THE INFORMATION CONTENT OF ABNORMAL TRADING VOLUME

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Abstract

This paper investigates the role of abnormal trading volume on the Italian equity market as revealing new information. In an efficient market, volume should be correlated to simultaneous returns, but should have no predictive power for future returns. When new information arrives in the market, prices should adjust to a new equilibrium and the increase of volume should be the natural effect of informed trades. However, empirical evidence documents that the release of new information, price changes and volume increases are not necessarily simultaneous phenomena, as market efficiency would suggest. If information is not perfectly spread out in the market, but rather held by more informed traders, observation of trading volumes may enhance the information set. The hypothesis is that large changes in volume, especially when not accompanied by any news disclosure, incorporate a non-public information content and signal future excess returns.

Evidence confirms this intuition. I find strong excess returns (higher when no new information is simultaneously released) around extreme trading levels and strong evidence of price continuation, even though mainly concentrated on the day after the event. The magnitude of post-event excess returns is also profitably tradable with a portfolio strategy. These findings strongly corroborate the hypothesis of an information content of abnormal volume.

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1. Introduction

The relationship between price and volume has been extensively studied in literature, but, quite surprisingly, not many studies have tried to investigate whether the volume pattern can help to predict future returns. In an efficient market, volume should be correlated to simultaneous returns, but should have no predictive power for future returns. When new information arrives in the market, prices should adjust to a new equilibrium and the increase of volume should be the natural effect of informed trades. However, empirical evidence documents that the release of new information, price changes and volume increases are not necessarily simultaneous phenomena, as market efficiency would suggest. More specifically, the stock market often shows sudden and large changes in price and volume without any new information. The possible reasons are numerous: unreported news (more likely for small firms), communication between financial analysts or advisors and their clients that are not made public, to cite some, or trading based on private information[1]. A possible question rises inevitably: how often the large and unexplained (by new information) trading volume is due to the activity of informed traders and when to illegal insider trading? To ascribe the abnormal trading to one of the two rationales is an extremely hard task. In addition, the demarcation line between trades initiated by informed traders (in a microstructure meaning) and those originated by insiders in possession of private information (legal meaning) is probably quite thin. In my assumption, caused by legal or illegal trades, the unexplained abnormal trading has an information content, since it is based on not public information. But, I also expect that the strength of the signal involved is related to the legality of the trade, since illegal transactions are more likely to produce more severe price effects. As a conclusive postulate, large changes in volume generally have an information content, but this effect is stronger and even more consistent with a market in which trading with private information is allowed or where the regulation that prohibits it is not enforced.

In this regard, in 1991, the Italian parliament voted a law that prohibits insider trading, but so far the number of convictions appears extremely scarce. This evidence raises some doubts on the effectiveness of enforcement in Italy[2]. A further motivation for the presence of insider trading is the typical Italian corporate ownership structure based on pyramidal groups, which allow shareholders to have a safe control of the companies with low cash flow rights. In such an environment, majority shareholders have the incentive to exploit the information advantage, harming therefore small investors.

Based on these considerations, Italy represents an interesting environment in which to test whether abnormal trading is able to predict future returns. In fact, previous related studies are mainly focused on the US or UK markets, where the level of investor protection is incommensurably higher and the corporate governance system is very different. Moreover, the approach used in this paper is different from the one usually found in related literature. Most studies use trading volume to create different portfolios, verifying whether high volume stocks earn a premium over low volume stocks (CONRAD et al, 1994; LEE and SWAMINATHAN, 2000; GERVAIS et al, 2001). The aim of this paper is different: I test the hypothesis that large and unexplained changes in volume can give an informative signal to the market.

This hypothesis is also consistent with MEULBROEK (1992). She documents that, in presence of a violation of insider trading laws, the abnormal trading volume is about to be almost equal to the volume generated by insiders' transactions. In addition, in this and other studies, trading volume is taken as an indicator of possible trading by insiders who possess private information. Not infrequently, stock exchange regulators use trading volume in order to control stock market activity and detect possible abuse.

Abnormal trading itself cannot give a possible indication of the sign of future returns, since by looking at volumes it is not possible to discriminate between good and bad underlying events. However, I assume that abnormal trading is, on average, a positive signal. The most important reason is the severe restrictions on short selling, which makes extremely complicated to exploit undisclosed negative information. Furthermore, there is some evidence in literature (HONG, LIM and STEIN, 2000; CHAN, 2003) of a slower market reaction to bad news. Usually negative information is more likely to be kept inside the firm and requires longer periods to be completely reflected in prices. Insiders are more likely to exploit positive undisclosed

information than speculate on negative events affecting their company.
Recent literature about herding[3] 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[4] but only the large trading activity, can herd causing an even higher trading volume and a longer length of abnormal market conditions (price continuation).
Another possible approach to investigate the information content of trades is by looking at prices. Several studies analyze the effects of large changes in price (BREMER and SWEENEY, 1991; COX and PETERSON, 1994; PARK, 1995) finding a not tradable price reversal over the following weeks, but only PRITAMANI and SINGAL (2001) attempt to relate these anomalous market movements to information releases. They find that *large price changes accompanied by a public announcement display price continuations, whereas large price changes without any accompanying news do not*. In addition, *large price change events with accompanying public announcement show even stronger evidence of price continuation*. These results confirm the importance of volumes in explaining future returns, but, on the other hand, contradict the hypothesis presented in this study. As previously discussed, large and unexplained volumes should produce subsequent excess returns, as a signal of undisclosed information. Hence, large unexplained volumes should lead to price continuation.
Empirical evidence seems to confirm the intuition of this paper. An abnormal and unjustified increase in trading volume is associated with excess returns which also strongly persist on the subsequent day, allowing the possibility of implementing a portfolio strategy. Moreover, excess returns are generally positive and, when negative, they are spread over a larger post-event window. Finally, no effect of price reversal is found, in particular for the sample of unexplained events.
The rest of the paper is organized as follows. Section 2 provides a brief overview of prior literature. Section 3 describes data, samples, selection procedures and methodology, while section 4 presents the results. Finally, section 5 concludes.

2. A Brief Background

The relationship between returns and trading volume has been studied over the past twenty years by many scholars and using several different approaches. Broadly, the role of volume has been investigated within the stream of return predictability and microstructure literature, where high trading is usually associated to the activity of informed traders, and within the literature of illegal insider trading, where an increase of volume may signal the action of a company insider trading with private information. Although the origin of the two streams is different, I will briefly discuss both since I assume informed or illegal trades produce common effects on share prices. In this study, large trading determines excess returns for 30 trading days after the event, but the causes (informed or illegal trading) are virtually undistinguishable.
The first contribution to the returns-volume relationship is EPPS (1975), who formalizes 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 high level of volume and magnitude of price change relative to both the equity and futures markets. He also observes a positive correlation between volume level and sign of price change, meaning that high trading volume more generally leads to a positive price runs up.
BLUME, EASLEY and O'HARA (1994) and CAMPBELL, GROSSMAN and WANG (1993) investigate the information content of trading volume. BLUME et al develop a model where investors can obtain important information by examining past prices and volumes. Trading volume can add significant information to the quality and precision of past price movements. As a consequence, they predict a relation between lagged volume and current return (more pronounced for smaller firms), even though they do not suggest the relation's sign. CAMPBELL et al investigate the same relation by studying the interaction between liquidity traders and market makers.
To partially test these two models, some authors use the information deriving from trading volume to

