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# Volume shocks and stock returns: An alternative test

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# Volume shocks and stock returns: An alternative test

Abstract

Using an alternative measure for abnormal trading volume, this article examines the role of volume shock in the generation of stock returns. We find a strong high volume effect at both portfolio and individual stock levels. A strategy that buys stocks experiencing high volume shocks and sells stocks experiencing low volume shocks generates positive returns up to 12 months after formation. The effect is robust after controlling for other stock characteristics that are known to affect stock returns. Our results show that trading volume becomes relatively higher after high volume shocks. Moreover, the relation between volume shocks and stock returns is stronger for stocks that previously failed to catch investors' attention. This finding is consistent with the view that abnormal trading volume proxies for unobserved attention-grabbing events. However, we find no evidence that volume shocks are priced.

JEL Classification: G12

Keywords: Trading volume, volume shocks, asset pricing, attention

## 1. Introduction

The relation between trading volume and price movements has long been the subject of academic study, resulting in a voluminous literature. Early studies focus on the contemporaneous relation between trading volume and price changes and find that trading volume is positively related with the absolute value of price changes (e.g., Karpoff, 1986; Gallant, Rossi, and Tauchen, 1992; Blume, Easley, and O'Hara, 1994). More recent studies focus on whether there exists a relation between trading volume and expected returns. The seminal work of Gervais, Kaniel, and Mingelgrin (2001) documents that stocks with an unusually high trading volume over a day or a week (compared with their own trading volumes in the prior 50 days or 10 weeks) have higher subsequent returns than stocks with an unusually low trading volume. This finding results in a high volume return premium implying that abnormal trading volume contains information about future price movements. Gervais et al. (2001) interpret the high volume return premium following the investor recognition hypothesis originated by Miller (1977).

Abnormal trading volume can be driven by factors such as hedging, overconfidence, differences of opinion, liquidity, and the portfolio rebalancing needs of investors. However, Chuang and Lee (2006) and Hong and Stein (2007) argue that hedging, liquidity, and portfolio rebalancing needs are too small to account for the large trading activity observed in the markets. Thus, abnormal trading volume is more likely attributable to the result of differences of opinion or overconfidence (Glaser and Weber, 2007; 2009). However, each explanation results in a different relation between volume shocks and subsequent stock returns. According to Gervais et al. (2001), a high volume shock induced by a high level of differences of opinion causes a stock to have higher subsequent returns after increased visibility.[1] The high volume shock therefore acts as an attention-grabbing event that draws investors' attention to the stock (Miller, 1977). This view is also in line with recent emerging literature on investor attention and asset pricing dynamics (e.g., Hirshleifer and Teoh, 2003; Sims, 2003; Peng and Xiong, 2006; Hou, Peng, and Xiong, 2008) that uses trading volume as a proxy for investor attention. Conversely, as documented by Odean (1998), a high volume

[1] Merton (1987), under the assumption of incomplete information, argues that an increase in the relative size of a firm's investor base (more visible) will reduce the firm's cost of capital and, consequently, lead to a higher market value. The literature refers to this phenomenon as the investor recognition hypothesis. Miller (1977) posits that differences of opinion and short-sale constraints are preconditions for the visibility hypothesis. These arguments lead to a similar conclusion: An increase in a stock's visibility results in higher stock prices.

shock induced by overconfidence will lead to inferior subsequent returns as a result of excessive trading on risky securities.

Empirically, the positive relation between volume shocks and stock returns has also been found in a number of studies (e.g., Watkins, 2006; Barber and Odean, 2008; Huang and Heian, 2010; Kaniel, Ozoguz, and Starks, 2012). In markets outside the US, however, the findings are mixed. Kaniel et al. (2012), using the same method as Gervais et al. (2001) to define volume shocks, find that the relation is most pronounced in developed markets compared to emerging markets. Emerging markets exhibit weaker and inconsistent high volume premiums. Similar findings have also been documented by Huang, Heian, and Zhang (2011), who find no evidence of high volume premiums (except for large firms in some countries) in six Asian markets, including Japan. The authors attribute this finding to the structural difference between US and Asian markets. Specifically, compared to Western financial markets, Asian markets are mostly dominated by individual investors who are believed to be less rational and to exhibit greater overconfidence and cognitive bias (Kim and Nofsinger, 2003; Kaniel, Saar, and Titman, 2008). The inconsistency highlights that the role of volume shocks in stock returns is an empirical question and calls for further investigation for reasons put forward by Lo and MacKinlay (1990). The relation depends on what drives volume shocks and the extent of volume shocks presented in the market. The latter is strongly affected by the structure of the market.

This paper attempts to provide further evidence on the relation between volume shocks and stock returns using data from the Australian equities market. The paper makes the following contributions to the literature. First, we propose a measure of volume shocks in the spirit of Chen, Hong, and Stein (2001) and Bali, Peng, Shen, and Tang (2014). Specifically, trading volume in month $t$ is classified as abnormally high if it is higher than the average trading volume of the prior $n$ months. The difference is then scaled by the volatility of the trading volume over the prior $n$-month period.[2] The advantage of using this measure is twofold. First, monthly trading volume is relatively easy to obtain compared to daily trading volume, especially in markets outside the US. It is also less noisy than daily or weekly data. This enables us to capture month-by-month variations in the volume of stocks and allows for

[2] Prior studies use different measures of abnormal trading volume. For example, Gervais et al. (2001) and Kaniel et al. (2012) define a stock as having extreme trading volume if the stock's trading volume for day $t$ is among the top or bottom 20% of the volume distribution in the (prior) 49-day estimation window. Lee and Swaminathan (2000), Watkins (2006), and Huang and Heian (2010) use the percentage change in trading volume to identify stocks with abnormal volume.

the examination of the volume shock effect across a large number of stocks over a long period. Second, we aim to examine the longevity of the high volume effect, and monthly trading volume is also consistent with the frequency of the number of shares outstanding data available in this market. This approach allows us to conduct formal asset pricing tests on the role of volume shocks in the generation of stock returns.

Second, Kaniel et al. (2012) point out that the volume shock effect is related to a market's composition, investor demographics and confidence, and the extent of information dissemination. The Australian market is one of the developed capital markets and the second largest in Asia-Pacific based on free-float market capitalization. Similar to the US, the market is dominated by institutional investors. However, its composition is heavily skewed toward a large proportion of small and illiquid stocks, which are outside the investment universe of institutional investors. As of December 2013, over 70% of stocks in our sample were priced below AU$1, which is below the minimum price listing requirement for Nasdaq. Dyl, Elliott, and Handley (2002), using Australian data, find that small and less well-known firms appear to attempt to increase their investor bases by having low stock prices, whereas large and more visible firms tend to have high stock prices. The market therefore has a small group of stocks that are well known to investors and a large group of stocks that are neglected by market participants, providing an interesting setting for studying the role of volume shocks in stock returns.[3]

Third, recent studies show that institutional and individual investors respond differently to return changes (e.g., Barber and Odean, 2008; Li, Wang, and Rhee, 2016) and the return-volume relation is found to be stronger when there is an increase in institutional ownership (Huang et al., 2011). Limited by data availability, prior studies either focus on a specific group of institutional investors, such as mutual funds, or rely on annual or quarterly institutional holdings, which may not fully reflect the dynamic trading of institutional investors. Using the monthly data of institutional holdings available in the Australian market,

[3] Australian evidence on high volume return premiums is documented by Kaniel et al. (2012), Tang, Zou, and Li (2013), and Gordon, Watts and Wu (2014). These studies' methods closely follow those of Gervais et al. (2001). However, the findings are mixed. Kaniel et al. (2012) find significant high volume return premiums over a 20-day holding period. However, their sample comprises only 193 stocks (out of an average of 1200 listed stocks in Australia). Tang et al. (2013) show weak evidence of high volume return premiums only in large stocks over a short horizon. Gordon et al. (2014) find supporting evidence only when the portfolios are equal-weighted, suggesting that the effect is only present in smaller firms.

we further address how institutional trading affects the relation between equity returns and trading volume.

We find a strong relation between volume shocks and stock returns at both portfolio and individual stock levels. A strategy that buys stocks with high volume shocks and sells stocks with low volume shocks generates a risk-adjusted return exceeding 6% in the year after portfolio formation. However, the magnitude of the returns declines as the holding periods are extended. This finding is consistent with the view that attracted attention wears off over time (Barber and Odean, 2008), causing a decline in returns. At the individual stock level of analysis, the volume shock effect persists, even after controlling for other stock characteristics such as size, book-to-market, momentum, share turnover, idiosyncratic volatility, short-term reversals, beta, and demand for extreme positive returns. This implies that none of these firm characteristics, which are known to be important in explaining the cross-section of stock returns, account for the volume shock effect. Our results are also robust when we control for seasonality and price-sensitive announcements and are comparable across subperiods.

The evidence confirms the predictability of trading volume on future returns. Barber and Odean (2008) argue that investors purchase only stocks that have caught their attention and an increase in investor attention leads to temporary positive price pressure. In other words, potential investors have to be aware of a firm before they can become familiar with it and eventually decide to invest in it, implying that attention is a necessary condition for a firm to be publicly recognized. Accordingly, our evidence is in line with the notion that high volume shocks attract investor attention and subsequently increase a stock's visibility, which lends credence to the investor recognition hypothesis.[4] We provide a number of tests to support this view.

An important methodological concern is to what extent trading volume proxies for stocks' visibility.[5] If a high volume shock attracts investor attention and subsequently

[4] As pointed out earlier, high volume shocks can be driven by investor overconfidence. However, the positive returns after volume shocks do not support this explanation in our sample. Further, our test rules out this possibility. We discuss this further in Section 4.

[5] Empirically, abnormal trading volume has been used as a proxy for an unobserved attention-grabbing event. Miller (1977) points out that if trading volume does attract attention and makes a stock more visible, some investors are likely to persuade themselves that the stock should be bought. Bank, Larch, and Peter (2011) show that Internet search traffic, which is a popular proxy for investor attention, is closely related to trading activity, such as trading volume. This argument supports the use of trading activity in measuring attention.

increases a stock's visibility, we should observe an increase in trading volume after the shock. Empirically, we find increased trading volumes after high volume shocks relative to prior trading volumes. This is particularly the case for stocks that were previously less visible in the market. These findings are consistent with the view that high volume shocks increase the probability of an investor investigating a stock (Miller, 1997) and are a suitable proxy for the unobserved attention-grabbing event.

In the absence of investor attention, stock prices underreact to public information about firm fundamentals.[6] If high-volume shocks do attract investor attention, the effect should be stronger in stocks that were previously less known to investors. Merton (1987) points out that firms with less or no coverage by institutional investors and professional analysts are less visible to investors. In line with this view, Barber and Odean (2008) argue that attention is not as scarce a resource for institutional investors as it is for individuals. Dyl and Elliot (2006) find that small and less well-known firms appear to attempt to increase their investor bases by having low stock prices. Less visible firms should also have relatively lower trading activities. In this paper, we use the proportion of institutional ownership, stock prices, firm size, and past share turnover as indicators of a stock's visibility.[7] We find that the volume shock effect is stronger for stocks with low share prices and small market capitalization, and with a low level of institutional ownership and past share turnover. The effect also vanishes quickly in stocks that were previously more visible to investors. This result is expected, since the effect of a high volume shock due to attention should be marginal for stocks that already have high visibility.

We further categorize stocks experiencing a high volume shock based on changes in their institutional ownership. Huang et al. (2011) argue that high volume shocks accompanied by increased institutional ownership are more likely attributable to increased recognition,

[6] A number of studies document that market underreaction is associated with investor inattention. For example, Hirshleifer, Lim, and Teoh (2009) find that when there are more firms reporting earnings on the same day, the immediate price reaction to a firm's own earnings surprise is weaker and post-earnings announcement drift is stronger. DellaVigna and Pollet (2009) and Hou et al. (2008) document similar results when announcements are made on Fridays and in down markets. Hou et al. (2008) further show that stocks with higher trading volume (i.e., more attention) experience smaller post-earnings-announcement drift. Similarly, Loh (2010) finds that stocks with higher trading volume react more to stocks recommendations during the announcement and experience smaller subsequent price drift. Using internet search volume and information acquisition via EDGAR (Electronic Data Gathering, Analysis, and Retrieval) as proxies for investor attention, Drake, Roulstone, and Thornock (2012, 2015) find that high attention is negatively associated with post earnings announcement drift.

