DO PROPRIETARY INVESTORS FRONT RUN OTHER INVESTORS' LARGE ORDERS?

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นักลงทุนประเภทบริษัทหลักทรัพย์มีการลงทุนตัดหน้าคำสั่งซื้อขายขนาดใหญ่ของนักลงทุน
ประเภทอื่นหรือไม่?

นายวีระชัย ตั้งวิจิตรสกุล

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Field of Study   Finance

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วีระชัย ตั้งวิจิตรสกุล : นักลงทุนประเภทบริษัทหลักทรัพย์มีการลงทุนตัดหน้าคำสั่งซื้อ
ขายขนาดใหญ่ของนักลงทุนประเภทอื่นหรือไม่ ? (DO PROPRIETARY INVESTORS
FRONT RUN OTHER INVESTORS' LARGE ORDERS?)
อ. ที่ปรึกษาวิทยานิพนธ์หลัก : อ. ดร.ณัฐวุฒิ เจนวิทยาโรจน์, 72 หน้า.

งานวิจัยนี้ได้ตรวจสอบแบบแผนการซื้อขายหุ้นของนักลงทุนประเภทบริษัทหลักทรัพย์ในช่วง
คำสั่งซื้อขายขนาดใหญ่ของนักลงทุนประเภทอื่นได้แก่ นักลงทุนรายย่อย   นักลงทุนต่างชาติ
นักลงทุนสถาบันและผู้บริหารบริษัท โดยใช้ข้อมูลจากตลาดหลักทรัพย์แห่งประเทศไทย
ระหว่างเดือนมีนาคม พ.ศ. 2550 ถึงเดือนธันวาคม พ.ศ. 2552 ทั้งนี้นักลงทุนบริษัทหลักทรัพย์
มียอดซื้อขายที่ผิดปกติในทิศทางเดียวกับคำสั่งซื้อขายขนาดใหญ่เพียงไม่กี่วันก่อนการซื้อขาย
ขนาดใหญ่ของนักลงทุนรายย่อยและผู้บริหารบริษัท   แต่ไม่พบยอดซื้อขายที่ผิดปกติในทิศทาง
เดียวกับคำสั่งซื้อขายขนาดใหญ่ก่อนการซื้อขายขนาดใหญ่ของนักลงทุนต่างชาติและนัก
ลงทุนสถาบัน ผลลัพธ์ของงานชิ้นนี้สามารถเป็นหลักฐานที่บ่งชี้ได้ว่ามีการลงทุนตัดหน้านัก
ลงทุนรายย่อยและผู้บริหารบริษัทโดยพฤติกรรมของกลุ่มนักลงทุนโดยรวมหลังจากที่กรอง
เหตุผลอื่นๆ ออกไป นอกจากนี้ผลกำไรแบบสะสมในช่วงการส่งคำสั่งซื้อขายขนาดใหญ่ของ
นักลงทุนแต่ละประเภทได้ถูกคำนวณเพื่อหากำไรจากการลงทุนตัดหน้าคำสั่งซื้อขายขนาด
ใหญ่ ผลปรากฏว่ากำไรจากการลงทุนตัดหน้านักลงทุนรายย่อยยังสรุปไม่ได้ ในขณะที่การ
ลงทุนตัดหน้าคำสั่งซื้อขนาดใหญ่ของผู้บริหารโดยเฉลี่ยแล้วมีผลกำไรแต่การลงทุนตัดหน้า
คำสั่งขายขนาดใหญ่ของผู้บริหารไม่เกิดผลกำไรและสูญเสียโอกาสที่จะทำกำไรในช่วง 10 วัน
หลังเหตุการณ์

ภาควิชา____การธนาคารและการเงิน____ลายมือชื่อนิสิต………………………………........
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ปีการศึกษา__2554_____

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KEYWORDS : FRONT RUN / INTERMEDIARIES / LARGE ORDERS / PROPRIETARY INVESTORS / PROPRIETARY TRADING PATTERN

WEERACHAI TANGVIJITSAKUL: DO PROPRIETARY INVESTORS FRONT RUN OTHER INVESTORS' LARGE ORDERS? ADVISOR : NATTAWUT JENWITTAYAROJE, Ph.D., CFA, 72 pp.

The proprietary trading pattern is investigated around the large order events of individual, foreign, institution and insider investors to examine whether they front run other investors' large orders, using the data from the Stock Exchange of Thailand (SET) during March 2007 to December 2009. The proprietary investors have statistically significant daily abnormal volume, in the same direction with the impending large orders, before the event date of the individual and insider large order events. The results suggest the evidence of front running in aggregate, after removing other explanations. Moreover, the daily abnormal returns and cumulative abnormal returns (CAR) around the large order events of each investor type suggest that the profits from front running the individual large orders are inconclusive. For the insider large order event, the proprietary investors gain on average according to the insider large buy event, while they not only have no profit but also lose the opportunities to gain according to the insider large sell event.

Department : Banking and Finance   Student's Signature

Field of Study : Finance   Advisor's Signature

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CHAPTER I

INTRODUCTION

1.1 Background and Problem Review

This paper investigates the proprietary trading pattern around large order events of all investor types (i.e. individual investors, foreign investors and institutional investors) and also insiders to examine whether the proprietary investor type front runs other investor types by exploiting material non-public information, such as unofficial analyst recommendations, impending large orders knowledge, and other investors' trading information, in anticipation of price impact. Especially in small emerging equity market like the Stock Exchange of Thailand (SET), large trades of these investors potentially cause price movement. In addition, hedging regarding to this material non-public information is also categorized as front running.

Front running is illegal if the trading is based on advance knowledge of impending large orders of other investors. For example, broker trades for his own account from knowing impending large orders of his clients, or trades for his own account before convincing his client to buy the same stock. On the other hand, front running is legal if the trading is based on appropriately acquired information or public information. In other words, the legality of front running does not depend on how much profit it makes but depends on information it uses. Front running using prohibited information is considered to be a crime which can be prosecuted by law. However, both legal and illegal front runnings reduce the incentive of other participants to trade because the front runners would trade based on others' skills and knowledge. Lastly, they make the market far from efficiency.

As advanced participants in equity market, proprietary investors are often questioned whether they seek and trade based on prohibited informational advantage. In many cases, bank or brokerage employee is alleged participating in front running or leaking information of impending large orders. For example, SEC investigates Merrill Lynch on trading for brokerage firm's own account ahead of client orders known as

"front running" in 2008. Subsequently, Merrill Lynch is charged for bad protection of institutional customer order flows.

This study uses the intraday transaction data of proprietary, individual, foreign and institution investors from the Stock Exchange of Thailand and aggregate those intraday transactions into daily net buy(sell) of such investor types. The transactions of insiders are retrieved from report announced by SEC. The report created by 59-2 form which has to be filled by insiders within 3 trading days after they trade (including the day of trading).

