The Information Content of Abnormal Trading Volume

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Abstract

This paper empirically investigates how abnormal trading volume reveals new information to market participants. Trading volume is generally regarded as a good proxy for information flow and theory argues that it enhances the information set of investors. However, as yet, no research has related the presence of abnormal trading volume to firm characteristics, such as ownership and governance structure, which also has a theoretical link to information quality. I find strong excess returns around extreme trading levels, which is only moderately attributable to information disclosure. Moreover, these returns are not caused by liquidity fluctuations since prices do not reverse over the following period. In contrast, and in violation of the semi-strong form of market efficiency, there is evidence of price momentum, suggesting that traders can implement successful portfolio strategies based on the observation of current volumes. Consistent with the hypotheses presented in this study, the information content of abnormal trading volume is related to ownership characteristics, such as the level of control and the family-firm status.

Key words: Abnormal trading volume, Italian equity market
JEL Classification: F23, G15

I. Introduction

The traditional definition of semi-strong form market efficiency assumes that all public information is reflected in market prices, but no role is played by trading volumes. In fact, when new information flows into the market, prices adjust to a new equilibrium level and any increase in volume is the resulting effect of informed trades. However, empirical evidence records that new information, concomitant price changes and heightened trading volume are not necessarily simultaneous phenomena, as market efficiency would suggest. More specifically, stock markets often show sudden and large changes in price and volume without any new information disclosure.

A number of reasons help to explain this phenomenon. These include unreported news (more likely for small firms), informal communication between financial analysts or advisors and their clients, and trading based on private information. A possible question is inevitably posed: how often is large and unexplained (by new information) trading volume due to the activity of investors trading on private information? Despite the fact that trading volume is used by stock exchange authorities to detect market abuses or that practitioners use abnormal volume as a signal of forthcoming public announcements, surprisingly no prior research has investigated the link between unexplained trading volume to the possible violation of insider trading laws.

A convincing argument is that observing trading volume alone is not sufficient to draw any conclusions regarding an insider trading law breach. However, the unobservability of illegal trades does not prevent us from conjecturing that, in a country with low investor protection and poor law enforcement, insiders can expropriate minority shareholders using their information advantage by trading the firm's stocks in advance of a public announcement. In this sense, Italy represents a perfect setting to test this hypothesis, given the weak legal protection of minority shareholders, the almost complete lack of enforcement of insider trading laws and the high ownership concentration obtained through pyramidal groups and nonvoting shares.

In this paper, I argue that the exploitation of non-public price-sensitive information represents an additional method of extracting private benefit from control. These actions are also facilitated by the level of insider trading law enforcement. In this regard, the first law on insider trading was introduced by the Italian parliament in 1991. Seven years later, the Draghi law strengthened the regulation and increased the relevant penalties. In spite of the activity of regulators, enforcement has been poor. In the period 1991-2002, CONSOB (the Italian stock exchange authority) reported only nine plea bargains and five convictions.

The presented hypothesis is also consistent with Bigelli, Mehrotra and Rau (2007) and Meulbroek (1992). Bigelli et al (2007) argue that Italian majority shareholders are able to transfer wealth from minority shareholders through dual class shares unification. Due to the huge discount at which nonvoting shares usually trade, a one-to-one conversion leads to strong price movements around the announcement and the opportunity of enormous profits for those who trade in advance to the information disclosure. Meulbroek (1992) documents that, in the event of a violation of insider trading laws, the abnormal trading volume is almost equal to the volume generated by insiders' transactions. Hence, she proves the relation between insider trading law violation and abnormal volumes, but she does not suggest the potential inverse relation between extreme trading levels and insider trading law breaches. Moreover, whereas she analyzes a small subset of volume events, I take into consideration the entire population. In this sense, a more general study can add a significant contribution to this field of research.

During the past twenty years a large number of other papers have taken into account the possible relevance of volume, but no prior work has explored the information content of extreme peaks in trading volume, with specific regards to those events where no new public information has been disclosed. In contrast to these studies, rather than analyzing the volume *per se*, I examine the information content of sudden and abnormal changes in volume. I believe the informative role of volume has not been fully exploited and a specific investigation of the determinants of its large change can add a contribution to the financial literature.

The rest of the paper is organized as follows. Section 2 develops the testable hypothesis. Section 3 describes the data, samples, selection procedures and methodology, while section 4 presents the results. Finally, section 5 concludes.

II. Related literature and testable hypotheses

The first contribution to the returns-volume relationship is Epps (1975), who formalized the *Wall Street* saying that bull (bear) stock market periods are usually associated with high (low) trading volume cycles. Karpoff (1987, 1985) finds a positive relation between a trading volume and price changes relative to both the equity and futures markets. Trading volume also plays an important role in all information-based models. According to this framework, prices alone cannot provide full information about the magnitude and precision of news signals. However, trades and volumes can also add information about the quality of traders' information that cannot be deducted from prices. Glosten and Milgrom (1985) demonstrate how trade imbalances might force prices to their full information value. In fact, if informed traders continue trading on the same side of the market - buying (selling) when in possession of good (bad) news - observation of the trades' concentration becomes informative.

Easley and O'Hara (1987) enhance this insight by considering the trade size. In their model, informed traders can vary the quantity of their trades, producing different effects on security prices. A common characteristic of these models is that prices immediately adjust to a public announcement, but not to private information. Consequently, the price adjustment is not instantaneous to its full informative level. The sequentiality of trading is also important [Easley and O'Hara (1992)]. As trades arise not just from information but also for liquidity reasons, the observation of a single trade is hardly revealing. Given the informed behaviour of trades' repetition, the observation of a trading sequence becomes informative. The relation between trading volume, price and private information has also been investigated in the derivative markets [Easley, O'Hara and Srinivas (1998), Pan and Poteshman (2006)]. In fact, the leverage embedded in

derivatives offers informed traders a way of enlarging their trading profits. The observation of trading volume and the imbalance between call and put options can provide an indication of future stock prices.
The common idea of these approaches is that the observation of trading volume or some of its characteristics (magnitude or timing of the trades) may enhance the information set. However, none of these studies suggest a role for a large and sudden change in trading volume, particularly when no contemporaneous information is disclosed. The main empirical hypothesis to be tested in this paper is the following:

H1:Large and unexplained changes in volume carries information content (undisclosed information)

The positive relation between volume and excess returns is well documented. However, the abovementioned hypothesis differs in a number of ways from what has been already proposed. First, this is the first study that looks at extreme changes in volume. Pritamani et al (2001) investigate the information content of large price changes, but no similar prior analysis has been conducted on trading volume. Second, the investigation of trading volume is generally associated with its ability to convey information to the market, but no prior work has related the presence of a high level of trading with firm characteristics, such as ownership and governance structure.

It is well known that the combination of high ownership (diluted through pyramidal structures and nonvoting shares) and low investor protection determines potential expropriation from minority shareholders by their controlling counterparts. In the context of the present study, the finance literature offers strong evidence of poor shareholder protection in Italy. Using a sample of Italian dual class firms, Zingales (1994) and Nenova (2003) find an average voting premium among the highest in the world. Based on controlling block sales in 39 countries, Dyck and Zingales (2004) document the value of control in Italy at 37% (compared to a 14% cross-country average), the highest level after the Czech Republic and Brazil. The high value of the voting premium is generally due to the private benefits of control, consisting of a number of

potential harmful actions able to expropriate minority shareholders. A comprehensive list of the ways in which controlling shareholders can tunnel resources away from minority shareholders is presented in Johnson, La Porta, Lopez-de-Silanes, and Shleifer (2000): selling assets, goods, or services to the company through self-dealing transactions, by obtaining loans on preferential terms, or by transferring assets from the listed company to other companies under their control. In a recent paper, Bigelli, Mehrotra and Rau (2007) show how dual class unification in Italy can serve to expropriate wealth from minority shareholders. The authors present a number of cases where the majority shareholders buy large stakes of non-voting shares before conversion. Due to the large discount at which non-voting shares trade, these actions represent an important loss for minority voting shareholders. Although a large number of examples have been described, no prior studies explicitly suggest that majority shareholders might use private information to further extract private benefits from control. According to this idea, two possible arguments can be put forward: the separation between voting and cash-flow rights might create an incentive for majority shareholders to exploit their informational advantage, trading with some anticipation of a public announcement. However, a counter-argument is also acceptable: the higher the separation, the easier it is for the controlling shareholder to expropriate minority shareholders through a number of more effective and profitable techniques. In this sense, a high degree of separation should be associated with a lower probability of trading driven by undisclosed private information. Therefore, two contrasting hypotheses can be proposed:

H2a: A higher separation between ownership and control leads to a strong trading volume – price change relationship

H2b: A lower separation between ownership and control leads to a weak trading volume – price change relationship.

