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ABSTRACT: Due to data concerns, the microstructure of the price–volume relationship is seldom explored in Taiwan. Through efforts to collect the data, we reveal two impressive findings to contribute to the literature. One is that declining share prices are followed by a burst in volume, especially at market close. The other is that total trading volume increased by foreign institutions boosts subsequent returns, whether the trading volume is increased by buying or selling. Both results are barely disclosed in previous studies.

KEY WORDS: institutional investors, microstructure, price–volume relationship.

Investors always pay attention to the share prices and trading volume while investing in stocks. Because market participants such as individual investors might not have private information, this study seeks to determine how to avoid loss and even make profits if more valuable information can be obtained. In addition, we would like to show that financial studies can provide valuable information for investors as a reference. In fact, previous studies show that employing the data related to trading volume can help understand why share prices move. For example, Hiemstra and Jones (1994) believe that the trading volume makes the price move. O'Hara (1995) also states that trading volume is the important factor in price change. However, Jain and Joh (1988) and Lakonishok and Smidt (1989) suggest that stock prices direct the trading volume and trading volume follows the price. Smirlock and Starks (1988) think causality exists between the price and volume.

The price–volume relation is based mainly on the following three viewpoints. First, Copeland (1976), Jennings et al. (1981), and Jennings and Barry (1984) believe that employing the trading volume would indeed affect the stock return, since the trading volume may be deemed the proxy variable for the newly obtained information. Second, several studies indicate that the probability distribution of the change in prices and volume is the joint probability distribution (Clark 1973; Epps and Epps 1976; Harris 1986; Karpoff 1986; Tauchen and Pitts 1983). Third, Epps (1975), Gallant et al. (1992), and Smirlock and Starks (1985) propose that asymmetrical change in volume results in asymmetrical change in stock returns.

This study reveals that the trading volume indeed affects stock returns. In addition, it investigates the daily trading volume taking the microstructure of trading volume into account. For example, when we observe trading volume from market open to market close, we find that the trading volume seems to be presented in a U-shaped figure, indicating that trading volume might contain some unrevealed, even asymmetric information, especially at market open or market close.

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Price–volume is the joint product of the market mechanism, so the stock price and trading volume are often taken into account for integrated analysis. By observing the change in stock price and volume, the response of investors to new information can be rapidly identified, as individual investors and institutional investors are the two major sources of trading volume. Glosten and Harris (1988), Hasbrouck (1991), Holden and Subrahmanyam (1992), and Ma et al. (1992) suggest that an informed trader and market maker profit from trading, whereas an uninformed trader is always a loser.

Margin-buying and short-selling balances are deemed proxy variables for individual trading behaviors. When individual investors chase higher stock prices, the margin-buy balance may increase, which may not easily result in rising future stock prices. On the contrary, the margin buyers may be forced to sell their stocks due to the pressure of falling share prices, so that the stock prices might decline further. In addition, when the short-selling balance is high, a high volume of subsequent selling boosts the stock price. Therefore, margin-buying and short-selling balances are deemed to indicate the behavior of individual investors.

Lakonishok et al. (1992) and Reilly and Wright (1984) consider that institutional investors' trading behavior has significant effects on stock prices. Brennan and Cao (1997) find that the trading behavior of domestic institutions differs from that of foreign institutions in Taiwan.

This study uses the constituent stocks of the Taiwan 50 index. Busse and Green (2002) also indicate that intraday trading data is a reliable and effective means for estimating stock price. Hence, the major contribution of the study is not only to investigate the price–volume microstructure of stock returns associated with the trading volume created by margin buying, short selling, and various institutional investors, but also to examine whether the trading volume at market open and close have different effects on stock returns.

In this study, important findings are revealed as follows. First, a volume burst at market open and close would cause stock prices to decline, especially at market close. Second, this study confirms that margin buying and short selling, deemed to be individual investors' trading behavior, might not benefit the investments of individual investors, since margin buying has a negative effect on the share price, whereas short selling has a positive effect on the share price. Third, the net buys of foreign institutions on the previous day could boost the stock price. Meanwhile, the trading volume, increased by foreign institutions at previous day, would boost returns further whether created by buying or selling stocks.

Hypotheses

This study examines the price–volume microstructure for the daily trading behaviors of Taiwan stock markets and, more particularly, whether daily trading volume at market open and close, trading volume created by margins and short sales, and trading volume generated by various institutions affect the stock returns. Thus, we test whether different trading volumes affect stock returns.