[7] We suggest that these visibility measures are passive indicators of investor attention because the high visibility of stocks does not necessarily mean that they yield more attention-grabbing events. Volume shocks, however, capture investor attention in a timelier fashion.

resulting in stronger high volume return premiums than otherwise. However, we argue that changes in the percentage of individual investors' holdings of a stock are also indicative of investor recognition. First, institutional investors have an information advantage and are able to access large databases consisting of nearly the whole universe of publicly traded companies. Second, Merton's (1987) model assumes that individual investors consider only stocks they know before investing and does not explicitly recognize institutional investors. In a similar vein, Barber and Odean (2008) argue that individual investors are net buyers of stocks that draw their attention. Accordingly, if a high volume shock does increase a stock's attention and the stock subsequently becomes more recognized, then higher returns should logically present, irrespective of which group of investors is buying. This should particularly be the case for stocks where attention matters the most. Our empirical results confirm this conjecture. High volume shock premiums are present for both the largest and smallest increases in institutional ownership, particularly among stocks that were previously less recognized.

Given the strong evidence supporting the existence of the volume shock effect, a natural question is whether the volume-shock effect is priced. To explore whether volume shock proxies for sensitivity to a priced risk factor, we construct a volume shock mimicking portfolio. Using both portfolio sorts and cross-sectional regressions, we find no evidence that stock-level sensitivities to the volume shock factor, obtained by running time-series regressions, are related to future stock returns. This result suggests that the volume shock effect is not related to the underlying economic source of risk.

The remainder of this study is organized as follows. Section 2 describes the data and the research design. Section 3 reports the main findings. Section 4 explores the underlying causes of the volume shock return premium. Section 5 examines whether volume shock is a priced factor. Finally, Section 6 concludes the paper.

## 2. Data and methods

### *2.1 Data*

The analysis in this study is conducted at the monthly level, from 1992 to 2013. The data are obtained from four sources. Monthly stock information is obtained from the Share Price and Price Relative (SPPR) file from the Securities Industry Research Centre of Asia-Pacific

(SIRCA). We obtain monthly stock returns, closing prices, number of shares outstanding, market capitalization, share types, return on the value-weighted market index (as a proxy for the market portfolios), and returns on the 13-week Treasury note to proxy for the risk-free rate. We then obtain daily share price information from SIRCA's Core Research Data (CRD) database. The daily data is used to calculate share turnover and control variables such as idiosyncratic volatility. The institutional holding data is sourced from the Clearing House Electronic Subregister System (CHESS). The CHESS data set is confidential and released only in very restricted form, where the information of any investor is not revealed.[8] We identify institutional investors based on their types[9] and aggregate the total holdings for each stock in our sample. Finally, we obtain the accounting data required to calculate the Fama-French factors from the Morningstar Aspect Huntley database. Only ordinary stocks are included in our sample.

*2.2 Methods*

In this study, we measure volume shocks at the monthly level, in the spirit of Chen et al. (2001) and Bali et al. (2014), as follows:

$$VOSHOCK_{i,t} = {VO_{i,t} - AVGVO_{i|t-12,t-1}} \Big/ {SDVO_{i|t-12,t-1}} \quad (1)$$

where $VO_{i,t}$ is the volume traded for stock $i$ in month $t$ divided by the number of shares outstanding; $AVGVO_{i|t-12,t-1}$ and $SDVO_{i|t-12,t-1}$ are the mean and standard deviation, respectively, of the volume traded divided by the number of shares outstanding for stock $i$ over the past 12 months.[10] The standardization process makes the volume shock measure

[8] The released CHESS shareholding data is aggregated to major groups of institutional investors such as banks, insurance, and superannuation funds in order to protect the privacy of market participants. The proposed access to the CHESS database must be designed to maintain the privacy of market participants, which is in line with the Australian Securities Exchange (ASX) standards and legislation. Before any data is released, ASX implements three tests: (1) threshold test, (2) dominance test, and (3) activity test. The three tests are implemented to ensure that no single observation accounts for more than 50% of the value for each data point in each data category. If any of the tests fails, the data for the particular company will be filtered out. Only after all the tests are passed, ASX releases the requested data to researchers.

[9] The following groups from CHESS are identified as institutional investors: domestic banks, domestic other deposit-taking institutions, domestic nominees, domestic insurance, domestic superannuation funds, domestic government, domestic incorporated companies, foreign banks, foreign other deposit-taking institutions, foreign nominees, foreign insurance, foreign superannuation funds, foreign government funds, foreign government and foreign incorporated companies.

[10] We calculated volume shocks relative to the past 3, 6 and 9 months as a robustness check. Our results remain qualitatively similar and are available upon request.

comparable across firms as well as across time.[11] A stock with an increase (decrease) in volume relative to its past 12-month average is regarded as having a positive (negative) volume shock.

We use both portfolio sorts and regressions in the main empirical analysis. We begin our empirical analysis with univariate portfolio sorts. For each month, stocks are ranked according to VOSHOCK and then divided into 10 portfolios. Decile 1 contains stocks with the lowest (negative) volume shocks and decile 10 contains stocks with the highest (positive) volume shocks. Once stocks are sorted into portfolios, monthly portfolio returns over the next $K$ months ($K$ = 1, 3, 6, 12) are calculated. Following the conventional method widely used in the asset pricing literature (e.g., Jegadeesh and Titman, 1993), we form portfolios on a monthly basis and thus have overlapping holding periods. We report both equal- and value-weighted portfolio returns. The equal-weighted approach demonstrates the average effect, whereas the value-weighted approach addresses concerns associated with small firm effects such as tradability, liquidity, and bid-ask bounces. The return difference between the high- and low-volume portfolios represents the return premium associated with volume shocks. To ensure that our results are not affected by extreme values, we also estimate the return difference between the averages of the two lowest and two highest volume shock portfolios. The significance of the portfolio returns is examined using a $t$-statistic adjusted for heteroskedasticity and autocorrelation (HAC) errors.

We use Carhart's (1997) four-factor model augmented with a liquidity factor to calculate the risk-adjusted returns. Specifically, we run the following time-series regression:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p MKT_t + s_p SMB_t + h_p HML_t + u_p WML_t + l_p LIQ_t + \varepsilon_{p,t} \qquad (1)$$

where $R_{p,t}$ is the return for portfolio $p$ in month $t$; $R_{f,t}$ is the risk-free rate in month $t$; MKT is the market excess return; SMB, HML, WML and LIQ are the factor-mimicking portfolios for size, book-to-market, momentum, and liquidity, respectively. The SMB and HML factors are constructed as follows. Since the Australian market is dominated by large firms and the majority of stocks are small, we use size cutoffs defined by Brailsford, Gaunt, and O'Brien (2012) in our factor construction. We form six portfolios from the intersections of two size and three book-to-market portfolios. Specifically, at the end of December of year $t$, we first

[11] For example, if the volume difference (the numerator in Equation (1)) is the same for two stocks, the stock with lower volatility in trading volume over the prior 12-month period should be regarded as having a higher volume shock at time $t$.

rank stocks according to their market capitalization. We then allocate stocks into two size portfolios. The largest 200 stocks in terms of market capitalization are classified as large and the remaining stocks are classified as small. Following Brailsford et al. (2012), we obtain the 30th and 70th percentiles of the book-to-market ratio from the largest 200 stocks. These breakpoints are then applied to the entire sample. Stocks with book-to-market ratios below or equal to the 30th percentile are classified as growth stocks and stocks with book-to-market ratios higher than the 70th percentile are classified as value stocks. The remainder are classified as neutral stocks (medium). The independent size and book-to-market sorts result in six portfolios (S/L, S/M, S/H, B/L, B/M, and B/H).

The monthly value-weighted returns on each of the six portfolios are calculated from January to December of year $t + 1$. The portfolios are re-formed each December. SMB is the average return on the three small size portfolios minus the average return on the three big size portfolios. Similarly, HML is the average return on the two high book-to-market portfolios minus the average return on the two low book-to-market portfolios. Following the same approach in creating the HML factor, the WML (winner-minus-loser) factor is constructed from six size- and momentum-sorted (past 12-month returns) portfolios, and the LIQ (illiquid minus liquid) factor is constructed from six size- and liquidity-sorted (the Amihud (2002) illiquidity ratio) portfolios. Both factors are rebalanced at the monthly level.

In addition to portfolio analysis, it is useful to examine the relation between volume shocks and stock returns at the individual stock level. Accordingly, each month, we run Fama and MacBeth (1973) cross-sectional regressions with stock returns over the subsequent 1, 2-6, and 7-12 months on VOSHOCK and a set of variables that are potential determinants of stock returns. The model is specified as follows:

$$R_{j|t+g,t+k} = \alpha_{j,t} + \beta_{j,t} VOSHOCK_{j,t} + \sum_{y=1}^{Y} \beta_{j,y,t} CONTROL_{j,y,t} + \varepsilon_{jt} \qquad (2)$$

where $j = 1, 2,\ldots, N$; $t = 1, 2,\ldots, T$; and CONTROL represents control variables such as size, book-to-market, past returns (momentum), idiosyncratic volatility, turnover level, short-term reversals, beta, and demand for extreme positive returns. Standard errors are adjusted for autocorrelations in the estimates.[12]

[12] The research method involves three stages. In stage one, the dependent and independent variables required are constructed. We then estimate different versions of Equation (3) each month over our sample period. In stage

The control variables are calculated as follows. The size variable is computed as the natural logarithm of a firm's market capitalization in month *t*. Book-to-market is computed as the natural logarithm of a firm's book-to-market ratio, defined as the book value of shareholders' equity plus deferred taxes minus the book value of preferred shares in the last fiscal year-end, scaled by the market value in the last fiscal year-end (Fama and French, 2015). Following Jegadeesh and Titman (1993), momentum is the cumulative return of a stock over a period of 11 months ending one month prior to time *t*. In light of the studies of Jegadeesh (1990) and Lehmann (1990), a stock's month-*t* return controls for short-term reversals (REV). Following Bali, Cakici, and Whitelaw (2011), the firm's extreme positive return (MAX) is defined as its maximum daily return in a month. The monthly idiosyncratic volatility (IV) of stock *j* is calculated as the standard deviation of the residuals from the regression:

$$R_{j,d} - R_{f,d} = \alpha_j + \beta_j MKT_d + s_j SMB_d + h_j HML_d + \varepsilon_{j,d} \quad (4)$$

where $R_{j,d}$ is the return for stock *j* on day *d*, $R_{f,d}$ is the risk-free rate on day *d*, MKT is the daily value-weighted market excess return, and SMB and HML are the daily size and book-to-market factors. Following Ang, Hodrick, Xing, and Zhang (2006), we estimate Equation (4) over the previous 252 trading days and a stock must have at least 65 days of trading to qualify for the estimation.

## 3. Empirical results

### *3.1 Portfolio sorts*

We start our empirical analysis by investigating whether portfolios that contain stocks experiencing high volume shocks outperform portfolios that contain stocks experiencing low volume shocks. Table 1 displays the summary statistics of the decile portfolios formed based on VOSHOCK. Both firm size and share price tend to exhibit a U-shaped relation with VOSHOCK. Other firm characteristics, such as book-to-market, past returns, and the Amihud illiquidity ratio, do not exhibit an apparent pattern. Both MAX and REV increase with VOSHOCK. As expected, VOSHOCK is found to be positively related with share turnover.

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three, we compute the average coefficient and variance from the time series of the cross-sectional regression coefficients generated in the second stage.

