Institutional Trading During Extreme Market Movements

Marc Lipson
Darden Graduate School of Business Administration
Charlottesville, VA, 22906
Phone: 434-924-4837
Email: mlipson@virginia.edu

Andy Puckett
University of Missouri
Columbia, MO 65211
Phone: 573-884-5666
Email: puckettw@missouri.edu

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Abstract

We investigate the trading of mutual funds and pension plan sponsors on days of extreme market-wide price movements. Using a proprietary database of institutional trading activity, we find that institutions are net sellers when markets are rising and net buyers when markets are falling. Results are driven by trades arising from orders initiated prior to the event days, and suggest that the effects we document are due to implementation rather than position decisions. We also provide evidence that positions established on these days are modestly profitable. Taken together, our results suggest that institutions do not contribute to the previously documented distortion of prices during periods of extreme market movements and may even provide a degree of price stability. The actions of institutions on these days are consistent with a focus on long term price changes and a desire to minimize implementation costs.

I. Introduction

The rising concentration of institutional ownership and trading activity in U.S. equity markets has focused attention on the impact of institutional trading on market efficiency. Clearly, institutional trading moves prices. To the extent these trades are motivated by private information, price efficiency would be enhanced. On the other hand, the magnitude of institutional trading and the possibility that such trading is correlated across institutions raises concerns that institutions may drive prices too far, resulting in excessive price movements and degraded efficiency.

Empirical evidence is mixed. While institutional trading has been shown to be informative, it has also been shown to be positively correlated with prior period returns (positive feedback trading) and the prior period trading of other institutions (herding).[1] Positive feedback trading and herding are trading strategies that can potentially destabilize prices. Similarly, whereas Boehmer and Kelly (2007) and Sias and Starks (1997) show that the level of institutional ownership is positively related to some measures of price efficiency, Dennis and Strickland (2002) show that stocks with relatively greater institutional ownership move more during large market-wide price movements, experience a disproportionate increase in volume, and experience subsequent price reversals. Dennis and Strickland conclude from their results that institutions, on average, may herd together during extreme market-wide movements by buying during a market rise or selling during a market decline to a degree that drives prices beyond fundamental values. We provide new evidence on the link between institutional trading and price efficiency by examining institutional trading activity on days with extreme market-wide price movements.[2] We use proprietary institutional trading data provided by Abel Noser, which includes pension plan sponsors and money managers that Dennis and Strickland (2002) find to be most closely associated with the price distortions they document.

[1] Evidence of positive feedback trading can be found in Hvidkjaer (2005), Cai and Zheng (2004), Griffin, Harris and Topologlu (2003), Burch and Swaminathan (2003) and Nofsinger and Sias (1999). Evidence of herding can be found in Sias (2004). Prior studies, such as Lakonishok, Shleifer and Vishy (1992) and Wermers (1999) found mixed evidence regarding herding and positive feedback trading.

[2] Our event days are those where absolute return on the CRSP equal- or value-weighted market index is greater than 2.0% (as in Dennis and Strickland (2002)). We also provide results for alternate cutoffs of 1.5% and 2.5%, which are generally similar.

In contrast to the conclusions in Dennis and Strickland (2002), we find that, on average, institutions trade in the opposite direction of large market moves. Specifically, both pension plan sponsors and money managers are net sellers (net buyers) on days when markets experience large price increases (decreases). In addition, while institutional trading activity is higher on these days, the institutions in our sample increase their trading levels along with overall market volume and therefore remain at a typical proportion of aggregate volume. We also find no evidence of price reversals associated with institutional trading on these days. In fact, we find some evidence that the trades are profitable – that institutions are effectively buying the stocks that subsequently rise in price and selling those that subsequently fall in price. These results suggest that during periods of market turmoil, rather than herding together, trading aggressively, and destabilizing prices in order to participate in a broad market movement, institutions are providing some measure of price stability by trading against the market.

A unique feature of our data allows us to provide some additional insight into what characteristic of institutional trading may be driving our results. Specifically, our data include information on both the decision to establish or liquidate holdings (the order) as well as the resulting executions of that order (the trade). Large orders quite frequently give rise to trades that span multiple days. Thus, we can distinguish between trades resulting from orders initiated during the extreme market movements we examine (event initiated trades) and the activity resulting from orders initiated in prior days (pre-event initiated trades). We observe the negative relation between trading imbalance and market-wide movements almost exclusively in the pre-event initiated sample. This suggests that the effects we document arise from *implementation* decisions rather than *position* decisions. In effect, our results arise because institutions who already wished to sell decide to sell more actively as markets are rising and those who already wished to buy decide to buy more actively as markets are falling. This behavior is consistent trading strategies based on long term price movements that also seek to minimize implementation costs by selling (buying) when there is increased demand (supply).[3] Clearly, institutions

[3] Rather than simply responding to counterparty order flow, trading decisions can also be influenced by organizational structure and incentives. Edelen and Kaldec (2007) model the behavior of trading desk that is evaluated by comparing execution prices to the volume weighted average price (VWAP) during the day. As markets rise, for example, a trading desk that is selling will sell more aggressively since they will be

are not trading as though they need to jump into the market to participate in a rise or avoid a fall.

We also explore trading behavior during event days using firm level regressions in a manner similar to Griffin, Harris, and Topologlu (2003). Similar to their analysis, we find that daily imbalances are positively related to past imbalances and both contemporaneous and past returns for our entire sample. However, the relation to contemporary returns is significantly attenuated on event days – the coefficient on contemporary returns is less than half that on other non-event days.[4] This suggests a reduced tendency to chase prices (relative to prior behavior), rather than the increase that would be expected with herding. More importantly, we find that for pre-event initiated trades, there is a negative correlation with contemporaneous returns, consistent with our univariate findings for aggregate trading. In effect, we find that while institutions clearly alter their trading behavior on days with extreme market-wide movements, they do so in a manner that benefits rather than attenuates price efficiency.

Our results suggest that institutional trading does not contribute to the previously documented distortion of prices during periods of extreme market movements and may even provide a modest stabilizing influence. Furthermore, the behavior we document results from implementation decisions, such as those that emphasize long run investment strategies and seek to minimize implementation costs. Our analysis is the first to document this stabilizing influence and a potential reason for it.[5] While our results challenge the conclusions reached by Dennis and Strickland (2002) in their analysis using institutional ownership, our results using order and trade data do not contradict their actual empirical findings. In fact, we show that even for the sample period we examine, the empirical regularities they document are largely unchanged. Our results simply narrow the set of possible explanations for the price behavior they document. They

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executing favorably against their benchmark. The predictions of this model are also consistent with our observed results.

[4] We do not observe a negative correlation, which differs from results at the aggregate level. This is not an artifact of using multiple regressions. Instead, the difference is a result of the implicit weighting of the regressions (one observation per firm) rather than the aggregation of trading volumes which differ across firms. However, the results for pre-event initiated trades are consistent with the aggregate results.

[5] Prior studies have not done so since institutional trading is typically informed and therefore positively correlated, on average, with contemporary prices. Our analysis of extreme market-wide movements provides a context in which these results could be observed.

concluded that the link between price behavior and institutional ownership was likely due to institutional trading. Our results suggest that this is not the case.[6] Identifying alternative explanations for the link between ownership and excessive price movements is an area for future research.

The paper proceeds as follows. The next section reviews the relevant literature on institutional trading. Section III discusses the data and our sample. Section IV replicates some of Dennis and Strickland's findings in order to reconcile the samples. Section V presents our results using trading activity and section VI concludes.

II. Related Literature

Institutional investors clearly gather and generate value-relevant price information. As such, their activities will increase the informativeness of prices (see Holden and Subramanyam, 1992; Sias and Starks, 1997). It is not surprising; therefore, that institutional trading is positively correlated, on average, with contemporaneous price changes (Grinblatt and Titman (1993), Grinblatt, Titman, Wermers (1995), Wermers, (1999), Nofsinger and Sias (1999), Sias, Starks and Titman (2002), among others). At the same time, it is possible that institutional investors may drive prices too far and this could lead to temporary price distortions. In this section, we discuss the conditions that would give rise to such distortions and the existing empirical evidence.

Price distortions may occur as a result of specific trading patterns that would lead to large temporary price pressures from institutional trading. These trading patterns include chasing past returns (positive feedback trading) and following other institutions into or out of equity positions (herding). A number of models establish that these trading patterns, even when they distort prices, can exist in equilibrium. Froot, et. al. (1992) present a model of herding in which institutions rationally choose to focus on short horizons and ignore valuable information that may take a long time to be impounded in stock prices. Such trading strategies may be rational since institutions are evaluated against each other, and therefore have incentives to trade the same stocks to avoid falling behind their peer group (also see Scharfstein and Stein, 1990; and Lakonishok, Shleifer

[6] Furthermore, the Abel Noser trading data originates from pension plan sponsors and money managers, which are precisely the institutions Dennis and Strickland (2002) found to be most closely associated with the price movements they document.

and Vishny, 1992). DeLong, et. al. (1990) propose a model where institutions may rationally choose to follow positive feedback trading strategies in order to earn abnormal profits. In this model, rational speculators may earn abnormal profits by trading ahead of other positive feedback traders; however, these actions can cause asset prices to deviate from their fundamental values.