The exploitation of undisclosed information is intuitively negatively related to the level of monitoring over those subjects who have a direct access to the information source (insiders). In Italy, insiders are typically majority shareholders. The monitoring of this category of insiders is determined by a combination of several factors, both internal and external to the firm. However, the presence of other relevant shareholders is probably among the most effective device. *Ceteribus paribus*, a lower control stake implies the presence of other relevant shareholders, higher monitoring over the controlling shareholders and a lower chance of exploiting private information through informed trading. Hence, I hypothesize:

H3: The information content of abnormal trading volume is positively associated with the level of control

According to their ultimate owner, Italian listed companies can be classified into three main categories[1]: financial institutions, state and families (when one or more individuals directly or through other companies control the firm). In family firms the control is usually shared among a large number of family members. Hence, information is spread over a higher number of insiders and their relatives. In such a setting, informed investors trading in possession of undisclosed information is more likely. The resulting hypothesis is:

H4: The information content of a large change in volume is higher for family-controlled firms

A number of studies [Ball and Brown (1968); Bernard and Thomas (1990); Ikenberry et al. (1995; 1996); Loughran and Ritter (1995); Michaely et al. (1995)] provide evidence of under-reaction to news relating to different types of corporate events. Pritamani et al. (2001), analyzing a sample of large price changes, document the existence of price continuation for some specific categories of events, but no work has yet examined trading volume and its under or over-reaction to corporate news. According to information-based

[1] Not accounting for other residual cases (i.e. foreign or public companies)

models, and consistent with the main hypothesis of this study, an increase on trading volume is caused by informed investor (or insider) trading behavior. In a setting where all informed traders simultaneously have access to private information, high trading volume is likely to be informative only on the same day. Unusual trading can eventually take place afterwards, but only through market herding[2]. If private information slowly filters through insiders, trading will last for a longer period (volume-continuation) and prices will need a longer time to fully incorporate any embedded information. In the event of volume persistence (corroborated by price continuation), we should expect lower excess returns on the event day (as prices do not fully reflect the fundamental value). Hence, the fourth hypothesis is the following:

H5: A higher degree of volume-continuation is likely to be associated with weaker information content

III. Methodology and Sample Selection

The main hypothesis driving this study is that large changes in trading volume have information content. Hence, what becomes crucial is not the observation of trading volume *per se*, but rather the recognition of unusual volume. In other words, the phenomenon to be detected is not a high level of trading volume, but rather the extreme deviation from what can be considered standard trading activity. This interpretation of abnormal trading is suitably captured by the *normalized abnormal volume* (*NAV*), first used by Jarrell and Poulsen (1989)[3]. The *NAV* for stock *i* on day *t* is computed as:

$$NAV_{i,t} = \frac{TV_{i,t} - \mu_{i,t}}{\sigma_{i,t}}$$

where $\mu_{i,t} = \frac{1}{66}\sum_{t=1}^{66} TV_{i,t}$

[2] Recent literature about herding suggests that trading initiated by those in possession of private information can represent a signal for uninformed traders. In such a framework, uninformed traders, who cannot observe the identity of the person who initiated the trade but only the large trading activity, can herd causing an even higher trading volume and a longer length of abnormal market conditions (price continuation).

[3] A similar approach is used in Pritamani and Singal (2001) for detecting large price changes.

and $$\sigma_{i,t} = \sqrt{\frac{1}{65}\sum_{t=1}^{66}\left(TV_{i,t} - \mu_{i,t}^{TV}\right)^2}$$

$TV_{i,t}$ is trading volume[4] for stock *i* on day *t*; μ and σ are the mean and standard deviation of trading volume in the 66 window immediately prior to the observation[5]. Contrasting with Jarrell and Poulsen (1989), the number of days where the mean and standard deviation are computed does not include days with no trading. In the event that a zero-trading day is found, the estimation window goes back to have 66 days with positive trading. This methodology is intended to avoid any possible bias arising from less liquid stocks. In effect, the inclusion of non-trading days in an estimation model[6] causes a downward bias in the estimate of the average trading volume and a resulting upward bias in *NAV*. The consequential effect is that normal trading activity (albeit infrequent) becomes similar in appearance to abnormal activity. A simple example can further clarify the problem. Consider two equivalent stocks with a different degree of liquidity: stock A is traded once a day, whereas stock B only once a month. For both, investors trade only one share. Suppose to observe that today one share of both is traded. The NAV of stock A is zero; the NAV of stock B is zero if zero-trading days are excluded from the estimation window or otherwise 4.54. The probability of observing a value of 4.54 in a standard normal distribution is lower than 0.1%, which would signal extreme and informative trading activity when this is not the case.

Table 1 shows the empirical distribution of the NAV. Since NAV is re-estimated on a daily basis for each firm, the universe of observations consists of roughly 650,000 estimations that goes down to 450,000 after the exclusion of days with no trading. The distribution is only approximately normal, as it is slightly skewed to the right and has fatter tails. [7]

[4] Computed as the natural logarithm of volume + 1.
[5] The choice of mean - rather than median - as a benchmark to detect trading volume anomaly does not affect results. I also estimated, for each company, abnormal trading volumes as the difference between the daily trading volume and the median calculated over the same defined estimation period (66 working days with positive volumes) with no virtual difference in sample composition and excess returns around days of abnormal trading (results are not shown in the paper).
[6] Infrequently traded stocks have a large proportion of days with zero trading volume.
[7] Both Kolmogorov-Smirnov and Jarque-Bera tests reject the hypothesis of normality at a 1% level.

Excess returns are computed using a standard event study methodology. *Market adjusted* and *market and risk adjusted returns* are estimated in a window of 36 days [-5, +30] around the event. The estimation of beta is based on a five year (monthly returns) pre-event window. In order to avoid potential bias deriving from infrequent trading, I use an aggregated coefficients method proposed by Dimson (1979), using a two week lag and lead factor. Data on prices and volumes are obtained from *Datastream*; news is collected from the electronic version of "*Il sole 24 ore"* (main Italian financial newspaper).

3.1. Sample selection

To test the hypothesis of information content in abnormal volume, the initial sample consists of the entire population (320) of firms listed on the Milan Stock Exchange (Borsa Italiana) over the 1997-2003 period. The daily computation of NAV for the entire sample leads to close to 650,000 values. An extreme level of daily trading volume is called an event. A level of trading is said to be "extreme" if the daily trading volume is more than 2.33 standard deviations away from the mean.[8] This selection generates a sample of 10,104 events, approximately 36 events *per* day.[9]

Next, I select those observations with no large volume over the preceding 30 trading days. This criterion is needed to ensure that there are no multiple events in the same period for the same firm. In fact, in the case of an event, an increase in trading tends to occur for a number of consecutive days. In order to remove this problem and keep unique observations, I exclude repeated abnormal trading events from the sample that occur over the 30 preceding days. This reduces the final sample to 3,353 events, consisting of 303 securities with an average of 11.06 observations *per* firm. According to this figure, the events are well spread out over the sample, meaning that results cannot be considered firm-specific in any sense. Table 2 reports some descriptive statistics of the firms belonging to the sample with regards to financial, ownership and

[8] To guarantee robustness and remove the possible bias introduced by an arbitrary choice of the cut-off, a sensitivity analysis is carried out, replicating the sample creation using two different levels of *NAV:* 1.64 and 3.09, corresponding to 5% and 0.1% of the extreme values drawn from a (standard) normal distribution.
[9] The top 1% of the total observations should lead to roughly 4.500 events. Nonetheless, the NAV distribution, showing higher kurtosis, presents extreme events with a higher frequency than a normal distribution would predict.

governance characteristics. The typical presence of a majority shareholder is well reflected in the very high ownership stake of the ultimate shareholder along with the level of control. The mean (median) ownership of the ultimate shareholder is 41.61% (46.92%), while the percentage of voting rights is moderately higher (45.68% and 50.49% respectively in mean and median). The difference between the percentage of ownership and control is the result of a number of legal devices, such as pyramidal structures or nonvoting shares, which allow the majority shareholder to dilute the ownership stake without losing voting rights. The table also shows the same statistics for the subsample of firms where the ultimate shareholder is a family or the state. In both cases the three ownership characteristics do not dramatically differ from the whole sample. Family and state-owned firms tend to show a slightly higher level of both ownership and control and a lesser degree of separation between voting and cash-flow rights.

IV. Results

According to the main hypothesis of this study, abnormal and unexplained volume conveys information to the market. The evidence seems to confirm this, as the price response to high volume does not revert over the following days as a result of simple liquidity effects (i.e. price-pressure). In contrast, the findings show a price continuation the day after abnormal trading volume, allowing a potential herder to implement a portfolio strategy based on an observation of trading volume alone. Consistent with the hypotheses presented in the second section of this study, the information content is also related to some ownership characteristics, such as the level of control and family-firm status.

The results are organized as follows. In the first part, I examine the information content of abnormal trading volume with no regard to the presence of contemporaneous information disclosure. The second part focused only on the investigation of the price-news relation in a setting of extreme trading activity. The third part is dedicated to an understanding of the determinants (ownership and control, firm characteristics, trading

volume and news disclosure) of the market response to abnormal volume. Finally, in the last section a possible portfolio strategy is proposed and analyzed.

4.1 The relation between abnormal volume and excess returns

The first section investigates the relation between abnormal trading volume and excess returns, ignoring the presence of contemporaneous information disclosure. Table 3 presents abnormal returns (*AR*) and cumulative abnormal returns (*CAR*) for the whole sample using three different possible *NAV* cut-offs: 1.64, 2.33 and 3.09 corresponding to the 5, 1 and 0.1 percentiles of the theoretical distribution. Results do not significantly differ between the two methodologies used (*market* and *market and risk adjusted),* the statistical tests (parametric or non-parametric) or the NAV cut-offs. Firms earn positive and strongly excess abnormal returns in the three days around the event [-1, +1]. More extreme events (higher NAV) tend to show higher *AR*s and a higher degree of anticipation (relative to the event day). The mean of *AR*s on the event day ranges from 1.67% (NAV > 1.64) to 3.65% (NAV > 3.09). Given the impossibility of discriminating between positive and negative underlying information, this result suggests that a sudden change in volume more often embeds good news. There are a number of possible reasons helping to explain this phenomenon. First of all, stock exchanges and regulators often impose restrictions on short selling, making more difficult to exploit undisclosed negative information. The block of trading for insiders – also known as blackout period - is particularly common around the release of earning news. If so, the insider in possess of negative information could take advantage of his superior information set only if he had previously purchased the shares. Secondly, sales are a less clean signal than purchases, as they are mainly driven by liquidity purposes. As a matter of fact, if purchases suggest that investors believe the shares being unevaluated, the signal inferable from sales is instead diluted by an undistinguishable number of liquidity traders. Finally, consistent with the hypothesis presented in this study, if most of the informative trading is driven by insiders in possession of undisclosed information, it is more likely that they are willing to exploit positive information rather than

speculate on negative events affecting their company. This is unlikely to be the case if insider interests are not aligned with those of shareholders. However, in Italy, directors and top management are typically appointed by the majority shareholder and often they are member of the controlling family. In the event of negative news, it is likely that insiders would prefer to hide or at least lessen the outcry deriving from it. Trading on private and negative information would instead increase the chance to send a signal to the market and harm the controlling shareholder's reputation in the event that these speculative trades become public.

