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Relative performance of trading halts and price limits: Evidence from the Spanish Stock Exchange[☆]

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Abstract

We study the relative performance of trading halts and price limits using data from the Spanish Stock Exchange where both mechanisms have coexisted. According to our evidence, trading activity increases after either mechanism is triggered. Volatility stays the same after trading halts but increases after price limit hits. Our evidence also shows that the bid–ask spread is narrower after trading halts but wider after price limit hits. Information is efficiently reflected in stock prices once trading resumes after trading halts, but there is evidence of market overreaction for upper price limits. Our overall result may have important policy implications for financial markets in the world.
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1. Introduction

In semi-strong efficient markets, asset prices reflect all publicly available information, and prices change only in response to relevant new information (Fama, 1970). Therefore, any artificial interruption imposed on the market should have little impact on price movements. However, organized exchanges generally have special rules or procedures that come into play in connection with events that result in, or are likely to result in, large changes in asset prices. Following the 1987 market crash, the level of interest in procedures to limit large or sudden changes in prices has increased. The Brady Report (1988) suggests that circuit breaker mechanisms, such as trading halts and price limits, should be

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imposed to protect the market system. It appears that stock exchanges in the United States prefer trading halts to price limits.[1]

The NYSE has imposed both market-wide trading halts and individual news or order-imbalance trading halts. News-related trading halts also exist at the NASDAQ. Unlike those stock exchanges, the U.S. futures markets seem to favor price limits. Many countries in Europe and Asia also impose price limits on their stock markets.[2]

Although trading halts and price limits are both circuit breakers, they differ in several ways.[3] First, by definition, trading halts represent a temporary interruption in the trading of an individual asset on an exchange to disseminate information, whereas price limits are boundaries set by market regulators to confine the daily movements of security prices within a predetermined range to mitigate excessive price volatility. Therefore, trading halts indicate a complete cessation of trading activity, whereas in the case of price limits, trading is still permissible as long as it remains within the preset trading range. Second, trading halts do not include limitations on price movements. Once trading resumes after a trading halt, the price is determined solely by the market. Third, trading halts are not mechanically or predictably imposed but rather are subjectively imposed in certain circumstances by exchange officials or supervising authorities. That is, trading halts are called at the discretion of officials. In contrast, the activation of price limits depends solely on the price movements. Price limits are therefore easier for investors to observe and predict than are trading halts.

Despite the differences between trading halts and price limits, we believe that they could be viewed as trying to achieve either directly or indirectly the same objective, which is to reduce information asymmetry. Problems associated with asymmetric information include excessive price volatility (Spiegel & Subrahmanyam, 2000), unwarranted trading uncertainty (Greenwald & Stein, 1991), and transactional risk (Kodres & O'Brien, 1994). The activation of circuit breakers attempts to provide investors with more time to evaluate new information and make rational decisions. In the case of trading halts, trading is suspended so investors are forced to cool off and obtain and digest new information. Although price limits allow investors to continue trading at the limit price, they also give investors the option of choosing not to trade. In the latter case, the effect is similar to trading halts because during the cooling-off period, investors can reevaluate the market information. On the basis of this cooling-off argument, regulators expect that trading halts and price limits cause stock prices to become more informative, reduce uncertainty, and protect uninformed investors from excessive price movements.

In previous literature, trading halts and price limits have been either treated equally (e.g., Kyle, 1988) or studied separately (e.g., see Christie, Corwin, & Harris, 2002; Corwin & Lipson, 2000; Edelen & Gervais, 2003; Lee, Ready, & Seguin, 1994; Schwartz, 1982 for trading halts and Bildik & Gülay, 2006; Brennan, 1986; Kim & Rhee, 1997; Kodres & O'Brien, 1994 for price limits).[4] Although Telser (1981) informally argues that rule-based price limits are superior to discretionary trading halts because they are more predictable, no theoretical model has been developed, nor any empirical test performed, to support that argument. To the best of our knowledge, only two studies formally compare trading halts with price limits. Subrahmanyam (1995) theoretically analyzes the relative desirability of discretionary and rule-based procedures and argues that discretionary closures enable exchange regulators to consider more information (e.g., market liquidity, volatility) in the closure decision than just the size of the price movement, which makes them more effective than price-triggered closures. Therefore, according to Subrahmanyam (1995), discretionary trading halts should be more effective than rule-based price limits. Coursey and Dyl (1990) conduct an experimental study to compare the market's adjustment to significant new information in the presence of price limits or trading halts. Their findings seem to indicate that the adjustment of asset prices to new information is more effective in markets with price limits than in those with trading halts, in contrast with Subrahmanyam's (1995) argument. We attempt, for the first time to our knowledge, to provide empirical evidence for the relative performance of trading halts and price limits.

The Continuous Spanish Stock Market, or SIBE,[5] provides a natural setting to study the performance of trading halts and price limits because both mechanisms had been used in this market prior to May 2001. The supervisory committee of the SIBE has the authority to halt trading on any individual stock, similar to NASDAQ trading halts, in that they are mainly imposed to force information disclosure to eliminate asymmetric information or await a pending

[1] Besides the U.S., stock exchanges in Australia, Canada, Germany, Hong Kong, Israel, the United Kingdom, etc. also choose trading halts rather than price limits.

[2] Examples of countries with price limits include Austria, Belgium, France, Greece, Italy, Netherlands, Spain, Switzerland, and Turkey in Europe and China, Japan, Korea, Malaysia, Taiwan, and Thailand in Asia.

[3] We focus on individual trading halts. For details on market-wide circuit breakers imposed on the NYSE, see Goldstein and Kavajecz (2004).

[4] For a comprehensive review of trading halt and price limit studies, see Kim and Yang (2004).

[5] In Spanish, SIBE stands for Sistema de Interconexión Bursátil Español, or the Spanish Stock Exchange Interconnection System.

announcement by a listed firm. During our study period from January 1998 to April 2001, the SIBE also set a daily maximum price fluctuation of 15% from the previous day's closing price. Although reasons for hitting price limits are not officially determined, they often relate to news or announcements about the listed firms. Therefore, both discretionary trading halts and rule-based price limits are associated with essentially the same market conditions and have the same objectives: to eliminate unwarranted asymmetric information and uncertainty about an individual stock value.

In the spirit of Subrahmanyam (1995), we hypothesize that trading halts are more effective than price limits because exchange officials incorporate relevant information into the trading halt decision and can ask companies to provide relevant information. For the purpose of this paper, we call this the "discretion hypothesis". We investigate the pattern of trading activity, liquidity, and volatility, as well as the speed of price discovery, in the period surrounding trading halts and price limit hits and then compare the performance of these two circuit-breaking mechanisms. Because trade-to-trade movements are essential for conducting microstructure studies, we examine transaction data from the SIBE.

Our results show that trading activity increases after trading halts and price limit hits. Volatility stays at the same level after trading halts but increases after price limit hits. We also show that the bid–ask spread is narrower after trading halts but wider after price limit hits. Our spread decomposition analysis suggests that the change in spreads is likely attributed to the changes in the fixed component of trading costs. For price discovery, information is efficiently reflected in stock prices when trading resumes after trading halts, but market overreaction may occur after upper price limit hits. Overall, the results support our discretion hypothesis.

Although our results are based on a market where both trading halts and price limits are present, we believe that our results are relevant to markets with either trading halts or price limits. First, in an effort to remove any potential contamination to our sample, we exclude observations whose price limits are reached and trading is halted concurrently. Second, our daily analysis of market quality shows that the individual results of trading halts and price limits are consistent with the findings from the existing trading halt and price limit literature. That is, the coexistence of trading halts and price limits does not seem to generate different behaviors of market participants than what have been observed in other markets. Third, the fact that firms with trading halts are larger on average than those with price limits is consistent with Kim and Limpaphayom's (2000) finding that small market capitalization stocks hit price limits more often and Bhattacharya and Spiegel's (1998) finding that larger capitalization stocks are suspended more often on the NYSE. Thus, the coexistence of trading halts and price limits does not seem to alter firm characteristics of trading halt and price limit firms.

However, the interpretation of our results needs to be cautious. The support of the discretion hypothesis seems to indicate that trading halts are more desirable than price limits, but we have no intention, nor are we able, to make that argument because of the following reasons. First, trading halts and price limits are two different mechanisms with possibly different immediate objectives. Exchanges may use trading halts to disseminate new information while using price limits to restrict daily price movements. In this sense, both mechanisms have achieved their goals. Second, the occurrence of a trading halt or the hitting of a price limit is an endogenous event that itself might have caused our results. Although the reasons for trading halts are available, we do not always know the cause of a price limit hit and thus unable to adjust for the potential endogeneity problem. Lastly, with price limits already imposed, the officials in the Spanish market could use trading halts more efficiently at their discretion. For example, they can treat price limits as a safety net and halt trading only if price limits are not useful or trading halts will resolve issues quickly. This opportunity does not exist in markets with only trading halts. Nevertheless, our results represent the first empirical evidence for the relative performance of trading halts and price limits.

The remainder of the paper is organized as follows: the next section describes the institutional background of the SIBE. Section 3 outlines the hypothesis and presents our research methodology, followed by data selection and sample descriptions in Section 4. Section 5 provides empirical results of various tests of trading halts and price limits, as well as comparisons of them, and Section 6 provides a conclusion.