Trading by Investors at Market Open and Close

Jennings and Barry (1984) show that the price is unknown before the complete dissemination of sequential information. Thus, we infer that the information released by the volume change would lead to the change in stock returns. Jain and Joh (1988) represent

that a very high trading volume usually boosts stock price. O'Hara (1995) points out that trading volume is an important factor affecting share prices. Silvapulle and Choi (1999) also find that trading volume can be used to accurately predict stock price trends in the Korean stock market. Lamoureux and Lastraps (1991) find that trading volume is an important factor affecting stock returns. Hiemstra and Jones (1994) have a different point of view, finding that stock returns affect trading volume, but that trading volume has no effect on stock returns.

However, Smirlock and Starks (1988) prove the existence of the price–volume causality, and reveal a contemporaneous correlation between price variability and volume, and autocorrelation in price variability. In addition, Chan et al. (2002) analyze the intraday interdependence of order flows and price movements for stocks actively traded on the New York Stock Exchange (NYSE) and options traded on the Chicago Board Options Exchange (CBOE). The net stock trade volume has strong predictive ability for stock and option quote revisions, but the net option trading volume has no incremental predictive ability. Chen et al. (2005) examine the dynamic relationships among returns, volume, and volatility of stock indices. Their results show a positive correlation between trading volume and the absolute value of the stock price change. In addition, the Granger causality tests based on the vector autoregression models demonstrate that returns cause volume and volume causes returns, which indicates that trading volume contributes some information to the returns process.

Similar findings are reported by Deo et al. (2008). The results show that there are significant relationships existed between trading volume and the absolute value of price changes. The returns are influenced by volume for most of the markets, which reveals that trading volume contributes some information to the return. Recently, Easley and O'Hara (2010) revealed that reducing ambiguity can benefit liquidity and further increase volume.

The causal relationships between stock returns and volume based on quantile regressions are investigated by Chuang et al. (2009). They find that the quantile causal effects of volume on returns exhibit a V-shaped relation such that the dispersion of return distribution increases with volume. This suggests that volume has a positive effect on return volatility.

Daily data may be employed to investigate the microstructure price–volume relationship. This study examines whether daily trading volume (DTV), the first fifteen minutes over the DTV (F15), and the last fifteen minutes over the DTV (L15) affect the constituent stocks of the Taiwan 50 index. It also proposes that the coefficient of variation (CV) has a positive effect on returns because investors might ask for a risk premium because they are investing in stocks with higher volatility.

Trading by Margin Buyers and Short Sellers

Margin trading might promote market efficiency in the capital market. The investors who engage in securities trading may borrow money to invest in securities. Hardouvelis (1990) indicates that margin trading enhances the efficiency of share markets. Hardouvelis and Peristiani (1992) point out that an increased margin trading cost has a negative effect on the trading volume, but stock price is affected only at the time of announcement, which might not make a significant difference in the long run. Recently, Hirose et al. (2009) also found a significant relationship between margin buying and stock returns by employing weekly data spanning from 1994 to 2003.

Figlewski (1981) and Brent et al. (1990) indicate that there are no significant relationships between short sales and future stock prices, but Asquith and Meulbroek (1995) find that short selling a very large number of stocks brings negative excess future returns. Christophe et al. (2004) examine short sales transactions in the five days before the earnings announcements of companies listed on the NASDAQ (National Association of Securities Dealers Automated Quotation) and reveal that short selling is significantly linked to postannouncement stock returns. In addition, Diether et al. (2009) show that some short sellers could earn profits by increasing their trading volume as they are predicting future negative abnormal returns correctly. This might imply that some short sellers might collect information before releasing.

Moreover, Christophe and Hsieh (2010) find that short sellers are informed traders and exploit profitable opportunities contained in downgrade announcements. Takahashi (2010) indicates that short sellers act not only as informed investors who gain negative news, but also as skillful investors who detect stock price deviations from fundamental values. Blau and Wade (2012) indicate, however, that short selling prior to analyst recommendations is more likely speculative than informed.

Margin buying and short selling are deemed to be the trading behaviors only of individual investors in Taiwan, since the authorities prohibit credit trading for institutional investors. Therefore, whether employing data from Taiwan will provide results different from relevant studies is of concern in this study.

Trading by Various Institutional Investors

Informed traders can take advantage of the information obtained personally to gain more profits. Institutional investors might have more information than individual investors generally, so that institutional investors are deemed informed traders. Admati and Pfleiderer (1988) suspect that institutional investors might obtain inside information; therefore, they indicate that institutional investors' trading behavior might signal hidden information.

Lakonishok et al. (1992) divide the investment strategies of institutional investors into two categories: the follow-up strategy and the positive-contribution trading strategy. The former strategy is to trade the same stocks as other institutional investors, and the latter is to buy strong stocks and sell weak stocks. Their results show that herding phenomena emerge, as institutional investors have more trading information than individual investors.