Table 3 also shows how excess returns are not constrained to the event day, but persist on the following day. This finding is consistent with Pritamani et al (2001). Analyzing excess returns around large price changes, they find a significant persistency of returns the day after the event and no price-reversal over the following month. However, very different is the magnitude of documented returns. In this study, the market rises by 1.02% the day following large trading activity in contrast to 0.25% (-0.29%) documented in Pritamani et al (2001) for a sample of positive (negative) large changes in price. This seems to suggest that abnormal trading volume is a more relevant signal to detect forthcoming information than price changes.

The last important insight derives from the analysis of *CAR [0, 30]*. The simplest explanation for the excess returns found around the event period could be liquidity. If a stock experiences days with abnormal trading activity, its price will likely diverge from its current level, moving up or down depending on which side of the market generates the trades. However, the lack of price reversal over the subsequent 30 days excludes the possibility that such returns are due to some kind of price-pressure caused by large trading volume. This is an important confirmation that abnormal trading volume contains information not yet reflected in prices. The analysis of the pre-event period does not reveal any particular insight. CAR (-5,-1) is statistically significant, but this result is almost fully driven by the AR (-1).

4.2 The effect of news disclosure

Previous analyses investigate the relationship between abnormal trading and excess return predictability, but the examination is performed with no regard to the possible presence of news disclosure. To reflect the impact of new information, I split the sample by the presence of contemporaneous news events. The aim is twofold: evaluating the informative role of extreme trading when no contemporaneous announcements are observed and providing a small contribution to the existing debate on the market reaction to public news. This section analyzes the second aspect - the return-volume relationship when news is contemporaneously disclosed; the next section investigates the informative role of apparently unjustified abnormal trading.

In order to check for the possible presence of contemporaneous news, I searched for any firm-specific news published in Italian newspapers (collected from the database Lexis-Nexis) and examined the abnormal trading volume and price changes within a four-day period (-1,+2) around the event. The data collection ultimately resulted in 564 abnormal trading volume events[10]. Each announcement was examined and manually classified in terms of the signal conveyed (good, bad or neutral), precision of the announcement (news or rumour), timing of disclosure (with respect to the event day) and information content. [11] This classification necessarily involves some degree of subjectiveness, particularly for the attribution of good/bad news and the distinction between news and rumours, since it has been developed using a personal – and not univocal - judgement. However, in order to minimize the risk of false attributions, I made a large use of the category "neutral" whenever the announcement was not detailed, was previously released, was involving negligible amount of money, or when the information set was not enough to infer the expected price impact of the news story.[12] The category, "rumours", includes any article where the information (often reported in response to the unusual behaviour of trading volume or returns) was presented as the author's supposition or

10 Approximately, 17% of the whole sample.

[11] Using the same classification proposed by Pritamani and Singal (2001). The seven types of announcement are the following: (1) Actual earnings by management; (2) Forecast of earnings by management; (3) Analyst recommendations by security analysts and information regarding credit ratings by rating agencies; (4) Capital structure related information (dividends, stock repurchases, stock/debt issues and preferred stock/debt redemption); (5) Restructuring related information (mergers, acquisitions, asset sales, hiring and firing of top management); (6) General business related information (sales, product related information, business contracts and joint ventures); (7) Miscellaneous information (legal and legislative announcements, labor disputes).

[12] For instance, the announcement was reporting the earnings but there was no information about what previously declared or what the market expectation was.

the market expectation rather than an official firm announcement. Table 4 shows some news distribution statistics. Announcements embedding positive information (191) are roughly three times as much as the bad news (67), but the larger number of announcement falls into the category of "neutral".[13] Most of the articles report clear announcements rather than market rumours and are usually published within two days of the abnormal trading volume event [0,+1]. Nevertheless, 83 events are associated with announcements published two days after the first detection of abnormal trading, showing that extreme trading activity can in fact anticipate information disclosure. With respect to the content of announcements, large volume is more commonly associated with restructuring (164) and general business (107) announcements, whereas a few cases of forecast of earnings (24) or analyst recommendations (25) are encountered.

In spite of the relatively small sample, this investigation represents an experimental test due to the contemporaneous presence of news disclosure and abnormal trading volume. In the literature, the analysis of the market reaction to public news has already taken into account the role of trading volume, but attention has focused on the distinction between news with high and low volume. I believe such an approach does not fully address the potential informative role of volume, as it distinguishes only between high and low volume stocks. Instead, it is crucial is to understand the effect of high trading volume relative to standard activity. An examination of the market reaction to news in a setting with large trading is particularly valuable as the existence of high volume enhances the precision of the related signal[14] and gives more strength to the empirical findings.

Many event studies show an under-reaction to news demonstrated by significant post-event abnormal returns: Ball and Brown (1968) and Bernard and Thomas (1990) for earning announcements; Ikenberry et al. (1995; 1996) for, respectively, open-market share repurchases and stock splits; Loughran and Ritter (1995) for SEOs; Cusatis et al. (1993) for divestitures; Michaely et al. (1995) for initiating (omitting) dividends. A contrary result is found in Barber et al. (1993) who analyze post-event price behaviour after public disclosure

[13] Evidence of the robustness of classification criteria used.

[14] Several theoretical information-based models [Harris and Raviv (1993); Kim and Verrecchia (1994)] show how trading volume can capture the signal accuracy.

of analysts' stock recommendations, finding a price reversal effect within 25 trading days. Pritamani et al. (2001) document price continuation for earnings' announcements (actual and forecasted) and analyst recommendations, but no evidence of under-reaction to news containing other type of information. Chan (2003) and Hong et al. (2000) prove a stronger under-reaction effect for bad news.

The sample partitioning among the types of announcement allow us to understand better the nature of market reaction around the event. All the sub-samples, with the exception of announcements of earnings forecasts, show a statistically significant positive market reaction on the event day and the following day. The disproportion between good and bad news found in the sample helps to explain the sign of excess returns and validate the initial assumption that large volume contains, on average, positive information content. The analysis of post-event behaviour is likewise informative. Evidence of price continuation (or under reaction) is found only for analyst recommendations (differently from Barber et al. (1993)) and general business related information.

A possible confirmation of the thesis that "bad news travels slowly" (underreaction to bad news) arises from the distinction between good and bad information. The sample of good news earns excess returns mainly on the event day (+3.99%). In fact, the analysis of 10 and 30 day CARs shows a moderate degree of price continuation (+4.50% and +4.56%). The price behaviour in the sample of bad news is different. In spite of an important negative market reaction on the event day (-4.53%), Table 4 exhibits unambiguous evidence of excess returns persistency over the following month: CAR (0, 10) and CAR (0, 30) are respectively equal to -6.87% and -8.27%.

Table 4 also shows the different market reaction between news and rumours. Besides the apparent problem of selection bias in the rumours sample, that justifies the higher excess returns, the most interesting insight is its lower statistical significance. This result is consistent with the hypothesis that volumes enhances the precision of the information conveyed. The lower accuracy of rumours leads to a wider variability of returns and a lower significance of the t-test.

The last comment relates to the timing of the information release. Consistent with the *information content of volume* hypothesis, the market reaction largely occurs simultaneously with large volume (event day), even when the announcements are made public one or two days after the large trading initiation.

4.3 Multivariate analysis

Previous results show the positive relation between abnormal trading volume and excess returns along with some evidence of price continuation. This effect, although limited to the day after the event, is notably stronger than that documented in previous research - a puzzling result since it apparently violates the Efficient Markets Hypothesis (EMH). If new information filters slowly into the market, any uninformed investor can infer the signal by observing abnormal trading activity and implement profitable trading strategies. Whether the magnitude of excess returns is tradable will be the object of investigation in this and the next section, which aims to understand the major determinants of the information conveyed by abnormal trading.

Such investigation would crucially benefit from knowledge of the signal transmitted by each event. However, the exclusive observation of trading volume cannot distinguish between good or bad underlying private information. To reduce the offsetting bias produced when positive and negative information is pooled, I use excess returns on the event day to proxy the signal embedded with high trading volume. In other words, I assume that positive (negative) excess returns are likely to signal good (bad) undisclosed news. It is possible that excess returns may arise simply as the effect of noise. In order to control for this and make the results more robust, regressions are repeated for two restricted subsamples filtered by 1% and 3% day zero excess returns.

