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Convergence to market efficiency of top gainers

Yong-Chern Su [a], Han-Ching Huang [b,*], Ming-Wei Hsu [a]

[a] Department of Finance, National Taiwan University, No. 1, Sec, 4, Roosevelt Road, Taipei City 10617, Taiwan, ROC
[b] Department of Finance, Chung Yuan Christian University, No. 200, Chung Pei Road, Chung Li City, Taoyuan County 32023, Taiwan, ROC

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ABSTRACT

This study investigates the convergence process toward efficiency of daily top gainers. The convergence process toward efficiency is much clearer as a result of using a GARCH(1, 1) model compared to the OLS model, and exhibits a monotonic decline as the time interval increases. The relationship between volatility and order imbalances is, however, not strong enough, suggesting that market makers do have the capability to reduce price volatility. This study develops an imbalance-based trading strategy, which earns a positive profit but fails to outperform the buy-and-hold strategy (i.e., open-to-close returns). A nested causality approach, which examines the dynamic return–order imbalance relationship during the price-formation process, confirms the results.

1. Introduction

The concept of market efficiency was both developed and refined by Fama (1970), who defines "efficient" as any market in which prices always "fully reflect" available information. In an efficient market, nobody can earn abnormal returns based on any trading strategy since the relevant information will, as soon as it is revealed, be impounded into stock prices by rational investors.

While the majority of financial research assumes a broad rationality, many recent studies highlight market anomalies and the link between psychology and behavioral finance, e.g., the January effect, the weekend effect, the small firm effect, and the momentum effect (Durham, 2001; Rachev et al., 2007; Huang and Wang, 2009).

The irrationalities of individual investors seem to move the stock prices away from the fundamental values, making the stock market less efficient. However, professionals and money managers seldom beat passive investment strategies. To some extent, this means that the market is efficient enough. Although these phenomena appear to be self-contradictory, many researchers translate this feature as "aggregation." All investors, as they gather together and engage in diversified investment behavior, push the market toward efficiency.[1]

It needs, however, to be asked how the market converges to efficiency? A good example is that of Chordia et al. (2005) who interpreted convergence based on individual actions. First, order imbalances arise from traders who demand immediacy for liquidity or informational needs. These order imbalances are positively auto-correlated, suggesting that traders are either herding or spreading their orders out over time, or both. Second, NYSE specialists react to initial order imbalances by altering quotes away from the fundamental value in an effort to control inventory. Finally, outside arbitragers intervene to add market-making capacity by performing countervailing trades in the opposite direction. This arbitrage activity takes at least a few minutes since arbitragers must ascertain whether or not there is new relevant information regarding values. Chordia et al. (2005) indicate that efficiency does not happen immediately, and they examine the process in which markets converge to efficiency based on the data of large NYSE firms. They declare that order imbalances are highly positively dependent over both short and long intervals, and that these imbalances predict future returns only over very short intervals.

* Corresponding author. Tel.: +886 3 265 5710; fax: +886 3 265 5749.
E-mail addresses: ycsu@ntu.edu.tw (Y.-C. Su), samprass@cycu.edu.tw (H.-C. Huang), r95723055@ntu.edu.tw (M.-W. Hsu).

[1] In addition, Aktas et al. (2008) use data on 59,244 aggregated daily insider trades and find the significant change in price sensitivity to relative order imbalance due to abnormal insider trades, which implying that legal insider trading contribute to market efficiency.

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They find that it takes more than 5 min but less than 60 min[2] for the market to achieve weak-form efficiency.[3]

In contrast to Chordia et al. (2005), we narrow the range of our study to daily top gainers. Top gainers play an important role in market efficiency because of information diffusion.[4] Usually these stocks provide extremely valuable information to the general public. We use intra-day data to examine not only the impact of discretionary traders on returns but also the impact of discretionary traders on volatility and especially the according responses from uninformed market makers who have the responsibility to reduce volatility.

We are interested in the process by which the news is incorporated into stock prices. We use order imbalances as an indicator of the price movements. Chordia and Subrahmanyam (2004) document the market order imbalance, defined as aggregated daily market purchase orders less sell orders for stocks, as being highly predictable from 1 day to the next while returns are independent. They find that price pressures caused by auto-correlated imbalances give rise to a positive relationship between lagged imbalances and returns. Under different time intervals, we examine the predictive and explanatory ability of imbalances on returns and explore the convergence process of top gainers. Su and Huang (2008) investigate the intra-day behavior of NASDAQ speculative top gainers in examining the relationship between returns and order imbalances in light of extraordinary events and conclude that order imbalances convey more information than trading volume. Besides, they observe a negative relationship between firm size and order imbalances, i.e., order imbalances serve as a better return predictor in the small trading volume quartile. In this paper, we investigate how long it takes for the stock price of the daily top gainers to reach market efficiency. Finally, we try to develop a trading strategy based on the return–order imbalance relationship. Several hypotheses have been established in order to examine whether the strategy earn a positive return and beat the original open-to-close return, and whether time intervals matter.

