The Effect of Trading Halts on the Speed of Price Discovery*

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Abstract

Trading halts are aimed at reducing information asymmetry by granting investors the opportunity to reassess trades upon arrival of new, substantial information. This study is the first to address the efficiency of the price discovery process with respect to time, i.e., the speed of adjustment to new information. A unique database allow us to conduct an event study analysis and measure the impact of trading halts on price discovery while controlling for content, operational and value effects. We find that information dissemination following trading halts is over 40% faster and that abnormal trading activity is positively related to the speed of price adjustment.

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* The authors wish to thank Menachem Brenner, Gitit Gur-Gershgoren and Beni Lauterbach for their valuable comments on earlier drafts of the paper.

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I. Introduction

Trading halts are aimed at reducing information asymmetry, and at giving investors a limited amount of time to reassess their buy and sell orders upon the arrival of an exceptional piece of information. From an asset-pricing perspective, investors normally trade based on a specific assumption of the security's return distribution, while the arrival of the exceptional information might indicate that a change in the underlying distribution is potentially evolving. Facing different information sets, investors may wish to reconsider their already submitted trade orders. So far, empirical studies reported changes in trading volume, order cancellations and resubmissions, and volatility, following trading halts.[1] This paper is the first to address the time dimension of the efficient price discovery process following a trading halt. A unique data set from the Tel Aviv Stock Exchange (TASE) enables us to compare the magnitude and pace of investors' reaction to announcements of similar content and value, with and without trading halts. We do so by comparing the speed of price adjustment while controlling for content factors with one control group (same announcement type) and the magnitude of price change (comparable value) as a second control group. Both are controlled for industrial sector, time-of-the-day and trading volume.

Although trading halts exist in many stock exchanges, empirical evidence is often inconclusive and there is still a debate in the economic literature about the benefits of trading

[1] For example, Grossman (1990), Lee, Ready and Seguin (1994), Corwin and Lipson (2000), Christie, Corwin and Harris (2002), Edelen and Gervais (2003), Kryzanowski and Nemiroff (1998, 2001) and Bhattacharya and Spiegel (1998).

halts. Corwin and Lipson (2000)[2] claim that *"the stated interest of trading halts is to allow investors a chance to react to new information and facilitate the orderly emergence of a new equilibrium price."* This helps reduce information asymmetry and supposedly enables a quicker price discovery based on all available information. They also note that investors, who recognize their ability to cancel their buy or sell orders when a company releases new and unexpected information, will be less reluctant to engage in trade on a regular basis. Hence, liquidity during normal market conditions will improve.

In contrast, Grossman (1990) claims that a trading halt is not desirable because it *"…merely prevents consenting adults from carrying out their desires on the floor of the stock exchange."* Consequently, trading halts may distort the price revelation process over time as they accumulate all orders to a single point in time and do not allow investors to utilize the information released to the market continuously (Corwin and Lipson (2000)). It is also argued that this may hamper the efficiency of price discovery because share prices variability is expected to rise when trading halts are imposed (Lee, Ready and Seguin (1994)).

Some argue, however, that trading halts may induce a reduction of share prices variability because they can prevent unwanted, temporary price fluctuations. This argument has not received unanimous empirical support in several of the studies that have examined the issue. In Lee, Ready and Seguin (1994) and Christie, Corwin and Harris (2002), the empirical findings indicate increased variability of share prices when trading halts are imposed and removed on the same day. However, Christie, Corwin and Harris (2002) also found that share price variability declines when trading halts last until the next trading day. Our finding with respect to price

[2] See also Greenwald and Stein (1988), Koders and O'Brien (1994).

variability is that the increased volatility, reported in the literature, is positively related to the speed of price adjustment to arrival of new information.

Another finding reported by Corwin and Lipson (2000) and others is that trading volume is significantly greater on days a trading halt is imposed than that in other 'normal' days. One possible explanation is that investors, at large, take advantage of the time-out in order to cancel or update orders they had given previously. When trading resume, the order-book contains mainly orders that had been sent during the trading halt (see also Christie, Corwin and Harris, 2002.) These findings are supported by our findings as well. In particular, from a different perspective, we also find that the abnormal trading activity – increase in volume and in order cancellations and new submissions - is positively related to the speed of price adjustment to new information.

Trading halts on the TASE are similar to those practiced in the US and other countries by exchanges such as the AMEX, the NYSE and NASDAQ. Two types of trading halts are imposed by these exchanges: regulatory halts and non-regulatory halts.[3] Regulatory trading halts, the type that also exists on the TASE, are imposed when a company reveals information that could substantially affect its share price. By halting trade, investors are given time to assess the new information arriving to the market. Non-regulatory halts are imposed when there is a significant imbalance between purchase- and sell-orders for a particular stock. In such a case, trading halts are aimed at warning investors about trade imbalance and enable the market-maker to inform investors regarding the price range at which trade is likely to resume.[4]

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[3] There are no non-regulatory trading halts on the Nasdaq.