This paper constructs events from large orders of all investor types because the large orders of these types of investors tend to cause price impact which favor front runners. In addition, the large orders of insiders are also our events because they are considered the most informed investors. Thus, this paper focuses on 8 large order events which are individual large buys, individual large sells, foreign large buys, foreign large sells, institution large buys, institution large sells, insider large buys and insider large sells. The large buy(sell) order events of such investors are defined as top 10% daily net buy(sell), as percentage of shares outstanding, of all daily trades in the sample period, from March 29, 2007 to December 16, 2009.

Unfortunately, with the available level of data, it allows specifying only the type of investors, not the identification number of investors. Therefore, the result could explain for a group level, not for particular investor. Additionally, only the results from event studies and regressions cannot clearly conclude that the proprietary investors' trades ahead of large orders are front running. However, other explanations would be ruled out in chapter 4.3.

The gains of front running are inconclusive because the holding periods of each stock are unknown. However, the abnormal returns and the cumulative abnormal returns (CAR) in the [-10, +10] trading day window around each large order event type are provided to show a big picture of the benefits from front running.

The benefits of front running are from either providing the liquidity to large orders of other investors (knowledge of the liquidity traders), or expecting to profit

over time (knowledge of informed traders). For the former, the front runners need to buy(sell) the stocks to(from) their inventories several days before the event date when the price is not yet impacted by the large orders, then they trade in the opposite direction on the event date or several days after the event date. In this case, front runners do not care whether the price impact is permanent or temporary, but they do care about whether there is a price impact. For the latter, the front runners have to identify which traders are informed, so the front runners could enjoy the benefits with informed traders for longer interval than the former. There are some empirical findings about informed traders in the Stock Exchange of Thailand. Norasing (2008) suggests that institution and foreign investors are not more informed than individual investors based on price impacts during May 2004 to June 2004. Lertsuwannavin (2007) examines which trade sizes move stock prices, known as stealth trading, and also examines who initiates those transactions during 1999 to 2004. He suggests that the foreign investors are informed based on the disproportion of cumulative price change and their trades.

1.2 Objectives of the Study

To investigate the proprietary daily trading pattern to examine whether they front run other investors' large order. The other investors are individual, foreign, institution and insider investors.

1.3 Scope of the Study

The proprietary trading pattern is investigated around the large order events of individual, foreign, institution and insider investors to examine whether they front run other investors' large orders, using the data from the Stock Exchange of Thailand (SET) during March 2007 to December 2009.

1.4 Limitation

The proprietary investors are examined whether they front run large orders of individual investors, foreign investors, institution investors and insiders. However, the available level of data allows specifying only the type of investors, not the identification number of investors. Therefore, this study could test at an investor group level, not a particular investor level.

1.5 Contribution

In past several years, proprietary firms considerably emerge in Thailand. Consequently, proprietary trader becomes the popular job among financial jobs. Consistent with the boom of proprietary traders, the transaction data of proprietary investors seems intense since 2006. In 2008, proprietary trades account for 10% of total market trading value[1], thus SET start reporting daily trades and volumes of proprietary investor type. In 2009, there are 39 proprietary investors in the market. However, the order flows come from only several proprietary investors[2]. Amazingly, although proprietary investor type demonstrates such a significant volume, there are a few researches about proprietary investors and most papers focus only on individual, institutional and foreign investors.

Examining front-running of proprietary investors through large orders of individual, foreign, institution and insider investors is constructed for the three reasons. First, proprietary investors are often alleged to involve with trading on inappropriately acquired information because most of them affiliate with brokerage firms, which possibly provide prohibited source. To answer the question, we need to know proprietary trading pattern around the large order events of other investor types. These large order events potentially cause price impact which favors front runners, thus they would trade around

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[1] The Stock Exchange of Thailand reports the yearly trading value categorized by investor type.

[2] ASTV manager online. 2009. SEC strictly monitors brokers whose trades account for 10% of the market. Bangkok, Thailand : ASTV manager online.

the large order events expecting benefit from price movement. Second, there are few empirical studies about trading pattern of proprietary investors, who start demonstrating such significant volume, in emerging market like SET. This paper provides the evidence of how they respond to such interesting events like large order events of other investor types. Third, a number of empirical studies investigate the trading behavior of intermediaries around analyst recommendations suggested by Heidle and Li (2003) and by Juergens and Lindsey (2009), or around private information suggested by Khan and Lu (2011) to examine whether there is the information leakage. Whereas, this study investigates proprietary trading pattern around large order events of other investor types, which has never been done before, to examine whether the proprietary investors front run other investors from knowing their impending large orders. Unlike most of the literature studies which investigate abnormal short sells, this paper investigates trading pattern using all transactions from proprietary investor type, including both long and short transactions.

1.6 Research Hypotheses

Hypothesis 1: Proprietary investors front run individual large orders.

Hypothesis 2: Proprietary investors front run foreign large orders.

Hypothesis 3: Proprietary investors front run institution large orders.

Hypothesis 4: Proprietary investors front run insider large orders.

In examining the trading pattern of proprietary investors, if proprietary investor type's trades significantly and persistently lead large orders and significantly deviate from normal trading volumes in the estimation window, front-running is one of many reasons which can explain this incident. "Front-runners buy in front of large purchase orders and sell in front of large sell orders. They hope to profit from the market impacts of the large orders" (Harris 1997). However, the other effects and other explanations are ruled out in Chapter 4.3.

CHAPTER II

LITERATURE REVIEW

2.1 Front Running

Front-running, caused by the conflicts of interest, has been occurring since the past. There is little empirical literature on front-running because it is difficult to directly test with the limitation due to the confidential data. Heidle and Li (2003) find the evidence of front-running before analyst recommendations. Also called recommending market makers, recommending analysts significantly and increasingly quote at the inside bid(ask) in the hour and a half before upgrades(downgrades), whereas their ask(bid) quotes do not change. The evidence suggests the information leakage between research and trading departments in the same brokerage house. Bernhardt and Taub (2008) suggest the evidence of front running from market makers by trading in the same direction as future liquidity flow based on fundamental in the first period and then reverse their trades with non-fundamental in the second period. Therefore, they can smooth their profits intertemporally. Juergens and Lindsey (2009) find that market makers, within the same firm of analysts, increase trading volume before analyst recommendation in the same firm suggesting the information leakage. They also find high abnormal short sells prior to analyst downgrades. Moreover they provide evidence that some investors could access information prior to the official release. On the other hand, Blau and Wade (2012) reexamine the short selling activities before analyst recommendation changes the same as Juergens and Lindsey (2009) and find that there are high abnormal short sells prior to both analyst downgrades and upgrades. They suggest that short sellers do not have private information of upcoming analyst recommendations. Anand and Subrahmanyam (2008) suggest that although intermediaries contribute more to price discovery than their clients, they do not illegally trade or front run large orders of their customers. On the other hand, they are skillful and can trade at lower cost which enable them to trade more efficiently and more frequently on their information.

