Chiao Da Management Review
Vol. 29 No. 1, 2009
pp.41-78

台灣股市投資人交易動態效果之分析

The Dynamic Analysis of Investors' Trading in The Taiwan Stock Market

蕭朝興[1] Chao-Shin Chiao
國立東華大學 財務金融學系
Department of Finance, National Dong Hwa University
王子湄 Zi-Mei Wang
銘傳大學 財務金融學系
Department of Finance, Ming Chuan University
黃常和 Chang-Ho Huang
國立東華大學 國際經濟學系
Graduate Institution of International Economic, National Dong Hwa University

摘要：本文檢測三大法人、個別投資人對於臺灣 50 交易行為與股票報酬的每日與日內關係，發現三大法人(個別投資人)每日淨買賣超與當日股票報酬之間具有強烈的正(負)相關，同時也有追逐動能(反向交易)的傾向。進一步利用逐筆委託資料來探討這正相關的可能原因，發現法人沒有預測日內短期報酬能力，雖然法人會正向追隨過去日內報酬變化，但相較之下，法人交易產生的價格壓力才是主要因素；同時，當個別投資人與法人同步且大幅買賣超時，才能對股價產生較大的衝擊。

關鍵字：法人；個別投資人；可市價化限價單；委託不均衡比率

Abstract: This paper examines the daily and intraday relationship between stock return and the trading of institutional and individual investors on the TSEC 50 securities. First, the contemporaneous relation between stock return and the trade imbalance by institutions (individuals) at the daily level is strongly positive (negative) and institutions (individuals) tend to be trend-chasing (contrarian).

[1] Corresponding author: Department of Finance, National Dong Hwa University, Hualien City, Taiwan. E-mail: cschiao@mail.ndhu.edu.tw

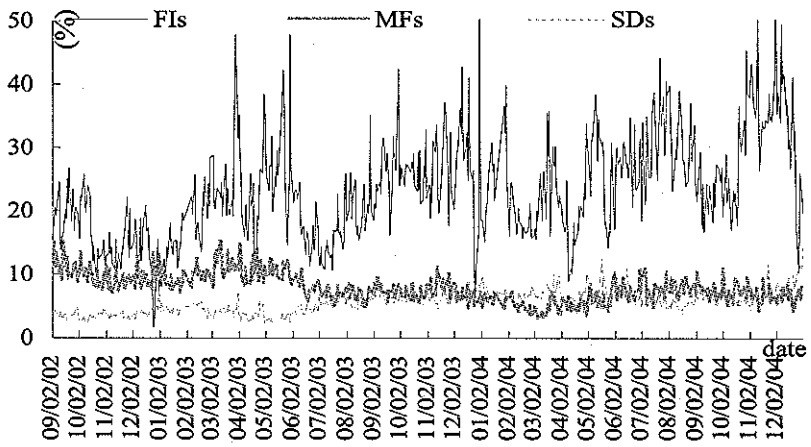
Second, applying intraday order data, this paper finds that the observed positive contemporaneous relation is largely driven by the price pressure from institutional trading. Third, no consistent evidence supports that institutional order imbalance predicts future stock returns. Finally, the stock prices will move more when the trading direction of individuals is consistent with that of institutions.

Keywords: Institutional investor; Individual investor; Marketable limit order; Order imbalance

1. Introduction

Since the early 1980s, the Ministry of Finance of Taiwan has made efforts to globalize its stock market, widely dominated by individual investors (Harrison, 1994), in order to enhance its efficiency. After two decades, its institutionalization and globalization achievements have been recognized. For instance, up to 37.1% of dollar trading volume in the Taiwan stock market is attributable to trades by professional institutional investors from 2002/9 to 2004/12, as drawn in Figure 1.

Figure 1
Percents of Total Dollar Trading Volume



This figure draws the proportion of dollar trading volume by each group of institutional investors from 2/9/2002 to 31/12/2004, for a total of 580 trading days. FIs, MFs, and SDs stand for foreign investors, mutual funds, and securities dealers, respectively. Sample averages of FIs, MFs, and SDs are 23.53%, 7.91%, and 5.66%, respectively.

Contrasted with a mere 3% in 1989 (Schwartz and Shapiro, 1991), institutional trading has increased fast over recent years. Given the growing importance of institutional trading, it would be instructive and even profitable to understand the relation between institutional trading patterns and stock returns.

Recent studies document that institutional investors not only tend to herd (Wermers, 1999; Shu, Chen, and Huang, 2005), but also follow past price movements (Grinblatt, Titman, and Wermers, 1995; Lee et al., 2006). Additionally, the contemporaneous relation between changes in institutional ownership and stock return is stronger than the trend chasing effect (Nofsinger and Sias, 1999). Employing the limit-order data for the Taiwan Stock Exchange (TSE), a purely order-driven market, this paper aims to explain the positive contemporaneous relation between changes in institutional ownership and stock returns found in previous studies and examine the relative importance among possible causes. We also analyze the roles of the trading behaviors of institutional and individual investors in the short-run (daily and intraday) price movements

According to the literature, one possibility resulting in the positive contemporaneous relation between institutional trading activities and stock returns is that institutional investors successfully forecast returns (Wermers, 1999; Choe, Kho, and Stulz, 2005; Yu and Lai, 1999). Another possibility is about the institutional positive-feedback tendency (Grinblatt, Titman, and Wermers, 1995; Lin and Ma, 2002) and/or the concurrent price pressure (French and Roll, 1986; Lee et al., 2004; Chakravarty, 2001). Due to the lack of high frequency data, the previous literature mainly uses quarterly ownership data to compute the changes in institutional holdings. For example, in order to examine the relation between changes in institutional ownership and stock return, Nofsinger and Sias (1999) use annual institutional holdings on the NYSE stocks, while Sias, Starks, and Titman (2001), Boyer and Zheng (2004) and Cai, Kaul, and Zheng (2000) employ the quarterly institutional ownership.

Even with intraday data, Griffin, Harris, and Topaloglu (hereafter GHT, 2003) still cannot identify the types of investors, such as institutional or individual investors. As the authors are obliged to estimate both sides of all trades as originating from which type of investors, a task is unavoidably subject to at least

some measurement errors. In contrast, our data recording all orders submitted to the TSE can unambiguously classify each limit order into one of five groups, including foreign investors, mutual funds, securities dealers, individual investors, and corporate institutions.[2] Due to different investor compositions and market microstructures, the conclusions from other developed markets may not entirely be applied to the Taiwan stock market. Therefore, this paper may provide investors with not only a broader view of a fast emerging market but also a potentially profitable application. To our knowledge, there is no empirical study related to this issue for the Taiwan stock market.

Furthermore, from the angle of order submission behaviors, our conclusions help us gain a better understanding of the relation between the short-run price movements and the trading behaviors of investors. To distinguish investors' trading behaviors and intentions, we calculate the imbalance of orders seeking immediacy for the TSEC 50 stocks.[3] Specifically, we pay attention to the "marketable" limit orders, defined by Chiao, Wang, and Lai (2007), in the likelihood that private information is encapsulated in such orders (Lee et al., 2004).[4] The observed relations are expected to clarify the timing ability and the strength with which institutional and individual investors move stock prices.

As a result, first, the contemporaneous relation between stock return and trade imbalance by institutions (individuals) at the daily level is strongly positive (negative) and institutions (individuals) tend to be trend-chasing (contrarian). Second, applying a vector auto-regressions (VAR) analysis, this paper shows the persistence of institutional and individual trading, but institutional trading cannot

---

[2] Mutual funds, formally called securities investment trust companies, are solely composed of domestic mutual-fund firms, while foreign investors cover a wide variety of foreign institutions, including foreign (investment) banks, insurance companies, mutual funds, pension funds, hedge funds, and so on. The corporate institutions consist of all domestic institutional investors other than the domestic professional institutional investors, such as mutual funds and securities dealers.

[3] We choose the TSEC 50 because they are the most liquid and actively traded stocks on the TSE, consistent with institutional investors' preference (Gompers and Metricks, 2001; Choe, Kho, and Stulz, 1999). The TSEC 50 stocks are the most highly capitalized blue chip stocks representing around 70% of the market and the correlation between TSEC 50 and TSE index is above 98%, indicating that our results are representative.

[4] We shall specifically discuss the definition in the Section 4.2.1.

predict future daily returns. Third, the intraday analyses still find no consistent evidence that the institutional order imbalances predict future 30-minite returns. Although the institutional trading positively follows past intraday returns, the positive contemporaneous relation is largely driven by the price pressure from concurrent institutional trading. Fourth, the stock prices will move more when the trading direction of individuals is consistent with that of institutions, implying that individual investors play a deterministic role in the observed price behaviors. Finally, we find that the information content of daily institutional trade imbalances lasts only for a short period, indicating that their trading has limited contribution to the process of incorporating information into stock prices.

This remaining paper proceeds as follows. Section 2 briefly reviews the related literature. Section 3 reports our datasets and summary statistics. Section 4 discusses the empirical results. Finally, we conclude this paper in Section 5.

2. Literature Review

There is a growing body of literature on the relation between trading patterns of institutional and individual investors and stock returns. Many existing studies document that institutional investors tend to engage in momentum investing (also recognized as trend chasing or positive-feedback trading) (e.g., DeLong et al., 1990; Froot, Scharfstein, and Stein, 1992; Hong and Stein, 1999; Scharfstein and Stein, 1990; Cai, Kaul, and Zheng, 2000). Lakonishok, Shleifer, and Vishny (1992) find only weak evidence supporting momentum trading and herding for pension funds. Grinblatt, Titman, and Wermers (1995) observe that 77% of mutual funds in the US are momentum traders and Choe, Kho, and Stulz (1999) find strong evidence of trend chasing by foreign investors in Korea. As to empirical studies on the TSE, most studies document that institutional investors positively follow past stock returns (e.g., Chen, Shyu, and Wang, 2002; Lin and Ma, 2002; Lee et al., 2006).

The studies on the trading behavior of individual investors find evidence of the contrarian investment tendency. Barber and Odean (2002) document that individual investors are net sellers following large daily positive return movement.

Odean (1998) finds that individual investors are reluctant to realize their loss and selling the past winners, which is so called disposition effect. Similarly, Hsu and Lin (2005) find evidence sustaining the disposition effect of individual trading on the TSE. Grinblatt and Keloharju (2000) find that Finnish individual investors are contrarian investors, while foreigners tend to be momentum investors.