[4] Edelen and Gervais (2003) present and test empirically a model where these two sources of trading halts serve as a tool that resolves an agency conflict between specialists and the exchange. Specialists halt trade upon trade imbalances while the exchange halts trade following company announcements. Both parties benefit from high trade execution reputation of the exchange, but have incentives to draw from the pulled reputation. Their empirical

Although trading halts initiated by the TASE are similar in nature to the regulatory type of trading halts in the US, our dataset offers a unique opportunity to investigate the pace and magnitude of information dissemination and investigate its relationship to abnormal trading activity around trading halts. There are two unique characteristics to our data set: (1) the TASE imposes trading halts for a limited period of 45 minutes, enabling us to examine, as in an event study, investors' response-time to new information that was followed by the imposition of a trading halt. Other stock exchanges such as the NYSE and NASDAQ do not have a specified time limit for trading halts, and many last anywhere from several minutes to several hours. (2) The announcement content is coded, allowing us to control for announcement content, together with other operational control variables (hour of the day, industry type and trade volume.)

We use two control groups. The first control group includes public announcements that were not followed by trading halts, but which are operationally similar to announcements that were followed by trading halts based on the following operational factors: announcement type, industry sector and trading volume. Henceforth, we shall refer to it as the *operational* control group. The operational control group allows us to measure the effect trading halts have on the speed of information dissemination by comparing prices of the sample group to those of the control group every five minutes. We find that stock prices in the sample group, adjust about 120% faster than those in the control group. It should be emphasized that the qualitative question of whether fast price adjustments are desired or not is beyond the scope of our research.

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findings indicate that the high informational asymmetries across traders around trading halts should be augmented by the asymmetry between the exchange and the specialist in order to explain high volatility, trade volume and price changes. Our analysis and that of Edelen and Geravis are similar as they focus on causes of trading halts, yet they differ as they examine orthogonal effects of trading halts. Thus, the two papers complement each other as they demonstrate that trading halts reduce information asymmetries.

While the operational control group enable us to measure the magnitude of price change given similar operational announcements, this comparison may be argued to be subject to a joint hypothesis: the informational content of an announcement that was followed by a trading halt may be of higher value than an announcement that was not followed by a trading halt. To address this issue, we construct the second control group, and refer to it henceforth as the *value* control group. The value control group is similar to the "pseudo-halts" of Lee, Ready and Seguin (1994) and Christie, Corwin and Harris (2002). It controls for the value of the content (measured by price change). By comparing the two, we can test the net effect of a trading halt on price change. We find that stock prices in the sample group adjust about 40% faster than those in the control group. The rest of the paper is made of Section II, which describes Data and Methodology, Section III presents empirical findings and Section IV concludes.

II. Data and Methodology

Trading on the TASE starts with a pre-opening phase between 8:30-10:00 AM. Between 10:00 AM to 4:45 PM (continuous phase) trading is through a computerized system with no specialist. During the pre-opening phase investors submit buy and sell orders and a theoretical price is calculated and reported electronically. This phase ends at about 10:00 AM when the "opening-price" is determined via a computerized auction that accounts for price and time priorities. At this time, the "continuous phase" starts through a computerized system that matches electronically investors' buy and sell orders. During this period, the best three Bids and Asks are disclosed electronically to all investors. Between 4:45 – 5:00 PM all transactions are based on a

single "closing-price," essentially representing an average of the last half hour transactions.[5] There are no price bands during the continuous phase of trading. There is a price band, however, during the opening phase, right after the conclusion of trading halts of a maximum price change of 15%. We note that since the beginning of the current trading system in 1997, rarely did share prices change by 10%. In fact, Kalay and Wohl (2004) found that only in 2 transactions out of 15,449 they investigated in the opening session, share prices changed by more then 10%. If this band were effective, it would indicate that our results underestimate the contribution of trading halts to the efficiency of price discovery. We also note that there is one circuit breaker of a general trading halt to all shares in case the general index changes by more then 8% during the day. This happened only once during a lynch of Israeli soldiers by terrorists.

According to the TASE bylaws, the exchange is authorized to impose a trading halt if a company is about to release new information that could have a substantial effect on stock prices. The objective of the trading halt is to allow investors time to obtain the information and/or reassess their buy or sell orders. Unlike stock exchanges in the US where trading halts can last from a few minutes to several hours, the TASE limits trading halts to a fixed period of 45 minutes. During this time, a theoretical price is calculated and reported. At the end of the 45-minute halt, an auction is held to determine an opening price prior to the re-commencement of the continuous trading phase.[6, 7]

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[5] See Kalay, Wei, and Wohl (2002) for detailed information on trading at the TASE.

[6] According to the TASE bylaws, in certain cases the trading halt may be extended for additional 45 minutes, or even until the end of the day. Our sample group does not include such cases.

[7] Recently, the Israeli SEC (ISA) debated with the TASE on the need for trading halts in a computer-based trading and reporting systems. The debate was a result of the ISA inquiry to the TASE if they would consider giving up trading halts once electronic reporting via internet was introduced (Mid of 2004). Both, the TASE and the ISA agreed that trading halts help achieving the goal of providing investors the opportunity to reassess buy and sell orders upon arrival of new information and thereby facilitate a quicker fair equilibrium price, in spite of the fact that the speed during the halt is zero. It was argued that the gradual and slower adjustment to the new information

The data was gathered from the TASE and the ISA (Israeli SEC). Both code immediate reports filed by companies according to the type of information disclosed. In order to examine the effect of trading halts on the speed of price discovery, we selected a sample of all company announcements to the TASE during 2001. There were 14,573 announcements of various types. Of them, 1,465 announcements were accompanied by trading halts. We excluded announcements of thinly traded shares (being shares that did not trade at all during the trading halt day and two weeks around that day), and announcements that were made outside of our inspection time-frame between 10:30 AM and 3:00 PM. We thus remained with 213 cases of the more liquid shares in the market. Our sample group includes announcements within this time-frame in order to allow an inspection window of two hours – from 10 minutes prior to the announcement and up to 110 minutes after the announcement. Of the 213 trading halts, we removed 34 announcements because they were compiled by the TASE or the ISA by mistake as trading halts, where in practice trading halts were not imposed. Of the remaining 179 cases, we found 95 cases with comparable cases in at least one of our two control groups.