Panels A and B of Table 2 display the mean monthly portfolio returns for each of the decile portfolios over different holding periods for the equal- and value-weighted methods, respectively. The return difference between the high- and low-VOSHOCK portfolios represents the return premium associated with volume shocks. To alleviate the concern that the results may be influenced by extremes, we also calculate the return premium by taking a long position in both portfolios 9 and 10 (high) and a short position in both portfolios 1 (low) and 2. There are three notable findings. First, there is a monotonic increase in returns from low- to high-VOSHOCK portfolios for the equal-weighted method. For the value-weighted approach, the monotonic return pattern is less obvious. There is evidence of a volume shock return premium, since the strategy of buying the high-VOSHOCK portfolio(s) and selling the low-VOSHOCK portfolio(s) is statistically significant for most of the holding periods analyzed. Second, the return premium declines as the holding period increases. For example, the high-minus-low equal-weighted strategy generates an average monthly return of 2.91% ($t$ = 9.03) when $K$ = 1 and an average return of 0.93% ($t$ = 5.36) when $K$ = 12. This result suggests a reversal in the return premium as the holding period is extended. The decline is somewhat more rapid in the value-weighted approach. This return pattern is consistent with that predicted by Barberis and Shleifer (2003) and similar to that found by Huang and Heian (2010) for the US market. For example, among smaller firms, Huang and Heian (2010) show that the average weekly volume shock returns are 0.25% and 0.03% per week when the holding periods are 4 and 52 weeks, respectively. Third, it is evident that the equal-weighted approach generates higher returns than the value-weighted approach. This result indicates the volume shock effect is stronger for smaller firms.[13] This finding is consistent with the theoretical prediction of Blume et al. (1994), that trading volumes are more informative for smaller stocks.

**[Insert Tables 1 & 2 about here]**

Table 3 shows the risk-adjusted returns to the VOSHOCK portfolios (the regression intercepts from Equation (2)). The results remain robust after controlling for the size, book-to-market, momentum, and liquidity effects. Overall, the results from this section indicate that investors can earn substantially positive abnormal returns from a volume shock trading strategy. However, the strategy is more economically meaningful over a shorter holding period.

[13] Panel C in Table 7 confirm that small firms exhibit higher volume shock returns. This will be discussed in Section 4.

**[Insert Table 3 about here]**

*3.2 Stock-level analysis*

In this section, we further investigate the relation between VOSHOCK and stock returns at the individual stock level. We run different specifications of Equation (3). Table 4 displays the results. Panels A to C show the results when the dependent variables are the buy-and-hold individual stock returns for the next 1, 2-6 and 7-12 months, respectively. As a base case, regression 1 suggests a strong positive relation between VOSHOCK and subsequent returns. The relation is statistically significant at the 1% level for returns over the next 1 and 2-6 months and at the 5% level for returns over the next 7-12 months. It is important to note that the magnitudes of the coefficients decline for holding periods farther from the volume shock month. This result reinforces the finding at the portfolio level that returns associated with VOSHOCK decline as the holding period lengthens.

Regression 2 augments the base variable with share turnover (level). A number of studies document a negative relation between share turnover and stock returns (e.g., Datar, Naik, and Radcliffe, 1998; Chan and Faff, 2003). One of the possible explanations for this empirical finding is that share turnover (or trading volume) acts as a proxy for liquidity, with less liquid stocks (low trading volume) generating higher expected returns (Amihud and Mendelson, 1986). Regression 2 shows that share turnover is negatively related to future returns. However, such a relation is not statistically significant across all three panels. This finding is consistent with that reported by Chan and Faff (2003). More importantly, the relation between VOSHOCK and stock returns remains strong in the presence of share turnover, suggesting that the volume shock premium is not a result of trading volume levels.

Regression 3 examines the impact of VOSHOCK on subsequent returns in the presence of size, book-to-market, and momentum. The explanatory power of VOSHOCK remains strong and its impact on returns is only marginally smaller compared to that of the base case. The signs of the size, book-to-market, and momentum variables are consistent with empirical findings. Regression 4 augments Regression 3 with share turnover and IV and Regression 5 augments Regression 4 with MAX, short-term reversals, and beta. The positive (negative) coefficient of IV (MAX) mirrors the evidence of Zhong and Gray (2016), who study the interaction between IV and MAX in Australia. Short-term reversals have a negative (positive) impact on short-term (long-term) future returns. Beta, however, is not statistically significant. Statistically, MAX seems to have the strongest effect on stock returns compared to the other control variables. However, the results show that neither IV nor MAX subsumes the explanatory power of VOSHOCK. VOSHOCK is positively related with returns over the next 1 and 2-6 months in the presence of all the other control variables. The magnitude of the coefficients also remains quite consistent for different regression specifications in all three panels.

Overall, the regression analysis at the individual stock level supports the findings at the portfolio level, that VOSHOCK is related to the cross-section of stock returns. The volume shock effect remains strong in the presence of other variables, including share turnover, that are known to affect stock returns.

**[Insert Table 4 about here]**

*3.3 Robustness checks*

Prior studies in examining the relation between abnormal trading volume and stock returns tend to use weekly or daily data. An important methodological concern that has arisen is whether our finding remains robust when the analysis is conducted using higher frequency data. To explore this possibility, we repeat the portfolio level analysis using weekly data with holding periods of 1, 2, 4, 26, and 52 weeks.[14]. As in the main analysis, we use the weekly liquidity-augmented Carhart model to adjust for risk. Table A1 in the appendix shows the results. There is strong evidence of the volume shock effect in weekly data. The return patterns are greatly similar to those reported in Table 3. This alleviates the concern that our results are exclusive to monthly data.

Kim and Verrecchia (1994) provide a theoretical model showing that trading volume can increase due to informed trading at the time of an earnings announcement. This relation is empirically documented in a number of studies (e.g., Kim, Krinsky, and Lee, 1997). Motivated by this empirical finding, we test whether the relation between VOSHOCK and stock returns remains robust after controlling for price-sensitive announcements. We obtain data on price-sensitive announcements from SIRCA.[15] We then remove firms that have price-

[14] We thank the referee for suggesting this robustness check.

[15] Unlike the US market where firms are required to provide earnings update each quarter, there is no such requirement in Australia. However, throughout the financial year, Australian firms are required to make numerous disclosures to the ASX. Certain reports are deemed more likely to be price sensitive and are tagged as such by the ASX. These include regular reports such as half-year results, full-year results, and for certain firms, quarterly results. In addition, firms are required to update the market whenever they are aware of circumstances that are likely to affect the final result. These include irregular announcements such as market update, investor

sensitive announcements at the portfolio formation date and repeat the same portfolio-level analysis as in Section 3.1. Panel A of Table 5 shows the results. To conserve space, we only present the zero-cost VOSHOCK returns over different holding periods. The results are comparable to those reported in Table 2, suggesting that VOSHOCK is not driven by price-sensitive announcements.

In the Australian market, January and July have been shown to exhibit higher returns (Gaunt et al., 2000; Gray and Tutticci, 2007). Ligon (1997) reports that higher January returns are related to higher January trading volume and lower real interest rates in the US market. Therefore, to check that our results are not driven by seasonality, we re-examine the performance of VOSHOCK investment strategies when January and July are excluded. Panel B of Table 5 shows that the strategies continue to report positive and statistically significant profits. We also check the robustness of the results in the first and second halves of the sample period. Panels C and D of Table 5 display the results, respectively. The volume-shock effect is comparable across subperiods, particularly in equal-weighted results.

The literature documents that market states play a role in explaining capital market anomalies (e.g., Cooper, Gutierrez, and Hameed, 2004). In our case, since the degree of overconfidence should increase after market gains, the volume shock effect should be weaker in up markets. Accordingly, we examine how the states of the market affect the volume shock returns. Following Cooper et al. (2004), the up and down markets are defined based on 36-month value-weighted market cumulative returns preceding the event month. If the return is nonnegative (negative), the period is defined as an up (down) market. Panels E and F display the results for up and down markets, respectively. There is a tendency that the volume shock effect is stronger in down markets. However, some caution is needed when interpreting the results, as the Australian market experienced an overall bull market over our sample period.

**[Insert Table 5 about here]**

## 4. Volume shocks and investor attention

Merton (1987, p. 500) shows analytically that, when a stock is more publicly recognized, there will be an increase in its shareholder base and concurrent share price, resulting in lower expected returns and improved risk sharing across investor portfolios. This investor

update or trading update, which could also invoke a strong market reaction. We collect these earnings-related updates and also any updates that are tagged ‘price sensitive’.

recognition hypothesis is used by a number of studies to explain the high volume return premium (Gervais et al., 2001; Kaniel et al., 2012). Stocks that are less recognized by investors are generally small in size and have less or no coverage by professional analysts or institutional investors on a regular basis (e.g., Arbel, Carvell, and Strebel, 1983). Since attention is a necessary condition for a stock to become more publicly recognized, the effect of a high volume shock due to attention should be stronger for stocks that were previously less recognized by investors. In this paper, we use institutional ownership, stock prices, firm size, and share turnover as direct measures of stocks' popularity to further examine (1) whether volume shocks are a useful proxy for attention and (2) whether our findings are due to changes in investor recognition.[16] A stock with a large number of institutional investors is arguably more visible to investors (Arbel et al., 1983). Likewise, as pointed out by Dyl et al. (2002), high-priced stocks are also more recognized by investors. In line with the view that trading volume reflects investor recognition, more visible stocks should have relatively higher average trading volume. Finally, large firms are generally most visible to market participants.

*4.1 Changes in trading volume in stocks with different levels of visibility*

Recall that the main theme of this paper revolves around the notion that high volume shocks act as an attention-grabbing event that improves a stock's visibility (Merton, 1987). Following this view, changes in trading volume before and after a volume shock could indicate a change in a stock's visibility. If VOSHOCK does attract investor attention, we should observe, on average, higher trading volume after a high VOSHOCK relative to prior trading volume due to the positive attention shock. This should particularly be the case for stocks that were previously less visible to investors. We conduct a simple test to provide support for this view. Each formation month, we first divide the stocks into three groups (30:40:30 split) based on their level of institutional ownership and share turnover over the past twelve months, respectively. Similarly, stocks are grouped as having high stock prices (above $1), median stock prices (between 50c and $1), and low stock prices (below 50c). Finally, stocks are divided into two groups based on their market capitalization and the top

[16] One of the common measure of a firm's popularity is its financial analyst coverage. However, the quality and coverage of such data is poor in Australia. On average, only about one third of Australian firms are covered by analysts. The average (median) number of analysts per company is 3.3 (2.5) for companies with analyst coverage. Thus, we are unable to finely divide our sample based on analyst coverage. Our unreported tests find that the volume shock effect is stronger in companies without analyst coverage. The results are available upon request from the authors.

200 stocks are classified as big stocks. Within each of the visibility group, we form quintile portfolios based on VOSHOCK, as in Section 3.1.[17]

We calculate the turnover ratio for each VOSHOCK quintile portfolio for the holding periods of the first month, months 2 to 6, and months 7 to 12 relative to their previous 12-month (i.e., *t*–1 to *t*–12) turnover ratios. A high relative turnover ratio for the holding period indicates an increase in trading volume after the volume shock. Table 6 displays the results. For brevity, we report only the results for the low- and high-VOSHOCK quintile portfolios in stocks that are the most and least popular to investors, categorized by the visibility proxies. The results indicate that the relative turnover ratio is significantly higher after a high volume shock than after a low volume shock for the holding periods analyzed. More importantly, the relative turnover rate is significantly higher after a high volume shock for low profile stocks, that is, those priced below 50 cents, with small market capitalization, and with a low level of institutional ownership and share turnover. This result is consistent with the view that a high volume shock attracts investor attention and stocks experience increased visibility (high trading volume) after such an attention-grabbing event.

**[Insert Table 6 about here]**

*4.2 Volume shock effect in stocks with different visibility levels*

In this section, we examine the effect of volume shock in stocks with different visibility levels. As in the previous section, we form quintile portfolios based on VOSHOCK within each institutional ownership, stock price, size, and share turnover group, respectively. We then calculate the high-minus-low VOSHOCK hedge returns within each group. We expect the volume shock return premium to be stronger for stocks that are previously less visible to investors.

In addition, we are interested in how changes in institutional ownership at the time of a high volume shock affect volume shock returns. Intuitively, a high volume shock that coexists with a large (positive) change in institutional ownership indicates that institutional investors are buying more than individual investors are. Conversely, a small change in institutional ownership implies that individual investors are buying more than institutional investors are. A number of studies document that changes in institutional ownership are related to stock returns and have been used as a proxy for changes in investor recognition (Sia,

[17] We use quintiles to ensure a sufficient number of observations in each portfolio.

