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ABSTRACT

Trading halts increase, rather than reduce, both volume and volatility. Volume (volatility) in the first full trading day *after* a trading halt is 230 percent (50 to 115 percent) higher than following "pseudohalts": nonhalt control periods matched on time of day, duration, and absolute net-of-market returns. These results are robust over different halt types and news categories. Higher posthalt volume is observed into the third day while higher posthalt volatility decays within hours. The extent of media coverage is a partial determinant of volume and volatility following both halts and pseudohalts, but a separate halt effect remains after controlling for the media effect.

IN THE WAKE OF the 1987 market break, a number of commentators, including the Presidential Task Force on Market Mechanisms, recommended the establishment of "circuit breaker" mechanisms. The primary argument supporting circuit breakers (both price limits and trading halts) is that nontrading periods provide an opportunity for normal information transmission in times of market duress. Proponents of circuit breakers claim that, during major price changes there can be a breakdown in the transmission of information between the trading floor and market participants. Therefore, "the primary function of a circuit breaker should be to reinform participants" (Greenwald and Stein (1988), p. 17). By lowering informational asymmetries between traders, halts could permit the orderly emergence of a new consensus price.

But would "informative" trading halts succeed? Many academics are openly suspicious of any kind of market interference and assume that trading halts are guilty until proven innocent. Grossman (1990, p. 3), for example, argues that the closing of markets "merely prevents consenting adults from carrying out their desires on the floor of the stock exchange." Not only do halts impose a liquidity cost on traders, but studies suggest that information will not be as

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readily revealed during a halt as through continuous trading (Miller (1990), McMillan (1990), Grundy and McNichols (1989), Brown and Jennings (1989), Dow and Gorton (1989)).

This study investigates the efficacy of trading halts by examining the effect of firm-specific New York Stock Exchange (NYSE) trading halts on volume and price volatility. Prior studies have examined circuit breakers by analyzing volume and price movements at the open and close of markets (Amihud and Mendelson (1987, 1991), Stoll and Whaley (1990), and Gerety and Mulherin (1992a)). Our approach differs in two important respects. First, unlike daily market openings and closings, the timing of trading halts is generally *unpredictable*. The volume and volatility effects of unpredictable trading cessations have received little academic attention.

Second, in contrast to the relatively placid market conditions at daily openings, NYSE trading halts are called during "unusual market situations" (NYSE (1991), p. 57) and are typically associated with important news events. While halts generally last only around one hour, the average absolute net-of-market return over the halt period is in excess of 8%. Clearly, trading halts provide a rare opportunity to examine the effect of circuit breakers in a period of large rapid price adjustment.

We focus our investigation on the levels of trading volume and price volatility surrounding trading halts relative to a control sample. We use intraday data and precise announcement times to compare volume at the reopening and volume and volatility in the posthalt period to statistics associated with "pseudohalt" periods for the same firm. A pseudohalt is a control period of continuous trading for the same firm, matched on time of day and duration. To investigate factors other than the price informativeness of the signal, we also match halt observations to pseudohalts with net-of-market returns of similar size.

Our primary conclusion is that trading halts do not reduce either trading volume or price volatility. Contrary to what might be expected after the emergence of a consensus price, the period after a trading halt is characterized by higher levels of both volume and volatility. Elevated levels of volume and volatility are found after halts, even when pseudohalts are matched on net-of-market returns. Trading volume *during* the halt period (i.e., the trading volume of the resuming batch trade) is not significantly different from the cumulative volume during price-matched pseudohalts. However, in the first full trading day (6.5 trading hours) *after* a halt, volume is 230 percent greater and volatility is 50 to 115 percent larger than after price-matched pseudohalts, depending on the measure employed. Further, higher trading volume is observed for at least three full trading days after halts. Price volatility effects remain for one full trading day. These findings are robust across different types of halts, different types of news events, and different times of the day when the halts are called. Supplemental analyses show that our results are not due to data outliers, the duration of the posthalt period, insufficient price matching, prehalt activity levels, or off-NYSE trading during the halt.

What might account for these results? One explanation is that the price discovery and batch reopening mechanism employed by the NYSE during a halt is inefficient when compared to a continuous trading process. Consistent with the "learning through trading" class of models (Grundy and McNichols (1989), Brown and Jennings (1989), and Dow and Gorton (1989)), our results suggest the absence of recent transaction prices may make potential traders less willing or able to reveal their demands, particularly during periods of large price adjustments. This reluctance leads to a noisier (though possibly unbiased) reopening price, followed by higher volume and volatility in the posthalt period.

It is important to distinguish between the trading cessation itself and the particular price discovery (call mechanism) used by the NYSE. That is, although a trade cessation might "calm" the market, the NYSE price discovery process (with its reliance on indicator quotes) and batch reopening mechanism could be inefficient. Since the trading cessation and the price discovery process are both fundamental features of NYSE halts, our procedures do not allow us to indict either individually. However, the evidence shows that the combination of the two does not result in lower volume and volatility.

We further show that media coverage affects volume and volatility after halts and pseudohalts: Volume and volatility are both reliably larger for events accompanied by news releases. Interpreted in the context of Kim and Verrecchia (1991a), Grundy and McNichols (1989), and Harris and Raviv (1991), this evidence suggests that media coverage increases the degree of divergence in interpretations of a common signal. However, media coverage does not fully account for the increased volume and volatility after halts. After controlling for differences in media coverage and different news categories, we still find significantly higher posthalt volume and volatility.

One alternative explanation for some of our findings is that they reflect fundamental differences in news related to halts versus nonhalts. No two news events are identical. Though our research design controls for the more obvious possibilities (firm characteristics, halt types, time of day, price effects, and news categories), it is conceivable that other subtle differences exist between news that results in halts and news that does not, and that these differences give rise to higher volume and volatility after halts. For reasons discussed in Section III, we view this as unlikely.

In the next section, we review the pertinent literature and provide some regulatory and institutional details. Section II contains a description of the sample, data, and measures employed. Comparisons of trading halts to price-matched pseudohalts appear in Section III, where we also provide results partitioned by the type of halt and the nature of the news release. In Section IV, we investigate the impact of news coverage on posthalt activity. Section V presents a multiple decomposition of the excess volume and volatility associated with halts, including the impact of news coverage, the effect of off-NYSE trading, and the prehalt activity level. Conclusions appear in the final section.

I. Background

A. Regulatory and Institutional Details

Under typical conditions, trading in major North American exchanges follows a continuous auction. In times of important firm-specific news events, however, the continuous process may be strained. The specialist may call a temporary suspension in the continuous process in these circumstances. At the NYSE, these trading halts may be classified according to their cause or time of occurrence. A halt may be called when an unusual order flow imbalance occurs that cannot be matched immediately (an "order imbalance" or "nonregulatory" halt), or when there is an impending or actual news announcement that is expected to have substantial market impact (a "regulatory" halt; also referred to as a "news pending" or "news disseminating" halt).[1] Halts may be called during continuous trading or, more often, at the beginning of the day, when they are called "delayed openings." Three-quarters of the halts in our sample are delayed openings.

Order imbalance halts are initiated by the specialist, after consultation with floor officials. These halts reflect imbalances in the buy-sell direction of orders that cannot be resolved immediately. News, or regulatory, halts are called in response to known or expected news announcements by listed corporations or other parties. In NYSE listing agreements, listed corporations are required to provide the exchange with information that might have a significant price effect "no later than simultaneously with the release of the announcement to the news media."[2] On receipt of such information, the exchange immediately informs the specialist. After consultation with floor officials, the specialist may elect to initiate a news-pending or news-disseminating halt, depending on whether the news release is imminent or already in progress. A news halt may also be initiated by the exchange's Stock Watch surveillance system or the specialist if either becomes aware of rumors that may merit investigation.

The specialist enacts the halt by issuing a quote with zero-bid, zero-ask, and a condition code corresponding to the type of halt. During a halt, the specialist engages in price exploration (*tatonnement*) by issuing indicator quotes, which are lower and upper bounds for the probable reopening price. Indicator quotes are binding on the specialist to the extent that the reopening price must be within the range of the last indicator quote. In effect, the indicator quotes serve as "trial balloons" to which potential buyers and sellers respond by placing commitments to trade on either side of the market. These commitments can be changed or withdrawn during the halt since no

[1] See Hopewell and Schwartz (1978) and the NYSE (1991) for more detailed descriptions of the procedures and policies for halts.

[2] The New York Stock Exchange, "Expanded Policy on Timely Disclosure" (1968), as quoted in Hopewell and Schwartz (1978).

trading takes place before the reopening. Participants have incentives to respond to indicator quotes since orders received during the halt get execution priority over subsequent orders. The reopening is a call auction where existing commitments to buy and sell are matched and reflected in a single aggregate trade. A new quote is also posted and the normal, continuous auction is reconvened.