2. Institutional background

According to the annual report on the securities market of the Comisión Nacional del Mercado de Valores (CNMV), at the end of 2000, there were 155 companies listed on the SIBE. The SIBE has experienced significant growth and, with a trading volume of $454.6 billion, became the fourth most active market in the European Union and the seventh worldwide in 2000.

The SIBE, managed by the Sociedad de Bolsas (SB), is an order-driven market with automatic dissemination of real-time trading information. Unlike U.S. markets, the SIBE does not include market makers. Orders submitted from electronic terminals are routed to the centralized limit order book. All orders are managed according to a strict price–time priority. The opening price is determined by an opening auction, followed by continuous trading. The closing price used to be the trading price of the last 500 traded shares closest to the share-weighted average price of those 500 shares, but a closing auction has been in place since June 2000.

There are two categories of security-specific trading halts in SIBE: CNMV-initiated suspensions that are related to news and SB-initiated suspensions that are initiated after price limits are hit. The CNMV, the Spanish version of the SEC, is responsible for the regulation, supervision, and inspection of the stock market and the related activities of all individuals and legal entities. Although the rules of suspension use broad, vague terms, the CNMV is authorized to suspend trading on any stock in the SIBE for any duration it deems necessary. A trading suspension remains in force until authorities believe that new information related to the security has been released or that the circumstances provoking the suspension no longer exist. Trading is reopened with a call auction similar to that used at openings in the morning. The CNMV is also obligated to suspend trading when it receives a tender offer. The trading of shares affected by tender offers is suspended from the time the application of authorization is presented at the CNMV until the conditions of the tender offer become public. The objective of this regulation is to ensure that sufficient information is available for investors to make rational, informed decisions and reduce information asymmetry among market participants.

Between November 1999 and May 2001, trading could also be interrupted by a trading halt called by the SB. When stock prices hit limits, the SB, after studying several characteristics of a stock (including liquidity, volatility, accumulated volume, number of orders, and the existence of any significant events), could suspend trading and decide whether to widen the price limits of that particular stock.

The SIBE sets daily upper and lower price limits at a predetermined rate on the basis of the previous day's closing price. Stocks that hit their price limits were still allowed to trade as long as the transaction prices were within the limits. In a case when the price hits the limit and no other trades occurred for the rest of the day, trading resumes the following day with a normal opening call auction and with new price limits in place. The price limits are considered boundaries, not triggers for trading halts, except when the SB decides to widen the boundaries. In that case, trading is halted until a decision is made. During our study period, the daily maximum price fluctuation limit was 15% (25% for stocks in *Nuevo Mercado*).[6] Tick sizes vary with market prices. In January 1999, the tick size changed to reflect the adoption of the euro as the currency for trading stocks.[7]

3. Discretion hypothesis and methodology

To date, the effectiveness of trading halts and price limits remains a subject of regulatory and academic debate. Because there is no way to know what would have happened without the circuit breakers, it is extremely difficult to examine their effectiveness empirically. Rather than test the absolute effectiveness of the circuit breakers, we study their relative performance.

We examine the trading activity, liquidity, volatility, price discovery, and efficiency of trading halts and price limits using the discretion hypothesis, in line with Subrahmanyam's (1995) work. Our hypothesis states that trading halts enable policymakers to bring more information (e.g., market liquidity and volatility) into the system at their discretion, whereas price limits depend solely on the size of the price movement. More important, during trading halts, firms are required to release information related to the cause of the halt, which reduces the degree of information asymmetry among market participants. No such requirement exists for price limits. Therefore, prices become more informative after trading halts, and investors are consequently more willing to provide liquidity to the market. Thus, the discretion

[6] On May 14, 2001, this price limit system was replaced. Under the new system, each stock is assigned two fluctuation ranges-static and dynamic—which are calculated on the basis of its historical volatility. Any variation in prices beyond the limits, whether with respect to the latest auction (static price) or the price of the previous trade (dynamic price), will automatically trigger a five-minute volatility auction that randomly terminates in a 30-second period. This change is a response to the latest requirements in financial markets and the harmonization of trading systems in Europe. The *Nuevo Mercado* encompasses technological stocks with strong growth potential.

[7] Before January 1, 1999, stocks were quoted in pesetas and tick sizes were: 1 peseta for stocks under 1000 pesetas, 5 pesetas for stocks between 1000 pesetas and 5000 pesetas, and 10 pesetas for stocks 5000 pesetas and above. Since then, stocks have been quoted in euros and tick sizes are: €0.01 for stocks below €50 and €0.05 for stocks €50 and above.

hypothesis implies that trading halts are more effective than price limits in improving liquidity and decreasing information asymmetry, which in turn will assist price discovery and reduce volatility.

3.1. Analysis of market quality

We begin our analysis by obtaining the values of trading activity, liquidity, and volatility for a period starting 10 days prior to a trading halt or price limit hit and ending 10 days after the event. In this analysis, the pre-event period is denoted by days −10 to −1, the event day is marked 0, and the post-event period covers days marked +1 to +10. To examine the relative performance of trading halts and price limits, we perform two kinds of analyses. First, in our day-by-day analysis, we focus on the days surrounding the event day. Second, we examine the changes in means and medians from the pre-event period to the post-event period. Specifically, for each firm, we calculate the mean daily values in the pre- and post-event periods separately and then obtain cross-sectional means and medians. These two analyses provide direct evidence about the relative performance of the trading halts and price limits.

For their impact on trading activity, we examine three measures: trading frequency, trading volume, and euro volume. Trading frequency is the number of trades executed each day for each firm; trading volume represents the number of shares traded each day for each firm; and euro volume is the total euro value traded each day for each firm.

As for liquidity measures, the concept of stock liquidity has been defined in terms of spreads and depths. Bid–ask spreads reflect the cost of transactions in the market. We calculate the quoted spread (QS) and relative quoted spread (RQS) as follows:

$$\mathrm{QS}_{it} = A_{it} - B_{it}, \tag{1}$$

$$\mathrm{RQS}_{it} = (A_{it} - B_{it})/M_{it}, \tag{2}$$

where A_{it} is the ask quote prevailing immediately before the trade at time t, B_{it} is the bid quote prevailing immediately before the trade at time t, and M_{it} is the bid–ask midpoint. We also estimate the effective spread (ES) and relative effective spread (RES) as follows:

$$\mathrm{ES}_{it} = 2|P_{it} - M_{it}|, \tag{3}$$

$$\mathrm{RES}_{it} = 2|P_{it} - M_{it}|/M_{it}, \tag{4}$$

where P_{it} is the transaction price for security i at time t. We then obtain the mean of all the spreads on a given day to come up with a daily spread measure. The ES can differ from the QS if transactions are executed at prices above the ask price or below the bid price. In the Spanish market, transactions cannot be closed inside the quotes, so the ES is always equal to or greater than the QS. However, measures of depth reflect the ability to trade at the prevailing bid and ask quotes. We therefore calculate depth in terms of the number of shares and the value in euros available at the prevailing bid and ask prices.

To examine changes in volatility, and to gain robustness, we consider four volatility measures: daytime volatility (DV), high-low (HL), standard deviation of trade price (SDTP), and standard deviation of midpoint (SDMP). The DV is the square of the daytime return (the natural logarithm of the ratio between the midpoint of the last quote of the day and the midpoint of the first quote of the day), whereas HL is the natural logarithm of the ratio of the highest midpoint to the lowest midpoint on each day. SDTP is the standard deviation of the transaction prices on each day, and SDMP is the standard deviation of the midpoints on each day.

To gain more insight into the performance of trading halts and price limits, we further divide both mechanisms into two subsamples. For trading halts, we identify good- and bad-news trading halts. If the first trade after a halt is a buy, we consider the trading halt good news. If the first trade following a halt is a sell, however, the trading halt is related to bad news (see also Kryzanowski & Nemiroff, 1998, 2001). For price limits, we identify both upper and lower limit hits. Upper price limit hits occur when the price hits the upper limit; lower price limit hits occur when the price hits the lower limit.

3.2. Price discovery and efficiency

To analyze the efficiency of the price discovery around both trading halts and price limit hits, we implement two different analyses. First, we examine the stock price movement immediately subsequent to the event day. Second, we apply the traditional event-study methodology to examine the abnormal return around trading halts and price limit hits.

We apply Kim and Rhee's (1997) methodology to analyze the immediate stock price movement after trading halts and price limit hits. Although they study only the effects of upper and lower price limits, we apply their procedure for both price limits and trading halts and assimilate upper (lower) price limit hits with good (bad) news-related trading halts. The daytime return (R_t^{d}) represents the open-to-close return, as measured by $\ell n(P_t^{\mathrm{c}}/P_t^{\mathrm{o}})$, and the overnight return (R_t^{n}) represents the close-to-open return, as measured by $\ell n(P_{t+1}^{o}/P_t^{c})$, where P^{c} and P^{o} denote closing and opening prices, respectively, and t represents the event day. Stock returns can be positive (+), negative (−), or zero (0), which provides nine possible returns series. For upper price limit hits and good-news halts, we classify the set of $\{[R_t^{\mathrm{d}}, R_t^{\mathrm{n}}] | [+,+],[0,+]\}$ as price continuation, the set of $\{[R_t^{\mathrm{d}}, R_t^{\mathrm{n}}] | [+,0],[0,0]\}$ as no change, and all others as price reversals. For lower price limit hits and bad-news halts, we classify the set of $\{[R_t^{\mathrm{d}}, R_t^{\mathrm{n}}] | [-,-],[0,-]\}$ as price continuation, the set of $\{[R_t^{\mathrm{d}}, R_t^{\mathrm{n}}] | [-,0],[0,0]\}$ as no change, and all others as price reversals. More price continuations imply that the price discovery process is delayed to a higher degree and that the halting mechanism has prevented prices from reaching their equilibrium levels efficiently.