Chan and Lakonishok (1993) find that when institutional investors buy stocks, the stock index rises 0.34 percent; whereas when institutional investors sell stocks, the stock index declines 0.04 percent. As a result, general investors who follow the institutional investors' trading behaviors create a herding effect, which increases market liquidity.

Brennan and Cao (1997) indicate that foreign and local institutions derive different information, which might cause different trading behavior resulting from information asymmetry. Choe et al. (1999) also find that foreign investors buy stocks as share prices rise and sell stocks as share prices fall, which resulted in greater volatility in the Korean stock markets before the financial crisis. However, during the financial crisis period, the stock market responded to foreign investors' large trading volume quickly and effectively, such that foreign investors did not significantly affect the Korean stock markets.

Institutional investors might have abundant capital to affect the stock markets, and they might take advantage of the information obtained to gain more profits. Thus, in order to reduce institutional investors' influence on the market, Bushee et al. (2003) suggest that

financial institutions should communicate information to the public in order to reduce individual investors' incomprehension of the information resulting from information asymmetry.

Ferreira and Matos (2008) find that institutional investors have a strong preference for acquiring firms with good corporate governance, which they determine by examining comprehensive equity data from twenty-seven countries. Examining a broad panel of NYSE-listed stocks from 1983 to 2004, Boehmer and Kelley (2009) find that stocks with greater institutional ownership are priced more efficiently.

Yan and Zhang (2009) indicate that institutional investors are better informed, so trade actively because of their informational advantage. Baika et al. (2010) also show that local institutional investors may earn higher returns than other investors, which is similar to the findings disclosed by Puckett and Yan (2011). In addition, Kim (2011) finds that foreign investors encourage value-enhancing risk taking in order to improve the performance of their investments. In addition, Chen et al. (2011) indicate that stock price performance are significantly different within the electronics, financial, and other nonfinancial sectors in the Taiwan Stock Exchange (TSE) since the foreign institutional investment quota was abolished in 2003.

For example, foreign investors buy NT$50 billion[1] and sell NT$20 billion of Taiwan stocks in a trading day, which means that they buy net NT$30 billion. Similarly, foreign investors buy NT$500 billion and sell NT$470 billion of Taiwan stocks in another trading day, which also means that they buy net NT$30 billion. However, the signal for these two cases might be different. Similarly, the signals might be different if foreign investors buy net NT$30 billion of a total volume of NT$600 billion or if they buy net NT$30 billion of a total volume of NT$1,800 billion.

Thus, this study explores whether the individual stock returns might be affected differently by either net trading from institutional investors over total daily trading volume or total buying and selling volume over total daily trading. For example, the Taiwan stock market day trading volume is NT$1,000 billion in a day, and foreign investors buy NT$100 billion and sell NT$80 billion in that day. The former ratio is 2 percent, and the latter ratio is 18 percent. However, the signal of the former ratio would be different from that of the latter ratio. By way of the above concerns rarely employed in previous studies, we then retrieve more information to construct the price–volume microstructure for Taiwan stock markets.

Moreover, Brennan and Cao (1997) point out that the behavior of domestic institutions might be different from those of foreign institutions. In addition, the trading volume of foreign institutional investors (FIIs), securities investment trust enterprises referred to as domestic institutional investors (DIIs), and securities dealers (SDs) are reported by authorities separately. Thus, we investigate whether the behavior of different institutions would result in different results.

In this study, we include intraday volume including market open and market close, credit trading volume, and institutional trading volume. In addition, we take into account selling volume subtracted from buying volume, or selling volume added to selling volume over daily trading volume, which seems to be neglected in previous studies.

Thus, we examine whether FIIs' net trading volume over daily trading volume (FI-N) and FIIs' buying and selling volume over daily trading volume (FI-T) have a positive effect on daily stock returns (DSR). Similarly, the study investigates whether DIIs' net trading volume over daily trading volume (DI-N), DIIs' buying and selling volume over

daily trading volume (DI-T), SDs' net trading volume over daily trading volume (SD-N), and SDs' buying and selling volume over daily trading volume (SD-T) have an impact on DSR.