Table 5 shows the effect on the event day excess returns of a number of variables grouped by: ownership and control, firm characteristics, trading volume and news disclosure. Relative to the first group, the control seems the only variable with an extensive influence, while the family dummy is statistically

significant only in the sample of negative information. The former confirms the initial hypothesis of a positive association between control and the information content of excess trading. In fact, Table 5 shows how high levels of control lead to more positive (negative) excess returns in the sample of positive (negative) information. According to the first hypothesis, a higher control share implies lower monitoring by other relevant shareholders, making it easier for the insider to trade when in possession of important undisclosed information. A confirmation of the third hypothesis is also found in the sample of negative information, as family-controlled firms are associated with a more severe negative price drop. The larger number of insiders (family member related) enhances the private information dissemination and the informative role of trading volume. Quite surprisingly, and in contrast to the second hypothesis, the ownership-control separation variable has no effect on the magnitude of event day excess returns. The separation between voting and cash-flow rights causes expropriation and tunnelling of resources. In this study, I also argue that it may produce the exploitation of private information. However, some valid arguments can either support a positive or a negative relation as a higher separation incentivises information exploitation but also the use of alternative and more effective expropriation techniques. Probably due to the mixing effect, the results do not corroborate any of the two conflicting hypotheses.

In terms of firm characteristics, higher event day excess returns are positively associated with market-to-book and negatively with size, liquidity and dividends. The market-to-book ratio is generally identified as a proxy for firms' growth opportunities. Hence, the positive regression coefficient signals that stronger expected growth leads to larger excess returns. This result is perfectly explainable if we interpret the phenomenon in terms of the potential relevance of undisclosed information. Firms with higher growth opportunities normally show a stronger market reaction at news announcements, as the potential for value creation is greater. If the information content of trading volume is determined by informed trades, the larger excess returns are necessarily associated with younger and growing firms. Besides, as trading in anticipation to public news will more likely take place when the expected profit is larger, high market-to-book firms will

exhibit more informative trading volume. The relation to firm size is consistent with the main hypothesis of this study, as smaller firms are more seriously affected by information asymmetry problems. For those firms, the proportion of trades initiated by informed traders is larger and the information content of abnormal trading volume is presumably higher. Liquidity is another important feature, as for less traded stocks the transactions initiated by informed investors are likely to produce a stronger price-impact. Lastly, the negative relation to dividend yield is mainly due to an industry-effect. In fact, higher dividend yields are usually associated with regulated industries (such as utilities), for which the degree of information asymmetry is generally lower.

Trading volume is obviously a critical variable in explaining the magnitude of excess returns. According to the main hypothesis of this study, extreme levels of trading activity convey information, producing significant price changes. The positive relation between abnormal trading volume and excess returns is the resulting outcome of this phenomenon, probably corroborated by a liquidity effect. Above and beyond this relation, I also take into account the role of the volume-persistency. This effect is captured by the change in abnormal trading volume in the window [0,1]. If private information slowly filters across insiders, positive serial correlation, either for abnormal volumes and/or excess returns, is expected (price and volume continuation). In other words, in the event of volume persistence (corroborated by price continuation), a higher change in abnormal trading volume should be associated with lower excess returns on the event day (as prices do not fully reflect the fundamental value), which means a negative (positive) coefficient for the positive-information (negative-information) sample. The statistical significance is limited to the negative-information sample, whose negative coefficient contradicts the hypothesis of the informative role of volume-continuation.

To conclude, the regression models are controlled for information disclosure around the event. Given the hypothesis of this investigation, this aspect becomes critical. Two dummies are considered as a proxy of information disclosure: *headlines* and *news*. The former detects the existence of any article published in the

main Italian financial newspaper (*Il Sole 24 Ore*) in a narrow window around the event[15] citing the company's name either in the headline or inside the text; the latter refers only to those articles which contain relevant and previously undisclosed information. Although the observations accompanied by information disclosure exhibit a stronger market reaction, large excess returns still persist when no public information is contemporaneously released.

4.4 A possible portfolio strategy

To some extent, assessing the profitability of volume-based portfolios represents a test of a semi-strong form of market efficiency. If abnormal trading volume is a reliable signal for informed trades, prices should adjust in an efficient market to their full informative value at the time the anomaly becomes apparent, so avoiding tradable and profitable opportunities for mimickers. Previous findings show that abnormal trading volume generally anticipates future excess returns, although this pattern is mainly bounded on the first day after the high trading activity. Nevertheless, a portfolio strategy based on the observation of extreme trading can still be profitable in apparent violation of the EMH.

Any uninformed investor willing to undertake a volume-based portfolio strategy can observe a stock experiencing abnormal volume[16], but he will be able to detect the volume anomaly only at the market closing. Hence, I assume that he initiates the trade (at opening price) only at the beginning of the following day. However, observing only abnormal trading volume cannot help the uninformed investor to discover whether abnormal trading activity is driven by positive or negative undisclosed information, but the same investor can infer that by looking at price changes. Following these considerations, a portfolio strategy can be based on the observation of abnormal trading volume to detect the opportune timing of the trades and excess returns to choose the trade direction (buy or sell).

[15] Two window periods: [-1,+2] and [0,+1].

[16] This strategy is based on the assumption that volume data is continuously known by the market. The Italian Stock Exchange releases directly, and indirectly through a number of financial information providers, real time data on trading volume for each listed company for an inexpensive subscription. 20 minutes trading volume data is offered with no charge in the Italian Stock Exchange and many other financial web sites.

Given that excess returns, on average, tend to persist for one day after the event, I assume that the uninformed investor prefers closing his position within the same day, that is, selling (buying) at the last ask (bid) price. Taking into consideration the bid-ask spread involved in a round-trip transaction allows us to assess the real profitability of such a volume-based strategy. Notwithstanding, for the sake of comparability, I also estimate the theoretical profit earned by the same uninformed investor who initiates the trade at the end of the event date, buying and selling at closing prices. Such a strategy does not reflect the loss coming from the bid-ask spread embedded in the round-trip trade and requires the investor to trade at the end of the event date, when the abnormal volume is not necessarily known. [17] The resulting profit represents the theoretical gain obtainable in the absence of market frictions. In terms of market efficiency expectations, this theoretical profit should disappear after transaction costs.

The different portfolio strategies are analysed throughout the whole sample period (1997-2003) and for all observations. In order to ensure the reliability of the findings, some standard filters are used to check for the correctness of the bid-ask spread data. Specifically, in order to be included in the sample, the following conditions need to be met (in parenthesis the number of excluded observations): bid-ask price data availability (168), ask price higher than bid price (149), ask price not larger than 1.9 times the bid price (2). After the exclusion of these observations, the final sample consists of 3040 events (6080 transactions).

In terms of composition rules, I consider equally-weighted portfolios. Hence, whenever a stock is added, the entire portfolio is rebalanced among the securities. If no stock experiences abnormal trading volume, the portfolio is eventually emptied. The portfolio return is compared to a market index replicating portfolio (*buy and hold* strategy). Table 6 shows the results obtained by the several strategies adopted, reporting both implementable and theoretical returns. The former (indicated as "feasible strategy") accounts for round-trip transaction costs (bid-ask) and initiates the trading the day next to the event; the latter (labelled as

[17] The uninformed investor can observe trading volume and estimate abnormal volumes in real time. However, before the last trade, he is able to detect abnormal trading only if the NAV is already above the threshold. In other words, the investor can pursue this strategy only if the last trade's volume is not needed to pass the abnormal volume cut-off.

"theoretical strategy") – reported as theoretical benchmark and not implementable - assumes to begin trading at the end of the event days and it does not reflect any transaction costs.

The first portfolio is based, regardless of the information deriving from the observation of price changes, on a pure long strategy with one day holding period. This strategy leads to more than six thousand transactions over the seven years period. The daily return is negative (-0.24%) and statistically significant at 5% level. Table 6 also shows that comparing theoretical portfolio returns earns a strongly significant positive return (0.96% market adjusted), meaning that the different trading timing and, more importantly, the transaction costs are able to make the gains vanish. While the choice of the one day holding period is consistent with prior findings, as the persistence of excess returns is essentially concentrated on the day after abnormal trading, the restriction of a long portfolio is necessarily inefficient since the information of the price change on the event day is not used. The uninformed investor can in fact exploit the sign of the excess returns to discriminate between positive or negative underlying information and the magnitude to infer any information relevance. According to this intuition, the next three portfolios (2 to 4) use the information embedded in the event date's price changes, setting long (short) portfolios for observations with positive (negative) excess returns. The three portfolios use different excess returns thresholds (1%, 3% and 5%) in order to evaluate the magnitude effect. In terms of expected portfolio profitability, two counter-arguments could be discussed. A stronger market movement is generally a consequence of more important information reflecting in prices, suggesting the prospect to earn higher trading profits. However, stronger price changes on the event date makes it more likely that information is fully incorporated into prices, leaving negligible trading profits on the following day. Table 6 shows that the first hypothesis seems verified. Trading initiated at the end of the event date leads to positive and strongly significant returns (gross of transaction costs) for long strategies and the profit magnitude increases as the event date price change is more pronounced. Short strategies appear profitable only for high excess return thresholds, confirming the importance of the price change in predicting the next day return. In terms of real profitability, transaction costs are able to make

disappear most of the theoretical gains. Short strategies lead to significant losses, but long strategies are still profitable mainly when the information coming from the price change is used. The portfolio market adjusted daily return is 0.32% and 0.39% for 3% and 5% thresholds respectively, both statistically significant.

The last set of portfolios (5 and 6) is based on a different holding period for the short strategy. In fact, previous analyses evidence a longer price persistency for the sample with negative excess returns, consistent with the literature according to which bad news tend to travel slow. Following this idea, setting a longer holding period might lead to higher portfolio profitability. Results contradict this supposition, as such a strategy leads to weaker portfolio returns, which becomes strongly negative when transaction costs are taken into consideration.