B. A Brief Review of the Trading Halt Literature

Hopewell and Schwartz (1978) examine daily abnormal returns associated with NYSE trading halts and document large price changes: uptick (or downtick) halts averaged 7.54 percent (or −8.36 percent) measured over the day of the halt. Larger absolute changes are documented for multiday halts. In the prehalt period, Hopewell and Schwartz find anticipatory price reactions for trade imbalance halts and good news halts, but none for bad news halts. Posthalt returns are close to zero on average, though there is some evidence that day +1 returns of good news (or bad news) halts are significantly positive (or negative), implying that price adjustments at the reopening are incomplete. The authors conclude that these inefficiencies cannot be exploited profitably after considering typical transactions costs. There is also no sign of price reversals over the six days following the halt, suggesting that the price discovery process does not typically overreact to the information associated with the trading halt.

Schwartz (1982) and King, Pownall, and Waymire (1991) examine the behavior of specialist indicator quotes during the halt. Schwartz (1982) documents that the high-low price range of successive indicator quotes narrows and that the last indicator (which is still larger in magnitude than normal bid-ask spreads) appears to be an accurate predicator of the reopening price. He argues that this is consistent with a progressive price discovery process. King, Pownall, and Waymire (1991) focus on the relation between the magnitude of the price change and characteristics of the indicator quotes. They find that halts associated with greater eventual price movements are longer in duration, have more indicator quotes and generate indicator quotes that tend to be less accurate.

Fabozzi and Ma (1988) examine over-the-counter activities for NYSE stocks during the halt. For more than half of the halts in their sample, trading on NASDAQ occurs during the NYSE suspension. Using trade-by-trade data for 314 halts during 1985, they find that NASDAQ trading is characterized by high volatility. There are no apparent opportunities for arbitrage profits, however, since the first transaction price during the halt is an unbiased estimate of the eventual NYSE reopening price.

In summary, the existing literature on trading halts yields three stylized facts: 1) trading halts are associated with highly informative news events, 2) during the halt, the specialist engages in a price discovery process using indicator quotes that converge toward the reopening price, and 3) opportunities for abnormal profits are insignificant before, during, and after a halt.

Surprisingly, volume and volatility issues have been largely ignored in this research.

C. The Effects of Halts on Volume and Volatility

Several existing studies suggest that volatility after trading halts should be lower, relative to volatility following periods of continuous trading. For example, Stein (1987) presents a model where, during periods of price uncertainty, continuous trading by rational, profit-maximizing traders can lower the informativeness of prices. In the same spirit, Greenwald and Stein (1988) argue that when prices are uninformative, the risks of trading discourage agents from doing so. The resulting reduction in volume decreases the informativeness of prices relative to prices following a trading cessation. In these regimes, trading suspensions enhance price discovery by allowing better information transmission during the price adjustment process. Kodres and O'Brien (1991) argue that price limit halts aid in achieving Pareto-optimal risk sharing following fundamental information shocks. Goldman and Sosin (1979) suggest that policies such as trading halts may improve market efficiency if there is sufficient price uncertainty. Greenwald and Stein (1991) present a model where uncertainty over the number of uninformed traders on each side of the market creates excess price volatility in continuous trading, independent of the volatility in fundamentals. In their model, trading halts reduce the risk created by this type of price volatility.

In contrast, Grundy and McNichols (1989), Brown and Jennings (1989), and Dow and Gorton (1989) present models where trading is necessary to reveal heterogeneous information. In these "learning-through-trading" models, strategic traders learn from and condition their orders on recent transactions. These models predict that during a suspension of trading, the absence of recent transaction prices makes potential traders unwilling or unable to reveal their demand completely.[3] Although the reopening price may be unbiased, the price adjustment process is incomplete. Consistent with this hypothesis, Amihud and Mendelson (1987) and Gerety and Mulherin (1992b) demonstrate that the opening price is relatively noisy. Amihud and Mendelson (1991) demonstrate that reopening volume is a function of the time between trading sessions, and Stoll and Whaley (1990) find differences in market behavior for continuous versus periodic batch trading comparing open-to-open to close-to-close return data.

Finally, Madhavan (1991) models the relation between security prices and market transparency, defined as information about order imbalances. His model assumes that trading halts are accompanied by communication of order imbalance information. Imbalance information reduces noise, which he assumes is essential for profitable market making. The strategic response of liqudity providers to this change in information results in a higher risk premium and greater market volatility after halts. Thus, in his model, even

[3]Lee (1992) makes a similar argument in the specific context of NYSE trading halts.

though the precision of traders' predictions about an asset's value increases after a halt, posthalt volatility is higher.

The applicability of these models to NYSE trading halts is an empirical issue. During a NYSE trading halt, the specialist conducts a *tatonnement* auction by issuing range indicator quotes. Trading is then reconvened using a batch reopening. The efficacy of these price discovery mechanisms should be reflected in the subsequent trading activity. If the reopening price is less noisy and better reflects an equilibrium valuation compared to a price derived through continuous trading, we would expect reduced volatility in the posthalt period relative to similar pseudohalt periods. Similarly, if the *tatonnement* process and the batch reopening mechanism are able to resolve and reflect disagreement among traders and establish a consensus price, we would expect reduced volume in the posthalt period. Conversely, if traders are unable or reluctant to reveal their demand fully during the halt, or if they are impaired by the reopening mechanism, the reopening price may be noisy, resulting in higher subsequent volume and volatility.

D. The Effect of Media Coverage

The above discussion was predicated on the implicit assumption that identical news is released in all cases. Our research design controls for the most obvious characteristics of a news release: the price effect of the news, information environment of the firm, and time of day and duration of the halt. As a final control, we also ensure that both the halt and the pseudohalt receive comparable media coverage.

The importance of controlling for media coverage is suggested by Pfleiderer (1984), Holthausen and Verrecchia (1990), Kim and Verrecchia (1991a), and Harris and Raviv (1991), who present models where the volume reaction to news events is an increasing function of the dispersion in investor beliefs. In a related paper, Kim and Verrecchia (1991b) speculate that different types of news can generate different volume and volatility reactions after conditioning on the size of the price effect.

When a trading halt is announced, the news is typically reported by wire services (Dow Jones and Reuters). To the extent that this increased media coverage draws potential traders into the market and thus increases the dispersion in investor beliefs, higher volume and volatility may result.

Some existing empirical evidence claims that media coverage affects trading volume. Dopuch, Holthausen, and Leftwich (1986) find a significant market reaction to qualified audit opinions only if there is media coverage. Their result holds even when the media coverage is not the first public disclosure of the event. Stice (1991) finds a similar result for earnings announcements. He finds a market reaction to *Wall Street Journal* earnings digest reports even after the news has been reported in a 10-K or 10-Q filing. Our analysis adds to this work by examining the incremental effect of media coverage in relation to halts and pseudohalts.

II. Research Design

A. Data and Sample Definitions

The Institute for the Study of Security Markets (ISSM) database contains every trade and quote revision for firms listed on the NYSE or American Stock Exchange. The data include bids, asks, and depths (for quotes) and execution prices and volumes (for trades). All data are time stamped to the nearest second.

Our initial sample consisted of all trading halts on NYSE common stocks during 1988 as identified by the ISSM tape.[4] We excluded halts preceding delistings or transfers to other exchanges and trading halts representing the first transaction of a new listing (three halts). We discovered a few cases where a news pending halt was called, then immediately canceled with no associated volume, news, or indicator quotes. Since discussions with NYSE specialists indicate that a legitimate halt should have at least one indicator quote, we eliminated thirteen halts that did not have at least one price range indicator. Sixteen halts that occurred within one day of the beginning or the end of the year were eliminated because statistics could not be generated for the day preceding or following the halt. Ten other halts were not used since shares-outstanding data were unavailable. A total of 42 observations were eliminated yielding a sample of 852 trading halts.

The beginning of a trading halt is identified by a halt indicator quote containing a halt condition code. Although ISSM documentation suggests several possible codes for trading halts, only three types of condition codes were actually found in the 1988 data: I for imbalances, D for news dissemination, and P for news pending. We define the end of the halt as the first NYSE trade or quote which is "normal" (a trade coded as regular or opening, or a BBO-eligible quote). The vast majority of our halts reopen with a trade, although sometimes a halt is terminated by a quote without a reopening trade. Lee and Ready (1991) show that quotes are sometimes recorded faster than trades, and recommend a general five-second quote delay when working with ISSM data. However, we observe some apparent reopening trades just beyond the five-second correction. Thus, when an opening quote is encountered first, but the quote is within ten seconds of a NYSE trade with normal condition codes, we deem the halt to have ended on the opening trade.