We also examine how effective the trading halts and price limits are in conveying new information by investigating the stock return behavior around the event day using event-study methodology. In this analysis, we use the daily individual stock returns and daily returns of a value-weighted market index for the 35 most liquid stocks listed on the SIBE (IBEX35). Returns are measured by logarithmic price differences adjusted for cash dividends, stock splits, and rights issues. Excess returns are calculated for the entire study period (±10 trading days around the event date) using the market-adjusted returns model. We define the abnormal return of firm i on day t (AR_{it}) as:

$$\mathrm{AR}_{it} = R_{it} - R_{mt}, \tag{5}$$

where R_{it} is the observed return for security i, and R_{mt} is the return of the IBEX35 index on day t. Although alternative methods have been used to detect abnormal returns, including the market model and the mean-adjusted returns model, we choose the market-adjusted returns for the following reasons: First, for our study, it is difficult to apply the market or mean-adjusted returns models because the estimation period needed to generate expected or normal returns may be contaminated by other trading halts or price limit hits. Second, as Brown and Warner (1985) and Dyckman, Philbrick, and Stephan (1984) show, the abilities of the three models to detect the presence of abnormal performance are similar for non-clustered daily returns data.

The daily average abnormal return (AAR_t) for a given day t across n events is defined as:

$$\mathrm{AAR}_t = \frac{1}{n}\sum_{i=1}^{n} \mathrm{AR}_{i,t}. \tag{6}$$

Using the event window [−10, +10], we compute the cumulative average abnormal return (CAAR) from a set of windows embedded in the event window. The CAAR in the window (T_1, T_2) ($\mathrm{CAAR}_{(T_1,T2)}$) is as follows:

$$\mathrm{CAAR}_{(T_1,T_2)} = \sum_{t=T_1}^{T_2} \mathrm{AAR}_t. \tag{7}$$

We perform both parametric t-tests and non-parametric Wilcoxon signed rank tests to determine the statistical significance of the abnormal returns.

Because we assume that trading halts and price limit hits are associated with the arrival of new information, we examine the market adjustment process before, during, and after the events. If both control mechanisms are effective, we should find no abnormal returns on days prior to or after trading halts or price limit hits.

4. Data selection and sample description

In this study, we use trade and quote data supplied by the SB, which include trading volume, trading price, transaction time, and the best quotes at the bid and offer side of the limit order book, as well as their depths immediately

Table 1
Summary statistics

Panel A: Trading halts

	All	Good-news	Bad-news
Number of observations	66	49	17
Halt time of day			
Delayed openings	47	37	10
Intraday halts	19	12	7
Resolution of halts			
Same trading day	45	32	13
Next day's open	21	17	4
Reasons for halts			
By release of information	58	43	15
By presentation of tender offers	8	6	2
Mean (median) of halt duration in hours	4.76 (5.26)	5.19 (5.78)	3.54 (2.76)

Panel B: Price limit hits

	All	Upper	Lower
Number of observations	160	106	53
Hit time of day			
Opening hit	10	5	5
Intraday hit	78	38	39
Intraday close	37	33	4
Closing hit	30	27	3
All day hit	5	3	2

Panel A subdivides trading halts according to their suspension time, resolution time and reasons. Intraday halts are initiated during the trading session, whereas delayed openings are initiated prior to the opening. To measure the halt duration, we consider only trading hours. For halts that are not resolved by the end of the trading day, duration excludes the non-trading period between closing on the halt day and opening on the following day. The sample includes the 66 trading halts called by the CNMV between January 1998 and April 2001. If the first trade following a halt is a buy (sell), the trading halt is related to good (bad) news. Panel B reports the price limit hits by the hit time of day. Opening hit refers to price limit hits happened at the opening; Intraday hit includes price limit hits that occurred during the continuous trading session; Intraday close refers to intraday hit that followed by closing hit; Closing hit refers to price limit hits that happened at the closing; All day hit refers to price limit hits that happened from the opening to the closing. In one case, both upper and lower price limit hits are identified on the same day, so the sum of upper and lower price limit hits is 159, not 160.

prior to each trade. We examine trading halts and price limit hits occurring between January 1, 1998, and April 30, 2001. Our main focus is those stocks traded in the Main trading market of the SIBE, so stocks listed on Nuevo Mercado and Latibex are excluded. To avoid problems and bias that might arise from different trading systems, we do not consider shares traded in the fixing system.[8] Moreover, because stocks in the fixing system are, by definition, less liquid, we eliminate the problem of thin trading.

The sample of trading halts is drawn from the register of relevant events of the CNMV.[9] The initial sample consisted of 115 trading halts corresponding to 67 firms. To make a valid comparison, we excluded halts for which trading was not resumed prior to the opening of the following trading day, because our price limit sample contains only single-day price limit hits. Thereby, we eliminated 31 observations. To avoid possible contaminant effects, we excluded 7 trading halts that followed price limit hits on the same or following day, as well as 1 special trading halt that occurred because the SB widened the usual price limits when trading resumed. Finally, we excluded trading halts that occurred within 10 trading days after the previous trading halt for the same firm to avoid overlapping data in our 21-day window (−10 to +10) analysis. The final sample therefore consists of 66 trading halts that correspond to 48 firms.

In Panel A of Table 1, we subdivide these trading halts according to their suspension time, resolution time, and reasons. On the basis of the initiation time of each trading halt, we differentiate two types: intraday halts and delayed

[8] *Latibex* encompasses Latin American stocks listed on the SIBE. The fixing system is reserved for less liquid shares. In the fixing modality, purchases and sales are grouped together twice during a trading session that consists of two auctions.
[9] That is, we do not consider permanent suspensions by delisting.

openings. The former is initiated during the trading session, whereas the latter is initiated prior to the opening. The sample includes 47 delayed openings and 19 intraday halts. The resumption time represents the time stamp associated with the first trade after each trading halt. If the CNMV reported the resumption of the trading after the closing of the trading session, we consider the resumption time as the opening on the following day. In the sample, 45 trading halts resumed on the same trading day, and 21 resumed at the next day's open. With regard to the reasons for trading halts, the most frequent cause, at 58 occurrences, was the release of price-sensitive information, which usually involved disclosures of significant events related to possible takeovers and mergers. In addition, 8 temporary suspensions were triggered by the presentation of tender offers at the CNMV. To measure the halt duration, we consider only trading hours. For halts that were not resolved by the end of the trading day, duration excludes the non-trading period between closing on the halt day and opening on the following day. The mean (median) duration of trading halts is 4.76 (5.26) hours.

Among the 66 trading halts, 49 are good-news, and 17 are bad-news halts. As shown in Panel A of Table 1, on average, the duration of good-news halts (mean 5.19, median 5.78 h) is longer than that of bad-news halts (mean 3.54, median 2.76). This difference seems to suggest that firms are eager to provide information to clarify unfavorable rumors and thereby resolve bad-news halts within a shorter period of time.

Unlike trading halts, price limit observations are not recorded or reported by the CNMV. We identify price limit hits using our transaction data, the 15% price limits, and tick sizes. An upper limit is reached for a stock when

$$H_t = P^c_{t-1} + \mathrm{LT}_t. \tag{8}$$

Similarly, a lower limit is reached for a stock when

$$L_t = P^c_{t-1} + \mathrm{LT}_t, \tag{9}$$

where H_t represents the highest price on day t, L_t represents the lowest price on day t, $P^c_{t\text{-}1}$ is the previous day's closing price, and LT_t is 15% of P^c_{t-1} adjusted for tick sizes. With tick sizes, the actual price limits are usually slightly less than 15%.

Table 2
Firm characteristics

Firm characteristics	Trading halts	Price limit hits	t-test (p-value)	Z (p-value)
Market capitalization (in millions of euros)				
Mean	5406.93	1489.11	2.69	6.45
Median	994.87	157.37	(0.01)	(0.00)
Stock price (in euros)				
Mean	20.67	15.88	1.54	3.32
Median	14.06	9.40	(0.12)	(0.00)
Daily euro volume (in thousands of euros)				
Mean	18,046.66	4289.48	3.10	5.37
Median	2970.59	561.90	(0.00)	(0.00)
Beta				
Mean	0.653	0.616	0.60	1.10
Median	0.665	0.524	(0.55)	(0.27)
Residual risk				
Mean	0.022	0.025	−0.79	−2.61
Median	0.018	0.021	(0.43)	(0.00)
Total risk				
Mean	0.025	0.027	−0.55	−1.70
Median	0.020	0.024	(0.58)	(0.09)

This table reports some characteristics of the sample trading halt and price limit firms. Market capitalization (in millions of euros) is based on the ending value of the firm's stock in the year prior to that in which trading halts or price limit hits occurred. Stock price (in euros) is the prior year's closing price. Daily euro volume is the average daily trading volume in thousands of euros in the year prior to the studied year. Beta is estimated from the standard market model using daily stock and IBEX35 returns in the year prior to the year in which the events occurred. Residual risk is the standard deviation of the residuals from the market model. Total risk is the standard deviation of the daily stock returns in the year prior to the year in which trading halts or price limit hits occurred. The daily stock returns are calculated as $\ell n(P^c_t/P^c_{t-1})$, where P^c is the closing price adjusted for dividends, stock splits, and rights offerings. The t-test is used to test the differences in means, whereas the Man–Whitney test is used to determine the difference in medians between the trading halt and price limit samples. p-values are reported in parenthesis.