Chen, Hanson, Hong and Stein (2007) suggest that hedge funds front runs distress mutual funds by selling ahead of mutual funds. Consistent with Chen, Hanson, Hong and Stein (2007), Khan and Lu (2011) suggest that short sellers front run insider sales. They find that there is a significant increase of short sales just the day before announcement of large insider sales, but not for small insider sales. They conclude that the front running is facilitated by the information leakage of impending large insider sales.

Our paper is based on Khan and Lu (2011) who investigate short sales and use insider sales as event study. Unlike Khan and Lu (2011), this study investigates all orders of proprietary investors, not just short sales, before event date. Moreover, this paper extends to cover various events not only insider large sales, but also insider large buys, individual large buys, individual large sells, foreign large buys, foreign large sells, institution large buys and institution large sells to examine whether proprietary investors front run other investors regarding to these attractive events.

2.2 Price Movement and Informed Traders

A number of empirical studies provide the evidence of informed traders from the relationship between their trades and lagged price or lagged return to investigate whether their trades have impact on stock price. In other words, the investors are informed if their trades can move the price. Norasing (2008) examines the price impacts from all investor types in the Stock Exchange of Thailand during May 2004 to June 2004. He suggests that there is asymmetric price impact and it is influenced by market condition for each investor type. In bull market, buys have a larger permanent price impact than sells and have a smaller temporary price impact than sells. On the other hand, in bear market sells have a larger permanent price impact than buys and have a smaller temporary price impact than buys. Contrast to intuition that foreign and institutional investors are informed than individual investors, the price impacts of both foreign and institution investor types are not different from those of individual investor type.

Charoenwong, Ding, and Jenwittayaroje (2007) investigate which trade sizes move stock prices, known as stealth trading, over both bull and bear market conditions on the Stock Exchange of Thailand, the pure limited order market. The final samples are 73 liquid stocks during 2000 to 2004. They find that the large size trades, larger than 75 percentile, have disproportionately large impact on the change in traded and quoted prices. They suggest that informed traders in the Stock Exchange of Thailand can use large size trades because there is no market maker. The result contrasts to informed traders in NYSE who usually employ the medium trade size, which is suggested by Barclay and Warner (1993). Further study to Charoenwong, Ding, and Jenwittayaroje (2007), Lertsuwannavin (2007) reexamines the stealth trading to find which trade sizes move the stock prices on the Stock Exchange of Thailand during a different period from the previous study. The final samples are 106 liquid stocks from 1999 to 2004. Consistent with the previous study, he finds that the cumulative price changes occur on large size trades. In other words, informed trades are concentrated in large trade sizes. Additionally, he also examines which investor types are informed traders. In contrast to the US market that the institution investors are informed traders, the result suggests that foreign investors are smart and well informed based on disproportion of cumulative price change and their trades.

Although there is evidence suggesting that large trade sizes are informative in the Stock Exchange of Thailand, it is possible that informed traders employ the other trade sizes to camouflage the information content, called splitting orders. To be conservative when construct large order events, this paper aggregates the transactions into daily net buy(sell). Therefore, the event dates of large orders are constructed without concerning about splitting orders.

CHAPTER III

DATA AND METHODOLOGY

3.1 Data and Sample

3.1.1 Data

The intraday transaction data of all investor types are obtained from the Stock Exchange of Thailand, and insider trading data is obtained from report announced by SEC. The sample stocks are the stocks on the main board (There are 4 board types which are main board, foreign board, big lot board, and odd lot board). The sample period is from January 2007 to December 2009 in which the proprietary trades seem intense (the proprietary trading value accounts for 7%, 10% and 12% of total market trading value in 2007, 2008 and 2009 respectively). Although there are 39 proprietary investors during the sample period, the orders are submitted only from several proprietary investors.

3.1.2 Sample

To find such large buy(sell) event dates, (Panel A in table 1) the intraday transactions separated by investor types (individual, foreign, institution, and insider investors) are aggregated into daily net volume of each stock. Then keep the daily data within 29 March 2007 and 16 December 2009 to guarantee that there are the estimation window ([-30, -11] trading days before the event date) and the event window ([-10, +10] trading days after the event date) for the sample events. The events are also excluded from the sample if they have earnings announcements within 15 trading days because the earnings announcements might cause the deviation from normal trading. In other words, the proprietary trades ahead of large order event dates must be occur from knowledge of impending large orders to be front running, not from anticipation of earnings announcements. (Panel B in table 1) Then the data is selected for top 10% daily net buy(sell) of all daily trades to be large buy(sell) events. However, the sample events are filtered out more for 3 cases. First, although some investors might trade over multiple days, the large trades on the first date are the signal for large orders. Therefore,

the measure of large orders of each event is the net buy(sell) on the first day of event (day 0). The sample excludes the large-order dates within 15 trading days of each event date. Second, the events that have no trading activities of proprietary investors in estimation window are adjusted to have zero trading volume for everyday in the estimation window. These events have expected volume in estimation window equal to zero and are categorized to have zero trading days in estimation window. These events are very interesting if they have no trading activities in estimation window but have many trading activities several days before event dates. This implies the knowledge of impeding large orders. Therefore, these events are not excluded from our sample due to no trading activity of proprietary investors in estimation window. On the other hand, the trading days in estimation window are excluded if they are in earnings announcements weeks because the trading volume could be affected by earnings announcement and they are, in turn, not the exactly normal trading volume of proprietary investors. If all trading days in estimation window are excluded due to earnings announcements, the expected volume could not be measured. Therefore, these events are filtered out from our sample due to no trading activity of proprietary investors in estimation window. Third, some events have no trading activity of proprietary investors in the event window. Therefore, the abnormal volume could not be measured. These events are also filtered out from our sample. Finally, the last samples for each large order event type are reported in table 1, in which the criteria of sample selection and number of observations are shown.

Table 1: The Sample Selection and the Number of Observations

Panel A: Sample selection for each investor type

No	Criteria	Number of Observation			
		Individual	Foreign	Institution	Insider
1	All transactions of the investors (thousand transactions)	24,017,345	15,657,046	5,707,739	12,302
2	Aggregating transactions into daily	184,745	175,424	68,381	10,070
3	Keeping transaction dates in the window from 29 March 2007 to 16 December 2009	174,571	165,778	64,533	9,609
4	Exclude events with earnings announcement within 15 days	86,618	82,016	32,665	5,595

Table 1: (Continued)

Panel B: The sample selection for each large order event type

No	Criteria	The Number of Observations							
		Individual		Foreign		Institution		Insider	
		Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
1	Select large buys(sells) of the investors	8,661	8,661	8,201	8,201	3,266	3,266	559	559
2	Keep only the first day as distinct large buys(sells)	2,807	2,705	2,608	2,657	1,152	1,238	313	303
3	Exclude events with no trade in the estimation window	2,624	2,536	2,437	2,492	1,125	1,189	296	290
4	Exclude events with no trade in the event window	2,192	2,100	2,020	2,070	1,031	1,060	110	136
	Final Sample Events	2,192	2,100	2,020	2,070	1,031	1,060	110	136

Table 1 reports the criteria of sample selection and the number of observations for 8 large order event types which are the individual large buy event, the individual large sell event, the foreign large buy event, the foreign large sell event, the institution large buy event, the institution large sell event, the insider large buy event, and the insider large sell event. The estimation window is [-30,-11] trading days before the event date. The event window is [-10, +10] trading days around the event date.