We selected companies to the first control group based on the following criteria: (1) the announcement was of the same type as the announcement made in the sample group. Announcements include publication of financial statements, transaction with a stakeholder, acquisitions, transfer of control and public offerings. (2) The company belonged to the same economic sector as the comparable stock in the sample group. (3) The difference between the average volume of the control stock and that of its twin stock in the sample was the smallest possible. For 73 out of the 95 announcements in the sample group we found operationally similar

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released to the public, when trading halts are not imposed, is inefficient to the extent that a small group of better informed traders have an advantage over the others. We also note that during our sample period reporting was not

announcements that were not followed by a trading halt. The 73 cases with no trading halt make the "operational control group," and their 73 comparable cases in the sample group are referred to as the "operational sample group."[8] In order to assure comparability of the sample and control groups we show in Table 1 that the first control group is insignificantly different from the sample group in all categories on non-halt days. For example, the average daily trade volume in the 73 shares of the operational sample group was NIS 1.42 million, compared with NIS 0.85 million in the operational control group with insignificant difference between the two (t=1.39). In the next section, we discuss and address the possibility that these differences in trading volumes, though insignificant, might still affect our results. We emphasize that the second control group is based on the same shares of the sample group, satisfying this comparability as well.

[Table 1**]**

The second control group has been constructed based on the following criteria: (1) the change in share price following an announcement with no trading halt was similar to that of the same stock in the sample group (announcements that were followed by a trading halt); (2) the share price change took place during the same trading hours and it occurred within the three months preceding the trading halt. Lee, Ready and Seguin (1994) and Christie, Corwin and Harris (2002) used such a control group, referring to it as a "pseudo-halt." Out of 95 announcements that were followed by trading halts in the sample group, we could find only 60

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electronic and firms were required to release new information to the public within 3 hours via fax to the ISA and the TASE.

[8] It should be clarified why there were no halts for operationally similar events in the control group. We note that the exchange officials announce halts based on a set of rules governed by the TASE bylaws and working guidelines adopted over the years. In particular, these guidelines are based on accumulated experience of the exchange employees, and a close supervision of the ISA, including the need to report to the ISA. It should also be noted that

trading halts where the share price change was similar to that of sample group.[9] Share price change in the sample group, as measured over the -10 to +110 minutes before and after the announcement, was 2.73% and insignificantly different from the 2.69% in the control group (t=0.18).

For each stock, in the sample group and in both control groups, we compared trading volume and bid-ask spread on announcement and non-announcement days. We further compared share prices over the time interval starting from -10 minutes prior to +110 minutes following the trading halt, at 5-minute intervals. Trading halt impact was also examined within the context of positive vs. negative announcements.

III. Empirical Findings

In this section, we analyze the impact of trading halts on price volatility and liquidity in subsection A, on the speed of price adjustment in subsections B and C and the impact of liquidity and volatility on the speed of price adjustment in subsection D.

A. The impact of trading halts on price volatility and liquidity

We start with a brief comparison of documented results concerning trading halt effects on trading volume, bid-ask spread, number of transactions and stock price volatility on the trading halt day vs. both control groups. 2001 daily averages serve as benchmark where relevant. Table 2 shows that the differences between the sample and control of both operational and value groups were significant in most parameters.

[Table 2]

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up until today, the TASE officials have never been blamed for being closely connected to insiders or found to abuse such discretions. TASE employees are prohibited from engaging in trading on the TASE.

We further address the hypothesis that investors utilized trading halts to cancel or revise trade orders they had submitted prior to the announcement. Table 3 displays the results of newly submitted orders, canceled orders and changes in orders on trading halt vs. other days. The results indicate that the number of orders, and those that were changed or canceled, was almost doubled because of the trading halt. These findings are consistent with the findings reported by Corwin and Lipson (2000), Christie, Corwin and Harris (2002), and others.

[Table 3]

B. Speed of price adjustment to new information - Operational control group

In order to assess the impact of trading halts on the speed of price adjustment, we estimate the speed of adjustment to new information around trading halts compared with similar type of information represented by the operational control group. The speed of adjustment is measured by:

$$SOAdj = \frac{CR(-2,T)}{CR(-2,21)},$$

where CR(-2,T) is the cumulative return starting two intervals before trading halts are imposed (and announced) to interval T, where T=-2,-1,0,…21. Each interval is five minutes long, thus, for example, CR(-2,7) represents 10 minutes before and 35 after the halt, a total of 45 minutes. Accordingly, our frequently used measure, CR(-2,21) is the cumulative rate of return over the 2-hour inspection window.[10]

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[9] We note that there were 38 cases in the sample groups that were included in both control groups. All our findings below remain qualitatively unchanged when we controlled for the 38 joint observations.

