have merger and acquisition news tend to have over 7% lower cumulative abnormal returns (panel C). This may indicate investors in China digested information about merger and acquisition deals slowly and generally have negative sentiment toward the M&A deals.

As expected, most 1-day lagged returns are significant and positive on day 0, suggesting serial autocorrelation. Trading volume seems to have an overall significant and positive effect on abnormal returns on day 0, but the economic significance seems very small. For the subsamples, this significance disappears. Return volatility, on the other hand, shows generally a significant and positive effect on abnormal returns, especially on day 0 for upper limit hits and on later days for lower limit hits. This is consistent with the risk-return tradeoff relationship between volatility and abnormal returns.

The macro control variables all appear to have some impact on the abnormal returns when price limit hits. The exchange rate change has a significantly positive effect on abnormal returns of the A shares that hit price limits. When exchange rate goes down meaning Chinese RMB appreciation against the U.S. dollar, the export businesses are affected negatively and their stocks underperform compared to other stocks in the market. Term spread in China has a stronger impact on the abnormal returns on day 0 and day 1 around price limit hits. A higher term spread indicates better economic prospect in China and therefore posing a positive relationship with the abnormal returns in day 0 in upper limit hits, and the negative relationship with the abnormal returns in day 1 in upper limit hits could come from a mean reversion. Since China and Hong Kong has such close ties including economic ties, term spread in HK also has a similar impact as term spread in China. However, the term spread in the U.S.

[30] Only results for the A&H group are shown. Results for the A&N group are similar and are available upon request.

Table 6
News impact on stock abnormal returns.

Panel A: A-share stock abnormal returns around price limit hits for cross-listed stocks

Dependent variable	AR on day 0		AR on day 1		CAR for days 2–5	
	Simple equation	Complete equation	Simple equation	Complete equation	Simple equation	Complete equation
Intercept	0.0277*** (7.27)	0.0628*** (6.70)	0.0026 (1.42)	0.0086* (1.76)	0.6449*** (123.58)	0.6280*** (46.27)
$News\_Int_0$	0.0160 (0.99)	0.0200 (1.30)	0.0082 (1.05)	0.0056 (0.72)	−0.0063 (−0.29)	0.0029 (0.13)
$News\_CHN_0$	0.0015 (0.19)	−0.0037 (−0.48)	−0.0006 (−0.15)	−0.0012 (−0.32)	0.0081 (0.75)	0.0059 (0.53)
$News\_Corp\_1_0$	0.0011 (0.13)	−0.0013 (−0.15)	−0.0057 (−1.38)	−0.0072* (−1.73)	−0.0370*** (−3.17)	−0.0358*** (−3.00)
$News\_Corp\_2_0$	−0.0115 (−0.68)	−0.0046 (−0.29)	−0.0051 (−0.62)	−0.0044 (−0.54)	−0.0587** (−2.54)	−0.0536** (−2.28)
$News\_Corp\_3_0$	0.0008 (0.08)	0.0015 (0.15)	0.0094* (1.89)	0.0100* (1.93)	−0.0200 (−1.44)	−0.0144 (−0.96)
$News\_Corp\_4_0$	−0.0189 (−1.42)	−0.0151 (−1.17)	0.0061 (0.94)	0.0048 (0.75)	0.0118 (0.64)	0.0047 (0.25)
$News\_Corp\_5_0$	0.0185* (1.89)	0.0141 (1.52)	0.0046 (0.97)	0.0035 (0.75)	−0.0411*** (−3.08)	−0.0416*** (−3.11)
$AR_{i,t-1}$		0.2568*** (3.72)		−0.0348 (−1.00)		0.0583 (0.58)
$TV_{i,0}$		0.0007*** (3.09)		−0.0002 (−1.36)		0.0001 (0.44)
$Vol_{i,0}$		0.0022 (0.90)		0.0004 (0.32)		0.0084** (2.41)
$Spread_{CHN,0}$		−0.0158*** (−6.17)		−0.0016 (−1.18)		0.0020 (0.54)
$Spread_{US,0}$		0.0028 (1.36)		−0.0002 (−0.17)		0.0080*** (2.65)
$Spread_{HK,0}$		−0.0011 (−0.31)		−0.0019 (−1.02)		−0.0046 (−0.87)
$\Delta Exchange_0$		1.2476 (0.45)		−0.2421 (−0.17)		5.5842 (1.39)
$China\ index_{t-1}$		0.0836 (0.48)		0.0183 (0.22)		0.0021 (0.01)
$US\ index_{t-1}$		0.7823*** (4.79)		−0.2187** (−2.38)		0.4797** (2.03)
$HK\ index_{t-1}$		0.4938* (1.95)		0.3006** (2.32)		0.4298 (1.17)
R^2	0.0076	0.1312	0.0090	0.0600	0.0275	0.0601