Additionally, recent studies document a strong positive cross-sectional relation between changes in institutional ownership and returns. For example, Wermers (1999) find positive contemporaneous relation between quarterly institutional trading and stock returns in the US. Chiao, Cheng, and Shao (2006) argue that daily institutional trade imbalances are positively associated with the concurrent stock returns on the TSE. One possibility is related to the presumption that institutions are able to forecast returns. If institutional investors are better informed, the stocks that institutions buy are expected to outperform those that they sell (Chen, Jegadeesh, and Wermers, 2000; Yu and Lai, 1999).

The second possibility is that institutional trading activities can move stock prices (French and Roll, 1986; Barclay, Litzenberger, and Warner, 1990; Chakravarty, 2001; Sias, Starks, and Titman, 2001). For instance, Lee et al. (2004) find that institutional order imbalances are persistent due to herding and order splitting exerts greater impacts on stock prices. Another possibility is about the positive-feedback trading (Grinblatt, Titman, and Wermers, 1995). If, for instance, the price impact of institutional buying is offset by the price impact of non-institutional selling, then changes in institutional ownership are still correlated with same period returns if the institutional investors follow a short-term positive-feedback trading strategy (DeLong et al., 1990; GHT, 2003; Lee et al., 2006).

3. Data

3.1 Data Source

This paper employs two datasets to gather all required information. The first dataset, maintained by the Taiwan Economic Journal, comprises the daily stock trading information, including daily stock prices, returns, and volumes for

all listed individual stocks. In addition, this dataset provides intraday bid and ask quotes information of each listed stock.

The second dataset, obtained from the TSE, contains the intraday information on every original limit orders and trades through the Fully Automated Securities Trading (FAST) system. Explicitly, for each order (trade), our sample includes the time stamp to the nearest one hundredth second, stock code, investor type, a buy-sell indicator, order (trade) size, and limit (trade) price. Odd-lot and bulk orders, separately drafted by the FAST, are excluded from our sample. The corporate institutions are not professional investors and eliminated in the following analyses. Therefore, the institutional investors in this paper only include foreign investors, mutual funds, and securities dealers. Our data cover from 2/9/2002 to 12/31/2004, for a total of 580 trading days.

3.2 Descriptive Statistics

Table 1 reports the descriptive statistics on trades and limit orders by each investor group for the TSEC 50 stocks. The daily number of trades and trading volume are recorded in Panel A. First, individual investors are certainly main participants. In terms of the average number of trades and trading volume, theirs ranks first and foreign investors' ranks second. For instance, the number of buy trades and volume by individual investors are respectively 180,173 and 932,824 and account for 82.588% and 75.766% of total buy trades and volume. Those by foreign investors respectively account for 13.338% and 17.239%.

Second, as reported in Panel B, the pattern of the number of limit orders submitted by each type of investors is similar to that of trades. However, the order size by individuals is the smallest (7.98 =1206.623/151.179). As to foreign investors, mutual funds, and securities dealers, their order sizes are 22.94, 61.68 and 55.52, respectively. The evidence further suggests that foreign investors are likely to split their limit orders into smaller ones to camouflage their trades and minimize possible price impacts, consistent with Chan and Lakonishok (1995), Kyle (1985), and Chakravarty (2001).

Regarding the aggressiveness of the executed orders, we employ the execution rate and the time to execution as the measures often applied to proxy

for investors' demand for immediacy (e.g., Cooney, Van Ness, and Van Ness, 2003; Ranaldo, 2004). Higher submitted prices for buy limit orders (and lower prices for sell limit orders) should result in higher execution rates and shorter time to execution. If the execution rate of orders by an investor is high or the time to execution is short, he/she is likely to be impatient and acts as a liquidity demander. Conversely, a value-motivated or patient trader, acting as liquidity provider, may not be willing to trade until trading opportunities arise.

Reported in Panel C of Table 1, the execution rate and the time to execution of orders by professional institutions are respectively larger and shorter than those of individual investors. It follows that the professional institutions place orders in a more aggressive way. Among professional institutions' orders, the execution rate of mutual funds' orders is the highest while the time to execution of foreign investors' orders is the shortest, indicating that foreign investors and mutual funds are more impatient and willing to pay more to liquidity providers.[5]

---

[5] One may question why the results measured by the execution rate and the time to execution for foreign investors and mutual funds are contradictory. From the angle of the execution rate, the limit orders submitted by foreign investors are more aggressive; however, short time to execution for the limit orders by mutual funds implies that they are less patient. To solve the inconsistency, we attempt to examine the executed limit orders in more detail. First, we partition these orders into marketable and non-marketable limit orders, as to be defined in Section 4.2.1. In brief, since there is neither a pre-trade period nor order information disseminated before the opening auction, we regard the orders submitted before the opening as the marketable limit orders, if their buy (sell) prices are greater (less) than or equal to the corresponding preceding day's closing prices. After the opening auction, a marketable buy (sell) order is a limit order whose limit price is greater (lower) than or equal to the concurrent best offer (bid) price.

The unreported results show that, first, the executed marketable limit buy (sell) orders submitted by foreign investors and mutual funds respectively account for 52.9% and 51.1% (52.4% and 52.6%) of their own total limit buy (sell) orders. Hence, foreign investors and mutual funds exhibit a similarity in the preference for marketable limit orders. Second, the observed buy (sell) order aggressiveness of foreign investors and mutual funds are respectively 0.0114 and 0.00354 (0.0112 and 0.0027), the inequality that is consistent with their observed the time to execution. Overall, the two observations above show a better skill of mutual funds in pricing non-marketable limit orders. Namely, albeit mutual funds are relatively patient and willing to wait a longer time, their submitted orders still can be executed. We particularly thank an anonymous referee for this suggestion.

Table 1

Descriptive Statistics

	Buy				Sell			
	INDIs	FIs	MFs	SDs	INDIs	FIs	MFs	SDs
Panel A: Trade data								
Daily no. of trades (1000)	180.173	29.099	4.504	4.382	180.434	26.724	5.344	4.696
	(82.588)	(13.338)	(2.065)	(2.009)	(83.074)	(12.304)	(2.460)	(2.162)
Daily trading volume (1000)	932.824	212.249	42.606	43.509	945.767	193.615	42.737	43.644
	(75.766)	(17.239)	(3.461)	(3.534)	(77.157)	(15.795)	(3.487)	(3.561)
Panel B Order data								
Daily no. of orders (1000)	151.179	10.786	0.753	0.933	155.091	8.759	0.796	0.898
	(92.379)	(6.591)	(0.460)	(0.570)	(93.686)	(5.291)	(0.481)	(0.542)
Daily order volume (1000)	1206.623	247.458	46.443	51.797	1303.285	230.491	46.444	53.693
	(77.730)	(15.941)	(2.992)	(3.337)	(79.765)	(14.107)	(2.843)	(3.286)
Panel C Executed orders								
Execution rate (%)	75.352	84.819	91.172	82.615	70.887	83.472	92.119	80.891
Time to execution (seconds)	826.887	347.341	504.526	552.280	758.941	354.439	496.958	509.726

Note: This table reports the descriptive statistics on trades and limit orders by each group of investors for the TSEC 50 stocks. The ratios of the number of buy (sell) trades by each investor type to the total buy (sell) trades and the trading volume to the total trading volume are reported in parentheses. The average execution rate (%) of limit orders by a given group of investors is expressed as a percentage of total limit orders by that given group of investors. The average time to execution is the average time of orders between being submitted and executed over the selected stocks, ignoring orders cancelled before execution. FIs, MFs, SDs, and INDIs stand for foreign investors, mutual funds, securities dealers, and individual investors, respectively.

4. Empirical Results

4.1 Daily Analysis

Employing trade data, this section examines the daily relation between trading activities, concurrent returns, past returns, and institutional trading persistence. It studies whether institutional trading activity, measured by the institutional trade imbalance, predicts daily stock returns as well. For each stock, the trade imbalance is defined as the difference between the buy and sell volumes scaled by the daily trading volume.[6] Then, for each day, we sort the TSEC 50 stocks equally into quintiles, from low to high, based on the daily institutional trade imbalance. With the five portfolios, we examine the institutional trade imbalances and returns over the formation day (day 0) and the 5 days before formation (days -1 to -5). Finally, we introduce a VAR analysis to examine the lead-lag relation between stock returns and trading activities of each investor type.

4.1.1 On The Basis of Institutional Trade Imbalance

Table 2 reports the results, on the basis of institutional trade imbalance. First, there is a significantly positive contemporaneous relation between the institutional trade imbalances and stock returns, consistent with Chiao and Lin (2004) and Chiao, Cheng, and Shao (2006). On day 0, the portfolio return is monotonically increasing with the trade imbalance. The portfolio with the largest institutional sell imbalances has a lower average return of -0.907%, whereas the portfolio with the largest institutional buy imbalances yields 1.285%. The difference between the highest and the lowest portfolios (H-L) is 2.192% and significant at the 1% level.

Second, institutional investors tend to engage in momentum trading. The returns over days -1 through -5 generally increase with the trade imbalance. For the portfolio with the largest institutional selling imbalances on day 0, there is a return -0.540% on day -1, whereas the portfolio with the highest net buy imbalance yields 0.858%. The H-L return is 1.398% on day -1 and 0.569% on day

[6] We also calculate the institutional trading imbalance in terms of the dollar trading volume and obtain quantitatively and qualitatively similar results.

-2, clearly revealing the institutional positive-feedback trading tendency, supporting Grinblatt, Titman, and Wermers (1995), Wermers (1999), and GHT (2003). Third, pertaining to the persistent of institutional trade imbalances, we observe that the portfolio with the highest institutional trade imbalances on day 0 has significantly higher trade imbalances over days -1 to -5 as well, confirming the persistence of the institutional trading activity.

Finally, the average daily correlation between the institutional and individual trade imbalances is -0.63. Although the institutional and individual imbalances are not perfectly negatively correlated, it seems safe to make a statement on the relation between individual trading and stock returns. That is, the presumably negative contemporaneous relation between the individual trade imbalance and stock return preliminarily suggests that individuals behave as contrarian traders.

4.1.2 On The Basis of Stock Return

Adopting a similar procedure to the one in the previous sub-section, we divide the TSEC 50 stocks equally into quintiles based on daily return. For each portfolio, the ratios of stocks for which institutions and individuals are net buyers over day +1 (the day after formation) are drawn in Figure 2. Stocks with the highest daily stock returns are net bought with a probability of 67% by institutions on day +1, whereas the stocks with the lowest returns are net bought only with a probability of 37%. Conversely, individuals are more likely to net sell (buy) the stocks with the highest (lowest) daily stock returns. Therefore, even on the basis of daily stock return, we still find that institutions (individuals) tend to be trend-chasing (contrarian).