[10] This measure is related to Biais, Hillion and Spatt (1999) who test the hypothesis of "learning" an equilibrium price over time by estimating the regression

$$\nu - E(\nu \mid I_0) = \alpha_t + \beta_t[P_t - E(\nu \mid I_0)] + Z_t,$$

where ν is the equilibrium price (proxied by the transaction price two hours following the halt or the closing price at the end of that day), P_t is the indicative (or transaction) price and $E(\nu \mid I_0)$ is the expected price given information set I_0 (p. 1234). β_t measures the information content of P_t at time *t* during the inspection period. If

The data include both positive and negative announcements. A positive (negative) announcement has been defined as such when the share price increased (decreased) at the end of the two hours time window starting 10 minutes before the announcement was made, *CR(-2,21)*>0 (*CR(-2,21)* <0). We multiplied *CR*(-2,T) by –1 if the announcement was negative. This issue is further discussed below.

Figure 1 and Table 4 present the main results. Figure 1 depicts the change in share prices during the 2-hour inspection window. It appears that, on average, the speed of adjustment of share prices to the new information is significantly greater in the sample group, when trading halts are imposed, than in the control group, when trading halts are not imposed. Most of the change occurred in the first 10 minutes of trading following the trading halt (55 minutes after the announcement was made).

[Figure 1 and Table 4]

Specifically, we compare the rate of information dissemination and share price changes in the operational sample group with its control group. Forty-five minutes into the trading halt (interval #8) the change in price constitutes approximately 80% of the daily return, compared to about 36% for the control group. That is, when trading halts are imposed, the speed of adjustment, *SOAdj*, is over 100% faster (80%/36%-1=1.22), in spite of the fact that trade did not stop for the control group shares. Moreover, 10 minutes after the trading halt ended (55 minutes after the public announcement, interval #10), the average share price change in the sample group

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$\beta_t = 0$ one may conclude that no learning took place between periods *0* and *t* as E(Z_t)=0. $\beta_t = 1$ implies an immediate adjustment of P_t to ν_t that indicates that the equilibrium price has been learnt at *t*. If, however β_t is less (greater) then unity at *t*, it indicates overreaction (underreaction) to the information set as transaction prices converge to the equilibrium price (see also Amihud and Mendelson, 1987). Using this concept we measure the speed of price adjustment around trading halts by $[P_t - E(\nu \mid I_0)]/[\nu - E(\nu \mid I_0)]$ where $E(\nu \mid I_0)$ is proxied by the share price at the beginning of the 2-hour inspection window. This allows us to measure the way prices evolve

was about 94% of the price changes that day (CR(-2,21)) compared with about only 50% for the control group[11] as presented in Panel B of Table 4. From that point in time, CR(11,21) in the sample group is 0.49% and insignificantly different from that in the control group, CR(11,21)=0.56%. Note, that the reported returns are not adjusted for the market return. Yet, we found that the results would not have been different if we deducted market returns (general stock index) since the market return on the days we examined, during the 2-hour inspection window, had an average of about 0.07% in the sample group compared with 0.04% in the control group. The difference between these market returns was not significant (p-value = 0.173).

Finally, we test for a possible market sentiment effect (Chiyachantana, Jain, Jiang, and Wood (2004)) by examining the possibility that the impact of trading halts on share prices was different for positive vs. negative announcements. The effect was measured using the following regression:

$$\Delta CR(-2,10) = 0.0235 + 0.0669D$$
$$\text{(t=)} \qquad (0.87) \quad (2.14) \qquad R^2 = 0.061$$

where D is a dummy variable whose value is 1 if the announcement was positive, and 0 if the announcement was negative. An announcement is positive or negative when the return during the examination window of two hours of trading yielded a positive or negative return, respectively. The significant positive coefficient of D (0.0669) indicates that price changes were about 6.7% higher when announcements were positive than those that followed negative

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over the 2-hour inspection window. It should be noted that when eq. 1 was used to estimate the information content of P_t via Bias et al. methodology, we obtained similar results.

[11] In 27 out of 73 cases examined, the operational control group was from the same stock as the sample group. When we reviewed the test presented in Table 4 regarding these cases, the results we obtained were not significantly different from those reported in Table 4.

announcements. One of the explanations for this is the positive liquidity effect on price changes. An increase in trading volumes has a positive effect on prices (p-value=0.002), thus positive announcements were amplified. When we extracted the volume effect from *CR*, by looking on the residuals of a regression of CR with volume, this discrepancy was greatly reduced and turned insignificant at a almost 8% level). Thus, once the liquidity effect has been accounted for in the regressions, the sentiment effect appeared to be marginally significant. This conclusion is reinforced when we repeated the test for the second control group (using the same shares and hence no volume diffrenecs), and found that there were no significant differences between positive and negative announcements :

$$\Delta CR(-2,10) = -0.0081 + 0.01206D$$
$$\text{(t=)} \qquad (1.07) \quad (1.32) \qquad R^2 = 0.029$$

C. Speed of price adjustment to new information - Value control group

The findings reported earlier may be subject to potential value bias: the operational control group (announcement without trade halt) and the sample group (announcement with trade halt) may differ in the informational value of the respective announcements. We therefore use the value control group, where the first criteria for being included was a similar price change to that of the sample group, as in the "pseudo-halt" used by Lee, Ready and Seguin (1994). We imposed a second criterion whereby the price change occurred at a similar time of the day, within the 2-hour inspection window (before and after the announcement). The control group was selected from the three months period preceding the trading halt. The underlying assumption is that when the magnitude of price change in the sample group is similar to that of the control group over the 2-hour window, the information contained in the announcement is of similar importance. The results are presented in Figure 2 and Table 5.