One set of empirical studies has explored these issues using quarterly or annual institutional holdings. In the case of herding, Lakonishok, Shliefer, and Vishney (1992) find evidence of herding by institutions in small stocks. Wermers (1999) also finds evidence of herding by mutual funds in smaller stocks, but extremely low levels of herding in large stocks. Most recently, Sias (2004) provides quite strong evidence of herding by institutions. As for positive feedback trading, Cai and Zheng (2004) find that returns Granger-cause institutional trading, but that institutional trading does not Granger-cause returns. Similarly, Burch and Swaminathan (2003) find significant evidence of momentum trading in response to past returns, but not with respect to past earnings news. Using annual changes in institutional ownership, Nofsinger and Sias (1999) document a strong positive correlation between changes in institutional ownership and lag returns and conclude that institutions rationally engage in positive feedback trading since stocks that institutions purchase subsequently outperform those they sell. Sias, Starks and Titman (2006), on the other hand, reject the positive feedback trading hypothesis in favor of the hypothesis that institutions trade because they possess superior information. They further suggest that the price impact of institutional trading is primarily responsible for the previously documented positive contemporaneous correlation between quarterly changes in institutional ownership and quarterly returns.

Even if institutions engage in positive feedback trading and herding, this does not necessarily imply any price inefficiency. Some studies of price behavior, such as Nofsinger and Sias (1999), Wermers (1999), and Sias (2004), suggest that herding moves stock prices toward (rather than away from) their fundamental values.[7] Boehmer and Kelly (2007) find that stocks with greater institutional ownership are priced more

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[7] This is consistent with very early work by Friedman (1953), who suggests that traders who earn positive profits do so by trading against less rational investors who move prices away from fundamental values, and Fama (1965), who proposes a rational market view where agents may trade irrationally, but that such trading does not substantially affect prices since sophisticated traders quickly trade against these agents to eliminate deviations from true economic values.

efficiently in the sense that their prices more closely follow a random walk. On the other hand, Griffin, Harris, and Topaloglu (2003) look at daily trading data for institutions and find that it is correlated with past daily returns (positive feedback trading), past trading decisions (herding), and also with contemporaneous returns (consistent with price pressure). A central problem, of course, is that whether institutions are informed and driving prices to their correct values or are trading irrationally and driving prices too far, we will observe a positive correlation between trading and contemporaneous returns. Distinguishing between the two possibilities is empirically challenging. Furthermore, even if institutional trading does not distort prices on average, it may be true that they distort prices in some circumstances.

Dennis and Strickland (2002) examine the relation between quarterly institutional ownership levels and the cross sectional volatility of stock returns and turnover. They focus on days when the absolute value of returns for the equal- or value-weighted CRSP market index is greater than 2%. These extreme market movements are potentially periods when institutions may act similarly (herding) in response to common market movements and drive prices too far. Consistent with this possibility, they find that stocks with high levels of institutional ownership experience more extreme returns and abnormal volume than stocks with low levels of institutional ownership.

The results in Dennis and Strickland (2002) are quite striking. In conjunction with the daily trading results in Griffin, Harris and Topalaglu (2003), which suggests herding at the daily level, the Dennis and Strickland results provide a strong indication that institutional trading can distort prices. However, their study, though it focuses on specific events where trading by institutions *might* be concentrated, uses ownership data rather than trading data. Furthermore, ownership levels and trading activities need not be related. In fact, Boehmer and Kelly (2007) provide evidence that quarterly changes in ownership do not provide a clear picture of the actually trading patterns of institutions during the quarter. Using actual trade data, we reach very different conclusions than Dennis and Strickland.

Our analysis provides an interesting contrast to studies using changes in quarterly holdings by institutions. For example, Sias (2004) provides compelling evidence of herding looking at these changes, which must result from cumulative (relatively long term) trading decisions whereas we find no evidence of such herding looking at daily trading activity. This suggests that studies of institutional position decisions need to distinguish between short term and long term activities. It may very well be the case that at longer time frames, institutions exhibit herding but that it may not be true at shorter intervals, and we show it is clearly not true during extreme market-wide movements. This distinction is of importance because institutional trading is most likely to distort prices when it is concentrated into short intervals.

III. Data

We investigate institutional trading on days with extreme market movements using proprietary institutional trading data from the Abel Noser Corporation. Abel Noser is a widely recognized consulting firm that works with institutional investors to monitor their equity trading costs. Abel Noser clients include pension plan sponsors such as CALPERS, the Commonwealth of Virginia, and the YMCA retirement fund, as well as money managers such as MFS (Massachusetts Financial Services), Putman Investments, Lazard Asset Management, and Vanguard. Previous academic studies that have used Abel Noser data include Goldstein, Irvine, Kandel and Wiener (2006) and Chemanur and Hu (2007). The Abel Noser sample of institutional trade executions covers the period from January 1, 1999 until December 31, 2005.[8]

Summary statistics for Abel Noser trade data are presented in Table 1. The Abel Noser trading database contains a total of 845 different institutions responsible for approximately 87 million trades (reported executions) originating from 33 million orders (decisions to trade communicated to a trading desk). Clearly, an order may generate more than one execution. An order may also generate executions over multiple days. Consistent with findings by Chan and Lakonishok (1995) we find that more than 59% of the dollar value of all institutional trades are part of orders executing over multiple days. Orders for the entire sample span an average of 1.53 days, and are executed for an average of 22,653 shares.

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[8] Abel Noser provides consulting services for equity trading costs in a manner similar to the Plexus Group. Plexus data has been used extensively in academic empirical studies by Keim and Madhavan (1995), Jones and Lipson (1999), Conrad, Johnson and Wahal (2001), and Irvine, Lipson and Puckett (2007). The authors are happy to provide details of Abel Noser data upon request.

For each execution, the data include the date of the execution, a code for the institution responsible for the execution, the stock traded, the number of shares executed, the execution price, whether the execution is a buy or sell, the commissions paid, the brokerage firm executing the trade, and the corresponding order. The Abel Noser trading data is provided without institution names, but does identify institutions by a unique numeric code. In addition, the data include codes categorizing the institution as a pension plan sponsor or money managers. [9] The majority of institutions are pension plan sponsors, who account for 641 out of the 845 institutions. Pension plan sponsors are responsible for approximately 24 million executions during the sample period with a mean execution size of 6,647 shares. Although money managers represent only 204 of the 845 total institutions in the sample, they account for most of the executions in the sample (approximately 63 million). The mean execution size of money managers is also the largest in the sample with 9,360 shares.

The institutions in our sample, on average, are responsible for 7.97% of total CRSP daily dollar volume during the 1999 to 2005 sample period.[10] Thus, while our data represents the activities of a subset of pension funds and money managers, it represents a significant portion of total institutional trading volume. Finally, as noted in the introduction, Dennis and Strickland (2002) find that it is precisely ownership by pension funds and money managers that is associated with abnormal price movements and volume on days with extreme market movements.

We initially follow Dennis and Strickland (2002) and define extreme market movements as a 2% or more increase or decrease in the CRSP equal- or value-weighted

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[9] The Abel Noser data contain trades for two institutions classified as "brokers". These institutions are excluded from our analysis since we are unable to discern whether these trades represent market-making activities by the brokerage firm, or trades for the brokerage firm's own account. Furthermore, we eliminate all trades where more than 5% of totals shares outstanding are traded on a single day by a single Abel Noser client. We attribute these to misstatements of available shares outstanding by CRSP, or to trading in very small firms. This filter eliminates less than 0.01% of the sample and does not materially affect our results.

[10] We calculate the ratio of Abel Noser trading volume to CRSP trading volume during each day of the sample period. We include only stocks with sharecode equal to 10 or 11 in our calculation. In addition, we divide all Abel Noser trading volume by two, since each individual Abel Noser client constitutes only one side of a trade. We believe this estimate represents an approximate lower bound for the size of the Abel Noser database.

market index.[11] We also examine 1.5% and 2.5% cutoff samples. Results are generally similar and we tabulate only the central results. In order to benchmark normal trading activity, we require Abel Noser trading data for the 60 days before and after each event day. This additional requirement limits our window of analysis to the March 31, 1999 to September 30, 2005 period.