Table 3
Three-day average analysis of market quality around trading halts and price limit hits

	Mean		Median		Mean		Median	
	Before	After	Before	After	Before	After	Before	After
Panel A: All trading halts and price limit hits								
	Trading halts N=66				Price limit hits N=160			
Frequency	1.406	2.950^{x}	1.216	1.948^{x}	1.397	2.391^{x}	1.201	1.894^{x}
Volume	1.655	3.533^{x}	1.134	2.183^{x}	1.666	2.739^{x}	1.095	1.997^{x}
Euro volume	1.724	4.269^{x}	1.154	2.250^{x}	1.649	2.809^{x}	1.078	1.907^{x}
RQS	0.493	0.396^{b}	0.402	0.326^{a}	1.127	1.276^{x}	0.873	0.914^{x}
RES	0.538	0.434^{b}	0.450	0.358^{a}	1.223	1.399^{x}	0.931	1.043^{x}
Depth €	1.079	5.100	0.970	1.203^{x}	1.108	1.001	0.944	0.919
HL	0.030	0.034	0.026	0.031	0.041	0.061^{x}	0.036	0.051^{x}
SDMP	0.149	0.154	0.096	0.128	0.145	0.202^{x}	0.081	0.111^{x}
Panel B: Good- and bad-news trading halts								
	Good news N=49				Bad news N=17			
Frequency	1.426	3.423^{x}	1.250	2.170^{x}	1.348	1.583	1.189	1.267
Volume	1.797	4.096^{x}	1.332	2.720^{x}	1.245	1.910^{y}	0.905	1.267^{y}
Euro volume	1.880	5.072^{x}	1.350	3.027^{x}	1.275	1.953^{y}	0.934	1.292^{y}
RQS	0.535	0.423^{b}	0.442	0.333^{a}	0.371	0.317	0.231	0.230
RES	0.584	0.465^{b}	0.464	0.368^{a}	0.408	0.342	0.259	0.251
Depth €	1.120	6.492	0.965	1.330^{x}	0.963	1.085	0.976	1.150
HL	0.030	0.036^{y}	0.026	0.033	0.031	0.027	0.028	0.026
SDMP	0.157	0.171	0.096	0.132	0.125	0.104	0.099	0.079
Panel C: Upper and lower price limit hits								
	Upper N=106				Lower N=53			
Frequency	1.422	2.577^{x}	1.215	2.158^{x}	1.349	2.051^{y}	1.049	1.556^{x}
Volume	1.472	2.606^{x}	1.129	2.153^{x}	2.058	3.040	0.991	1.895^{x}
Euro volume	1.471	1.535^{x}	1.154	2.355^{x}	2.009	2.553	1.000	1.586^{x}
RQS	1.092	1.113	0.805	0.823	1.208	1.609^{x}	1.015	1.175^{x}
RES	1.191	1.237	0.878	0.943	1.298	1.731^{x}	1.149	1.214^{x}
Depth €	1.090	1.042	0.952	1.009	1.135	0.993	0.867	0.799 b
HL	0.041	0.061^{x}	0.037	0.056^{x}	0.042	0.064^{x}	0.035	0.049^{x}
SDMP	0.122	0.195^{x}	0.063	0.107^{x}	0.191	0.215	0.101	0.130

This table reports the means and medians of the cross-sectional 3-day average trading activity and liquidity prior to (Before) and following (After) trading halts and price limit hits. Panel A presents the results from full samples of trading halts and price limit hits. Panel B shows the results for good- and bad-news trading halts. Panel C reports the results from upper and lower price limit samples. The measures of trading activity are: Frequency (number of trades executed each day); Volume (number of shares traded each day); Euro volume (trading volume in euros). Each daily figure is scaled by the 7-day (−10 to −4) average. The liquidity measures are: RQS (the quoted bid–ask spread divided by the bid–ask midpoint, where quoted bid–ask spread is the difference between ask quote and bid quote); RES (effective spread divided by the bid–ask midpoint, where effective spread is twice the absolute value of the difference between trade price and the bid–ask midpoint). Both RQS and RES are reported in percentage; Depth € is the sum of euro value of the shares available at the bid and ask quotes scaled by their 7-day (−10 to −4) average. The volatility measures are: HL (the natural logarithm of the ratio of the highest bid–ask midpoint to the lowest bid–ask midpoint); SDMP (the standard deviation of all bid–ask midpoints). The t-test and the Wilcoxon signed rank test are used to determine the significance levels for means and medians, respectively.
Notes: Superscripts indicate that After is significantly less than Before at the ^{a}1% and ^{b}5% levels or that After is significantly higher than Before at the ^{x}1% and ^{y}5% levels.

After all transactions were verified, our initial sample includes 342 price limit hits that correspond to 92 different firms. In our sample, each day on which a limit is reached is treated as an independent observation. We apply several filters to this initial sample. First, we eliminate 28 observations because the SB widened the boundaries after the price limits were hit. Second, to avoid possible contaminant effects, we exclude 17 price limit hits that occurred on the same, the previous, or the subsequent day that CNMV called a trading halt. Third, we eliminate 5 price limit hits associated with initial public offerings or delisting. Fourth, we exclude those observations that occurred within 10 trading days of the previous price limit hits to enable our 21-day window analysis. Thus, price limit hits that occur on consecutive trading days are eliminated. The final sample therefore comprises 160 events that correspond to 76 firms. Of those events, 53 observations are lower, and 106 are upper price limit hits. In one case, both lower and upper price limit hits are identified on the same day.

We report the price limit hits by the hit time of day in Panel B of Table 1. Opening hit refers to price limit hits that happened at the opening; Intraday hit includes price limit hits that occurred during the continuous trading session; Intraday close refers to intraday hit that followed by closing hit; Closing hit refers to price limit hits that happened at the closing; All day hit refers to price limit hits that happened from the opening to the closing. The majority of the price limit hits are intraday hits, indicating they are resolved on the same day. Closing hits and intraday closes, where price limits are not resolved on the event day, are primarily upper limit hits, so it is important to perform separate analyses for upper and lower price limit hits.

In Table 2, we report some characteristics of the firms subjected to trading halts and price limit hits, including market capitalization, stock price, euro volume, beta, residual risk, and total risk. Market capitalization (in millions of euros) is based on the ending value of the firm's stock in the year prior to that in which trading halts or price limit hits occurred. Stock price (in euros) is the prior year's closing price. Daily euro volume is the average daily trading volume in thousands of euros in the year prior to the studied year. Beta is estimated from the standard market model using daily stock and IBEX35 returns in the year prior to the year in which the events occurred. Residual risk is the standard deviation of the residuals from the market model. Finally, total risk is the standard deviation of the daily stock returns in the year prior to the year in which trading halts or price limit hits occurred. The daily stock returns are calculated as ℓn (P_t^c/P_{t-1}^c), where P^c is the closing price adjusted for dividends, stock splits, and rights offerings.

In terms of market capitalization, firms that suffer a trading halt are larger on average than those with a price limit hit, consistent with Kim and Limpaphayom's (2000) finding that small market capitalization stocks hit price limits more often and Bhattacharya and Spiegel's (1998) finding that larger capitalization stocks are suspended more often on the NYSE. Stock prices are higher for trading halt firms than for price limit firms, but the difference in means is not significant. On average, trading halt firms are more active, on the basis of the daily euro volume. For the average firm risk in terms of beta, residual risk, and total risk, we do not observe any significant difference between the trading halt and price limit samples, except that the median residual risk is higher for price limit firms than for trading halt firms. The fact that the average beta in our sample is less than one does not mean less risky firms hit price limits and are halted more often than others. Firms in our sample are indeed volatile, as evident from the high total risk, but the beta captures only a small fraction of the risk, as evident from the high residual risk, partly due to the fact that our market index includes only 35 stocks.

5. Empirical results

5.1. Market quality

Our market quality analysis, which covers the [−10,+10] event window, provides insight into the effect of trading halts and price limits on trading activity, liquidity, and volatility. We report the results of the Pre-event vs. Post-event analysis in Table 3 and plot the results of our daily analysis in Figs. 1, 2, and 3. In Table 3, we report the means and medians of the cross-sectional three-day average of market quality measures prior to and following trading halts and price limit hits. By excluding the event day, because by definition trading is constrained on that day, this analysis avoids the bias inherent in measures of market quality. For the robustness check, we also perform both five- and ten-day average analyses and find results similar to those for the three-day average analysis.[10] Hence, our results hold even when we extend our analyses to 10 days after the event day.