Starks, and Titman, 2006; Lehavy and Sloan, 2008; Huang et al., 2012). Barber and Odean (2008) argue that individual investors are net buyers of stocks that draw their attention, which results in a short-run price increase for these stocks. If a high volume shock does increase a stock's attention and makes the stock more recognized subsequently, then higher returns should logically present, irrespective of which group of investors is buying. This should particularly be the case for stocks for which attention matters the most. Accordingly, we further divide the stocks in the highest VOSHOCK quintile into three portfolios (30:40:30) based on their changes in institutional ownership in the portfolio formation month. We designate the sub-portfolio of those stocks with the greatest increase in institutional ownership as HI; similarly, the sub-portfolio of those stocks with the smallest increase in institutional ownership is designated LI. Table 7 presents the results when the stocks are grouped by different proxies for visibility.

Consistent with our conjecture, the high-minus-low VOSHOCK hedge portfolios generate significant risk-adjusted returns, particularly among stocks that are less covered by institutional investors, priced below 50 cents, with small market capitalization and low share turnover. Notably, the effect is stronger for equal-weighted returns, reflecting that smaller stocks are typically associated with a larger price impact. Furthermore, the return premiums vanish quickly and become economically insignificant as the holding period increases for stocks that are previously more recognized by investors. This result is expected, since the effect of a volume shock due to increased attention should only be marginal for stocks that were already visible to investors. To further strengthen the findings, we run Regression 5 (defined in Table 4) on a monthly basis within each visibility group. We expect the difference between the coefficients of VOSHOCK for the low- and high-visibility groups to be statistically significant for holding periods closer to the initial volume shock. Our untabulated results confirm this.[18]

When the high VOSHOCK quintile is further divided based on changes in institutional ownership, we observe that the VOSHOCK premiums (relative to the low VOSHOCK quintile) are present for both the largest and smallest increases in institutional ownership. As with the main results, the premiums are stronger for stocks that were

[18] For holding periods of one, 2-6 and 7-12 months, the spreads are 0.0061 ($t$ = 4.38), 0.0021 ($t$ = 3.32), and 0.0017 ($t$ = 1.40) for price groups, are 0.0036 ($t$ = 2.94), 0.0014 ($t$ = 1.87), and 0.0031 ($t$ = 1.74) for institutional ownership groups, are 0.0073 ($t$ = 4.00), 0.0004 ($t$ = 0.32), and 0.0001 ($t$ = 0.05) for firm size groups, and are 0.0113 ($t$ = 7.67), 0.0003 ($t$ = 0.03), and 0.0015 ($t$ = 1.32) for share turnover groups.

previously less recognized. These results provide further evidence that extreme volumes are informative of future returns, independent of the type of investors responding to the event.[19]

**[Insert Table 7 about here]**

## 5. Are volume shock effects priced?

The empirical findings in the previous sections show a robust volume shock effect in stock returns. In Section 4, we demonstrated that VOSHOCK captures investor attention and predicts future price movements. A natural question that has arisen is whether VOSHOCK is priced. To answer this question, we follow the procedure outlined by Bali et al. (2014). The procedure includes forming a volume shock-mimicking factor, denoted VOF, constructed from portfolios double-sorted on size and VOSHOCK in a manner similar to the six size and book-to-market portfolios in creating SMB and HML. Specifically, we independently sort all available stocks into two size groups (the top 200 stocks by market capitalization are classified as big stocks) and three VOSHOCK groups (based on a 30:40:30 partition of the top 200 stocks by market capitalization), yielding six portfolios from the intersection of the size and VOSHOCK groups. An important methodological consideration is how often should portfolios be held or updated. We argue that the volume shock effect should be observed quickly in stock returns, as our results have demonstrated. Thus, we rebalance the portfolios on a monthly basis, which allows stocks to move between portfolios when their characteristics change. Unlike yearly rebalancing, which keeps a stock in a particular portfolio for 12 months, we argue that monthly rebalancing would best reflect the relation between volume shocks and stock returns. Once the VOF is constructed, we calculate each stock's sensitivity to the VOF, denoted $\beta_{VO}$. Each month, for each stock in our sample, excess stock returns over the prior 60 months are regressed on the VOF, subject to a minimum time series of 24 valid monthly returns. This procedure yields $\beta_{VO}$ for each stock on a monthly basis in our sample.

[19] Our results on institutional ownership may seem inconsistent with US evidence at first glance. Huang et al. (2011) show that the volume premium is stronger for stocks with increased institutional ownership. However, they did not run tests on institutional ownership levels. It is important to note that in Huang et al. (2011), quarterly institutional ownership data is employed due to data availability. The stronger volume shock effect in stocks with a lower level of institutional ownership is consistent with the argument put forward by Barber and Odean (2008). Relative to institutions, individual investors are less informed and more vulnerable to the influence of market sentiment and attention-grabbing events. Thus, our findings are mostly consistent with the existing literature.

To examine whether the VOF bears a relation to future stock returns, we perform a univariate portfolio sort. At the end of each month, stocks are sorted into decile portfolios based on the ranking of $\beta_{VO}$. Both equal- and value-weighted risk-adjusted portfolios returns are calculated over the subsequent month.[20] Panel A of Table 8 presents the results. By construction, $\beta_{VO}$ increases from -2.49 for portfolio 1 to 4.20 for portfolio 10. There is no apparent relation between $\beta_{VO}$ and portfolio returns. The return difference between high $\beta_{VO}$ and low $\beta_{VO}$ is not statistically significant. We also run cross-sectional regressions to examine the explanatory power of $\beta_{VO}$, in the spirit of Daniel and Titman (1997). Following Ang et al. (2009), we include both VOSHOCK and $\beta_{VO}$ in cross-sectional regressions to explore their explanatory power. The results are presented in Panel B of Table 8. In the first model, stock returns at time *t*+1 are regressed on both VOSHOCK and $\beta_{VO}$ at time *t*. The slope coefficient of $\beta_{VO}$ is statistically insignificant. This result indicates that $\beta_{VO}$ does not bear a relation with future stock returns. However, VOSHOCK remains statistically significant at the 1% level ($t$ = 7.97). The results remain unchanged in the presence of other control variables. In summary, the results in this section provide no evidence that volume shock is a priced risk factor.

**[Insert Table 8 about here]**

## 6. Conclusion

Using an alternative measure of volume shocks, this article investigates whether a volume shock effect exists in the Australian equity market. The study provides out-of-sample evidence to the literature and contributes to the understanding of investor behaviors in the Australian market. Academically, the link between volume shocks and stock returns will advance our understanding on the risk-return relation. Practically, trading volume has long been used in technical analysis and the findings of this paper are of interest to technical analysts, since extreme volume shocks could be used as a signal in market timing.

At the portfolio level, we show that an investment strategy that buys stocks experiencing high volume shocks and sells stocks experiencing low volume shocks generates a significant return premium. However, this return premium is strongest over a short investment horizon. Over the long run, there is a reversal in returns associated with extreme

[20] We only report the return in the subsequent month to conserve space. In addition, as previously shown, the relation between VOSHOCK and returns is stronger over a shorter window. Thus, if $\beta_{VO}$ is related to returns, it would have been picked up over a short period.

volume shocks. The volume shock effect is also observed at the individual stock level. More importantly, the effect is robust after controlling for other firm characteristics that are known to affect stock returns.

Our results show that volume shocks capture investor attention, since trading volume becomes relatively higher after high volume shocks. Moreover, the relation between volume shocks and stock returns is stronger for stocks that previously failed to catch investor attention. This finding is consistent with the attention theory of Barber and Odean (2008). Finally, we conduct a formal asset pricing test to further explore whether the observed volume shock effect is priced. Sensitivity to the constructed volume shock factor is not related to returns, suggesting that volume shocks are not priced.

**References**


Arbel, A., S. Carvell, and P. Strebel, 1983. Giraffes, institutions and neglected firms. *Financial Analysts Journal 39*, 2–8.

Amihud, Y., 2002. Illiquidity and stock returns: Cross section and time series effects. *Journal of Financial Markets* 5, 31–56.

Amihud, Y., and H. Mendelson, 1986. Asset pricing and the bid-ask spread. *Journal of Financial Economics* 17, 223–249.

Ang, A., R. J. Hodrick, Y. Xing, and X. Zhang, 2006. The cross-section of volatility and expected returns. *Journal of Finance* 61, 259–299.

Bali, T. G., N. Cakici, and R. F. Whitelaw, 2011. Maxing out: Stocks as lotteries and the cross-section of expected returns. *Journal of Financial Economics* 99, 427–446.

Bali, T., L. Peng, Y. Y. Shen, and Y. Tang, 2014. Liquidity shocks and stock market reactions. *Review of Financial Studies* 27, 1434–1485.

Bank, M., M. Larch, and G. Peter, 2011. Google search volume and its influence on liquidity and returns on German stocks. *Financial Markets and Portfolio Management* 25, 239–264.

Barber, B. M., and T. Odean, 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21, 785–818

Barberis, N., and A. Shleifer, 2003. Style investing. *Journal of Financial Economics* 68, 161–199.

Blume, L., D. Easley, and M. O'Hara, 1994. Market statistics and technical analysis: The role of volume. *Journal of Finance* 49, 153–181.

Brailsford, T., C. Gaunt, and M. A. O'Brien, 2012. Size and book-to-market factors in Australia. *Australian Journal of Management* 37, 261–281.

Carhart, M., 1997. On persistence in mutual fund performance. *Journal of Finance* 52, 57–82.

Chan, H., and R. W. Faff, 2003. An investigation into the role of liquidity in asset pricing: Australian evidence. *Pacific-Basin Finance Journal* 11, 555–572.

Chen, J., H. Hong, and J. C. Stein, 2001. Forecasting crashes: Trading volume, past returns, and conditional skewness in stock prices. *Journal of Financial Economics* 61, 345–381.

Chuang, W. I., and B. S. Lee, 2006. An empirical evaluation of the overconfidence hypothesis. *Journal of Banking and Finance* 30, 2489–2515.

Cochrane, J. H., 2005. Asset pricing (Vol. 1). Princeton, NJ: Princeton University Press.

Cooper, M. J., R. C. Gutierrez, and A. Hameed, 2004. Market states and momentum. *Journal of Finance 59*, 1345–1365.

Datar, V., N. Naik, and R. Radcliffe, 1998. Liquidity and stock returns: An alternative test. *Journal of Financial Markets* 1, 203–219.

Daniel, K., and S. Titman, 1997. Evidence on the characteristics of cross sectional variation in stock returns. *Journal of Finance 52*, 1–33.

DellaVigna, S., and J. M. Pollet, 2009. Investor inattention and Friday earnings announcements. *Journal of Finance 64*, 709–749.

Drake, M. S., D. T. Roulstone, and J. R. Thornock, 2012. Investor information demand: Evidence from Google searches around earnings announcements. *Journal of Accounting Research 50*, 1001–1040.

Drake, M. S., D. T. Roulstone, and J. R. Thornock, 2015. The determinants and consequences of information acquisition via EDGAR. *Contemporary Accounting Research 32*, 1128–1161.

Dyl, E., W. Elliott, and J. Handley, 2002. Do share prices matter? *Accounting and Finance* 42, 225–237.

Dyl, E., and W. Elliott, 2006. The share price puzzle? *Journal of Business* 79, 2045–2066.

Fama, E., and J. MacBeth, 1973. Risk, return and equilibrium empirical test. *Journal of Political Economy* 81, 607–636.

Fama, E. F., and K. R. French, 2015. A five-factor asset pricing model. *Journal of Financial Economics* 116, 1–22.

Gallant, A. R., P. E. Rossi, and G. Tauchen, 1992. Stock prices and volume. *Review of Financial Studies* 5, 199–242.

Gaunt, C., P. Gray, and J. McIvor, 2000. The impact of share price on seasonality and size anomalies in Australian equity returns. *Accounting and Finance* 40, 33–50.

Gervais, S., R. Kaniel, and D. H. Mingelgrin, 2001. The high-volume return premium. *Journal of Finance* 56, 877–919.

Glaser, M., and M. Weber, 2007. Overconfidence and trading volume. *Geneva Risk and Insurance Review* 32, 1–36.

Glaser, M., and M. Weber, 2009. Which past returns affect trading volume. *Journal of Financial Markets* 12, 1–31.

Gordon, N., E. Watts, and Q. Wu, 2014. The high volume return premium and changes in investor recognition. Working paper, Macquarie University.

Gray, P., and I. Tutticci, 2007. Australian stock market anomalies: A review and re-examination of the January and small-firm effects. *Journal of Investment Strategy* 2, 27–35.