We compute the stock return over the halt using the midspread (the midpoint of the bid-ask spread) of the last NYSE quote before the halt and the reopening price, which is either the price of the reopening batch trade or

[4] We compared our sample to the sample used by King, Pownall and, Waymire (1991), which was taken directly from the NYSE Trading Halt Log for August 1 to October 20, 1988. During this period, our tape contained 193 halts compared to 189 halts in the King *et al.* sample. The difference appears attributable to slightly different filter rules for new and delisted stocks. We also compared our sample over the November 21 to December 31, 1988 period against the NYSE Halt Log (earlier logs were unavailable). All of the halts from the NYSE log were found on the ISSM tape. However, we found five halts (on December 12) included on the ISSM tape that appear to be actual halts (based on media stories), but were omitted from the NYSE halt log.

the midspread of a quote if trading resumed with a quote. This mitigates against bid-ask biases in intraday returns. To purge general market movements, we compute returns on the S & P500 index futures price in five-minute intervals using data from TICK DATA, Inc. This overall market return is subtracted from firm returns to obtain net-of-market or excess returns.

We searched the *Wall Street Journal Index*, the *New York Times Index*, and the "Wires" and "Papers" services in the Lexis/Nexis online database to classify the news events underlying the halts. We used only those articles that expressly mentioned the firm and provided a reason for the halt on the day indicated by the ISSM tape. We classified the news into six general categories: 1) Acquisitions and Divestitures, 2) Capital Structure Changes, 3) Takeovers and Leveraged Buyouts (LBOs) (where the firm is a target), 4) Financial Information, 5) Legal and Miscellaneous News and 6) No News. The Appendix provides a detailed description of procedures used to identify and classify the news events and a listing of the news categories and subcategories.

B. Sample Description

The 852 halts involved 449 firms. Of these firms, 254 (57 percent) experienced only one halt during the year. At the other extreme, four firms (Irving Bank Corp., Pillsbury Co., MacMillan Inc., and RJR Nabisco) were targets in protracted takeover battles and experienced over ten trading halts during the year. A typical day has just over 3.5 trading halts. However, there were two days with 10 halts and one day with 12 halts.

Table I contains summary statistics for the duration of the sample halts, as well as signed and absolute net-of-market returns both in aggregate and broken down by trading halt type. A typical trading halt is roughly one hour in length, though imbalance halts are shorter and news-pending halts are longer. Associated price moves are dramatic. For the entire sample, the average absolute net-of-market return is 8.1 percent, while the median is 4.2 percent. On average, trading halts are associated with good news for our sample. Signed net-of-market returns are reliably positive with mean and median signed returns of 4.2 and 1.6 percent respectively. We provide evidence below that the positive response is primarily attributable to the large number of takeover-related announcements in our sample.

It is interesting to note the inverse relation between measures of trading halt length and price adjustments across the three types of halts. Imbalance halts are typically shorter in duration, yet mean and median absolute returns are largest for this group. In contrast, news-pending halts are the longest on average, yet they are associated with the smallest unsigned price revisions. The shorter duration in the imbalance halts may be due, in part, to competitive pressure from other exchanges. In 1988, other exchanges were allowed to trade a NYSE-listed issue during a NYSE imbalance halt, but not during news-pending or news dissemination halts.

Table I
Summary Statistics for Full Sample

Duration, market-adjusted return, and market-adjusted absolute return statistics for the 852 NYSE trading halts called during 1988, reported by type of halt, nature of the information release and time of day.

	Number of Halts in Sample	Duration Mean (Median) in Hours	Market-adjusted Return Mean (Median) in Percentages	Market-adjusted Absolute Return Mean (Median) in Percentages
Total sample	852	1.09	4.18	8.13
		(0.73)	(1.60)	(4.20)
By halt type				
Order imbalance	334	0.48	4.35	9.88
		(0.40)	(3.10)	(6.10)
News pending	303	1.66	3.16	5.92
		(1.28)	(0.70)	(2.30)
News dissemination	215	1.22	5.34	8.51
		(0.80)	(1.80)	(3.70)
By information				
Acquisitions and divestitures	89	1.82	1.11	4.03
		(1.00)	(0.60)	(2.50)
Capital structure changes	85	1.20	1.66	6.53
		(0.78)	(0.02)	(2.10)
Takeovers and LBOs	465	1.06	7.43	9.97
(firm is target)		(0.78)	(3.60)	(5.10)
Earnings and other	90	0.78	−3.13	6.97
financial news		(0.56)	(−1.00)	(5.25)
Legal and miscellaneous	79	1.01	1.17	7.34
		(0.73)	(0.40)	(4.30)
No news	44	0.46	1.15	3.77
		(0.38)	(1.05)	(2.65)
By time of day				
Delayed opening	635	1.06	4.30	8.43
		(0.62)	(1.90)	(4.70)
Intraday halts	217	1.16	3.83	7.25
		(0.98)	(0.99)	(2.60)

Table I also reports statistics for halts classified by the type of underlying news. With the exception of the takeover and LBO category and the no-news category, each group contains roughly the same number of events. Over half the sample consists of takeovers and LBOs (trading in the target firm was halted). During the halt, the mean signed net-of-market return was 7.4 percent for this class and the mean absolute net-of-market return was 10.0 percent. Although the remainder of the categories exhibit less-dramatic price moves, the mean absolute net-of-market return during the halt exceeds 3.5 percent for every category.

The last two rows of Table 1 shows that 635, or 75 percent, of the halts occur at the opening of trading. Delayed opening halts are slightly shorter in duration, but generally have mean signed and absolute returns similar to intraday halts.

C. Variables and Statistics

Volume and volatility are closely related measures of market activity. Empirical evidence suggests that the amount of trading volume and the magnitude of the price change are positively related (see Karpoff (1987) for summary). Recent market microstructure research also supports the notion that price changes (measured, for example, by revisions in the specialist's mispread) are related to volume.[5] In this study we use both price volatility and trading volume to measure the market response to information shocks.

For each halt, we calculate the return during the halt and the reopening batch volume. We also calculate several statistics for a full trading day (6.5 hours) before the initiation of the halt and a full trading day after the reopening. These statistics include three volatility and two volume measures.

Volatility measures

1. *ABSRET* = the absolute return, computed as the difference between the last trade price before the interval and the last trade price in the interval.
2. *HILOW* = the absolute difference between the highest and lowest trade price, and
3. *SPDREV* = the number of revisions to the midspread (midpoint between the bid and ask price) of the NYSE specialist's quote. Quote revision involving only the quoted size (i.e. depth at the offer or bid) are not included.

Each statistic captures a slightly different dimension of price volatility. *ABSRET* is a traditional measure of volatility. Schwert and Seguin (1990, p. 1147) argue that absolute value measures of firm or portfolio variance are preferred to squared return measures. The *HILOW* measure is an intraday analog of the extreme value estimator in Wiggins (1991), who demonstrates that this estimator can provide a more efficient volatility measure than absolute returns. Whereas *HILOW* captures the *range* over which the price drifts in a given time period, *SPDREV* measures the *frequency* of price changes.

Given our experimental design, we can draw inferences about volatility before and after the halt, but we do not offer evidence on the price path during the halt. In particular, it is impossible for us to determine whether halts eliminate wild swings or price reversals that may have occurred had a

[5]See Hasbrouck (1988) and Madhavan and Smidt (1991) for empirical evidence and Easley and O'Hara (1992) for a model of the phenomenon.

halt not been called. This potential benefit of a trading halt is not examined in our study.

Volume measures

1. *VOLSHR* = the number of shares traded in the time interval, and
2. *VOLTRD* = the number of trades in the time interval.

Since volume results are similar using either measure, the tables that follow report the findings using *VOLSHR* only.

III. Empirical Methods and Results

The ideal experiment investigating the marginal effect of trading halts would involve identical firms with identical information shocks. A trading halt would be called for one of the events, with trading continued for the second firm. Such a test may be possible in an experimental market, but in actual markets, finding identical firms and informational releases is impossible, so a perfectly controlled experiment is infeasible. However, the objective of our research design is to approach the ideal experiment as closely as possible.

We control for firm-specific time-of-day effects by comparing each halt to data from the same firm's other trading days, measured over the same time of day as the halt (Table II). We then control for the amount of information released by finding a reference observation with a net-of-market return of similar magnitude, again matched by time and firm (Tables III and IV). We evaluate the level of volume and volatility in the prehalf period (Table V). Finally, we control for media coverage and the type of news event (Table VI), as well as prehalt activity levels and off-NYSE activity (Table VII).

It is still conceivable that halt news differs fundamentally from the types of news associated with pseudohalts. Thus, our findings may simply reflect the ability of exchange officials to forecast higher postannouncement volume and volatility. We believe this to be unlikely, since floor procedures and specialist incentives suggest halts are called mainly in anticipation of potentially large price moves (NYSE (1991)). The primary issue in the decision to call a halt is the expected price impact of the news, not the expected postreopening volume or volatility. There is little evidence that specialists have either the *incentive* or the *ability* to forecast excessive volume and volatility *after* conditioning on price effects.