Empirical Results and Analysis

Data and Model

The intraday data for constituent stocks of the Taiwan 50 index was collected from one of top three security companies in Taiwan. Since there is no database available for the intraday data set related to trading volume, we collected the intraday data for each company for these constituent stocks. In addition, the variables related to credit trading and institutional investors are collected from *Taiwan Economic Journal (TEJ).*

Because of the bias caused by the financial crisis of 2008, we collected three years of data, covering 2005–7, for these constituent stocks. The forty-five stocks used in the study[2] include twenty-three electronic stocks, twelve bank stocks, and ten stocks related to traditional industry, and are investigated using the following model:

$$\begin{aligned} DSR_{i,t} = {} & \text{constant}_{i,t} + DTVC_{i,t} + F15_{i,t} + L15_{i,t} + MBC_{i,t} + SSC_{i,t} + CV_{i,t} \\ & + DM(F > L)_{i,t} + DM1_{i,t} + DM2_{i,t} + FI\text{-}N_{i,t-1} + FI\text{-}Ti_{,t-1} + DI\text{-}N_{i,t-1} \\ & + DI\text{-}T_{i,t-1} + SD\text{-}N_{i,t-1} + SD\text{-}T_{i,t-1} + \varepsilon_{i,t}, \end{aligned}$$

where DSR = daily stock return; DTVC = daily trading volume, where DTVC = $(DTV_t - DTV_{i,t-1}) / DTV_{t-1}$; F15 = the first-fifteen-minute trading volume over the DTV; L15 = the last-fifteen-minute trading volume over the DTV; MBC = (margin buy balance$_t$ –margin buy balance$_{t-1}$)/margin buy balance$_{t-1}$; SSC = (short sales balance$_t$ –short sales balance$_{t-1}$)/short sales balance$_{t-1}$; CV = coefficients of variation by using the five-minute trading volume data; DM(F > L) = the dummy variable set as 1 if F15 > L15, and 0 otherwise; DM1 = the dummy variable for the 2006 data, and 0 for others; DM2 = the dummy variables for the 2007 data, and 0 for others; FI-N = the FIIs' net trading volume: the selling volume subtracted from the buying volume of foreign investment institutions, over the DTV; FI-T = the FIIs' buying and selling trading volume over the DTV; DI-N = the DIIs' net trading volume: the selling volume subtracted from the buying volume of domestic investment institutions, over the DTV; DI-T = the DIIs' buying and selling volume over the DTV; SD-N = the SDs' net trading volume: the selling volume subtracted from the buying volume of securities dealers, over the DTV; and SD-T = the SDs' buying and selling volume over the DTV.

The above variables may be separated into three main categories. One is the trading volume at market open and close, such as F15 and L15; another is the variables for margin buying and short selling, such as MBC and SSC; and the other is volume traded by various institutional investors, including FI-N, FI-T, DI-N, DI-T, SD-N, and SD-T.

Descriptive Statistics

Table 1 shows the descriptive statistics for the mean and standard deviation for each variable. The average daily stock return and standard deviation for constituent stocks are 0.08 percent and 1.95 percent. In addition, the average DTVC is 19.47 percent, and the standard deviation attains 97.17 percent, which implies that trading volume volatility is not very low. Total trading time is 270 minutes per day, and average trading volume per

Table 1. Descriptive statistics analysis (percent)

Variable	3-year average	3-year average standard deviation
DSR	0.08	1.95
DTVC	19.47	97.17
F15	10.77	6.85
L15	11.96	7.15
MBC	0.033	0.66
SSC	–0.032	4.8
CV	116.08	269.15
DM (F>L)	43.45	48.49
DM1	33.08	47.08
DM2	33.58	47.26
FI-N	1.56	7.03
FI-T	37.8	8.95
DI-N	-0.12	1.02
DI-T	6.04	2.06
SD-N	0.02	1.21
SD-T	6.09	1.45

fifteen minutes is above 5.56 percent, but the average F15 and L15 reach 10.77 percent and 11.96 percent, which implies that trading volume at market open and close is higher than in other time slots. Moreover, DM(F > L) is 43.45 percent, which indicates that on average, trading volume at market close is higher than trading volume at market close.

The average MBC is 0.033 percent and the standard deviation about 0.66 percent. The average of the SSC is –0.032 percent and the standard deviation is 4.8 percent. The standard deviation of the SSC is higher than that of the MBC, which implies that SSC volatility is higher than that of MBC. With regard to institutional investors, the FIIs have the highest ratios for net trading volume and total buying and selling volume over daily trading volume, which are much higher than the trading volumes of the SDs and DIIs. Thus, we would infer that foreign investors play important roles in the volume traded on the Taiwan stock markets.

Results

The previous studies show that share prices might affect trading volume, trading volume can affect share prices, and both variables affect each other. Thus, we should be concerned that price and volume might be decided simultaneously, just like the price and quantity are decided concurrently in the theory of supply and demand; therefore, endogenous problems might exist if we put the trading volume variable as an independent variable.