[Figure 2 and Table 5]

As with the results based on the operational control group, it appears that investors' response time was faster in the sample group compared with that of the value control group. This conclusion is drawn by comparing the pace of information dissemination between the two groups. At the end of the 45-minute trading halt, price adjustment to the new information in the sample group constituted 55% of the total 2-hour price change, compared with only about 38% for the control group, where trade did not stop. That is, when trading halts are imposed, *SOAdj* is over 40% faster (55%/38%-1=0.45)). After an additional 10 minutes (55 minutes after the public announcement), *SOAdj* in the sample group was about 71% of the total change in price for that day, compared with only 55% for the control group.[12] These results are not affected by changes in the market. We found that the stock index changed by about 0.02% for the sample group, which was insignificantly different from the 0.05% in the control group. Both are considerably smaller then CR(-2,21).[13]

Finally, we examined whether the results are affected by the choice of the 2-hour inspection window. First, based on the results displayed in Panel B of Table 5 and Table 6, it appears that the selection of the 2-hour window had no qualitative influence on the results. Second, when we also examined a 3-hour window, or a shorter time frame of only 45 minutes (the duration of the trading halt), or used CR(-2,close) as a benchmark instead of CR(-2,21), we obtained similar results.[14] Combining the results of the first and second control groups enables us

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[12] The difference between the response time in both of the sample groups stems from the fact that the value group and its corresponding control group are based on cases of similar price changes. These occur when price changes are not drastic. See Lee, Ready and Seguin (1994), p. 197.

[13] p-value for the difference was 0.39.

[14] We also used the TASE-25 index of the 25 largest stocks in the market as another control group and found that 45 minutes into the trading halt the speed of adjustment was almost 3/8th of the return over a 2-hours window around the trading halt (45/120 minutes =3/8).

to draw the conclusion that trading halts cause the information announced to the public to be reflected faster in price, compared with cases when trading halts were not imposed.

D. The impact of liquidity and volatility on the speed of price adjustment

In this section we examine the effect of liquidity and share prices volatility on the speed of price adjustment to new information using regression analysis. Liquidity is measured by: ΔLIQ - the difference between changes in trading volume of the sample group and that of the control group.[15] The results displayed in Table 6 indicate that liquidity is positively related to the speed of adjustment of share prices to new information arriving to the market.[16] These results are consistent with the numerous microstructure studies that liquidity is positively related to the efficiency of price discovery. We also find that changes in volatility are positively related to the speed of adjustment, although not significant in the first control group. The increased standard deviation is consistent with empirical findings that volume is positively correlated with volatility (e.g. Karpoff (1987) and Hauser and Lauterbach (2003)).

[Table 6]

IV. Summary and Conclusions

In this study we examined the effect of trading halts on the process of price discovery with respect to the speed of adjustment to new information. The empirical findings are based on

[15] We also examined changes in share prices as a function of changes in the bid-ask spread and found that they did not have a significant impact on *SOAdj*. This is consistent with the finding that there was no significant change in the bid-ask spread, and with the claim that increased variability on one hand and increased trading volume on the other hand, have offsetting effects on the bid-ask spread.

[16] We also used two other liquidity measures: change in the number of order cancellations and submissions and the change in the number of daily transactions. The results for the former were qualitatively similar to those reported in Table 6, but marginally significant. The results with the latter were not significant.

a distinctive dataset that enables us to measure the speed of adjustment to new information and its relationship to liquidity and price variability. We compared announcements that were followed by trading halts with similar cases that were not followed by trading halts, employing two control groups that complement each another. The first control group included public announcements that were not followed by trading halts but which were operationally similar to the announcements that were followed by trading halts (based on type of announcement, industrial sector and trading volume). In contrast with other research, this paper analyzes the time dimension of price discovery following trading halts. The results should be interpreted in the context of the TASE, though they may be indicative for other exchanges with similar trading systems such as, Euronext, Greece and South Africa.

Our main finding is that the information contained in the announcement is disseminated faster when a trading halt is imposed, indicating a more efficient price discovery in such cases. Yet, the term "efficient" should not be taken as a qualitative judgment on the desirability of fast price changes (e.g., the NYSE specialist should smooth prices) since the normative question is beyond the scope of this paper. We analyze the speed of convergence to an informationally efficient equilibrium price. We also find that investors use trading halts to re-evaluate their buy or sell orders they had placed prior to the public announcement, and that the increased liquidity and volatility on days trading halts were imposed had a positive influence on the speed of price adjustment to new information.

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Table 1: Comparability of the Sample and Control Groups

Volume figures are daily averages per stock in NIS. (1 $US is about 4 NIS during the sample period.) %Bid-Ask Spread is calculated by: $(Ask - Bid)/(Ask + Bid)/2$. Avg. Transactions represent the mean per share. The difference in means is tested by t-test.