A. Comparisons to All Trading Periods

Initially, for each firm we use all trading days when the firm did not experience a halt to develop a reference sample. For each day in this nonhalt sample, we develop a pseudohalt observation beginning at the same time of day and lasting for the same duration as the actual halt. When the halt arises from a delayed opening, both the halt and pseudohalt returns include the

overnight price move. We calculate the cumulative return and volume over the pseudohalt period as well as volume and volatility statistics for the trading day (6.5 trading hours) immediately before and after the pseudohalt. We allow overlaps in our reference observations so that trade and quote data for the day following one pseudohalt may be used as data for the day before the next pseudohalt. However, if the pseudohalt is within one trading day (6.5 trading hours) of a true halt, we exclude that observation from the reference distribution. This reference distribution allows us to calculate firm-specific averages. These averages are then compared to the statistics generated around the halt period. This comparison is the basis for the results in Table II. Notice that in this test we do not control for the size of the price move during the halt. In a later test (Table IV), we compare halt volume and volatility statistics to the pseudohalt whose absolute net-of-market return most closely matches the actual absolute return over the halt period.

Table II compares halt statistics with averages from the pseudohalt reference distribution. Each halt observation is expressed as the percent *difference* from the pseudohalt average. This percent difference is then averaged across all halts. For example, the number 447.4 at the top of the column labeled "Reopening Volume" indicates that, for the average halt, the volume of the call auction that reopened trading is 447.4 percent higher than (or 5.474 times) the volume during normal continuous trading for the time interval covered by the halt. The volume for the 6.5 hours of trading after the reopening is 570.3 percent higher than (roughly 6.8 times) the average daily volume for the nonhalt period.

It is clear from Table II that the volume at reopening is extremely high relative to normal trading in the same time interval. This is true for all three types of halts and all six types of news events. Reopening volume for acquisitions and divestitures is lowest, but is still 2.5 times the normal volume. Volume and price volatility in the 6.5 hours following the end of the halt are also uniformly large. It is apparent that the price and volume adjustment process is incomplete at the reopening trade following the halt. These results are generally consistent across types of halts and information and the time of the halt.

B. Comparisons to Price-matched Periods

While Table II results control for firm and time-of-day, there is no control for the magnitude of the price move during the halt. Typically, a halt is associated with a major price move, so a portion of the posthalt volume and volatility may be attributable to liquidity trading and portfolio-rebalancing activities made in reaction to changes in share value. Thus, the Table II results may not be surprising. We control for these price-related activities by comparing each halt to the single observation from the reference distribution whose absolute net-of-market return over the pseudohalt period most closely matched the absolute net-of-market return during the halt ("price-matched" pseudohalts, hereafter). To ensure a close match, we require that there be at

Table II

Abnormal Volume and Volatility for Full Sample

Mean abnormal volume and volatility statistics for the 852 NYSE trading halts called during 1988. Table values represent abnormal statistics, which are computed by subtracting the mean corresponding statistic for all reference pseudohalts. A reference pseudohalt is a period of trading on a nonhalt day that has the same starting time and duration as the actual trading halt. Except for column 1, all table values are expressed as a percentage of the average normal statistic for the reference pseudohalts. "Reopening volume" is the number of shares traded at the halt reopening. "Posthalt Volume" and "Posthalt Volatility" are statistics calculated over the 6.5 trading hours immediately following the halt. Two and three asterisks indicate significance at the five and one percent levels, respectively.

				Post-halt Volatility		
	Number	Reopening Volume	Posthalt Volume	Market-adjusted Absolute Return	High-Low Price Spread	Number of Quote Revisions
Total Sample	852	447.4***	570.3***	125.5***	128.0***	247.7***
By halt type						
Order imbalance	334	736.4***	581.5***	102.1***	120.8***	243.2***
News pending	303	182.4***	561.5***	170.6***	152.6***	285.6***
News dissemination	215	372.0***	565.5***	98.4***	104.3***	201.3***
By information						
Acquisitions and divestitures	89	149.3***	280.8***	114.6***	99.1***	164.4***
Capital structure changes	85	160.6***	309.5***	146.7***	130.2**	148.3***
Takeovers and LBOs	465	512.9***	724.4***	110.8***	137.3***	295.5***
Financial/earnings information	90	631.7***	541.9***	191.1***	144.9***	245.5***
Legal and miscellaneous	79	527.7***	512.8***	163.6***	123.2***	242.8***
No news	44	391.7***	193.4***	59.3**	57.0***	116.6***
By time of day						
Delayed openings	635	464.0***	560.6***	110.8***	106.6***	225.9***
Intraday halts	217	398.8***	598.9***	168.6***	190.3***	311.4***

most a one percent difference between the absolute pseudohalt net-of-market return and the absolute halt net-of-market return. A total of 500 halts (59 percent of our full sample) had qualified matches.

Whether a halt can be successfully matched is not random. This matching process typically excludes halts with extremely large absolute price moves. There are two implications of this selection bias. First, by excluding large price moves, we reduce the power of our tests, thus biasing against finding a difference in the matched sample. Second, the resulting selection bias narrows the scope of the conclusions, since we can now only differentiate pricing under batch versus continuous regimes for relatively small halt returns.

Table III provides the same statistics as Table I, but for the sample of 500 halts with a qualified match. Column 1 shows that the matching process retained 42 to 76% of the full sample, depending on the news or halt type. There is little difference in the duration of the halts but, as expected, the matched sample in Table III has lower returns and absolute mean returns than the full sample. The mean absolute net-of-market return for the matched sample is 2.5 percent compared to 8.1 percent for the full sample. This difference reflects the failure to find a suitable match for the halts with the biggest price moves. The mean signed net-of-market return for the matched sample is 0.7 percent, compared to 4.2 percent for the full sample, indicating that the matched sample is affected less by good news events. The drop in mean net-of-market absolute return is reflected in all news categories, but is most pronounced for takeovers and LBOs, where it decreased from 10 percent to less than 3 percent. Intraday halts had lower mean and median absolute returns than delayed opening halts.

Table IV displays the difference between the halt statistic and the matched pseudohalt statistic, expressed as a percentage of the average for the nonhalt period. We again use the same deflators used in Table II to normalize each halt observation. This avoids overweighting of firms with high normal volume or price volatility. For Tables IV, V, VI and VII, the table values reflect:

$$\textit{Averaged abnormal statistic} = \frac{1}{n}\sum_{i=1}^{n}\frac{\textit{Halt Statistic}_i - \textit{Matched Statistic}_i}{\textit{Average Statistic}_i}$$

where

n = number of halts in sample,
$\textit{Halt Statistic}_i$ = The statistic from the ith halt,
$\textit{Matched Statistic}_i$ = The corresponding statistic from around the ith matched pseudohalt, and
$\textit{Average Statistic}_i$ = The average statistic for the reference distribution corresponding to the ith halt.

It is useful to recall that a "typical" (median) halt lasts about one hour (say from 10:00 A.M. to 11:00 A.M.) and results in an absolute price move of about 5 percent. Table II shows that the average volume over the 10:00 to 11:00 interval on all of the nonhalt days is substantially lower than the reopening

Table III
Summary Statistics for Matched Sample

Duration, return and absolute return for a sample of 1988 halts with at least one qualifying pseudohalt matched on absolute net-of-market return. A pseudohalt is a period of trading on a nonhalt day that has the same starting time and duration as the actual trading halt. A qualifying pseudohalt is a pseudohalt with an absolute net-of-market return that is within one percent of the absolute net-of-market return over the halt period.

	Number of Halts (as % of Full Sample)	Duration Mean (Median) in Hours	Market-adjusted Return Mean (Median) in Percentages	Market-adjusted Absolute Return Mean (Median) in Percentages
Total sample	500	1.25	0.72	2.52
	(59)	(0.82)	(0.40)	(1.65)
By halt type				
Order imbalance	141	0.45	0.35	3.67
	(42)	(0.38)	(1.09)	(3.05)
News pending	220	1.67	0.50	2.11
	(73)	(1.27)	(0.30)	(1.15)
News dissemination	139	1.41	1.07	2.69
	(65)	(0.80)	(0.50)	(1.60)
By information				
Acquisitions and divestitures	62	2.23	0.45	2.01
	(70)	(1.11)	(0.30)	(1.10)
Capital structure changes	65	1.30	−0.21	1.86
	(76)	(0.85)	(−0.10)	(1.20)
Takeovers and LBOs (firm is target)	247	1.19	1.23	2.56
	(53)	(0.88)	(0.80)	(1.90)
Earnings and other financial news	45	0.88	−0.56	2.58
	(50)	(0.62)	(−0.40)	(1.70)
Legal and miscellaneous	48	1.13	1.27	3.91
	(61)	(0.80)	(0.25)	(1.90)
No news	33	0.46	0.20	2.35
	(75)	(0.33)	(0.40)	(1.70)
By time of day				
Delayed openings	357	1.32	0.81	2.79
	(56)	(0.78)	(0.40)	(1.90)
Intraday halts	143	1.07	0.51	1.85
	(66)	(0.88)	(0.40)	(1.10)

volume from the batch reopening following the halt. However, Table IV shows that for the 500 halts with a matchable continuous auction return, nonhalt day trading volume (the volume from 10:00 to 11:00 on a day where the absolute return during this interval is within one percent of the unsigned halt return) is much closer to halt volume. This difference is, of course, consistent with prior findings of a positive contemporaneous relation between absolute price changes and volume. In fact, the average reopening volume for halts is lower than for matched pseudohalts, but the difference is not signifi-