As we show in Panel A of Table 3, the results from the full samples indicate that frequency, volume, and euro volume are significantly higher after trading halts and price limit hits. This significant increase in trading activity may occur because trading halts and price limits constrain investors from trading until trading resumes or new price limits are established on the following day(s). Therefore, after trading halts and price limit hits, trading activity is abnormally high. The intensified trading activity following trading halts and price limit hits is consistent with Lee et al. (1994) and Kim and Rhee (1997), respectively. Our daily analysis shows that, we show that the increase in trading activity is transitory (Panel A of Fig. 1).

[10] Results are not reported due to space limitations, but they are available on request.

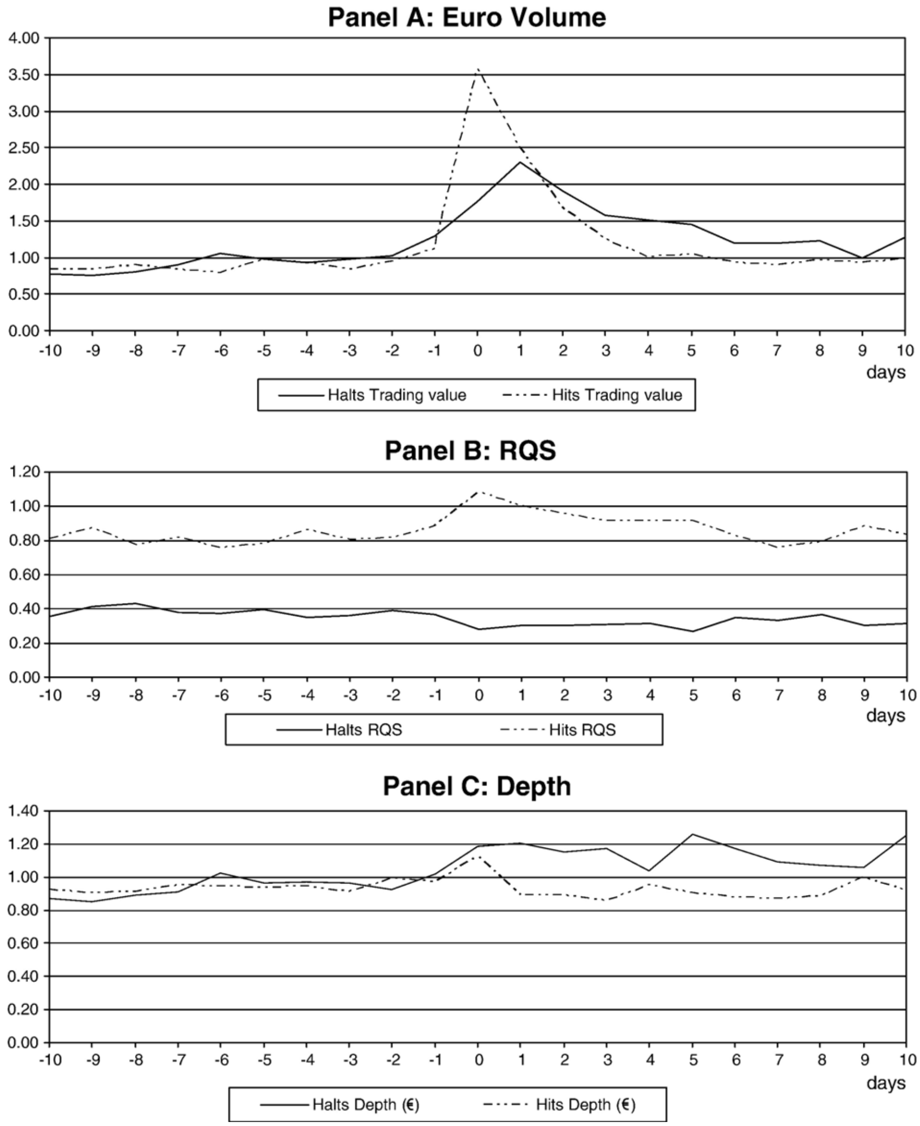

Fig. 1. Daily cross-sectional median of trading activity and liquidity around trading halts and price limit hits. Event date (day 0) is defined as either the trading halt day or the price limit day. Euro volume is the trading volume in euros; RQS is the quoted bid–ask spread divided by the bid–ask midpoint; depth (€) is the sum of euro value of shares available at the bid and ask quotes. Euro volume and depth (€) are scaled by their 7-day (days −10 to −4) average.

Trading activity increases significantly, at 1% level, from day −1 to day +1 and gradually decreases to its pre-event level within days.[11]

Unlike trading activity, the liquidity results differ for trading halts and price limit hits. As we show in Panel A of Table 3, after trading halts, both RQS and RES decrease, whereas depth (€) increases significantly. That is, liquidity increases after trading halts. Panel B of Table 3 shows that the overall trading halt results seem to be driven by good-news halts due to the small sample size of bad-news halts. After price limit hits, however, the results are just the opposite: both spread measures increase significantly and the depth measure decreases. Upper and lower price limits

[11] Please note that although the numbers are scaled to the average across days −10 to −4, the graph does not center itself around 1 for those 7 days. This result is due to the cross-sectional averages of the scaled numbers. We use the Wilcoxon signed rank test to determine the significance level. Detailed results of the daily comparison are available on request.

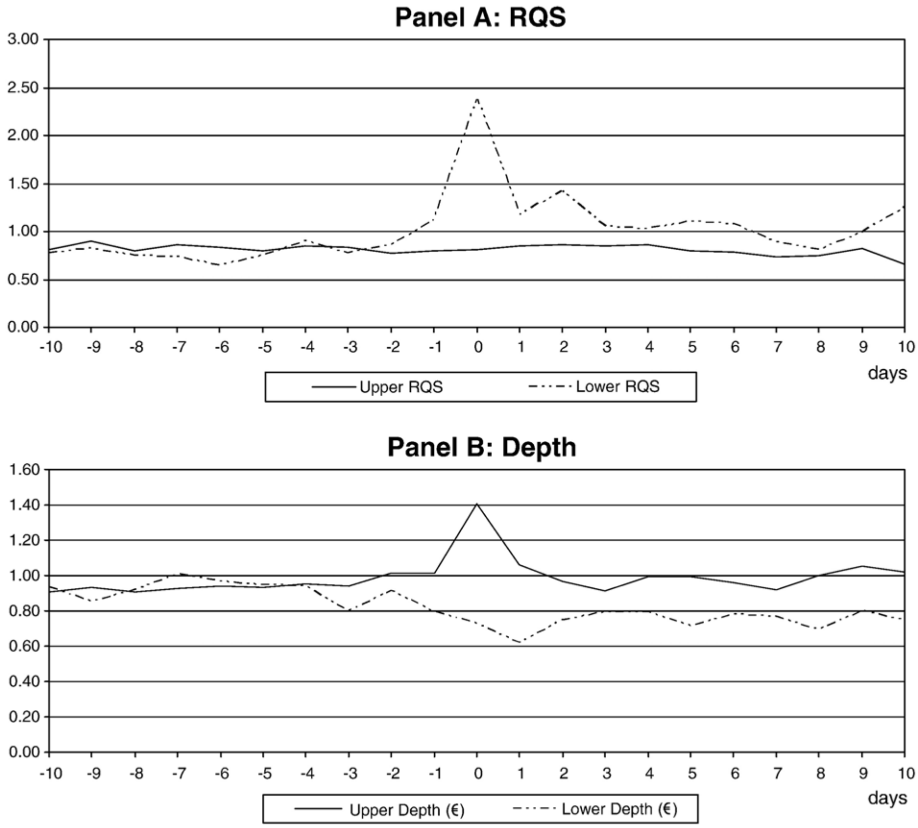

Fig. 2. Daily cross-sectional median of liquidity measures around upper and lower price limit hits. An upper (lower) price limit hit occurs when the price hits the upward (downward) price limits. Event date (day 0) is defined as the price limit day. RQS is the quoted bid–ask spread divided by the bid–ask midpoint; depth (€) is the sum of the euro value of the shares available at the bid and ask quotes. Depth (€) is scaled by the 7-day (days −10 to −4) average.

provide similar results, but the change in liquidity is significant only for the latter (Panel C of Table 3). Apparently, liquidity decreases after price limit hits, especially after lower price limit hits.

Our finding that liquidity increases after trading halts seems to contradict some current literature. For example, Corwin and Lipson (2000) and Christie et al. (2002) find that liquidity decreases following NYSE and NASDAQ trading halts, respectively. One possible reason for this conflicting result is that we conduct daily analyses, whereas their studies are based on intraday analyses. In previous trading halt or price limit studies, both daily and intraday analyses have been implemented.[12] Although intraday analysis could be done and probably provide insights into the intraday effects, we choose the daily analysis because of the following two reasons. First, price limit hits can occur consecutively within a short period of time (e.g., 10 hits in 20 min), but trading halts usually last for hours. To compare the intraday performance, we need to match the duration and the time of the day, further reducing our already small sample size. Second, in addition to the event day, the daily analysis captures the effects of trading halts and price limits on days before and after the events. Our results are consistent with the prediction by Spiegel and Subrahmanyam (2000) that liquidity during normal market conditions can be improved if rules require the disclosure of high variance events (such as quarterly earnings) to the exchange. During trading halts, firms are required to either announce news or clarify rumors, and therefore, the degree of information asymmetry should decrease following trading halts. The three-day average liquidity increase we observed matches this prediction.