3.1.3 Descriptive Statistics

Table 2 reports descriptive statistics for the samples of each large order event type. *Event Date Proprietary Transactions* is the number of proprietary investors' transactions on the event date. *Event Date Proprietary Trade* is proprietary investors' net buy(sell), as percentage of shares outstanding, on the event date. *Individual Buys(Sells)/Shares Outstanding* is the net buy(sell) of individual investors, as percentage of total shares outstanding, on the event date. *Firm Size* is the market value of the firm at fiscal year end. *Shares Outstanding* is the total shares outstanding of the firm at fiscal year end. *Market/Book* is the proportion of market value to book value of the firms. *Average Proprietary Daily Transactions* is the average number of proprietary daily transactions in the estimation window, [-30,-11] trading days before event date. *Average Proprietary Daily Trade* is the average daily number of shares traded by proprietary investors as percentage of total shares outstanding in the estimation window, [-30,-11] trading days before the event date.

Panel A in table 2 reports the descriptive statistics of the individual large order event. For the individual large buy(sell) event, the mean of *Average Proprietary Daily Trade* is 0.0004%(-0.0014%) while the mean of *Event Date Proprietary Trade* is -0.0203%(0.0177%). This suggests that the proprietary investors buy(sell) some amount on average in the estimation window but they reverse their trades against individual large buys(sells) on the event date. The mean of *Average Proprietary Daily Transactions* is 66.35(75.25), while the mean of *Event Date Proprietary Transactions* is 140.66(150.56). This suggests that proprietary investors increase their trading activities on the event date compared to those in their normal trading period. *Individual Large Buys(Sells)/Shares Outstanding* is 0.1926(-0.1686). Compared to other large buy(sell) events, the individual large net buys(sells) on the event date, as percentage of total shares outstanding, are greater(less) than foreign large buys(sells), greater than institution large buys(sells), and less than insider large buys(sells). The mean and median of *Firm Size* are 26.756(34.930) and 5.234(5.667) billion baht respectively. The mean and median of *Shares Outstanding* are 2.487(2.446) and 0.950(0.966) billion shares respectively. Compared to other large buy(sell) events, the firms of individual large buy(sell) event are not different to those of foreign large buy(sell) event, smaller than those of institution large buy(sell) event, and bigger than those of insider large buy(sell) event. The mean of *Market/Book* is 1.38(1.50). It implies that the individual large buys(sells) are concentrated in value firms.

Panel B in table 2 reports the descriptive statistics of the foreign large order event. For the foreign large buy(sell) event, the mean of *Average Proprietary Daily Trade* is -0.0007%(-0.0001%) while the mean of *Event Date Proprietary Trade* is 0.0004%(0.0010)%. This suggests that proprietary investors sell some amount on average in the estimation window and reverse their trades to buy in the same direction with(against) foreign investors' large buys(sells) on the event date. The mean of *Average Proprietary Daily Transactions* is 70.69(69.31), while the mean of *Event Date Proprietary Transactions* is 145.75(135.93). This suggests that proprietary investors increase their trading activities on the event date compared to those in their normal trading period. *Foreign Large Buys(Sells)/Shares Outstanding* is 0.1555(-0.1725). Compared to other large buy(sell) events, the foreign large net buys(sells) on the event date, as percentage

of total shares outstanding, are less(greater) than individual large buys(sells), greater than institution large buys(sells), and less than insider large buys(sells). The mean and median of *Firm Size* are 34.025(30.579) and 5.682(5.606) billion baht respectively. The mean and median of *Shares Outstanding* are 2.418(2.411) and 0.950(1.034) billion shares respectively. Compared to other large buy(sell) events, the firms of foreign large buy(sell) event are not different to those of individual large buy(sell) event, smaller than those of institution large buy(sell) event, and bigger than those of insider large buy(sell) event. The mean of *Market/Book* is 1.51(1.40). It implies that the foreign large buys(sells) are concentrated in value firms.

Panel C in table 2 reports the descriptive statistics of the institution large order event. For the institution large buy(sell) event, the mean of *Average Proprietary Daily Trade* is -0.0010%(-0.0013%) while the mean of *Event Date Proprietary Trade* is 0.0031%(0.0008%). This suggests that proprietary investors sell some amount on average in the estimation window and reverse their trades to buy in the same direction with(against) institution investors' large buys(sells). The mean of *Average Proprietary Daily Transactions* is 101.91(86.80), while the mean of *Event Date Proprietary Transactions* is 157.14(152.81). This suggests that proprietary investors increase their trading activities on the event date compared to those in their normal trading period. *Institution Large Buys(Sells)/Shares Outstanding* is 0.1291(-0.1448). Compared to other large buy(sell) events, the institution large net buys(sells) on the event date, as percentage of total shares outstanding, are the least amount. The mean and median of *Firm Size* are 44.457(33.962) and 16.388(11.08) billion baht respectively. The mean and median of *Shares Outstanding* are 2.704 (2.564) and 1.446(1.2) billion shares respectively. Compared to other large buy(sell) events, the firms of institution large buy(sell) event have the biggest size on average. The mean of *Market/Book* is 1.76(1.62). It implies that the institution large buys(sells) are concentrated in growth firms.

Panel D in table 2 reports the descriptive statistics of the insider large order event. For the insider large buy(sell) event, the mean of *Average Proprietary Daily Trade* is -0.0018%(0.002%) while the mean of *Event Date Proprietary Trade* is -

0.0245%(0.0014%). This suggests that proprietary investors sell(buy) some amount in the estimation window and sell(buy) more against insider investors' large buys(sells). The mean of *Average Proprietary Daily Transactions* is 11.28(23.69), while the mean of *Event Date Proprietary Transactions* is 21.82(86.77). This suggests that proprietary investors increase their trading activities on the event date compared to those in their normal trading period. *Insider Large Buys(Sells)/Shares Outstanding* is 0.5776(-0.7919). Compared to other large buy(sell) events, the insider large net buys(sells) on the event date, as percentage of total shares outstanding, are the greatest amount. The mean and median of *Firm Size* are 4.047(10.174) and 1.942(2.034) billion baht respectively. The mean and median of *Shares Outstanding* are 1.835 (1.564) and 0.658(0.634) billion shares respectively. Compared to other large buy(sell) events, the firms of insider large buy(sell) event have the smallest size on average. The mean of *Market/Book* is 1.1(1.64). It implies that the insider large buys(sells) are concentrated in value firms(growth firms).

