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Abstract

This paper investigates the intraday effects on market quality of a unique trading suspension mechanism in place at the Italian stock market (*Borsa Italiana*) in case of price limit hit. Specifically, when prices hit the limit, *Borsa Italiana* halts trading for 5 minutes ('freeze phase') and removes the order that caused the limit to be hit. If trading regularly resumes after the freeze phase, exchange officials make no other intervention and we call this sequence of events 'Type 1' halt (i.e., freeze-only halt). Alternatively, if a second limit hit occurs after the freeze phase, an intraday call auction replaces the continuous trading. We name this sequence 'Type 2' halt (i.e., intraday auction halt).

We examine both the general effects of trading halts and the specific effects of Type 1 and Type 2 trading suspensions on three dimensions of market quality: trading activity, return volatility, and price discovery. The full sample results reveal mixed evidence about the usefulness of price limit hit trading halts: trading volume and return volatility after the halt are abnormally high (trading interference hypothesis for volume and spillover hypothesis for volatility), whereas prices converge towards equilibrium values (cool off hypothesis for price discovery). When we partition the sample by type of halt three main results arise. First, Type 2 halts always show larger abnormal volume measures than Type 1 and this indicates a greater interference on the normal trading process of Type 2 relative to Type 1 halts. Second, Type 2 halts show lower post-halt abnormal volatility than Type 1. This might be explained by the difference in the way the market restarts after the halt. The call auction procedure associated with Type 2 allows for wider information dissemination, whereas the price discovery process in Type 1 trading halts takes place only through the tâtonnement process in continuous trading. Third, for the price discovery process, the call auction reopening procedure of Type 2 halts also has a stronger cool off effect relative to the Type 1 continuous trading.

Keywords: price limits; trading halts; market quality; Italian stock market

JEL Classification: G10; G14

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I. INTRODUCTION

Trading halts are non planned interruptions to the normal trading process. Trading halts can be classified into two main categories: discretionary and non discretionary (or automatic) trading halts. A halt is discretionary when the suspension is called by an exchange official under specific circumstances, expressly defined by the market rulebook. For example, in case of rumors regarding one or more securities an exchange official may stop trading and simultaneously request the issuer to provide the market with complete information. A halt is non discretionary when it is inevitably triggered by a specific event, regulated by a market rulebook provision, such as the break of a maximum price variation limit. Trading halts triggered by price limit hit fall, therefore, in the second type of suspensions (i.e., non discretionary trading halts).

Market authorities employ trading suspensions to limit "both potential and actual market disorder" (Iosco (2002)). It is believed that a suspension during abnormal market conditions (a 'disordered market') may prevent the degeneration of the market or, if the disordered conditions are already in place, may facilitate the restoration of orderly trading (*cooling off effect*).

The main reasons given for supporting the opportunity to suspend trading differ between discretionary and non discretionary trading halts. For discretionary trading halts the reasons most frequently mentioned are related to market transparency, the repression of illegal trading practices, and exceptional market conditions (Iosco (2002)). First, in case of a firm-specific information event, a trading halt allows the issuer to release appropriate news, and market participants to assess the impact of such news on market prices. Second, the market authority can stop trading if he suspects that some form of fraud or manipulation is being carried

out,[1] or the issuer fails to comply with some material listing rules.[2] Third, a particular case of discretionary trading halt is when the market authority closes the whole market (i.e., trading is halted for all the securities listed). This may happen in very specific circumstances, as in the case of September 2001 U.S. markets four days closure.

The use of non discretionary trading halts is mainly related to the objective of avoiding the inauspicious effects of erroneous traders conducts. By providing a cooling off period, trading halts allow market participants to evaluate information during times of panic and to trade "with less emotion" (Iosco (2002)). Moreover, trading suspensions also allow market authorities to take appropriate actions in order to ascertain the reasons of anomalous price fluctuations. Lastly, in case of orders or quotes erroneously entered into the system, trading halts provide market participants with the opportunity to correct such mistakes without material consequences. Trading suspensions called when the price hits a predetermined boundary are usually known as 'price limit hit trading halts.'

Unanimous consensus is far from being reached, both in the academia and in the exchange industry, on the actual net benefits of price limit hit trading halts. Several papers investigate this issue and provide useful insights, but (understandably) no definitive answer on this point. In the exchange industry as well there is no common view about the usefulness of stopping the trading process when the price hits a predetermined price boundary. As a matter of fact, securities markets with and without price limit hit trading halts coexist. The first motivation for this study thus arises from the currently active debate on the actual net benefits of trading halts.[3]

The investigation of the effects of price limit hit trading halts is particularly important for order driven markets, as the Italian stock market (*Borsa Italiana*) and

[1] Fraud or manipulation can happen either "outside" the market (e.g., someone releases false or exaggerate pieces of information) or "inside" the market (e.g., a trader submits orders with size and timing such that other market participants are likely to be induced to trade accordingly).

[2] If the conditions that lead to the suspension persist, the market authority can deliberate the delisting of the firm.

[3] Kim and Yang (2004) provide a survey of studies on trading halts, and summarize the current state of the debate on their usefulness.

many others, and especially for their liquidity. In such markets liquidity comes from traders who submit standing limit orders and the ultimate viability of the market depends on the equilibrium between liquidity suppliers (limit order traders) and liquidity demanders (market order traders). Trading suspensions triggered by price limit hits favor limit order traders. As shown by Harris (1998), when price is dropping (increasing) quickly, traders using limit orders to buy (sell) a stock suffer from immediate losses when their orders execute as price continue to fall (rise). If price limits are in place, this will not occur and limit order traders may be more willing to offer liquidity under normal circumstances.

The goal of this study is to investigate the effects of a unique two-stage mechanism to halt and to resume trading after a price limit hit on several dimensions of market quality. *Borsa Italiana* employs a non standard procedure to stop trading in case of price limit hit. Specifically, when a trader sends an order that could generate a transaction price that would break the preset limit for the first time, the market is automatically stopped for 5 minutes (we name this as 'freeze phase') and the order that would have broken the limit is removed. If trading regularly resumes after the freeze phase, we call this sequence of events 'Type 1 limit hit.' Alternatively, if a second limit hit occurs after the freeze phase, exchange officials arrange an intraday call auction to find a new equilibrium price. We name this sequence 'Type 2 limit hit.' In this paper we examine both the general effects of trading halts and the specific effects of Type 1 and Type 2 trading suspension mechanisms on market activity, return volatility, and price efficiency of individual stocks.[4]

This paper differs from previous studies on price limits and trading halts in two ways. First, this study analyzes a two-stage non discretionary trading halt mechanism that works in a significantly different way relative to the price limit and trading halt mechanisms investigated in previous papers. Second, the empirical analysis is based on a new and very detailed data set. Our data set differs from previously used for two reasons. First, we have the official *Borsa Italiana* detailed

[4] Our analysis exclusively refers to individual security halts. Market-wide trading halts, that can be called by *Borsa Italiana* in case of exceptional events or abnormally large market-wide price movements, are outside the scope of this paper.

transcript of all price limit suspensions occurred in a three-year period. Previous papers on price limits usually infer (with a certain degree of misrepresentation risk) price limit hits by using the algorithm developed by Kim and Rhee (1997). Second, we use intraday data to capture the immediate effects of price limit suspensions. To the best of our knowledge, previous papers on price limits use daily data.[5] However, this feature does not enable to grasp the instantaneous effects of price limit hits, and market reactions observed in subsequent days may also possibly include other confounding effects.

The rest of the paper is organized as follows. Section II reviews and discusses the previous research on trading halts. Section III provides regulatory and institutional details on the mechanics of trading halts in place on *Borsa Italiana*. Section IV develops three testable hypotheses related to the effects of trading halts on market quality. Section V provides a description of the data and sample characteristics. Section VI presents the results of the empirical analysis and Section VII concludes.

[5] By contrast, several papers on trading halts employ intraday data (Lee, Ready, and Seguin (1994); Corwin and Lipson (2000); Christie, Corwin, and Harris (2002)).

II. RELATED STUDIES

In this Section we provide a summary of selected theoretical models and empirical studies on trading halts.

Supporters of trading suspensions argue that they can serve to protect market participants, allowing them to assess a new equilibrium price in case of an high level of uncertainty. Greenwald and Stein (1988) argue that when there is the risk of trading on the basis of uninformative prices, traders prefer to refrain from trading. This results in a reduction of market liquidity and, in turn, in a further reduction of price informativeness. In such conditions, a trading halt can be beneficial in that it restores investors' confidence on the fairness of market prices. In a later study (Greenwald and Stein (1991)) the same authors develop a model where uncertainty on the importance of uninformed traders drives to excess volatility during the continuous market phase. In this case, trading halts may be beneficial in maintaining the excess volatility at reasonable levels. Kodres and O'Brien (1994) claim that price limits help traders to share risks when some pieces of material information are released and, therefore, price limits dampen excess volatility.

Detractors of trading suspensions argue that any kind of market interference should be restricted to the minimum and that halts impose unnecessary liquidity costs on market participants. The discovery of a new equilibrium price is, in their view, far easier and more accurate when trading is permitted rather than when it is suspended. In the model developed by Grundy and McNichols (1989) the revelation of information takes place through trading (as for the "learning-through-trading" process in Lee, Ready, and Seguin (1994)). When trading is suspended, potential traders are inhibited from revealing their offer and demand schedules, and this harms the price discovery process.