Table 2 contains summary statistics for our event days. We find 130, 72, and 39 days when the value-weighted CRSP index return is greater than 1.5%, 2.0%, and 2.5% respectively. Similarly, we find 153, 76, and 34 days when the value-weighted CRSP index return is less than -1.5%, -2.0%, and -2.5% respectively. Results suggest that, on average, the value-weighted CRSP index moves by at least 2% about once every eleven trading days. Extreme equal-weighted return days are less frequent. On average, the equal-weighed market index moves by at least 2% about once every thirty-one trading days. We find 76, 29, and 16 days when the equal-weighted CRSP index return is greater than 1.5%, 2.0%, and 2.5% respectively. Similarly, we find 66, 24, and 9 days when the equal-weighted CRSP index return is less than -1.5%, -2.0%, and -2.5% respectively.

Conditioning on value-weighted return days will tend to pick days when large stocks move more than small ones. Because institutional ownership is correlated with size, conditioning on the value-weighted index could induce a sample-selection bias (Gompers and Metrick, 2001). To ensure that value-weighted up (down) days in the sample are representative of days when the majority of stocks experience increases (decreases) in value, we calculate the percentage of CRSP firms with positive and negative returns for the 2.0% cutoff sample. On average, 60.9% of firms experience positive returns on 2.0% value-weighted up days, while 29.2% of firms experience negative returns. For 2.0% value-weighted down days, on average, 26.5% of firms experience positive returns, while 63.5% of firms experience negative returns.

[11] This cutoff is roughly two standard deviations from the mean CRSP equal-weighted market return during our sample period. The 2% cutoff represents approximately three standard deviations from the mean return during the 1988 to 1996 sample period used by Dennis and Strickland (2002), however, they state that their results hold for days when the return is two standard deviations above or below the 1988 to 1996 daily mean.

IV. Replication of Dennis and Strickland

In this section we replicate Denis and Strickland's (2002) study during our 1999 to 2005 sample period. Dennis and Strickland (2002) find that stocks with higher institutional ownership experience more extreme returns and increases in trading volume on event days. They hypothesize that such behavior is driven by institutions herding together and buying (selling) stocks on large market up (down) movement days. We obtain institutional ownership data from Thompson Financial for Dennis and Strickland's original sample period from 1988 to 1996 and for our sample from 1999 to 2005.[12] We then partition all stocks by the median level of institutional ownership on days when the CRSP equal- or value-weighted index moves by more than 2.0%. Finally, we compare returns and trading activity across the partition.

Results are presented in Table 3, and are consistent across both sample periods. For the 1999 to 2005 sample period, the mean (median) return on value-weighted up days for the high institutional ownership portfolio is 2.30% (1.58%) compared to the low institutional ownership portfolio which is 1.29% (0.30%). For value-weighted down days, mean (median) returns for the high institutional ownership portfolio are -2.10% (-1.65%) versus the low institutional ownership portfolio where returns are -1.16% (-0.51%). Findings are similar when investigating the difference between high and low institutional ownership portfolio returns on equal-weighted days. For all event day samples, univariate tests reject the equality of means and medians between the high and low institutional ownership portfolios.

Dennis and Strickland (2002) also test whether abnormal trading levels differ between high and low institutional ownership portfolios. They hypothesize that if institutional investors herd together on event days, this will lead to higher than normal turnover for the high institutional ownership portfolio compared to the low institutional ownership portfolio. Event day abnormal turnover is defined as the event-day turnover (shares traded divided by shares outstanding) minus the median turnover for days [-250, -50]. We find that on value-weighted up days mean (median) abnormal turnover for the high institutional ownership portfolio is 0.252 (0.037) percent, and for the low

[12] Institutional ownership data from Thomson Financial is drawn from quarterly 13(f) filings. The Securities Act Amendment of 1975 requires that institutional investors managing more than $100 million report their portfolio holdings to the SEC on a quarterly basis (13(f) filings).

institutional ownership portfolio abnormal turnover is 0.085 (0.000) percent. Table 3 reveals similar results for value-weighted down days. Consistent with Dennis and Strickland's results, we are able to reject the equality of means and medians between the two samples.[13]

Based on these results, Dennis and Strickland conclude that institutions herd together on event days and drive asset prices beyond fundamental values. We replicate their analysis for our sample period to ensure that the difference in our conclusions is a result of data and methodology, not just time period.

V. Trading Analysis

We begin by looking at aggregate trading measures for all executions in our sample. We then focus on trades that result from orders originating prior to the event days we examine (pre-event initiated trades). These orders allow us to assess the relation between market movements and trading strategies where the decision to buy or sell is not contingent on the market movement. We then look at institutional trading at the individual firm level and conclude by looking at the trading profits of positions established on extreme market movement days.

V.i. Volumes and Imbalances

In this section we examine the aggregate trading activity of institutions. Table 4 presents mean aggregate trading statistics for both volume and imbalance (buys minus sells). These measures are presented four ways: shares traded, shares traded divided by market-wide trading volume, turnover (shares traded divided by CRSP reported shares outstanding), and excess turnover (turnover minus the mean turnover over the benchmark period which spans days [-60, -20] and [20, 60]).[14] We normalize turnover and imbalance measures by shares outstanding to prevent results from being entirely driven by large firms and to minimize cross sectional variation driven by firm size. We examine excess turnover to determine whether trading differs from typical trading. This is clearly important in the case of volume. It is also important in the case of imbalances since

[13] We repeat this analyses for equal-weighted up and down days and find similar results.
[14] Our measures of trading volume and imbalance is similar to those of Dennis and Strickland (2002), Griffin, Harris, and Topaloglu (2003), and Irvine, Lipson and Puckett (2007).

institutions are typically net buyers and comparisons to zero are not appropriate. Thus, excess volume and imbalance are the meaningful measures we examine and are the only ones for which we provide tests of significance.

To determine the significance of excess volume and imbalance, we use a t-test based on the standard deviation of the daily means during the benchmark period. Since we are using the time series standard deviation of daily means, we are only assuming independence across event time daily means – clustering in calendar time, which would lead to cross sectional correlation, will not affect our inferences. Since we are testing for a difference between a specific daily mean and the benchmark, we are identifying days in which trading activity exceeds normal (see Bamber, Barron, and Stober, 1997).[15]

Table 4 presents all volume and imbalance statistics for the 2.0% cutoff sample. In addition, the primary variable of interest (excess imbalance) is presented for the 1.5% and 2.5% cutoff samples.[16] When investigating institutional trading volume, we find that mean trading volume on the event day is significantly higher than mean trading volume during the benchmark period for both value- and equal-weighted up days. For the 2.0% cutoff sample, aggregate institutional turnover is 5.24 basis points (BPs) and 5.26 BPs for value- and equal-weighted up days respectively. Event day turnover exceeds normal turnover by 0.48 BPs on value-weighted up days, and 0.73 BPs on equal-weighted up days. When investigating down days, we find that institutional turnover is not significantly different from the benchmark levels with the exception of pension funds on equal-weighted down days. Results for up days are consistent with findings by Dennis and Strickland (2002), while results for down days are not.

To explore the relation between institutional trading volume and aggregate market volume, we calculate the ratio of Abel Noser turnover to total market turnover. If institutions increase their trading relative to other market participants on event days (Dennis and Strickland, 2002), we expect this ratio to increase significantly. We find no evidence to support the hypothesis that institutions increase their trading activity when compared to other market participants. In fact, the ratio actually decreases (although not

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[15] This methodology is identical to Corwin and Lipson (2004) and Irvine, Lipson, and Puckett (2007).
[16] Inference obtained from all three cutoff samples is similar in both magnitude and significance. Tabulated results are limited for the sake of brevity.

statistically significant) for three out of four extreme day sub-samples. The ratio decreases by 0.063% (0.103%) on value-weighted up (down) days.

Looking at imbalances, we find that institutions are actually net sellers when market indexes experience large increases and net buyers on extreme down movement days. For the 2.0% cutoff sample, mean institutional share imbalance is -13.3 million (-2.8 million) shares for value- (equal-) weighted up days. When investigating large down movement days, we find mean institutional share imbalance on value-weighted down days is 5.5 million shares, and on equal-weighted down days is 7.4 million shares.[17]

Excess turnover measures presented in Table 4 provide even stronger evidence of this relationship. We find mean excess imbalances of -0.70, -0.80, and -0.91 basis points when value-weighted CRSP index returns are greater than 1.5%, 2.0%, and 2.5% respectively. For value-weighted down days we find mean excess imbalances of 0.37, 0.26, and 0.30 basis points for the 1.5%, 2.0%, and 2.5% cutoff samples. Significance tests reveal that imbalances on these days are significantly more negative (positive) than benchmark levels on extreme market-wide up (down) movement days. Results are similar in both magnitude and significance when investigating the equal-weighted samples. We find only one instance where results are marginally different: money managers do not exhibit significant excess imbalances on equal-weighted down days. However, results do suggest that money managers continue with their positive buying levels even when markets experience large declines.