improve return predictability. Within the literature of momentum and contrarian strategies, some studies include volume information to create portfolios. For example, CONRAD, HAMEED and NIDEN (1994) find that highly traded securities show a more pronounced price reversal, whilst low volume ones tend to have a strong positive auto-covariance in weekly returns. A more rapid price reversal for high volume stocks is also found by LEE and SWAMINATHAN (2000) for momentum portfolios. COOPER (1999) tests a contrarian strategy using different filters both on past returns and lagged volume changes. This portfolio scheme outperforms a buy-and-hold strategy, but, contrary to previous studies, he finds a lower price reversal for low volume stocks and a positive return autocorrelation for highly traded securities. CHORDIA, BHASKARAN and SWAMINATHAN (2000) show the existence of a lead-lag cross autocorrelation. Highly traded stock returns are usually correlated with the subsequent days' returns of low traded stocks. In fact, they provide evidence that portfolios composed of high volume stocks are partially able to explain the following days' returns of low volume portfolios. This result brings the authors to state that higher trading volume helps prices to quicker reflect full information. Within the literature of return predictability, PRITAMANI and SINGAL (2001) examine return behaviour following large price changes. The authors investigate the post-event price behaviour conditional to public announcements and the type of news involved. They also consider the role of volume by distinguishing between samples with substantial increase or decrease of trading activity. Their results show that large price changes are characterized by price continuation (or under-reaction to news) when accompanied by a public announcement and an increase in volume.
GERVAIS, KANIEL and MINGELGRIN (2001) confirm the hypothesis that a high trading activity has an information content for future returns, postulating a "High-volume return premium" to explain price run-ups following large changes in trading volume. They argue that this evidence is consistent with the *visibility hypothesis*, suggested by MILLER (1977) and MAYSHAR (1983). According to this hypothesis, traders who hold certain stocks tend to be more optimistic about their value. In addition, pessimistic traders cannot affect stock price since short-selling is not normally allowed. As a consequence, when a shock in stock visibility occurs, the number of potential buyers increases, leaving the number of potential sellers unchanged: this leads to a shift on the demand curve but not on the supply curve, causing abnormal returns in the following period. GERVAIS et al control for some other possible explanations such as return autocorrelation, earning or dividend announcements, systematic risk, bid-ask spreads or liquidity explanations, but reject these alternative explanations. A number of studies also looked at option volume in order to explain future stock price [EASLEY, O'HARA and SRINAVAS (1998); CAO, CHEN and GRIFFIN (2005)]. General evidence shows that both option volume level and option volume imbalance are good predictors of future excess returns of underlying stock.
Though GERVAIS, KANIEL and MINGELGRIN (2001) do not document evidence of news releases after the increase of trading volume, in this paper I assume that a possible motivation for large trading is an anticipation of a future announcement, supporting the possible presence of insider trading. According to this conjecture, abnormal volumes are a proxy of informed investors' trading. MEULBROEK (1992) studies price and volume behaviour around trades put in place by company insiders. Working on a SEC dataset of insider trading law's violations, she shows that abnormal returns on the event date (insiders' trade date) are close to 3%, half as much as the market reaction after public announcement. Although the increase in volume is not extremely large, it is adequate to produce an increase in price. Moreover, she shows that the excess volume around those days is approximately equal to the volume generated by insiders, concluding that this additional trading is itself enough to cause an abnormal price increase. Similarly, BAGLIANO, FAVERO and NICODANO (2001) analyze a sample of illegal transactions by Italian insiders indicted by Consob (the Italian security exchange commission) for insider trading law violations. Results suggest that Italian insiders generally start to trade in advance of US insiders; market reaction occurs before the announcement and, consequently, abnormal returns are lower around the news publication date. This evidence seems to confirm the idea that the Italian market is more severely affected by insider trading violation than the US market.

3. Methodology and sample selection

The aim of this paper is to verify whether abnormal volume has an information content and, as a consequence, it can help to predict future stock returns. In order to test this hypothesis, both a measure for abnormal trading volume and a model for calculating abnormal returns are needed.

In order to detect abnormality on trading, we need to compare the current level of trading to some standard measure. A measure often proposed in literature is the turnover, the ratio between trading volume and the number of outstanding shares. As this is not available information in Italy[5], in this study I use a different measure: the *normalized abnormal volume* (*NAV*). Firstly used by JARRELL and POULSEN (1989)[6], *NAV* for the stock *i* on day *t* is computed as:

$$NAV_{i,t} = \frac{TV_{i,t} - \mu_{i,t}^{TV}}{\sigma_{i,t}^{TV}} \qquad (1)$$

$$\mu_{i,t}^{TV} = \frac{1}{66} \sum_{j=0}^{NTD-1} TV_{i,t-j} \qquad (2)$$

$$\sigma_{i,t}^{TV} = \sqrt{\frac{1}{65} \sum_{j=0}^{NTD-1} (TV_{i,t-j} - \mu_{i,t}^{TV})^2} \qquad (3)$$

where *NTD* (number of days of trading) is 66 (3 months) non-missing trading days; $TV_{i,t}$ is the trading volume[7] for stock *i* on day *t*; μ and σ are, respectively, the mean and the standard deviation of trading volume (for stock *i* on day *t*) calculated on a window of the previous 66 days with positive trading. Differently from JARRELL and POULSEN (1989), the number of days where mean and standard deviation are computed does not include any days with no trading. This is to avoid distortions that might arise from less liquid stocks. In fact, the inclusion in the computation of the days with no volume would produce (in the presence of less liquid stocks) a lower mean[8] and, consequently, extremely and unjustifiably high values of *NAV*, due to an underestimation of the trading volume's mean rather than an actual abnormal volume. This feature should be able to avoid problems deriving from infrequent trading.

The empirical distribution of NAV (Table 1) is approximately normally distributed, but it is slightly right skewed and shows fatter tails. Both Kolmogorov-Smirnov and Jarque-Bera tests reject the hypothesis of normality at a 1% level.

[Table 1 about here]

For the computation of abnormal returns, I use the standard event study methodology (BROWN and WARNER, 1985). Abnormal returns[9] are computed with a *market adjusted* and *market and risk adjusted return* for a window of 36 days [-5, +30] around the event.

The use of *market adjusted* models may originate some doubts, since abnormal returns do not take into account the different level of risk that characterizes each stock. However, since the main analyses and conclusions are based on two or three days around the event, potential bias are likely to be small. In addiction, the results from the regression analysis are controlled for systematic risk.

The second approach (*market and risk adjusted*) avoids this problem, since expected returns are computed taking into consideration the systematic risk, but it requires the estimation of beta. This is based (for each stock and for the whole period considered) on a pre-event window of five years (monthly returns). 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[10]. Moreover, I also check for the statistical significance of each regression and, in order to exclude betas obtained with a very low fit of regression from the sample, I use a 0.2 *cut-off*[11] on R^2.
For the statistical significance of abnormal returns, both parametric (t-test) and non parametric tests (generalized sign test and Corrado test) are used. Data on prices and volumes have been collected from Datastream; news from the electronic version of "*Il sole 24 ore*" (main Italian financial newspaper).

3.1. Sample selection
To test the hypothesis of the information content of abnormal volume, the initial sample consists of all stocks listed at Milan Stock Exchange (Borsa Italiana) over the 1997-2003 period. For each of the 320 stocks in the sample, I compute the normalized abnormal volume (*NAV*), obtaining close to 450,000 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[12]. This selection generates a sample of 10,104 events, about 36 events *per* day.
Subsequently, among those events, I select firms with no large volume (*NAV* > 2.33) over the 30 preceding trading days. This criterion is needed to ensure not to have multiple events in the same period for the same firm. In fact, in case of an event, usually, the increase of trading among investors tends to occur for a number of consecutive days. In order to remove this problem and keep unique observations, I exclude repeated observations from the sample, events with *NAV* > 2.33 over the 30 preceding days. This reduces the sample to 3,353 events. This is also the final sample that lists 303 securities (representing almost the whole market), 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.
Applying the same criteria (*NAV* cut-off and multiple events exclusion) to the comparison sample based on a *market and risk adjusted methodology* I obtain 955 events. What significantly reduces the sample size is the cited requirement for the reliability of the coefficients alpha and beta (0.2 as a minimum R^2 level). The loss of a reasonable number of events does not represent a negligible cost, but the exclusion of the coefficients resulting from an inadequate regression fit ensure the validity and the correctness of abnormal returns[13].