We have several marginal contributions besides Chordia et al. (2005). First of all, we argue that the direct relationship between order imbalances and returns should consider the linkage with volatility. Secondly, market maker behavior plays a very important role in mitigating volatility from discretionary trades through inventory adjustments. Finally, we investigate the nested causality between order imbalances and returns as we explore the intra-day dynamics that is essential in convergence process.

The remainder of this paper is organized as follows. Section 2 describes the data and methodology. Section 3 presents the empirical results, and Section 4 concludes.

2. Data and methodology

We obtain our sample from the Center for Research in Security Prices (CRSP) database. Our sample covers the period from July 1, 2006 through December 31, 2006. A top gainer, defined as the stock with the highest daily open-to-close return, has been selected. For each top gainer, we obtain the intra-day trading data from the Trade and Automated Quotations (TAQ) database. The intra-day data include not only trade prices and volume, but also bid and ask quotes. To be included in our sample, a top gainer must meet the following criteria:

1. The firm shall be covered by both the CRSP and the TAQ.
2. The daily trading volume is above 200,000 shares for the trading to be sufficiently frequent and liquid.
3. If there are any stock splits, reverse splits, stock dividends, repurchases or a secondary offering, the firm will be deleted from our sample.
4. The quotes with an abnormally large bid–ask spread or a negative bid–ask spread will be dropped.

Every transaction is assigned using the Lee and Ready (1991) trade assignment algorithm[5] to estimate whether it is buyer-initiated or seller-initiated. Any quote less than 5 s prior to the trade is ignored and the first one at least 5 s prior to the trade is retained. A trade is classified as buyer- (seller) initiated if it is closer to the ask (bid) price of the prevailing quote. If the trade is exactly at the midpoint of the quote, a "tick test" is used whereby the trade is classified as buyer- (seller) initiated if the last price change prior to the trade is positive (negative).

Since we are particularly interested in the convergence process of top gainers, we cumulate order imbalances and returns under three different time intervals: 5, 10, and 15 min. After processing the data, 56 firms remain in our sample. The untabulated results indicate that the average open-to-close return of our sample is 49.022%, with a median of 41.852%. Besides, the average market capitalization of the sample is $103.541 million, with a median of $35.685 million. We also find that the capitalization of the top gainers is quite small.

Under three different time intervals (5, 10, and 15 min), we regress five lags of imbalances on daily open-to-close returns for each top gainer. We expect to find a significantly negative relationship between current returns and lagged order imbalances, which could let us develop an imbalance-based trading strategy to earn excess returns for top gainers. We also regress the contemporaneous and four-lag order imbalances on daily open-to-close returns to explore the conditional return–order imbalance relationship. Moreover, in order to make sure that the return–order imbalance relationship does not arise because of volatility, we check the relationship between volatility and order imbalances.

We use the GARCH(1, 1) model to examine the dynamic relationship between returns and order imbalances for the three different time intervals:

$$\begin{aligned} R_t &= \alpha + \beta * \mathrm{OI}_t + \varepsilon_t, \\ \varepsilon_t|\Omega_{t-1} &\sim N(0, h_t), \\ H_t &= A + Bh_{t-1} + C\varepsilon^2_{t-1}, \end{aligned} \tag{1}$$

where R_t is the return in period t, and is defined as $\ln(P_t/P_{t-1})$, OI_t is the order imbalance, β is the coefficient describing the impact of the order imbalance on stock returns, ε_t is the residual value of the stock return in period t and Ω_{t-1} is the information set in period $t-1$.

Furthermore, we monitor how long it takes for the market to achieve efficiency. Whether or not a large order imbalance has an impact on volatility among top gainers is under investigation. Since we are interested in the relationship between volatility and order imbalance, a GARCH(1, 1) model is used:

[2] Visaltanachoti and Yang (2010) find that, on average, it takes 30–60 min for a foreign stock listed on the NYSE to achieve market efficiency. For a comparable US stock, it takes only 10–15 min.

[3] Chordia et al. (2005) report that there is little evidence of unconditional serial dependence on returns since no t-statistic exceeds 2.0 in absolute value and 13 of the 15 t-statistics are less than 1.0 in absolute value. This suggests that these stocks conform well to weak-form efficiency; that is to say, using only the past history of returns, there is little, if any, predictability of future returns even over intervals as short as 5 min.

[4] Under the Chordia and Subrahmanyam (2004) theoretical framework, the information diffusion is from informed traders, such as discretionary investors, to uninformed ones, instead of being from specific firms to other firms. Therefore, there will be still information diffusion occurring as the news is mainly relevant to the specific firm.

[5] For classifying ECN (Electronic Communications Network) trades, Chakrabarty et al. (2007) propose an alternative algorithm that performs better than the current trade classification rules, especially for trades inside the quotes.