Table IV

Abnormal Volume and Volatility for Matched Sample

Mean abnormal volume and volatility statistics for 1988 trading halts, matched against the qualifying pseudohalt with the closest absolute net-of-market return. A pseudohalt is a period of trading on a nonhalt day that has the same starting time and duration as the actual trading halt. A qualifying pseudohalt is a pseudohalt with an absolute net-of-market return within one percent of the absolute net-of-market halt return. The matching pseudohalt is the qualifying pseudohalt that most closely matches the halt in absolute net-of-market return. "Reopening Volume" is the shares traded at the halt reopening minus the shares traded during the matching pseudohalt period. "Posthalt Volume" and "Posthalt Volatility" are statistics calculated over the 6.5 trading hours immediately following the halt, minus the corresponding statistics during the 6.5 trading hours immediately following the matching pseudohalt. Except for column 1, all table values are expressed as a percentage of the average normal statistic for the reference pseudohalts. One, two, and three asterisks indicate significance at the ten, five, and one percent levels, respectively.

				Posthalt Volatility		
	Number	Reopening Volume	Posthalt Volume	Market-adjusted Absolute Return	High-Low Price Spread	Number of Quote Revisions
Total sample	500	−21.2	228.5***	49.1***	50.9***	116.9***
By halt type						
Order imbalance	141	93.1	214.0***	−7.5	21.7	70.1***
News pending	220	−108.6*	276.4***	86.0***	82.0***	174.1***
News dissemination	139	1.2	167.3***	48.1**	31.2*	73.9***
By information						
Acquisitions and divestitures	62	−18.6	152.0**	109.8***	61.8**	100.2***
Capital structure changes	65	−21.1	123.7**	58.0*	42.2**	92.9***
Takeovers and LBOs	247	−49.8	310.8***	17.8	48.4***	135.7***
Financial/earnings information	45	73.7	249.2***	174.6***	117.5***	164.5***
Legal and miscellaneous	48	27.4	201.2***	73.8*	54.5**	95.7***
No news	33	−11.9	−25.8	−55.6**	−30.3*	20.8
By time of day						
Delayed openings	357	2.2	196.3***	40.2***	39.6***	91.5***
Intraday halts	143	−79.7	308.8***	71.2***	79.0***	180.2***

cant for the total sample. These findings suggest that if traders are inclined to understate their demands during the halt, this activity is not reflected in the level of reopening volume.

The posthalt results in Table IV represent the primary findings of this study. Although average halt reopening volume is similar to the cumulative volume over matched pseudohalts, volume and volatility following the halts are significantly larger in the trading day (6.5 trading hours) following the halt. Following the halt, trading volume is 230 percent higher than normal. The absolute price change and extreme value estimators are each 50 percent higher than normal and the number of quote revisions is 117 percent higher than normal.

This excess volume and volatility is observed across most subcategories. Interestingly, the only category that does not show significant increases in volume and volatility is the "No news" category. In fact, for this category the posthalt volume and volatility is lower than in the pseudohalt sample, significantly so for two of the volatility measures. Below, we examine news versus no-news events and report some analyses designed to distinguish a halt effect from a news or media coverage effect.

Consistent with the daily results in Hopewell and Schwartz (1978), we also find a slight price drift in the posthalt period. Computed over the 6.5 trading hours after the halt, the mean excess return after bad news halts is -1.53 percent ($n = 209$) and the mean excess return after good news halts is 0.84 percent ($n = 291$). Both are statistically significant.[6] While probably not economically exploitable after transaction costs, this drift does suggest that the adjustment process is not complete at the resumption of trading.

These price continuation results are consistent with Stoll and Whaley (1990). They argue that the market maker may participate in low-volume openings at a price favorable to him. This behavior at low-volume batch openings induces "temporary price deviations" that lead to price reversals. However, the study demonstrates that prices from above-average volume openings are not reversed, and there is higher subsequent volatility. In our sample, reopening volume is roughly 5.7 times the average opening volume. So, the absence of reversals and high subsequent volatility in our sample is consistent with Stoll and Whaley's conjecture that it is more difficult for the market maker to liquidate a position at advantageous prices during periods of high volume.

To summarize the results presented in this section, volume and volatility following a major news events are affected by factors other than the magnitude of the price move. In particular, calling a trading halt seems to increase subsequent volume and volatility. Since we compare events with similar

[6]Good (or bad) news halts are defined as halts with returns greater than or equal to (or less than) the contemporaneous market return. These returns are computed using midspreads of prevailing quotes to eliminate bid-ask biases. We acknowledge that our significance tests may be affected by the fact that we are sampling from a censored distribution and that the sample of 500 events examined here excludes some of the largest absolute price moves.

returns, it is difficult to argue that the excess volume and price volatility are attributable primarily to liquidity trading or portfolio rebalancing.

C. Supplemental Analyses

C.1. Outlier Tests

Because our pricematch procedure systematically searches across all trading days and identifies days with large absolute returns, we are concerned about the effect of outliers. If these reported returns are data errors, we would have spuriously controlled for the price effect. For each pseudohalt day, we compared ISSM-reported prices at the beginning and end of the pseudohalt with the high and low prices reported for that day in the *Wall Street Journal*. In each case, the ISSM data seemed reasonable.

C.2. Prehalt Activity

As discussed earlier, one potential explanation for our findings is that they reflect rational anticipation of higher volume and volatility by the specialist or floor official. For example, if halts are called when volume or volatility is already high, posthalt results may simply reflect a continuation of this phenomenon. To examine this possibility, we evaluate the same volume and volatility statistics for the matched sample in the 6.5 trading hours *before* the halt. Table V reports the prehalt abnormal volume and volatility for the matched sample of halts. Prehalt volume and volatility statistics are larger, especially for intraday, news dissemination (the dissemination is already in progress when the halt is called) and imbalance halts. Not surprisingly, it appears at least some halts are called during periods of unusual market activities. On the other hand, the magnitudes of these prehalt measures are much lower than their posthalt counterparts. Moreover, delayed openings, news-pending halts, and most news categories do not exhibit abnormal prehalt volume or volatility. Since the posthalt increases are observed across all subcategories, it appears that the prehalt activity could only partially explain our results. We directly accommodate the effect of the prehalt activity as an explanatory variable for our posthalt results below (Table VII).

C.3. Alternative Matching Procedures

We were initially concerned about asymmetry in the market responses to good news and bad news events. The proportion of good news (price increase) events in both the control and halt samples is approximately 60 percent. However, 117 out of 298 (39 percent) of the good news halts were matched with bad news pseudohalts, while 120 out of 202 (59 percent) of the bad news halts were matched with good news pseudohalts. To ensure Table IV results were not driven by these differences, we replicated this table with pseudohalts matched on the basis of the closest signed rather than absolute return. The results (not reported) are very similar to Table IV, suggesting that the sign of the price movement is not a factor in explaining the higher posthalt activities.

Table V

Prehalt Abnormal Volume and Volatility for Matched Sample

Mean abnormal prehalt statistics for 1988 trading halts, matched against the qualifying pseudohalt with the closest absolute net-of-market return. A pseudohalt is a period of trading on a nonhalt day that has the same starting time and duration as the actual trading halt. A qualifying pseudohalt is a pseudohalt with an absolute net-of-market return within one percent of the absolute net-of-market halt return. The matching pseudohalt is the qualifying pseudohalt that most closely matches the halt in absolute net-of-market return. "Reopening Volume" is the shares traded at the halt reopening minus the shares traded during the matching pseudohalt period. "Posthalt Volume" and "Posthalt Volatility" are statistics calculated over the 6.5 trading hours immediately following the halt, minus the corresponding statistics during the 6.5 trading hours immediately following the matching pseudohalt. Except for column 1, all table values are expressed as a percentage of the average normal statistic for the reference pseudohalts. One, two, and three asterisks indicate significance at the ten, five, and one percent levels, respectively in two-tailed paired t-tests.