Panel B: A-share stock abnormal returns around upper price limit hits for cross-listed stocks

Dependent variable	AR on day 0		AR on day 1		CAR for days 2–5	
	Simple equation	Complete equation	Simple equation	Complete equation	Simple equation	Complete equation
Intercept	0.0919*** (111.12)	0.0857*** (50.09)	0.0063*** (3.02)	0.0264*** (4.83)	0.6478*** (104.81)	0.6344*** (39.49)
$News\_Int_0$	0.0051 (1.52)	0.0050* (1.84)	−0.0018 (−0.21)	−0.0027 (−0.33)	0.0127 (0.51)	0.0181 (0.72)
$News\_CHN_0$	−0.0018 (−1.07)	−0.0004 (−0.31)	0.0038 (0.89)	0.0041 (0.96)	0.0180 (1.42)	0.0195 (1.46)
$News\_Corp\_1_0$	0.0016 (0.83)	0.0006 (0.41)	−0.0019 (−0.39)	−0.0044 (−0.94)	−0.0328** (−2.34)	−0.0312** (−2.13)
$News\_Corp\_2_0$	0.0052 (1.34)	0.0045 (1.43)	0.0055 (0.56)	0.0040 (0.42)	−0.0401 (−1.38)	−0.0387 (−1.31)
$News\_Corp\_3_0$	0.0027 (1.20)	0.0014 (0.73)	0.0171*** (3.04)	0.0172*** (2.98)	−0.0093 (−0.56)	−0.0062 (−0.35)
$News\_Corp\_4_0$	−0.0010 (−0.31)	−0.0004 (−0.17)	0.0152* (1.94)	0.0151* (1.92)	0.0272 (1.17)	0.0223 (0.91)
$News\_Corp\_5_0$	0.0012 (0.58)	0.0013 (0.79)	0.0018 (0.35)	0.0007 (0.15)	−0.0423*** (−2.83)	−0.0435*** (−2.83)
$AR_{i,t-1}$		0.0355*** (2.67)		−0.0451 (−1.12)		0.0080 (0.06)
$TV_{i,0}$		0.0000 (−0.41)		−0.0002* (−1.67)		0.0001 (0.29)
$Vol_{i,0}$		0.0014*** (3.17)		−0.0028** (−2.09)		0.0052 (1.26)
$Spread_{CHN,0}$		0.0014*** (2.77)		−0.0050*** (−3.20)		0.0021 (0.43)

$Spread_{US,0}$		0.0001 (0.26)		−0.0005 (−0.43)		0.0067* (1.92)
$Spread_{HK,0}$		0.0022*** (3.28)		−0.0057*** (−2.73)		−0.0022 (−0.35)
$\Delta Exchange_0$		0.8305* (1.81)		0.0323 (0.02)		2.4947 (0.58)
$China\ index_{t-1}$		−0.0596** (−1.98)		0.0616 (0.65)		−0.3696 (−1.31)
$US\ index_{t-1}$		−0.5216*** (−15.49)		−0.2561** (−2.41)		0.0866 (0.27)
$HK\ index_{t-1}$		0.1346*** (3.00)		0.1024 (0.65)		0.4170 (0.99)
R^2	0.0125	0.3886	0.0222	0.0869	0.0301	0.0437