	Volume of Trade		% Bid-Ask Spread		Avg. Transactions	
	Sample	Control	Sample	Control	Sample	Control
Mean	1,423,214	844,561	5.79%	6.97%	55	39
t-value	1.387		1.269		1.168	

Table 2: The Impact of Trading Halts on Trading Variables

Trading volumes are given in New Israel Shekels, NIS (about 4 NIS/$US). Effective bid-ask spreads are calculated by the ratio between the spread and the trading price (prices prior to the transaction). We calculate the ratio between each of these variables and its 2001 daily average; an asterisk (*) indicates a significant difference (5%). Price variability is measured by the standard deviation of the 5-minute interval returns, starting from the announcement of the halt. The test for differences between averages is a single-sided *t*-test, where the null hypothesis is that the average in the sample group is greater than that of the control group. The right-most column compares the sample and control groups across all variables.

	Sample (with TH)	**Controls (without TH)**	**Test for differences between averages (*p-value*)**
Operational sample group vs. Operational control group (n=73)			
Ratio of trading volume on day of announcement vs. 2001 daily average	*5.46	*2.53	0.006
Trading volume 30 min. prior to announcement	146,291	114,508	0.325
Trading volume 110 min. after announcement	600,210	366,358	0.079
Bid-ask spread on day of announcement following the trading halt	3.60%	4.34%	0.013
Ratio of bid-ask spread to 2001 average on day of announcement	*0.83	0.94	0.038
Intra-day (5 minute) standard deviation	1.68%	0.30%	0.000
Number of transactions on day of announcement	99.73	68.10	0.129
Ratio of number of transactions on day of announcement vs. 2001 average	*6.22	2.02	0.000
Value sample group vs. Value control group (n=60)			
Ratio of trading volume on day of announcement vs. 2001 daily average	*2.79	*1.90	0.097
Trading volume 30 min. prior to announcement	173,304	165,140	0.461
Trading volume 110 min. after announcement	636,532	479,348	0.126
Bid-ask spread on day of announcement following the trading halt	2.33%	2.85%	0.279
Ratio of bid-ask spread to 2001 average on day of announcement	*0.81	1.04	0.008
Intra-day (5 minute) standard deviation	0.69%	0.56%	0.002
Number of transactions on day of announcement	113.28	83.80	0.079
Ratio of number of transactions on day of announcement vs. 2001 average	*2.53	*1.76	0.047

Table 3: The Impact of Trading Halts on Canceling or Changing Orders

This table compares the average number of orders per stock on days when trading halts were imposed, with the daily average number of orders per stock on days when trading halts were not imposed (daily average for the month preceding the trading halt).

Panel A: 95 cases of trading halts.

	Sample	**Control**	**Test for differences between averages (*p-value*)**
Number of orders given	223	123	0.000
Number of orders canceled	72	38	0.000
Of these: number of orders changed	55	29	0.000

Panel B: The data are based on 60 company reports that were followed by trading halts and for which a control group of "pseudo-halts" could be found. The daily average for the control group is calculated on the basis of the number of orders given or canceled on days when "pseudo-halts" were imposed.

	Sample	**Control**	**Test for differences between averages (*p-value*)**
Number of orders given	256	190	0.035
Number of orders canceled	79	44	0.001
Of these: number of orders changed	61	43	0.016

Table 4: Cumulative Return (CR)

Operational control group (Panel A)

The average cumulative return is calculated relative to announcement and/or the trading halt time (T=0), from 10 minutes prior to the announcement up to 110 minutes after the announcement, at 5-minute intervals. Thus T=(-2,-1,0,…,21) is the trade interval relative to the time of the announcement. The rate of information dissemination is measured by the ratio, $SOAdj = CAR(-2,T)/CAR(-2,21)$. The results displayed in this table include both positive and negative announcements. A positive (negative) announcement has been defined as such when the share price increased (decreased) at the end of the two hours time window starting 10 minutes before the announcement was made, *CR(-2,21)* >0 (*CR(-2,21)* <0). We multiplied *CR* by –1 if the announcement was negative. An asterisk (*) indicates that the average is different from zero at a 5% significance level.

Trade interval relative to announcement	Average cumulative return *(CR)* %			Speed of adjustment (%): $\frac{CR_{-2,T}}{CR_{-2,21}}$	
	Sample	Control	t-Test	Sample	Control
-2	0.03	-0.03	0.80	0.42	-2.82
-1	0.06	0.08	0.10	0.80	6.78
0	0.06	0.24	1.12	0.80	20.18
1	0.06	0.18	0.67	0.80	15.99
2	0.06	0.14	0.43	0.80	12.48
3	0.06	0.28	1.24	0.80	24.10
4	0.06	0.30	1.52	0.80	26.59
5	0.06	0.40*	1.97	0.80	34.76
6	0.06	0.40*	2.09	0.80	35.03
7	0.06	0.42*	2.19	0.80	37.06
8	6.39*	0.41*	4.37	79.77	36.31
9	7.20*	0.51*	4.65	89.82	44.59
10	7.52*	0.58*	4.84	93.85	50.73
11	7.65*	0.57*	4.86	95.40	50.16
12	7.40*	0.84*	4.64	92.28	73.51
13	7.41*	0.94*	4.59	92.40	82.14
14	7.47*	0.89*	4.62	93.22	77.91
15	7.45*	0.99*	4.58	92.89	86.83
16	7.47*	1.04*	4.56	93.21	91.03
17	7.70*	1.04*	4.66	96.10	91.01
18	7.82*	1.06*	4.73	97.58	92.62
19	7.99*	1.12*	4.86	99.69	97.90
20	7.97*	1.08*	4.92	99.37	94.86
21	8.02*	1.14*	4.92	100.0	100.0

Table 4 (Continued): Cumulative Return (CR)

Operational control group (Panel B)

$CR_{0,T}$ represents the cumulative rate of return from the time of trading halt ($T=0$). T represents the number of five minutes intervals relative to the time of the announcement. The test for the difference between averages is a *t*-test to examine the hypothesis that there is no difference between the averages for cumulative return. $T=8$ represents the time at which the trading halt was ended, at which point the share price was set via auction.