Our results are quite apparent when illustrated graphically as in Figure 1. This figure graphs the daily mean imbalance turnover for all institutions during the [-20, +20] trading day window around value-weighted large movement days for the 1.5% cutoff sample. The first graph shows institutional imbalance turnover around value-weighed up days, where day zero represents the event day. On large up movement days, the aggregate negative imbalance is more than ten times as large as any other day in the 41 day window. The second graph depicts institutional imbalance turnover around value-weighted down days, where we find a sharp increase in imbalance. The mean positive

[17] Results are consistent when analyzing institutional dollar imbalances on large movement days. Only median dollar imbalances on equal-weighted down days suggest a possible positive correlation between large market returns and institutional imbalance.

imbalance turnover on these days is almost twice as large as any other day in the [-20, +20] window.[18]

To confirm that aggregate imbalance results are not driven by a small number of active institutions, we also investigate the number of institutions who are buyers and sellers (not reported in Table 4). When investigating the 1.5% cutoff sample for equal-weighted up days, we find that on average, 46.1% of institutions are net buyers and 53.9% of institutions are net sellers. For equal-weighted down days, on average, 54.6% of institutions are net buyers and 45.4% of institutions are net sellers. These results are slightly stronger when investigating value-weighted movements. On value-weighted up days we find that, on average, 44.3% of institutions are net buyers and 55.7% of institutions are net sellers. For value-weighted down days we find that 55.7% of all institutions are net buyers and 44.3% are net sellers.[19]

Taken together, our results thus far suggest that trading by institutions in our sample is certainly not positively correlated with extreme market returns and, in fact, is typically negatively correlated.[20] In order to flesh out the nature of trading decisions driving this relationship, we first divide all trading by institutions into buys and sells. Consistent with empirical tests presented in Table 4, we test whether buy and sell activities on event days are significantly different from benchmark levels.

Table 5 presents buy and sell volume and imbalance statistics for the 2.0% cutoff sample, and excess imbalance statistics for the 1.5% and 2.5% cutoff samples. Selling activity increases (i.e. imbalance turnover is more negative) on up movement days. Specifically, excess selling imbalance increases by 0.65, 0.88, and 1.00 basis points on value-weighted up days for the 1.5%, 2.0%, and 2.5% cutoff samples respectively.[21] Alternatively, there is no corresponding change in excess buying imbalances. For value-weighted down days, we find an increase in excess buying imbalance, however, the increase is only significant for the 2.5% cutoff sample. Results are similar for equal-weighted large movement days. For the 2.0% cutoff sample, we find that institutional

[18] Figures illustrating institutional imbalance surrounding equal-weighted large movement days and for other sample cutoff levels reveal a similar picture, but are not included for the sake of brevity.
[19] We use daily dollar imbalance for each institution to calculate net buyers and sellers. When using share imbalances and when investigating the 2.0% and 2.5% cutoff samples, results are quantitatively similar.
[20] Results using medians, in particular comparing median trading levels on event days to median levels during benchmark periods, are quantitatively and statistically similar to those reported in table 4.
[21] All excess selling imbalances for value-weighted up days are statistically significant at the 1% level.

selling (buying) excess imbalance increases by 1.14 (0.56) basis points on large up (down) movement days.

Table 5 also investigates buy and sell turnover as a percentage of overall market turnover for the 2.0% cutoff sample. On up days, we find that selling (buying) volume increases (decreases) as a percentage of aggregate market turnover. For value-weighted days the ratio of selling volume to total market volume increases by 0.29%, while the ratio for buy volume decreases by 0.35%. When investigating down markets, we find that selling volume decreases as a percentage of market volume; however, we do not find a symmetric statistically significant increase in the buying volume ratio.

Clearly, our results are inconsistent with the notion that institutions are jumping into rising or falling markets in a manner that would contribute to the excess price movement on those days. These results do suggest, though weakly, that institutional trading is the result of trading strategies that are contingent on price movements. The exact nature of those strategies is not clear from Table 5. In the next section we will look at a subset of trading activity for which the trading strategies and implications for market volatility are much clearer.

V.ii Pre-Event Initiated Trades

As described in the introduction, one plausible explanation for the observed institutional trading behavior is that rising or falling markets allow institutions to complete desired reductions or expansions (respectively) in their positions that result from trading decisions unrelated to current market movements. According to this explanation, portfolio managers (or possibly the institutional trading desk – see Edelen and Kadlec (2007)) who were buying in the pre-event period will increase their buying on days when markets move downward. Of course, these extreme market movements may also make it more difficult for institutions to complete desired position changes. Thus, institutions that were selling in the pre-event period might decrease their selling when the market moves downward.

More than 59% of the total dollar value of all trade executions in our database are part of orders which take more than one day to execute. We test our theory by partitioning trade executions into two categories: 1) executions that are part of trade orders originating prior to the event day, and 2) executions where the decision to trade is made on the event day. In particular, execution results for pre-event initiated orders are clearly a function of trading strategies (i.e. implementation) rather than position decisions. Results are presented in Table 6. Variables are calculated as before, where adjusted values are the difference between event day means and benchmark period means. Statistical tests are also identical to those presented earlier. In this partition, we see that the negative contemporaneous relationship between institutional imbalance and large market movements documented in table 4 is almost entirely explained by pre-event initiated executions. For the 2.0% cutoff sample, the pre-event initiated imbalance is -0.64 (-0.70) basis points for the value- (equal-) weighted sample, while the event-day initiated imbalance is positive. The pattern is similar for value- (equal-) weighed down days, with pre-event initiated imbalances of 0.35 (0.43) basis points. Excess imbalance measures for all pre-event initiated execution in the 1.5%, 2.0%, and 2.5% cutoff samples are significantly different than benchmark levels at the 1% level.

The adjusted measures calculated in Table 6 for pre-event initiated orders show how realized execution levels differ from typical trading periods. It does not reflect the degree to which the pre-event initiated execution levels differ from what would have been expected for those orders had price movements been typical. The reason is that trading strategies may not allocate trades equally across days. To investigate this, we first need to infer the expected execution level for the pre-event initiated orders. In particular, we need to predict the execution levels based on typical execution patterns.

To do so, we take all trade orders of length *n*, where *n* is the number of days over which the order is executed, and we determine the average number of shares executed each day as a percentage of the total shares in the trade order. For example, for all orders that execute over three days, on average, 42.18% of the total order volume is executed on the first day. Over the next two trading days, 16.69% and 39.12% of the total order volume is executed each day, respectively.[22] This method allows us to quantify measures of expected trading that are consistent with multiple-day trade executions for institutions in the Abel Noser database. Using the predicted levels of trading, we are able to calculate

[22] These percentages represent average expectations over the entire sample period. Since trading strategies may vary over time, actual expectations exhibit time varying properties.

unexpected execution volume for event days.[23] Since trading strategies may vary over time, expected execution levels are based on realized multiple-day trade order results for the prior three month calendar period. We calculate a daily aggregate unexpected execution level by summing across all institutions and all open pre-event initiated orders. In the absence of any other effect, unexpected execution levels should be zero, and our tests use the variance of unexpected execution levels to test significance.

Results are presented in Table 7 for pre-event initiated buy and sell orders separately. We present only unexpected shares traded for the 1.5%, 2.0%, and 2.5% cutoff samples, though inferences using unexpected turnover are similar. For the 2.0% cutoff sample, on value- (equal-) weighted down days pre-event initiated buy orders are responsible for purchasing 4.8 million (4.1 million) more shares than would be expected in a normal trading environment. Pre-event initiated sell orders on these days do not experience any abnormal activity. Similarly, on value- (equal-) weighted up days pre-event initiated sell orders are responsible for selling 10.7 million (10.4 million) more shares than would be expected in a normal trading environment. Results for abnormal buying on down days and abnormal selling on up days are all statistically significant at the 1% level. Results are generally consistent for both pension funds and money managers, and for the 1.5% and 2.5% alternate cutoff samples. These results suggest that institutions are using market wide demand (either to buy or sell depending on market movements) as an opportunity to complete more of an order than would typically be the case.

Also notable in Table 7 is that we find very little evidence that on down days, for example, institutions that were selling before the event day sell any less than expected. Analogous conclusions apply to up days. This suggests there is more to execution strategies than simply the use of limit prices. In particular, our results suggest that when the market moves in favor of execution, executions increase, but that when markets move against execution, the execution strategy is reconsidered. For example, if a limit price

[23]For example, if the typical execution level for the second day of an order executed over three days is 16.69%, we calculate the expected execution level for a three day order where the second day is our event day as 0.1669 times the total shares executed in the order. Thus, for a 400,000 share buy order (that spans three trading days) initiated the day before our event day, we would expect 66,760 shares to be executed on our event day. If the institution actually buys 125,000 shares, the unexpected execution level is 125,000-66,760 = 58,240.

was given for a buy order, and markets move down, the buy order is more likely to execute. On the other hand, if the market moves up, the limit price must have been raised so that the order will execute with a probability no different from other days.