Moving to empirical studies, in their seminal paper Hopewell and Schwartz (1976) observe price adjustments abnormally large (and proportional to the duration of the trading suspension) over the suspension period, and an anticipatory behavior of stock returns prior to the suspension. They consider such a behavior consistent with a very rapid adjustment to new equilibrium prices. Ma, Rao, and Sears (1989)

find a positive contribution to market stabilization of price limits on futures contracts in that, after a price limit hit, prices tend to stabilize (or even to reverse), return volatility declines and volumes have a tendency to remain stable. Lauterbach and Ben-Zion (1993), studying the performance of the Tel Aviv Stock Exchange during the October 1987 market crash, find that the implementation of trading halts in the form of circuit breakers had no net impact on the overall (negative) return, but smoothed the fluctuations and contributed to reduce the supply imbalance. Their evidence shows that circuit breakers served to hedge against execution price surprises.

Lee, Ready, and Seguin (1994) find that trading halts at the NYSE do not reduce either volume nor price volatility, but merely interfere with the normal trading activity (i.e., trading interference hypothesis): the period immediately following a trading halt shows higher levels of both volume and price volatility. They argue that the reason for the documented market behavior is that the price discovery process of the batch reopening mechanism employed at the NYSE is less efficient than the price discovery process of the continuous trading. Specifically, they find that the reopening price is noisy, and consequently that it is counterproductive to stop trading. This leaves open the question whether the halt is inefficient, or the reopening mechanism is not appropriate, or both.

Corwin and Lipson (2000) study the order flow pattern around NYSE trading halts. Their main hypothesis is that, if traders have the opportunity to cancel orders in case of extreme market conditions (thanks to trading halts), they are more willing to submit limit orders during normal market conditions. Corwin and Lipson find that limit order cancellation and submission is exceptionally high during halts and remains high for many hours after the halt. A second important finding is that the order book depth is very thin near the best quotes before, during and after the halts. This implies lower market liquidity around trading halts.

A final noisy effect of price limits is the so called 'magnet effect' that is observed when prices show a tendency to accelerate toward the bounds as these approach (Arak and Cook (1997); Cho, Russel, Tiao, and Tsay (2003)). This effect is originated by two, concurring factors: the trading behavior induced by fear of

market illiquidity, and the specific trading strategies employed by market participants in periods of market stress. The first factor induces traders to trade more actively than during normal market condition when there is a risk of being closed out of the market as a consequence of a trading suspension. This in turn increases price variability and, thus, the probability of hitting the limit (Subrahmanyam (1994)). The second factor is behavioral and relates to the fact that investors who follow price trends may step in the market when prices break certain thresholds. Again, this category of traders may anticipate their trades if they are afraid of being closed out of a trend (Arak and Cook (1997)). Cho, Russel, Tiao, and Tsay (2003) study the Taiwan Stock Exchange price limit mechanism and find a clearly documented effect in the movement toward the upper limit, while the effect is less clear when the movement is toward the lower limit.

The existing literature does not provide conclusive results on the performance of trading halts. We believe the main reasons for this are two. First, there is a very widespread and heterogeneous array of institutional settings concerning trading halts and price limits, with reference to what happens when an abnormal change in contract prices is observed (the trigger event), how trading is resumed after a suspension, the duration of the suspension and so on. Moreover trading suspensions have different meanings and non homogeneous consequences in order driven and quote driven markets,[6] and in floor-based or screen-based markets.[7] Second, a conclusive result on the desirability of trading suspension mechanisms could be obtained only if it were possible to contrast the performance of the same market with *and* without suspension, which is clearly impossible.

[6] In quote driven markets trading suspensions protect market makers, while in order driven markets they mainly protect limit order traders. It is clear that they both are liquidity providers, but they are made by possibly different categories of traders: market makers are only professional traders, limit order traders may also be retail investors.

[7] As far as trading suspensions are meant to allow market participants to completely exchange the available information during times of market disorder, one should observe different institutional settings in case of different information transmission technologies (i.e., the halts should in principle be shorter and triggered by wider limits in case of electronic markets than in case of physical markets).

III. TRADING SUSPENSIONS IN THE ITALIAN STOCK MARKET

Trading on *Borsa Italiana* takes place through a totally electronic screen-based system. The system supports two trading mechanisms: a call auction used to open and close trading, and a continuous auction operating throughout the trading day.[8] An electronic limit order book supports the system in both phases and allows the completion of trades by automatically matching buy and sell (limit and market) orders. The book is open to all intermediaries either to observe the state of the book (price and quantity for all orders on both sides), or to enter orders into the system.

Under particular market conditions, *Borsa Italiana* may alter the ordinary operation of the trading process with different measures: [9] prolonging or delaying the start of one or more phases (e.g., stock X opens at 10:00 a.m.); interrupting the continuous phase and simultaneously activating a call auction; suspending and reactivating trading.

A particular market condition occurs, under *Borsa Italiana* Rules (article 4.10.2), with reference to spot markets, when: a price variation boundary is exceeded (i.e., a price limit hit), prices or volumes of trading can be deemed as anomalous (i.e., anomalous trading conditions), it is necessary to obtain information on a particular market situation concerning a financial instrument or the issuer (also known as news pending halt), technical reasons or other circumstances are such that the regular operation of the market cannot be guaranteed (also known as technical halt). In this study we focus on price limit hit trading halts.

The limit hit suspension mechanism on the Italian market unfolds in a sequence of possibly two steps: a freeze phase and an intraday reopening call auction. The call auction occurrence is conditional upon the outcome of the freeze phase. As for the first step, during the continuous market, trading is immediately and

[8] The opening phase takes place at different times depending on the market segment: for the blue-chip segment, for example, the opening call auction unfolds between 8:00 and 9:15 and the closing call auction between 17:25 and 17:35. The continuous market phase, for blue-chip stocks, takes place between 9:30 and 17:25.

[9] In this paper we look at price limits in place on the MTA ("Mercato Telematico Azionario") segment of *Borsa Italiana*, which is the main market segment for trading Italian stocks. For other market segments, *Borsa Italiana* follows basically the same rules, the only change is in the price variation limit, that differs according to the type of security.

automatically interrupted for a period of 5 minutes (this is the 'freeze phase') when an order that would make a price change larger than 10% relative to the control price[10] arrives on the market. The order that would have made the price to exceed the limit is cancelled and the market restarts with the continuous phase, based on the same orders standing on the book as at the halt but the one that triggered it. During the freeze phase traders are not allowed neither to modify (or cancel) previously posted orders, nor to post new orders.

When trading resumes after the freeze phase, two possible states of nature may arise: the market works regularly or a second price limit hit occurs. In the latter case, the market is again suspended for 25 minutes and *Borsa Italiana* announces a new call market phase lasting 5 minutes that will end before the expiration of the 25 minutes delay. The intraday reopening call auction follows the same rules as the ordinary opening or closing auctions and therefore market participants may post new orders, cancel or modify previously posted orders; they can also observe the value of a provisional opening price.[11] The orders standing on the limit order book when the halt is declared are automatically transferred to the new opening call auction phase.[12]

[10] The control price is the opening auction price or, if an opening auction price has not been determined, the previous day closing auction price.

[11] The opening (market clearing) price in the *Borsa Italiana* call auction is established on the basis of the following hierarchical rules: a) it is the price at which the largest quantity of stocks can be traded; b) if where the largest tradable quantity can be traded at more than one price, the opening price is the one which produces the smallest imbalance between buy and sell unexecuted orders; c) if neither a) nor b) are decisive, the opening price is the one which is closest to the last official price; d) finally where applying rule c) results in two prices equidistant from the last official price, the opening price is equal to the higher of the two.

[12] Orders not fulfilled at the end of the intraday call auction are automatically transferred to the continuous market session that follows.

IV. TESTABLE HYPOTHESES

A. Effects on market activity

Trading halts triggered by price limit hits, as any other trading suspension, by definition impede trading to take place. If price limit hits trigger the halt when trading is not going to occur, then market activity after the suspension should not be different from that occurred before the price limit was hit. However, if trading is equally distributed over time this is not going to be the case. When the market resumes after a price limit hit suspension, the trading volume will be higher to compensate for the period of market artificial closure.

This hypothesis is empirically testable as follows:

H_0: Trading volume in the post limit hit period of a trading halt day is as high as in a normal trading day.

H_1: Trading volume in the post limit hit period of a trading halt day is higher than in a normal trading day.

B. Effects on return volatility

One of the aims of price limits is to reduce stock returns volatility. First, price limits literally establish boundaries for the price change within a trading day. Second, they provide time to reassess information during times of market stress (cooling off period). However, along the same lines as the trading interference hypothesis, price limits prevent immediate price corrections to take place. For example, consider when the new equilibrium price is out of the boundaries established by the price limits. The absence of transactions may also exacerbate

information uncertainty[13] and cause an increase in return volatility in the post limit hit period when trading resumes.

This hypothesis is empirically testable as follows:

H_0: Return volatility in the post limit hit period of a trading halt day is lower than in the pre limit hit period.

H_1: Return volatility in the post limit hit period of a trading halt day is higher than or equal to return volatility in the pre limit hit period.