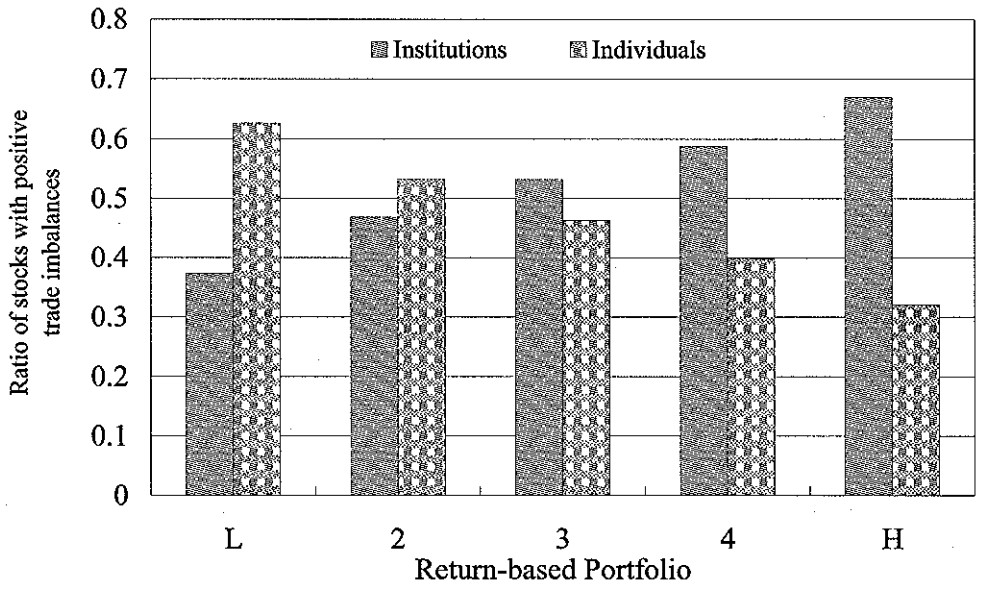
Table 2

Lagged Returns and Institutional Trade Imbalances for Portfolios Based onInstitutional TradeImbalances

	Day -5	Day -4	Day -3	Day -2	Day -1	Day 0	Day -5	Day -4	Day -3	Day -2	Day -1	Day 0
Rank	Return (%)						Institutional trade imbalance (%)					
L	0.056 (0.736)	0.021 (0.276)	-0.017 (-0.230)	-0.137 (-1.846)	-0.540** (-7.260)	-0.907** (-12.259)	-1.061	-1.793	-2.281	-3.640	-6.286	-15.633
2	0.065 (0.932)	0.040 (0.579)	0.013 (0.187)	-0.047 (-0.675)	-0.213** (-3.162)	-0.374** (-5.261)	-0.485	-0.427	-0.455	-1.089	-1.781	-4.811
3	0.067 (0.972)	0.079 (1.174)	0.047 (0.709)	0.045 (0.669)	0.318 (0.475)	-0.007 (-0.110)	0.182	0.313	0.212	0.405	0.627	0.553
4	0.101 (1.474)	0.118 (1.708)	0.149* (2.157)	0.177** (2.579)	0.362** (5.318)	0.488** (7.109)	0.963	1.149	1.310	1.896	2.830	6.163
H	0.149* (2.036)	0.211** (2.85)	0.274** (3.71)	0.432** (5.868)	0.858** (11.143)	1.285** (17.842)	3.422	3.873	4.438	5.786	8.071	17.307
H-L	0.093* (2.305)	0.190** (4.609)	0.291** (6.945)	0.569** (13.407)	1.398** (29.211)	2.192** (47.082)	4.483	5.666	6.719	9.426	14.357	32.940

Note: This table reports the lagged returns and institutional trade imbalances for portfolios based on institutional trade imbalances. For each trading day, the TSEC 50 stocks are divided into quintiles, from low to high, based on the daily institutional trade imbalance. For each stock, institutional trade imbalance is the difference between the institutional buy and sell volumes for that day and scaled by the daily trading volumes. We report the average of lagged and concurrent institutional trade imbalances and stock returns for each portfolio. The last row reports the difference between the highest and the lowest portfolios (H-L) for each variable. The *t*-ratios are reported in parentheses. *, ** indicate significance at the 5% and 1% levels, respectively.

Figure 2
Institutional and Individual Trade Imbalances on The Return-Based Portfolios Over Day +1



For each trading day from 9/2/2002 to 12/31/2004, the TSEC 50 stocks are equally divided into quintiles, from low to high, based on their daily return. For each portfolio, the ratios of stocks for which institutions and individuals are net buyers over day +1 are reported.

4.1.3 Daily VAR Analysis

This section will conduct a VAR analysis to explore the lead-lag relation between trade imbalances and stock returns on a daily basis. Because the TSE change the members of the TSEC 50 once a quarter, we focus only on the stocks that are in the TSEC 50 stocks throughout the whole sample period. There are totally 34 stocks selected. Then, we calculate the daily returns, institutional and individual trade imbalances for each stock. In order to extract the common market-wide effects, these variables are subtracted by the equal-weighted TSEC 50 return, institutional trade imbalance, and individual trade imbalance, respectively. Finally, for each stock, the following equations are estimated:

$$R_t = \alpha_R + \sum_{i=1}^{5} \beta_{i,R} R_{t-i} + \sum_{i=1}^{5} \lambda_{i,R} I_{t-i} + \sum_{i=1}^{5} \gamma_{i,R} J_{t-i} + \delta_{t,R}, \quad (1)$$

$$I_t = \alpha_I + \sum_{i=1}^{5} \beta_{i,I} R_{t-i} + \sum_{i=1}^{5} \lambda_{i,I} I_{t-i} + \sum_{i=1}^{5} \gamma_{i,I} J_{t-i} + \delta_{t,I}, \quad (2)$$

$$J_t = \alpha_J + \sum_{i=1}^{5} \beta_{i,J} R_{t-i} + \sum_{i=1}^{5} \lambda_{i,J} I_{t-i} + \sum_{i=1}^{5} \gamma_{i,J} J_{t-i} + \delta_{t,J}, \quad (3)$$

where R_{t-i} is the TSEC-50-adjusted return at day -*i* relative to time *t* and I_{t-i} and J_{t-i} are respectively the adjusted institutional and individual trade imbalances at day $-i$. We present the cross-sectional averages of the coefficient estimates and the percentages of stocks with significantly positive or negative coefficients at the 10% level in Panel A of Table 3.

First, the institutional (individual) trade imbalances are positively (negatively) related to the previous day's returns. For the institutional and individual trade imbalance equations, equations (2) and (3), the average coefficients on the previous day's return are 0.777 and -0.846, respectively. There are 79.4% (79.4%) of stocks that have significantly positive (nergative) coefficients at the 10% level. Although the institutional (individual) net buying activity increases (decrease) with the previous day's return, the pattern reverses quickly, as shown by slightly negative (positive) coefficients on the day -2's to day -5's returns.

Second, institutional investors persistently trade in the same stocks for several days, consistent with Sias and Starks (1997). The average coefficient on the previous day's institutional trade imbalance is 0.278 and 91.2% of stocks have a significantly positive coefficient. The coefficients on the day -2's to day -5's institutional trade imbalances are still positive. Also, we find that individual trade imbalances are positively related to their own past trade imbalances.

Third, the institutional trade imbalance cannot predict daily returns. Although the average coefficient on the previous day's institutional trade imbalance in the return equation (equation (1)) is 0.008, only 14.7% of stocks have a significantly positive coefficient. Additionally, all of the lagged individual

Table 3
A Daily VAR

dependent		R_t						I_t					J_t				
variables	α	β_0	β_1	β_2	β_3	β_4	β_5	λ_1	λ_2	λ_3	λ_4	λ_5	γ_1	γ_2	γ_3	γ_4	γ_5
		Panel A VAR without the concurrent excess returns in the institutional and individual trade imbalance equations															
R_t	0.000		-0.028	-0.028	-0.034	-0.026	-0.013	0.008	-0.005	-0.002	-0.001	0.005	-0.011	0.003	-0.001	0.000	0.011
positive	0.059		0.059	0.029	0.000	0.000	0.000	0.147	0.000	0.000	0.000	0.029	0.000	0.000	0.059	0.088	0.118
negative	0.029		0.235	0.235	0.147	0.118	0.029	0.059	0.059	0.000	0.059	0.029	0.147	0.000	0.000	0.088	0.000
I_t	0.002		0.777	-0.053	-0.056	-0.067	-0.171	0.278	0.096	0.044	0.049	0.075	-0.018	-0.003	0.005	0.015	0.051
positive	0.235		0.794	0.000	0.000	0.000	0.000	0.912	0.353	0.147	0.147	0.147	0.000	0.059	0.118	0.088	0.059
negative	0.265		0.000	0.059	0.059	0.088	0.059	0.000	0.000	0.029	0.000	0.000	0.029	0.088	0.059	0.059	0.000
J_t	-0.001		-0.846	0.057	0.039	0.127	0.160	0.040	0.009	0.024	0.004	-0.028	0.307	0.105	0.062	0.036	-0.006
positive	0.235		0.000	0.059	0.059	0.088	0.059	0.147	0.059	0.088	0.088	0.000	0.971	0.235	0.235	0.147	0.029
negative	0.235		0.794	0.000	0.029	0.000	0.000	0.000	0.059	0.000	0.088	0.000	0.000	0.000	0.059	0.088	0.029
		Panel B VAR with the concurrent excess returns in the institutional and individual trade imbalance equations															
R_t	0.000		-0.028	-0.028	-0.034	-0.026	-0.013	0.008	-0.005	-0.002	-0.001	0.005	-0.011	0.003	-0.001	0.000	0.011
positive	0.059		0.059	0.029	0.000	0.000	0.000	0.147	0.000	0.000	0.000	0.029	0.000	0.000	0.059	0.088	0.118
negative	0.029		0.235	0.235	0.147	0.118	0.029	0.059	0.059	0.000	0.059	0.029	0.147	0.000	0.000	0.088	0.000
I_t	0.002	**2.836**	**0.860**	0.037	0.054	0.024	-0.120	0.250	0.107	0.055	0.045	0.060	-0.001	-0.009	0.013	0.012	0.020
positive	0.206	0.971	0.912	0.029	0.029	0.029	0.000	0.882	0.412	0.235	0.088	0.176	0.000	0.059	0.088	0.088	0.088
negative	0.294	0.000	0.000	0.029	0.059	0.029	0.059	0.000	0.000	0.029	0.000	0.000	0.029	0.088	0.059	0.000	0.029
J_t	-0.001	-2.773	-0.931	-0.029	-0.067	0.039	0.114	0.066	-0.001	0.014	0.008	-0.012	0.288	0.111	0.055	0.039	0.025
positive	0.294	0.000	0.000	0.059	0.000	0.029	0.059	0.324	0.029	0.088	0.059	0.000	1.000	0.382	0.206	0.118	0.059
negative	0.265	1.000	0.971	0.029	0.088	0.000	0.000	0.000	0.059	0.029	0.059	0.000	0.000	0.000	0.000	0.000	0.000