4. Results
This paper tests the information content of abnormal trading volume. To verify this hypothesis, I compute a measure of abnormal volume (*normalized abnormal volume*) and study the market performance around this high level of trading. In order to only relate the excess return to the abnormal volume, I also check for possible news disclosed simultaneously to the large trading levels.
Results are organized as follows. In the first part, an examination of the market reaction following abnormal volume is presented. Initially, I only examine the relationship between abnormal trading and returns, with no concern to possible information disclosed simultaneously. Subsequently, the role of news or rumours is investigated: in a window of four days around the day of large trading, I control for possible relevant information reported in the main Italian financial newspaper. In the final part, a possible portfolio strategy is proposed and analyzed.
The evidence shows that abnormal volumes are associated with strong excess returns on the three days around the event. This evidence is also confirmed after controlling for possible news disclosed around the event: unjustified high volume activity (not explained by new information) shows an even higher market response. Liquidity is another important variable since less liquid stocks (small firms) experience a more severe *volume effect*, meaning that abnormal returns are usually higher for smaller companies. This evidence confirms the idea that abnormal volume has an information content. Both the *visibility* and the *informed traders' hypotheses* are consistent with this phenomenon. In the first case, an increase in volume could attract attention to a stock, leading to new purchases and a price increase. In the latter, investors with a higher

information set (or in possession of undisclosed relevant information) could enter the market determining an increase in price and volume.
Very interesting insights come from the portfolio analysis. According to main results found in this paper, abnormal volumes tend to anticipate future extra-returns. This might suggest that abnormal volumes can be taken as a signal for trading strategies. Based on this idea, I create some portfolios following *NAV* index signals: buying stocks experiencing abnormal volumes leads to significant excess returns, even after transaction costs.

4.1 The relation between abnormal volume and excess returns

The first analysis examines the relation between abnormal volume and excess returns, without considering new information disclosure. Table 2 lists abnormal returns (*AR*) and cumulative abnormal returns (*CAR*) for the whole sample.

[Table 2 about here]

Examining the price behaviour, it emerges, with both methodologies and all the statistical tests[14], that firms earn positive and strongly significant abnormal returns on the three days around the event [-1,+1]. This first finding is consistent with PRITAMANI et al (2001). They analyze excess returns around large price changes, finding a significant persistency of returns the day next to the event and no price-reversal over the following month. But, in this investigation, the magnitude of returns of day 1 is significantly higher than the one found in the previously cited study[15]. The day following the event, the market shows a +1.02% (+0.77%) excess return computed with a *market adjusted* (*market and risk adjusted*) methodology. The absence 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 volume. As a manner of fact, the *market adjusted* CAR(1,30) level is almost as much as AR(1), meaning that no effect of price-reversal is found, whilst the *market and risk adjusted* CAR(1,30) increases over time even suggesting the possibility of a larger price continuation. This effect would be consistent with this paper's hypothesis. If volumes anticipate future information, we should observe excess returns around abnormal volumes and, subsequently, with the public announcement, even though the effect of price continuation is weak and only statistically significant for the second sample (*market and risk adjusted*). A possible explanation could derive from the large window period in which the news could be spread out, which would make it extremely difficult to produce statistically significant post-event abnormal returns.
The analysis of the pre-event period does not reveal any particular insight. CAR(-5,-2) is statistically insignificant with no regards to the methodology used. This is consistent with the expectation: the information effect is assumed to be simultaneous to the high trading, whilst multiple events (large trading during pre-event period) are excluded from sample.

[Table 3 about here]

These results support the relationship between high level of trading volume and corresponding returns. However, this paper's hypothesis postulates that unjustified abnormal volume is a good predictor of future excess returns. Hence, I select observations with information disclosure around the event period, in order to distinguish how much of these excess returns are driven by public information and to isolate the exclusive contribute of large trading. Table 3 reports the findings for informative and uninformative samples.
To have a measure of the information content, I consider two different proxies: *press coverage* and *news*. The first proxy considers any article published in the main Italian financial newspaper (*Il Sole 24 Ore*) that cites the company's name either in the headlines or inside the text; *news* refers only to those articles which contain relevant information[16]. Two window periods around the event [-1,+2] and [0,+1] are considered for both

proxies[17].

No difference is found between the two sub-samples for the pre-event window, whereas some insights come from the investigation of the event and the post-event periods. Around the event, sub-samples with associated information show, quite surprisingly, lower excess returns. Prices respond to large volume more dramatically when no new information is simultaneously disclosed. This result is in some degree discordant with PRITAMANI et al (2001), who find higher returns following large change in prices when news is simultaneously released. However, a deeper analysis of these results evidences that the difference between informative and uninformative samples weakens when we consider the *news* proxy instead of *press coverage*, suggesting that this difference could be partially affected by a size effect[18].

Further interesting insights come from the study of post-event period. As previously reported, some studies [PRITAMANI et al (2001); CHAN (2003)] demonstrate a price-continuation (or under-reaction) effect to news. The results presented in Table 3 totally contradict previous findings and corroborate this paper's hypothesis. Uninformative samples show a higher price continuation when no simultaneous information is disclosed on the press. According to the assumptions, large volumes should reveal undisclosed information and eventual anticipate the release of forthcoming news.

4.2 The effect of news disclosure

For 564 events (roughly 17% of the whole sample), it is possible to associate public news to the large volumes' movement. This allows the investigation of the price-news relation and gives a small contribution to the existing debate on the market reaction to public news. Although the sub-sample is relatively small, the presence of high volume enhances the precision of the related signal[19] and gives more strength to the empirical findings. Moreover, this represents, to my knowledge, the first empirical investigation on this issue applied to the Italian stock market.

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 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 of 564 events with associated news is first divided in seven groups, according to the type of announcement[20] and subsequently partitioned following the signal conveyed (good, bad or neutral), the precision of the announcement (news or rumour) and the timing of disclosure (respect to the event day).In terms of distribution among the types of announcement, large volume is more commonly associated with restructuring (164) and general business (107) announcements, whereas few cases of forecast of earnings (24) or analyst recommendations (25) are encountered. Relatively to the other criteria used for splitting news, the number of positive news items (191) is roughly three time as much as negative information (67); significantly larger is the number of news items relative to rumours and, finally, announcements are almost completely concentrated (475) on the two days around the event [0,+1].

The sample partitioning among the types of announcement allow us to better understand the nature of market reaction around the event. In fact, sensible differences can be detected inside the whole sample of 564 events once we examine each sub-sample. All the categories, with the exception of announcements of forecast of earnings, show a statistically significant positive market reaction on the event day and the following. 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, in average, a positive information content. The

analysis of post-event behaviour is likewise informative. A larger number of sub-samples display a price-reversal after the event, with the exclusion of analyst recommendations and general business related information which show price continuation. These results partially contradict the study carried out by PRITAMANI (2001) that evidences price continuation (or under reaction) for events associated to earnings announcements, but it is consistent with it in term of post-event price behaviour for analyst related information (differently from BARBER et al. (1993)).
A confirmation of the thesis that bad news travels slowly (under reaction) arrives from the analysis of the signal conveyed by the announcement. Omitting the obvious positive (negative) abnormal return sign around the event for good (bad) news, the good-news sample shows a strong reaction immediately after the event (AR_1 is +1.64%), but over the following ten trading days this is almost re-absorbed (CAR(1,10) is +0.51%). For the opposite (bad-news) sample, cumulative abnormal returns are -0.44%, -2.34% and -3.74% respectively for 1, 10 and 30 trading days horizon (from day one).
The following criterion of distinction is precision. A specification has to be taken into consideration for the definition of rumour, that includes those articles in which the source of the information is not precise or where this is presented as an author's supposition. Commonly, rumours are reported in correspondence of an abnormal behaviour of volume or returns in the early day. Hence, results could suffer the problem of selection bias. However, the most visible difference between the two samples is the higher (lower) market reaction around the event but the lower (higher) statistical significance for rumours (news). This is consistent with the precision of the information conveyed: the lower accuracy of rumours leads to a wider variability of returns around the disclosure, also lowering the power of the t-test. The last comment is addressed to the timing of the information release: the larger part of market reaction occurs in correspondence to large volume (event day) rather than to the publication of the announcement, consistently with the *information content of volume* hypothesis.