C. *Effects on price discovery*

Proponents argue that trading halts allow investors time to react to material news event and allow market participants to search for the new equilibrium price. Goldman and Sosin (1979) suggest that policies such as price limits may improve market efficiency if there is sufficient price uncertainty, by reducing transitory deviations from fundamentals. On the other hand, detractors argue that price limits and trading halts are unnecessary barriers to trading. Since trading stops when limit hits occur, price limits truly represent upper and lower bounds on stock prices. Thus, price limits interfere with the price discovery process. If price limits prevent prices to reach their equilibrium value on the limit hit day, then stocks have to wait until the next trading period to reach the new equilibrium price. As a result, in subsequent trading rounds, the price will continue to move in the direction of the new equilibrium value (price continuation). Thus, by comparing the return for the pre-halt period with the return for the post-halt period we can identify price reversal or price continuation patterns:[14] the delayed price discovery hypothesis is supported by a pattern of price continuations after the halt, while it is rejected by the observation of a pattern of price reversals. The outcome depends on the source of the order

[13] Brown and Jennings (1989) suggest that information will not be as readily revealed during a suspension as through continuous trading.

[14] We define a pattern of pre and post-halt prices as a continuation (reversal) if the sign of the pre-halt return is (not) the same as the sign of the post-halt return; we define a pattern as "other possibilities" if the pre-halt and/or the post-halt return is zero.

imbalance that makes the price to hit the limit. If the order imbalance comes from informed traders, trading halts merely postpone the price adjustment and are to be considered harmful. Conversely, if the order imbalance comes from uninformed traders, trading halts provide the opportunity to attract the order flow on the opposite side of the market, dampening transitory volatility. In short, trading halts alter the price discovery process; whether this is beneficial or harmful is an empirical matter.

This hypothesis is empirically testable as follows:

H_0: The proportion of price reversals after a trading halt is lower than normal.

H_1: The proportion of price reversals after a trading halt is higher than normal.

V. DATA DESCRIPTION AND METHODOLOGY

A. Data Description

We identify our sample by merging two data sets provided by *Borsa Italiana*. First, the transcript of all non discretionary trading halts (NDTHs) occurred on the MTA segment of the Italian stock market between September 8, 2000 and September 24, 2003.[15] Second, a time stamped record of all intraday price and quantity occurred in the 21 days event window (-10,+10 days) around the halt day.[16]

Table 1 presents descriptive statistics for the full sample. All limit hit trading halts occurred on *Borsa Italiana* in the period from September 8, 2000 to September 24, 2003 amount to 26,051 (about 34 per trading day). Type 1 (2) limit hits represent about 56% (44%) of the sample. Partitioning the sample by day of the week, an almost monotonically decreasing number of limit hits arise as the week progresses: the highest number of hits occurs on Mondays, the lowest on Fridays. The proportion of Type 1 and Type 2 halts is approximately constant across days of the week.

Table 2 shows the duration of trading suspension for Type 2 limit hits. We classify a Type 2 trading halt as 'standard' when, after the first freeze phase (lasting 5 minutes) triggered by a price limit hit, there is a second price limit hit occurring at the tentative restart of the continuous phase and the market reopens with a call auction after a pre-opening phase. During the pre-opening phase, the ordinary rules for the opening auction clearing price apply. Thus, it may happen that the opening is delayed (i.e., the pre-opening is prolonged) when the tentative opening price exceeds the limits set by *Borsa Italiana*. In such cases, we define a Type 2 with 'n pre-opening phases' trading halt. In special cases, *Borsa Italiana* may switch the market to the pre-opening phase immediately after a price limit hit (that is without the tentative restart of continuous trading). In this special case we define a Type 2 'without freeze phase' trading halt. About 80% of the Type 2 trading halts belongs to

[15] This file was provided by the Market Supervision Department at *Borsa Italiana*.

the standard category, 6% to the Type 2 with 2 re-opening phases, 3% to the Type 2 with 3 re-opening phases, 4% to the Type 2 without freeze phase.

To work with a manageable amount of data, the intraday analysis refers to a randomly selected sub-sample of 300 firm-event observations. Because we analyze trading activity and other market quality variables before and after the halts, delayed openings are not considered. For similar reasons, we also exclude halts that were not resolved within one trading day. Our final sample includes 217 trading halts.

B. Methodology

We follow the methodology first introduced by Lee, Ready, and Seguin (1994), and then adopted by Corwin and Lipson (2000) and by Christie, Corwin, and Harris (2002), to investigate the intraday effects of NYSE and Nasdaq trading halts.

The Lee, Ready, and Seguin's methodology is based on the detection of abnormal values of the variable under investigation. Under this framework, the effect of a trading halt is measured by comparing intraday statistics for a stock experiencing a halt event with the same statistics computed for the same stock in a normal (i.e., non-halt) trading day. We consider a normal trading day as the average non-halt day, where the average is calculated with reference to the data observed 10 days before and 10 days after the halt day (the non-halt period). This procedure controls for security characteristics that may affect the variables under investigation.

To look at intraday effects, we partitioned the halt day (as well as non-halt days) in thirty-minute intervals, which are measured backward from the beginning of the halt to the open of trading for pre-halt periods and forward from the resuming of the trading activity to the end of the trading day for post-halt periods. We provide results for 3 hours prior (6 thirty-minute intervals) the halt and 3 hours after (6 thirty-minute intervals) the halt. Time-of-the-day effects in the variables that we

[16] This file was provided by the Research & Development Department at *Borsa Italiana*.

analyze (e.g., the U-shaped pattern in trading activity) are accounted for by exactly matching identical time periods for halt and non-halt days.

For example, an abnormal measure of trading activity ($ATA1$), for firm i and intraday sub-period t, is computed as follows:

$$ATA1_{i,t} = \frac{\#\,of\ trades_{i,t} - \left(nonhalt\ days\ mean\ \#\,of\ trades\right)_{i,t}}{\left(nonhalt\ days\ mean\ \#\,of\ trades\right)_{i,t}} \qquad [1]$$

where # of $trades_{i,t}$ is the total number of transactions occurred in the 30-minute interval denoted by t for stock i. Thirty-minute intervals run from –6 to +6, where 0 is the halt period.

Statistics of anomaly for the variable under investigation are computed according to equation [1] for each firm-event observation (i.e., a trading halt) and for each intraday sub-period. This indicator is then averaged across all firm-event observations and further partitioned by halt type.

VI. RESULTS

We first investigate the effects of trading halts on market activity to test the trading interference hypothesis stated in Section IV.A. We consider three measures of trading activity: the number of shares traded, the monetary value of trading, and the number of trades. For each of the three metrics of trading activity we computed the measure of anomaly defined as in [1] to compare trading activity around the limit hit trading halt with ordinary trading activity during non-halt periods. Table 3 shows the summary statistics of the three measures on a 6-hour interval around the halt for each market suspension event in our sample.

Full sample analysis reveals that the trading activity is higher than normal both before and after the halt. This result is consistent across all the trading activity measures we considered. Halt days are thus characterized by an abnormally higher trading pressure both before and after the halt. Measures of anomalous trading activity increase as the halt time approaches and decreases, but remain significantly higher, for the half-hour intervals more distant from the halt (Figure 1). In other words, the difference between halt days and non-halt days tends to decay as one departs in both directions from the halt time, but it remains significantly positive during the entire intraday period under investigation (ranging up to 12 half-hour periods around the halt).

The median abnormal volume measures, displayed in Figure 2, show a relatively different pattern for the following features: the highest measure of anomaly is detected in the thirty-minute interval preceding the halt, the size of the median anomaly is always far lower than the average anomaly, and the degree of abnormality declines more rapidly for the time intervals more distant from the halt. The strongly positive difference between mean and median suggests that a small number of very sizable deviations from normality occurs. This may be due to the very low level of activity of some stocks in our sample during the non-halt days used as a benchmark in the computation of the abnormal measure of trading activity. The normally thin market in these stocks may thus lead to huge increases – in relative terms – in trading activity.

The abnormally high trading activity after the halt may be explained by traders' demand for immediacy. If price limits prevent trading, then the lack of trades implied by a trading halt may cause intensified trading activity in subsequent trading rounds (i.e., intraday sub-periods). Lehmann (1989) distinguishes between patient traders and impatient traders. When the market reopens after a trading halt, impatient traders will buy or sell (at unfair prices if prices have not yet reached their equilibrium level, at fair prices if prices have reached their equilibrium level), and patient traders (who waited for prices to reach their equilibrium level) might trade at the new equilibrium price if this is convenient for them. In both cases, this implies that trading activity will be higher in sub-periods following the limit-hit sub-period, regardless of the actual effects of trading halt on the price discovery process.

The abnormally high trading activity before the halt can be driven by information motivated trading in case the price variation that would trigger the trading halt is information driven, and also by a sort of magnet effect (Arak and Cook (1997)) as market participants tend to anticipate their trades by fear of being crowded out by the declaration of the halt.

When we partition the sample according to the halt type (Table 3, panel B and Figure 3), we find that the abnormal volume statistics are consistently higher, in most sub-periods, for Type 2 trading halts than for Type 1 trading halts. We also find for Type 2 trading halts evidence of a statistically significant abnormally high volume measures *following* the halts. This implies that they prevent rational market participants to voluntarily trade and partially supports the trading interference hypothesis. This hypothesis is indirectly supported also by the differences in abnormal volumes observed for Type 1 and Type 2 halts: Type 1 halts – where the market closure is shorter than in the case of Type 2 halts – are quickly resolved, and trading activity responds to the lower interference of Type 1 halts showing a smaller deviation from a normal trading day.