In Panel B of Fig. 1, we show that RQS is the narrowest for trading halts but the widest for price limit hits on day 0, suggesting that the high degree of information asymmetry when limit hits occur prompts investors to require a larger spread to compensate for their potential loss to informed traders. In contrast, the narrower spread for trading halts

[12] For intraday price limit studies, please see Chan, Kim, and Rhee (2005) and Cho et al. (2003) for example.

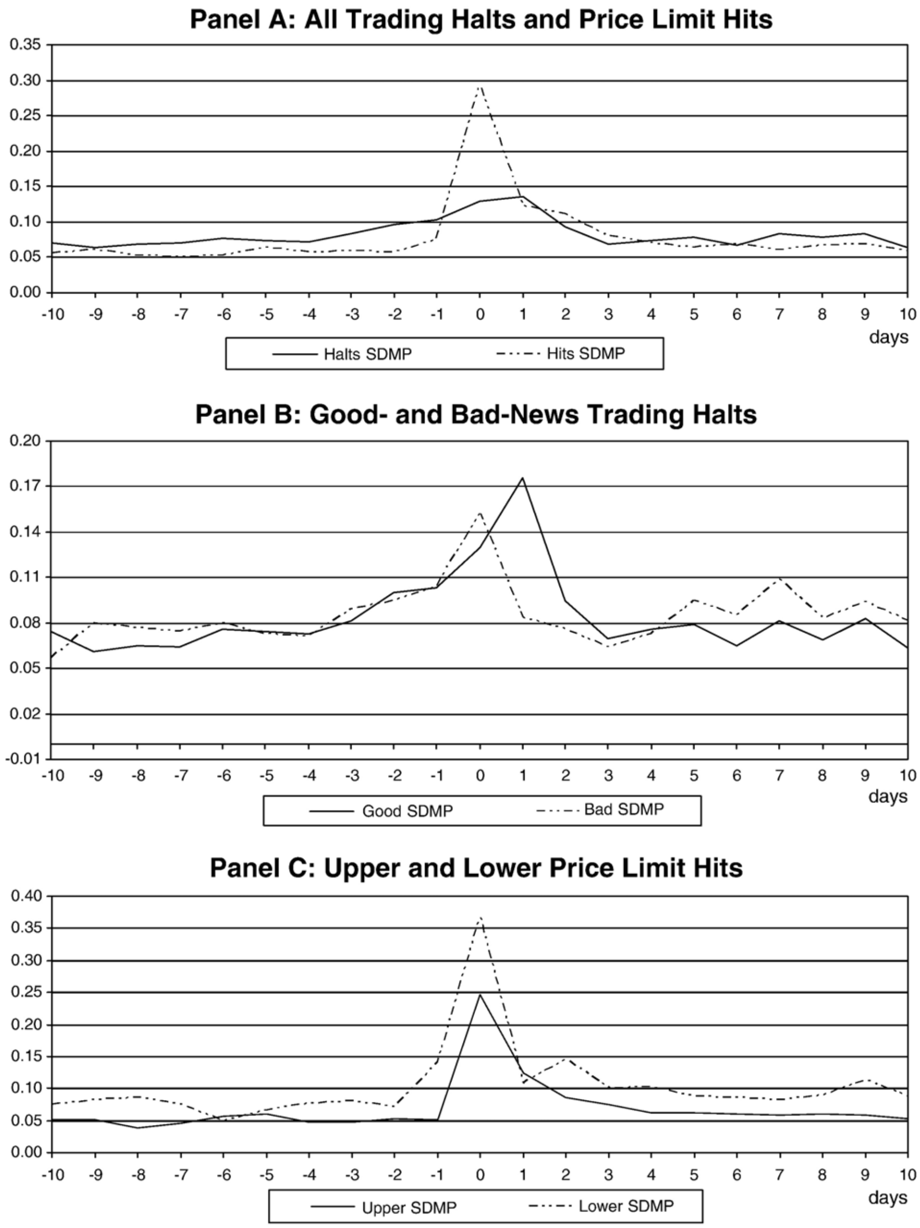

Fig. 3. Daily cross-sectional analysis of volatility around trading halts and price limit hits. This figure plots the daily cross-sectional median of SDMP from day −10 to day +10. Event date (day 0) is defined as either the trading halt or the price limit day. SDMP is the standard deviation of all bid–ask midpoints on each day.

indicates that less asymmetric information exists in the market following the release of information by the involved companies. The large gap between the small RQS of trading halts and the larger RQS of price limit hits can be attributed to the findings presented in Table 2: trading halt firms are larger and more actively traded than are price limit firms on average.

As Panel C of Fig. 1 shows, though the depth is at similar level for both trading halts and price limit hits prior to day 0, it is lower from day +1 to day +10 for price limits, indicating that liquidity is reduced after price limit hits. Depth increases significantly at 1% level from day −1 to day 0 in both cases. This result for trading halts is reasonable, due to the narrow spread and low asymmetric information. However, the price limit result is counterintuitive, because we expect investors to be unwilling to provide liquidity to the market when information asymmetry is high on day 0.

We find that the conflicting observation from price limit hits is caused by the asymmetric impact of upper and lower price limits. In Fig. 2, we report the results for upper and lower price limits. The spreads do not change significantly on a daily basis for upper price limit hits around day 0, but for lower price limit hits, spreads are the highest on day 0. Though the spread of lower price limit hits is close to that of upper price limit hits before day −2, it widens significantly at 1% level on day −1 and stays at a relatively high level until at least day +10. Finally, depth (€) reaches its highest level on day 0 for upper but not for lower price limit hits. That is, investors are willing to provide liquidity to the market on days of upper but not lower price limit hits, which explains the counterintuitive observation that both spreads and depth (€) reach their highest levels on day 0. The overall wide spread is driven by lower price limit hits, and the high depth is caused by the upper price limit hits. This asymmetric finding between upper and lower price limits has also been observed by Cho, Russelll, Tiao, and Tsay (2003).

Panel A of Table 3 shows that volatility increases significantly after price limit hits, consistent with Kim and Rhee (1997), but no significant change is observed after trading halts. Engelen and Kabir (2006) do not find significant changes in daily stock return volatility around trading suspensions on the Brussels Stock Exchange, in line with our result. In that the primary objective of trading halts and price limits is to reduce excess volatility, price limits do not appear to be effective in achieving their intended goal.

In Fig. 3, we show that although volatility on day 0 is not the highest for trading halts, the comparison between day −1 and day +1 shows that volatility increases significantly at 5% level; it reaches its highest level on day +1 and gradually decreases afterwards. This result is consistent with Lee et al. (1994), Corwin and Lipson (2000), and Christie et al. (2002), who find that volatility increases immediately after trading halts and gradually returns to its previous level. For price limits, the greatest and most extreme volatility occurs on day 0, after which volatility decreases significantly and approaches the pre-event level.

The volatility results are different for good- and bad-news halts, but they are similar for upper and lower price limit hits. Panel B of Fig. 3 shows that volatility decreases after bad-news halts but increases immediately after good-news halts, and then begins to reverse. Several studies have provided evidence that the volatility of stock returns displays asymmetric response to good and bad news (e.g., see Engle & Ng, 1993; Kroner & Ng, 1998). One plausible explanation is the increase in the information flow following bad news, leading to high volatility for bad-news halts on the event day. Also, 17 of the 49 good-news halts are not resolved till the next day's open (Table 1), causing high volatility for good-news halts on day +1. As depicted by Panel C of Fig. 3, day 0 is the most volatile for both upper and lower price limit hits; the overall patterns of daily volatility movements are also similar.

To understand the change in the information asymmetry following trading halts and price limit hits, we use the Hasbrouck–Foster–Viswanathan model suggested by Brennan and Subrahmanyam (1996) to decompose the spread into two components: the adverse selection cost and fixed costs components. The adverse selection component

Table 4
Delayed price discovery: Price continuations and reversals

	Trading halts price		Limit hits		Binomial test (i value)	
	Good news (N=32)	Bad news (N=13)	Upper (N=106)	Lower (N=53)	Good news — upper	Bad news — lower
Price behavior						
Continuation	0.44	0.31	0.65	0.11	−1.50	0.77
Reversal	0.53	0.69	0.27	0.83	1.75	−0.985
No change	0.03	0.00	0.08	0.06		
Binomial test (Z)						
Continuation–reversal	−0.52	−1.29	3.42 *	−3.78 *		

This table reports the total proportions of price continuations, reversals, and no change for price limit hits (upper and lower) and trading halts (good and bad news). We apply the Kim and Rhee's (1997) method. We examine daytime return (R_t^{d}) for the event day and the overnight return (R_t^{n}). The daytime return is the open-to-close return measured by $\ell n(P_t^{\mathrm{c}}/P_t^{\mathrm{o}})$ and overnight return represents close-to-open returns measured by $\ell n(P_{t+1}^{\mathrm{c}}/P_t^{\mathrm{o}})$, where P^{c} and P^{o} denote closing and opening prices respectively and t represents the event day. We examine daytime return for day t and the following overnight return. Stock returns can be positive (+), negative (−) or zero (0). For upper price limit hits and good-news halts, we classify the set of $\{[R_t^{\mathrm{d}}, R_t^{\mathrm{n}}]|[+,+],[0,+]\}$ as price continuation, the set of $\{[R_t^{\mathrm{d}}, R_t^{\mathrm{n}}]|[+,0],[0,0]\}$ as no change, and all others as price reversals. For lower price limit hits and bad-news halts, we classify the set of $\{[R_t^{\mathrm{d}}, R_t^{\mathrm{n}}]|[-,-],[0,-]\}$ as price continuation, the set of $\{[R_t^{\mathrm{d}}, R_t^{\mathrm{n}}]|[-,0],[0,0]\}$ as no change, and all others as price reversals. In the trading halt sample, we remove those with trading resumption on the next day's open because of the lack of closing price on trading halt day.