[Table 4 about here]

4.3 Regression analysis

The shown evidence suggests that the positive relationship between abnormal volume and returns is not driven by new information disclosure, consistently with the *information content of volume hypothesis*. In addition, the magnitude of price continuation, especially for the day next to the event, is consistently higher than that documented in previous researches. This result is, to some extent, also a puzzling phenomenon. In fact, if new information flows slowly into the market, any investor can infer it by observing abnormal market activity and consequently obtain profits. Whether the magnitude of excess returns is tradable will be object of investigation in the next paragraph, now the possible determinants of excess returns for the day next to the event are studied with a regression analysis.

[Table 5 about here]

Both univariate and multivariate analyses (Table 5) confirm that day 1 excess returns (AR_1) are positively related to the magnitude of the same day trading volume (NAV_1 whereas NAV_0 has no explanatory power) and one day lagged abnormal returns (AR_0). Both these results are consistent with the assumptions: higher trading volume carries a stronger signal to the market and the positive autocorrelation between returns [0,+1] indicates the monotonic persistency of the price pattern. In other words, when large trading activity is accompanied by positive (negative) excess returns, the following day a rise (decline) in prices follows. This is also consistent with possible herding behaviour by uninformed traders, who simply infer the undisclosed information by observing unexplained large changes in volume and price.
Firm size is another important factor, since smaller firms are more seriously affected by information asymmetry problems. For smaller firms, larger is the proportion of trades initiated by informed traders,

higher should be the information content of abnormal trading volume. This is confirmed by the analysis in which the natural logarithm of market capitalization is always negative and strongly significant[21].

The persistency of excess returns is also controlled for news disclosed in a window [0,+2] around the high trading activity. Returns are positively and strongly correlated to simultaneous news and, with a lower statistical significance, positively to the news on day +2 and negatively to day 0. This evidence is accordant with the hypothesis of the information content of trading volume. Omitting the obvious relation to the existence of simultaneous news, the positive (negative) sign of the $news_{[+2]}$ ($news_{[0]}$) coefficient suggests that returns are higher (lower) when some news is about to be (has just been) disclosed. Maintaining constant the level of trading, the stock market earns higher excess returns when in proximity of forthcoming new official information, sustaining the hypothesis that a large trading level has an information power (news anticipation).

Contrary to the initial assumptions, apparently no role is played by the ownership structure. To verify this, I use the variable *OC*[22] as a proxy for ownership/control separation. This measure is constructed as the ratio between the percentage of the first shareholder's cash flow rights over his votes. When *OC* assumes a value equal to 1, no separation is implied; lower is its level, higher is the separation between ownership and control[23]. No significance is found for dummies relative to financial firms and companies whose first shareholder is the state. Results are controlled for systematic risk and for market to book ratio, but those variables are almost never significant.

4.4 A possible portfolio strategy

The previous results show that abnormal volumes can be taken as a reliable signal for future excess returns, even though their persistency is mainly concentrated on the day after the high trading. However, a portfolio strategy can be still profitable. Unlike the standard portfolios setting procedure, where the entire listing is ranked and divided in deciles according to some stock characteristics (like trading volume or turnover) to form a number of portfolios rebalanced on a monthly basis, in this study I propose a different approach. The first difference relates to the stocks included in the portfolios: not the entire listing, but only those securities involved in abnormal trading. Consequently, the returns of portfolios with large trading levels are not compared to low volume portfolios, but to a market index replicating portfolio. In other words, I compare the performance of the portfolio with a *buy and hold* strategy, evidencing the excess return both gross and net of transaction costs[24].The second difference is found in the frequency of the rebalancing. As the return persistency is short, I rebalance the portfolio on a daily basis, following the signals that arrive from abnormal trading.

[Table 6 about here]

Table 6 presents some possible portfolios. All the strategies consist in buying (long portfolios) or selling (short portfolios) at the end of the event day (at closing price), closing the position after a predetermined period. To potentially distinguish between positive and negative information, I use the sign of abnormal return at the same instant I include a stock in the portfolio, 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. Whenever a new stock is inserted, the entire portfolio is rebalanced and equally-weighted among the securities. If no stock experience abnormal volumes, the portfolio is eventually emptied. In order to check the statistical significance of the returns of these portfolios, I simulate with a *Monte Carlo* analysis of 10,000 replicating portfolios, randomly selecting the exact number of securities and the same number of transactions for each portfolio.

The first portfolio, using only a long strategy[25] and a one day holding period, yields to more than 6,700 transactions (over the seven years considered) and a daily return close to 1% (0.56% after transaction costs). Yearly returns[26] are equal to 38% and close to 30% net of market returns and transaction costs. These results

are significant at 1% error level. The length of the holding period is consistent with prior findings: the persistence of excess returns is highly concentrated on the day after abnormal trading, making it not economically convenient to hold the stock longer.
The following three portfolios (2 to 4) are created using the same logic. As noted earlier, abnormal returns on day 0 play an important role in determining the following day's returns. In other words, the sign of an abnormal return can help discriminate between positive or negative underlying information. According to this assumption, I go long (short) on stocks with AR_0 higher (lower) than a specified cut-off (1%, 3% and 5%). Results show that long portfolios are always profitable at 1% error level and the returns are strongly significant even after transaction costs; short portfolios evidence positive net returns and a statistical significance only with a cut-off below -3%.
Portfolios 5 and 6 use a five days holding period for the short strategy, but the evidence confirms prior findings: long strategies are always strongly profitable and statistically significant, whilst short portfolios hardly ever lead to positive net returns. These results are consistent with the hypothesis that high trading volume leads, in average, to positive abnormal returns**.** The reason for this assumption, as cited previously, could be two-fold. The most important reason is the severe restrictions to short selling, which makes it extremely complicated to take advantage of negative private information. Secondly, usually negative information is more likely to be kept inside the firm and requires longer time to be completely reflected on prices. Insiders are more likely to exploit positive undisclosed information than speculate over negative events connected to their companies.

5. Conclusion

This paper examines the informative role of abnormal trading volume on Italian stock market. If information is not perfectly spread out in the market, but rather held by more informed traders, observation of trading volume may enhance the information set. The hypothesis is that large changes in volume, especially when not accompanied by news disclosure, incorporate a not public information content and signal future excess returns.
Evidence confirms this intuition, since I find abnormal returns in a three days window around high trading levels (from day -1 to +1). If returns simultaneous to abnormal volumes can be driven by price pressure or some information that drives trades, the persistence of returns after the large trading activity may suggest a slow process of information flow into prices, a possible information content of trading volume and, at the same time, the possibility of a portfolio strategy.
Interestingly, abnormal returns are not influenced by news disclosure. Contrary to what could be intuitively expected, uninformative samples (with no associated information) exhibit higher abnormal returns, consistently with this paper's hypothesis of trading produced by more informed traders (or possible insider trading). As a further confirmation, I find a more severe effect on smaller companies (less liquid stocks), which are usually affected by stronger information asymmetry problems.
Finally, I test a possible portfolio strategy. In order to exploit the extra-return persistency after large trading, I create a portfolio buying stocks at the end of the event date closing the position at the end of the following day. This portfolio yields a daily return close to 1% and is strongly and statistically significant, after controlling for transaction costs. Some other portfolios have been tested using, as further information, the abnormal return in order to distinguish between potential positive and negative information. On this basis, long portfolios always lead to significant excess returns, while short portfolios are not always profitable.