These results are also consistent with the theoretical model proposed by Edelen and Kadlec (2007). In their model, traders whose performance is evaluated using volume weighted average prices (VWAP) during the trading day will have incentives to aggressively execute buy (sell) orders against a falling (rising) market.

V.iii. Firm Level Trading Patterns

In this section we examine the determinants of institutional trading patterns at the firm and institution level. Prior literature suggests that trading decisions are motivated by price changes, and recent work by Griffin, Harris, and Topaloglu (2003) further suggests that aggregate institutional trading imbalance is related to the prior day aggregate institutional imbalance. In this section we assess the degree to which these trading patterns differ on days of extreme market movements and if these changes are consistent with our aggregate trading results.

We first take the imbalance turnover (imbalance divided by shares outstanding) for each institution and stock during each day of the sample period. We model these institution/firm level imbalances as a function of independent variables that prior literature suggests may affect trading behavior. We estimate the following pooled regression:

$$Imbalance_{j,i,t} = \alpha_0 + \sum_{i=1}^{5} \alpha_i \sum_{r=1}^{5} Imbalance_{j,i,t-r} + \sum_{i=6}^{11} \alpha_i \sum_{r=0}^{5} Return_{j,i,t-r} + \varepsilon_i$$

Where *j* refers to the institution trading, *i* is the i^{th} firm, and *t* refers to the event day. The dependent variable, *Imbalance*, is measured for each institution and firm. We include five days of lagged institutional trading imbalance to test whether institutional trading on large movement days is related to pre-event trading. In order to test findings by Dennis and Strickland (2002) and Griffin, Harris, and Topaloglu (2003) that institutional imbalance is positively correlated with both contemporaneous and lagged daily firm returns, we include variables $Return_t$, $Return_{t-1}$, $Return_{t-2}$, $Return_{t-3}$, $Return_{t-4}$, and $Return_{t-}$

$_5$. $Return_t$ is the firm's return on the event day, while other return variables represent five days of lagged firm returns.

We run this regression for non-event days and event days separately. Specifically, we pool all days during our sample period that are not included in our sample of extreme movements (1327 days). From this sample, we randomly select 133 trading days (10%) as control days. Results for this regression are presented in Table 8 along with the results for value-weighted and equal-weighted event days for the 2.0% cutoff sample. In addition, the primary independent variables of interest ($Return_t$ and *Prior*) are presented for the 1.5% and 2.5% cutoff samples.

For both the control and event day samples, coefficient estimates confirm that an institution's trading behavior with regard to a stock is highly significantly correlated with the previous five days of trading activity for that institution. For the control days sample, the coefficient on $Imbalance_{t-1}$ is 0.032, suggesting that a one standard deviation increase in an institution's trading imbalance on day t-1 results in an increase of 0.06 basis points in event day imbalance. The regression also shows that both contemporaneous returns on day *t* and prior day returns are significantly related to an institution's trading imbalance. This result confirms findings by Griffin, Harris, and Topaloglu (2003). The coefficient on contemporaneous returns is 0.42 and significant at the 1% level. The coefficient indicates that as a stock's price increases by 1 standard deviation, this results in an increase of 0.41 basis points in event day imbalance.

If institutions are even more prone to follow stock returns on days with extreme price movements, driving stock prices past fundamental values, then one would expect the coefficient on contemporaneous returns to increase for a sample of event days. Looking at regression results for both value- and equal-weighted event days, we find that the coefficient estimates for $Return_t$ decrease from 0.42 on control days to 0.151 on value-weighted event days, and 0.076 on equal-weighted event days. Results suggest that institutional imbalances become less sensitive to firm returns on these event days.[24]

In unreported results, we formally test the equality of coefficients on contemporaneous returns for control days versus event days by pooling the control and

[24] All results hold for pension funds and money managers separately. All standard errors are Rogers/clustered to control for any within institution correlated trading patterns.

event day samples. We introduce the variable *Event* which equals one if the observation occurs on an event day, and zero if it occurs on a control day. We then interact the *Event* variable with $Return_t$. This variable, therefore, captures the marginal effect on the coefficient on returns for event days, assuming all other coefficients are unchanged. For both the value- and equal-weighted event day samples, the coefficient on this interaction term is negative and significant (at the 1% level).

Although the reduction in sensitivity to contemporaneous returns on extreme movement days suggests that firms reduce, rather than increase, their trading in response to the market movement, the results are not entirely consistent with our aggregate results. In particular, at the aggregate level imbalances are negatively correlated with returns while at the firm/institution level they are still positively correlated. This difference in inferences, of course, results from the fact that the regressions weight each firm/institution equally whereas trading activity will not be equal across all observations. Thus, it must be that trading volumes are relatively higher for firms/institutions that are trading against the market (e.g. buying in a down market) than for those that are trading with the market (e.g. selling in a down market). This is shown to be true in the aggregate volume results.

The regression framework also allows us to provide further evidence that trading patterns on event days are related to prior trading decisions. We note, first, that in cases where an institution is buying a stock during the five day pre-period, 83% of institutions continue to buy that stock on the event day, regardless of whether the market moves up or down. In cases where an institution is selling a stock during the five day pre-period, 79% of institutions continue to sell that stock on the event day, regardless of the market movement.[25] This is consistent with trading strategies where institutions implement position decisions over multiple days.

To formally test for a link between event day trading and prior trading activity, we include the term *Prior*, which is the absolute value of the mean of the previous five days imbalance turnover in a stock times $Return_t$. If institutions use event days as an opportunity to rapidly execute previously determined trade orders, we should expect a negative coefficient on the term *Prior*. For example, if an institution is a net buyer of a

[25] This analysis is conditioned on an institution trading a stock on the event day.

stock in the period before a event day, and the stock decreases in value on day *t* (along with the aggregate market), we would expect the institution to increase their level of buying in order to take advantage of the opportunity to complete their trading decision at lower prices. Consistent with our prior results, we find negative and significant coefficients for the term *Prior* in both value- and equal-weighted day regressions, and for all three cutoff samples.

While the trading we observe in firm level regressions is still positively related to contemporaneous returns and therefore differs from the aggregate results, when we look only at pre-event initiated trades, results at the firm level mirror those at the aggregate level. This analysis is presented in Table 9. We use the same regression specification presented in Table 8. Similar to previous results, we present these regressions for non-event days and event days separately. Of central importance, we now find that the contemporaneous relationship between imbalance and returns is negative for the event day samples. The result is consistent for both equal- and value-weighted days and exists for all cutoff subsamples. Thus far our evidence confirms that institutions use extreme market movements as opportunities to complete previously initiated trade orders.

V.iv. Profits

A notable conclusion in Dennis and Strickland (2002) is that institutions are behaving irrationally since their trading is driving prices too far. This conclusion follows from their analysis since the stocks with the largest institutional ownership are those that experience subsequent reversals, and they assume ownership is positively related to trading. We directly test the profitability of institutional trading on event days by using the actual trades of institutions in our sample. The results in this section are not necessarily implied by our earlier results, since even if aggregate trading is negatively related to market-wide returns, individual firm trading activity may not be negatively correlated with those individual firm returns that are subsequently reversed. This analysis also provides further evidence on whether institutional trading is driven by market demand (e.g. that institutional buying is driven by market selling). Specifically, if institutions are responding to market demand, when market demand is extreme and likely to have driven prices past fundamentals, institutions are all the more likely to have been on the other side.

In calculating the performance of institutional trading we proceed as follows: We assume that the initial endowment for all institutions is zero on day t-1. We then calculate the net position established by all Abel Noser clients for each stock traded on our event day (day t) using actual execution prices. We track the principal-weighted raw and abnormal portfolio return for 1 week, 1 month, and 3 months following the event day by applying CRSP returns to the net position value at the end of the event day. By using CRSP returns we acknowledge cash received in the form of dividends. Abnormal portfolio returns are the raw return minus DGTW benchmark returns (Daniel, Grinblatt, Titman, and Wermers, 1997). DGTW benchmark returns are the value-weighted returns to portfolios of stocks sorted into quintiles by size, book-to-market, and past 12 month return.

Results for our return analysis following event days are presented in Table 10. We find no evidence of negative abnormal performance for institutional positions established on event days. In fact, we find some evidence that trades are profitable. For the 1.5% cutoff sample, three month (60 trading day) post-event DGTW abnormal returns are 0.89% for institutional positions established on equal-weighted up days, and 0.78% for positions established on equal-weighted down days. Abnormal returns are significantly positive at the 5% level. When investigating the three month performance of positions established on value-weighted extreme movement days (for the 1.5% cutoff sample) we find no evidence of significant abnormal returns.

Post-event performance measures provide some evidence that positions established on event days are marginally profitable. Furthermore, we find no evidence that positions established on these days experience negative abnormal returns.