In conclusion, table 2 describes mainly about the proprietary investors' trades, on average, in the estimation window compared to those on the event date. Additionally it shows that the proprietary investors considerably increase their trading activities on the event date compared to those in the estimation window, except insider large buy events in which proprietary investors increase a few trading activities on the event date. However, in order to identify front running, the daily trading pattern in the event window is needed, not just the trading on average in the estimation window, to know how they response to large orders of other investors. This is examined in the event study and regression approaches in chapter 3.2.

Table 2: The Descriptive Statistics of Sample Events

Panel A: Individual Large Order Event

Descriptive Statistics	Individual Large Buy Event			Individual Large Sell Event		
	Mean	Median	StdDev	Mean	Median	StdDev
Event Date Proprietary Trade Transactions	140.66	25.00	325.19	150.56	26.00	349.59
Event Date Proprietary Trade (%)	-0.0203	0.0000	0.1144	0.0177	0.0000	0.0834
Individual Large Buys(Sells)/Shares Outstanding (%)	0.1926	0.1230	0.2266	-0.1686	-0.1000	0.2127
Firm Size (million baht)	26,756	5,234	74,159	34,930	5,667	95,356
Shares Outstanding (million shares)	2,487	950	5,213	2,446	966	4,895
Market/Book	1.37	1.01	1.39	1.50	1.13	1.50
Average Proprietary Daily Transactions	66.35	9.75	184.84	75.25	11.00	206.20
Average Proprietary Daily Trade (%)	0.0004	0.0000	0.0286	-0.0014	0.0000	0.0302

Panel B: Foreign Large Order Event

Descriptive Statistics	Foreign Large Buy Event			Foreign Large Sell Event		
	Mean	Median	StdDev	Mean	Median	StdDev
Event Date Proprietary Trade Transactions	145.75	22.00	353.42	135.93	22.00	308.95
Event Date Proprietary Trade (%)	0.0004	0.0000	0.0564	0.0010	0.0000	0.1001
Foreign Large Buys(Sells)/Shares Outstanding (%)	0.1555	0.0969	0.1786	-0.1725	-0.1133	0.1969
Firm Size (million baht)	34,025	5,682	92,971	30,579	5,606	80,056
Shares Outstanding (million shares)	2,418	950	4,772	2,411	1,034	4,739
Market/Book	1.51	1.13	1.52	1.40	1.02	1.43
Average Proprietary Daily Transactions	70.69	10.85	190.23	69.31	10.00	190.18
Average Proprietary Daily Trade (%)	-0.0007	0.0000	0.0208	-0.0001	0.0000	0.0263

Panel C: Institution Large Order Event

Descriptive Statistics	Institution Large Buy Event			Institution Large Sell Event		
	Mean	Median	StdDev	Mean	Median	StdDev
Event Date Proprietary Trade Transactions	157.14	32.00	333.07	152.81	29.00	349.37
Event Date Proprietary Trade (%)	0.0031	0.0000	0.0419	0.0008	0.0000	0.0486
Institution Large Buys(Sells)/Shares Outstanding (%)	0.1291	0.0830	0.1765	-0.1448	-0.0967	0.1812
Firm Size (million baht)	44,457	16,338	79,284	33,962	11,800	66,335
Shares Outstanding (million shares)	2,704	1,446	4,821	2,564	1,200	4,802
Market/Book	1.76	1.43	1.40	1.62	1.32	1.28
Average Proprietary Daily Transactions	101.91	19.50	234.91	86.80	15.00	201.02
Average Proprietary Daily Trade (%)	-0.0010	0.0000	0.0205	-0.0013	0.0000	0.0281

Table 2: (Continued)

Panel D: Insider Large Order Event

Descriptive Statistics	Insider Large Buy Event			Insider Large Sell Event		
	Mean	Median	StdDev	Mean	Median	StdDev
Event Date Proprietary Trade Transactions	21.82	7.00	29.90	86.77	13.50	266.21
Event Date Proprietary Trade (%)	-0.0245	0.0000	0.0760	0.0014	0.0000	0.0393
Insider Large Buys (Sells)/Shares Outstanding (%)	0.5776	0.1533	1.3699	-0.7919	-0.0937	2.4016
Firm Size (million baht)	4,047	1,942	6,274	10,174	2,034	20,085
Shares Outstanding (million shares)	1,835	658	3,569	1,564	634	2,457
Market/Book	1.10	0.85	0.89	1.64	1.25	1.51
Average Proprietary Daily Transactions	11.28	4.25	20.62	23.69	6.63	64.37
Average Proprietary Daily Trade (%)	-0.0018	0.0000	0.0621	0.0002	0.0000	0.0371

Table 2 reports the descriptive statistics for the samples of each large order event type. The large buys (sells) of each investor type are defined as top 10% daily net buy(sell), as percentage of shares outstanding, of all daily trades from each investor type in the sample period from March 29, 2007 to December 16, 2009. *Event Date Proprietary Transactions* is the number of proprietary investors' transactions on the event date. *Event Date Proprietary Trade* is the proprietary investors' net buy(sell), as percentage of shares outstanding, on the event date. *Individual Buy(Sell)/Shares Outstanding* is the net buy(sell) of the individual investors, as percentage of total shares outstanding, on the event date. *Firm Size* is the market value of the firm at fiscal year end. *Shares Outstanding* is the total shares outstanding of the firm at fiscal year end. *Market/Book* is the proportion of market value to book value of the firm. *Average Proprietary Daily Transactions* is the average number of proprietary daily transactions in the estimation window, [-30,-11] trading days before the event date. *Average Daily Proprietary Trade* is the average daily number of shares traded by the proprietary investors as percentage of total shares outstanding in the estimation window, [-30,-11] trading days before the event date.

Table 3 categorizes sample events by proprietary investors' trading days in the estimation window and their trading days in the event window. The groups with lower proprietary trading days in the estimation window than those in the event window have high possibilities for front running, because the proprietary investors do not usually trade in the stocks but increase their trading activities in the period of large order event. On the other hand, the groups with higher proprietary trading days in the estimation window than those in the event window have the low possibilities for front running, because they have trading activities in the large order period greater than those in the normal period. Additionally, the groups with the highest possibilities for front running are the groups with 0-5 days in the estimation window because they contain no trading activities or less activities in the estimation window but contain higher trading activities in the event window, while the groups with the lowest possibilities for front running are the

groups with 16-20 days in the estimation window because they contain higher trading activities in the event window than in the estimation window. Nevertheless, this paper focuses only on the groups with high possibilities for front running.

Panel A in table 3 categorizes the sample events of individual large order event by the number of proprietary trading days in the estimation window and that in the event window. For the individual large buy event, the 0-5 days in the estimation window, 0-5 days in the event window is the top 1st group with the highest number of events. The 0-5 days in the estimation window, 6-10 days in the event window is the top 4th group. These 2 groups have high possibility for front running and account for 44.48% of all sample events, which is the high proportion. For the individual large sell event, the 0-5 days in the estimation window, 0-5 days in the event window is the top 1st group with the highest number of events. This high possibility for front running group accounts for 32.05% of all sample events.