Gray, P., and J. Johnson, 2011. The relationship between asset growth and the cross-section of stock returns. *Journal of Banking and Finance* 35, 670–680.

Hirshleifer, D., and S. H. Teoh, 2003. Limited attention, information disclosure, and financial reporting. *Journal of Accounting Economics* 36, 337–386.

Hirshleifer, D., S. S. Lim, and S. H. Teoh, 2009. Driven to distraction: Extraneous events and underreaction to earnings news. *Journal of Finance 64*, 2289–2325.

Hou, K., L. Peng, and W. Xiong, 2008. A tale of two anomalies: The implication of investor attention for price and earnings momentum. Working paper, Ohio State University.

Huang, Z., and J. B. Heian, 2010. Trading-volume shocks and stock returns: An empirical analysis. *Journal of Financial Research* 33, 153–177.

Huang, Z., J. B. Heian, and T. Zhang, 2011. Differences of opinion, overconfidence, and the high-volume premium. *Journal of Financial Research* 34, 1–25.

Jegadeesh, N., 1990. Evidence of predictable behaviour in security returns. *Journal of Finance* 45, 881–898.

Jegadeesh, N., and S. Titman, 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance* 48, 65–91.

Kaniel, R., A. Ozoguz, and L. Starks, 2012. The high volume return premium: Cross-country evidence. *Journal of Financial Economics* 103, 255–279.

Kaniel, R., G. Sarr, and S. Titman, 2008. Individual investor trading and stock returns. *Journal of Finance* 63, 273–310.

Karpoff, J. M., 1986. A theory of trading volume. *Journal of Finance* 41, 1069–1087.

Kim, A. K., and J. R. Nofsinger, 2003. The behavior and performance of individual investors in Japan. *Pacific-Basin Finance Journal* 11, 1–22.

Kim, J., I. Krinsky, and J. Lee, 1997. Institutional holdings and trading volume reactions to quarterly earnings announcements. *Journal of Accounting, Auditing and Finance* 12, 1–14.

Kim, O., and R. E. Verrecchia, 1994. Market liquidity and volume around earnings announcements. *Journal of Accounting and Economics* 17, 41–76.

Lee, C. M. C., and B. Swaminathan, 2000. Price momentum and trading volume. *Journal of Finance* 55, 2017–2069.

Lehavy, R., and R. Sloan, 2008. Investor recognition and stock returns. *Review of Accounting Studies* 13, 327–361.

Lehmann, B. N., 1990. Fads, martingales, and market efficiency. *Journal of Finance* 34, 717–724.

Li, W., G. Rhee, and S. S. Wang, 2016. Differences in herding: Individual vs. institutional investors. *Pacific-Basin Finance Journal Forthcoming*.

Ligon, J., 1997. A simultaneous test of competing theories regarding the January effect. *Journal of Financial Research* 20, 13–32.

Lo, A. W., and A. C. MacKinlay, 1990. When are contrarian profits due to stock market overreaction? *Review of Financial Studies* 3, 175–205.

Loh, R. K., 2010. Investor inattention and the underreaction to stock recommendations. *Financial Management 39*, 1223–1252.

Merton, R. C., 1987. A simple model of capital market equilibrium with incomplete information. *Journal of Finance* 42, 483–510.

Miller, E., 1977. Risk, uncertainty, and divergence of opinion. *Journal of Finance* 32, 1151–1168.

Newey, W. K., and K. D. West, 1987. A simple positive semi-definite, heteroscedasticity and autocorrelation consistent covariance matrix. *Econometrica* 55, 703–708.

Odean, T., 1998. Are investors reluctant to realize their losses? *Journal of Finance* 53, 1775–1798.

Peng, L., and W. Xiong, 2006. Investor attention, overconfidence and category learning. *Journal of Financial Economics* 80, 563–602.

Sia, R. W., L. T. Starks, and S. Titman, 2006. Change in institutional ownership and stock returns: Assessment and methodology. *Journal of Business* 79, 2869–2910.

Tang, T., L. Zou, and J. Li, 2013. The high-volume return premium: Evidence from the Australian equity market. *Journal of Accounting and Finance* 13, 74–93.

Watkins, B. D., 2006. Institutional ownership and return reversals following short-term return consistency. *Financial Review* 41, 435–448.

Zhong, A., and P. Gray, 2016. The Max effect: An exploration of risk and mispricing explanations. *Journal of Banking and Finance* 65, 76–90.

**Table 1 Summary statistics**

For each month *t*, from 1992 to 2013, we sort stocks into deciles based on VOSHOCK in that month. The low (high) portfolio is the decile that contains stocks with the lowest (highest) level of volume shock. The table reports the number of stocks and the mean value of VOSHOCK, market capitalization, book-to-market, share price, past returns (*t*–1 to *t*–12), the Amihud illiquidity ratio, share turnover, the maximum daily return within month *t* (MAX), beta, short-term reversals (REV), and idiosyncratic volatility (IV). Beta is estimated using the market model over the past 252 trading days, IVOL is estimated using Equation (4) over the past 252 trading days, and REV is stock return in month *t*. The statistics are computed every month for each portfolio and then averaged across the entire sample period. The market capitalization is reported in millions of dollars and the Amihud ratio is multiplied by 1 billion. The variable MAX is reported as a percentage.

| | Low | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | High |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of stocks | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| VOSHOCK | 0.19 | 0.35 | 0.48 | 0.60 | 0.74 | 0.89 | 1.07 | 1.34 | 1.83 | 4.99 |
| Size | 65.26 | 107.62 | 222.20 | 359.39 | 728.65 | 980.99 | 1026.74 | 929.47 | 644.52 | 211.56 |
| Book-to-market | 1.02 | 0.96 | 0.91 | 0.91 | 0.87 | 0.85 | 0.86 | 0.88 | 0.93 | 1.03 |
| Price | 0.81 | 0.86 | 1.11 | 1.44 | 1.96 | 2.41 | 2.56 | 2.45 | 2.02 | 1.28 |
| Past returns | 0.33 | 0.29 | 0.28 | 0.23 | 0.23 | 0.21 | 0.20 | 0.19 | 0.17 | 0.09 |
| Illiquidity ratio | 192.22 | 51.87 | 39.63 | 31.50 | 22.43 | 26.94 | 17.97 | 66.90 | 25.08 | 51.53 |
| Turnover level | 0.01 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.05 | 0.06 | 0.12 |
| MAX | 9.34 | 10.7 | 11.73 | 12.19 | 12.64 | 12.89 | 12.71 | 13.03 | 13.69 | 18.52 |
| Beta | 0.65 | 0.64 | 0.69 | 0.76 | 0.65 | 0.73 | 0.74 | 0.82 | 0.77 | 0.77 |
| REV | −0.03 | −0.03 | −0.02 | −0.01 | −0.01 | 0.01 | 0.02 | 0.04 | 0.07 | 0.16 |
| IV | 5.19 | 6.04 | 6.54 | 6.75 | 6.86 | 6.74 | 6.44 | 6.16 | 6.03 | 6.67 |

**Table 2 Mean returns of the portfolios formed on VOSHOCK**

At the end of each month, stocks are sorted into decile portfolios based on the ranking of VOSHOCK. The low (high) portfolio is the decile that contains stocks with the lowest (highest) level of volume shock. Monthly portfolio returns over the next *K* months (*K* = 1, 3, 6, 12) are calculated for each decile portfolio. This procedure is repeated every month over our sample period. Panel A reports the averaged value-weighted portfolio returns and Panel B reports the averaged equal-weighted portfolio returns. The High–Low column shows the return differences between the highest and lowest VOSHOCK portfolios. The *t*-statistics listed in parentheses are based on Newey-West standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Low | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | High | High – Low | (V10 + V9) – (V1 + V2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A: Value-weighted | | | | | | | | | | | | |
| K = 1 | 0.0016 | 0.0049 | 0.0081 | 0.0060 | 0.0076 | 0.0077 | 0.0116 | 0.0103 | 0.0099 | 0.0148 | 0.0132 | 0.0091 |
| | (0.50) | (1.38) | (2.40)** | (1.77) | (2.39)** | (2.57)*** | (4.32)*** | (3.96)*** | (3.52)*** | (4.87)** | (5.34)*** | (4.19)*** |
| K = 3 | 0.0064 | 0.0060 | 0.0095 | 0.0067 | 0.0090 | 0.0098 | 0.0103 | 0.0089 | 0.0096 | 0.0107 | 0.0043 | 0.0040 |
| | (1.97)** | (1.97)** | (3.42)*** | (2.11)** | (3.04)*** | (3.39)*** | (3.93)*** | (3.41)*** | (3.63)*** | (3.78)*** | (2.35)** | (2.68)*** |
| K = 6 | 0.0071 | 0.0068 | 0.0089 | 0.0082 | 0.0104 | 0.0089 | 0.0098 | 0.0090 | 0.0096 | 0.0097 | 0.0026 | 0.0027 |
| | (2.24)** | (2.16)** | (3.09)*** | (2.50)** | (3.45)*** | (3.02)*** | (3.70)*** | (3.39)*** | (3.77)*** | (3.60)*** | (1.93)* | (2.21)** |
| K = 12 | 0.0081 | 0.0071 | 0.0088 | 0.0088 | 0.0097 | 0.0092 | 0.0095 | 0.0092 | 0.0098 | 0.0098 | 0.0017 | 0.0022 |
| | (2.71)*** | (2.39)** | (3.02)*** | (2.87)*** | (3.53)*** | (3.33)*** | (3.64)*** | (3.61)*** | (3.68)*** | (3.64)*** | (1.64) | (2.48)** |
| Panel B: Equal-weighted | | | | | | | | | | | | |
| K = 1 | −0.0005 | 0.0059 | 0.0102 | 0.0144 | 0.0144 | 0.0135 | 0.0185 | 0.0227 | 0.0258 | 0.0287 | 0.0291 | 0.0246 |
| | (−0.11) | (1.19) | (2.03)** | (2.83)*** | (2.91)*** | (2.78)*** | (3.86)*** | (4.57)*** | (5.13)*** | (5.48)*** | (9.03)*** | (9.41)*** |
| K = 3 | 0.0043 | 0.0076 | 0.0100 | 0.0123 | 0.0131 | 0.0151 | 0.0162 | 0.0178 | 0.0186 | 0.0217 | 0.0173 | 0.0142 |
| | (0.88) | (1.42) | (1.79)* | (2.25)** | (2.50)** | (2.79)*** | (3.14)*** | (3.47)*** | (3.54)*** | (4.02)*** | (6.99)*** | (6.81)*** |
| K = 6 | 0.0058 | 0.0080 | 0.0108 | 0.0130 | 0.0130 | 0.0139 | 0.0162 | 0.0169 | 0.0176 | 0.0198 | 0.0140 | 0.0117 |
| | (1.14) | (1.48) | (1.84)* | (2.17)** | (2.31)** | (2.50)** | (2.97)*** | (3.22)*** | (3.33)*** | (3.66)*** | (6.18)*** | (6.45)*** |
| K = 12 | 0.0079 | 0.0099 | 0.0120 | 0.0137 | 0.0134 | 0.0139 | 0.0158 | 0.0157 | 0.0164 | 0.0172 | 0.0093 | 0.0079 |
| | (1.60) | (1.85)* | (2.15)* | (2.43)** | (2.47)** | (2.61)*** | (2.96)*** | (3.10)*** | (3.27)*** | (3.40)*** | (5.36)*** | (5.48)*** |