VI. Conclusion

This paper investigates the trading behavior of money managers and pension plan sponsors on days when markets experience large increases or decreases in value. Large increases (decreases) occur when the absolute value of returns for the CRSP equal- or value-weighted market index is greater than 1.5%, 2.0% or 2.5%. Using a proprietary database of institutional trades from the Abel Noser Corporation, we find strong evidence that both money managers and pension plan sponsors are net sellers on days when the market experiences large increases and net buyers on days when the market experiences large decreases.

Exploring the mechanism driving this pattern in trading, we find that this aggregate behavior is driven by orders that were placed in days prior to the large market movements (pre-event initiated orders). This suggests the trading patterns result from implementation strategies rather than decisions about positions. In effect, institutions view rising markets as opportunities to execute previously determined decreases in ownership. The reverse holds for falling markets. Interestingly, the relationship is not symmetric: while a rising market implies a significant increase in selling, it does not imply a notable change in buying. Again, an analogous pattern holds for falling markets. Results suggest a fairly sophisticated trading strategy. However, what is abundantly clear is that institutions do not appear to chase price changes and jump into markets to buy shares when markets are rising or sell shares when markets are falling. Instead, institutions appear to have a long-term perspective on their holdings and respond to market movements as opportunities to execute previously determined position changes, rather than motivators for new position changes. Consistent with this view, we find some evidence that positions established by institutions on event days earn abnormal profits as institutions buy (sell) more when market demand is excessively negative (positive).

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Table 1 – Summary Statistics for Abel Noser Data

Table 1 presents summary information for the institutional trading sample provided by the Abel Noser Corporation. The trades in the sample are placed by 845 different institutions during the time period from January 1, 1999 to December 31, 2005. Daily volume summary statistics aggregate all institutional trading volume by firm and trading day. We then present separate statistics for orders (instructions to trade initiated by a client's trading desk and given to brokerage firms for execution) and executions. Summary statistics are also broken down by pension plan sponsor and money manager.

	Daily Volume Characteristics	Order Characteristics	Execution Characteristics
Total Sample (845 Institutions)			
Mean Shares	148,191	22,653	8,622
Median Shares	20,000	1,800	950
Mean Dollars	4,499,723	687,863	261,821
Median Dollars	383,491	53,200	26,980
Observations	5,080,132	33,232,124	87,308,205
Average Duration in Days		1.53	
Pension Plan Sponsors (641 Institutions)			
Mean Shares	43,709	15,613	6,647
Median Shares	7,700	2,331	1,200
Mean Dollars	1,289,645	460,663	196,119
Median Dollars	167,968	70,510	32,865
Observations	3,611,475	10,110,445	23,748,384
Average Duration in Days		1.74	
Money Managers (204 Institutions)			
Mean Shares	137,667	25,732	9,360
Median Shares	18,600	1,500	900
Mean Dollars	4,211,563	787,211	286,370
Median Dollars	364,108	46,053	24,822
Observations	4,321,829	23,121,679	63,559,821
Average Duration in Days		1.45	

Table 2- Summary Statistics for Large Market Movement Days

Table 2 presents summary information for days during the March 31, 1999 to September 30, 2005 sample period where the absolute value of the CRSP equal- or value-weighted market index return is large. We initially define large as a 2.0% or larger movement in either the equal- or value-weighted market index. However, we also present results for alternate cutoffs of 1.5% and 2.5%. The table presents the number and annual distribution of large market movement days for each cutoff level. The table also presents mean returns for each cutoff level.

	All Days	1999	2000	2001	2002	2003	2004	2005
Value-Weighted								
Up								
# of days (1.5% cutoff)	130	17	31	23	35	20	3	1
# of days (2.0% cutoff)	72	5	21	14	23	9	0	0
# of days (2.5% cutoff)	39	2	15	6	13	3	0	0
Mean Return (1.5% cutoff)	2.37%	1.97%	2.60%	2.48%	2.56%	2.06%	1.62%	1.79%
Mean Return (2.0% cutoff)	2.91%	2.57%	3.04%	2.94%	3.02%	2.48%	n/a	n/a
Mean Return (2.5% cutoff)	3.51%	3.01%	3.38%	3.88%	3.64%	3.17%	n/a	n/a
Down								
# of days (1.5% cutoff)	153	12	42	38	43	11	6	1
# of days (2.0% cutoff)	76	6	20	16	29	5	0	0
# of days (2.5% cutoff)	34	1	11	8	12	2	0	0
Mean Return (1.5% cutoff)	-2.17%	-2.00%	-2.26%	-2.17%	-2.25%	-2.01%	-1.56%	-1.58%
Mean Return (2.0% cutoff)	-2.63%	-2.23%	-2.81%	-2.80%	-2.52%	-2.48%	n/a	n/a
Mean Return (2.5% cutoff)	-3.16%	-2.57%	-3.26%	-3.42%	-2.97%	-2.95%	n/a	n/a
Equal Weighted								
Up								
# of days (1.5% cutoff)	76	1	22	20	21	11	1	0
# of days (2.0% cutoff)	29	0	12	10	7	0	0	0
# of days (2.5% cutoff)	16	0	6	6	4	0	0	0
Mean Return (1.5% cutoff)	2.08%	1.68%	2.22%	2.31%	1.98%	1.65%	1.63%	n/a
Mean Return (2.0% cutoff)	2.70%	n/a	2.63%	2.85%	2.61%	n/a	n/a	n/a
Mean Return (2.5% cutoff)	3.14%	n/a	3.08%	3.33%	2.94%	n/a	n/a	n/a
Down								
# of days (1.5% cutoff)	66	0	26	14	17	2	7	0
# of days (2.0% cutoff)	24	0	9	7	7	0	1	0
# of days (2.5% cutoff)	9	0	4	4	1	0	0	0
Mean Return (1.5% cutoff)	-2.09%	n/a	-2.15%	-2.30%	-2.02%	-1.79%	-1.71%	n/a
Mean Return (2.0% cutoff)	-2.75%	n/a	-2.97%	-2.94%	-2.36%	n/a	-2.12%	n/a
Mean Return (2.5% cutoff)	-3.64%	n/a	-3.90%	-3.51%	-3.11%	n/a	n/a	n/a

Table 3-Replication of Dennis and Strickland

Table 3 presents a replication of Dennis and Strickland's (2002) results during their original sample period from January 1, 1988 to December 31, 1996, and for our sample from March 31, 1999 to September 30, 2005. For each day when the absolute value of the return for the CRSP equal- or value-weighted index is greater than 2%, we divide all stocks into two portfolios based on whether the aggregate institutional ownership (IO) level for a stock is above or below the median level of institutional ownership for all stocks. The table presents mean and median statistics for returns and abnormal turnover (*abn. turn*.) for the entire sample, the high institutional ownership portfolio (High IO), and the low institutional ownership portfolio (Low IO). Significance levels presented in the table reflect a standard t-test, testing the equality of means (medians) between the high IO and low IO portfolios.

		Dennis and Strickland Sample (Jan. 1, 1988 – Dec. 31, 1996)			**Study Sample (March 31, 1999 – Sept. 30, 2005)**		
		All Stocks	**High IO**	**Low IO**	**All Stocks**	**High IO**	**Low IO**
Value Weighted							
Up							
Returns	*mean*	1.72%	2.08%***	1.37%	1.80%	2.30%***	1.29%
	median	0.79%	1.64%***	0.00%	0.94%	1.58%***	0.30%
Abn.Turn.	*mean*	0.108%	0.128%***	0.052%	0.099%	0.252%***	0.085%
	median	0.009%	0.020%***	0.000%	0.001%	0.037%***	0.000%
Down							
Returns	*mean*	-2.08%	-2.55%***	-1.62%	-1.63%	-2.10%***	-1.16%
	median	-1.59%	-2.17%***	0.10%	-1.11%	-1.65%***	-0.51%
Abn.Turn.	*mean*	0.145%	0.181%***	0.107%	0.169%	0.120%***	0.077%
	median	0.009%	0.024%***	0.000%	0.007%	0.020%***	0.000%
Equal Weighted							
Up							
Returns	*mean*	2.49%	2.71%***	2.28%	2.64%	3.14%***	2.13%
	median	1.55%	2.13%***	0.51%	1.33%	2.06%***	0.61%
Abn.Turn.	*mean*	0.105%	0.155%***	0.054%	0.151%	0.242%***	0.059%
	median	0.005%	0.029%***	0.000%	0.005%	0.039%***	0.000%
Down							
Returns	*mean*	-2.42%	-2.75%***	-2.09%	-2.66%	-2.93%***	-2.40%
	median	-1.88%	-2.28%***	-1.20%	-1.77%	-1.19%***	-1.25%
Abn.Turn.	*mean*	0.135%	0.179%***	0.090%	0.199%	0.294%***	0.103%
	median	0.022%	0.048%***	0.007%	0.018%	0.062%***	0.003%

* denotes significance at the 10% level
** denotes significance at the 5% level
*** denotes significance at the 1% level

Table 4 - Trading Activity

Table 4 presents mean statistics for institutional trading volume, trading volume divided by aggregate market trading volume, and imbalance on days during the March 31, 1999 to September 30, 2005 sample period when the absolute value of the CRSP equal- or value-weighted market index return is large. We initially define large as a 2% or greater move in the index, however, we also include excess imbalance statistics for alternate cutoffs of 1.5% and 2.5%. Volume and imbalance (buy volume minus sell volume) are presented in three ways: shares traded, turnover (shares traded divided by shares outstanding), and excess turnover (turnover less the mean turnover over the benchmark period spanning days [-60, -20] and [20, 60]). Turnover statistics (both volume and imbalance) are presented in basis points (BP). The significance of trading measures is evaluated using a t-test comparing the event day means to the means over benchmark level using the standard deviation of the daily averages during the benchmark period. The table also presents measures partitioned by pension plan sponsor and money manager.