				Prehalt Volatility		
	Number	Reopening Volume	Posthalt Volume	Market-adjusted Absolute Return	High-Low Price Spread	Number of Quote Revisions
Total sample	500	−21.2	57.9***	−2.0	8.1	34.1***
By halt type						
Order imbalance	141	93.2	53.7***	13.2	24.8	27.5**
News pending	220	−108.6*	50.3	12.7	21.9	59.9***
News dissemination	139	1.2	74.4*	−40.7*	−30.5*	−0.2
By information						
Acquisitions and divestitures	62	−18.6	−81.6	−16.9	−11.2	15.0
Capital structure changes	65	−21.0	87.7**	32.1	23.7	39.3
Takeovers and LBOs	247	−49.8	91.4***	−14.5	9.6	37.6**
Financial/earnings information	45	73.7	45.6	20.2	18.7	35.3*
Legal and miscellaneous	48	27.4	69.3	32.1	21.4	44.5
No news	33	−11.9	11.0	−27.5	−31.2	16.7
By time of day						
Delayed openings	357	2.3	2.9	−29.9	−17.4	6.6
Intraday halts	143	−79.7	131.5***	67.7*	71.8**	102.6***

We were also aware that a bias may occur if the matching pseudohalts have, on average, lower absolute price moves than the true halts. The requirement of a 1 percent match mitigates this problem, but the bias may still exist. To alleviate this possibility, we created an "overmatched" sample where every halt was matched against the pseudohalt with the closest absolute net-of-market return *greater than* the absolute net-of-market halt return. This clearly overcompensates for the price effect, and biases against finding higher volume and volatility in the posthalt period. Though not reported, the reopening volume is again not significantly different, while the posthalt volume and volatility measures are similar to the Table IV results. We also obtained similar results using 2, 0.5, and 0.25 percent as alternatives to the one percent maximum allowable price difference.

C.4. Duration of the Posthalt Period

To examine the duration of the posthalt effect, we report the intraday pattern of adjustment in volume and volatility after our sample of halts and pseudohalts. Figure 1 shows that in the first half hour immediately after a halt, the average trading volume is 10.5 times normal levels. In the first half hour immediately after pseudohalts, volume is only 2.5 times normal levels. This difference decays throughout the first trading day, but remains significant even 6.5 hours (13 intervals) after trading has resumed.

Volatility effects decay more quickly. The absolute price adjustment and the number of quote revisions become insignificantly different from post pseudohalt periods after approximately 4 trading hours (8 half hour intervals). The high-low price spread remains significantly higher for the halt sample throughout the first 6.5 hours. These results suggest that the halt mechanism cannot be readily improved by increasing the length of the halt period. In terms of volatility and volume, our results show that posthalt effect lasts hours or even days. If halts are terminated prematurely, they are premature by *hours* or *days*. We doubt regulators would find such a lengthy cessation a satisfactory way to resolve the volatility problem.

One possible concern is that a halt merely *accelerates*, rather than *increases*, overall trading volume. For example, part of the volume increase may be attributable to discretionary liquidity traders who, for any number of reasons, choose to trade immediately following the halt. This behavior would have the effect of substituting volume from later days to immediately after the halt. To examine this possibility and the long-term effects of halts, all results were replicated using average volume and volatility measures over days $+1$, $+2$, and $+3$ after halts and after price-matched pseudohalts. As suggested by the intraday decay patterns in Figure 1, posthalt volume continues to be higher for days $+2$ and $+3$, while posthalt volatility is no longer greater after day $+1$.

In summary, our central finding, that volume and volatility following halts are abnormally large, is robust to data errors, our return-matching methodology, and the size of the posthalt window.

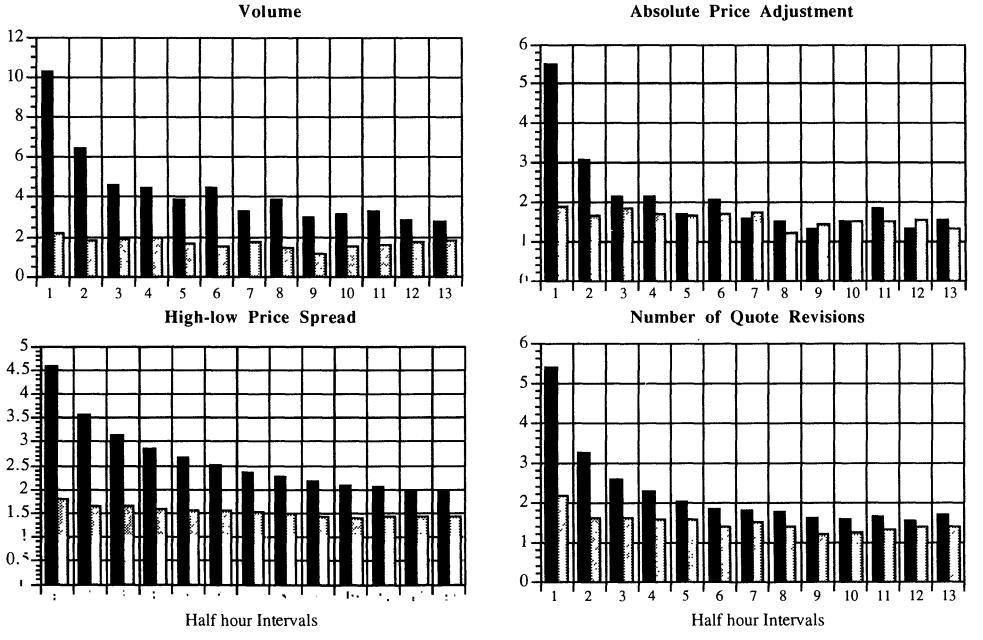

Figure 1. Intraday volume and volatility after halts and matched pseudohalts. The figures depict the average volume and volatility in the 13 half hour intervals (one full trading day) after 500 trading halts (black bars) and after 500 matching pseudohalts (gray bars) with similar market-adjusted price moves. All statistics are expressed as ratios of the normal statistic during nonhalt days, so that a value of one in each figure reflects normal activity level for that statistic.

IV. The Effects of Media Coverage

In this section, we investigate the relation between posthalt activity and the extent of news coverage. This investigation is performed for two reasons. First, a lack of results in the sample of "No news" halts is at least suggestive that posthalt behavior is related to news coverage. We therefore control for the "media effect" and evaluate its contribution relative to the residual "halt effect." Therefore, our first motivation is to examine if any residual halt effect exists after controlling for differences in media coverage.

A second motivation for this analysis is that our sample of trading halts offers a relatively clean setting for testing the "differences of opinion" models (Holthausen and Verrecchia (1990), Kim and Verrecchia (1991a), and Harris and Raviv (1991)). In these models, volume and volatility are generated by differences of opinion in the interpretation of a common signal. Our sample of halts and pseudohalts reflects major price moves that are sometimes, but not always, accompanied by media coverage. If media coverage affects the dispersion of investor opinion, volume and volatility should be higher for those observations that are accompanied by news coverage. This evidence would be

consistent with earlier findings by Dopuch, Holthausen, and Leftwich (1986) and Stice (1991).

We repeat the procedures outlined in Section II.*A* and the Appendix to classify news coverage for each of the 500 matching pseudohalts employed in Table IV. As expected, the extent of news coverage differs between the two samples. Fully 224 or 44.8 percent of the matched pseudohalt sample have no news coverage compared to only 33 or 6.6 percent of the halt sample. While takeover news dominates both samples, capital structure and acquisition news are more prominent in the halt sample, and financial or legal news is more prevalent in the pseudohalt sample. These differences further suggest media coverage and news categories should be controlled for.[7]

To assess the effect of media coverage, we estimate cross-sectional regressions with unexpected halt statistics (*UHS*) as the dependent variable. We define *NEWS* as a dummy variable equaling zero for no news in either the halt or match sample or news in both samples, +1 for news only in the halt sample, and −1 for news only in the matched pseudohalt sample. This specification was prompted by the fact that dependent variables are of the form

$$\textit{Unexpected Halt Statistic} = \frac{\textit{Halt Statistic}}{\textit{Average Statistic}} - \frac{\textit{Pseudohalt Statistic}}{\textit{Average Statistic}}.$$

So, if news coverage has an equal effect on a halt or pseudohalt statistic, its effect on the *UHS* will be equal and opposite depending on whether the halt or pseudohalt was covered. Specifications allowing: (1) asymmetric responses to a news type for the halt versus match sample, and/or (2) differences between news/news and no-news/no-news responses were estimated, but the conclusions are not meaningfully different.

The results of the five regressions of each of the unexpected halt statistics on the *NEWS* indicator variable appear as Model 1 in Table VI. The coefficient associated with *NEWS* is uniformly positive and significant for all four posthalt regressions, suggesting that media coverage associated with halts is partially responsible for the increase in volume and volatility.

The intercept from such a regression is the average unexpected halt statistic, given equal amounts of media coverage. We interpret this as the nonmedia or pure halt effect. The intercept is significant at traditional levels for all four posthalt statistics. This indicates that, after controlling for

[7]Note that we have not done an exhaustive survey of all announcements for all firms in the year, so it is impossible for us to draw inferences about what types of news are more likely to cause halts. It is also impossible to be completely certain of causality. A credible alternative to a news-causes-trading hypothesis is that unusual market activity in the posthalt period might prompt investigation by a wire service. We try to mitigate the effect of the latter chain of causation by considering only those news releases that discuss an economic event (not a comment on market conditions) and by ensuring the coverage is on the same day as the halt or pseudohalt.