Note: For each of 34 stocks that are the members of the TSEC 50 for the whole sample period, the following daily vector auto-regressions with 5 lags are estimated:

$$R_t = \alpha_R + \sum_{i=1}^{5} \beta_{i,R} R_{t-i} + \sum_{i=1}^{5} \lambda_{i,R} I_{t-i} + \sum_{i=1}^{5} \gamma_{i,R} J_{t-i} + \delta_{t,R},$$

$$I_t = \alpha_I + \sum_{i=1}^{5} \beta_{i,I} R_{t-i} + \sum_{i=1}^{5} \lambda_{i,I} I_{t-i} + \sum_{i=1}^{5} \gamma_{i,I} J_{t-i} + \delta_{t,I},,$$

$$J_t = \alpha_J + \sum_{i=1}^{5} \beta_{i,J} R_{t-i} + \sum_{i=1}^{5} \lambda_{i,J} I_{t-i} + \sum_{i=1}^{5} \gamma_{i,J} J_{t-i} + \delta_{t,J},,$$

where R_{t-i} is the adjusted return at day $-i$ and I_{t-i} and J_{t-i} are the adjusted institutional and individual trade imbalance at day $-i$, respectively. These three variables are adjusted by separately subtracting the equal-weighted average over the stocks comprising the TSEC 50 stocks for the corresponding day. This table reports the cross-sectional averages of the coefficient estimates, and the percentage of stocks with positive and negative coefficients that are significantly different from 0 at the 10% level.

trade imbalance coefficients are close to 0 and less than 12% of the coefficients are significant at the 10% level. Therefore, consistent with the finding from Odean (1999), there is no clear evidence that the past individual trade imbalance forecast daily returns.

In order to compare the contemporaneous relation between stock returns and the institutional trade imbalances with the effect of the lagged returns on the institutional trade imbalances, we propose a structural VAR including the contemporaneous returns as an independent variable in the institutional and individual trade imbalance equations, (2) and (3), respectively (GHT, 2003). From Panel B of Table 3, we observe that the contemporaneous relation is stronger than the relation between the lagged returns and the institutional trade imbalances. In institutional trade imbalance equation, the average coefficient on the concurrent return is 2.836 and larger than the average coefficient on the lagged one-period return (0.860), shown in bold. Moreover, up to 97.1% of stocks have a significantly positive coefficient on the concurrent return at the 10% level.

According to the related literature, this strong daily contemporaneous relation may arise from price pressure from institutional trading (French and Roll, 1986; Chakravarty, 2001), positive-feedback tendency (GHT, 2003), or forecasting capability (Wermers, 1999; Grinblatt and Titman, 1993; Nofsinger and Sias, 1999; Choe, Kho, and Stulz, 2005). Thanks to the richness of our data, the next sub-section will apply an intraday analysis to justify the three possibilities.

4.2 Intraday Analysis

We intend to explore several competing explanations for the strong daily contemporaneous relation between imbalances and returns in the following ways similar to those proposed by GHT. First, we use an intraday VAR analysis to disclose the time-series properties of the order imbalances and returns. Second, we examine returns and order imbalances surrounding extreme institutional and individual order imbalances events as well as extreme returns.

In the intraday analysis similar to the previous daily analysis, we only focus on 34 stocks that are the members of the TSEC 50 throughout the whole sample

period. Each trading day is divided into 54 five-minute intervals from 9:00 a.m. to 1:30 p.m. For each selected stock, we calculate the institutional and individual order imbalances and use the trade prices to compute the returns over intervals.[7]

One major difference from the approach proposed by GHT (2003) results from the employed data. Because the TSE is an order-driven market where stock prices are purely driven by order flows, this sub-section uses limit-order data rather than trade data. Thereby, we can expect to learn more about how the trading intentions of investors affect short-term price movements, from the angle of order submission behavior.

Generally speaking, investors seeking immediacy tend to submit orders more aggressively and exert more pressure on stock prices. However, unlike limit-order data, trade data act as the *ex-post* realizations rather than the *ex-ante* intentions of investors because execution prices may not be equal to the submitted order prices. More importantly, trade data cannot cover the part of limit orders not executed. Therefore, compared to trade data, limit-order data capture more clearly the timing and strength with which the orders by investors move the stock prices. Furthermore, we adopt the method advanced by Chiao, Wang, and Lai (2007) and analyze the imbalances of orders that seek immediacy, i.e., marketable limit orders, to measure the extent to which trading activities immediately impact the stock prices.

4.2.1 Order Imbalances

Order imbalances, often indicating private information, could reduce liquidity at least temporarily and move the market price permanently. A positive order imbalance signals the prevalence of demanders, engendering an upward price pressure, a positive transitory volatility, and a tighter spread (Ranaldo, 2004). Blume, MacKinley, and Terker (1989) argue that there is a strong relation between order imbalances and stock price movements, in the analyses of both time series and cross sections.

Nevertheless, a total order imbalance — total buy orders less total sell orders — may fail to provide an unambiguous association between investors'

[7] We also use the mid-quote to calculate intraday returns and still obtain similar results.

order submission behaviors and the price impact. For instance, under the rule of the single-price opening auction, the buy (sell) orders with very low (high) submitted prices would not impact the concurrent stock prices. In order to distinguish the orders that can effectively and immediately move stock prices, this sub-section analyzes the imbalance of marketable limit orders.

Like prior studies (e.g., Lee et al., 2004; Peterson and Sirri, 2002), a marketable limit order is a buy (sell) limit order that is immediately executable upon its receipt if the limit price is greater (lower) than or equal to a benchmark price. Before the opening auction, no order information is disseminated; afterwards information pertaining to the limit order book (for up to five best bid and ask queues) is disseminated to the public on a real-time basis. From the standpoint of investors, before the opening auction, the benchmark price of a selected stock is defined as its closing price on the preceding trading day (Chiao, Wang, and Lai, 2007). For a buy (sell) limit order submitted afterwards, the benchmark price is assigned to the prevailing best ask (bid) price. Traders seeking immediacy tend to use the marketable limit orders, while patient traders submit non-marketable limit orders.

4.2.2 Intraday VAR Analysis

In the intraday analysis, we calculate the returns and institutional and individual order imbalances during each interval for each stock. The institutional (individual) order imbalance is defined as the difference between the institutional (individual) marketable buy and sell limit orders for that 5-minute interval scaled by the daily order volume.[8] In order to control for common market-wide effects, these variables are subtracted by the equal-weighted TSEC 50 return, institutional or individual order imbalance, respectively. Then, the following equations are estimated for each stock:

[8] Marsh and Rock (1986) find that the price impact of order imbalances varies with the stock sizes. For instance, given the 10,000 of order imbalances, the larger stocks with deeper depths will suffer smaller price impacts than smaller stocks.

$$R_t = \alpha_R + \sum_{i=1}^{6} \beta_{i,R} R_{t-i} + \sum_{i=1}^{6} \lambda_{i,R} I_{t-i} + \sum_{i=1}^{6} \gamma_{i,R} J_{t-i} + \delta_{t,R}, \quad (4)$$

$$I_t = \alpha_I + \sum_{i=1}^{6} \beta_{i,I} R_{t-i} + \sum_{i=1}^{6} \lambda_{i,I} I_{t-i} + \sum_{i=1}^{6} \gamma_{i,I} J_{t-i} + \delta_{t,I}, \quad (5)$$

$$J_t = \alpha_J + \sum_{i=1}^{6} \beta_{i,J} R_{t-i} + \sum_{i=1}^{6} \lambda_{i,J} I_{t-i} + \sum_{i=1}^{6} \gamma_{i,J} J_{t-i} + \delta_{t,J}, \quad (6)$$

where R_{t-i} is the adjusted return at interval -*i* and I_{t-i} and J_{t-i} are respectively the adjusted institutional and individual order imbalance at interval -*i*. To avoid crossing day boundaries for the lagged returns and order imbalances, the first half hour of each trading day (9:00 a.m. ~ 9:30 a.m.) is excluded from the analysis. There are totally 48 five-minute intervals for each trading day. Table 4 reports the cross-sectional averages of the coefficient estimates and the percentages of stocks with significantly positive or negative coefficients at the 10% level.

Panel A of Table 4 reveals several interesting findings. First, the institutional order imbalances are positively related to the past returns. The average coefficient on the lagged one-period return is 0.110 and 73.5% of stocks having a significant coefficient. There are at least 32.4% of stocks with a significantly positive coefficient on the lagged three-period returns, the institutional positive-feedback strategy that lends support to GHT (2003) but is inconsistent with Nofsinger and Sias (1999).