The second step of our analysis is the investigation of the effects of trading suspensions on return volatility. Market regulators expect that stopping the trading process when price variations exceed some pre-specified limit can help to reduce 'excessive' stock return volatility and to prevent panic behavior. However, the effects

on return volatility may be temporary in that trading halts might prevent immediate price corrections to take place and so simply delay the prompt attainment of a new equilibrium price. When the market reopens, return volatility will be again higher than normal due to the price discovery process still taking place. Therefore, return volatility might even increase when trading resumes.

We test the null hypothesis that return volatility in the post limit hit period is lower than in the pre limit hit period against the alternative hypothesis that the return volatility in the post limit hit period is higher than or equal to return volatility in the pre limit hit period (volatility spillover hypothesis according to Kim and Rhee (1997)). Our results (Table 4 and Figure 4) show that the intraday abnormal volatility around trading halts is higher after the halt. The average abnormal volatility in the post-halt periods is always positive, statistically significant and higher than in the pre-halt period. When we use the median as a measure of central tendency, the pattern of abnormal volatility is qualitatively the same, while the magnitude of the abnormality is lower. We find a pattern of almost monotonically declining abnormal volatility measures in the periods following the halt. The hypothesis that the return volatility in the post-halt period is lower than in the pre-halt period can be safely rejected in favor of the alternative hypothesis (volatility spillover). Moreover, volatility tends to increase in the half-hour period immediately before the halt and this is consistent with a magnet effect hypothesis.

Our results are consistent with Lehmann (1989) who suggests that order imbalance between patient and impatient traders influences the likelihood of hitting price limits and price volatility. In fact, rather than reducing volatility, price limits may cause volatility to spread out over a longer period of time because limits prevent large one-time price changes and prevent immediate corrections in order imbalance. This spillover of trades to subsequent trading rounds and the search for a new equilibrium price after the halt is consistent with the volatility spillover hypothesis. Lee, Ready, and Seguin (1994) find increased trading volume and volatility on days following trading halts. As well known (Karpoff (1987)), volume and volatility are positively correlated. This may also explain why we find an increase in both variables.

When we distinguish between Type 1 and Type 2 halts (Table 4, panel B and Figure 5), we find similar results: volatility unusually increases during the post-halt periods for both Type 1 and Type 2 halts. However, we find interesting differences in the magnitude of the abnormality measure between Type 1 and Type 2 halts: in the first post-halt period, the abnormal volatility for Type 1 halts is more than twice the corresponding abnormal volatility for Type 2 halts and the measure of abnormality is statistically significant in both cases. Similar conclusions can be drawn when looking at the median. Type 1 halts show a significant increase in volatility during the 2 periods just before the halt, while Type 2 halts exhibit an abnormal increase in volatility only in the period immediately preceding the halt.

The difference in abnormal volatility in the first post-halt period can be explained by the different reopening procedures employed for Type 1 and Type 2 halts: the call auction associated with Type 2 halts smoothes volatility more than the restart of the market via continuous auction as with Type 1 halts. This evidence relates to the different price discovery mechanisms: tâtonnement process via continuous trading for Type 1 and market clearing auction for Type 2. The call auction seems to be more appropriate for absorbing the order imbalance that normally occur when trading is halted. By contrast, Type 1 halts need more time to process the order imbalance (and the abnormal trading activity), and this reflects in a greater abnormal volatility especially in the half-hour just after the suspension. Given that the tâtonnement process implied with continuous trading takes place through real trades, the price discovery process for Type 1 halts is much more costly than that for Type 2 (based on an intraday call auction).

Finally we focus our analysis on the effects of price limit hit trading halts on market efficiency. Here the competing hypotheses are that the suspension of the trading process can give market participants the time to assess new material pieces of information regarding the suspended stock,[17] whereas – on the other hand – a halt in the trading process may prevent securities prices to attain more quickly their new

[17] This is particularly true in case of severe adverse selection problems. In such cases, to avoid unexpected execution prices, market participants immediately abstain from trading, causing a sudden drop in liquidity. If market participants are given a cooling off period to reassess the information set,

equilibrium values (delayed price discovery hypothesis). We test these competing hypotheses (stated in Section IV.C) by comparing post-halt returns with pre-halt returns. Evidence of a predominance of price continuation (that is, the halt interferes with the incorporation of information into prices) would support the delayed price discovery hypothesis, while evidence of price reversal could signal the correction of an over-reactive behavior of market participants and thus would support the cool off hypothesis.

We define price continuations when the sign of the post-halt return is the same as the one of the pre-halt return and price reversals when the signs of pre and post-halt returns are the opposite. Specifically, we define as price continuations the following returns series: [+,+] and [-,-], where the first (second) sign in parenthesis indicates the sign of the return in the pre(post)-halt period. Similarly, we define as price reversals the following returns series: [+,-] and [-,+]. The remaining five combinations – where at least one return is zero – are defined as 'other possibilities'. Table 5 and Figures 6 and 7 show our results. On non-halt days, the frequency of price continuation is approximately equal to the frequency of price reversal. Interestingly, on halt days the frequency of price continuation is far lower than the frequency of price reversal. This evidence supports the cool off hypothesis since it indicates that the market was over-reacting prior to the halt. When partitioning the sample according to the halt type, we find an even larger difference between price reversals and continuation for Type 2 trading halts relative to Type 1. As earlier, this difference may be driven by the difference in the reopening mechanism. This implies that the call auction procedure associated with Type 2 facilitates the cool off of the market.

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they can redesign their trading strategies and submit orders to the market. The reduction of the degree of informational asymmetry facilitates the emergence of a new equilibrium price.

VII. SUMMARY AND CONCLUSIONS

This study examines the intraday effects of non discretionary trading halts triggered by price limit hits on volume, volatility, and price discovery by comparing statistics computed on a 30-minute basis on the halt day with the same statistics computed for the same stocks in normal trading sessions (non-halt days).

The full sample results reveal mixed evidence about the usefulness of price limit hit trading halts. Consistently with previous studies on trading halts, we find unusually higher levels of both volume and volatility after the halt (Lee, Ready, and Seguin (1994), Corwin and Lipson (2002), Christie, Corwin, and Harris (2002)). Differently from previous studies, we find abnormally higher levels of volume prior to the halt. We find strong support for the trading interference hypothesis: both pre-halt and post-halt market behavior is unusual in halt days compared with non-halt days. The abnormal volatility in the post-halt periods is always positive and statistically significant, and higher than in the pre-halt period. This evidence supports the volatility spillover hypothesis. The abnormal positive volatility in the half-hour interval before the halt is also consistent with a magnet effect hypothesis. The pattern of price continuations and reversals around trading halts supports the cool off hypothesis in that prices tend to over-react before the halt and to revert to their equilibrium values after the halt.

The institutional setting of *Borsa Italiana* allows us to disentangle the effects of the trading halt itself from the effects of the way in which trading is resumed after the halt. Type 1 trading halts resume trading with a continuous market, while Type 2 trading halts employs a call auction to restart trading after the suspension. Three main results arise. First, Type 2 halts always show larger abnormal volume measures than Type 1 and this indicates a greater interference on the normal trading process of Type 2 relative to Type 1 halts. Second, Type 2 halts show lower post-halt abnormal volatility than Type 1. This might be explained by the difference in the way the market restarts after the halt. The call auction procedure associated with Type 2 allows for wider information dissemination, whereas the price discovery process in Type 1 trading halts takes place only through the tâtonnement process in

continuous trading. Third, the call auction reopening procedure of Type 2 halts also has a stronger cool off effect relative to Type 1 also for the price discovery process.

Halting the trading process does not completely fulfill the purpose of cooling off the market in extreme volatility conditions. However, this does not mean that trading halts are harmful or useless. Trading halts may serve other purposes than cooling off only. They can reduce the amount of disequilibrium that would take place during large price adjustments or compensate liquidity providers (limit order traders) for the losses they suffer in case of extreme price movements. Limit order traders will be in fact more willing to submit limit orders (and thus to supply liquidity) if they anticipate that the market will be stopped (and so they will have the chance to revise their limit orders) in case of major price moves, potentially harmful for them. Thus, even if trading halts may not positively alter the quality of the market when a halt is called, they may be beneficial in improving the liquidity during non-halt periods.

Previous studies have shown that anticipated market closures (e.g., end of session or weekend) are associated with typical patterns in various measures of market performance: bid-ask spread, stock returns, volatility and volume. Typically, measures of intraday returns, volatility and volume show U-shaped patterns that can be interpreted based on the strategies of different classes of traders as, e.g., in Admati and Pfleiderer (1988). Models that explain intraday patterns can also help to explain the differences we found between Type 1 and Type 2 halts. Unlikely ordinary market closures, neither Type 1 nor Type 2 halts are foreseeable. However, Type 2 halts call for a reopening that is foreseeable (in the short time span of 25 minutes). The reopening procedure of Type 2 halts might thus introduce trading patterns not due to the halt process itself or to its causes, but merely to the event that the market closes and then reopens. This fact provides market participants with an additional coordination mechanism (the delay) and implies a switch to a different pricing rule (from a discriminatory to a uniform pricing rule). Both these factors can affect traders' order submission strategies and the equilibrium between liquidity demanders and liquidity providers.

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Table 1 - Descriptive Statistics

This table presents the frequency of Type 1 and Type 2 non discretionary trading halts by day of the week for the full sample. We classify a trading halt as Type 1 when, after a price limit hit and the following freeze of the market, trading resumes regularly with the continuous market. A trading halt is classified as Type 2 when, after a price limit hit as in Type 1, there is a second limit hit at the restart of the continuous market and trading restarts with a call auction, preceded by a pre-opening phase.