Table VI

Separation of Halt Effect and Media Effect

An analysis of the excess volume and volatility around NYSE trading halts by media coverage and news category. Table values are estimated regression coefficients for a sample of 500 NYSE trading halts which have been matched against the qualifying pseudohalt with the closest absolute net-of-market return (two-tailed p-values in parentheses). Two regression models are estimated.

$$\text{Model 1: } UHS = \alpha_0 + \beta_0 NEWS + \varepsilon, \quad \text{and} \quad \text{Model 2: } UHS = \alpha_1 + \sum_{i=1}^{5} \beta_i NEWSTYPE_i + \varepsilon$$

where *UHS* equals the unexpected halt statistic; calculated as the halt statistic minus the corresponding statistic from a price-matched pseudohalt, and expressed as a percentage of the average normal statistic. *NEWS* equals 1 if only the halt is covered in the media, 0 if neither the halt nor the matching pseudohalt is covered, and −1 if only the pseudohalt is covered in the media. $NEWSTYPE_i$ equals 1 if only the halt news is of type i, 0 if neither or both the halt and pseudohalt news are of type i, and −1 if only the pseudohalt news is of type i. The five news types are: 1 = Acquisitions and Divestitures, 2 = Capital Structure Changes, 3 = Takeovers and LBOs, 4 = Financial and Earnings Information, 5 = Legal and Miscellaneous.

		Model 1			Model 2						
Unexpected Halt Statistic	Mean UHS	Halt Effect (α_0)	Media Effect (β_0)	Adj. R^2	Halt Effect (α_1)	News Type 1 (β_1)	News Type 2 (β_2)	News Type 3 (β_3)	News Type 4 (β_4)	News Type 5 (β_5)	Adj. R^2
Reopening volume	−21.2	−18.0	−8.3	−0.2	7.4	−143.3	−21.9	−39.9	54.9	34.8	−0.4
		(0.696)	(0.903)		(0.886)	(0.209)	(0.855)	(0.642)	(0.558)	(0.731)	
Posthalt volume	228.5	203.1	66.4	0.4	182.2	−26.5	−44.1	168.7	26.0	49.8	3.2
		(0.000)	(0.083)		(0.000)	(0.675)	(0.507)	(0.000)	(0.618)	(0.377)	
Posthalt market-adjusted abs. return	49.1	28.9	52.8	1.0	43.1	88.7	48.9	11.0	79.1	62.0	1.6
		(0.051)	(0.015)		(0.009)	(0.015)	(0.199)	(0.688)	(0.008)	(0.055)	
Posthalt hi-low spread	50.9	35.0	41.7	1.0	38.0	60.7	23.0	35.6	47.6	37.5	0.5
		(0.003)	(0.014)		(0.004)	(0.034)	(0.444)	(0.099)	(0.044)	(0.141)	
Number of posthalt quote revisions	116.9	90.9	68.2	2.1	82.5	68.2	39.1	97.5	57.7	45.1	2.3
		(0.000)	(0.001)		(0.000)	(0.041)	(0.264)	(0.000)	(0.036)	(0.128)	

differing levels of media coverage, significant differences in market behavior following halt events and matched pseudohalt events remain.

It is possible that differences in the types of underlying news may generate differences in subsequent volume and volatility (Kim and Verrecchia (1991b)). Consequently, we define a vector of five *NEWSTYPE* indicator variables corresponding to the five news categories employed above. Each variable equals zero if neither or both the halt and pseudohalt events were generated by that type of news, +1 if the halt was generated by that type of news and the match was not, and −1 if the match was generated by that type of news while the halt was not. For example, if the halt was associated with news type 3, while the match was associated with type 2, the five indicator variables would be coded (0, −1, 1, 0, 0). If only the halt was associated with news, then four of the indicators would be zero. We also test a model allowing for different reactions for good and bad news and for halts versus pseudohalts. The symmetry restrictions imposed by the reported model could not be rejected in favor of an asymmetric model.

Estimates associated with this specification appear under Model 2 of Table VI. Consistent with the intuition outlined above, coefficients associated with the type of news are almost uniformly positive for the posthalt statistics. In this formulation, the intercept represents the mean response when: (1) *neither* the halt nor the matched pseudohalt were accompanied by a news release, or (2) *both* the halt and the match were accompanied by the same type of news. Models that treat these two cases separately generate similar conclusions. Consequently, the intercept can be interpreted as the effect of a halt after conditioning on both the existence of news coverage and the type of underlying news. For all four posthalt statistics, the intercept of this specification is both positive and significant. Further, given the similarity of the magnitudes of the intercepts between the two specifications, it appears that conditioning on the type of news in addition to the existence of media coverage does little in diminishing the importance of the pure halt effect.

V. Off-NYSE Trading and Prehalt Activities

As a final test, we simultaneously control for the news effect, the level of prehalt activity, and the amount of off-NYSE trading during the halt. Since earlier tests showed higher levels of prehalt volume and quote revisions, it is necessary to evaluate the contribution of this prehalt activity to our posthalt results. Our concern is that, for whatever reasons, halts may be called in response to levels of volume and volatility that are on average higher than the levels associated with the price-matched pseudohalts. In this case it is imperative to dichotomize posthalt abnormal activity levels into the component attributable to the halt and the component that merely reflects a continuation of the prehalt situation.

Table VII reports the results of cross-sectional regressions with *UHS* as the dependent variable. In this formulation, we include controls for media cover-

Table VII

Multiple Decomposition of the Excess Volume and Volatility Associated with NYSE Trading Halts

An analysis of excess and volatility around NYSE trading halts as a function of media coverage, the abnormal off-NYSE volume during the halt, and the level of abnormal volume and volatility before the halt. Table values are estimated regression coefficients for a sample of 500 NYSE trading halts that have been matched against the qualifying pseudohalt with the closest absolute net-of-market return (two-tailed p-values in parentheses). The following regression model is estimated:

$$UHS = \alpha_0 + \beta_0 NEWS + \beta_1 OFFNYSE + \sum_{i=1}^{4} \delta_i PREHALT_i + \varepsilon$$

where *UHS* equals the unexpected halt statistic. *NEWS* equals 1 if only the halt is covered in the media, 0 if neither the halt nor the matching pseudohalt is covered, and −1 if only the pseudohalt is covered in the media. *OFFNYSE* equals the abnormal off-NYSE volume during the halt. $PREHALT_i$ equals the level of abnormal prehalt activity, where i equals 1 for prehalt volume, 2 for prehalt absolute price adjustment, 3 for prehalt high-low price spread, 4 for the number of prehalt revisions in the midspread of the specialist's quote. All variables except *NEWS* are calculated as the halt statistic minus the corresponding statistic from a return-matched pseudohalt, expressed as a percentage of the average normal statistic.

	Halt Effect (α_0)	Media Effect (β_0)	Off-NYSE Trading during Halt (β_1)	Prehalt Volume (δ_1)	Prehalt Abs. Price Adjustment (δ_2)	Prehalt High-Low Price Spread (δ_3)	Prehalt Quote Revisions (δ_4)	Adj. R^2
Reopening volume	6.41	−9.36	0.10	0.25	−0.07	0.36	−0.34	9.1
	(0.862)	(0.862)	(0.022)	(0.001)	(0.707)	(0.235)	(0.114)	
Posthalt volume	192.80	78.87	0.07	0.04	0.02	−0.04	0.49	5.3
	(0.000)	(0.044)	(0.017)	(0.444)	(0.899)	(0.856)	(0.002)	
Absolute price adjustment	24.98	62.17	0.02	−0.06	0.15	−0.20	0.10	1.4
	(0.084)	(0.003)	(0.191)	(0.025)	(0.036)	(0.094)	(0.243)	
High-low price spread	25.13	42.84	−0.01	−0.07	0.06	−0.07	0.24	5.3
	(0.019)	(0.006)	(0.655)	(0.001)	(0.283)	(0.447)	(0.000)	
Number of quote revisions	67.60	64.92	−0.02	−0.02	0.09	−0.07	0.52	23.3
	(0.000)	(0.000)	(0.096)	(0.417)	(0.131)	(0.611)	(0.000)	

age (*NEWS*), Off-NYSE volume during the halt (*OFFNYSE*),[8] and our four measures of prehalt volume and volatility examined in Table V ($PREHALT_i$). Aside from a strong news effect, there appears to be some evidence that prehalt activities are positively associated with excess posthalt volume and volatility. In particular, both the prehalt volume and the prehalt number of quote revisions seem to foreshadow the posthalt activities. However, the intercepts are uniformly significant, indicating that posthalt volume and volatility are still significantly higher even after all these factors are accommodated.

There is little theoretical guidance on how off-NYSE trading activity is likely to affect posthalt trading. One hypothesis is that off-NYSE trades during a halt enhance the price discovery process. For example, under the "learning by trading" paradigm, information on off-exchange prices and volumes is of value to all participants. Alternatively, these trades could be positively related to posthalt trading activities in two ways. First, competitive pressures from the regionals could cause the NYSE to "rush" into releasing a noisy reopening price. Also, it is possible that these off-NYSE trades are early indicators of strong pent up demands to trade. Thus, the halts that experience off-NYSE trades may also be the ones with higher posthalt trading activities. If so, we might expect a positive relation between off-NYSE trading and volume both at the reopening and in the posthalt period.