This study therefore employs instrument variables estimated using both the two-stage least squares and generalized method of moments approaches, and finds that trading volume is an exogenous variable in our model as shown by their insignificant Hausman statistics. This may be because we employ stock returns and trading volume changes instead of stock price and trading volume in order to avoid spurious regressions.

In addition, most investors might prefer investing in individual stocks instead of common funds in Taiwan, so we examine each constituent stock of the Taiwan 50 index, which might be beneficial for individual investors.

Thus, we process the regression model for each stock in the Taiwan 50 index, and then check for differences among the three main industries: electronic, financial, and traditional industries, as presented in Table 2.

The variables related to trading volume are then separated into three groups—trading volume at market open and close, credit trading volume, and institutional trading volume—and analyzed as follows.

First, we find that changes in trading volume rarely affect the stocks of the banking industry, in accordance with the results disclosed by Chen et al. (2011), which might be a result of the comparatively large company size for the banks listed in the TSE. Second, individual investors might not make profits easily, since the margins have a negative effect on DSR and the short sales have a positive effect on the DSR. Third, the trading volume at previous day of foreign institutions, as opposed to that of securities investment trust enterprises and securities dealers, affects the DSR.

Table 3 shows that the DTVC, the SSC, and the CV are positive related to the DSR for over 90 percent of the sample firms. Furthermore, these variables significantly affect the DSR for more than 50 percent of sample firms. This indicates that the higher price might be pushed by the greater trading volume, that investors require a higher risk premium when investing in high-risk stocks, and that increasing short sales pushes up the share price. In addition, we find that there are no differences from 2005 to 2007, since DM1 and DM2 have insignificant effects on DSR.

On the contrary, Table 3 indicates that L15 and MBC have negative effects on the DSR, since over 90 percent of the L15 and MBC have negative effects on the DSR. The results indicate that a higher L15 and increasing margin balance would cause the DSR to decline.

Furthermore, the negative ratios are 93.33 percent and 71.11 percent for L15 and F15, respectively. In addition, the percentage of significantly negative ratios is also higher for L15 (100 percent) than F15 (85.71 percent), which shows that a volume burst at market close might be worse than at market open.

As for the margin buying and short selling, we find that SSC has a significantly positive effect on the DSR, and MBC has a significantly negative effect on the DSR for over 70 percent of the constituent stocks of the Taiwan 50 index. The results could be interpreted to mean that increasing MBC might not increase future prices, since chasing stocks by leverage might result in the subsequent stock price falling. In addition, as stock prices fall, margin buyers might be forced to sell stocks because of the pressure of maintaining the minimum margin, which might make share prices drop further.

On the contrary, increasing SSC seems to be favorable for increasing future share prices because investors would suffer pressure if share prices rise further. Thus, short sellers might suffer losses if they are unable to buy back stocks as a result of the price limit system regulated by the TSE, which might result in the share prices rising further.[3] In sum, individual investors might be hurt if they invest in stocks by employing margins or short sales.

With regard to various institutional investors, we find that the sum of buying volume plus selling volume plus net buying volume previous day would have more impact on the DSR for the FIIs than does the trading volume created by the DIIs and the SDs.

Table 2. Multiple regression models for individual stocks of constituent stocks of the Taiwan 50