**Table 3 Risk-adjusted returns of the portfolios formed on VOSHOCK**

At the end of each month, stocks are sorted into decile portfolios based on the ranking of VOSHOCK. The low (high) portfolio is the decile that contains stocks with the lowest (highest) level of volume shock. Monthly portfolio returns over the next *K* months (*K* = 1, 3, 6, 12) are calculated for each decile portfolio. This procedure is repeated every month over our sample period. Panels A and B report the value- and equal-weighted risk-adjusted portfolio returns (regression intercept) from the Carhart four-factor model augmented with a liquidity factor, respectively. High–Low is the return difference between the highest-VOSHOCK portfolio and the lowest-VOSHOCK portfolio. The *t*-statistics listed in parentheses are based on Newey-West standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Low | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | High | High – Low | (V10 + V9) – (V1 + V2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A: Value-weighted | | | | | | | | | | | | |
| K = 1 | −0.0073 | −0.0057 | −0.0036 | 0.0012 | −0.0002 | −0.0008 | 0.0043 | 0.0084 | 0.0114 | 0.0107 | 0.0180 | 0.0175 |
| | (−3.36)*** | (−2.83)*** | (−1.77)* | (0.67) | (−0.09) | (−0.37) | (2.03)** | (4.28)*** | (5.40)*** | (4.74)*** | (5.56)*** | (7.66)*** |
| K = 3 | −0.0016 | −0.0006 | −0.0015 | 0.0017 | 0.0015 | −0.0001 | 0.0038 | 0.0040 | 0.0059 | 0.0071 | 0.0087 | 0.0076 |
| | (−0.88) | (−0.36) | (−0.92) | (1.24) | (1.00) | (−0.03) | (2.56)*** | (2.72)*** | (3.93)*** | (4.05)*** | (3.36)*** | (3.63)*** |
| K = 6 | −0.0005 | 0.0004 | 0.0004 | 0.0017 | 0.0018 | 0.0005 | 0.0032 | 0.0043 | 0.0054 | 0.0061 | 0.0067 | 0.0058 |
| | (−0.32) | (0.31) | (0.32) | (1.34) | (1.50) | (0.33) | (2.95)*** | (3.21)*** | (4.18)*** | (3.91)*** | (2.80)*** | (3.03)*** |
| K = 12 | 0.0007 | 0.0007 | 0.0017 | 0.0024 | 0.0019 | 0.0015 | 0.0033 | 0.0043 | 0.0050 | 0.0044 | 0.0037 | 0.0040 |
| | (0.55) | (0.54) | (1.23) | (2.21)** | (1.72) | (1.35) | (3.17)*** | (3.52)*** | (4.90)*** | (4.14)*** | (2.39)** | (2.82)*** |
| Panel B: Equal-weighted | | | | | | | | | | | | |
| K = 1 | 0.0015 | 0.0062 | 0.0100 | 0.0107 | 0.0118 | 0.0109 | 0.0158 | 0.0171 | 0.0212 | 0.0232 | 0.0218 | 0.0184 |
| | (0.54) | (2.29)** | (4.18)*** | (3.91)*** | (4.52)*** | (3.81)*** | (5.81)*** | (6.43)*** | (7.86)*** | (8.80)*** | (6.10)*** | (6.81)*** |
| K = 3 | 0.0070 | 0.0075 | 0.0078 | 0.0094 | 0.0087 | 0.0095 | 0.0132 | 0.0114 | 0.0127 | 0.0144 | 0.0075 | 0.0063 |
| | (2.81)*** | (3.45)*** | (3.48)*** | (4.41)*** | (4.11)*** | (5.08)*** | (5.65)*** | (5.93)*** | (6.80)*** | (7.52)*** | (2.87)*** | (3.04)*** |
| K = 6 | 0.0070 | 0.0066 | 0.0086 | 0.0081 | 0.0082 | 0.0090 | 0.0106 | 0.0106 | 0.0112 | 0.0117 | 0.0046 | 0.0046 |
| | (3.19)*** | (3.60)*** | (4.25)*** | (3.81)*** | (3.83)*** | (4.72)*** | (5.40)*** | (5.55)*** | (6.76)*** | (5.90)*** | (2.14)** | (2.66)*** |
| K = 12 | 0.0065 | 0.0065 | 0.0081 | 0.0077 | 0.0082 | 0.0091 | 0.0090 | 0.0094 | 0.0096 | 0.0095 | 0.0030 | 0.0031 |
| | (3.81)*** | (3.57)*** | (4.24)*** | (4.44)*** | (4.45)*** | (4.49)*** | (4.52)*** | (5.83)*** | (5.74)*** | (5.62)*** | (2.08)** | (2.23)** |

**Table 4 Fama-MacBeth cross-sectional regressions**

At the end of each month over our sample period, we run Equation (3) using individual stocks. The dependent variables are the individual stock buy-and-hold returns over the next 1 (Panel A), 2-6 (Panel B) and 7-12 (Panel C) months. The explanatory variable set comprises various combinations of VOSHOCK and firm characteristics. TURN is share turnover; SIZE is market capitalization; BM is the book-to-market ratio; MOM is the cumulative return of the past 12 months with a one month lag; IVOL is idiosyncratic volatility estimated over the past 252 trading days; MAX is the maximum daily return within month *t*; REV is stock return in month *t*; and Beta is the beta of a stock estimated using the market model over the past 252 trading days. Both SIZE and BM are natural log transformed. All variables are winsorized at the 1 and 99th percentiles. The table reports the time series average of the monthly cross-sectional estimates. The *t*-statistics are adjusted for Newey and West (1987) standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Constant | VOSHOCK | TURN | SIZE | BM | MOM | IVOL | MAX | REV | Beta |
|---|---|---|---|---|---|---|---|---|---|---|
| Panel A: Return *t* + 1 | | | | | | | | | | |
| Regression 1 | 0.0149 | 0.0042 | | | | | | | | |
| | (2.69)** | (8.34)*** | | | | | | | | |
| Regression 2 | 0.0166 | 0.0049 | −0.0381 | | | | | | | |
| | (3.42)*** | (6.60)*** | (−0.94) | | | | | | | |
| Regression 3 | 0.0941 | 0.0035 | | −0.0044 | 0.0034 | 0.0017 | | | | |
| | (3.52)*** | (7.62)*** | | (−3.45)*** | (2.95)*** | (1.10) | | | | |
| Regression 4 | 0.0756 | 0.0042 | −0.0423 | −0.0034 | 0.0034 | 0.0020 | 0.0596 | | | |
| | (3.99)*** | (6.15)*** | (−1.37) | (−3.69)*** | (3.31)*** | (1.23) | (1.12) | | | |
| Regression 5 | 0.0629 | 0.0054 | −0.0001 | −0.0028 | 0.0036 | 0.0014 | 0.1633 | −0.0545 | −0.0541 | −0.0009 |
| | (3.29)*** | (8.81)*** | (−0.01) | (−2.98)*** | (3.72)*** | (0.88) | (3.58)*** | (−5.52)*** | (−6.33)*** | (−0.69) |

**Table 4 Continued**

| | Constant | VOSHOCK | TURN | SIZE | BM | MOM | IVOL | MAX | REV | Beta |
|---|---|---|---|---|---|---|---|---|---|---|
| Panel B: Return [$t + 2$, $t + 6$] | | | | | | | | | | |
| Regression 1 | 0.0143 | 0.0016 | | | | | | | | |
| | (2.94)*** | (4.16)*** | | | | | | | | |
| Regression 2 | 0.0164 | 0.0024 | −0.0491 | | | | | | | |
| | (3.71)*** | (4.05)*** | (−1.35) | | | | | | | |
| Regression 3 | 0.0852 | 0.0016 | | −0.0039 | 0.0033 | 0.0001 | | | | |
| | (4.00)*** | (4.31)*** | | (−3.91)*** | (2.98)*** | (0.01) | | | | |
| Regression 4 | 0.0501 | 0.0021 | −0.0544 | −0.0023 | 0.0025 | 0.0001 | 0.1278 | | | |
| | (3.19)*** | (4.11)*** | (−1.90)* | (−2.91)*** | (2.26)** | (0.11) | (2.69)*** | | | |
| Regression 5 | 0.0516 | 0.0018 | −0.0471 | −0.0023 | 0.0023 | −0.0001 | 0.1537 | −0.0087 | 0.0083 | −0.0013 |
| | (3.31)*** | (4.20)*** | (−1.72)* | (−3.00)*** | (2.12)** | (−0.10) | (3.45)*** | (−1.58) | (2.70)*** | (−1.02) |
| Panel C: Return [$t + 7$, $t + 12$] | | | | | | | | | | |
| Regression 1 | 0.0152 | 0.0013 | | | | | | | | |
| | (3.06)*** | (1.93)* | | | | | | | | |
| Regression 2 | 0.0177 | 0.0023 | −0.0659 | | | | | | | |
| | (3.90)*** | (2.36)** | (−1.92)* | | | | | | | |
| Regression 3 | 0.1029 | 0.0012 | | −0.0049 | 0.0012 | −0.0039 | | | | |
| | (4.32)*** | (1.79)* | | (−4.16)*** | (0.48) | (−3.37)*** | | | | |
| Regression 4 | 0.0667 | 0.0015 | −0.0504 | −0.0032 | 0.0006 | −0.0041 | 0.1303 | | | |
| | (2.36)** | (1.84)* | (−2.15)** | (−2.23)** | (0.25) | (−3.60)*** | (1.77)* | | | |
| Regression 5 | 0.0645 | 0.0013 | −0.0355 | −0.0030 | 0.0004 | −0.0043 | 0.1490 | −0.0023 | −0.0003 | −0.0021 |
| | (2.31)** | (1.88)* | (−1.51) | (−2.17)** | (0.17) | (−3.68)*** | (2.18)** | (−0.37) | (−0.09) | (−1.33) |

**Table 5 Returns to portfolios formed on VOSHOCK: Sensitivity analysis**

At the end of each month, stocks are sorted into decile portfolios based on the ranking of VOSHOCK. The low (high) portfolio is the decile that contains stocks with the lowest (highest) level of volume shock. Monthly portfolio returns over the next *K* months (*K* = 1, 3, 6, 12) are calculated for each decile portfolio. This procedure is repeated every month over our sample period. This table shows the raw (High – Low) and risk-adjusted (alpha from the Carhart four-factor model augmented with a liquidity factor) volume shock return premiums when price-sensitive announcements are excluded (Panel A), when months January and July are excluded (Panel B), over the first half (Panel C) and second half (Panel D) of the sample period, and in up (Panel E) and down (Panel F) markets (based on the previous 36-month value-weighted market returns). The *t*-statistics listed in parentheses are based on Newey-West standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| | K = 1 | K = 3 | K = 6 | K = 12 | K = 1 | K = 3 | K = 6 | K = 12 |
|---|---|---|---|---|---|---|---|---|
| | Value-weighted | | | | Equal-weighted | | | |
| Panel A: Exclude price-sensitive announcements | | | | | | | | |
| High – Low | 0.0130 | 0.0049 | 0.0022 | 0.0017 | 0.0258 | 0.0154 | 0.0119 | 0.0078 |
| | (3.87)*** | (2.44)** | (1.53) | (1.57) | (7.17)*** | (5.61)*** | (5.43)*** | (5.35)*** |
| Alpha | 0.0139 | 0.0049 | 0.0021 | 0.0013 | 0.0188 | 0.0088 | 0.0062 | 0.0032 |
| | (4.07)*** | (1.93)* | (1.00) | (0.82) | (4.96)*** | (2.99)*** | (2.45)** | (1.69)* |
| Panel B: Exclude January and July | | | | | | | | |
| High – Low | 0.0130 | 0.0038 | 0.0019 | 0.0012 | 0.0247 | 0.0155 | 0.0130 | 0.0084 |
| | (4.87)*** | (1.91)* | (1.21) | (1.11) | (7.75)*** | (6.58)*** | (5.53)*** | (4.94)*** |
| Alpha | 0.0126 | 0.0045 | 0.0016 | 0.0015 | 0.0201 | 0.0103 | 0.0071 | 0.0038 |
| | (4.39)*** | (2.07)** | (0.86) | (0.80) | (5.62)*** | (3.80)*** | (2.95)*** | (2.10)** |
| Panel C: First half of the sample period | | | | | | | | |
| High – Low | 0.0139 | 0.0047 | 0.0016 | 0.0001 | 0.0299 | 0.0200 | 0.0161 | 0.0106 |
| | (3.50)*** | (1.75)* | (0.76) | (0.26) | (5.44)*** | (4.69)*** | (4.89)*** | (3.89)*** |
| Alpha | 0.0125 | 0.0033 | 0.0006 | −0.0012 | 0.0167 | 0.0081 | 0.0062 | 0.0048 |
| | (3.17)*** | (1.12) | (0.35) | (−0.74) | (3.48)*** | (1.95)* | (1.72)* | (1.44) |
| Panel D: Second half of the sample period | | | | | | | | |
| High – Low | 0.0122 | 0.0031 | 0.0025 | 0.0017 | 0.0280 | 0.0143 | 0.0114 | 0.0072 |
| | (3.58)*** | (1.10) | (1.13) | (1.16) | (8.80)*** | (6.79)*** | (4.32)*** | (4.20)*** |
| Alpha | 0.0143 | 0.0064 | 0.0041 | 0.0032 | 0.0286 | 0.0127 | 0.0090 | 0.0053 |
| | (4.15)*** | (2.54)** | (1.98)** | (2.33)** | (7.47)*** | (4.75)*** | (3.21)*** | (2.65)*** |
| Panel E: Up markets | | | | | | | | |
| High – Low | 0.0120 | 0.0036 | 0.0021 | 0.0019 | 0.0294 | 0.0175 | 0.0142 | 0.0097 |
| | (4.55)*** | (1.81)* | (1.36) | (1.44) | (8.02)*** | (6.21)*** | (5.75)*** | (5.27)*** |
| Alpha | 0.0111 | 0.0037 | 0.0012 | 0.0006 | 0.0239 | 0.0113 | 0.0090 | 0.0053 |
| | (4.01)*** | (1.72)* | (0.67) | (0.38) | (6.39)*** | (3.96)*** | (2.95)*** | (2.33)** |
| Panel F: Down markets | | | | | | | | |
| High – Low | 0.0221 | 0.0097 | 0.0060 | −0.0001 | 0.0277 | 0.0158 | 0.0123 | 0.0061 |
| | (3.12)*** | (2.05)** | (1.55) | (−0.07) | (4.84)*** | (3.58)*** | (3.50)*** | (2.24)** |
| Alpha | 0.0197 | 0.0088 | 0.0037 | −0.0011 | 0.0240 | 0.0135 | 0.0110 | 0.0060 |
| | (2.56)*** | (1.67)* | (1.01) | (−0.81) | (6.04)*** | (2.83)*** | (4.21)*** | (4.47)*** |