Panel C: A-share stock abnormal returns around lower price limit hits for cross-listed stocks

Dependent variable	AR on day 0		AR on day 1		CAR for days 2–5	
	Simple equation	Complete equation	Simple equation	Complete equation	Simple equation	Complete equation
Intercept	−0.0885*** (−76.06)	−0.0956*** (−33.52)	−0.0041 (−1.17)	−0.0333*** (−2.91)	0.6405*** (67.59)	0.6242*** (19.95)
$News\_Int_0$	0.0031 (0.57)	−0.0001 (−0.02)	0.0264 (1.63)	0.0209 (1.24)	−0.0629 (−1.43)	−0.0603 (−1.33)
$News\_CHN_0$	0.0013 (0.53)	0.0016 (0.85)	−0.0087 (−1.18)	−0.0084 (−1.13)	−0.0141 (−0.71)	−0.0167 (−0.84)
$News\_Corp\_1_0$	0.0031 (1.22)	0.0005 (0.27)	−0.0122 (−1.60)	−0.0097 (−1.25)	−0.0451** (−2.18)	−0.0379* (−1.83)
$News\_Corp\_2_0$	−0.0003 (−0.06)	−0.0044 (−1.22)	−0.0165 (−1.17)	−0.0106 (−0.73)	−0.0813** (−2.14)	−0.0734* (−1.88)
$News\_Corp\_3_0$	−0.0029 (−0.94)	−0.0010 (−0.40)	−0.0033 (−0.36)	−0.0036 (−0.36)	−0.0407 (−1.64)	−0.0221 (−0.83)
$News\_Corp\_4_0$	−0.0049 (−1.34)	−0.0035 (−1.29)	−0.0028 (−0.26)	−0.0020 (−0.18)	−0.0071 (−0.23)	−0.0250 (−0.83)
$News\_Corp\_5_0$	0.0009 (0.27)	0.0011 (0.43)	0.0083 (0.81)	0.0067 (0.67)	−0.0426 (−1.55)	−0.0393 (−1.47)
$AR_{i,t-1}$		−0.0002 (−0.01)		−0.0765 (−1.14)		−0.0526 (−0.28)
$TV_{i,0}$		−0.0002 (−0.59)		−0.0004 (−0.34)		0.0041 (1.30)
$Vol_{i,0}$		0.0002 (0.28)		0.0072*** (2.77)		0.0117* (1.68)
$Spread_{CHN,0}$		0.0009 (1.42)		0.0052* (1.91)		0.0025 (0.35)
$Spread_{US,0}$		−0.0024*** (−3.55)		−0.0044 (−1.48)		0.0106 (1.40)
$Spread_{HK,0}$		−0.0003 (−0.36)		0.0064* (1.74)		−0.0172* (−1.65)
$\Delta Exchange_0$		2.1330** (2.25)		−2.9534 (−0.78)		22.3451** (2.15)
$China\ index_{t-1}$		−0.0311 (−0.59)		−0.2982 (−1.38)		1.0062* (1.75)
$US\ index_{t-1}$		−0.3179*** (−7.80)		−0.2463 (−1.41)		0.7473* (1.67)
$HK\ index_{t-1}$		−0.2307*** (−3.01)		0.6149** (2.12)		−0.6027 (−0.72)
R^2	0.0143	0.4924	0.0268	0.1081	0.0407	0.1410