V. Conclusion

This paper examines the informative role of abnormal trading volume on the Italian stock market. If information is not perfectly inculcated in the market, but rather held by more informed traders, the observation of trading volume may enhance the information set. The hypothesis is that large changes in trading volume (not accompanied by news disclosure) incorporate non-public information and signal future excess returns. This phenomenon could much more important in a country with low investor protection and poor law enforcement, as insiders can expropriate minority shareholders using their information advantage.

The hypothesis is consistent with most of the findings. In a three-day window around abnormal trading I find excess returns that are not driven by price-pressure, as they do not revert over the following days. In contrast, there is evidence of price-persistence after large trading activity, which may suggest a slow filtering of information into prices and the possibility of a profitable portfolio strategy.

Interestingly, excess returns are influenced by news disclosure, but the market reaction for the uninformative sample (observations with no contemporaneous news) is almost as high as the opposite sample. As hypothesized, the information content is also related to some ownership characteristics: higher

control shares (lower monitoring over the majority shareholders) and family-firm status (larger number of insiders and higher probability of private information-based trades) contribute positively to the magnitude of the excess returns. More information content is found for smaller companies where the agency problems are stronger between majority and minority shareholders (stock market), and for firms with higher market-to-book ratios, where undisclosed information is likely to be more price-sensitive.

Finally, some portfolios based on volume signal are analyzed. To exploit the excess return persistence after large trading, tested portfolios include any stock experiencing extreme trading volume. As the trading signal is known only at the end of the day, the uninformed trader is assumed to trade the day after the event, selling (buying) at the open price and buying (selling) at the last ask (bid) price. For the sake of comparability, portfolio returns is evaluated relative to the theoretical profit earned by the same uninformed investor who initiates to trade at the end of the event date and not incurring any transaction cost from the round-trip trade. Different tested portfolios indicate that the theoretical volume-based profits are important and statistically significant, particularly for long strategies. However, after taking into consideration transaction costs and the different trade timing, profits tend to vanish with the exception of long portfolios that include only stocks experiencing strong price changes on the event date.

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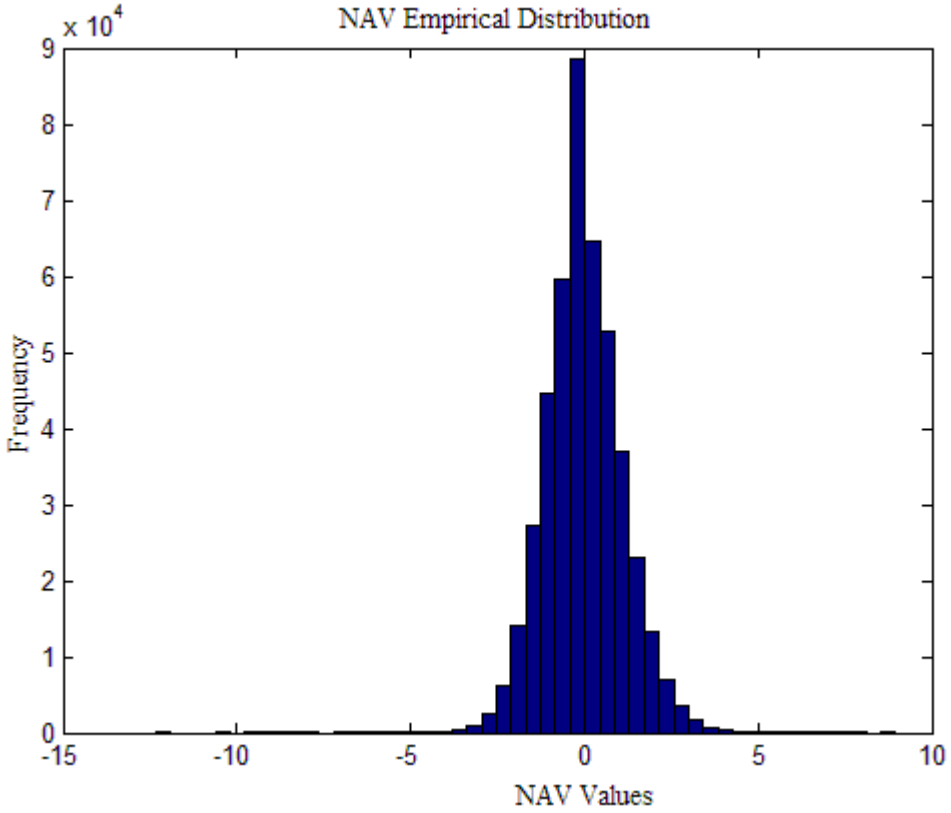
Table 1. **NAV descriptive statistics.**

The NAV (Normalized Abnormal Volume) detects unusual trading activity and it is computed as:

$$NAV_{i,t} = \frac{TV_{i,t} - \mu_{i,t}}{\sigma_{i,t}} \quad \text{where} \quad \mu_{i,t} = \frac{1}{66}\sum_{t=1}^{66} TV_{i,t} \quad \text{and} \quad \sigma_{i,t} = \sqrt{\frac{1}{65}\sum_{t=1}^{66}\left(TV_{i,t} - \mu_{i,t}^{TV}\right)^2}$$

$TV_{i,t}$ is the trading volume for stock *i* on day *t*; μ and σ are the mean and the standard deviation of trading volume (for stock *i* on day *t*) in a 66 preceding days window. In the event that a zero-trading day is found, the estimation window goes backwards to have 66 days with positive trading. The NAV is computed for the whole sample (303 firms) and for the entire period considered (1997-2003), obtaining nearly 450.000 observations. The distribution of NAV and some descriptive statistics are reported here. This distribution appears slightly right skewed and shows fatter tails. Both Kolmogorov-Smirnov and Jarque-Bera tests reject the hypothesis of normality at 1% level.



Percentiles	**0.1**	**1**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**95**	**99**	**99.9**
NAV	-3.78	-2.52	-1.73	-1.34	-0.88	-0.55	-0.25	0.00	0.18	0.48	0.85	1.38	1.84	2.79	4.04

Observations	665,600	Mean	-0.005
Days of zero trading	216,723	Median	0
		Standard Deviation	1.0888
NAV Values	448,877	Skewness	0.1563
Events (NAV > 2.33)	10,104	Kurtosis	3.9530

Table 2 – Firms' descriptive statistics

Financial, ownership and governance characteristics for the 304 firms belonging to the sample. Descriptive statistics for industrial and financial firms' financial characteristics are reported in Panels A and B. Panel C reports ownership and governance characteristics referred to the year of the first inclusion in the sample. Ownership and Control respectively measures the percentage of cash flows and votes pertaining to the ultimate shareholder.

Panel A. Financial characteristics for industrial firms (242)

	Mean	Median	Min	Max
Market capitalization (mln €)	1351	152	5	41436
Total assets (mln €)	2177	249	9	62114
Market to book	2.42	1.55	0.00	31.83
Return on Equity (%)	6.13	6.89	-22.55	23.88
Debt/Asset at market value (%)	31.83	26.72	0.00	0.81
EBIT/Total Asset (%)	4.38	5.75	-86.75	38.29
EBITDA/Total Asset (%)	9.02	10.51	-74.59	50.53

Panel B. Financial characteristics for financial firms (62)

	Mean	Median	Min	Max
Market capitalization (mln €)	2269	788	7	19787
Total assets (mln €)	10100	2252	7	71193
Market to book	1.77	1.28	0.00	6.36
Return on Equity (%)	6.29	6.72	-22.32	19.92
Debt/Asset at market value (%)	52.77	76.63	0.00	0.99
EBIT/Total Asset (%)	0.29	1.48	-28.51	4.12
EBITDA/Total Asset (%)	0.33	1.24	-28.44	4.72

Panel C. Ownership and governance characteristics

	Mean	Median	Min	Max
Ownership by ultimate shareholder (%)	41.61	46.92	0.00	91.10
Control by ultimate shareholder (%)	45.68	50.49	0.00	91.10
Ownership/Control	0.85	1.00	0.00	1.00
Family Firms (138)				
Ownership by ultimate shareholder (%)	42.87	48.53	0.32	88.02
Control by ultimate shareholder (%)	48.02	50.13	4.11	88.02
Ownership/Control	0.86	1.00	0.01	1.00
Firms State-owned (19)				
Ownership by ultimate shareholder (%)	43.55	51.00	3.94	74.58
Control by ultimate shareholder (%)	47.51	51.00	9.45	74.58
Ownership/Control	0.87	1.00	0.42	1.00

Table 3. **Abnormal volumes and excess returns.**

The table analyzes the relation between extreme trading activity and excess returns. The abnormal trading is detected using the normalized abnormal volume index (NAV). In order to assure higher robustness of results, different NAV's cut-offs are considered: 1.64, 2.33, 3.09 corresponding to 5%, 1% and 0.1% of the cumulative probabilities (on the right tail) embedded in a standard normal distribution. Abnormal returns and cumulative abnormal returns are reported respectively for a [-5,+5] and [-5,30] window period. Excess returns are computed both with a market adjusted and with a market and risk adjusted methodology. The statistical significance is evaluated using parametric (T-test) and non-parametric (Sign test) tests. a, b, c indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively.