Panel B in table 3 categorizes the sample events of foreign large order event by the number of proprietary trading days in the estimation window and that in the event window. For the foreign large buy event, the 0-5 days in the estimation window, 0-5 days in the event window is the top 1st group with the highest number of events. This group has high possibility for front running and accounts for 32.97% of all sample events which is economically significant. For the foreign large sell event, the group that has highest number of events is 0-5 days in the estimation window, 0-5 days in the event window. This group has the high possibility for front running and accounts for 33.52% of all sample events which is economically significant.

Panel C in table 3 categorizes the sample events of institution large order event by the number of proprietary trading days in the estimation window and that in the event window. For the institution large buy event, the group that has the highest number of events is 6-10 days in the estimation window, 16-21 days in the event window. This group has high possibility for front running due to much higher trading days in the event window than those in the estimation window. This group accounts for 26.47% of all sample events which is economically significant. For the institution large sell event, the group that has the highest number of events is 6-10 days in the estimation window, 16-

21 days in the event window. This group has high possibility for front running and accounts for 23.20% of all sample events which is economically significant.

Panel D in table 3 categorizes the sample events of insider large order event by the number of proprietary trading days in the estimation window and that in the event window. For the insider large buy event, the group that has the highest number of events is 0-5 days in the estimation window, 0-5 days in the event window. This group has high possibility for front running and accounts for 59.09% of all sample events, which is economically significant. For the insider large sell event, the group that has the highest number of events is 0-5 days in the estimation window, 0-5 days in the event window. This group has high possibility for front running and accounts for 43.38% of all sample events, which is economically significant.

Table 3: The Sample Events Categorized by the Number of Proprietary Trading Days in the Estimation Window and Number of Proprietary Trading Days in the Event Window

Panel A: Individual Large Order Event

No. of Proprietary Trading Days in the Estimation Window	No. of Proprietary Trading Days in the Event Window	The Number of Sample Events	
		Individual Large Buy Event	Individual Large Sell Event
0-5	0-5	774	673
	6-10	201	209
	11-15	77	93
	16-21	42	35
6-10	0-5	51	47
	6-10	91	76
	11-15	101	92
	16-21	352	383
11-15	0-5	9	7
	6-10	23	22
	11-15	52	57
	16-21	103	95
16-20	0-5	0	0
	6-10	4	7
	11-15	35	19
	16-21	277	285
Total Sample Events		2192	2010

Table 3: (Continued)

Panel B: Foreign Large Order Event

No. of Proprietary Trading Days in the Estimation Window	No. of Proprietary Trading Days in the Event Window	The Number of Sample Events	
		Foreign Large Buy Event	Foreign Large Sell Event
0-5	0-5	666	694
	6-10	195	181
	11-15	82	79
	16-21	28	36
6-10	0-5	41	50
	6-10	71	66
	11-15	103	113
	16-21	353	360
11-15	0-5	6	8
	6-10	26	16
	11-15	44	58
	16-21	99	103
16-20	0-5	0	0
	6-10	5	1
	11-15	22	32
	16-21	279	273
Total Sample Events		2020	2070

Table 3: (Continued)

Panel C: Institution Large Order Event

No. of Proprietary Trading Days in the Estimation Window	No. of Proprietary Trading Days in the Event Window	The Number of Sample Events	
		Institution Large Buy Event	Institution Large Sell Event
0-5	0-5	130	229
	6-10	65	77
	11-15	41	52
	16-21	18	18
6-10	0-5	12	15
	6-10	29	33
	11-15	66	61
	16-21	273	246
11-15	0-5	3	3
	6-10	5	12
	11-15	41	26
	16-21	102	70
16-20	0-5	0	0
	6-10	2	2
	11-15	19	19
	16-21	225	197
Total Sample Events		1031	1060

Table 3: (Continued)

Panel D: Insider Large Order Event

No. of Proprietary Trading Days in the Estimation Window	No. of Proprietary Trading Days in the Event Window	The Number of Sample Events	
		Insider Large Buy Event	Insider Large Sell Event
0-5	0-5	65	59
	6-10	11	18
	11-15	4	9
	16-21	0	3
6-10	0-5	4	3
	6-10	4	5
	11-15	5	5
	16-21	6	10
11-15	0-5	0	0
	6-10	2	2
	11-15	3	3
	16-21	2	7
16-20	0-5	0	0
	6-10	0	0
	11-15	4	1
	16-21	0	11
Total Sample Events		110	136

Table 3 categorizes sample events by the number of proprietary trading days in the estimation window, [-30, -11] trading days before the event date, and the number of proprietary trading days in the event window, [-10, +10] trading days around the event date.

3.2 Methodology

3.2.1 Event Studies

3.2.1.1 The Proprietary Trading Pattern around Large Order Events

The proprietary trading pattern around large order events is investigated by using the event study, applied from Brown and Warner (1985), MacKinlay (1997), Campbell, Lo and MacKinlay (1997, Ch.4) and Khan and Lu (2011). The 8 events constructed in this paper are large buy and large sell events of individual, foreign,

institution and insider investors. Day 0 is the event date when large buys(sells) of each investor are executed. For each event, transactions are grouped into daily net buy or net sell. The estimation window, used to estimate normal or expected daily net buy or net sell, is [-30, -11] trading day window. The event window, or test window, is [-10, +10] trading day window.

According to the sample events in a data section (Table 1), the other factor that could affect the trading behavior of proprietary investors is earning announcement. Sample events are excluded if they have earnings announcement within 15 trading days because buys and sells of front runners must be executed from knowing impending large orders, not from anticipation of good or bad earnings announcement. In addition, the earnings announcement weeks are excluded from estimation window, which is used to calculate daily normal or expected buy(sell) of proprietary investors.

As percentage of shares outstanding, the abnormal volume of stock i on day t ($A_{i,t}$) is calculated as follow:

$$A_{i,t} = V_{i,t} - \bar{V}_i$$

where

$$\bar{V}_i = \frac{1}{T_i} \sum_{t=-30}^{t=-11} V_{i,t}$$

$V_{i,t}$ is the daily net buy or net sell for stock i on day t. $\bar{V}_i$ is the expected trading volume in estimation window for stock i. T_i is the number of trading days in estimation window for stock i. The t-statistics of each day in the event window are calculated as follow:

$$\bar{A}_t / \hat{S}(\bar{A}_t) \qquad\qquad t \in [-10, +10]$$

where

$$\bar{A}_t = \frac{1}{N_t} \sum_{i=1}^{i=N} A_{i,t}$$

$$\hat{S}(\bar{A}_t) = \sqrt{\left\{ \sum_{t=-30}^{t=-11} (\bar{A}_t - \bar{\bar{A}})^2 \right\}/19}$$

$$\bar{\bar{A}} = \frac{1}{20} \sum_{t=-30}^{t=-11} \bar{A}_t$$

$\bar{A}_t$ is the average abnormal volume across all stocks on day t. N_t is the number of sample securities whose abnormal volumes are available on day t. $\hat{S}(\bar{A}_t)$ is the standard deviation from time series of average abnormal volume. $\bar{\bar{A}}$ is the average of $\bar{A}_t$ from day t = -30 to day t = -11.