Cumulative return from time of announcement	Average *CR*		Test for difference between averages
	Sample	Control	*(p-value)*
$CR_{0,21}$	7.95%	1.06%	0.000
$CR_{0,8}$	6.33%	0.34%	0.000
$CR_{0,10}$	7.46%	0.50%	0.000
$CR_{11,21}$	0.49%	0.56%	0.846

Table 5: Cumulative Return (CR*)*

Value control group

The average cumulative return is calculated relative to announcement and/or the trading halt time (T=0), from 10 minutes prior to the announcement up to 110 minutes after the announcement, at 5-minute intervals. Thus T=(-2,-1,0,…,21) is the trade interval relative to the time of the announcement. The rate of information dissemination is measured by the ratio, $SOAdj = CAR(-2,T)/CAR(-2,21)$. The data include both positive and negative announcements. A positive (negative) announcement has been defined as such when the share price increased (decreased) at the end of the two hours time window starting 10 minutes before the announcement was made, *CR(-2,21)* >0 (*CR(-2,21)* <0). We multiplied *CR* by –1 if the announcement was negative. An asterisk (*) indicates that the average is different than zero at a 5% significance level.

Trade interval relative to time of announcement	Average cumulative return *(CR)* %			Speed of adjustment (%): $\frac{CR_{-2,T}}{CR_{-2,21}}$	
	Sample	Control	t-Test	Sample	Control
-2	-0.04	0.12	1.50	-1.56	4.48
-1	-0.02	0.31	1.60	-0.60	11.47
0	-0.02	0.40*	2.04	-0.60	14.74
1	-0.02	0.43*	2.25	-0.60	15.91
2	-0.02	0.40*	2.05	-0.60	14.72
3	-0.02	0.48*	2.49	-0.60	17.82
4	-0.02	0.72*	3.31	-0.60	26.92
5	-0.02	0.83*	3.58	-0.60	30.72
6	-0.02	0.80*	3.53	-0.60	29.64
7	-0.02	0.94*	4.07	-0.60	34.89
8	1.49*	1.01*	1.12	54.42	37.57
9	1.78*	1.43*	0.95	64.99	53.19
10	1.93*	1.48*	1.23	70.58	55.09
11	2.01*	1.55*	1.33	73.41	57.58
12	2.13*	1.74*	1.18	78.03	64.71
13	2.18*	1.84*	1.02	79.67	68.45
14	2.22*	1.88*	1.07	81.34	69.82
15	2.28*	2.01*	0.83	83.32	74.88
16	2.43*	2.04*	1.47	89.08	76.11
17	2.48*	2.20*	1.07	90.63	81.92
18	2.66*	2.62*	0.16	97.34	97.51
19	2.69*	2.65*	0.17	98.50	98.61
20	2.66*	2.67*	0.04	97.30	99.33
21	2.73*	2.69*	0.18	100.0	100.0

Table 5 (Continued): Cumulative Return (CR)

Value control group (Panel B)

$CR_{0,T}$ represents the cumulative rate of return from the time of trading halt ($T=0$). T represents the number of five minutes intervals relative to the time of the announcement. The test for the difference between averages is a *t*-test to examine the hypothesis that there is no difference between the averages for cumulative return. $T=8$ represents the time at which the trading halt was ended, at which point the share price was set via auction. As expected, $CR_{0,21}$ and $CR_{11,21}$ are insignificant.

Cumulative return from time of Announcement	Sample	Control	Test for difference between averages *(p-value)*
$CR_{0,21}$	2.75%	2.38%	0.277
$CR_{0,8}$	1.50%	0.70%	0.051
$CR_{0,10}$	1.95%	1.17%	0.025
$CR_{11,21}$	0.80%	1.21%	0.331

Table 6

The Effect of Liquidity and Volatility on the Speed of Price Adjustment: Regression Analysis

The dependent variable is the difference between the speed of price adjustment to new information in the sample group and that of control group:

$$\Delta SOAdj = \left[\frac{CAR(-2,T)}{CAR(-2,21)}\right]_{sample} - \left[\frac{CAR(-2,T)}{CAR(-2,21)}\right]_{control}.$$

Independent variables include volatility and liquidity. Volatility (ΔSD) is measured by the difference between 5-minute-interval of the sample group standard deviation of rates of returns and that of control group. Liquidity is measured by: LIQ - the difference between changes in the ratio of trading volume on trading halt day to the daily average volume in non-trading days of sample group and that of control group. Numbers in parenthesis are p-values. We use the Newey-West heteroskedasticity consistent variance estimators in the regression.