Stock code	Constant	DTVC	F15	L15	MBC	SSC	CV	DM(F > L)
Panel A: Electronic stocks (23 companies)								
2301	–0.0625**	0.0024**	–0.0066	–0.0633**	–0.2997**	0.0041**	0.0115**	–0.0021
2303	–0.0625**	0.0024**	–0.0066	–0.0633**	–0.2997**	0.0041**	0.0115**	–0.0021
2308	–0.0276	0.0045**	–0.0118	–0.0335*	–0.0767**	0.0074**	0.0045*	0.0018
2311	–0.0013	0.0052**	–0.0306	–0.0105	–0.1041**	0.0043**	0.0027	0.0038
2317	–0.0626**	0.0037**	0.0283	–0.0551**	–0.2026**	0.007*	0.009**	–0.0036
2324	–0.0497**	0.0032**	–0.0175	–0.0499**	–0.0003	0.0048**	0.0066**	0.0011
2325	–0.0155	0.0029*	–0.0469*	–0.0194	–0.1293**	0.0268**	0.014**	0.0035
2330	–0.0122	0.002	–0.0111	–0.0173	–0.156**	0.0074**	0.0046*	0.0005
2347	–0.0287	0.0042**	–0.0117	–0.0364*	–0.1439**	0.0014*	0.0066**	0.0044
2353	–0.0395	0.0019	–0.0407*	–0.0424*	–0.093**	0.0049**	0.0071*	0.0047*
2354	–0.0481*	0.0031*	–0.0449*	–0.0609**	–0.1474**	0.0406**	0.0064*	0.0016
2357	–0.0521**	0.003**	0.0084	–0.0511**	–0.1011**	0.023**	0.0064**	0.0003
2382	–0.027	0.0034**	–0.0101	–0.0276	–0.0586**	0.009**	0.0048*	0.0007
2408	–0.0535**	0.0044**	–0.0058	–0.0456**	–0.0453	0.0118**	0.0145**	0.001
2409	–0.0081	0.0035*	0.0471**	–0.0014	–0.2267**	0.0299**	0.0029	–0.0054*
2454	–0.0472*	0.0053**	–0.0581**	–0.0409	–0.2292**	0.0136**	0.0094**	0.0049*
2474	–0.0878**	0.0033	0.0104	–0.0917**	–0.0056	0.008**	0.0065*	–0.0058
2498	–0.0916**	–0.0011	–0.0293	–0.0888**	–0.1703**	0.0397**	0.0112**	0.0001
3009	–0.0988**	0.0038**	–0.0353	–0.082**	–0.129**	0.0105**	0.0218**	0.0042
3034	–0.0407	0.004**	–0.058**	–0.0286	–0.249**	–0.0004	0.0092**	0.0074**
3045	–0.0051	0.0006**	–0.0001	–0.0057	–0.0668**	0.0031**	0.0006	–0.0001
4904	–0.0055	0.0002	0.0109	–0.0053	–0.0426**	0.0002	0.0001	–0.0006
2412	–0.0069	0.0006	–0.0014	–0.0102	–0.0337**	0.0082**	0.0016	0.0003

(continues)

Table 2. Continued

Stock code	DM1	DM2	FI-N	FI-T	DI-N	DI-T	SD-N	SD-T
Panel B: Banking stocks (12 companies)								
2801	–0.0223	0.0004	–0.0022	–0.0261	–0.0626**	0.0067**	0.0075**	–0.0011
2880	–0.0004	0.0015*	0.002	–0.0045	–0.0249	0.0002*	–0.0008	–0.0006
2881	0.0124	0.0013	–0.0142	0.0065	–0.0026	0.0014**	0.0013	0.0024
2882	–0.0067	0.0019*	–0.0017	–0.0155	–0.001	0.0033**	0.0035	0.0004
2883	–0.0094	0.0008	–0.0126	–0.0104	–0.001	0.0004	0.001	0.0008
2885	–0.021	0.0005	–0.013	–0.0271*	–0.0364**	0.0043**	0.0074**	0.0004
2886	0.0038	0.0002	–0.0099	0.0038	–0.0224**	0.0061**	–0.0003	0
2887	–0.0328*	0.0008	0.0124	–0.0332**	–0.1904**	0.0013	0.0076**	–0.0017
2888	–0.0088	0.0008	0.0028	–0.0153*	–0.2375**	0.0002	0.0034**	–0.0007
2890	–0.0064	0.0009	–0.0019	–0.0142	–0.0614**	0.003**	0.0026	0.001
2891	–0.0142	0.0027**	–0.0023	–0.0163	–0.0431	0.0017**	0.0017	0.0002
2892	0.0077	0.0039**	–0.0293	–0.0066	–0.0447*	0.0051**	0.0029	0.0033
Panel C: Nonelectronic and nonbanking stocks (10 companies)								
1101	–0.0088	0.0028**	0.0009	–0.0154	–0.0346**	0.0029**	0.001	0.002
1102	–0.0124	0.0059**	–0.0255	–0.0091	–0.0002	0.0045**	0.0034	0.0045*
1216	–0.0346**	0.006**	0.0248	–0.0732**	–0.0228	0.0008**	0.0065**	–0.004
1301	–0.0061	0.0033**	–0.0164	–0.0054	–0.0195	0.0074**	0.0019	0.0024
1303	–0.0173	0.0034**	0	–0.0178	0.0018	0.0006	0.0033	–0.0003
1326	–0.0074	0.0021**	–0.0079	–0.004	–0.0379**	0.004**	0	0.0012
1402	–0.0444*	0.0027*	–0.0443*	–0.0647**	–0.0777**	0.0078**	0.009**	–0.0009
2002	–0.0027	0.0062**	0.0053	–0.0093	–0.1132**	0.0013	0.0025	0.0008
2912	0.0126	0.0015**	0.0082	0.006	–0.0568**	0.0025**	–0.0023	0.0014