NAV > 1.64 (6429 Observations)						
	MARKET ADJUSTED			**MARKET AND RISK ADJUSTED**		
Day	**AAR**	**T Test**	**Sign Test**	**AAR**	**T Test**	**Sign Test**
-5	-0.05%	-(2.24)	-(3.31) [a]	0.01%	(0.56)	-(1.95) [b]
-4	-0.11%	-(4.56) [a]	-(2.83) [a]	-0.01%	-(0.38)	-(0.53)
-3	-0.08%	-(3.56) [a]	-(2.73) [a]	0.05%	(1.90) [b]	(0.04)
-2	0.01%	(0.61)	(0.91)	0.09%	(3.62) [a]	(1.29) [a]
-1	0.38%	(15.92) [a]	(9.27) [a]	0.47%	(18.45) [a]	(10.42) [a]
0	1.67%	(69.99) [a]	(29.05) [a]	1.78%	(70.08) [a]	(26.20) [a]
1	0.78%	(32.82) [a]	(16.30) [a]	0.78%	(30.48) [a]	(12.99) [a]
2	-0.04%	-(1.50)	-(4.20) [a]	-0.03%	-(1.31)	-(5.62) [a]
3	-0.08%	-(3.45) [a]	-(3.06) [a]	-0.10%	-(4.00) [a]	-(5.22) [a]
4	-0.01%	-(0.47)	-(1.38)	0.01%	(0.36)	-(1.29)
5	0.05%	(2.16) [a]	-(0.76)	0.11%	(4.22) [a]	-(1.40)
Window	**CAR**	**T Test**	**Sign Test**	**CAR**	**T Test**	**Sign Test**
[-5,-1]	0.15%	(2.76) [a]	-(0.59)	0.61%	(11.55) [a]	(7.53) [a]
[0,5]	2.37%	(40.64) [a]	(19.67) [a]	2.54%	(43.58) [a]	(20.24) [a]
[0,10]	2.37%	(30.07) [a]	(16.18) [a]	3.66%	(30.82) [a]	(17.64) [a]
[0,30]	2.27%	(17.16) [a]	(9.57) [a]	3.82%	(19.17) [a]	(12.47) [a]

NAV > 2.33 (3353 Observations)						
	MARKET ADJUSTED			**MARKET AND RISK ADJUSTED**		
Day	**AAR**	**T Test**	**Sign Test**	**AAR**	**T Test**	**Sign Test**
-5	0.00%	-(0.74)	-(0.27)	0.04%	(1.25)	-(0.21)
-4	-0.03%	-(1.64)	-(0.03)	0.00%	-(0.12)	-(0.47)
-3	-0.02%	-(1.00)	-(0.20)	0.09%	(2.42) [a]	(0.51)
-2	0.17%	(4.16) [a]	(4.94) [a]	0.29%	(8.22) [a]	(3.74) [a]
-1	0.88%	(22.13) [a]	(15.00) [a]	1.12%	(31.29) [a]	(13.00) [a]
0	2.48%	(66.52) [a]	(27.85) [a]	2.71%	(75.53) [a]	(22.73) [a]
1	1.02%	(28.18) [a]	(14.41) [a]	1.14%	(31.90) [a]	(10.83) [a]
2	-0.20%	-(5.53) [a]	-(4.21) [a]	-0.34%	-(9.48) [a]	-(7.86) [a]
3	-0.11%	-(3.29) [a]	-(2.90) [a]	-0.11%	-(3.21) [a]	-(4.72) [a]
4	0.01%	-(0.58)	(1.07)	0.03%	(0.88)	-(1.44)
5	0.04%	(0.98)	(0.07)	0.03%	(0.74)	-(2.17) [a]
Window	**CAR**	**T Test**	**Sign Test**	**CAR**	**T Test**	**Sign Test**
[-5,-1]	1.00%	(15.56) [a]	(4.61) [a]	1.54%	(19.26) [a]	(9.79) [a]
[0,5]	3.23%	(42.54) [a]	(19.75) [a]	3.45%	(39.34) [a]	(20.19) [a]
[0,10]	3.42%	(31.00) [a]	(17.35) [a]	3.66%	(30.82) [a]	(17.62) [a]
[0,30]	3.22%	(17.37) [a]	(9.77) [a]	3.82%	(19.17) [a]	(12.32) [a]

NAV > 3.09 (881 Observations)						
	MARKET ADJUSTED			**MARKET AND RISK ADJUSTED**		
Day	**AAR**	**T Test**	**Sign Test**	**AAR**	**T Test**	**Sign Test**
-5	-0.01%	-(0.20)	(0.10)	-0.01%	-(0.12)	-(0.90)
-4	-0.09%	-(1.46)	-(1.52)	0.00%	-(0.06)	-(0.51)
-3	0.21%	(3.31) [a]	(0.17)	0.29%	(4.37) [a]	(2.23) [a]
-2	0.53%	(8.56) [a]	(2.32) [a]	0.60%	(9.16) [a]	(2.62) [a]
-1	1.74%	(27.97) [a]	(9.06) [a]	1.86%	(28.34) [a]	(8.34) [a]
0	3.65%	(58.71) [a]	(14.18) [a]	3.49%	(53.35) [a]	(12.88) [a]
1	1.08%	(17.39) [a]	(5.83) [a]	1.08%	(16.55) [a]	(4.66) [a]
2	-0.61%	-(9.88) [a]	-(5.09) [a]	-0.66%	-(10.11) [a]	-(4.66) [a]
3	-0.35%	-(5.68) [a]	-(3.74) [a]	-0.34%	-(5.22) [a]	-(4.11) [a]
4	0.04%	(0.67)	-(0.57)	0.07%	(1.02)	-(1.29)
5	-0.16%	-(2.54) [a]	-(0.77)	-0.10%	-(1.46)	-(1.06)
Window	**CAR**	**T Test**	**Sign Test**	**CAR**	**T Test**	**Sign Test**
[-5,-1]	2.37%	(15.56) [a]	(6.57) [a]	2.73%	(18.65) [a]	(7.08) [a]
[0,5]	3.65%	(42.54) [a]	(9.20) [a]	3.54%	(22.10) [a]	(9.74) [a]
[0,10]	3.42%	(31.00) [a]	(8.19) [a]	3.29%	(15.14) [a]	(8.41) [a]
[0,30]	2.09%	(17.37) [a]	(1.65) [c]	2.44%	(6.69) [a]	(4.11) [a]

Table 4. The effect of news disclosure

The table exhibits the analysis of CARs for the subsample with correlated news (564 observations). Using the same classification proposed by Pritamani and Singal (2001), the announcements are categorized as follows: (1) Actual earnings by management; (2) Forecast of earnings by management; (3) Analyst recommendations by security analysts and information regarding credit ratings by rating agencies; (4) Capital structure related information; (5) Restructuring related information; (6) General business related information (sales, product related information, business contracts and joint ventures); (7) Miscellaneous information (legal and legislative announcements, labor disputes).All the events are grouped according to the following criteria: the signal involved (good, bad or neutral); the precision of the information (news or rumours) and the timing of the disclosure (from day 0 to day 2). The information for day -1 is not reported because of the low number of events involved. News is obtained from the main Italian financial newspaper (Il Sole 24 Ore). In parenthesis the T statistic is shown only for the sub-samples with a minimum of 20 observations to guarantee the statistical significance of the results. a, b,c indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively.

				SIGNAL			PRECISION		TIMING		
OBS	**TYPE**	**ALL**	**GOOD**	**BAD**	**NEUTRAL**		**NEWS**	**RUMOR**	**DAY 0**	**DAY 1**	**DAY 2**
	Actual Earnings	113	72	22	19		108	5	51	44	18
	Forecast of Earnings	24	18	4	2		23	1	14	4	4
	Analyst recommend.	25	18	6	1		19	6	7	16	2
	Capital Structure	79	25	4	50		73	6	44	28	7
	Restructuring	164	19	5	140		129	35	76	67	19
	General Business	107	27	10	70		97	10	42	41	22
	Miscellaneous	52	12	16	24		45	7	18	23	11
	TOTAL	**564**	**191**	**67**	**306**		**494**	**70**	**252**	**223**	**83**