$$\Delta LIQ = \Delta\left(\frac{Volume\ on\ halts\ days}{Average\ Volume\ on\ non-halts\ days}\right)$$

Control Group	Independent Variables			R^2
	C	ΔLIQ	ΔSD	
Operational	1.3930 (0.000)	0.0295 (0.067)	33.570 (0.109)	0.010
Value	1.5495 (0.000)	0.1164 (0.049)	5.7930 (0.054)	0.065

Figure 1: Response-Time to New Information: Operational control group

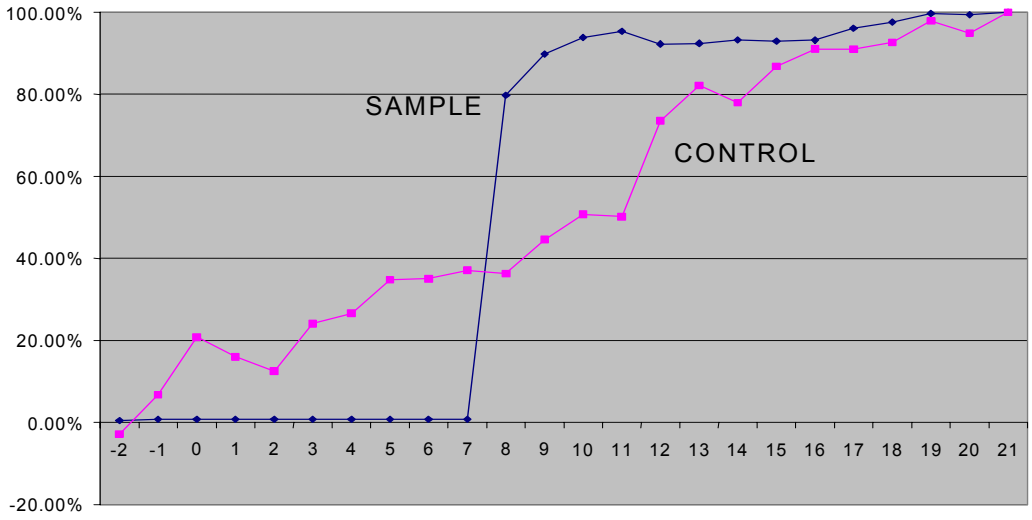

Figure 1 shows the cumulative rate of return (CR) from 10 minutes prior to the halt (interval -2) to 110 minutes after the halt (interval 21), for the Operational control group and its sample. The cumulative return immediately after trade resumes (45 minutes after the halt, interval 8) is 80% of the inspection window return for the Sample and 36% for the Control group, i.e., price adjustment is 122% faster when halts are imposed on interval 8. This difference remains positive until about interval 16. As indicated in the text, we tested additionally CR(-2,12), CR(-2,36) and CR(-2,close) and report similar qualitative findings.

Figure 2: Response-Time to New Information: Value control group

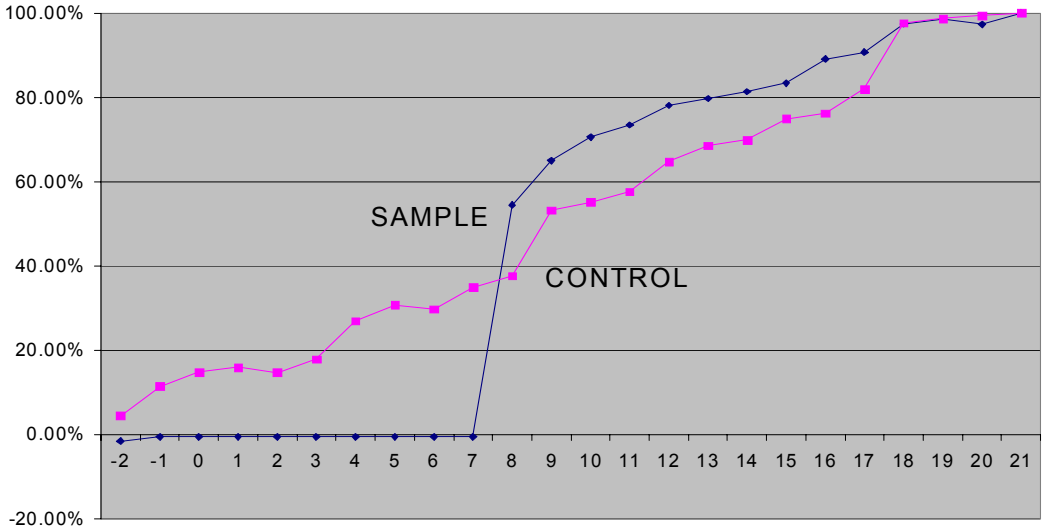

Figure 2 presents the cumulative rate of return (CR) from 10 minutes prior to the halt (interval -2) to 110 minutes after the halt (interval 21), for the Value control group and its sample. The cumulative return immediately after trade resumes (45 minutes after the halt, interval 8) was 55% of the 2-hour total return in the Value sample group and about 38% in the Control group, indicating that the speed of price adjustment was about 45% faster when halts were imposed. CR for the Sample group remained consistently higher than the control group until they reached a similar level at about interval 18. We tested in addition CR(-2,12), CR(-2,36) and CR(-2,close) total returns and report similar qualitative findings.