Though not central to this study, the relation between off-NYSE trading and posthalt activities is interesting. Both reopening and posthalt volume seem to be higher for halts with off-NYSE trading, but posthalt volatility is either unrelated or lower when there has been off-NYSE trading. The positive relation between off-NYSE activity and both reopening and posthalt volume is consistent with the notion that off-NYSE trading occurs when there is a greater pent up demand to trade. However, the relation with posthalt volatility seems to be insignificant or even negative, suggesting that NYSE specialists are not "rushed" into premature reopenings by these trades. If anything, these trades seem to improve the price adjustment process. When traders can and do carry out their desires on the floor of a competing exchange, posthalt volatility appears unchanged or marginally lower.

VI. Summary and Conclusions

In this study, we examine the effects of trading halts on volume and price volatility. We compare statistics from the halt and the trading day following the halt to a pseudohalt: a continuous trading period with the same time of

[8] We estimated specifications that included alternative measures of off-NYSE activity including the number of off-NYSE transactions, an indicator variable capturing whether there was any off-NYSE trading, a variable that equaled zero for all dissemination or pending halts and the actual off-NYSE volume for imbalance halts only. Though the significance of the partial relations between these off-NYSE activity variables and the posthalt activity variables varied across the off-NYSE activity variable specifications, the central conclusions concerning a residual halt effect remained robust.

day and duration as the halt. We find that the reopening trade that ends the halt does not have significantly higher volume than the cumulative volume over the price-matched pseudohalt period. But, we find that volume and volatility for the trading day following the halt are significantly larger than corresponding measures following the matched pseudohalt.

Halts may serve other economic purposes in the current NYSE market structure. For example, halts reduce the amount of disequilibrium trading that would otherwise take place during a period of price adjustment. To the extent that this is desirable, halts convey an economic benefit.[9] Another potential benefit of halts is that they "indemnify" liquidity suppliers from losses due to extreme price moves. Liquidity suppliers, including public limit orders and the NYSE specialist, may be willing to supply liquidity at lower costs knowing that halts will be called in the event of a major price move. Hence, the existence of halts may improve liquidity in nonhalt periods. Our findings do not detract from these benefits of trading halts: although halts may provide some economic benefits (like indemnification), it appears that the act of calling the halt does not generally achieve the objective of creating a "calming down" period that allows for the emergence of a new consensus price in an orderly fashion.

The effects of halts on volume and volatility are clear. However, determining the source of these effects is complicated, since a halt is associated with a number of simultaneous factors. First, halts are usually associated with large absolute price moves, so some posthalt activity may be attributable to liquidity needs or portfolio rebalancing (loosely defined as any uninformed trading done in response to past price moves). Indeed, the large difference between responses reported in Table II (no price match) and Table IV (price matched) indicates that a significant portion of the halt effect is associated with the magnitude of the price change during the halt. However, we find excess volume and volatility for halts compared to pseudohalts with similar absolute returns, indicating that portfolio rebalancing is not the complete explanation.

We show that a substantial portion of the posthalt volume and volatility is associated with the extent of media coverage. Most trading halts receive media attention while only half of the pseudohalts are associated with the announcement of some economic news. The fact that volume and volatility are not significantly large after no-news halts, despite the price informativeness of these events, suggests the news coverage may be a factor in explaining the posthalt results. In Section IV, we provide evidence that news coverage explains a significant portion, but not all, of the remaining effect. Establishing a link between media coverage and market activity is important, since traditionally the degree of news exposure has not been regarded as relevant to firm valuation and has not been considered relevant in

[9]One way to reduce price volatility is to prevent trading altogether, and halts are certainly effective in this regard. However, some may wish to trade even at "disequilibrium" or "incomplete information" prices. Rather than forbidding trading, it may be preferred to simply warn them that such conditions exist.

explaining trading volume. Further, this link provides some support for the "differences of opinion" class of models, where agents with common information trade because of differences in their interpretation of the common signal. In our sample, media coverage seems to increase heterogeneity of beliefs.

A potential candidate for explaining the remaining portion is the "learning-by-trading" class of models. Since a trading halt interrupts the flow of recent transactions, it is possible that the disruption of this important source of information impedes the price adjustment process. Agents are unwilling and unable to reveal their demands fully. Consequently, extra rounds of trading are required, and prices are noisy estimates of equilibrium values. The large surge in posthalt volume and volatility in the half hour after the halt and the rapid decay in the volatility measures thereafter are consistent with this hypothesis. However, unless we believe the market is extremely slow in learning through trading, the persistently high volume for the days +2 and +3 does not seem to fit these models.

Our price-matched case control methodology has the advantage of isolating the volume and volatility effects after accounting for possible confounding factors such as news events and the magnitude of the price impact. However, our findings are subject to several caveats outlined above. First, our main conclusions are drawn from only 500 of the over 800 original halts. Since the omitted halts tend to have the biggest price moves, our findings are based on halts accompanied by smaller price effects. Thus care must be taken in applying our results to price moves outside our sample range. Second, the price path during a halt is not observable. Thus, our tests cannot evaluate the benefits of the price volatility avoided by calling the halt. Finally, it is possible that some other fundamental, but unidentified, difference exists between news events that lead to a halt and those that do not. For example, it may be that our matched sample, based on continuous trading, may be composed of a disproportionate number of cases where insiders are slowly and steadily building up a position based on their informational superiority. Conversely, the halt sample is associated with sudden order imbalances or significant public information releases. Though our news events control should mitigate this problem, we cannot discount such a scenario completely.

Subject to these caveats, we find little evidence that trading halts facilitate the type of information transmission that results in cleaner reopening prices. Regardless of the source of the excess volume and volatility, the evidence presented here is inconsistent with the notion that circuit breakers typically facilitate information transmission, thus producing less-noisy reopening prices. Our results suggest trading halts do not "calm" the market.

Appendix

A. Procedures Followed to Classify Halts and Pseudohalts by News Category

1. Our primary source was the Lexis/Nexis online database. The library was "NEXIS"; the files were "Wires" and "Papers." "Wires" consisted of AP and Reuters news services. "Papers" consisted of all newspapers in the Nexis

database. To ensure completeness, we also crosschecked against the *Wall Street Journal* and *New York Times* indexes. In all cases, we found stories carried by the two indexes to be a subset of the Lexis/Nexis database.

2. With respect to "Wires" searches, we would type the name of the company and the date of the halt. With respect to "Papers" searches, we would type the name of the company and perform either a next day search or a general month search. We would then have all stories listed in citation form. Many times the headlines were quite explicit. When the headlines provided no information, we would check the story with either a "kwic" search (which keys for and highlights the name of the company in a short abstract) or a "full" search.

3. The news classification scheme on the next page is used to record the news type. We would classify a company into a news category only if the company was specifically mentioned in the context of a story of an economic nature—i.e., not simply a commentary on unusual price moves in the company. We also required that the story be dated on the day of the halt or pseudohalt.

4. Five halts and two matching pseudohalts have double listings for causes. In each case the news release was assessed as to primary and secondary effects and the primary code was used.

5. If the news release simply described an imbalance halt without providing an explanation of the cause, or if the halt was not found in these news sources, the halt was coded 901. Similarly, in the case of one pseudohalt, the news story reported unusual price movements and the firm's decline to comment. This was coded as 901 (no news).

B. News Categories

1. Acquisitions and Divestitures
   101 Preliminary disclosure
   102 Preliminary negotiations terminated
   103 Formal proposal/agreement
   104 Update on status or proposal

2. Capital Structure Changes
   201 Adopted/extended stock purchase rights plan
   202 Delayed distribution of stock purchase rights
   203 Announced/updated intent to repurchase stock or increase debt
   204 Announce/updated restructuring plans
   205 Stock/debt issues

3. Takeovers and LBOs (where the firm is a target)
   301 Rumor or preliminary disclosure
   302 Proposal offered, terms or existing proposal offered, agreement reached
   303 Proposal rejected/withdrawn or negotiations terminated
   304 Status of proposal or agreement (including revisions)

4. Financial Information
   401 Actual earnings announcements
   402 Earnings forecasts by company or analyst
   403 Dividend announcements
   404 Miscellaneous news (e.g., debt grading, add to S & P 500 list, etc.)

5. Legal and Miscellaneous
   501 Regulatory/legal decisions in favor of or against firm
   502 Announcement of plans to appeal
   503 Bankruptcy; announcement of and status
   504 Product announcements
   505 Internal restructuring/personnel announcements
   506 Miscellaneous news (e.g., engage financial advisor, adopt strategic plan, etc.)

9. No News
   901 No news/stock imbalance

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