* Significant at 1%.

Table 5
Return behavior around trading halts and price limit hits

	Trading halts						Price limit hits					
	Good news (N=49)			Bad news (N=17)			Upper (N=106)			Lower (N=53)		
Day	AAR (%)	t-test	$Z–W$	AAR (%)	t-test	$Z–W$	AAR (%)	t-test	$Z–W$	AAR (%)	t-test	$Z–W$
−10	0.219	0.79	0.67	−0.533	−1.60	−1.49	−0.548	−1.74	−2.13 *	−0.382	−0.92	−1.76
−9	−0.504	−2.06 *	−2.36 *	0.569	1.01	0.97	0.273	0.89	0.55	−0.210	−0.49	−0.62
−8	−0.008	−0.02	−0.30	1.401	1.47	1.11	−0.257	−1.09	−1.22	−0.881	−2.38 *	−2.54 *
−7	−0.118	−0.39	−0.50	−0.039	−0.08	0.26	0.011	0.05	−0.19	−0.008	−0.03	0.06
−6	0.699	1.70	1.38	0.763	1.22	0.78	0.583	1.75	1.04	0.835	2.47 *	2.68 **
−5	0.410	1.39	1.16	−0.057	−0.09	−0.07	−0.782	−2.56 *	−2.94 **	1.404	3.77 **	3.22 **
−4	−0.102	−0.44	−0.62	0.014	0.03	0.26	0.084	0.27	−0.22	−0.040	−0.10	−0.16
−3	0.376	0.90	−0.22	0.829	1.66	1.63	−0.038	−0.12	−0.31	−0.263	−0.81	−0.94
−2	0.108	0.32	−0.38	0.960	2.42 *	2.11 *	0.174	0.56	0.70	0.110	0.33	0.79
−1	0.809	2.16 *	2.02 *	0.357	0.60	0.50	0.958	2.26 *	1.14	−0.231	−0.48	−0.26
0	4.433	3.37 **	4.40 **	0.412	0.71	0.54	10.744	18.18 **	8.60 **	−5.286	−6.77 **	−5.40 **
1	2.313	3.34 **	2.82 **	−0.825	−1.55	−1.49	−0.618	−1.45	−1.97 *	0.266	0.31	1.18
2	−0.493	−1.67	−1.64	0.397	0.56	0.07	−1.259	−3.94 **	−4.02 **	−0.421	−0.81	−0.83
3	−0.694	−2.18 *	−2.06 *	0.614	1.29	0.64	−0.364	−1.38	−1.12	−0.366	−0.87	−1.11
4	−0.120	−0.38	−0.60	−0.024	−0.05	−0.12	0.063	0.21	−0.46	−0.064	−0.16	−0.36
5	−0.045	−0.16	−0.20	−0.767	−1.49	−1.44	0.314	1.03	0.52	−0.215	−0.66	−0.76
6	−0.333	−1.29	−1.13	−0.207	−0.73	−0.21	−0.170	−0.63	−0.98	−0.359	−0.96	−1.54
7	−1.070	−3.19 **	−3.45 **	−0.445	−1.37	−1.35	−0.494	−1.71	−1.80	−0.757	−1.79	−1.85
8	0.303	0.75	0.16	0.169	0.32	0.64	0.081	0.27	−0.46	0.864	2.05 *	2.08 *
9	0.175	0.74	0.70	−0.701	−1.43	−1.02	0.065	0.24	0.33	1.249	3.06 *	2.67 **
10	−0.426	−1.66	−1.27	0.058	0.13	0.78	0.162	0.60	0.35	−0.143	−0.37	−0.31
(−5,−1)	1.602	1.96	1.22	2.102	1.65	1.73	0.395	0.42	−0.26	0.979	1.02	1.05
(+1,+5)	0.962	0.99	0.78	−0.605	−0.41	−0.17	−1.864	−3.10 **	−3.26 **	−0.799	−0.69	−0.05

This table reports the Daily Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) around trading halts and price limit hits. The abnormal returns are estimated from market-adjusted returns. Excess returns are calculated for a study period of ±10 trading days around the event day 0. Event date is defined as either the trading halt day or the price limit day. We use both t-test and the Wilcoxon signed rank test ($Z–W$) to determine whether the AAR and CAAR are significantly different from zero.

* Significant at 5%.

** Significant at 1%.

decreases after trading halts but increases after price limit hits; however, the changes are not significant. We observe significant changes only in the fixed component of trading costs, which decreases after trading halts but increases after price limit hits.[13] This result suggests that our earlier finding that the bid–ask spread is narrower after trading halts but wider after price limit hits is likely attributed to the changes in the fixed component of trading costs.

In summary, our market quality analysis suggests that trading halts perform better than price limits, consistent with Subrahmanyam (1995) and in support of our discretion hypothesis. Because trading activity increases after both trading halts and price limit hits, due to trading interference, we are unable to judge their relative performance simply from the perspective of trading activity. However, using the changes in liquidity and volatility, we find sufficient evidence to show that trading halts seem to perform better than price limits. First, liquidity increases following trading halts, whereas it actually decreases after price limit hits. Second, volatility increases after price limit hits, but no significant change of volatility is observed after trading halts.

5.2. Price discovery and efficiency

We analyze the price discovery process and efficiency using the Kim and Rhee's (1997) method and the event-study methodology and report our findings in Tables 4 and 5, respectively. In addition, Fig. 4 plots the CAARs for the event window [−10,+10].

For trading halts, we observe more price reversals than continuations for both good- and bad-news halts (Table 4); thus, we do not find evidence that trading halts delay the price discovery process. However, because the differences

[13] Due to space limitation, detailed results are not reported but they are available on request.

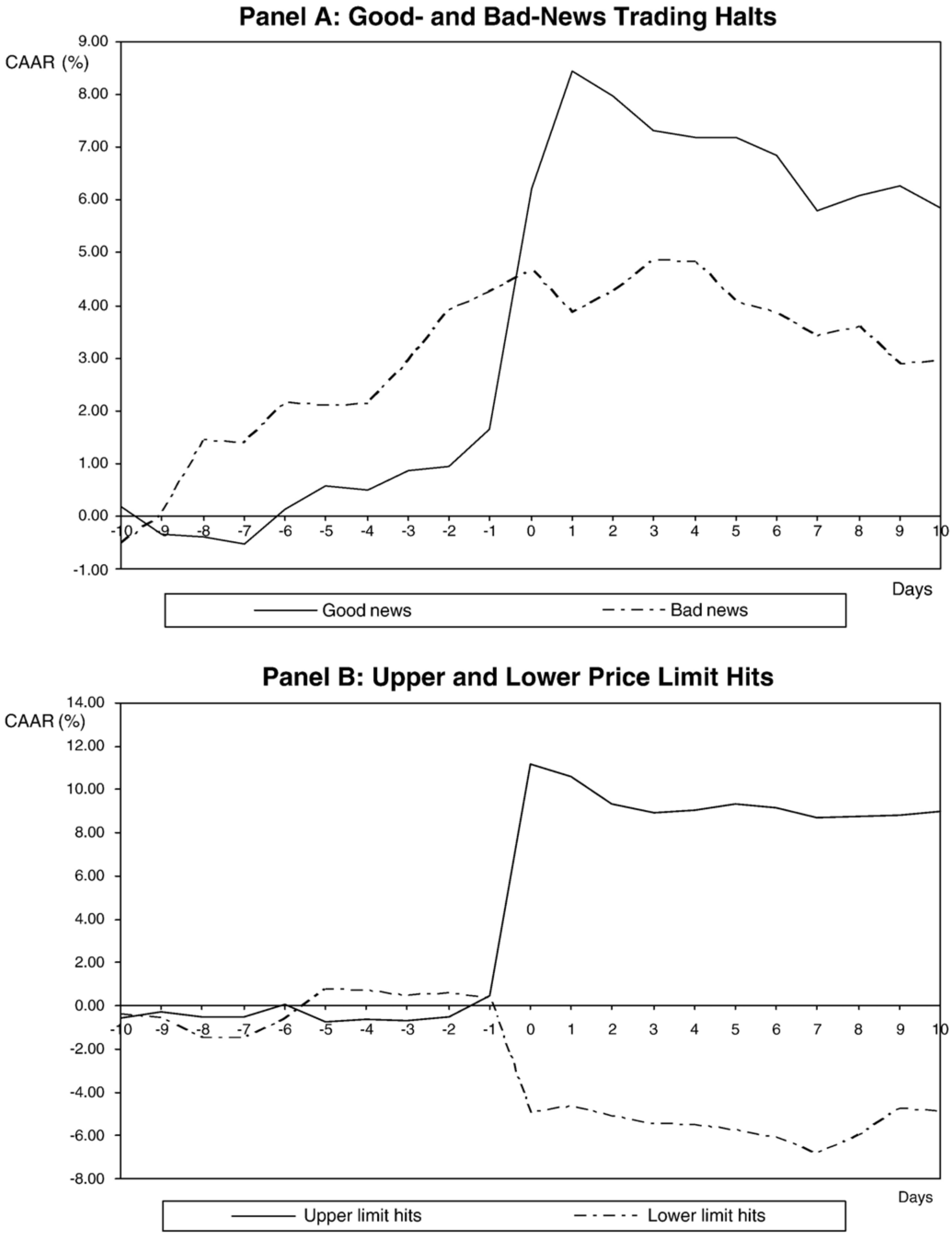

Fig. 4. Cumulative average abnormal returns around trading halts and price limit hits. This figure plots the cumulative average daily abnormal returns (CAAR) from day −10 to day +10. Event date (day 0) is defined as either the trading halt or the price limit day. Abnormal returns are estimated on the basis of the market-adjusted return model.

between reversals and continuations are not significant, the argument that trading halts provide a cooling-off period during which investor overreaction is minimized cannot be supported.