CAR	**TYPE**	**ALL**		**GOOD**		**BAD**		**NEUTRAL**		**NEWS**		**RUMOR**		**DAY 0**		**DAY 1**		**DAY 2**	
[-5,-1]	Actual Earnings	0.60%	(1.23)	0.85%	(1.26)	0.14%	(0.15)	0.18%		0.42%	(0.84)	4.38%		0.00%	(0.00)	0.16%	(0.25)	2.48%	
	Forecast of Earnings	-2.05%	(-2.35) [b]	-1.15%		-3.87%		-6.53%		-2.11%	(-2.35) [b]	-0.72%		0.00%		-0.42%		-3.90%	
	Analyst recommend.	-2.11%	(-2.89) [a]	-1.70%		-3.12%		-3.51%		-2.73%		-0.14%		-3.07%		-1.95%		-0.05%	
	Capital Structure	1.37%	(2.88) [a]	1.82%	(2.24) [b]	-4.81%		1.64%	(2.66) [b]	1.56%	(3.14) [a]	-0.90%		1.63%	(2.50) [b]	0.65%	(0.81)	2.62%	
	Restructuring	0.97%	(2.94) [a]	1.27%		-5.35%		1.15%	(3.24) [a]	0.30%	(0.81)	3.43%	(4.65) [a]	0.45%	(0.96)	1.50%	(2.75) [a]	1.42%	
	General Business	0.74%	(1.95) [c]	0.16%	(0.21)	0.58%		0.99%	(2.10) [b]	0.50%	(1.26)	3.06%		0.23%	(0.37)	0.96%	(1.49)	1.17%	(1.52)
	Miscellaneous	0.59%	(1.00)	0.91%		-0.93%		1.44%	(1.80) [c]	0.80%	(1.30)	-0.78%		1.10%		-0.16%	(-0.16)	1.31%	
	TOTAL	0.61%	(3.32) [a]	0.50%	(1.46)	-1.29%	(-2.53) [b]	1.09%	(4.61) [a]	0.37%	(1.89) [c]	2.29%	(4.45) [a]	0.40%	(1.41)	0.58%	(2.01) [b]	1.38%	(3.20) [a]
[0]	**TYPE**	**ALL**		**GOOD**		**BAD**		**NEUTRAL**		**NEWS**		**RUMOR**		**DAY 0**		**DAY 1**		**DAY 2**	
	Actual Earnings	1.60%	(6.58) [a]	3.09%	(9.17) [a]	-2.76%	-(6.06) [a]	1.01%		1.67%	(6.68) [a]	0.06%		1.93%	(4.42) [a]	1.47%	(4.59) [a]	0.99%	
	Forecast of Earnings	0.72%	(1.64)	2.53%		-4.40%		-5.40%		1.16%	(2.60) [b]	-9.59%		1.64%		0.79%		-2.64%	
	Analyst recommend.	1.94%	(5.33) [a]	2.73%		-0.36%		1.58%		1.04%		4.81%		3.60%		1.29%		1.39%	
	Capital Structure	2.81%	(11.81) [a]	5.03%	(12.37) [a]	-7.36%		2.51%	(8.15) [a]	3.19%	(12.87) [a]	-1.81%		2.74%	(8.44) [a]	2.87%	(7.10) [a]	2.98%	
	Restructuring	3.43%	(20.85) [a]	6.42%		-6.71%		3.39%	(19.09) [a]	2.89%	(15.71) [a]	5.44%	(14.75) [a]	2.39%	(10.35) [a]	4.56%	(16.77) [a]	3.57%	
	General Business	2.81%	(14.80) [a]	4.53%	(12.30) [a]	-4.16%		3.15%	(13.33) [a]	2.51%	(12.61) [a]	5.72%		3.63%	(11.99) [a]	2.37%	(7.35) [a]	2.12%	(5.48) [a]
	Miscellaneous	0.22%	(0.75)	6.23%		-7.41%		2.30%	(5.76) [a]	-0.42%	-(1.35)	4.32%		-0.25%		-0.29%	-(0.59)	2.05%	
	TOTAL	2.38%	(26.10) [a]	3.99%	(23.43) [a]	-4.53%	(-17.77) [a]	2.89%	(24.45) [a]	2.14%	(21.91) [a]	4.09%	(15.95) [a]	2.37%	(16.64) [a]	2.53%	(17.64) [a]	2.02%	(9.38) [a]
[-1,1]	**TYPE**	**ALL**		**GOOD**		**BAD**		**NEUTRAL**		**NEWS**		**RUMOR**		**DAY 0**		**DAY 1**		**DAY 2**	
	Actual Earnings	3.24%	(13.32) [a]	5.98%	(17.74) [a]	-4.25%	-(9.33) [a]	1.56%		3.25%	(12.97) [a]	3.17%		3.21%	(7.34) [a]	3.62%	(11.29) [a]	2.43%	
	Forecast of Earnings	0.07%	(0.17)	3.45%		-8.00%		-14.13%		0.75%	(1.68)	-15.52%		1.71%		-0.92%		-6.26%	
	Analyst recommend.	3.74%	(10.24) [a]	6.10%		-3.11%		2.36%		2.11%		8.89%		8.10%		2.32%		-0.17%	
	Capital Structure	4.69%	(19.71) [a]	6.76%	(16.64) [a]	-8.49%		4.70%	(15.26) [a]	5.08%	(20.53) [a]	-0.16%		4.28%	(13.15) [a]	4.64%	(11.50) [a]	7.43%	
	Restructuring	5.66%	(34.39) [a]	9.96%		-13.53%		5.76%	(32.47) [a]	4.32%	(23.48) [a]	10.61%	(28.78) [a]	2.96%	(12.78) [a]	8.35%	(30.70) [a]	7.51%	
	General Business	4.77%	(25.09) [a]	6.16%	(16.74) [a]	-4.29%		5.52%	(23.40) [a]	4.23%	(21.23) [a]	9.97%		4.86%	(16.06) [a]	4.74%	(14.68) [a]	4.61%	(11.93) [a]
	Miscellaneous	1.18%	(4.00) [a]	10.03%		-8.29%		3.07%	(7.68) [a]	0.49%	(1.59)	5.60%		0.34%		1.08%	(2.19) [b]	2.75%	
	TOTAL	4.13%	(45.28) [a]	6.53%	(38.35) [a]	-6.29%	(-24.66) [a]	4.92%	(41.57) [a]	3.58%	(36.64) [a]	8.05%	(31.34) [a]	3.44%	(24.16) [a]	4.94%	(34.38) [a]	4.15%	(19.26) [a]
CAR	**TYPE**	**ALL**		**GOOD**		**BAD**		**NEUTRAL**		**NEWS**		**RUMOR**		**DAY 0**		**DAY 1**		**DAY 2**	
[0,10]	Actual Earnings	1.41%	(1.83) [c]	4.29%	(4.02) [a]	-8.41%	-(5.83) [a]	1.85%		1.31%	(1.65)	3.57%		2.79%	(2.02) [b]	1.66%	(1.63)	-3.11%	
	Forecast of Earnings	-0.52%	-(0.38)	2.03%		-7.19%		-10.07%		0.09%	(0.07)	-14.60%		-0.17%		3.21%		-8.78%	
	Analyst recommend.	6.39%	(5.53) [a]	9.17%		0.23%		-6.85%		5.56%		8.99%		10.06%		5.72%		-1.19%	
	Capital Structure	2.76%	(3.67) [a]	3.61%	(2.81) [a]	-9.56%		3.32%	(3.41) [a]	3.06%	(3.90) [a]	-0.83%		1.02%	(0.99)	4.60%	(3.60) [a]	6.40%	
	Restructuring	3.87%	(7.44) [a]	4.13%		-13.38%		4.45%	(7.93) [a]	3.22%	(5.54) [a]	6.27%	(5.38) [a]	1.70%	(2.32) [b]	5.46%	(6.35) [a]	8.43%	
	General Business	4.20%	(6.99) [a]	2.95%	(2.53) [b]	3.38%		4.80%	(6.43) [a]	3.83%	(6.08) [a]	7.79%		1.92%	(2.01) [c]	5.45%	(5.34) [a]	6.47%	(5.29) [a]
	Miscellaneous	-1.09%	-(1.17)	8.40%		-11.05%		0.81%	(0.64)	-1.12%	-(1.15)	-0.88%		-0.39%		-3.72%	-(2.37) [b]	3.26%	
	TOTAL	2.75%	(9.53) [a]	4.50%	(8.36) [a]	-6.87%	-(8.52) [a]	3.77%	(10.07) [a]	2.45%	(7.92) [a]	4.91%	(6.04) [a]	1.81%	(4.03) [a]	3.63%	(8.00) [a]	3.49%	(5.12) [a]
CAR	**TYPE**	**ALL**		**GOOD**		**BAD**		**NEUTRAL**		**NEWS**		**RUMOR**		**DAY 0**		**DAY 1**		**DAY 2**	
[0,30]	Actual Earnings	1.07%	(0.80)	4.51%	(2.44) [b]	-7.78%	-(3.11) [a]	-1.72%		1.09%	(0.79)	0.72%		4.03%	(1.68) [c]	1.30%	(0.74)	-7.87%	
	Forecast of Earnings	-1.42%	-(0.59)	1.20%		-9.35%		-9.07%		-1.21%	-(0.49)	-6.25%		-3.46%		7.50%		-6.93%	
	Analyst recommend.	4.71%	(2.36) [b]	7.42%		-0.73%		-11.43%		4.13%		6.57%		12.36%		1.39%		4.48%	
	Capital Structure	3.52%	(2.70) [a]	5.07%	(2.28) [b]	5.78%		2.56%	(1.52)	3.31%	(2.44) [b]	5.99%		2.25%	(1.26)	4.89%	(2.21) [b]	5.97%	
	Restructuring	2.15%	(2.39) [b]	4.21%		-10.25%		2.32%	(2.38) [b]	0.92%	(0.91)	6.69%	(3.31) [a]	-1.90%	-(1.50)	5.72%	(3.84) [a]	7.42%	
	General Business	4.92%	(4.73) [a]	4.16%	(2.06) [b]	4.88%		5.22%	(4.04) [a]	4.12%	(3.77) [a]	12.71%		2.40%	(1.45)	6.11%	(3.46) [a]	8.47%	(4.00) [a]
	Miscellaneous	-5.32%	-(3.30) [a]	6.05%		-22.62%		0.53%	(0.24)	-1.27%	-(0.75)	-31.37%		-9.63%		-5.64%	-(2.08) [b]	2.39%	
	TOTAL	1.92%	(3.85) [a]	4.56%	(4.89) [a]	-8.27%	-(5.92) [a]	2.51%	(3.87) [a]	1.76%	(3.29) [a]	3.06%	(2.18) [b]	0.50%	(0.64)	3.36%	(4.28) [a]	2.83%	(2.40) [b]

Table 5. Regression analysis

The entire sample (3353 observations) is first divided between positive and negative event day excess returns, to proxy for the type of the information involved in the extreme trading. The dependent variable in both panels is the event day excess returns. Independent variables are grouped in four main categories: ownership and control, firms' characteristics, news disclosure and trading volume. Ownership measures the first shareholder's cash flow rights, while control its the voting rights. The ownership/control ratio is a proxy of ownership separation. State, family, no financial are all dummy variables that indicates the majority shareholder being the state, a family or a non-financial institution. Group is a dummy variable for firms belonging to a group. Headlines and news are dummy variables indicating the presence of headlines or news referred to the company in a window of four [-1;2] or two [0;1] days around the event. NAV[0] is the event-day normalized abnormal volume and Delta NAV the change in NAV between the event day and the next day (NAV[1] - NAV[0]). T-test is in parenthesis. Adj R square is the adjusted R square. a, b, c indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively.