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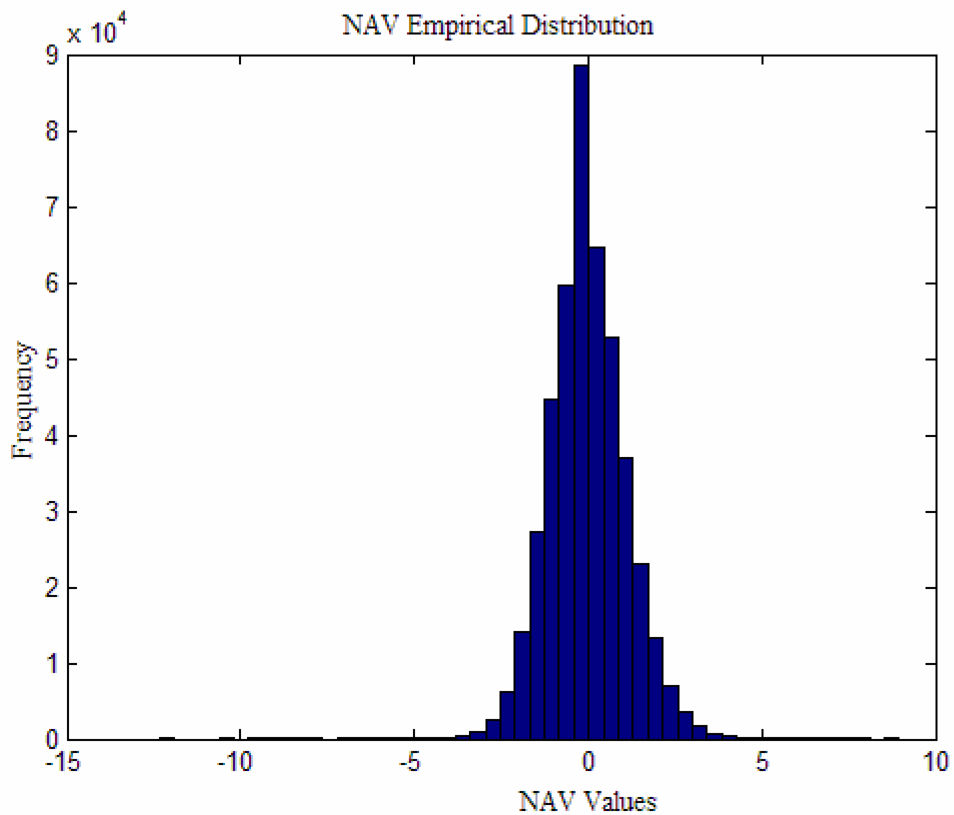
Table 1. NAV (Normalized Abnormal Volume) descriptive statistics. The distribution of NAV for close to 450.000 observations is plotted here together with some descriptive statistics. This distribution appears slightly right skewed and shows fatter tails. Both Kolmogorov-Smirnov and Jarque-Bera tests 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. Abnormal return and cumulative abnormal return analysis for 16 days around the event (NAV > 2.33). The analysis here presented is carried out both with a market adjusted and with a market and risk adjusted methodology. The tests used are T test, Sign and Corrado Test. % posit. indicate the percentage of positive abnormal returns.

	MARKET ADJUSTED (N = 3353)								**MARKET AND RISK ADJUSTED** (N = 955)							
Day	**AAR**	**T Test**		**% posit.**	**Sign Test**		**Corrado**		**AAR**	**T Test**		**% posit.**	**Sign Test**		**Corrado**	
-5	0.00%	-(0.74)		48.7%	-(0.27)		-(0.82)		0.08%	(0.36)		49.7%	-(0.49)		-(0.42)	
-4	-0.03%	-(1.64)		48.9%	-(0.03)		-(0.78)		-0.03%	-(0.73)		49.9%	-(0.36)		-(0.51)	
-3	-0.02%	-(1.00)		48.8%	-(0.20)		-(0.67)		0.01%	-(0.47)		50.3%	-(0.17)		-(0.16)	
-2	0.17%	(4.16)	***	53.2%	(4.94)	***	(0.58)		0.14%	(1.84)		53.1%	(1.58)		(0.97)	
-1	0.88%	(22.13)	***	61.9%	(15.00)	***	(4.00)	***	0.48%	(6.66)	***	59.9%	(5.79)	***	(5.89)	***
0	2.48%	(66.52)	***	73.0%	(27.85)	***	(9.75)	***	1.64%	(23.82)	***	67.3%	(10.38)	***	(14.48)	***
1	1.02%	(28.18)	***	61.4%	(14.41)	***	(4.03)	***	0.77%	(10.62)	***	58.8%	(5.14)	***	(6.57)	***
2	-0.20%	-(5.53)	***	45.3%	-(4.21)	***	-(2.43)	***	-0.17%	-(1.98)	**	44.8%	-(3.53)	***	-(2.96)	***
3	-0.11%	-(3.29)	***	46.4%	-(2.90)	***	-(1.86)		0.02%	-(0.43)		47.9%	-(1.65)		-(2.07)	**
4	0.01%	-(0.58)		49.9%	(1.07)		-(0.73)		0.03%	(0.82)		50.1%	-(0.30)		-(0.10)	
5	0.04%	(0.98)		49.0%	(0.07)		-(0.62)		0.12%	(0.77)		47.9%	-(1.65)		-(0.39)	
6	0.06%	(1.40)		49.9%	(1.11)		-(0.50)		0.19%	(2.70)	***	52.7%	(1.32)		(1.28)	
7	0.04%	(1.27)		49.5%	(0.69)		-(0.53)		0.13%	(1.67)		50.2%	-(0.23)		-(0.01)	
8	0.03%	(0.65)		48.8%	-(0.17)		-(0.74)		0.12%	(0.89)		49.9%	-(0.36)		-(0.90)	
9	-0.02%	-(0.26)		48.2%	-(0.83)		-(0.86)		0.06%	(0.65)		48.8%	-(1.07)		-(0.95)	
10	-0.04%	-(0.89)		49.7%	(0.83)		-(0.52)		-0.02%	-(1.21)		47.5%	-(1.85)		-(0.90)	

Window	**CAR**	**T Test**		**CAR**	**T Test**	
[-1,0]	3.36%	(62.67)	***	2.12%	(21.55)	***
[-1,1]	4.24%	(67.44)	***	2.89%	(23.73)	***
[-5,-2]	0.12%	(0.39)		0.20%	(0.49)	
[1,10]	0.82%	(6.93)	***	1.25%	(4.58)	***
[1,30]	0.79%	(3.97)	***	1.99%	(2.80)	***

*, **,*** indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively

Table 3. The influence of information disclosure: CAR analysis for informative and uninformative samples. The whole sample is split taking into account the release of new information. As proxy of information, *press coverage* (any possible article that cites the company's name during the window period analyzed) and *news* (any information reported on the press that can be considered price-sensitive) are used. Each of the information proxies considered are analyzed using two different window periods ([-1,2] and a narrower [0,1]). In the event that any window period includes a weekend, the information released in Saturdays and Sundays' newspapers is added to the ones reported on the working days. N indicates the number of events. The T statistic is reported in brackets.