For good-news trading halts, we find that AAR is equal to 4.43% on day 0 and significantly different from 0 at the 1% level. This is understandable because stock prices reflect new information on a trading halt day 0 and thus generate significant abnormal returns. In addition, this evidence is consistent with the purpose of trading halts, to release new information or clarify rumors. On the day immediately prior to good-news trading halts, we also find a 0.81% abnormal return, statistically significant at a 5% level, which could indicate the presence of anticipatory behavior, information leaks, or insider trading. Similarly, on day +1, the abnormal return reaches a significant value of 2.31%, which seems to suggest that price discovery has been delayed by trading halts and that the market does not efficiently reflect all information on the trading halt day.

As reported in Table 1, among the 49 good-news halts, 32 cases were resolved on the same trading day. We perform an AAR analysis on these 32 cases and find that the significant abnormal return is observed on day 0 but not on day +1.[14] That is, if trading resumes on the trading halt day, information can be fully reflected and there is no delayed price discovery. For the 17 cases that were resolved the following day, there is no abnormal return on day 0, but a positive abnormal return appears on day +1. Apparently then, the positive abnormal return observed on day +1 in our overall results for good-news halts is driven by these 17 cases. The significant abnormal return observed on the resolution day suggests that stock prices adjust quickly and completely to new information released during the suspension.

The analysis of CAAR for event windows [−5,−1] and [+1,+5] confirms the preceding conclusion. The [−5,−1] CAAR is significantly positive at a 10% level, based on the *t*-test, consistent with a possible information leak. Panel A of Fig. 4 also shows that the CAAR increases prior to trading halts. In contrast, the insignificant CAAR for [+1,+5] shows no sign of inefficient stock price adjustment.

In the case of bad-news trading halts, we observe no significant abnormal returns around day 0. There is no apparent information leak or delayed price discovery associated with bad-news trading halts. However, due to the small sample size, we do not overemphasize our interpretation of this subsample's results.

For upper price limit hits, we observe more price continuations than reversals using Kim and Rhee's (1997) method. As we show in Table 4, price continuations occur 65% of the time, whereas price reversals occur only 27% of the time. This evidence seems to suggest that price limits delay the price discovery process. However, price limits also may fail to counter investor overreaction, so prices continue to increase after hitting the upper limits. This possibility can be verified by observing the negative abnormal returns following upper price limit hits. As shown in Table 5 and Panel B of Fig. 4, we find a significant positive AAR of 10.74% on day 0 and negative AARs on days +1 and +2 for upper price limit hits. Also, the CAAR for [+1,+5] is negative and significant at the 1% level. This return reversal suggests that investors overreact to the good news on the price limit day 0 and that prices eventually reverse when the overreaction is corrected. The return reversal is not caused by the cooling-off effect of price limits; if they did have a cooling-off effect, we would observe both price reversals from Kim and Rhee's (1997) method and return reversals from the event-study methodology. Our evidence of price continuations and return reversals eliminates the possibility of a cooling-off effect and indicates that the upper price limit does not reduce overreaction. In that the objective of price limits is to reduce overreaction, upper price limits fail to achieve their intended goal. The analysis of the window [−5,−1] shows that there is no significant CAAR during the five-day period and therefore no apparent information leak prior to upper price limit hits.

For lower price limits, we observe contrasting results. According to Table 4, there are more price reversals (83%) than continuations (11%), and the difference is statistically significant at the 1% level. In addition, we find a significant AAR of −5.29% on day 0, but the abnormal returns on the following days are not significant (Table 5). These results suggest that lower price limits function positively by providing a cooling-off period.

In summary, for trading halts, we find that there is no delayed price discovery and that information is efficiently reflected in stock prices when trading resumes. However, for price limits, we find contrasting results, including evidence of market overreaction for upper price limits and evidence consistent with the cooling-off argument for lower price limits.

5.3. Robustness check

As we reported in Table 2, there are significant differences in market capitalization between halted and limit-hitting firms. On average, halted firms are larger than limit-hitting ones, which raises the possibility that our results are driven by a size effect. To test this possibility, we examine firms that experienced both trading halts and price limit hits, in whose case the size difference does not exist. Through our analysis of the new sample, which consists of 26 trading halts and 30 price limit hits, we find that the results are similar to those for our full sample.[15] The notable difference is that the levels of

[14] Results are not reported, but they are available on request.

[15] Due to the space limitation and the similarity of results, we do not report the new results here. Results are available on request.

Table 6
Summary table: Trading halts and price limit hits

Category	Analyzed variables	Trading halts	Price limit hits
Trading activity	Frequency Volume Euro volume	Increased	Increased
Liquidity	RQS RES Depth (shares) Depth (€)	Increased (spread decreased and depth increased)	Decreased (spread increased and depth unchanged)
Volatility	Daytime volatility High–low Standard deviation of transaction prices Standard deviation of bid–ask midpoints	No change	Increased
Price discovery and efficiency	Price continuation abnormal returns	No delayed price discovery; market is efficient	Overreaction observed from upper price limit; lower price limit has cooling-off effect

significance are weaker, which may relate to the very small size of the new sample. Nevertheless, because the results are virtually identical, the main findings of this paper probably are not driven by the effect of firm size.

Although trading halts and price limit hits are mostly related to firm-specific news, we re-examine our sample to see if any observations are driven by macro events. Intuitively, price limit hits are more likely to be linked to macro events than are trading halts because the former is determined by the market while the latter is called by the CNMV. We find that 22 lower price limit hits occurred on August 28, 1998, apparently related to macro events. Our results do not change after removing those 22 observations from our sample.

5.4. Summary results

In Table 6, we summarize the findings of the relative performance of trading halts and price limits. Although trading activity increases following both, from the liquidity perspective, trading halts seem to perform better than price limits. Spreads decrease and depths increase following trading halts, but the opposite occurs for price limit hits. With trading halts, the degree of information asymmetry is reduced after the release of information by firms, and thus, investors are willing to provide liquidity to the market. However, price limits prevent market participants from trading beyond the limits, and information cannot be fully transmitted, which results in an increase of information asymmetry and traders' unwillingness to provide liquidity. Volatility increases after price limit hits but does not change after trading halts. In that the primary objective of price limits is to reduce volatility, they not only fail to achieve their intended goal, they make it worse. Our results with regard to price discovery and efficiency are mixed. We find that prices efficiently reflect information following trading halts and lower price limit hits, but for upper price limit hits, we find evidence of market overreaction. Overall, our results support our discretion hypothesis that trading halts are more effective than price limits.

6. Conclusion

The performance of trading halts and price limits has been studied extensively and separately, particularly after the 1987 market crash. However, the relative performance of trading halts and price limits has not been examined using market data. In this paper, we study these two mechanisms using data from the Spanish stock market, where both trading halts and price limits have been imposed. We make no attempt to test the effectiveness of either trading halts or price limits but focus instead on their relative performance.

Using Subrahmanyam's (1995) findings, we hypothesize that trading halts may be more effective than price limits because exchange officials can incorporate related information into their trading halt decisions and ask companies to provide relevant information. Specifically, we investigate the pattern of trading activity, liquidity, and volatility, as well as the speed of price discovery in the periods surrounding trading halts and price limit hits. Our results show that (1) trading activity increases after trading halts and price limit hits; (2) liquidity increases after trading halts but decreases after price limit hits; (3) volatility stays at the same level after trading halts but increases after price limit hits; and (4) information is efficiently reflected in stock prices when trading resumes after trading halts, but market overreaction may occur for upper price limits. Overall, our results are consistent with Subrahmanyam (1995).

Although our results may have important policy implications, three potential issues do remain. First, in Spain, firms are required to release information during trading halts but not price limit hits. Therefore, a question may arise: "Would price limits perform equally well if they require information release?" (or "Would trading halts perform equally badly if no information is released?") We are not addressing this important but hypothetical question in this paper. Second, this study is subject to a form of "joint hypotheses" problem. That is, we made an implicit assumption that current trading halt and price limit mechanisms are optimally imposed. However, trading halts have performed better than price limits perhaps because the 15% price limit is sub-optimal. Third, the Spanish market is completely order-driven and has no market makers, so we do not know if trading halts are still preferable in markets where market makers exist. We leave these three issues to future research.

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