		Volume					**Imbalance**			**Imbalance Alternate Cutoffs**	
										1.5%	**2.5%**
		Volume Shares (1,000s)	Volume Turnover (BP)	Excess Volume (BP)	Volume/ Market (%)	Excess Volume/Mkt (%)	Imbalance Shares (1,000s)	Imbalance Turnover (BP)	Excess Imbalance (BP)	Excess Imbalance (BP)	Excess Imbalance (BP)
Value Weighted											
Up	*All*	400,411	5.34	0.48***	6.63	-0.063	-13,305	-0.62	-0.80***	-0.70***	-0.91***
	Pension Funds	70,404	1.17	0.07*	1.61	-0.067	-4,277	-0.20	-0.18***	-0.16***	-0.18***
	Money Mangers	330,007	4.17	0.41***	5.02	0.004	-9,028	-0.42	-0.63***	-0.53***	-0.73***
Down	*All*	378,091	4.86	-0.01	6.59	-0.103	4,691	0.43	0.26**	0.37***	0.30*
	Pension Funds	70,110	1.10	-0.03	1.62	-0.081	4,772	0.13	0.15***	0.13***	0.19***
	Money Mangers	307,981	3.76	0.02	4.97	-0.022	-81	0.30	0.11	0.23***	0.10
Equal Weighted											
Up	*All*	402,622	5.26	0.73***	6.24	0.017	-2,883	-0.57	-0.82***	-0.48***	-0.86***
	Pension Funds	73,475	1.24	0.14**	1.50	-0.131	-2,675	-0.18	-0.14**	-0.12***	-0.19**
	Money Mangers	329,147	4.02	0.59***	4.74	0.148	-208	-0.40	-0.68***	-0.36***	-0.67***
Down	*All*	420,883	5.32	0.49*	6.42	-0.142	8,818	0.45	0.15	0.25*	0.17
	Pension Funds	87,037	1.37	0.20***	1.79	0.058	7,295	0.21	0.23***	0.18***	0.24**
	Money Mangers	333,847	3.95	0.29	4.63	-0.200	1,523	0.24	-0.08	0.07	-0.07

* denotes significance at the 10% level, ** denotes significance at the 5% level, *** denotes significance at the 1% level

Table 5 – Buy and Sell Volume Separately

Table 5 presents mean statistics for buy and sell trading volume separately on days during the March 31, 1999 to September 30, 2005 sample period when the absolute value of the CRSP equal- or value-weighted market index return is large. We initially define large as a 2% or greater move in the index, however, we also include excess imbalance statistics for alternate cutoffs of 1.5% and 2.5%. The table presents results for buy and sell turnover divided by aggregate market turnover and buy and sell imbalance turnover. Imbalance turnover is measured as signed trading volume divided by shares outstanding, and excess imbalance is turnover less the mean turnover over the benchmark period spanning days [-60, -20] and [20, 60]. Imbalance turnover and excess imbalance statistics are presented in basis points (BP). The significance of trading measures is evaluated using a t-test comparing the event day means to the means over benchmark level using the standard deviation of the daily averages during the benchmark period.

		Volume/Mkt		**Imbalance**		**Imbalance Alternate Cutoffs**	
						1.5%	**2.5%**
		Volume/ Market (%)	Excess Vol./Mkt (%)	Imbalance Turnover (BP)	Excess Imbalance (BP)	Excess Imbalance (BP)	Excess Imbalance (BP)
Value Weighted							
Up	*Buys*	3.15	-0.35***	5.03	0.08	-0.04	0.09
	Sells	3.48	0.29***	-5.65	-0.88***	-0.65***	-1.00***
Down	*Buys*	3.61	0.09	5.08	0.12	0.09	0.42*
	Sells	2.98	-0.19***	-4.65	0.14	0.28***	-0.12
Equal Weighted							
Up	*Buys*	3.00	-0.31***	4.97	0.32	0.49**	0.97**
	Sells	3.24	0.33**	-5.54	-1.14***	-0.97***	-1.83***
Down	*Buys*	3.51	0.01	5.54	0.56*	0.20	1.11**
	Sells	2.91	-0.15	-5.09	-0.41	0.05	-0.94***

* denotes significance at the 10% level, ** denotes significance at the 5% level, *** denotes significance at the 1% level

Table 6 – Pre-Event Initiated Trading Volume

Table 6 presents mean statistics for pre-event initiated and event initiated trading volume separately on event days during the March 31, 1999 to September 30, 2005 sample period when the absolute value of the CRSP equal- or value-weighted market index return is large. We initially define large as a 2% or greater move in the index, however, we also include imbalance statistics for alternate cutoffs of 1.5% and 2.5%. Pre-event initiated trading includes executions that are part of trade orders originating prior to the event day, and event day initiated trading includes executions where the decision to trade is made on the day. Turnover is measured as volume or imbalance (buy volume minus sell volume) divided by shares outstanding, and excess turnover (both volume and imbalance) is turnover less the mean turnover over the benchmark period spanning days [-60, -20] and [20, 60]. Turnover statistics (both volume and imbalance) are presented in basis points (BP). The significance of trading measures is evaluated using a t-test comparing the event day means to the means over benchmark level using the standard deviation of the daily averages during the benchmark period.

		Volume		**Imbalance**		**Imbalance Alternate Cutoffs**	
						1.5%	**2.5%**
		Volume Turnover (BP)	Excess Volume (BP)	Imbalance Turnover (BP)	Excess Imbalance (BP)	Excess Imbalance (BP)	Excess Imbalance (BP)
Value Weighted							
Up	*Pre-Event*	2.33	0.12*	-0.64	-0.67***	-0.60***	-0.73***
	Event-Day	3.01	0.36***	0.01	-0.13*	-0.10*	-0.19*
Down	*Pre-Event*	2.14	-0.08	0.35	0.31***	0.41***	0.29**
	Event Day	2.72	0.07	0.08	-0.05	-0.04	0.00
Equal Weighted							
Up	*Pre-Event*	2.37	0.32***	-0.70	-0.78***	-0.59***	-0.85***
	Event-Day	2.89	0.41***	0.13	-0.03	0.11	-0.01
Down	*Pre-Event*	2.20	0.00	0.43	0.32**	0.41***	0.46**
	Event Day	3.12	0.49***	0.02	-0.17	-0.15**	-0.29

* denotes significance at the 10% level, ** denotes significance at the 5% level, *** denotes significance at the 1% level

Table 7 – Unexpected Trading from Pre-Event Initiated Orders

Table 7 presents mean statistics for unexpected trading volume for multiple-day trade orders where the decision to trade is made prior to event days. We present results for multiple-day buy and sell orders separately, and all results are presented in shares. Trade order expectations are generated using the prior quarter trading data (see Section V. ii. for a more complete description). As such, positive (negative) numbers signify higher (lower) than expected trading volumes. Event days are those during our March 31, 1999 to September 30, 2005 sample period when the absolute value of the CRSP equal- or value-weighted market index return is large. We initially define large as a 2% or greater move in the index, however, we also include statistics for alternate cutoffs of 1.5% and 2.5%. Significance levels are obtained from t-tests that use the variance of unexpected execution levels.