	Whole sample N = 3353		
Window	**CAR**	**T Test**	
[-1,0]	3.36%	(62.67)	***
[-1,1]	4.24%	(67.44)	***
[-5,-2]	0.12%	(0.39)	
[1,10]	0.82%	(6.93)	***
[1,30]	0.79%	(3.97)	***

	Press Coverage[-1,2] N = 1783			**No Press Coverage[-1,2]** N = 1570			**Difference**		
Window	**CAR**	**T Test**		**CAR**	**T Test**		**CAR**	**T Test**	
[-1,0]	3.26%	(45.99)	***	3.47%	(43.15)	***	-0.22%	-(2.02)	**
[-1,1]	4.14%	(47.79)	***	4.64%	(47.09)	***	-0.50%	-(3.79)	***
[-5,-2]	0.12%	(1.21)		0.11%	(0.98)		0.01%	(0.06)	
[1,10]	0.67%	(4.25)	***	1.00%	(5.54)	***	-0.32%	-(1.35)	
[1,30]	0.37%	(1.34)		1.27%	(4.09)	***	-0.91%	-(2.19)	**

	Press Coverage[0,1] N = 1318			**No Press Coverage[0,1]** N = 2035			**Difference**		
Window	**CAR**	**T Test**		**CAR**	**T Test**		**CAR**	**T Test**	
[-1,0]	3.18%	(38.85)	***	3.47%	(49.65)	***	-0.29%	-(2.73)	***
[-1,1]	3.90%	(38.96)	***	4.68%	(54.66)	***	-0.78%	-(5.90)	***
[-5,-2]	0.11%	(0.96)		0.12%	(1.22)		-0.01%	-(0.06)	
[1,10]	0.17%	(0.91)		1.25%	(8.00)	***	-1.09%	-(4.51)	***
[1,30]	-0.32%	-(1.01)		1.51%	(5.58)	***	-1.83%	-(4.40)	***

	News[-1,2] N = 564			**No News[-1,2]** N = 2789			**Difference**		
Window	**CAR**	**T Test**		**CAR**	**T Test**		**CAR**	**T Test**	
[-1,0]	3.10%	(23.99)	***	3.41%	(58.36)	***	-0.31%	-(2.21)	**
[-1,1]	4.13%	(26.14)	***	4.43%	(61.84)	***	-0.29%	-(1.68)	*
[-5,-2]	-0.11%	-(0.59)		0.16%	(1.96)	**	-0.27%	-(1.35)	
[1,10]	0.37%	(1.28)		0.92%	(7.01)	***	-0.55%	-(1.73)	*
[1,30]	-0.46%	-(0.92)		1.04%	(4.62)	***	-1.50%	-(2.74)	***

	News[0,1] N = 476			**No News[0,1]** N = 2877			**Difference**		
Window	**CAR**	**T Test**		**CAR**	**T Test**		**CAR**	**T Test**	
[-1,0]	3.15%	(22.03)	***	3.39%	(59.13)	***	-0.24%	-(1.57)	
[-1,1]	4.14%	(23.66)	***	4.42%	(62.85)	***	-0.27%	-(1.45)	
[-5,-2]	-0.22%	-(1.11)		0.17%	(2.14)	**	-0.40%	-(1.83)	*
[1,10]	0.22%	(0.70)		0.92%	(7.20)	***	-0.70%	-(2.03)	**
[1,30]	-0.60%	-(1.08)		1.02%	(4.60)	***	-1.62%	-(2.72)	***

*, **,*** indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively

Table 4. Car analysis for the sample with related news. 564 events (about 17% of whole sample) are associable to public news disclosed on the main Italian financial newspaper (Il sole 24 ore). These events are also distinguished 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 (5). In brackets, the T statistic is shown only for the sub-samples with a minimum of 20 observations to guarantee the statistical significance of the results.