Second, the institutional order submission behaviors are persistent since the institutional order imbalances are positively autocorrelated. For instance, the average coefficient on the lagged one-period institutional order imbalance in equation (5) is 0.120 and all of stocks have statistically significant coefficients. This is possibly because institutional investors tend to split their large orders to smaller ones so as to camouflage their trades to minimize possible price impacts (Chan and Lakonishok, 1995; Admati and Pfleiderer, 1988). However, the findings is contrary to those by GHT (2003) who find that the institutional order imbalance is negatively related to the lagged own one-period order imbalance but

Table 4
An Intraday VAR

dependent					R_t							I_t						J_t					
variables	α	β_0	β_1	β_2	β_3	β_4	β_5	β_6	λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	γ_1	γ_2	γ_3	γ_4	γ_5	γ_6
	Panel A		**VAR without the concurrent excess returns in the institutional and individual order imbalance equations**																	
R_t	0.000		-0.380	-0.240	-0.150	-0.110	-0.060	-0.040	0.070	0.020	0.020	0.010	0.000	0.000	0.170	0.030	0.020	0.020	0.010	0.010
positive	0.176		0.000	0.000	0.000	0.000	0.000	0.000	0.941	0.441	0.412	0.176	0.088	0.029	1.000	0.853	0.765	0.559	0.559	0.294
negative	0.176		1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.029	0.000	0.118	0.029	0.176	0.000	0.000	0.000	0.000	0.000	0.000
I_t	0.000		0.110	0.040	0.020	0.010	0.000	0.000	0.120	0.020	0.020	0.010	0.000	0.020	0.030	0.010	0.010	0.000	0.000	0.000
positive	0.294		0.735	0.412	0.324	0.147	0.235	0.118	1.000	0.735	0.529	0.235	0.147	0.294	0.676	0.118	0.088	0.088	0.029	0.059
negative	0.235		0.029	0.029	0.059	0.118	0.088	0.059	0.000	0.000	0.029	0.118	0.059	0.059	0.029	0.059	0.029	0.059	0.000	0.029
J_t	0.000		0.220	0.120	-0.090	-0.050	-0.030	-0.010	0.000	0.000	0.000	-0.010	-0.010	-0.010	0.180	0.120	0.020	0.020	0.010	0.000
positive	0.265		0.971	1.000	0.000	0.000	0.000	0.000	0.176	0.000	0.088	0.029	0.000	0.029	1.000	0.706	0.529	0.529	0.294	0.000
negative	0.206		0.029	0.000	1.000	0.824	0.588	0.294	0.118	0.147	0.059	0.088	0.206	0.147	0.000	0.000	0.000	0.000	0.000	0.029
	Panel B		**VAR with the concurrent excess returns in the institutional and individual order imbalance equations**																	
R_t	0.000		-0.380	-0.240	-0.150	-0.110	-0.060	-0.040	0.070	0.020	0.020	0.010	0.000	0.000	0.170	0.030	0.020	0.020	0.010	0.010
positive	0.176		0.000	0.000	0.000	0.000	0.000	0.000	0.941	0.441	0.412	0.176	0.088	0.029	1.000	0.853	0.765	0.559	0.559	0.294
negative	0.176		1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.029	0.000	0.118	0.029	0.176	0.000	0.000	0.000	0.000	0.000	0.000
I_t	0.000	0.530	0.080	0.080	0.050	0.050	0.030	0.020	0.080	0.030	0.000	0.020	0.000	0.020	-0.050	0.000	-0.010	-0.010	-0.010	0.000
positive	0.294	1.000	0.706	0.882	0.735	0.676	0.618	0.559	1.000	0.853	0.059	0.882	0.000	0.618	0.000	0.059	0.000	0.059	0.000	0.029
negative	0.235	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.059	0.029	0.029	0.000	0.735	0.235	0.235	0.118	0.206	0.088
J_t	0.000	0.540	-0.010	0.000	-0.010	0.000	-0.010	0.010	-0.040	-0.020	-0.010	-0.010	-0.010	-0.010	0.100	0.040	0.020	0.020	0.000	0.000
positive	0.235	1.000	0.265	0.235	0.118	0.265	0.088	0.265	0.000	0.000	0.029	0.000	0.000	0.029	1.000	0.912	0.735	0.588	0.147	0.000
negative	0.294	0.000	0.471	0.294	0.412	0.235	0.206	0.118	0.529	0.294	0.088	0.118	0.206	0.118	0.000	0.000	0.059	0.118	0.000	0.176

Note: For each of 34 stocks that are the members of the TSEC 50 for the whole sample period, the following daily vector auto-regressions with 6 lags are estimated:

$$R_t = \alpha_R + \sum_{i=1}^{6} \beta_{i,R} R_{t-i} + \sum_{i=1}^{6} \lambda_{i,R} I_{t-i} + \sum_{i=1}^{6} \gamma_{i,R} J_{t-i} + \delta_{t,R},$$

$$I_t = \alpha_I + \sum_{i=1}^{6} \beta_{i,I} R_{t-i} + \sum_{i=1}^{6} \lambda_{i,I} I_{t-i} + \sum_{i=1}^{6} \gamma_{i,I} J_{t-i} + \delta_{t,I},$$

$$J_t = \alpha_J + \sum_{i=1}^{6} \beta_{i,J} R_{t-i} + \sum_{i=1}^{6} \lambda_{i,J} I_{t-i} + \sum_{i=1}^{6} \gamma_{i,J} J_{t-i} + \delta_{t,J},$$

where R_{t-i} is the adjusted return at interval *-i* and I_{t-i} and J_{t-i} are respectively the adjusted institutional and individual order imbalance at interval *-i*. These three variables are adjusted by separately subtracting the equal-weighted average over the stocks comprising the TSEC 50 stocks for the corresponding 5-minute interval. The institutional (individual) order imbalance is the difference between the institutional (individual) marketable buy and sell limit orders scaled by the daily order volumes for that 5-minute interval. For limit orders placed prior to the opening, a marketable limit order is a buy (sell) limit order whose price is greater (lower) than or equal to the corresponding closing price on the preceding trading day. For the orders submitted after the opening, a marketable limit order is a buy (sell) limit order whose price is greater (lower) than or equal to the prevailing best offer (bid) To avoid crossing day boundaries for lagged returns and order imbalances, the first half hour of each trading day is excluded from the analysis. This table reports the cross-sectional averages of the coefficient estimates and the percentage of stocks with positive and negative coefficients that are significantly different from 0 at the 10% level.

positively related to the lagged own two-period to six-period order imbalances for the NASDAQ100 stocks. This difference may result from the microstructure of NASDAQ that the market makers tend to smooth inventory around block trades to control inventory risk (Reiss and Werner, 1998). Conversely, the TSE is a purely order-driven market without designated market makers, so our results are immune from the inventory effect. Moreover, we observe that individuals tend to herd across trading days. Even for the lagged four-period individual order imbalance, more than 52% of stocks have a significantly positive coefficient.

Third, both the institutional and individual order imbalances are positively related to the future returns, and the relation is strongest for the lagged one period. In the return equation (equation (4)), for 94.1% (100%) of the stocks, the lagged one-period institutional (individual) order imbalances exert a significantly positive influence on the concurrent returns. Finally, there is no clear evidence that the lead-lag relation between institutional and individual order imbalances exists. For instance, the average coefficients on the lagged institutional order imbalances in individual order imbalance equation (equation (6)) are close to 0 and there are only a few stocks with significant coefficients.

4.2.3 Intraday Event study

To emphasize the timing at which the order imbalances by each investor type take place, this section will pay attention to the five-minute periods of order imbalances and stock returns surrounding events of intensive trading or extreme return.

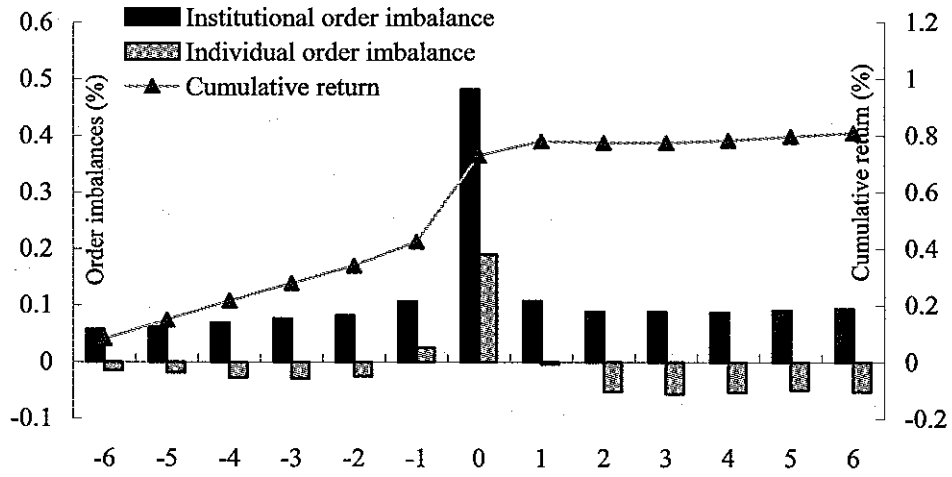
(1) Events of Extreme Institutional Order Imbalance

We first seek to examine all investors' order imbalances and returns around the events of extreme institutional order imbalance. We divide each trading day into 54 five-minute intervals from 9:00 a.m. to 1:30 p.m. There are totally 24,360 intervals for each stock. Around 20% of them—the 2,436 intervals of the largest and the smallest institutional order imbalances, separately—are then selected for each stock. This application is essentially similar to that of GHT (2003). To avoid crossing daily boundaries while examining intervals -6 to +6, the events starts from the 7^{th} interval (9:30-9:35) through the 48^{th} interval (12:55-1:00 p.m.).

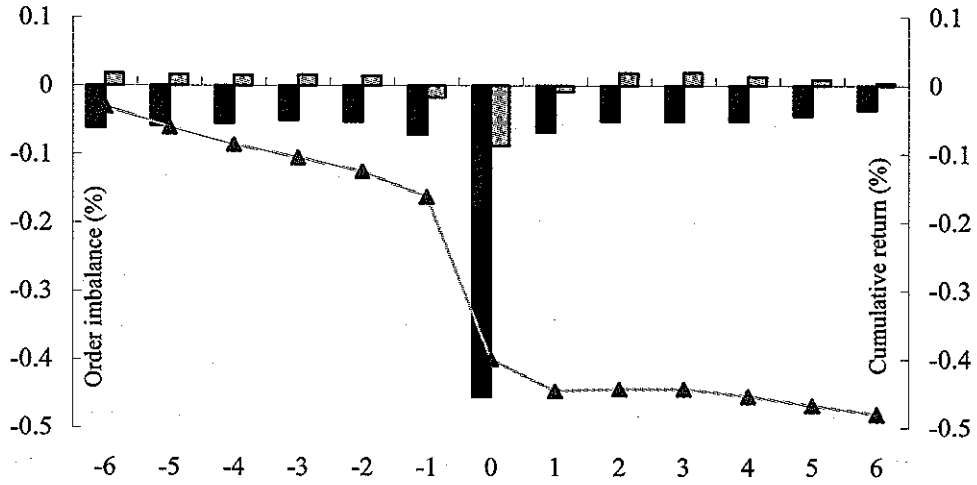
Figure 3 plots the cumulative average returns and institutional and individual order imbalances for the thirty-minute periods (-6 to +6) surrounding the events of the extreme institutional order imbalances.