		Monday		**Tuesday**		**Wednesday**		**Thursday**		**Friday**		**Total**	
		# obs.	%	# obs.	%	# obs.	%	# obs.	%	# obs.	%	# obs.	%
Type 1	# obs.	3,338	12.81	2,960	11.36	2,941	11.29	2,831	10.87	2,558	9.82	14,628	100.00
	%	55.61		56.11		54.91		56.45		58.11		56.15	
Type 2	# obs.	2,665	10.23	2,315	8.89	2,415	9.27	2,184	8.38	1,844	7.08	11,423	100.00
	%	44.39		43.89		45.09		43.55		41.89		43.85	
Total		6,003	23.04	5,275	20.25	5,356	20.56	5,015	19.25	4,402	16.90	26,051	100.00

Table 2 - Duration of Trading Halts

This table presents the duration of the trading suspension in case of Type 2 trading halts for the full sample. We classify a Type 2 trading halt as "standard" when, after the first freeze phase (lasting 5 minutes) triggered by a price limit hit, there is a second price limit hit occurring at the tentative restart of the continuous phase and the market reopens with a call auction after a pre-opening phase. During the pre-opening phase, the ordinary rules for the opening clearing price apply. Thus, it may happen that the opening is delayed (i.e., the pre-opening is prolonged) when the tentative opening price exceeds the limits set by the ISE. In such cases, we define a Type 2 with "n pre-opening phases" trading halt. In special cases, the ISE may switch the market to the pre-opening phase immediately after a price limit hit (that is without the tentative restart of continuous trading). In this special case we define a Type 2 "without freeze phase" trading halt.

			Duration			
	# obs.	**%**	**average**	**min**	**median**	**max**
Type 2 standard	9082	79.51	35.28	11.85	31.02	468.50
Type 2 with 2 pre-opening phases	735	6.43	63.24	30.38	60.69	303.31
Type 2 with 3 pre-opening phases	349	3.06	94.05	88.24	90.71	214.26
Type 2 with 4 pre-opening phases	209	1.83	123.93	117.20	120.57	394.92
Type 2 with 5 pre-opening phases	122	1.07	152.74	146.31	150.57	210.25
Type 2 with 6 pre-opening phases	98	0.86	183.06	175.43	180.73	248.66
Type 2 with 7 pre-opening phases	70	0.61	212.18	204.40	210.46	265.87
Type 2 with 8 pre-opening phases	78	0.68	244.13	230.95	240.62	303.06
Type 2 with 9 pre-opening phases	72	0.63	271.84	262.27	270.47	320.46
Type 2 with 10 pre-opening phases	49	0.43	302.56	291.32	300.61	369.74
Type 2 with 11 pre-opening phases	36	0.32	329.62	318.09	330.66	343.61
Type 2 with 12 pre-opening phases	27	0.24	362.79	349.23	360.75	409.79
Type 2 with 13 pre-opening phases	29	0.25	391.59	378.31	390.59	439.22
Type 2 with 14 pre-opening phases	27	0.24	420.77	407.21	420.57	434.64
Type 2 with 15 pre-opening phases	29	0.25	451.27	436.32	451.09	473.50
Type 2 with 16 pre-opening phases	10	0.09	473.69	465.26	473.62	483.64
Type 2 with 17 pre-opening phases	1	0.01	449.33	449.33	449.33	449.33
Type 2 without freeze phase	400	3.50	24.62	5.23	25.14	388.84

Table 3 - Intraday Trading Activity Around Trading Halts

This table shows summary statistics of the abnormal measures for the number of shares traded, the monetary trading volume, and the number of trades. The abnormal measures are computed on the basis of the halt day values relative to the mean nonhalt days values. Nonhalt days include 10 days before and 10 days after the halt. The halt period extends from the beginning of the halt to the market resuming trade. Thirty-minute prehalt periods are measured backward from the beginning of the halt. Thirty-minute posthalt periods are measured forward from the reopening time.

		Abnormal share volume				**Abnormal monetary volume**				**Abnormal number of trades**			
Period	# obs.	Avg	Std Dev	T-Stat	Median	Avg	Std Dev	T-Stat	Median	Avg	Std Dev	T-Stat	Median
Panel A: Full sample													
-6	94	0.79	2.16	2.82	0.00	0.74	2.13	2.67	-0.08	0.49	1.39	2.72	0.08
-5	108	0.90	2.40	2.84	0.04	0.85	2.42	2.65	-0.07	0.57	1.35	3.17	0.08
-4	110	1.22	5.12	1.93	0.12	1.19	5.26	1.85	0.07	0.72	2.37	2.47	0.09
-3	134	0.98	3.00	2.86	-0.09	0.96	3.14	2.69	-0.16	0.75	2.08	3.17	0.00
-2	154	1.93	4.63	3.99	0.52	1.88	4.75	3.80	0.41	1.25	3.03	3.97	0.43
-1	227	3.47	5.99	7.11	1.33	3.54	6.50	6.70	1.24	2.43	3.72	8.01	1.33
During halt	28	2.50	5.96	2.05	-0.11	2.71	6.65	2.00	-0.03	1.39	3.24	2.10	0.00
+1	179	3.16	7.23	4.63	0.57	3.42	8.26	4.38	0.43	2.51	5.49	4.83	0.55
+2	137	1.99	4.32	4.01	0.41	2.03	4.46	3.96	0.25	1.36	2.53	4.69	0.44
+3	114	1.47	3.76	3.15	0.33	1.56	4.20	3.00	0.26	1.17	2.44	3.85	0.28
+4	95	1.15	2.88	3.00	0.18	1.23	3.18	2.90	0.16	0.97	2.11	3.44	0.18
+5	86	1.43	3.40	3.08	0.18	1.53	3.86	2.90	0.14	0.83	2.13	2.85	0.27
+6	80	0.76	2.71	1.99	-0.11	0.86	3.08	1.97	-0.16	0.52	1.44	2.54	0.02

Table 3 (cont.)

	Period	# obs.	Abnormal share volume				Abnormal monetary volume				Abnormal number of trades			
			Avg	Std Dev	T-Stat	Median	Avg	Std Dev	T-Stat	Median	Avg	Std Dev	T-Stat	Median
Panel B: By type of trading hal														
Type 1	-6	30	0.86	2.75	1.29	-0.36	0.76	2.71	1.16	-0.34	0.03	0.93	0.12	-0.23
	-5	35	-0.05	1.11	-0.18	-0.32	-0.15	0.92	-0.68	-0.39	0.08	0.87	0.38	-0.21
	-4	36	0.50	1.48	1.52	0.08	0.44	1.47	1.34	-0.04	0.21	0.80	1.17	0.10
	-3	43	0.36	0.90	1.85	0.33	0.28	0.83	1.54	0.25	0.31	0.82	1.75	0.28
	-2	44	0.09	0.73	0.61	0.02	0.03	0.66	0.21	0.01	0.07	0.68	0.48	0.00
	-1	71	1.95	3.03	4.26	1.13	1.89	2.98	4.21	0.81	1.63	2.23	4.86	0.98
	During halt													
	+1	64	0.96	2.46	2.32	-0.04	0.97	2.55	2.26	-0.16	0.94	1.87	2.96	0.44
	+2	51	2.04	5.19	2.19	0.34	2.00	5.22	2.14	0.22	1.11	2.22	2.77	0.41
	+3	41	0.28	1.44	0.90	-0.07	0.25	1.39	0.82	-0.09	0.70	1.50	2.15	0.38
	+4	38	0.50	1.52	1.44	0.07	0.48	1.51	1.40	0.00	0.38	1.10	1.50	0.07
	+5	34	0.78	1.44	2.36	0.37	0.77	1.48	2.29	0.37	0.53	1.07	2.17	0.25
	+6	32	0.11	1.07	0.46	-0.33	0.14	1.19	0.55	-0.28	0.41	1.29	1.46	-0.04
Type 2	-6	64	0.76	1.91	2.59	0.05	0.73	1.89	2.51	-0.02	0.68	1.50	2.92	0.19
	-5	73	1.34	2.70	3.09	0.21	1.31	2.75	2.98	0.13	0.80	1.48	3.35	0.16
	-4	74	1.53	6.06	1.71	0.15	1.52	6.21	1.66	0.11	0.94	2.77	2.31	0.07
	-3	91	1.21	3.45	2.61	-0.15	1.22	3.62	2.52	-0.24	0.92	2.38	2.89	0.00
	-2	110	2.54	5.19	4.06	0.66	2.50	5.34	3.89	0.68	1.65	3.39	4.04	0.50
	-1	156	4.09	6.76	6.26	1.55	4.22	7.39	5.91	1.39	2.75	4.15	6.86	1.46
	During halt	28	2.50	5.96	2.05	-0.11	2.71	6.65	2.00	-0.03	1.39	3.24	2.10	0.00
	+1	115	4.16	8.39	4.35	0.92	4.53	9.63	4.13	0.99	3.22	6.39	4.42	0.68
	+2	86	1.95	3.66	3.58	0.41	2.04	3.92	3.50	0.33	1.53	2.73	3.78	0.46
	+3	73	2.04	4.37	3.09	0.51	2.19	4.91	2.96	0.53	1.39	2.77	3.32	0.28
	+4	57	1.49	3.34	2.71	0.27	1.62	3.72	2.64	0.26	1.27	2.43	3.18	0.21
	+5	52	1.78	4.07	2.58	0.09	1.94	4.65	2.46	0.02	0.99	2.53	2.31	0.29
	+6	48	1.24	3.39	1.96	-0.06	1.38	3.86	1.92	-0.09	0.60	1.56	2.06	0.07

Table 4 - Intraday Volatility Around Trading Halts

This table shows summary statistics of the abnormal measure for the half-hour return volatility. The abnormal measure is computed on the basis of the halt day values relative to the mean nonhalt days values. Nonhalt days include 10 days before and 10 days after the halt. The halt period extends from the beginning of the halt to the reopening trade. Thirty-minute prehalt periods are measured backward from the beginning of the halt. Thirty-minute posthalt periods are measured forward from the market resuming time.