**Table 6 Relative turnover ratios after volume shock**

This table reports turnover ratios for the high- and low-VOSHOCK quintile portfolios over the holding periods of the first month, the second to sixth months, and the seventh to 12th months relative to their previous 12-month (i.e., *t*–1 to *t*–12) turnover ratios. The more visible group includes stocks with a higher level of institutional ownership (top 30%), stocks that are priced at above $1, the top 200 stocks by market capitalization and stocks with a higher level of turnover (top 30%). The less visible group includes stocks with a lower level of institutional ownership (bottom 30%), stocks that that are priced below 50 cents, stocks outside the top 200, and stocks with the lowest level of turnover (bottom 30%). Column (2) − (1) ((4) – (3)) shows the difference between the relative turnover ratios of high- and low-VOSHOCK portfolios within the more (less) visible stocks and column (4) − (2) indicates the difference between the high-VOSHOCK portfolio of the less visible group and the high-VOSHOCK portfolio of the more visible group. *, **, and *** denote the statistical significance of the differences at the 10%, 5%, and 1% levels, respectively.

| | More visible | | Less visible | | | | |
|---|---|---|---|---|---|---|---|
| | Low VOSHOCK (1) | High VOSHOCK (2) | Low VOSHOCK (3) | High VOSHOCK (4) | (2) − (1) | (4) − (3) | (4) − (2) |
| Panel A: Institutional ownership | | | | | | | |
| Month [*t* + 1] | 0.7824 | 2.1888 | 0.7556 | 2.9296 | 1.4064*** | 2.1740*** | 0.7408*** |
| Month [*t* + 2, *t* + 6] | 0.9450 | 2.0012 | 1.1301 | 2.7329 | 1.0562*** | 1.6028*** | 0.7317*** |
| Month [*t* + 7, *t* + 12] | 1.0674 | 1.9767 | 1.7931 | 3.4202 | 0.9093*** | 1.6271*** | 1.4435*** |
| Panel B: Share price | | | | | | | |
| Month [*t* + 1] | 0.8193 | 2.0231 | 0.9183 | 3.4290 | 1.2038*** | 2.5106*** | 1.4059*** |
| Month [*t* + 2, *t* + 6] | 0.9634 | 1.9613 | 1.3835 | 3.2035 | 0.9978*** | 1.8200*** | 1.2422*** |
| Month [*t* + 7, *t* + 12] | 1.1138 | 1.9523 | 1.9906 | 3.8872 | 0.8385*** | 1.8966*** | 1.9349*** |
| Panel C: Firm size | | | | | | | |
| Month [*t* + 1] | 0.8556 | 1.6621 | 0.7713 | 2.4949 | 0.8064*** | 1.7237*** | 0.8328*** |
| Month [*t* + 2, *t* + 6] | 0.9831 | 1.6291 | 1.1330 | 2.2798 | 0.6460*** | 1.1468*** | 0.6507*** |
| Month [*t* + 7, *t* + 12] | 1.1384 | 1.7496 | 1.5975 | 2.5324 | 0.6112*** | 0.9349*** | 0.7828*** |
| Panel D: Turnover | | | | | | | |
| Month [*t* + 1] | 0.6321 | 1.7702 | 0.9576 | 3.0059 | 1.1381*** | 2.0484*** | 1.2357*** |
| Month [*t* + 2, *t* + 6] | 0.7764 | 1.4281 | 1.4806 | 2.9920 | 0.6518*** | 1.5114*** | 1.5638*** |
| Month [*t* + 7, *t* + 12] | 0.8307 | 1.2614 | 2.3824 | 3.6902 | 0.4307*** | 1.3077*** | 2.4288*** |

**Table 7 Returns to portfolios formed on VOSHOCK in different visibility groups**

At the end of each month, stocks are first sorted into different visibility groups based on institutional ownership, share price, market capitalization and share turnover. Within each group, stocks are further sorted into quintile portfolios based on the ranking of VOSHOCK. Monthly portfolio returns over the next *K* months (*K* = 1, 3, 6, 12) are calculated for each quintile portfolio. This procedure is repeated every month over our sample period. V1 (V5) represents the portfolio with highest (lowest) VOSHOCK. Furthermore, stocks in V5 are sorted into three portfolios using a 30:40:30 split based on change in institutional ownership in the concurrent month. The rows marked (LI) represent the sub-portfolio of stocks with the lowest increase in institutional ownership and the rows marked (HI) represent the sub-portfolio of stocks with the highest increase in institutional ownership. Panel A presents the results of high (top 30%) and low (bottom 30%) institutional ownership. Panel B displays the results for high priced stocks (above $1) and low priced stocks (below 50cents). Panel C shows the results for large stocks (the top 200) and small stocks (outside the top 200). Panel D presents the results for high (top 30%) and low (bottom 30%) share turnover. The returns reported are risk-adjusted using the Carhart four-factor model augmented with a liquidity factor. The *t*-statistics listed in parentheses are based on Newey-West standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| | K = 1 | K = 3 | K = 6 | K = 12 | K = 1 | K = 3 | K = 6 | K = 12 |
|---|---|---|---|---|---|---|---|---|
| | Value-weighted | | | | Equal-weighted | | | |
| Panel A: Institutional ownership groups | | | | | | | | |
| High institutional ownership | | | | | | | | |
| V5 – V1 | 0.0070 | 0.0031 | 0.0020 | 0.0010 | 0.0149 | 0.0067 | 0.0048 | 0.0029 |
| | (2.38)** | (1.40) | (1.02) | (0.90) | (4.34)*** | (2.35)** | (1.89)* | (1.43) |
| V5 (LI) – V1 | 0.0095 | 0.0079 | 0.0063 | 0.0029 | 0.0167 | 0.0061 | 0.0057 | 0.0031 |
| | (2.49)** | (2.04)** | (2.16)** | (1.47) | (3.80)*** | (1.70)* | (1.93)* | (1.46) |
| V5 (HI) – V1 | 0.0108 | 0.0060 | 0.0043 | 0.0009 | 0.0130 | 0.0059 | 0.0041 | 0.0022 |
| | (2.56)** | (2.02)** | (2.01)** | (0.61) | (2.79)*** | (1.47) | (1.25) | (0.98) |
| Low institutional ownership | | | | | | | | |
| V5 – V1 | 0.0121 | 0.0072 | 0.0059 | 0.0033 | 0.0252 | 0.0102 | 0.0071 | 0.0053 |
| | (2.21)** | (2.32)** | (2.36)** | (1.48) | (6.41)*** | (3.31)*** | (2.68)*** | (2.51)*** |
| V5 (LI) – V1 | 0.0124 | 0.0072 | 0.0039 | 0.0027 | 0.0297 | 0.0088 | 0.0070 | 0.0051 |
| | (2.41)** | (2.25)** | (1.70)* | (1.37) | (5.27)*** | (2.57)*** | (1.90)* | (2.04)** |
| V5 (HI) – V1 | 0.0173 | 0.0084 | 0.0081 | 0.0042 | 0.0252 | 0.0096 | 0.0064 | 0.0025 |
| | (2.80)*** | (2.26)** | (2.25)** | (1.22) | (5.85)*** | (2.77)*** | (1.88)* | (0.85) |
| Panel B: Price groups | | | | | | | | |
| Priced above $1 | | | | | | | | |
| V5 – V1 | 0.0047 | 0.0033 | 0.0023 | 0.0016 | 0.0103 | 0.0063 | 0.0046 | 0.0032 |
| | (1.83)* | (1.58) | (1.11) | (1.58) | (5.15)*** | (4.15)*** | (3.74)*** | (3.59)*** |
| V5 (LI) – V1 | 0.0076 | 0.0045 | 0.0046 | 0.0018 | 0.0130 | 0.0068 | 0.0062 | 0.0035 |
| | (2.29)** | (2.06)** | (1.95)* | (1.55) | (5.15)*** | (3.15)*** | (3.41)*** | (2.85)*** |
| V5 (HI) – V1 | 0.0087 | 0.0059 | 0.0044 | 0.0028 | 0.0087 | 0.0053 | 0.0029 | 0.0023 |
| | (2.40)** | (3.35)*** | (2.27)** | (2.31)** | (2.79)*** | (2.43)** | (1.93)* | (1.91)* |
| Priced below 50¢ | | | | | | | | |
| V5 – V1 | 0.0159 | 0.0065 | 0.0042 | 0.0025 | 0.0211 | 0.0073 | 0.0058 | 0.0039 |
| | (3.48)*** | (2.03)** | (1.67)** | (1.51) | (5.92)*** | (2.83)*** | (2.47)** | (2.14)** |
| V5 (LI) – V1 | 0.0171 | 0.0052 | 0.0025 | 0.0023 | 0.0214 | 0.0080 | 0.0063 | 0.0056 |
| | (2.60)*** | (1.34) | (0.67) | (0.94) | (4.45)*** | (2.47)** | (1.99)** | (1.97)** |
| V5 (HI) – V1 | 0.0135 | 0.0048 | 0.0031 | 0.0003 | 0.0229 | 0.0070 | 0.0042 | 0.0019 |
| | (2.19)** | (1.19) | (1.06) | (0.15) | (4.81)*** | (2.15)** | (1.66)* | (1.03) |