					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**		
AR0	TYPE	ALL			GOOD			BAD			NEUTRAL			NEWS			RUMOR			DAY 0			DAY 1			DAY 2		
	Actual Earnings	1.60%	(6.58)	***	3.09%	(9.17)	***	-2.76%	-(6.06)	***	1.01%			1.67%	(6.68)	***	0.06%			1.93%	(4.42)	***	1.47%	(4.59)	***	0.99%		
	Forecast of Earnings	0.72%	(1.64)		2.53%			-4.40%			-5.40%			1.16%	(2.60)	**	-9.59%			1.64%			0.79%			-2.64%		
	Analyst recommend.	1.94%	(5.33)	***	2.73%			-0.36%			1.58%			1.04%			4.81%			3.60%			1.29%			1.39%		
	Capital Structure	2.81%	(11.81)	***	5.03%	(12.37)	***	-7.36%			2.51%	(8.15)	***	3.19%	(12.87)	***	-1.81%			2.74%	(8.44)	***	2.87%	(7.10)	***	2.98%		
	Restructuring	3.43%	(20.85)	***	6.42%			-6.71%			3.39%	(19.09)	***	2.89%	(15.71)	***	5.44%	(14.75)	***	2.39%	(10.35)	***	4.56%	(16.77)	***	3.57%		
	General Business	2.81%	(14.80)	***	4.53%	(12.30)	***	-4.16%			3.15%	(13.33)	***	2.51%	(12.61)	***	5.72%			3.63%	(11.99)	***	2.37%	(7.35)	***	2.12%	(5.48)	***
	Miscellaneous	0.22%	(0.75)		6.23%			-7.41%			2.30%	(5.76)	***	-0.42%	-(1.35)		4.32%			-0.25%			-0.29%	-(0.59)		2.05%		
	TOTAL	2.38%	(26.10)	***	3.99%	(23.43)	***	-4.53%	-(17.77)	***	2.89%	(24.45)	***	2.14%	(21.91)	***	4.09%	(15.95)	***	2.37%	(16.64)	***	2.53%	(17.64)	***	2.02%	(9.38)	***
AR1	TYPE	ALL			GOOD			BAD			NEUTRAL			NEWS			RUMOR			DAY 0			DAY 1			DAY 2		
	Actual Earnings	0.83%	(3.41)	***	1.71%	(5.06)	***	-1.49%	-(3.27)	***	0.20%			0.86%	(3.43)	***	0.19%			0.56%	(1.28)		1.64%	(5.10)	***	-0.37%		
	Forecast of Earnings	0.34%	(0.77)		0.73%			-0.83%			-0.91%			0.47%	(1.04)		-2.68%			0.10%			-0.20%			0.69%		
	Analyst recommend.	2.06%	(5.63)	***	2.83%			-0.07%			0.92%			2.06%			2.05%			3.62%			1.71%			-0.70%		
	Capital Structure	0.49%	(2.08)	**	0.65%	(1.61)		1.07%			0.37%	(1.19)		0.45%	(1.80)	*	1.08%			0.28%	(0.87)		0.46%	(1.14)		1.95%		
	Restructuring	1.33%	(8.10)	***	2.51%			-1.09%			1.26%	(7.10)	***	0.79%	(4.27)	***	3.35%	(9.08)	***	-0.07%	-(0.30)		2.61%	(9.60)	***	2.95%		
	General Business	1.21%	(6.38)	***	1.12%	(3.05)	***	0.34%			1.37%	(5.81)	***	1.10%	(5.51)	***	2.31%			0.73%	(2.41)	**	1.39%	(4.31)	***	1.74%	(4.49)	***
	Miscellaneous	0.85%	(2.89)	***	2.60%			0.30%			0.34%	(0.86)		0.85%	(2.76)	***	0.85%			0.92%			0.74%	(1.50)		0.97%		
	TOTAL	1.04%	(11.35)	***	1.64%	(9.61)	***	-0.44%	-(1.73)	*	0.99%	(8.33)	***	0.85%	(8.73)	***	2.33%	(9.09)	***	0.44%	(3.06)	***	1.62%	(11.26)	***	1.36%	(6.33)	***
CAR	TYPE	ALL			GOOD			BAD			NEUTRAL			NEWS			RUMOR			DAY 0			DAY 1			DAY 2		
[1,10]	Actual Earnings	-0.19%	-(0.25)		1.20%	(1.13)		-5.65%	-(3.92)	***	0.84%			-0.37%	-(0.46)		3.51%			0.86%	(0.62)		0.18%	(0.18)		-4.09%		
	Forecast of Earnings	-1.23%	-(0.89)		-0.51%			-2.79%			-4.67%			-1.07%	-(0.76)		-5.01%			-1.81%			2.43%			-6.14%		
	Analyst recommend.	4.44%	(3.85)	***	6.44%			0.59%			-8.43%			4.52%			4.18%			6.46%			4.44%			-2.57%		
	Capital Structure	-0.05%	-(0.06)		-1.42%	-(1.10)		-2.20%			0.81%	(0.83)		-0.13%	-(0.17)		0.97%			-1.73%	-(1.68)	*	1.73%	(1.36)		3.42%		
	Restructuring	0.44%	(0.84)		-2.30%			-6.67%			1.06%	(1.90)	*	0.33%	(0.57)		0.83%	(0.71)		-0.70%	-(0.95)		0.90%	(1.04)		4.86%		
	General Business	1.39%	(2.31)	**	-1.58%	-(1.36)		7.53%			1.66%	(2.22)	**	1.32%	(2.09)	**	2.07%			-1.71%	-(1.79)	*	3.08%	(3.02)	***	4.35%	(3.56)	***
	Miscellaneous	-1.31%	-(1.41)		2.17%			-3.64%			-1.49%	-(1.18)		-0.70%	-(0.72)		-5.20%			-0.14%			-3.43%	-(2.19)	**	1.20%		
	TOTAL	0.37%	(1.28)		0.51%	(0.95)		-2.34%	-(2.90)	***	0.88%	(2.34)	**	0.31%	(0.99)		0.81%	(1.00)		-0.56%	-(1.23)		1.10%	(2.42)	**	1.47%	(2.16)	**
CAR	TYPE	ALL			GOOD			BAD			NEUTRAL			NEWS			RUMOR			DAY 0			DAY 1			DAY 2		
[1,30]	Actual Earnings	-0.53%	-(0.40)		1.42%	(0.77)		-5.01%	-(2.01)	*	-2.74%			-0.59%	-(0.43)		0.65%			2.10%	(0.88)		-0.17%	-(0.10)		-8.86%		
	Forecast of Earnings	-2.13%	-(0.89)		-1.33%			-4.95%			-3.67%			-2.37%	-(0.97)		3.34%			-5.10%			6.71%			-4.29%		
	Analyst recommend.	2.77%	(1.38)		4.69%			-0.37%			-13.01%			3.09%			1.76%			8.76%			0.11%			3.10%		
	Capital Structure	0.71%	(0.54)		0.04%	(0.02)		13.14%			0.05%	(0.03)		0.12%	(0.09)		7.79%			-0.49%	-(0.28)		2.02%	(0.91)		2.99%		
	Restructuring	-1.28%	-(1.42)		-2.22%			-3.54%			-1.07%	-(1.10)		-1.97%	-(1.96)	*	1.25%	(0.62)		-4.30%	-(3.39)	***	1.15%	(0.77)		3.85%		
	General Business	2.11%	(2.03)	**	-0.36%	-(0.18)		9.04%			2.08%	(1.61)		1.61%	(1.47)		7.00%			-1.23%	-(0.74)		3.74%	(2.12)	**	6.36%	(3.00)	***
	Miscellaneous	-5.54%	-(3.43)	***	-0.19%			-15.21%			-1.77%	-(0.81)		-0.85%	-(0.50)		-35.70%			-9.38%			-5.35%	-(1.97)	*	0.34%		
	TOTAL	-0.46%	-(0.92)		0.57%	(0.61)		-3.74%	-(2.68)	***	-0.38%	-(0.59)		-0.38%	-(0.71)		-1.03%	-(0.73)		-1.87%	-(2.40)	**	0.83%	(1.06)		0.81%	(0.69)	

*, **,*** indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively

Table 5. Price continuation and regression analysis. Abnormal returns on day 1 (AR1) are regressed over the following variables: abnormal volume for day 0 and 1 (NAV0 and NAV1), abnormal returns on day 0 (AR0), natural logarithm of trading volume (LnTV), beta coefficient (beta), market to book (MtB), natural logarithm of market capitalization (LnCap), news disclosed in the interval [0, +2] (D_N0, D_N1 and D_N2), a dummy variable for financial firms (D_Fin), a dummy variable for firms with the State as first shareholder (D_State), ownership/control ratio (O/C), and dummy variables for years 1997-2002 (D_97 - D_02). Adj R indicates the adjusted R square, F the F-statistic and N the number of observations. The t-test value is in brackets.

	C	NAV 0	NAV 1	AR 0	LnTV	Beta	MtB	LnCap	D_N0	D_N1	D_N2	D_Fin	D_State	OC	D_97	D_98	D_99	D_00	D_01	D_02	Adj R	F	N
1	0.01	0.00																			0.000	0.05	3,062
	(2.50) **	(0.23)																					
2	0.01		0.00																		0.020	62.49	3,062
	(11.52) *** ***		(7.90) ***																				
3	0.01			0.07																	0.012	36.34	3,062
	(11.09) *** ***			(6.03) ***																			
4	0.02				0.00																0.007	21.77	3,062
	(8.76) *** ***				-(4.67) ***																		
5	0.01					0.00															0.000	0.82	3,003
	(5.87) *** ***					(0.90)																	
6	0.01						0.00														0.000	0.75	3,062
	(13.88) *** ***						(0.86)																
7	0.02							0.00													0.007	21.48	3,062
	(9.11) *** ***							-(4.63) ***															
8	0.01								-0.01												0.002	4.75	3,062
	(14.46) *** ***								-(2.18) **														
9	0.01									0.01											0.002	4.76	3,062
	(13.35) *** ***									(2.18) **													
10	0.01										0.01										0.001	2.42	3,062
	(14.00) *** ***										(1.56)												
11	0.01											0.00									0.001	2.49	2,009
	(7.29) *** ***											-(1.58)											
12	0.01												-0.01								0.001	2.30	2,009
	(11.27) *** ***												-(1.52)										
13	0.01													-0.01							0.001	1.69	2,009
	(4.19) *** ***													-(1.30)									
14	0.01		0.00	0.09		0.00	0.00	0.00	-0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.054	7.63	3,054
	(2.28) **		(5.47) ***	(5.25) ***		- (0.30)	(1.09)	-(3.59) ***	-(2.68) ***	(2.38) **	(2.17) **	-(1.41)	-(0.32)	(0.69)	(2.08) **	(4.26) ***	(2.68) ***	(1.84) *	-(0.06)	(1.06)			
15	0.01		0.00	0.06		0.00		0.00	0.00	0.01					0.01	0.01	0.01	0.01	0.00	0.00	0.045	12.77	3,000
	(3.74) ***		(7.54) ***	(4.66) ***		(1.38)		-(4.21) ***	-(1.84) *	(2.47) **					(2.50) **	(4.24) ***	(2.39) **	(2.55) **	(0.01)	(0.59)			
16	0.01		0.00	0.06		0.00	0.00	0.00	0.00	0.01	0.01				0.01	0.01	0.01	0.01	0.00	0.00	0.045	11.19	3,057
	(3.70) ***		(7.53) ***	(4.62) ***		(1.31)	(1.10)	-(4.31) ***	-(1.75) *	(2.55) **	(1.49)				(2.49) **	(4.28) ***	(2.39) **	(2.57) **	(0.04)	(0.67)			
17	0.01		0.00	0.09	0.00	0.00	0.00		-0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.057	7.95	3,000
	(2.58) **		(5.43) ***	(5.20) ***	-(4.24) ***	(0.67)	(1.07)		-(2.63) ***	(2.48) **	(2.19) **	-(1.35)	-(0.22)	(0.73)	(2.30) **	(4.30) ***	(2.61) ***	(1.74) *	-(0.07)	(1.19)			
18	(0.01)		(0.00)	(0.06)	(0.00)	(0.00)	(0.00)		(0.00)	(0.01)	(0.01)				(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	0.047	11.47	3,000
	(4.04) ***		(7.50) ***	(4.59) ***	-(4.71) ***	(2.24) **	(1.14)		-(1.63)	(2.64) ***	(1.53)				(2.61) ***	(4.25) ***	(2.26) **	(2.41) **	(0.00)	(0.80)			