9904	–0.0162	0.0037**	0.0066	–0.0178	0.1532**	0.0089**	0.0034	–0.0033
Panel A: Electronic stocks (23 companies)								
2301	–0.0006	–0.0024	0.0826	–0.0563	–0.0381	0.3363	–0.8069	–0.4418
2303	–0.0006	–0.0024	0.0826	–0.0563	–0.0381	0.3363	–0.8069	–0.4418
2308	0.0003	–0.0024	0.0189	0.0603	–0.3692	0.556	–0.4903	–0.5108
2311	–0.0014	–0.0028	0.0201	0.1498	0.2135	–0.3276	–1.3727	0.2237
2317	0.0005	–0.0001	0.1473*	0.0028	–0.601	0.1171	0.3933	–0.8629
2324	0.0004	–0.0006	0.0178	0.0149	0.3092	0.5375	–0.2987	0.1846
2325	–0.0017	–0.0027	0.0063	0.0802	–0.1868	0.7803	–1.1544	–0.3001
2330	–0.0003	–0.0016	–0.0053	–0.1462*	0.0044	0.2506	–0.6649	–0.6036
2347	–0.0001	–0.0007	–0.0694	0.196	–0.2723	1.4538	–0.9422	0.5706
2353	–0.002	–0.0039	0.1225	0.0544	0.3525	0.7131	–0.9403	0.8128
2354	–0.0007	–0.0035	–0.0047	0.212	0.3309	0.3418	–0.8207	–0.375
2357	–0.0002	–0.0011	0.0288	–0.0782	–0.1504	0.8857	0.1064	–0.1333
2382	0.0008	–0.0031	0.0804	0.047	0.3085	1.3748*	–0.9121	0.2475
2408	0.001	–0.001	0.0347	0.1498	–0.1374	0.107	–0.4313	–0.5482
2409	0.0009	0.0022	0.0238	0.0631	0.3945	0.3557	–0.5425	–0.5009
2454	–0.0014	0.0014	0.0271	0.3306**	–0.2266	0.2199	1.1234	–0.8359
2474	0.0005	–0.0038	–0.0051	0.3417*	0.0053	1.9679	0.6445	–0.7998
2498	–0.0022	–0.0015	–0.0619	0.3154*	0.7766	1.0197	1.1484	–1.2629
3009	–0.0016	0.0007	0.1576	0.1561	0.231	0.4589	0.0161	–0.6186
3034	–0.0002	–0.0002	0.0246	0.2432*	–0.0144	0.6011	1.2781	–0.7333
3045	0.0006	0.0002	0.0544	–0.0159	0.3091	0.5013	–0.6191	–0.5295
4904	0.0005	0.0005	–0.0025	–0.0064	0.3888	–0.249	–0.2703	–0.6253

Table 2. Continued

2412	–0.0002	–0.0005	0.0345	–0.0016	0.0201	0.0458	–0.6802*	–1.2394**

(continues)

Stock code	DM1	DM2	FI-N	FI-T	DI-N	DI-T	SD-N	SD-T
Panel B: Banking stocks (12 companies)								
2801	0.0015	–0.0004	–0.051	0.1008	–0.3629	–0.4336	–0.6953	–0.7403
2880	0.0002	–0.0011	0.0191	0.0515	–0.2512	0.2726	–0.2722	–0.1976
2881	–0.0003	–0.0026	–0.0347	–0.0376	0.1537	0.8603	–0.9054	–0.2433
2882	0.0001	–0.0017	–0.0581	0.0882	–0.4396	0.346	–0.7983	–0.3557
2883	0.002	0.0004	0.0163	0.1619*	0.2101	–0.0199	–0.4033	0.1553
2885	0.0008	0.0017	–0.0658	0.2426*	–0.3138	0.6373	–1.0834	–0.6018
2886	0.0006	–0.0008	0.0308	–0.0137	0.3179	0.04	–0.3188	–0.1929
2887	0.0005	–0.0006	–0.0668	0.0354	–0.2773	0.0972	–0.2167	–0.3657
2888	–0.0004	–0.0004	–0.096	–0.0268	–0.0871	0.2297	–0.6421	–0.1014
2890	–0.0004	–0.0028	0.008	–0.056	–0.1208	0.2939	–1.0722	0.0572
2891	–0.0003	–0.0006	0.0437	0.0205	–0.0635	–0.2363	–0.4759	–0.2468
2892	–0.0004	–0.0037	–0.0624	0.0829	–0.3953	0.4674	–1.3764*	–0.1509
Panel C: Nonelectronic and nonbanking stocks (10 companies)								
1101	0.0002	0.0001	–0.0596	0.1007	–0.4062	0.9417	–0.2122	–0.6488
1102	0.0013	0.0001	0.118	0.0446	–0.0596	1.313	–0.5155	0.3078
1216	0.002	0.0028	0.0453	0.2594*	0.0055	0.8455	–0.0223	–0.5276
1301	–0.0001	0.0017	0.0429	0.1116	–0.0583	0.2908	–0.2229	–0.5491
1303	0.0007	0.0023	–0.01	0.1274*	–0.1319	0.0098	–0.0965	–0.1341
1326	–0.0002	0.0014	0.1012*	0.0511	–0.2086	0.2714	0.2309	–0.2753
1402	–0.0005	–0.0036	–0.0107	0.2509*	–0.1323	0.6395	–2.0778**	–1.3997
2002	–0.0017	–0.0018	–0.0623	0.116	–0.2001	0.2888	–0.6827	–0.7816
2912	–0.0008	–0.0013	0.0224	0.0852	–0.4683	–0.2057	–0.3958	–0.069
9904	0.0018	–0.0004	0.0105	0.0712	0.1424	0.003	–0.7029	0.3816