3.2.1.2 The Other investor types' trading pattern around large order events

For the robustness, the other investors' trading patterns, other than proprietary trading pattern, around large order events are examined to identify the patterns of who do not know impending large orders. The abnormal volume of other investors and t-statistic are calculated same as those of proprietary investors in chapter 3.2.1.1.

3.2.2 Regression-Based Tests

Besides event study methodology, the regression-based approach applied from Khan and Lu (2011) is also used in this paper for the robustness. The regression equation is given as follow:

$$V_{t,i} = \beta_{1,i} + \beta_{2,i}Ret_{t,i} + \beta_{3,i}Ret_{t-1,i} + \beta_{4,i}HILO_{t,i} + \beta_{5,i}HILO_{t-1,i} + \beta_{6,i}ILT_{t,i} + u_{t,i}$$

V is the proprietary's daily net volume. Ret is daily stock return. HILO is the firm's intraday stock price volatility, which is the logarithm of the highest stock price to the lowest stock price of the day (Parkinson 1980). ILT is the impending large trade dummy variable. ILT is set to be 1 when t is in [-3, -1] trading day window before the event date, but it is set to be 0 when t is in the [-30,-11] estimation window. Therefore, each regression has 23 observations (20 days from the estimation window and 3 days from the event window). The ILT is the variable of interest. The mean coefficients are the average of coefficients across regressions, and the t-statistics are the standard error of the mean coefficients across regressions.

3.2.3 Abnormal Stock Returns around Large Order Events

The abnormal stock returns are determined in [-10, +10] trading days around the event date. The abnormal returns are value-weighted market-adjusted returns because of short window in this event study. Additionally, the cumulative abnormal returns (CAR) are also provided to give a big picture of benefits from front running around other investors' large order events.

Applied from Brown and Warner (1985), the abnormal return of stock i on day t ($AR_{i,t}$) is calculated as follow:

$$AR_{i,t} = R_{i,t} - \bar{R}_i$$

where

$$\bar{R}_i = \frac{1}{T_i} \sum_{t=-30}^{t=-11} R_{i,t}$$

$R_{i,t}$ is the daily return of stock i on day t. $\bar{R}_i$ is the expected return in estimation window for stock i. T_i is the number of days in estimation window for stock i. The t-statistics of each day in the event window are calculated as follow:

$$\overline{AR}_t / \hat{S}(\overline{AR}_t) \qquad\qquad t \in [-10, +10]$$

where

$$\overline{AR}_t = \frac{1}{N_t} \sum_{i=1}^{N_t} AR_{i,t}$$

$$\hat{S}(\overline{AR}_t) = \sqrt{\left\{ \sum_{t=-30}^{t=-11} \left(\overline{AR}_t - \overline{\overline{AR}} \right)^2 \right\} / 19}$$

$$\overline{\overline{AR}} = \frac{1}{20} \sum_{t=-30}^{t=-11} \overline{AR}_t$$

$\overline{AR}_t$ is the average abnormal return on day t. N_t is the number of sample securities whose abnormal returns are available on day t. $\hat{S}(\overline{AR}_t)$ is the standard deviation from time series of average abnormal return. $\overline{\overline{AR}}$ is the average of $\overline{AR}_t$ from day t = -30 to day t =-11.

CHAPTER IV

EMPIRICAL RESULTS AND RESULT DISCUSSION

4.1 Front Running of Proprietary Investors around Other Investors' Large Order Events

4.1.1 Event Studies

Table 4 reports the proprietary daily abnormal volumes and t-statistics in [-10, +10] trading days around the event date to show whether the proprietary investors trade ahead of other investors' large orders. Table 5 reports the other investors' daily abnormal volumes and the statistical significance in [-10, +10] trading days around the event date to show whether they trade ahead of the large orders.

Table 4 panel A reports the proprietary abnormal volume around the individual large order event. Table 5 panel A reports the other investors' abnormal volume around the individual large order event. (Table 4 Panel A) For the individual large buy event, the proprietary investors have positive daily abnormal volumes 4 days before the event date and the magnitudes also increase every day until the day before the event date. The daily abnormal volumes increase sharply to the peak just one day before the event date. On the event date, the proprietary investors reverse their trades to sell against individual large buys. The daily abnormal volumes are significant on day -2, -1, 0, 1, 4 and 7. The result suggests that the proprietary investors trade ahead of individual large buys several days prior to the event date. Then, they reverse their trades on the event date. This implies the knowledge of liquidity traders because they buy the stocks several days before the event date and sell them on the event date. (Table 5 Panel A) For the foreign investors, the daily abnormal volumes are positive from day -7 to day -1 and vary not much. They are statistically significant on day -6, -3 and -2. The result suggests that the foreign investors trade based on their strategies rather than front run individual large buys because the abnormal volumes are positive many days before the event date and are at the same level. For the institution investors, the daily abnormal volumes are substantially positive from day -9 to day -1 and are at the same level, except day -4 in which the daily abnormal volume is small negative. This suggests that

the institution investors do not front run individual large buys. Figure 1 provides the graphs of the daily abnormal volume of the proprietary investors and the other investors according to the individual large buy event, which are consistent with the table 4 panel A and table 5 panel A.

(Table 4 panel A) For the individual large sell event, the proprietary investors have negative daily abnormal volumes 2 days before the event date. It peaks and is statistically significant on day -2, but it is not economically and statistically significant on day -1. The result suggests that the proprietary investors trade ahead of individual large sells several days prior to the event date. (Table 5 panel A) For the foreign and institution investors, although there are negative daily abnormal volumes for 5 days before the individual large sell date, they are all at the same level. This suggests that the foreign and institution investors do not front run individual large sells. Figure 2 provides the graphs of the daily abnormal volume of the proprietary investors and the other investors according to the individual large sell event, which are consistent with the table 4 panel A and table 5 panel A.