Figure 3
Intraday Returns and Order Imbalances Around The 5-Minute Intervals of Extreme Institutional Order Imbalances

Panel A Top 20% intervals of the largest institutional buy order imbalances



Panel B Top 20% intervals of the largest institutional sell order imbalances



Each trading day is divided into 54 five-minute intervals from 9:00 a.m. to 1:30 p.m. For each interval, the return and order imbalance are computed for each of the 34 stocks that is a member of the TSEC 50 throughout the sample period from 2/9/2002 to 31/12/2004. The institutional (individual) order imbalance for each stock is the difference between the institutional (individual) marketable buy and sell limit orders scaled by the order volumes of the same stock over the trading day for that 5-minute interval. There are totally 24,360 intervals for each stock. Around 20% of them—the 2436 intervals of the largest and the smallest institutional order imbalances, separately—are then selected. To avoid crossing day boundaries while examining, the events are selected from the 7th interval (9:30-9:35 a.m.) through the 48th interval (12:55-1:00 p.m.).

Panel A of Figure 3 examines the activities around the events of the largest institutional buy imbalances. Before extreme institutional buy imbalances, the individual investors' order imbalances are small and negative for intervals -6 to -2 whereas institutional net buying activity is persistent. Therefore, stock prices are pushed up gradually and the returns range from 0.06% to 0.09% in each of the six 5-minute intervals preceding the event. It indicates that institutional investors demonstrate clear positive-feedback trading patterns, consistent with the preceding intraday VAR results.

Unlike the observations documented by GHT (2003), the return over interval 0 (0.30%) is significant and quite distinguishable. Not until interval -1, individual investors start to net buy the TSEC 50 stocks. Over interval 0, the order imbalances by institutional and individual investors reach the top simultaneously, moving the 5-minute return to its peak. The institutional order imbalances are 3 times more than the individual order imbalances over interval 0. It is clear that the order imbalances by institutions are the main driving force of the concurrent returns and, to a less extent, investors also plays a role. After interval 0, institutions continue to net buy with smaller scales while individual investors switch to net sell those stocks. The returns are relatively small with a cumulative 30-minute return of 0.08% only.

In Panel B of Figure 3, the return pattern and trading activities looks mirror reflections of those demonstrated in Panel A. Institutional investors tend to persistently net sell the TSEC 50 stocks over the entire 13 five-minute intervals. The order imbalances by individual investors, on the other hand, are close to 0 in all intervals except interval 0. The cumulative returns over intervals [-6, -1] and [+1, +6] are -0.16% and -0.08%, respectively. Institutions and individuals

simultaneously net sell the selected stocks over interval 0 with a return of -0.24%. We still find that the institutional order imbalance is the main driving force of the concurrent return.

(2) Events of Extreme Individual Order Imbalance

Figure 4 draws the trading activities surrounding the extreme individual order imbalances. The cumulative returns over interval [-6, -1] are 0.310% and 0.044%, as shown in Panels A and B, respectively. The difference in cumulative returns (0.266%) is significant at the 1% level, implying that individual investors submit more marketable buy (sell) limit orders before stock prices soars (plunges). The institutional investors also net buy the selected stocks on a small scale over interval 0. The return over this period is 0.36% and larger than the return over interval 0 with the largest institutional buy imbalance, as drawn in Panel A. This is perhaps because individual investors are the main market participants, as reported in Table 2, and play an important role in moving stock prices. The cumulative return over interval [+1, +6] is almost zero.

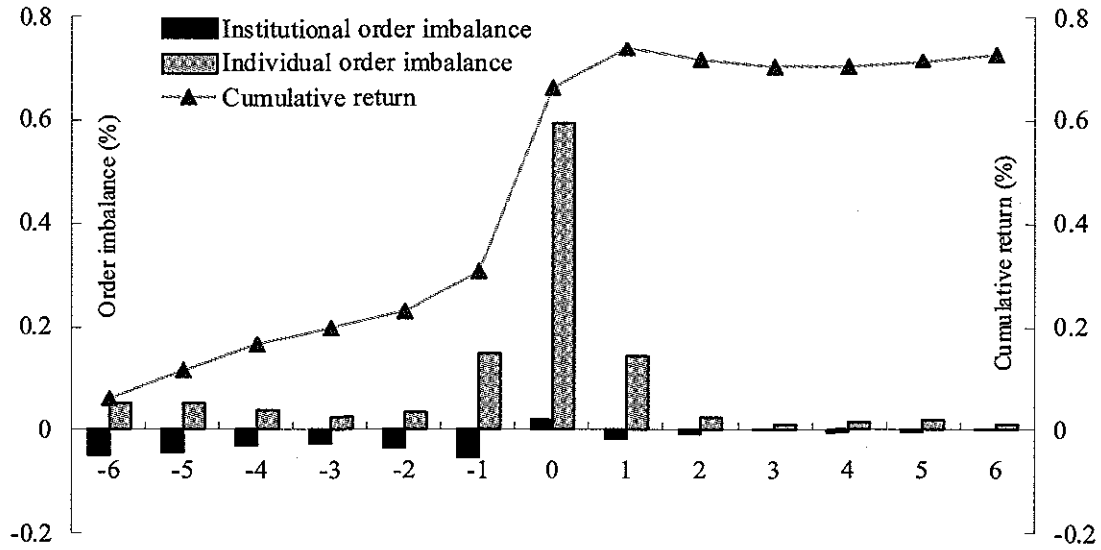
(3) Events of Extreme Return

In the preceding sub-sections, we have learned the intraday linkage from the order imbalances by each investor type to the short-term returns on the TSEC 50 stocks. To understand in more detail whether individual and institutional trading activities forecast, drive, or follow stock returns, we select the top 10% five-minute intervals separately with the largest and the smallest returns for each stock, and then examine institutional and individual trading activities over the thirty minutes surrounding the events.

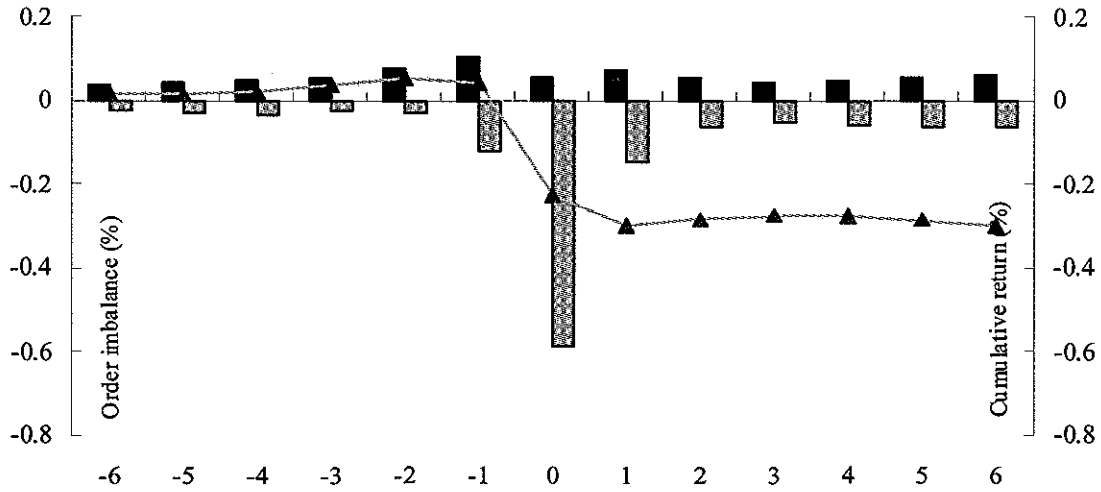
Panels A and B of Figure 5 plot the trading activities around the events of the largest and the smallest returns, respectively. In general, the stock prices move little prior to interval 0 and the order imbalances by all investors are rather small. Not until interval -1, the institutional and individual investors simultaneously act as net buyers and push up the stock prices by 0.066%. Following interval 0, institutional investors still persistently net buy those stocks but individual investors start to net sell stocks and the stock prices start to fall. Noteworthy is that, the trading directions of institutional investors are opposite to those of individual investors over intervals [-6, -1] and [+1, +6]; since their difference is

Figure 4
Intraday Returns And Order Imbalances Around The 5-Minute Intervals of Extreme Individual Order imBalances

Panel A Top 20% intervals of the largest individual buy order imbalances



Panel B Top 20% intervals of the largest individual sell order imbalances



Each trading day is divided into 54 five-minute intervals from 9:00 a.m. to 1:30 p.m. For each interval, the return and order imbalance are computed for each of the 34 stocks that is a member of the TSEC 50 throughout the sample period from 2/9/2002 to 31/12/2004. The institutional (individual) order imbalance for each stock is the difference between the institutional (individual) marketable buy and sell limit orders scaled by the order volumes of the same stock over the

trading day for that 5-minute interval. There are totally 24,360 intervals for each stock. Around 20% of them—the 2436 intervals of the largest and the smallest individual order imbalances, separately—are then selected. To avoid crossing day boundaries while examining, the events are selected from the 7th interval (9:30-9:35 a.m.) through the 48th interval (12:55-1:00 p.m.).

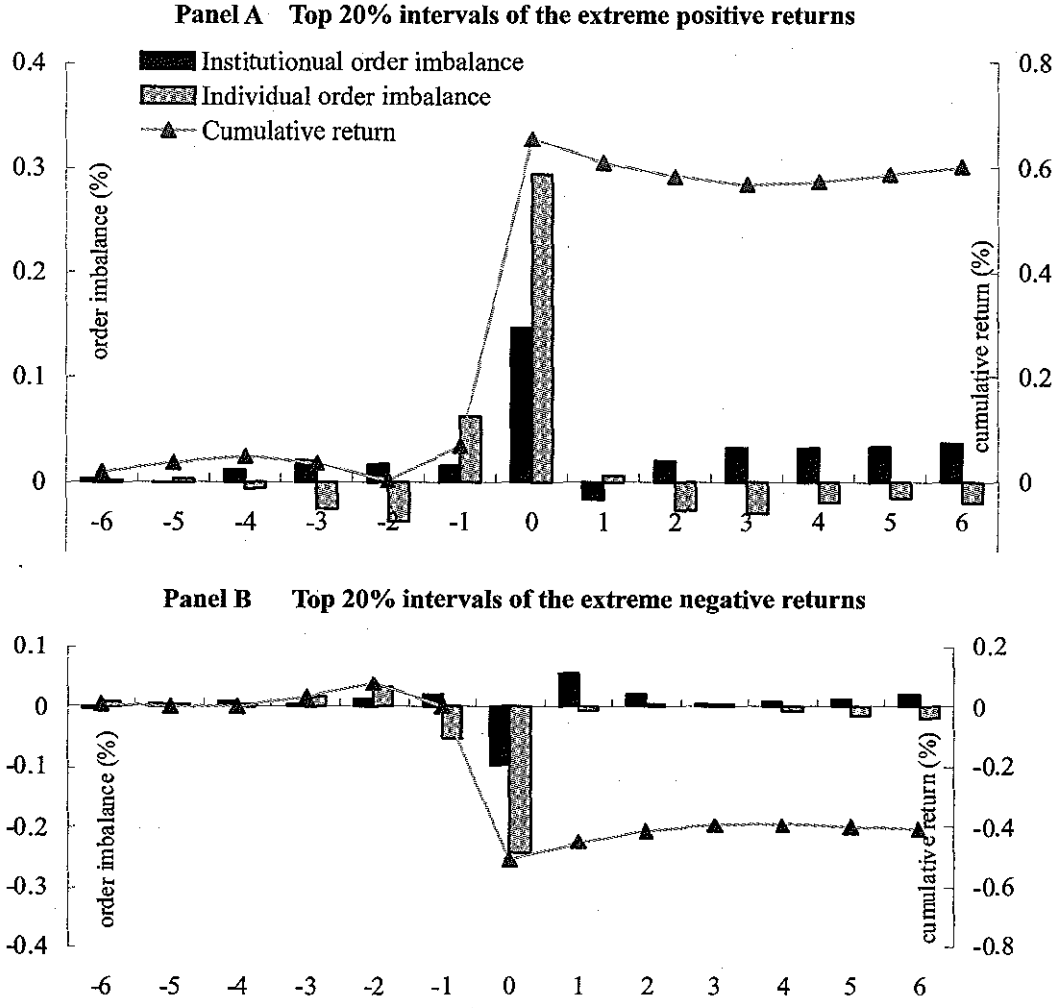
rather limited, the cumulative returns over intervals [-6, -1] and [+1, +6] are only 0.006% and 0.104%, respectively.