	POSITIVE EXCESS RETURNS									
							AR > 1%		AR > 3%	
	Model 1		*Model 2*		*Model 3*		*Model 4*		*Model 5*	
Intercept	0.0551	(6.17) [a]	0.0503	(6.16) [a]	0.0475	(5.77) [a]	0.0558	(5.49) [a]	0.0753	(5.30) [a]
Ownership (%)	0.0069	(1.03)								
Control (%)							0.0128	(1.87) [c]	0.0202	(2.17) [b]
Ownership/Control Ratio	0.0002	(0.03)			0.0044	(1.11)	-0.0029	-(0.60)	-0.0025	-(0.36)
State	0.0053	(0.97)	0.0018	(0.32)			0.0032	(0.55)	0.0057	(0.71)
Family	-0.0019	-(0.70)	-0.0013	-(0.46)			-0.0019	-(0.66)	-0.0015	-(0.38)
Group	0.0037	(1.41)	0.0004	(0.15)			0.0028	(0.97)	0.0020	(0.54)
No Financial	-0.0056	-(1.59)	-0.0009	-(0.27)			-0.0066	-(1.60)	-0.0165	-(2.91) [a]
Mean Trading value (Ln)			-0.0040	-(5.38) [a]						
Market Capitalization (Ln)	-0.0070	-(7.73) [a]			-0.0062	-(9.19) [a]	-0.0074	-(7.84) [a]	-0.0086	-(6.71) [a]
Asset Value (Ln)										
Roe (%)	-0.0002	-(1.52)	-0.0005	-(3.58) [a]						
Roa (%) (Ebit/Asset)							-0.0003	-(1.26)	-0.0001	-(0.18)
Dividend Yield (%)	-0.0019	-(3.05) [a]	-0.0022	-(3.48) [a]	-0.0019	-(3.09) [a]	-0.0019	-(2.96) [a]	-0.0017	-(1.82) [c]
Beta					0.0021	(1.06)	0.0020	(0.86)	0.0036	(1.22)
Market to Book	0.0020	(2.42) [b]	0.0007	(0.82)			0.0017	(1.79) [c]	0.0008	(0.65)
Debt/Asset (%) (Market)			-0.0110	-(2.74) [a]			-0.0088	-(1.94) [c]	-0.0107	-(1.72) [c]
Debt/Equity (Market)	-0.0015	-(0.65)								
Headlines [-1,2]										
Headlines [0,1]			0.0072	(2.99) [a]						
News[-1,2]										
News[0,1]	0.0118	(3.76) [a]			0.0118	(3.81) [a]	0.0091	(2.76) [a]	0.0103	(2.37) [b]
NAV[0]	0.0106	(5.06) [a]	0.0103	(4.91) [a]	0.0105	(5.06) [a]	0.0134	(5.80) [a]	0.0139	(4.43) [a]
Delta_AV	0.0005	(1.63)			0.0005	(1.53)	0.0002	(0.43)	-0.0007	-(1.28)
Adj R square	0.0765		0.0594		0.0744		0.0815		0.0754	

	NEGATIVE EXCESS RETURNS									
							AR < -1%		AR < -3%	
	Model 1		*Model 2*		*Model 3*		*Model 4*		*Model 5*	
Intercept	-0.0164	-(1.43)	-0.0183	-(1.67) [c]	-0.0123	-(1.16)	-0.0396	-(2.60) [a]	-0.0778	-(2.69) [a]
Ownership (%)			-0.0047	-(0.49)						
Control (%)	-0.0110	-(1.19)			-0.0133	-(1.66) [c]	-0.0131	-(1.10)	-0.0399	-(1.70) [c]
Ownership/Control Ratio	-0.0009	-(0.14)	-0.0018	-(0.26)			0.0020	(0.25)	0.0102	(0.64)
State	-0.0022	-(0.31)	-0.0022	-(0.31)	-0.0033	-(0.47)	-0.0091	-(0.93)	-0.0172	-(0.95)
Family	-0.0081	-(2.05) [b]	-0.0080	-(2.01) [b]	-0.0090	-(2.26) [b]	-0.0090	-(1.77) [c]	-0.0045	-(0.49)
Group	0.0039	(1.12)	0.0038	(1.09)	0.0047	(1.36)	0.0042	(0.91)	0.0008	(0.09)
No Financial	-0.0026	-(0.48)	-0.0042	-(0.80)	0.0022	(0.45)	0.0019	(0.27)	0.0130	(0.97)
Mean Trading value (Ln)										
Market Capitalization (Ln)	0.0016	(1.39)	0.0015	(1.46)	0.0009	(0.77)	0.0032	(2.12) [b]	0.0086	(2.93) [a]
Asset Value (Ln)										
Roe (%)					0.0002	(0.84)				
Roa (%) (Ebit/Asset)	0.0012	(2.91) [a]	0.0013	(3.20) [a]			0.0009	(1.72) [c]	0.0004	(0.40)
Dividend Yield (%)	0.0027	(2.96) [a]	0.0027	(2.93) [a]	0.0028	(3.00) [a]	0.0028	(2.11) [b]	0.0041	(1.36)
Beta	-0.0006	-(0.19)					-0.0003	-(0.08)	-0.0102	-(1.29)
Market to Book	-0.0022	-(1.87) [c]	-0.0022	-(1.95) [c]	-0.0017	-(1.48)	-0.0018	-(1.14)	-0.0012	-(0.44)
Debt/Asset (%) (Market)	-0.0010	-(0.16)					0.0003	(0.03)	-0.0150	-(0.92)
Debt/Equity (Market)			0.0006	(0.18)						
Headlines [-1,2]										
Headlines [0,1]										
News[-1,2]										
News[0,1]	-0.0178	-(3.98) [a]	-0.0181	-(4.04) [a]			-0.0186	-(3.23) [a]	-0.0105	-(1.12)
NAV[0]	-0.0070	-(2.88) [a]	-0.0071	-(2.91) [a]	-0.0079	-(3.21) [a]	-0.0076	-(2.51) [b]	-0.0095	-(1.74) [c]
Delta_AV	-0.0013	-(3.02) [a]	-0.0013	-(2.98) [a]	-0.0014	-(3.19) [a]	-0.0018	-(2.93) [a]	-0.0015	-(1.50)
Adj R square	0.0830		0.0828		0.0570		0.0777		0.0487	

Table 6. Portfolio strategies

The table reports the profits earned by some volume-based portfolios. The column "Feasible strategy" shows the outcomes of the implementable strategy consisting in buying (long portfolios) or selling (short portfolios) at the opening price of the day after the event and closing the position at the last ask (bid) price as indicated in the holding period column. The column "Theoretical portfolio" reports the profitability of the same strategy assuming to begin trading at the end of the event date and without incurring in the bid-ask spread cost embedded in the round-trip trade. Despite the impossibility to undertake such a strategy, the theoretical profits earned are reported for sake of comparability. To potentially distinguish between positive and negative information, the sign of abnormal return on the event day is used, assuming that positive (negative) excess returns are the likely effect of good (bad) undisclosed information. Each portfolio goes from the beginning of 1997 to the end of 2003. The portfolio is continuously rebalanced and equally-weighted among the securities. a, b, and c indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively.

Portfolio	Hoding Period (days)	AR0's Cutoff	Number of Transactions	Number of securities (average)	Feasible strategy returns		Theoretical strategy returns	
					Row	Mkt Adj	Row	Mkt Adj
Portfolio 1								
Whole Portfolio	1	-	6,080	1.46	-0.242[b]	-0.252[b]	0.97[a]	0.96[a]
Portfolio 2								
Long Portfolio	1	1%	3,929	0.94	-0.002	-0.052	1.39[a]	1.34[a]
Short Portfolio	1	-1%	1,155	0.28	-1.073[a]	-1.123[a]	0.13	0.08
Whole Portfolio			5,084	1.22	-0.499[a]	-0.549[a]	0.85[a]	0.80[a]
Portfolio 3								
Long Portfolio	1	3%	2,676	0.64	0.378[b]	0.318[b]	1.64[a]	1.58[a]
Short Portfolio	1	-3%	569	0.14	-0.793[b]	-0.883[b]	0.65[c]	0.56
Whole Portfolio			3,246	0.78	-0.036	-0.106	1.25[a]	1.18[a]
Portfolio 4								
Long Portfolio	1	5%	1,529	0.37	0.481[b]	0.391[c]	2.07[a]	1.98[a]
Short Portfolio	1	-5%	305	0.07	-2.384[a]	-2.314[a]	1.04[b]	1.11[b]
Whole Portfolio			1,833	0.44	-0.014	-0.074	1.69[a]	1.63[a]
Portfolio 5								
Long Portfolio	1	3%	2,676	0.64	0.378[b]	0.318[b]	1.64[a]	1.58[a]
Short Portfolio	5	-3%	569	0.68	-1.203	-1.213	0.24	0.23
Whole Portfolio			3,246	1.32	-0.606[c]	-0.636[c]	0.68[b]	0.65[b]
Portfolio 6								
Long Portfolio	1	1%	3,929	0.94	-0.002	-0.052	1.39	1.34
Short Portfolio	5	-3%	569	0.68	-1.203	-1.213	0.24	0.23
Whole Portfolio			4,499	1.63	-0.646	-0.676	0.64	0.61