		1.5 % Cutoff		**2.0% Cutoff**		**2.5% Cutoff**	
		Buy (1,000s)	*Sell* (1,000s)	*Buy* (1,000s)	*Sell* (1,000s)	*Buy* (1,000s)	*Sell* (1,000s)
Value Weighted							
Up	*All*	-993***	8,883***	325	10,699***	822	10,764***
	Pension Funds	-254**	1,823***	180	2,044***	753**	1,835***
	Money Manager	-739***	7,059***	144	8,655***	68	8,929***
Down	*All*	5,129***	-1,974**	4,844***	-1,395	6,036***	-1,959
	Pension Funds	1,109***	-1,200	1,083***	-1,301	1,460***	-2,948
	Money Manager	4,020***	-773***	3,761***	-94	4,575***	989
Equal Weighted							
Up	*All*	1,072***	11,153***	1,176*	10,473***	4,082***	12,624***
	Pension Funds	-30	1,994***	303	1,591***	473*	1,308***
	Money Manager	1,102***	9,158***	873	8,881***	3,609***	11,316***
Down	*All*	4,390***	-1,281	4,122***	-2,253	5,759***	-5,905
	Pension Funds	989***	-1,729	1,034***	-3,472	905***	-10,006
	Money Manager	3,400***	448	3,087***	1,219*	4,854***	4,100***

* denotes significance at the 10% level, ** denotes significance at the 5% level, *** denotes significance at the 1% level

Table 8 - Regression Analysis – All Orders

Table 8 presents pooled cross-sectional regressions where trade imbalance (shares bought minus shares sold divided by shares outstanding) on the event day is the dependent variable, and observations are aggregated at the institution and firm level. Independent variables include five days of lagged institutional trading imbalance. $Return_t$ is the firm's return on the event day, while variables $return_{t-1}$, $return_{t-2}$, $return_{t-3}$, $return_{t-4}$, and $return_{t-5}$ represent five days of lagged firm returns. The variable *Prior* is the absolute value of the mean of the previous five days imbalance turnover in a stock times $Return_t$. The table presents regression results for a randomly selected sample of non-event control days and for days when the value-or equal-weighted CRSP index moves by greater than 2%. The table also presents results for selected coefficients $Return_t$ and *Prior* for the alternate 1.5% and 2.5% cutoff samples.

		Control Days		Value-Weighted Days		Equal-Weighted Days	
Intercept		0.001	0.001	0.000	0.000	-0.002	-0.002
$Imbalance_{t-1}$		0.032***	0.032***	0.038***	0.057***	0.124***	0.126***
$Imbalance_{t-2}$		0.068***	0.069***	0.037***	0.036***	0.036***	0.036***
$Imbalance_{t-3}$		0.039***	0.039***	0.017***	0.017***	0.053***	0.053***
$Imbalance_{t-4}$		0.017***	0.017***	0.028***	0.026***	0.026***	0.024***
$Imbalance_{t-5}$		0.023***	0.023***	0.064***	0.064***	0.006***	0.006***
$Return_t$		0.420***	0.378***	0.151***	0.205***	0.076***	0.110***
$Return_{t-1}$		0.247***	0.249***	0.157***	0.153***	0.097***	0.095***
$Return_{t-2}$		0.159***	0.160***	0.096***	0.089***	0.026	0.022
$Return_{t-3}$		0.012	0.016*	0.040***	0.037***	0.051**	0.049**
$Return_{t-4}$		0.079***	0.080***	0.055***	0.056***	0.055**	0.056**
$Return_{t-5}$		0.025**	0.025**	0.068***	0.067**	0.062**	0.059**
Prior			0.320***		-0.453***		-0.279***
R-squared		2.88%	2.92%	1.15%	1.44%	0.55%	0.68%
Alternate Cutoffs – Selected Coefficients							
1.5% Movement	$Return_t$			0.187***	0.280***	0.121***	0.148***
	Prior				-0.724***		-0.212***
2.5% Movement	$Return_t$			0.098***	0.140***	0.054	0.075**
	Prior				-0.374***		-0.175***

* denotes significance at the 10% level, ** denotes significance at the 5% level, *** denotes significance at the 1% level

Table 9 - Regression Analysis – Pre-Event Initiated Orders

Table 9 presents pooled cross-sectional regressions for multiple-day trade orders where the decision to trade is made prior to the event day (i.e. pre-event initiated trading volume). The dependent variable is event day trade imbalance (shares bought minus shares sold divided by shares outstanding), and observations are aggregated at the institution and firm level. Independent variables include five days of lagged institutional trading imbalance. $Return_t$ is the firm's return on the event day, while variables $return_{t-1}$, $return_{t-2}$, $return_{t-3}$, $return_{t-4}$, and $return_{t-5}$ represent five days of lagged firm returns. The table presents regression results for a randomly selected sample of non-event control days, and for days when the absolute value of the CRSP equal- or value-weighted market index is large. We define large as greater than a 1.5%, 2.0%, or 2.5% move in the index.

	Control Days	Value-Weighted Days			Equal-Weighted Days		
		1.5% cutoff	**2.0% cutoff**	**2.5% cutoff**	**1.5% cutoff**	**2.0% cutoff**	**2.5% cutoff**
Intercept	0.001	0.001	0.000	0.000	0.001	0.000	-0.0003
$Imbalance_{t-1}$	0.022***	0.039***	0.029***	0.126***	0.028***	0.102***	0.109***
$Imbalance_{t-2}$	0.049***	0.003***	0.026***	0.019***	0.011***	0.026***	0.017***
$Imbalance_{t-3}$	0.023***	0.014***	0.011***	0.028***	0.025***	0.036***	0.043***
$Imbalance_{t-4}$	0.012***	0.010***	0.022***	0.013***	0.006***	0.019***	0.014***
$Imbalance_{t-5}$	0.015***	0.020***	0.026***	0.023***	0.006***	0.005***	0.017***
$Return_t$	0.014***	-0.032***	-0.034***	-0.035***	-0.036***	-0.049***	-0.058***
$Return_{t-1}$	0.246***	0.161***	0.158***	0.128***	0.147***	0.112***	0.100***
$Return_{t-2}$	0.136***	0.098***	0.087***	0.066***	0.085***	0.066***	0.062***
$Return_{t-3}$	0.006	0.054***	0.045***	0.028***	0.041***	0.010**	0.021***
$Return_{t-4}$	0.079***	0.053***	0.042***	0.041***	0.037***	0.021***	0.022***
$Return_{t-5}$	0.027**	0.024***	0.025***	0.024***	0.033***	0.023***	0.006
R-squared	4.61%	3.43%	3.80%	9.39%	2.98%	8.19%	8.38%

* denotes significance at the 10% level, ** denotes significance at the 5% level, *** denotes significance at the 1% level

Table 10-Post-Event Abnormal Returns

Table 10 presents the performance of trading positions established by institutions on event days. Raw returns presented in Panel A represent the value-weighted portfolio return of institutional positions established on the event day, where each position is weighted by the dollar value of the actual position cost (i.e. the transaction price times the number of shares traded). Panel B presents abnormal returns based on the approach by Dainiel, Grinblatt, Titman, and Wermers (1997). Specifically, DGTW benchmark returns are the value-weighted returns to portfolios of stocks that are sorted into quintiles by size, book-to-market, and past 12-month returns, yielding 125 portfolios. The DGTW-abnormal return is the raw return minus the characteristic-matched DGTW benchmark return. The table presents mean portfolio returns for 1 week, 1 month, and 3 months following the event day. The table also includes results for the 1.5%,. 2.0% and 2.5% cutoff samples.

Panel A: Raw Returns

		1 week	1 month	3 months
Value-Weighted				
1.50%	*Up*	0.20%**	0.09%	0.13%
	Down	0.13%	0.53%**	0.13%
2.00%	*Up*	0.22%*	0.11%	0.37%
	Down	0.09%	0.73%*	0.53%
2.50%	*Up*	-0.34%	-0.14%	-0.34%
	Down	0.14%	1.13%**	1.44%***
Equal-Weighted				
1.50%	*Up*	0.37%*	0.43%*	0.63%*
	Down	0.13%	0.95%**	0.64%*
2.00%	*Up*	0.45%	0.32%	-0.14%
	Down	0.29%	1.54%	1.53%**
2.50%	*Up*	-0.90%	-0.51%	0.58%
	Down	1.12%	3.20%	3.86%**

Panel B: DGTW Returns

		1 week	1 month	3 months
Value-Weighted				
1.50%	*Up*	0.12%**	0.11%	0.07%
	Down	0.11%	0.38%**	-0.06%
2.00%	*Up*	0.16%**	0.23%	0.30%
	Down	0.10%	0.49%	0.12%
2.50%	*Up*	-0.24%	-0.38%*	-0.26%
	Down	0.13%	0.64%**	0.90%**
Equal-Weighted				
1.50%	*Up*	0.14%	0.88%*	0.89%**
	Down	0.43%*	0.46%	0.78%**
2.00%	*Up*	0.56%	0.66%	0.13%
	Down	0.42%	1.50%	1.56%**
2.50%	*Up*	-1.17%	-1.15%	0.01%
	Down	1.33%	3.08%	3.85%**

* denotes significance at the 10% level, ** denotes significance at the 5% level, *** denotes significance at the 1% level

Figure 1 - Imbalance Turnover for All Institutions on Value-Weighted Days

Figure 1 presents the daily mean trading imbalance for all institutions (pension plan sponsors and money managers) during the [-20, +20] day period surrounding days when the absolute value of the CRSP value-weighted market index is greater than 1.5%.