		Abnormal volatility measure			
Period	# obs.	Avg	Std Dev	T-Stat	Median
Panel A: Full sample					
-6	96	0.06	0.71	0.56	-0.11
-5	108	0.13	0.82	1.15	-0.10
-4	111	0.07	0.69	0.77	-0.05
-3	136	0.01	0.53	0.19	-0.11
-2	157	0.15	0.73	1.78	-0.06
-1	231	0.67	1.42	5.38	0.19
During halt					
+1	178	0.90	1.50	5.46	0.53
+2	137	0.42	1.15	2.85	0.26
+3	114	0.50	0.87	4.05	0.31
+4	96	0.52	1.06	3.17	0.30
+5	86	0.47	1.02	2.95	0.14
+6	79	0.36	1.30	3.16	0.15

Table 4 (cont.)

	Period	# obs.	Abnormal volatility measure Avg	Std Dev	T-Stat	Median
Panel B: By type of trading halt						
Type 1	-6	31	0.08	0.40	0.70	0.07
	-5	35	0.01	0.48	0.08	-0.08
	-4	36	0.10	0.70	0.59	0.01
	-3	44	-0.04	0.59	-0.31	-0.18
	-2	45	0.45	0.59	3.14	0.52
	-1	73	0.72	1.35	3.18	0.36
	During halt					
	+1	64	1.40	1.70	4.28	0.92
	+2	51	0.51	1.29	2.07	0.32
	+3	42	0.56	1.04	2.21	0.35
	+4	38	0.84	1.21	2.69	0.54
	+5	34	0.56	1.00	2.22	0.18
	+6	32	0.46	1.66	2.48	0.38
Type 2	-6	65	0.05	0.79	0.36	-0.11
	-5	73	0.18	0.93	1.18	-0.10
	-4	75	0.06	0.70	0.53	-0.15
	-3	92	0.03	0.51	0.44	-0.07
	-2	112	0.06	0.74	0.65	-0.09
	-1	158	0.65	1.45	4.36	0.14
	During halt					
	+1	114	0.66	1.35	3.66	0.41
	+2	86	0.34	1.04	1.93	0.25
	+3	72	0.47	0.79	3.43	0.30
	+4	58	0.34	0.95	1.87	0.06
	+5	52	0.41	1.05	1.98	0.10
	+6	47	0.39	0.98	2.03	0.04

Table 5 - Intraday Price Behaviour Around Trading Halts

This table shows the frequency of price continuations, reversals, and no change for the full sample and by type of trading halt. We apply a variation of the Kim and Rhee (1997) algorithm. We examine the total return over the prehalt period and compare it with the posthalt return. If the sign of the prehalt return is (not) the same as the sign of the posthalt return the event is classified as price continuation (reversal). Combinations of prehalt and posthalt returns including zero returns are classified as 'other possibilities'. The null hypothesis for the Chi-Square test is that the proportion of continuation is 0.2222, the proportion of reversal is 0.2222, the proportion of other possibilities is 0.5556.

		Halt days				Non-halt days			
				Chi-Square Test				Chi-Square Test	
		Frequency	Proportion	Z value	Pr > |Z|	Frequency	Proportion	Z value	Pr > |Z|
Panel A: Full sample									
	Price continuation	46	0.21			1,836	0.42		
	Price reversal	64	0.29			1,750	0.40		
	Other possibilities	107	0.49	6.79	0.03	736	0.17	2,602.61	0.00
	Total	217	1			4,322	1		
Panel B: By type of trading hal									
Type 1	Price continuation	13	0.19			530	0.40		
	Price reversal	17	0.25			536	0.40		
	Other possibilities	37	0.55	0.54	0.76	262	0.20	690.59	0.00
	Total	67	1			1,328	1		
Type 2	Price continuation	33	0.22			1,306	0.44		
	Price reversal	47	0.31			1,214	0.41		
	Other possibilities	70	0.47	7.75	0.02	474	0.16	1,920.25	0.00
	Total	150	1			2,994	1		