**Table 7 Continued**

| | K = 1 | K = 3 | K = 6 | K = 12 | K = 1 | K = 3 | K = 6 | K = 12 |
|---|---|---|---|---|---|---|---|---|
| | Value-weighted | | | | Equal-weighted | | | |
| Panel C: Size groups | | | | | | | | |
| Big stocks | | | | | | | | |
| V5 – V1 | 0.0055 | 0.0027 | 0.0022 | 0.0014 | 0.0081 | 0.0047 | 0.0038 | 0.0023 |
| | (1.98)** | (1.37) | (1.18) | (1.47) | (3.99)*** | (3.45)*** | (3.09)*** | (2.49)** |
| V5 (LI) – V1 | 0.0022 | 0.0015 | 0.0040 | 0.0018 | 0.0107 | 0.0035 | 0.0028 | 0.0008 |
| | (0.88) | (0.74) | (1.56) | (1.20) | (3.65)*** | (1.90)* | (1.91)* | (0.65) |
| V5 (HI) – V1 | 0.0021 | 0.0019 | 0.0042 | 0.0025 | 0.0065 | 0.0053 | 0.0036 | 0.0022 |
| | (0.78) | (0.95) | (2.14)** | (0.81) | (2.94)*** | (3.24)*** | (2.03)** | (1.67)* |
| Small stocks | | | | | | | | |
| V5 – V1 | 0.0183 | 0.0080 | 0.0058 | 0.0035 | 0.0215 | 0.0080 | 0.0061 | 0.0040 |
| | (6.10)*** | (2.97)*** | (2.42)** | (2.09)** | (6.54)*** | (3.18)*** | (2.68)*** | (2.38)** |
| V5 (LI) – V1 | 0.0198 | 0.0093 | 0.0080 | 0.0050 | 0.0228 | 0.0092 | 0.0078 | 0.0061 |
| | (4.95)*** | (3.06)*** | (2.75)*** | (2.71)*** | (5.48)*** | (3.18)*** | (2.83)*** | (2.76)*** |
| V5 (HI) – V1 | 0.0205 | 0.0070 | 0.0042 | 0.0017 | 0.0220 | 0.0069 | 0.0040 | 0.0020 |
| | (4.88)*** | (2.03)** | (1.56) | (0.97) | (5.12)*** | (2.08)** | (1.61) | (1.19) |
| Panel D: Turnover groups | | | | | | | | |
| High share turnover | | | | | | | | |
| V5 – V1 | 0.0058 | 0.0023 | 0.0003 | 0.0009 | 0.0114 | 0.0012 | 0.0003 | 0.0001 |
| | (1.30) | (0.55) | (0.08) | (0.46) | (2.81)*** | (0.38) | (0.15) | (0.09) |
| V5 (LI) – V1 | 0.0137 | 0.0016 | 0.0012 | 0.0010 | 0.0158 | 0.0014 | 0.0002 | 0.0001 |
| | (2.50)** | (0.37) | (0.33) | (0.41) | (2.83)*** | (0.38) | (0.07) | (0.03) |
| V5 (HI) – V1 | 0.0021 | 0.0002 | 0.0013 | 0.0015 | 0.0087 | 0.0008 | 0.0027 | 0.0018 |
| | (0.42) | (0.05) | (0.33) | (0.61) | (1.78) | (0.19) | (0.95) | (0.81) |
| Low share turnover | | | | | | | | |
| V5 – V1 | 0.0072 | 0.0056 | 0.0039 | 0.0010 | 0.0261 | 0.0110 | 0.0077 | 0.0055 |
| | (1.67) | (2.09)** | (1.76)* | (0.46) | (8.07)*** | (4.82)*** | (3.61)*** | (3.70)*** |
| V5 (LI) – V1 | 0.0030 | 0.0028 | 0.0040 | 0.0022 | 0.0341 | 0.0153 | 0.0083 | 0.0065 |
| | (0.54) | (0.70) | (1.24) | (1.01) | (5.11)*** | (4.51)*** | (3.10)*** | (3.17)*** |
| V5 (HI) – V1 | 0.0120 | 0.0069 | 0.0050 | 0.0037 | 0.0238 | 0.0095 | 0.0044 | 0.0041 |
| | (2.24)** | (2.30)** | (1.67)* | (1.22) | (5.01)*** | (3.35)*** | (1.94)* | (1.89)* |

**Table 8 Sensitivity to volume shocks and stock returns**

At the end of each month, we estimate individual stocks' sensitivities to volume shocks ($\beta_{VO}$) by regressing excess stock returns on the constructed VOF over the previous 60 months. Panel A reports the value- and equal-weighted portfolio returns of decile portfolios sorted based on $\beta_{VO}$. H–L is the return difference between the highest- and the lowest-$\beta_{Vo}$ portfolios. Alpha is the regression intercept from the Carhart four-factor model augmented with a liquidity factor. Panel B reports the estimates from monthly cross-sectional regressions. The explanatory variable set comprises various combinations of VOSHOCK, $\beta_{VO}$, and firm characteristics. TURN is share turnover; SIZE is the market capitalization; BM is the book-to-market ratio; MOM is the cumulative return of the past 12 months with a one month lag; IVOL is the idiosyncratic volatility estimated over the past 252 trading days; MAX is the maximum daily return within month *t*; REV is stock return in month *t*; and Beta is beta of a stock estimated using the market model over the past 252 trading days. Both SIZE and BM are natural log transformed. All the variables are winsorized at 1 and 99th percentiles. The *t*-statistics listed in parentheses are based on Newey-West standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: $\beta_{VO}$ portfolios

| | Low | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | High | H – L | Alpha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\beta_{VO}$ | −2.49 | −0.93 | −0.50 | −0.21 | 0.05 | 0.32 | 0.65 | 1.10 | 1.80 | 4.20 | | |
| VW | 0.0075 | 0.0117 | 0.0074 | 0.0102 | 0.0071 | 0.0080 | 0.0086 | 0.0057 | 0.0023 | −0.0002 | −0.0077 | −0.009 |
| | (1.35) | (2.61)*** | (2.14)** | (3.26)*** | (2.36)** | (2.80)*** | (2.59)** | (1.37) | (0.42) | (−0.04) | (−1.38) | (−1.07) |
| EW | 0.0148 | 0.0139 | 0.0147 | 0.0116 | 0.0121 | 0.0118 | 0.0119 | 0.0121 | 0.0157 | 0.0140 | −0.0008 | 0.0013 |
| | (2.39)** | (2.75)*** | (3.19)*** | (2.76)*** | (2.92)*** | (2.71)*** | (2.49)** | (2.21)** | (2.45)*** | (1.99)** | (−0.24) | (0.34) |

Panel B: Cross-sectional regressions

| | Constant | VOSHOCK | $\beta_{VO}$ | TURN | SIZE | BM | MOM | IVOL | MAX | REV | Beta |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Regression 1 | 0.0146 | 0.0043 | −0.0003 | | | | | | | | |
| | (2.53)** | (7.97)*** | (−0.56) | | | | | | | | |
| Regression 2 | 0.0570 | 0.0058 | −0.0003 | −0.0241 | −0.0025 | 0.0038 | 0.0012 | 0.1661 | −0.0448 | −0.0523 | −0.0010 |
| | (2.93)*** | (9.72)*** | (−0.74) | (−0.85) | (−2.63)*** | (3.58)*** | (0.69) | (3.65)*** | (−5.31)*** | (−5.84)*** | (−0.74) |

## Appendix

### Table A1 Risk-adjusted returns of the portfolios formed on volume shocks – weekly data

We measure volume shocks at the weekly level as $WVOSHOCK_{i,t} = [VO_{i,t} - AVGVO_{i|t-26,t-1}]/SDVO_{i|t-26,t-1}$, where $VO_{i,t}$ is the volume traded for stock *i* in week *t* divided by the number of shares outstanding; $AVGVO_{i|t-26,t-1}$ and $SDVO_{i|t-26,t-1}$ are the mean and standard deviation, respectively, of the volume traded divided by the number of shares outstanding for stock *i* over the past 26 weeks. At the end of each week, stocks are sorted into decile portfolios based on the ranking of WVOSHOCK. The low (high) portfolio is the decile that contains stocks with the lowest (highest) level of volume shock. Weekly portfolio returns over the next *K* weeks (*K* = 1, 2, 4, 26, 52) are calculated for each decile portfolio. This procedure is repeated every week over our sample period. Panels A and B report the value- and equal-weighted risk-adjusted portfolio returns (regression intercept) from the Carhart four-factor model augmented with a liquidity factor, respectively. High–Low is the return difference between the highest-WVOSHOCK portfolio and the lowest-WVOSHOCK portfolio. The *t*-statistics listed in parentheses are based on Newey-West standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Low | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | High | High – Low | (V10 + V9) – (V1 + V2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A: Value-weighted | | | | | | | | | | | | |
| K = 1 | 0.0007 | 0.0001 | −0.0019 | 0.0027 | 0.0016 | 0.0015 | 0.0018 | 0.0022 | 0.0021 | 0.0026 | 0.0019 | 0.0019 |
| | (0.75) | (0.18) | (−0.92) | (1.82)* | (1.94)* | (1.98)** | (2.17)** | (2.94)*** | (2.58)*** | (3.27)*** | (2.32)** | (3.52)*** |
| K = 2 | 0.0007 | 0.0001 | −0.0004 | 0.0024 | 0.0016 | 0.0015 | 0.0020 | 0.0021 | 0.0020 | 0.0023 | 0.0016 | 0.0017 |
| | (0.84) | (0.18) | (−0.31) | (2.24)** | (2.20)** | (2.05)** | (2.66)*** | (3.08)*** | (2.75)*** | (3.00)*** | (2.63)*** | (4.20)*** |
| K = 4 | 0.0010 | 0.0006 | 0.0005 | 0.0017 | 0.0016 | 0.0016 | 0.0018 | 0.0019 | 0.0020 | 0.0020 | 0.0010 | 0.0012 |
| | (1.29) | (0.89) | (0.62) | (1.99)** | (2.33)** | (2.35)** | (2.59)*** | (2.95)*** | (2.88)*** | (2.76)*** | (2.12)** | (3.62)*** |
| K = 26 | −0.0119 | 0.0011 | −0.0017 | 0.0007 | 0.0014 | 0.0015 | 0.0015 | 0.0014 | 0.0016 | 0.0015 | 0.0134 | 0.0069 |
| | (−0.93) | (1.53) | (−0.47) | (0.74) | (1.96)** | (2.23)** | (2.24)** | (2.12)** | (2.26)** | (2.10)** | (1.05) | (1.09) |
| K = 52 | −0.0137 | 0.0013 | 0.0000 | 0.0011 | 0.0014 | 0.0014 | 0.0013 | 0.0014 | 0.0015 | 0.0013 | 0.0151 | 0.0076 |
| | (−1.01) | (1.80)* | (0.03) | (1.48) | (1.96)** | (2.11)** | (1.96)** | (2.09)** | (2.20)** | (1.94)* | (1.12) | (1.14) |

**Table A1 Continued**

| | Low | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | High | High – Low | (V10 + V9) – (V1 + V2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel B: Equal-weighted | | | | | | | | | | | | |
| K = 1 | −0.0012 | 0.0000 | 0.0009 | 0.0030 | 0.0040 | 0.0057 | 0.0058 | 0.0059 | 0.0058 | 0.0072 | 0.0084 | 0.0071 |
| | (−2.98)*** | (0.05) | (1.29) | (4.31)*** | (5.47)*** | (8.06)*** | (9.11)*** | (10.88)*** | (11.08)*** | (9.49)*** | (14.96)*** | (20.77)*** |
| K = 2 | 0.0001 | 0.0002 | 0.0012 | 0.0025 | 0.0035 | 0.0049 | 0.0053 | 0.0051 | 0.0047 | 0.0056 | 0.0056 | 0.0050 |
| | (0.07) | (0.32) | (1.74)* | (3.62)*** | (4.88)*** | (7.19)*** | (8.60)*** | (10.27)*** | (9.12)*** | (7.81)*** | (11.65)*** | (17.42)*** |
| K = 4 | 0.0009 | 0.0007 | 0.0015 | 0.0024 | 0.0032 | 0.0042 | 0.0049 | 0.0047 | 0.0038 | 0.0045 | 0.0036 | 0.0033 |
| | (1.99) | (1.21) | (2.27)** | (3.46)*** | (4.57)*** | (6.37)*** | (8.36)*** | (9.67)*** | (7.79)*** | (6.38)*** | (8.30)*** | (13.17)*** |
| K = 26 | 0.0022 | 0.0018 | 0.0020 | 0.0024 | 0.0030 | 0.0037 | 0.0042 | 0.0041 | 0.0030 | 0.0025 | 0.0003 | 0.0008 |
| | (4.51)*** | (2.81)*** | (3.10)*** | (3.44)*** | (4.33)*** | (5.50)*** | (7.09)*** | (7.77)*** | (6.11)*** | (3.77)*** | (1.16) | (5.40)*** |
| K = 52 | 0.0025 | 0.0020 | 0.0021 | 0.0022 | 0.0029 | 0.0036 | 0.0040 | 0.0040 | 0.0031 | 0.0024 | −0.0000 | 0.0005 |
| | (5.04)*** | (3.28)*** | (3.30)*** | (3.37)*** | (4.36)*** | (5.44)*** | (6.53)*** | (6.17)*** | (6.09)*** | (3.91)*** | (−0.14) | (5.33)*** |

Highlights

- There is a strong relationship between volume shocks and Australian equities returns.
- The relationship is particularly stronger for firms that are less visible to investors.
- Trading volume is higher after high volume shocks.
- Both institutional and individual investor are responsible for the volume shock effect.
- The volume shock effect is not priced.