This table shows news impact on stock abnormal returns (Cumulative Abnormal Returns) around stock price limit hits. Sample stocks are those cross listed on China's Shanghai/Shenzhen stock exchange (A-share) and Hong Kong stock exchange (H-share). Panel A presents the results for the whole sample, panel B presents the results for stocks that hit upper price limits, and panel C presents the results for stocks that hit lower price limits. $AR_{i,t}$ is market model adjusted stock daily abnormal returns calculated as $r_{i,t} - (\alpha_i + \beta_i \times R_{m,t})$, where $R_{m,t}$ is local market index return for day t, α_i and β_i are the coefficients estimated by the market model. News_Int, News_CHN, News_Corp_1, News_Corp_2, News_Corp_3, News_Corp_4, and News_Corp_5 are news variables[a]. The subscription 0 means the news event happened at the price limit day. $TV_{i,0}$ is the trading volume at price limit hit day, which is measured as the ratio of number of shares traded on day i to number of mean shares traded on day −5 to −3, the 5th day to the 3rd day before the hit day. $Vol_{i,0}$ is the return volatility at price limit hit day which is measured as $(\ln(H_t/L_t))$, where H_t is the high price and L_t is the low price on day t, and *ln* is the natural log operator and standardized based on the mean volatility of day −5 to −3, the 5th day to the 3rd day before the hit day. $Spread_0$ is the interest spread for China (CHN), the U.S. (US) and Hong Kong (HK) at price limit hit day, which is calculated as the difference between the long-term government bond rate and the short term government bond rate. $\Delta Exchange_0$ is the change of exchange rate of Chinese Yuan for each $100 at the price limit hit days. $China\_index_{t-1}$ is the lagged daily return of China stock index, US_index_{t-1} is the lagged daily return of US stock index and HK_index_{t-1} is the lagged daily return for Hong Kong stock index. Day 0 is the day that stocks price hit their price limit, day 1 is the day after the hit, and days 2–5 is the second day to the fifth day after the hit, etc. Stock prices data collected from 1993 to 2011 for A-share listed stocks and from 1999 to 2011 for N-share and H-share listed stocks. *T*-stats are in parentheses. Asterisks (***, **, *) denote that coefficient is significant at 1%, 5%, and 10% respectively.

[a]For detailed information, please check Appendix A.

poses a stronger impact after day 2 especially when price hits upper limits, which indicates a long standing international influence on A-share market. Stock market returns in the U.S., China, and Hong Kong are also significantly correlated with abnormal returns around price limit hits, suggesting the role of the U.S. and Hong Kong as the financial center in the world and in Asia, respectively.

Overall, the international news has short term impact while corporate level news has relatively long term impact. Firm-level control variables such as trading volume and volatility and most macro control variables significantly affect the abnormal returns of A shares.

6. Robustness check

6.1. Time zone difference and exchange rates

As mentioned in Section 2, this study may be subject to some limitations. In this section, we will perform robustness tests regarding the time zone difference and exchange rate changes. First, since the U.S. and China are in different time zones, the open and close times for NYSE and SHSE/SZSE do not overlap.[31] To investigate the possible bias caused by the time zone difference, we conduct a robustness check using close to open prices for N shares to calculate returns. We replicate the tests for Tables 2 and 3, with time zone adjusted N share stock returns.[32] We use the open price of day t and the close price of day $t-1$ to calculate N share stock returns of day t. The findings are consistent with unreported N share results using open-to-close returns and with those from Tables 2 and 3 in that price limit is effective in preventing price continuity, but it cannot prevent volatility spillover. This indicates that the information flow caused by price limit hits from A share stocks to their N share counterparts may mainly happen during the trading hours in Shanghai stock exchange and the afterhours in NYSE. However, this fact does not affect the main arguments in this paper.

International financial markets are also exposed to exchange rate risks. For example, Grammig et al. (2005) find that exchange rate is exogenous with respect to stock prices and is important in influencing stock prices. Gagnon and Karolyi (2010) examine the factors for price differentials of cross-listed stocks after adjusting for exchange rate changes. However, Chinese government implements a very tight exchange rate control and the exchange rates between Chinese RMB and HKD (or USD) have been stable. Nonetheless, to double check the possible error created by exchange rate fluctuation, we covert all H shares and N shares' prices into Chinese RMB and re-do Tables 2 and 3 by using Chinese RMB denominated returns to test price discovery and volatility spillover hypotheses.[33] Again, the results are very similar to those in Tables 2 and 3. The abnormal returns of A shares are significantly higher than those of H shares or N shares on day 0, but lose the momentum on day 1 and after, which indicates that price limit mechanism is more effective in preventing price continuity. Volatility spillover seems to be longer lasting as the volatility of A shares is higher on both day 1 and day 2 than that of H shares and N shares. The results suggest that exchange rates change is not a major concern in our analysis, mainly due to the controlled currency exchange in China.