The returns over interval 0 reported in Panels A and B are 0.586% and -0.515%, respectively. It is obvious that the order imbalances by individual investors are the main driving force of the extreme returns whereas institutional trading activities still have an impact on stock prices. For example, in Panel A, albeit both institutions and individuals are net buyers, the order imbalance by individual investors (0.294%) more than doubles that by institutional investors (0.146%). In addition, the results from the intraday event-study show that the extreme institutional order imbalances engender price pressure and have little ability to forecast subsequent stock price movements. The stock prices move more when the trading direction of individuals is in line with that of institutions. Our results contradict the observation for NASDAQ by GHT (2003) who find that prices move little in the 5-minute interval with large individual order imbalances.

Particularly note that, despite that the intraday VAR results in Panel A of Table 4 show that institutional order imbalances are positively related to the next 5-minute returns, Panels A and B of Figure 5 reveal that the returns following the extreme events are relatively smaller and close to 0. Therefore, there is no consistent evidence that the institutional order imbalances can predict future 30-minite returns.

Given the inconsistency observed above, one may wonder what driving force makes the positive correlation between institutional order imbalances and the stock returns on the same day. Is it the positive-feedback tendency or the price impact? To answer this question, we estimate regressions similar to those in Panel A of Table 4, except that the concurrent returns are additionally included for the imbalance equations. We report the regression results in Panel B of Table 4.

Figure 5
Intraday Returns And Order Imbalances Around The 5-Minute Intervals of Extreme Returns



Each trading day is divided into 54 five-minute intervals from 9:00 a.m. to 1:30 p.m. For each interval, the return and order imbalance are computed for each of the 34 stocks that is a member of the TSEC 50 throughout the sample period from 2/9/2002 to 31/12/2004. The institutional (individual) order imbalance for each stock is the difference between the institutional (individual) marketable buy and sell limit orders scaled by the order volumes of the same stock over the trading day for that 5-minute interval. There are totally 24,360 intervals for each stock. Around 20% of them—the 2436 intervals of the largest and the smallest returns, separately—are then selected. To avoid crossing day boundaries while examining, the events are selected from the 7th interval (9:30-9:35 a.m.) through the 48th interval (12:55-1:00 p.m.).

First, the contemporaneous relation is stronger than the relation between the lagged one-period returns and institutional order imbalances. In the institutional order imbalance equation, the average coefficient on the concurrent return is 0.530, shown in bold, and larger than the average coefficient on the lagged one-period return 0.080. Second, all stocks have significantly positive coefficients on the concurrent return at the 10% level. It indicates that, although the institutional trading positively follows the past intraday returns, the positive contemporaneous relation is largely driven by the price pressure from the concurrent institutional order submissions. These results support Sias, Starks, and Titman (2001) that the price impact of institutional buys is not offset by that of non-institutional sells.

4.3 Post-Formation Returns

If buying (selling) activity by positive-feedback traders moves prices beyond the fundamental values of stocks, then the activity has a destabilizing effect on stock prices. Nevertheless, it is also possible that those traders can move prices towards fundamentals if interring useful information from other traders (Bikhchandani et al., 1992; Hong and Stein, 1999). In this section, we will examine whether institutional trading activities contribute to the process of incorporating information into stock prices.

We adopt the ideas proposed by Wermers (1999) and GHT (2003), arguing that one obvious testable implication of destabilization is that excessive institutional net trades will be followed by stock price reversals, if the effect of positive-feedback trading is transitory; otherwise, the traders are informed and the price adjustments could be accelerated and long-lasting. To justify whether the effect is transitory or long-lasting, we first follow the procedures similar to those in the daily analysis to examine returns on the quintiles based on the institutional trade imbalances over the 5 days after formation.

Table 5 reports the post-formation returns. [+1, +5] represents the 5-day cumulative return after formation. On day +1, there is a monotonic relation between stock return and the order imbalance. The stocks with the largest institutional sell imbalances have the lowest return -0.123%, whereas the return

on stocks with the largest institutional buying activity is 0.355%. However, the stock prices start to reverse from day +2. The difference in the day +2's returns between the highest and the lowest institutional trade imbalances portfolios is -0.121% and significant at the 1% level. The cumulative-return difference over [+1, +5] between the two quintiles reduces to 0.007% and insignificant. In sum, our results show that institutional trading activities only have temporary information content and have limited contribution to process of incorporating information into stock prices.

Table 5
Post-Formation Returns

portfolio	Post-Formation Returns (%)					
	Day +1	Day +2	Day +3	Day +4	Day +5	[+1, +5]
L	-0.123 (-1.668)	0.142 (1.950)	0.163* (2.199)	0.149* (2.058)	0.142 (1.914)	0.474** (2.868)
2	0.011 (0.163)	0.133 (1.855)	0.106 (1.495)	0.097 (1.381)	0.100 (1.439)	0.448** (2.838)
3	0.090 (1.354)	0.096 (1.455)	0.069 (1.03)	0.126 (1.849)	0.056 (0.848)	0.441** (2.868)
4	0.123 (1.852)	0.060 (0.867)	0.090 (1.357)	0.018 (0.283)	0.088 (1.324)	0.384* (2.496)
H	0.355** (4.845)	0.021 (0.296)	0.016 (0.222)	0.062 (0.84)	0.036 (0.486)	0.482** (3.124)
H-L	0.478** (10.750)	-0.121** (-2.645)	-0.147** (-3.297)	-0.087* (-1.978)	-0.107* (-2.510)	0.007 (0.078)

Note: This table reports the returns over the 5 days after formation for the 5 portfolios based on the i nstitutional trade imbalance. For each trading day, the TSEC 50 stocks are divided into quintiles, from low to high, based on the daily institutional trade imbalance. The average stock returns for each portfolio are reported. The last row reports the difference between the highest and the lowest portfolios (H-L). The *t*-ratios are reported in parentheses. [+1, +5] represents the 5-day cumulative returns. *, ** indicate significance at the 5% and 1% levels, respectively.

4.4 Robustness Test

Even among institutions, their trading strategies could be substantially different (Dennis and Strickland, 2002; Grinblatt, Titman, and Wermers, 1995; Khorana, 1996). For instance, Scharfstein and Stein (1990) find that mutual fund

managers may trade with the herd due to career concerns. Dennis and Strickland (2002) and Khorana (1996) also show that mutual fund managers, often dismissed after only six to eight quarters of poor performance, are motivated to pursue momentum-based strategies that are more likely to payoff in the short run. Pensioners and banks, on the other hand, do not withdraw their funds when dissatisfied. They are likely to be conservative and make investment decisions based on loner-term criteria.

The literature shows that the order submission behaviors of institutional investors are influenced by their trading strategies. Aitken et al. (2005) find that compared to passive institutions, active institutions trade stocks more aggressively. Lee et al. (2004) that marketable limit orders submitted by institutions and individuals on the TSE all can move stock prices. Compared to foreign investors, domestic institutions have larger trading profit and engender smaller price impact, indicating that domestic institutions strategically trade in a manner that allows to profit on their information while minimizing their price impact.

Motivated by the documented different trading strategies among institutions, this sub-section will conduct robustness tests to examine whether the results vary with the types of institutions, including foreign investors, mutual funds, and securities dealers. The unreported results show that our previous conclusions are robust to the institutional types. Explicitly, all types of institutions, attempting to follow past price movements, trade persistently and have no ability to predict future returns. The contemporaneous relation between stock return and the net-trade activity of each institutional type on a daily basis is strongly positive, especially for foreign investors.

In the intraday analysis, we find that the order imbalances by each type of institutions are positively related to past returns but cannot forecast the short-run returns. In addition, the positive contemporaneous relation is largely driven by the price pressure from institutional trading. Finally, we find that in institutional order imbalance equation of the VAR analysis, the average coefficients on the concurrent return for foreign investors, mutual funds, and securities dealers are 0.382, 0.078 and 0.074, respectively. It implies that the orders of foreign investors

are the most influential for price movements among the institutional investors, consistent with Lee et al. (2004).

5. Summary and Concluding Remarks

Recent literature shows that the contemporaneous relation between changes in institutional ownership and stock returns is stronger than the trend chasing effect (Nofsinger and Sias, 1999; Wermers, 1999). Although many studies examine possible causes of contemporaneous relation, due to the lack of high frequency data, only a few studies explore the relative importance among the possibilities. Applying limit-order data, this paper aims to explain the positive contemporaneous relation and examine the role of trading behaviors of institutional and individual investors in the short-run (daily and intraday) price movements.

As a result, first, the contemporaneous relation between stock return and trade imbalance by institutions (individuals) at the daily level is strongly positive (negative) and institutions (individuals) tend to be trend-chasing (contrarian). Second, in the VAR analysis, there is strong evidence of persistence in institutional and individual trading but no evidence that institutional trading can predict future daily returns. Third, using an intraday analysis, we do not find consistent evidence that the institutional order imbalances predict the future 30-minite return. Although the institutional trading positively follows the past intraday returns, the positive contemporaneous relation is largely driven by the price pressure from the institutional trading. Fourth, the stock price will move more when the trading direction of individuals is in line with that of institutions, implying that individual investors play a deterministic role in the observed price behaviors. Finally, we find that the information content of daily institutional trade imbalance lasts only over a short period.