Notes: All the VIF (variance inflation factor) values for the above regressors are less than 5, which implies that the above models do not suffer from multicollinearity. In addition, after considering for heterogeneity as suggested by White (1980), the empirical results after revising the covariance matrix are almost the same as in the above models. * and ** significant at the 5 percent and 1 percent levels, respectively.

Table 3. Coefficient of multiple regression analysis (all samples) (in percent)

Variable	Positive ratio (n = 45)	Negative ratio (n = 45)	Significant ratio (n = 45)	Significantly positive ratio (n = 45)	Significantly negative ratio (n = 45)	Significantly positive ratio (n = significant numbers)	Significantly negative ratio (n = significant numbers)
DTVC	95.56	4.44	68.89	68.89	0	100	0
F15	28.89	71.11	15.56	2.22	13.34	14.29	85.71
L15	6.67	93.33	40	0	40	0	100
MBC	4.44	95.56	73.33	2.22	71.11	3.03	96.97
SSC	97.78	2.22	84.44	84.44	0	100	0
CV	91.11	8.89	53.33	53.33	0	100	0
DM(F > L) > L)	64.44	35.56	11.11	8.89	2.22	80	20
DM1	46.67	53.33	0	0	0	—	—
DM2	28.89	71.11	0	0	0	—	—
FI-N	62.22	37.78	4.44	4.44	0	100	0
FI-T	75.56	24.44	22.22	20	2.22	90	10
DI-N	40	60	0	0	0	—	—
DI-T	86.67	13.33	2.22	2.22	0	100	0
SD-N	17.78	82.22	6.67	0	6.67	0	100
SD-T	20	80	2.22	0	2.22	0	100

Conclusions

This study investigates the microstructure of the price–volume relationship for the constituent stocks of the Taiwan 50 index in 2005–7. The purposes of the study are to explore whether the trading volume at market open and close, credit trading volume, and institutional trading volume affect the daily returns of these constituent stocks and to reveal several important findings.

As for the trading volume at market open and close, the DTVC have significantly positive effects on DSR. Share prices are followed by volume bursts at market open and close, especially at market close. The CV has a significantly positive effect on the DSR, which means that investors require a higher risk premium for investing in high-risk stocks.

As for the trading volume from margins and short sales, the MBC have negative effects on DSR. Increasing margin buying is unfavorable for the future stock prices. Margin buyers may be forced to sell stocks as share prices drop, which would cause share prices to fall further. Similarly, the SSC have a positive effect on DSR. Increasing short selling is favorable for the future stock prices: short sellers may be forced to buy back stocks as share prices rise, which would increase the future stock prices.

As for the trading volume from various institutional investors, we find that FIIs have more influential power on share markets than the DIIs and SDs do, since the net buying volume and the sum of the buying and selling volumes at the previous day have positive effects on the DSR.

In sum, investors might not buy shares when a volume burst occurs at market open or close. In addition, individual investors should trade stocks by margin or short sales with care, since the results show investors might not benefit from credit trading. Furthermore, investors might observe the trading volume of foreign institutional investors, which would transmit valuable signals.

Note

1. The Taiwan currency is the New Taiwan dollar (NT$).
2. Five companies are excluded due to incomplete data.
3. According to the rules of the TSE, the stock price limit up is 7 percent. Once the price of a stock rises up to 7 percent, investors are possibly unable to buy the stock, which might result from the expectation of price rising in the next trading day. Therefore, the short sellers might be forced to buy back shares at a higher price in the next trading day because of the pressure of a price limit up happening again.

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