6.2. Consecutive day limit hit

Some could argue that consecutive day limit hit itself is evidence of ineffectiveness of price limit mechanism as the price continuation goes on into the third day. However, we focus on whether price will continue the momentum and how volatility and trading activity change after the limit hits. In order not to contaminate our sample, we separate the consecutive day limit hits from the single day limit hits and perform the robustness test in this section. The results for the first three hypotheses are shown in Table 7. Day 0 and day 1 are the two days that price limits were hit. Only the mean differences of the

[31] Specifically, NYSE stock exchange is 13 h behind of Shanghai stock exchange under standard time system and 12 h under daylight saving time system. When Shanghai stock exchange starts to trade at 9 a.m. on day t NYSE is at 8 p.m./9 p.m. for day $t-1$ and already closed. When Shanghai stock exchange closes at 3 p.m. on day t NYSE is at 2 a.m./3 a.m. on day t and has not opened. Shanghai stock exchange and Hong Kong stock exchange, however, are in the same time zone.

[32] To save space we do not report the results, but they are available upon request.

[33] Again, to save space we do not report the results, but they are available upon request.

Table 7
Robustness test for consecutive price limit hits.

Days around hit	Mean difference of daily abnormal stock returns		Mean difference of daily volatility		Mean difference of daily trading volume	
	Upper hits ($N = 163$)	Lower hits ($N = 109$)	Upper hits ($N = 163$)	Lower hits ($N = 109$)	Upper hits ($N = 163$)	Lower hits ($N = 109$)
−3	0.0039	−0.0157	0.0533	−0.2401**	0.3113	−2.0811**
−2	0.0046	−0.0404**	0.1577	0.0089	0.2751	−1.6879**
−1	−0.0168	−0.0159*	−0.0037	0.3177**	−0.8867	−1.6566**
0	0.0445***	−0.0531***	−0.2423	0.1197	−0.9339	−1.6934**
1	0.0682***	−0.0577***	−0.1403	0.3106	1.482	−1.7195**
2	0.0091	−0.008	0.5632**	0.6745**	3.5379***	−0.2925
3	−0.0068	−0.0227**	0.2435	0.252	2.5946*	−0.8109**
4	0.0041	0.0103	0.0886	0.3262**	1.8855	−0.0282
5	0.0056	0.0109	0.1739	0.2942**	1.0503	0.2872

This table replicates Tables 2–4 to test the abnormal returns, return volatility and trading volume around price limit hits when consecutive hits happened. The stocks are cross-listed on China's Shanghai/Shenzhen stock exchange (A-share) and Hong Kong stock exchange (H-share). Day 0 is the day that stocks price hits their price limit, day 1 is the second price limit hit day, day 1 is the day before the first price limit hit, day 2 is the day after the second hit, and day 3 is the second days after the second hit, etc. Stock price data collected from 1993 to 2011 for A shares and from 1999 to 2011 for H shares listed stocks. Asterisks (***, **, *) denotes that coefficient is significant at 1%, 5%, and 10%, respectively.[a]
[a]To save space, only the value and significance level of mean differences are reported.

abnormal returns, volatility and trading volume are reported due to space limitation. The abnormal returns in the A share market are not significantly higher than those in the H share market after two days of limit hits. We also find volatility is higher in A shares on day 2 and trading volumes remain higher (lower) in the case of upper (lower) limit hits. These findings are consistent with our findings for single day limit hits in that price limit mechanism is effective to prevent price continuity but not volatility spillover and trading interference in China. Most studies do not exclude the consecutive day limit hits from their samples; however, Kim et al. (2011) do find that results from consecutive day hits are qualitatively similar to those from single day hits.