Figure 1 - Mean Abnormal Volume Measures

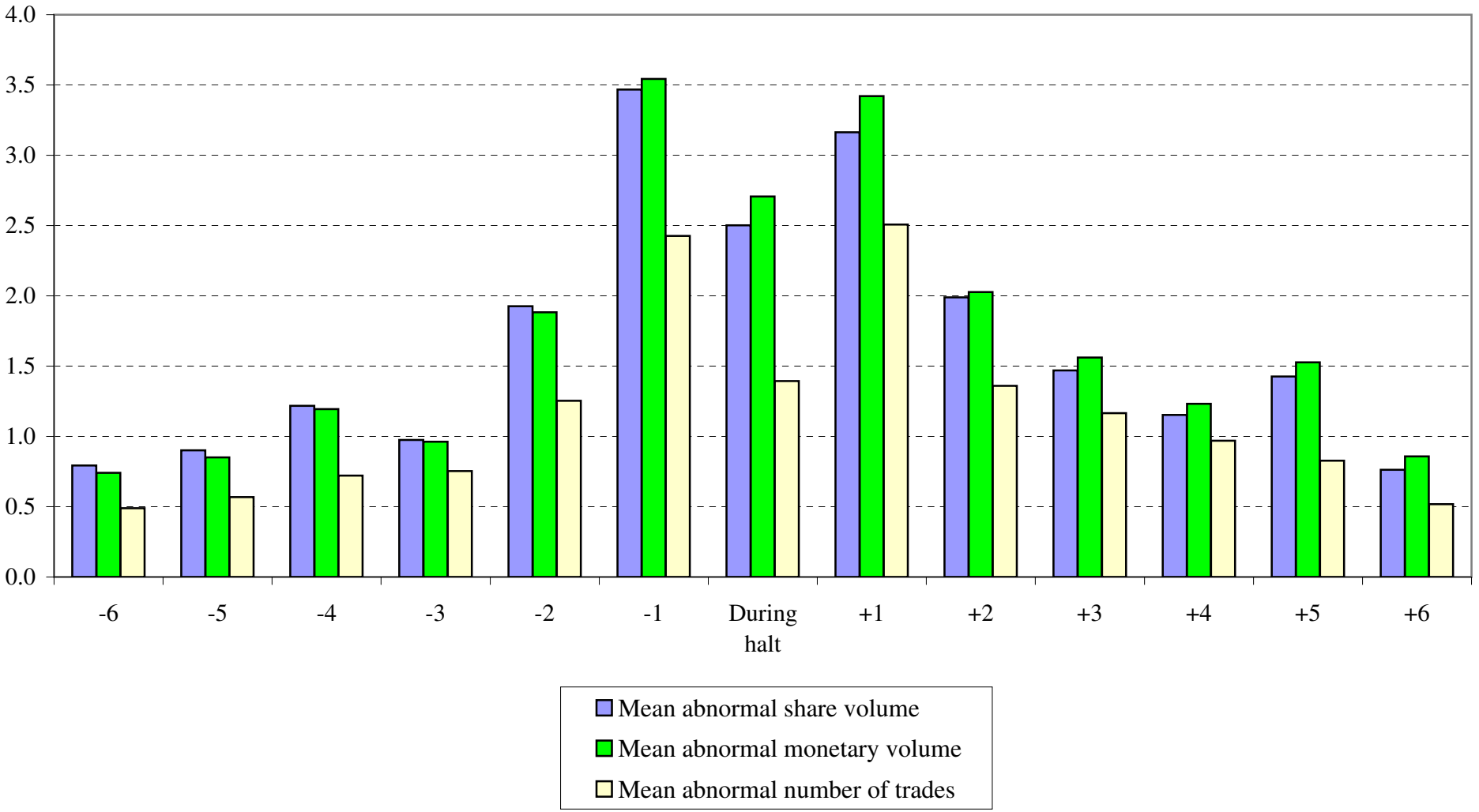

Figure 2 - Median Abnormal Volume Measures

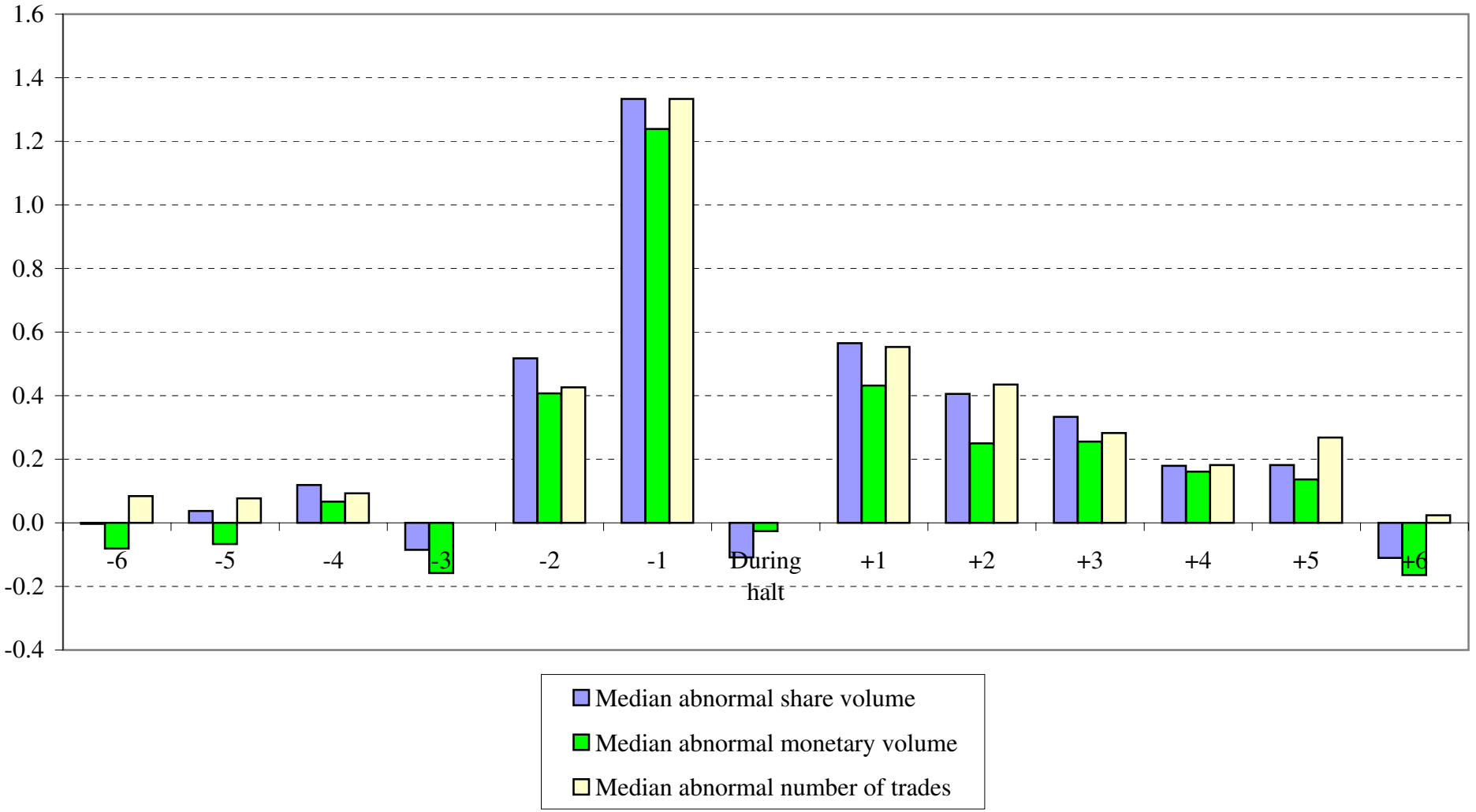

Figure 3 - Median Abnormal Monetary Volume Partitioned by Halt Type

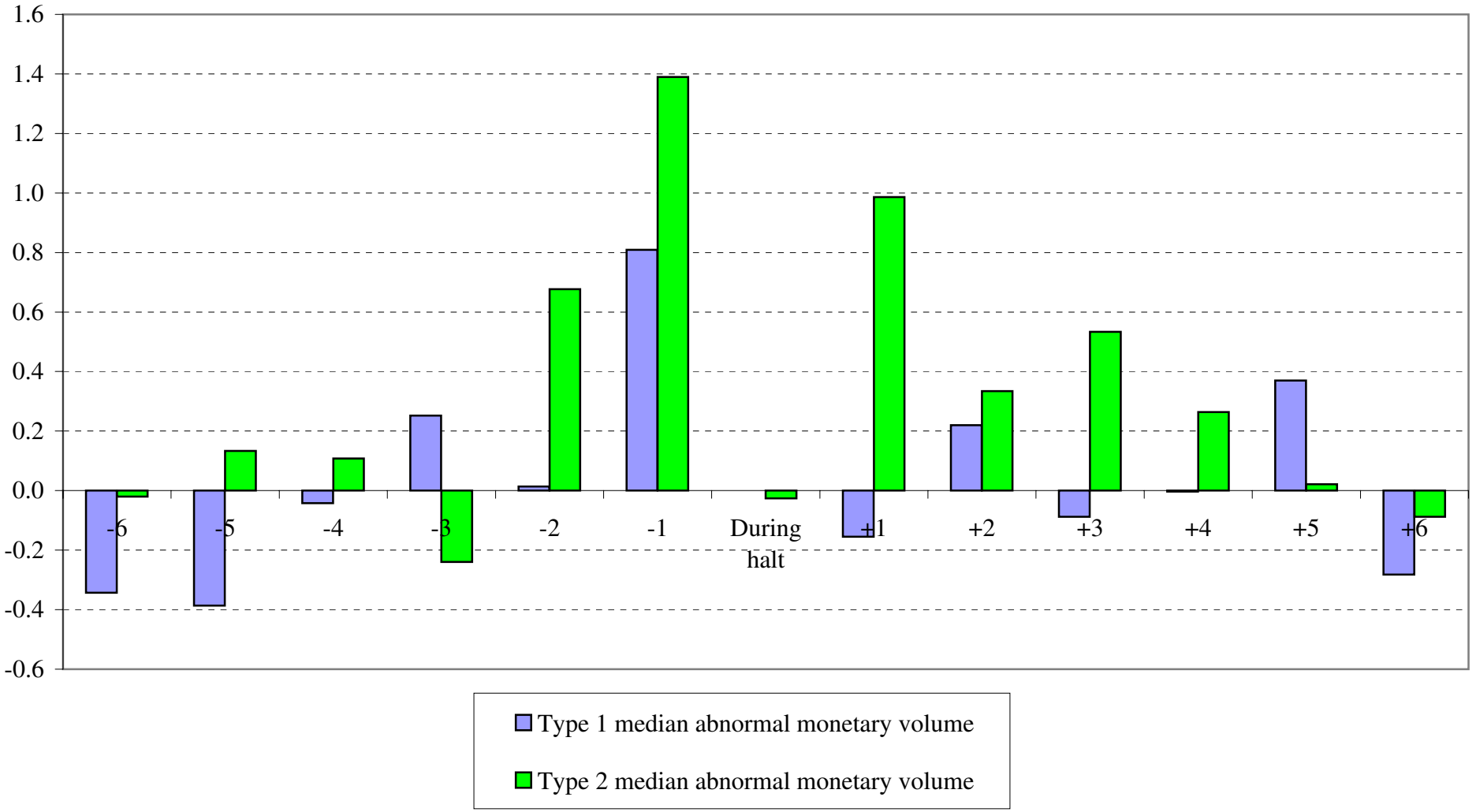

Figure 4 - Abnormal Volatility Measures