*, **,*** indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively

Table 6. Portfolio strategies. Some portfolio strategies based on abnormal volumes are here considered. All the strategies consist in buying (long portfolios) or selling (short portfolios) at the end of the event day (at closing price), closing the position after a predetermined period (date of selling). 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. The level of significance is obtained with a Monte Carlo simulation, randomly replicating each portfolio 10.000 times.

PORTFOLIO STRATEGY												
	Date of		AR0's	Number of	Number of securities	Daily Return				Yearly Return		
Portfolio	Purchase	Selling	Cutoff	Transactions	(average)	Row	Mkt Adj		Net	Row	Mkt Adj	Net
Portfolio 1												
Whole Portfolio	0	+1	-	6,706	1.61	0.97	0.96	***	0.56	37.99	37.68	29.52
Portfolio 2												
Long Portfolio	0	+1	+1%	4,334	1.04	1.39	1.34	***	0.94	40.10	39.49	33.91
Short Portfolio	0	+1	-1%	1,274	0.31	0.13	0.08		-0.32	6.30	4.10	-14.93
Whole Portfolio				5,608	1.35	0.85	0.80		0.44	38.52	37.51	28.56
Portfolio 3												
Long Portfolio	0	+1	+3%	2,952	0.71	1.64	1.58	***	1.18	39.40	38.83	34.27
Short Portfolio	0	+1	-3%	628	0.15	0.65	0.56	***	0.16	13.49	12.10	4.48
Whole Portfolio				3,580	0.86	1.25	1.18		0.81	39.60	38.72	32.86
Portfolio 4												
Long Portfolio	0	+1	+5%	1,686	0.41	2.07	1.98	***	1.58	36.92	36.26	32.82
Short Portfolio	0	+1	-5%	336	0.08	1.04	1.11	***	0.71	12.14	12.65	9.16
Whole Portfolio				2,022	0.49	1.69	1.63		1.25	37.41	36.89	32.83
Portfolio 5												
Long Portfolio	0	+1	+3%	2,952	0.71	1.64	1.58	***	1.18	39.40	38.83	34.27
Short Portfolio	0	+5	-3%	628	0.75	0.24	0.23		-0.17	15.84	15.46	-13.26
Whole Portfolio				3,580	1.46	0.68	0.65		0.29	37.70	36.84	25.17
Portfolio 6												
Long Portfolio	0	+1	+1%	4,334	1.04	1.39	1.34	***	0.94	40.10	39.49	33.91
Short Portfolio	0	+5	-3%	628	0.75	0.24	0.23		-0.17	15.84	15.46	-13.26
Whole Portfolio				4,962	1.80	0.64	0.61		0.25	38.44	37.64	24.90

*, **,*** indicate that the coefficients are significantly different from zero at the 1%, 5% and 10% levels respectively

[1] Liquidity needs is generally another possible reason for trading, but, since the subject of investigation is abnormal changes in volume activity, I tend to exclude it as a possible explanation.
[2]Consob (the Italian regulator) reports that in the 1991-2002 period there was a record of nine plea bargains and five convictions.
[3]See HIRSHLEIFER and TEOH (2003) for an excellent review.
[4]In Italy, before 2004, sophisticated investors could only be aware of the identity of the intermediary, not of the name of trader. Since 2004, trades are completely anonymous.
[5]Datastream does not directly provide the turnover ratio or indirectly the number of shares publicly traded.
[6] A similar approach is used in Pritamani and Subgal (2001) for detecting large price changes.
[7] Computed as the natural logarithm of volume + 1.
[8]Infrequently traded stocks have a large proportion of days with zero trading volume.
[9]Returns are computed as the natural logarithm of the ratio between prices on two consecutive days. To represent daily prices, I use the closing average price, computed as the average of the last 10% of daily trading.
[10]The Dimson beta estimates for each firm are obtained by summing the slope coefficients on a number of lagged and leading, together with simultaneous returns on a market index (RM). In this paper, I used as lead and lead factor two weeks. The regression used for stock i is the following:

$$R_i = \alpha_i + \sum_{k=-2}^{2} \beta_{i,k} R_{M,i+k}$$

This approach also allows for the spill over effect created by non-trading.
[11]There is not a specific motivation for this cut-off, but some sensitivity tests have been carried out in order to choose an appropriate level. With a 0.1 cut-off, the average (along the whole period and cross sample) beta is 0.87; with our cut-off, 0.96. This figure can be considered close enough to one, representative of the market's beta.
[12] As discussed earlier, the empirical distribution of NAV shows fat tails and consequently 1% of upper values corresponds to a level of NAV equal to 2.79 (instead of 2.33 as a normal distribution). However, the choice of the NAV cut-off between the two levels (2.33 and 2.79) does not affect the results.
[13] Although the events in the two samples are different in number and, probably, in composition, the results are notably similar, evidencing that the findings are not specific to the methodology used.
[14]0.88%, 2.48% and 1.02% abnormal returns are respectively on day -1, 0 and +1.
[15] PRITAMANI et al (2001) document an abnormal return for the next to the event day equal to +0.25% (-0.29%) for the sample of positive (negative) large changes in prices.
[16]While the first proxy can be considered as perfectly objective, the second is result of a subjective judgement by the author. Past information, quotes, cases of homonymy, accidental indication of the company's name are some examples of irrelevant information.
[17] Proxies count eventual articles published during the weekend, if this falls within the window period.
[18] Media coverage and company size are intuitively positively correlated variables.
[19] Several theoretical models of trading [HARRIS and RAVIV (1993); KIM and VERRECCHIA (1994)] show that volume captures the level of precision of a signal.
[20] 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).
[21]Size is highly correlated to the natural logarithm of historical trading volume, as can be easily noted in the univariate analysis. As a consequence, excess returns are also negatively correlated to liquidity.
[22]Differently from the US and the UK, Italian groups are often controlled through pyramidal structures that allow the majority shareholder to obtain safe control with low invested capital.
[23]For instance, suppose that the equity structure of company B and company C is equally split between voting and non voting shares. Suppose that company A controls B and B controls C with 50% of voting shares. Company A would have safe control over company C (50% of votes), but only with 25% * 25% = 6,25% of cash flow rights. The OC variable would be equal to 6,25%/50% =0.125
[24]As transaction costs, I consider only a 0.2% commission requested by the intermediary. I do not take into consideration bid-ask spread costs.
[25]In other words, buying all the stocks with $NAV > 2.33$, including those with negative returns probably carrying bad news, ignoring therefore the possible information coming from the sign of the abnormal return.
[26]Yearly returns are obtained with a geometric mean of the final value of the portfolio.