7. Conclusion

Price limit mechanism is designed to cool down the market and prevent overreaction to news information. However, findings from the literature have been contradictory for different markets. In China's A share market, price limit is found to be somewhat effective (Kim et al., 2011; Chen et al., 2005b; Wong et al., 2009a). This study reexamines the impact of price limit using cross-listed stocks in China, Hong Kong and the U.S. It is different from previous studies in that we compare the abnormal return, volatility and trading volume on the same event dates (price limit hit days) of A shares in China's stock market that impose 10% price limit to those of same companies of H shares listed on Hong Kong Stock Exchange or N shares listed on New York Stock Exchange that do not impose 10% price limit.

We provide four major sets of findings. First, contrary to most studies in the literature, we do not find delayed price discovery in China's stock market, whether in upper limit hit or lower limit hit. Chen et al. (2005b) and Wong et al. (2009a) find similar evidence, but only for lower limit hit. This finding provides some evidence supporting effectiveness of price limits. Second, contrary to prior studies on China but consistent with Kim and Rhee (1997) and most other studies, we find consistent volatility spillover in A share market one day after the limit hits compared to H or N share market. This indicates price limits are not effective in moderating volatility. Third, results on trading volume are mixed. Trading volume remains higher after upper limit hits while it stays lower after lower limit hits, which suggests that price limits only mitigate abnormal trading activity in times of lower limit hits. This same evidence of asymmetric impact from price limits is found in Wong et al. (2009a) using intra-day data and supports imposition of price limits in China. The reasons for the mixed effect from price limit hits in China's stock market may be worth further investigations.

Finally, the news arrival and return volatility are the two most significant causes for the price limit hits. Stocks with news arrival and higher volatility are more likely to hit price limits. Other control variables such as trading volume, lagged returns, term spread and lagged market index returns also show some degree of significance.

The news factors affect the abnormal returns around the price limit hits. While the impact of international news seems short-lived, the impact from corporate-level news is lingering for a few more days. Among the corporate-level news, the capital structure news and the corporate governance news have the most significant and immediate impact, probably due to the reform of equity ownership of state-owned enterprises. The findings are particularly true under upper limit hits, which is consistent with the attention-grabbing theory of Barber and Odean (2008).

This study provides evidence that the price limit mechanism could be effective to some extent, especially for preventing price continuation and mitigating abnormal trading in times of down market, which has policy implications for countries that plan to impose similar mechanisms, especially the emerging markets. However, for developed markets such as the U.S., as more experienced and informed institutional investors take the lead, the findings of this study may not apply. More research from developed markets could be done in the future, but caution needs to be taken as other limitations from this study, such as market-based frictions, could weaken the arguments.

Appendix A. News category

News code	Main category	News sub code	Definition
International News		US Macro Data News: GDP growth, Unemployment rate, Production index, Consumer price index, etc.; US policy news; US Competitors' Actions: New products, Mergers and Acquisitions, Legal filings, etc.; US Analysts' Recommendations; Regional Macro News: Macro News from Hong Kong, Japan, Korea, Taiwan, etc.; Regional countries' policy news; Regional Countries Competitors' Actions;	
Domestic News		China Macro Data News: Economic Indicators (GDP growth, Unemployment rate, Production index, Consumer price index, etc.); China Policy News; China Industry Level News; China Analysts' Recommendations;	
Corporate News	News_Corp_1	Financial Report Release (earnings announcements)	
	News_Corp_2	Merger and Acquisition	
	News_Corp_3	Capital structure news: stock splits; tender offer; open market repurchases; SEOs; etc.	
	News_Corp_4	Corporate Governance News: CEO/Management team change, Shareholders structure change, Board of director elections, etc.	
	News_Corp_5	Other corporate news: new products; research and development expenses increase; etc.	