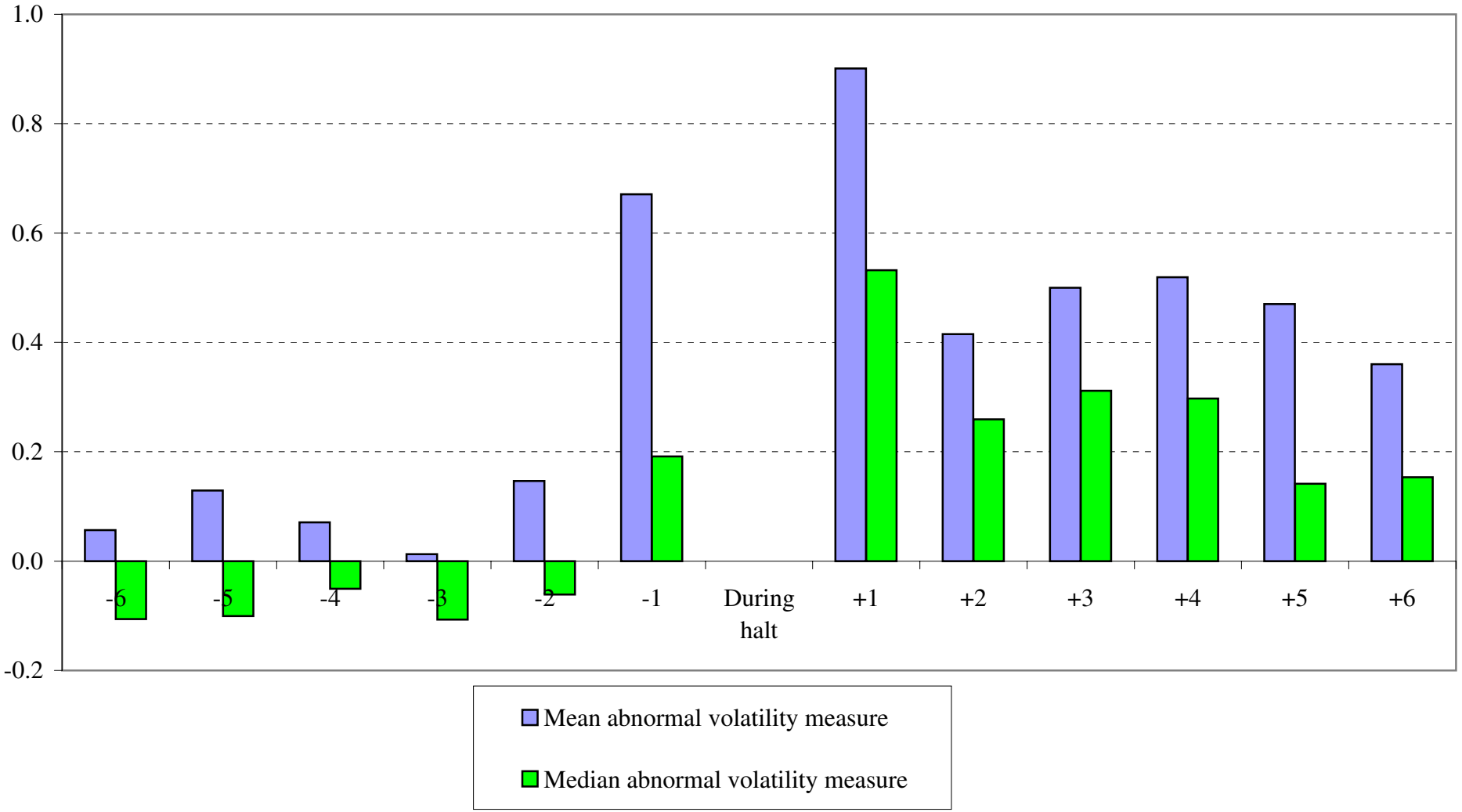

Figure 5 - Mean Abnormal Volatility Partitioned by Halt Type

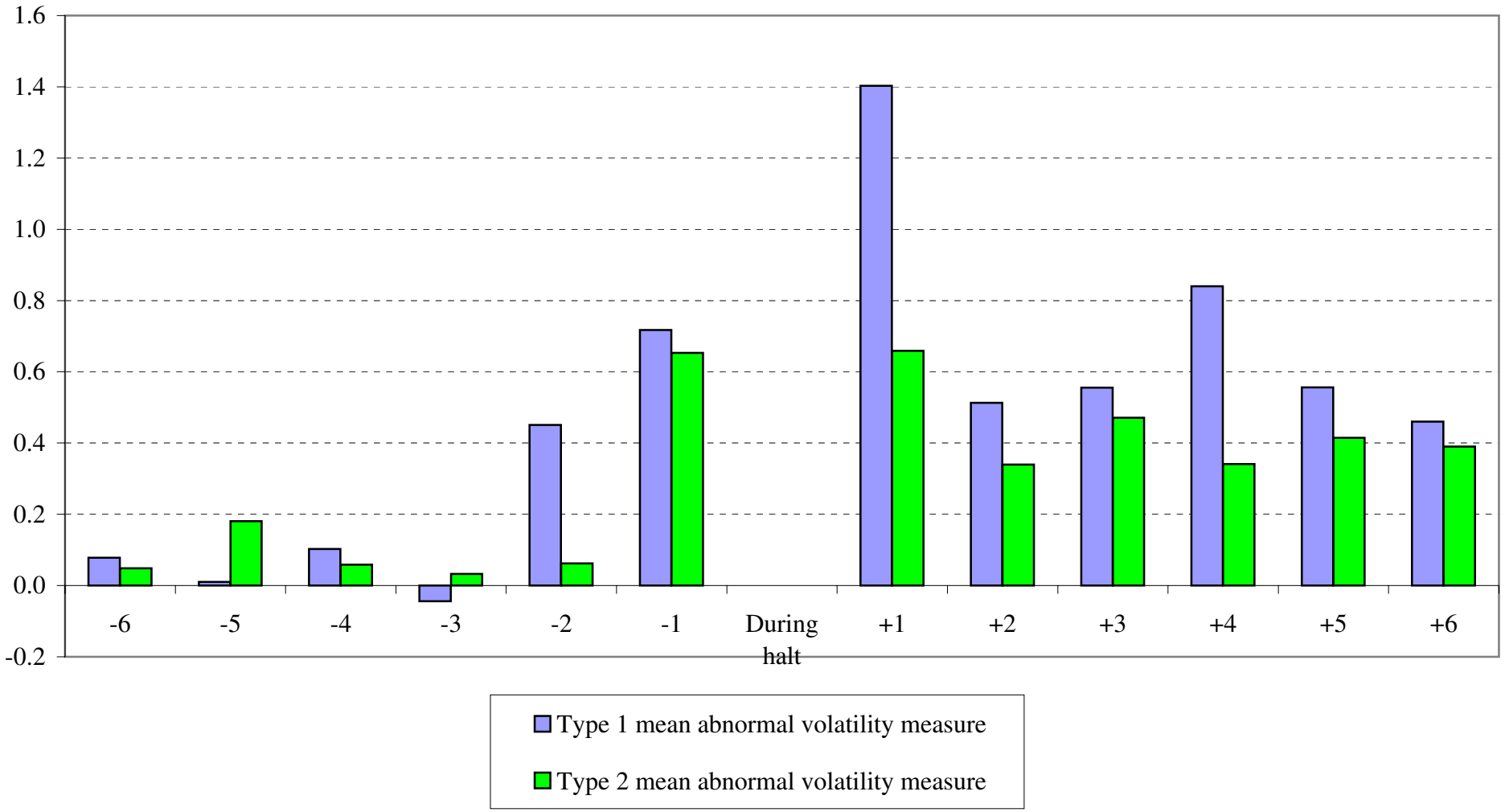

Figure 6 - Price Continuations and Price Reversals

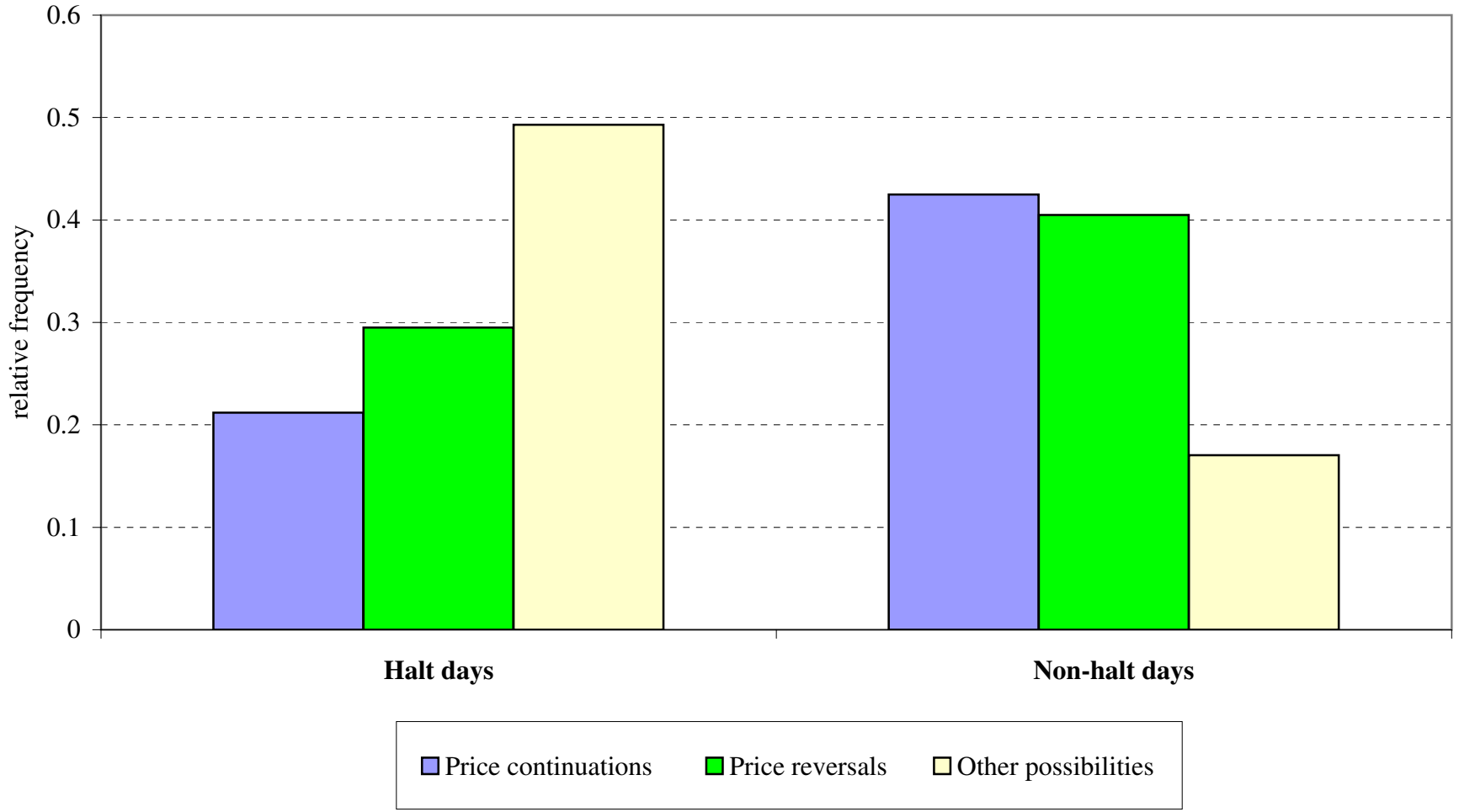

Figure 7 - Price Continuations and Price Reversals Partitioned by Halt Type