Our contributions can be placed on, first, the provision of the analysis on the relation between institutional trading and stock returns in the Taiwan stock market with the different trading mechanism (order-driven market) from that of many developed markets like U.S. (dealer-driven market). Second, the Taiwan stock market has been dominated by individual investors and its investor

composition is remarkably different from that in other developed markets. While institutional investors are often regarded as informed traders and their trading contributes to the process of incorporating information into stock prices, the observed trading behavior and the deterministic role of individual investors may provide investors and analysts with not only a broader view of a fast emerging market but also potentially profitable applications. Finally, as Taiwan has opened its financial markets and institutional trading increasingly gradually has gained its importance, Taiwan's development and outcomes may arouse the interests of policy makers of other developing countries. Taiwan's experience can assist them in establishing effective policies to promote the efficiency of price discovery.

6. References

Lee, J., Chou, R., Lin, C., and Hsieh, Y. (2006), "The Interactions between Foreign Investors and the Taiwan Stock Market around the Asian Financial Crisis," *Review of Securities and Futures Markets*, 18(3), 47-72.

Lin, M. and Ma, L. (2002), "The Interactions between Institutional Trading Information and Market Returns," *Review of Securities and Futures Markets*, 14(3), 113-144.

Hsu, K. and Lin, P. (2005), "A Study on Disposition Effect of Individual Investors: Empirical Findings Taking into Account Market Valuations," *Journal of Management,* 22(1), 85-107.

Shu, P., Chen, H., and Huang, S. (2005), "Why Do Mutual Fund Managers Trade in Herd?" *Management Review*, 24(4), 57-81.

Chen, C., Shyu, D., and Wang, Y. (2002), "Industrial Momentum Strategies and Investment Performance: An Empirical Study on Taiwan Stock Mutual Fund," *Sun Yat-Sen Management Review*, 10(2), 203-230.

Yu, C. and Lai, Y. (1999), "On the Informational Leading Role of Foreign Institutional Investors," *Journal of Financial Studies*, 7(3), 1-26.

Admati, A. and Pfleiderer, P. (1988), "A Theory of Intraday Patterns: Volume and Price Variability," *Review of Financial Studies*, 1(1), 3-40.

Ahn, H. J., Bae, K. H., and Chan, K. L. (2001), "Limited Orders Depth and

Volatility: Evidence from the Stock Exchange of Hong Kong," *Journal of Finance*, 56(2), 767-788.

Barber, B. M. and Odean, T. (2000), "Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors," *Journal of Finance*, 55(2), 773-806.

Barclay, M., Litzenberger, R., and Warner, J. B. (1990), "Private Information, Trading Volume and Stock-return Variances," *Review of Financial Studies*, 3(2), 233-253.

Blume, M. E., MacKinley, A. C., and Terker, B. (1989), "Order Imbalances and Stock Price Movements on October 19 and 20, 1987," *Journal of Finance*, 44(2), 827-48.

Boyer, B. and Zheng, L. (2004), "Who Moves the Market? A Study of Stock Prices and Sector Cashflows," *Working paper*, Marriott School, Brigham Young University.

Cai, F., Kaul, G., and Zheng, L. (2000), "Institutional Trading and Stock Returns," EFA 2001 Barcelona Meetings, EFMA 2001 Lugano Meetings, http://ssrn.com/abstract=251941.

Chakravarty, S. (2001), "Stealth Trading: Which Traders' Trades Move Stock Prices?" *Journal of Financial Economics*, 61(2), 289-307.

Chan, L. K. C. and Lakonishok, J. (1995), "The Behavior of Stock Prices around Institutional Trades," *Journal of Finance*, 50(4), 1147-1174.

Chiao, C., Cheng, D. C., and Shao, Y. (2006), "The Informative Content of the Net-Buy Information of Institutional Investors in the Taiwan Stock Market: A Revisit Using Conditional Analysis," *Review of Pacific Basin Financial Markets and Policies*, 9(4), 661-697.

Chiao, C. and Lin, K. I. (2004), "The Informative Content of the Net Buy Information of Institutional Investors: Evidence from the Taiwan Stock Market," *Review of Pacific Basin Financial Markets and Policies*, 7(2), 259-288.

Chiao, C., Wang, Z., and Lai, H. (2006), "Order Submission Behaviors and Opening Price Behaviors in the Taiwan Stock Market," presented at the 14th Conference on the Theories and Practices of Securities and Financial

Markets, Dec 15-16, 2006, Kaohsiung, Taiwan; Available at http://www.finance.nsysu.edu.tw/SFM/14thSFM/FullPapers/050.pdf.

Choe, H., Kho, R., and Stulz, R. M. (2005), "Do Domestic Investors Have an Edge? The Trading Experience of Foreign Investors in Korea," *Review of Financial Studies*, 18(3), 795-829.

Choe, H., Kho, R., and Stulz, R. M. (1999), "Do Foreign Investors Destabilize Stock Markets? The Korea Experience in 1997," *Journal of Financial Economics*, 54(2), 227-264.

Chordia, T., Roll, R., and Subrahmanyam, A. (2002), "Order Imbalance, Liquidity and Market Returns," *Journal of Financial Economics*, 65(1), 111-130.

Cushing, D. and Madhavan, A. (2000), "Stock Returns and Trading at the Close," *Journal of Financial Markets*, 3(1), 45-67.

Del Guercio, D. (1996), "The Distorting Effect of the Prudent-Man Laws on Institutional Equity Investments," *Journal of Financial Economics*, 40(1), 31-62.

DeLong, J. B., Shleifer, A., Summers, L. H., and Waldmann, R. J. (1990), "Positive Feedback Investment Strategies and Destabilizing Rational Speculation," *Journal of Finance*, 45(2), 379-395.

Dennis, P. J. and Strickland, D. (2002), "Who Blinks In Volatile Markets, Individuals or Institutions?" *Journal of Finance*, 57(5), 1923-1949.

French, K. and Roll, R. (1986), "Stock-return Variances: the Arrival of Information and the Reaction of Traders," *Journal of Financial Economics*, 17(1), 5-26.

Froot, K. A., Scharfstein, D. S., and Stein, J.C. (1992), "Herd on the Street: Informational Inefficiencies in A Market with Short-Term Speculation," *Journal of Finance*, 47(4), 1461-1484.

Gompers, P. A. and Metrick, A. (2001), "Institutional Investors and Equity Prices," *Quarterly Journal of Economics*, 116(1), 229-259.

Griffin, J. M., Harris, J. H., and Topaloglu, S. (2003), "The Dynamics of Institutional and Individual Trading," *Journal of Finance*, 58(6), 2385-2350.

Grinblatt, M., and Keloharju, M. (2000), "The Investment Behavior and

Performance of Various Investor Types: A Study of Finland's Unique Data Set," *Journal of Financial Economics*, 55(1), 43-67.

Grinblatt, M. and Titman, S. (1993), "Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns," *Journal of Business*, 66(1), 47-68.

Grinblatt, M., Titman, S., and Wermers, R. (1995), "Momentum Investment Strategies, Portfolio Performance, and Herding: A Study of Mutual Fund Behavior," *American Economic Review*, 85(5), 1088-1105.

Handa, P. and Schwartz, R. (1996), "Limit Order Trading," *Journal of Finance*, 51(5), 1835-1861.

Handa, P., Schwartz, R., and Tiwari, A. (2003), "Quote Setting and Price Formation in an Order Driven Market," *Journal of Financial Markets*, 6(4), 461-489.

Hansch, O., Naik, N., and Viswanathan, S. (1998), "Do Inventories Matter in Dealership Markets? Some Evidence from the London Stock Exchange," *Journal of Finance*, 53(5), 1623-1656.

Hong, H. and Stein, J. C. (1999), "A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets," *Journal of Finance*, 54(6), 2143-2184.

Lakonishok, J., Shleifer, A., and Vishny, R. W. (1992), "The Impact of Institutional Trading on Stock Prices," *Journal of Finance*, 49(5), 1541-1578.

Lee, C. M. C. (1992), "Earnings News and Small Traders: An Intraday Analysis," *Journal of Accounting and Economics*, 15(2), 265-302.

Lee Y., Liu, Y., Roll, R., and Subrahmanyam, A. (2004), "Order Imbalances and Market Efficiency: Evidence from the Taiwan Stock Exchange," *Journal of Financial and Quantitative Analysis*, 39(2), 327-341.

Lee, Y. T., Liu, Y. J., and Wei, K. C. (2004), "An Analysis of Tradeoff between Execution Costs and Opportunity Costs: Evidence from Institutional Investors' Order Submission Strategies," *Working paper*, Department of Finance, National Chengchi University.

Nofsinger, J. R. and Sias, R.W. (1999), "Herding And Feedback Trading by

Institutional and Individual Investors," *Journal of Finance*, 54(6), 2263-2295.

Odean, T. (1998), "Are Investors Reluctant to Realize Their Losses? " *Journal of Finance,* 53(5), 1775-1798.

Peterson, M. and Sirri, E. (2002), "Order Submission Strategy and the Curious Case of Marketable Limit Orders," *Journal of Financial and Quantitative Analysis*, 37(2), 221-241.

Ranaldo, R. (2004), "Order Aggressiveness in Limit Order Book Markets," *Journal of Financial Market*, 7(1), 53-74.

Reiss, P. C. and Werner, I. (1998), "Does Risk Sharing Motivate Interdealer Trading?" *Journal of Finance*, 53(5), 1647-1703.

Schwartz, R. A. and Shapiro, J. E. (1991), "The Challenge of Institutionalization for the Equity Market," in: *Recent Development in Finance: Conference in Honor of Arnold Sametz*, A. Saunders, NY: New York University Salomon Center.

Sias, R. W., and Starks, L. T. (1997), "Return Autocorrelation and Institutional Investors," *Journal of Finance* , 46(1), 103-131.

Sias, R. W., Starks, L. T., and Titman, S. (2001), "The Price Impact of Institutional Trading," available at http://ssrn.com/abstract=283779.

Scharfstein, D. S. and Stein, J. C. (1990), "Herd Behavior and Investment", *American Economic Review,* 80(3), 465-479.

Stoll, H. (2000), "Friction," *Journal of Finance* , 55(4), 1479-1514.

Wermers, R. (1999), "Mutual Fund Herding and the Impact on Stock Prices," *Journal of Finance*, 54(2), 581-623.