Appendix B. Chinese companies that are cross listed both in China and Hong Kong or New York

No.	Name	A share code and listing start date	H share code and listing start date	N share code and listing start date
1	ZTE Corporation	000063, 1997-11-18	00763, 2004-12-09	
2	Northeast Electric Development Co., Ltd.	000585, 1995-12-13	00042, 1995-7-6	
3	Jingwei Textile Machinery Co., Ltd.	000666, 1996-12-10	00350, 1996-2-2	
4	Shandong Xinhua Pharmaceutical Co., Ltd.	000756, 1997-08-06	00719, 1996-12-31	

Appendix B *(Continued)*

No.	Name	A share code and listing start date	H share code and listing start date	N share code and listing start date
5	Angang Steel Co., Ltd.	000898, 1997-12-25	00347, 1997-7-24	
6	Hisense Kelon Electrical Holdings Co., Ltd.	000921, 1999-07-13	00921, 1996-7-23	
7	Huaneng Power International, Inc.	600011, 2001-12-06	00902, 1998-3-4	HNP, 1994-10
8	Anhui Expressway Co., Ltd.	600012, 2003-01-07	00995, 1996-11-13	
9	China Shipping Development Co., Ltd.	600026, 2002-05-23	01138, 1994-11-11	
10	Huadian Power International Co., Ltd.	600027, 2005-02-03	01071, 1999-6-30	
11	Sinopec Group	600028, 2001-08-08	00386, 2000-10-19	SNP, 2000-10-18
12	China Southern Airlines Co., Ltd.	600029, 2003-07-25	01055, 1997-7-31	ZNH, 1997-7
13	China Merchant Bank	600036, 2002-04-09	03968, 2006-9-22	
14	China Eastern Airlines Co., Ltd.	600115, 1997-11-05	00670, 1997-6-10	CEA,1997-2
15	Yanzhou Coal Mining Co., Ltd.	600188, 1998-07-01	01171, 1998-04-01	YZC, 1998
16	Guangzhou Pharmaceutical Co., Ltd. Ltd.	600332, 2001-02-06	00874, 1997-10-30	
17	Jiangxi Copper Co., Ltd.	600362, 2002-01-11	00358, 1997-6-12	
18	Jiangsu Expressway Co., Ltd.	600377, 2001-01-16	00177, 1997-6-27	
19	Shenzhen Expressway Co., Ltd.	600548, 2001-12-06	00548, 1997-3-12	
20	Anhui Conch Cement Co., Ltd.	600585, 2002-02-07	00914, 2003-11-12	
21	Tsingtao Brewery Co., Ltd.	600600, 1993-08-27	00168, 1993-7-15	
22	Guangzhou Shipyard International Co., Ltd.	600685, 1993-10-28	00317, 1993-8-6	
23	Sinopec Shanghai Petrochemical Co., Ltd.	600688, 1993-11-08	00338, 1993-7-26	SHI, 1993-7
24	Nanjing Panda Electronics Co., Ltd.	600775, 1996-11-18	00553, 1996-5-2	
25	Shenji Group Kunming Machine Tool Co., Ltd.	600806, 1994-01-03	00300, 1993-12-7	
26	Maanshan Iron and Steel Co., Ltd.	600808, 1994-01-06	00323, 1993-11-3	
27	Beiren Printing Machinery Holdings Ltd.	600860, 1994-05-06	00187, 1993-8-6	
28	Sinopec Yizheng Chemical Fibre Co., Ltd.	600871, 1995-04-11	01033, 1994-3-30	
29	Tianjin Capital Environmental Protection Group Co., Ltd.	600874, 1995-06-30	01065, 1994-5-17	
30	Dongfang Electric Co., Ltd.	600875, 1995-07-04	01072, 1994-6-6	
31	Luoyang Glass Co., Ltd.	600876, 1995-10-31	01108, 1994-7-8	
32	Air China Ltd.	601111, 2006-08-18	00753, 2004-12-15	
33	Guangshen Railway Co., Ltd.	601333, 2006-12-19	00525, 1996-5-14	GSH, 1996-5-13
34	Industrial and Commercial Bank Of China, Ltd.	601398, 2006-10-27	01398, 2006-10-27	
35	Beijing North Star Co., Ltd.	601588, 2006-10-16	00588, 1997-5-14	
36	Bank Of China Ltd.	601988, 2006-07-05	03988, 2006-6-1	
37	Datang International Power Generation Co., Ltd.	601991, 2006-12-20	00991, 1997-3-21	

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