Table 4 panel B reports the proprietary abnormal volume around the foreign large order event. Table 5 panel B reports the other investors' abnormal volume around the foreign large order event. (Table 4 panel B) For the foreign large buy event, the signs of daily abnormal volumes of the proprietary investors always change with increasing magnitude in [-5, -1] trading days before the event date. They are statistically significant on day -3,-2 and -1. Although there is the significant positive abnormal volume just one day before event date, but the magnitude is not much different to those of the two days before that. The result suggests that the proprietary investors act as liquidity providers rather than front runners. Therefore, they do not front run foreign large buys. (Table 5 panel B) For the individual investors, although there is the significantly positive abnormal volume on day -2, the daily abnormal volumes are positive from day -10 to day -1 and they are at the same level. This suggests that the proprietary investors trade based on their strategies many days before event date, rather than front run foreign large buys. For the institution investors, the daily abnormal volumes are significantly positive on day -5 and -1 with the same magnitude 0.0066% of shares outstanding. It implies that the institution investors possibly trade over the normal volume

for 0.0066% of shares outstanding, although there is no information of large trade (day -5). In addition, the institution investors theoretically could not know impending large orders of foreign investors. This suggests that the institution investors do not front run foreign large buys. Figure 3 provides the graphs of the daily abnormal volume of the proprietary investors and the other investors according to the foreign large buys, which are consistent with the table 4 panel B and table 5 panel B.

(Table 4 panel B) For the foreign large sell event, the daily abnormal volume is significant only on day -5 in [-5, -1] trading days before the event date. Although there are negative abnormal volumes for 2 days before the event date, they are not statistically significant. The result suggests that the proprietary investors do not front run foreign large sells. (Table 5 panel B) For the individual investors, although the daily abnormal volumes are significantly negative on day -5 and -3, they initially are negative from day -7 to day -1 and are at the same level. This suggests that the individual investors trade based on their strategies rather than front run foreign large sells. For the institution investors, there is significantly negative abnormal volume just one day before the event date. Although the trading pattern is similar to the trading pattern of front runners, they theoretically could not know the impending large orders of foreign investors. This possibly occurs by chance. This suggests that the institution investors do not front run foreign large sells. Figure 4 provides the graphs of the daily abnormal volume of the proprietary investors and the other investors according to the foreign large sells, which are consistent with the table 4 panel B and table 5 panel B.

Table 4 panel C reports the proprietary abnormal volume around the institution large order event. Table 5 panel C reports the other investors' abnormal volume around the institution large order event. (Table 4 panel C) For the institution large buy event, although the daily abnormal volumes of proprietary investors are positive for day -2 and -1 in [-5, -1] trading days before the event date, they are not statistically significant. This suggests that the proprietary investors do not trade ahead of institution large buys. (Table 5 panel C) For the individual investors, although the daily abnormal volumes are significantly positive 2 days before the event date, they are at the same level with day -4 and -3. Additionally, the individual investors could not publicly observe

the impending large orders of institution investors. The result suggests that the individual investors do not front run institution large buys. For the foreign investors, the daily abnormal volumes are negative for 4 days before the event date and statistically significant only on day -1. This suggests that foreign investors do not concern about the impending large buys of institution investors. Therefore, the foreign investors do not front run institution large buys. Figure 5 provides the graphs of the daily abnormal volume of the proprietary investors and the other investors according to the institution large buys, which are consistent with the table 4 panel C and table 5 panel C.

(Table 4 panel C) For the institution large sell event, the daily abnormal volumes of proprietary investors are positive and statistically significant on day -3 and -2 which implies that they do not concern about the impending institution large sells. Although the daily abnormal volume is negative on day -1 but it is not statistically significant. This suggests that the proprietary investors do not front run institution large sells. (Table 5 panel C) For the individual investors, although the daily abnormal volumes are significantly negative on day -5, -3 and -2, these negative daily abnormal volumes begin from day -8 to day -1 and vary not much. This suggests that the individual investors do not trade regarding to knowledge of impending large sells of institution investors, but they trade regarding to their strategies. For the foreign investors, the daily abnormal volumes are positive 3 days before the event date and on the event date. They are statistically significant on day -2 and 0. This suggests that the foreign investors do not concern about institution large sells. Therefore, the foreign investors do not front run institution large sells. Figure 6 provides the graphs of the daily abnormal volume of the proprietary investors and the other investors according to the institution large sells, which are consistent with the table 4 panel C and table 5 panel C.

Table 4 panel D reports the proprietary abnormal volume around the insider large order event. Table 5 panel D reports the other investors' abnormal volume around the insider large order event. (Table 4 panel D) For the insider large buy event, the daily abnormal volumes are positive and vary from 0.0031% to 0.0049% of shares outstanding from day -8 to -3 except day -4 in which the daily abnormal volume is -0.0043% of share outstanding. These daily abnormal volumes are at the same level and

not statistically significant. The daily abnormal volumes start increasing sharply on day -2 and peak on day -1. Additionally, these abnormal volumes are statistically significant. This suggests that the proprietary investors trade ahead of insider large buys. This implies the knowledge of liquidity traders because they buy the stocks just 2 days before the event date and sell them on the event date. (Table 5 panel D) For the foreign investors, the daily abnormal volumes are positive on day -3 and -2, and become negative on day -1. This is not the front-running trading pattern because the foreign investors sell more stocks before insider large buy date. Additionally, the daily abnormal volumes are not statistically significant in 5-day period before the event date. These suggest that foreign investors neither anticipate the price impact from insider large buys nor front run them. For the institution investors, the daily abnormal volumes are statistically significant on day -5, -3, -2 and -1 for 5-day period before the event date. They are positive from day -5 to -3 and become negative 2 days before insider larges buys. This is not the front-running trading pattern because they sell stocks 2 days before the insider large buy date. Therefore, they could have no stock or have fewer stocks to gain if there is the price impact regarding to insider large buys or if the insiders are the informed traders. This suggests that the institution investors do not front run insider large buys. Figure 7 provides the graphs of the daily abnormal volume of the proprietary investors and the other investors according to the insider large buys, which are consistent with the table 4 panel D and table 5 panel D.

(Table 4 panel D) For the insider large sell event, the daily abnormal volumes are insignificantly positive varying from 0.0024% to 0.0069% of shares outstanding in [-5, -1] trading days, except day -1 in which the daily abnormal volume is significantly negative with the largest magnitude compared to those in [-10, +10] trading days around the event. This suggests that the proprietary investors trade ahead of insider large sells just one day before the event date. (Table 5 panel D) For the foreign investors, the daily abnormal volumes are positive for 4 days before the event date and are statistically significant only on day -3 and -2. This is not the front-running trading pattern because they buy stocks before large sells of insiders. This implies that they do not concern about price impact, which might occur due to large sells of insiders. Therefore, the foreign investors do not front run insider large sells. For institution

investors, the daily abnormal volumes are statistically significant on day -4 in 5-day period before the event date. The signs of daily abnormal volumes change every day in 5-day period before the event date. The daily abnormal volume is positive just one day before the event date. Additionally, they are significantly positive from day 0 to 2. This suggests that institution investors do not concern about large sells of insiders. Therefore, the institution investors do not front run insider large sells. Figure 8 provides the graphs of the daily abnormal volume of the proprietary investors and the other investors according to the insider large sells, which are consistent with the table 4 panel D and table 5 panel D.

In summary, the abnormal volume from proprietary trading patterns around each large order event suggest that the proprietary investors front run the individual and insider investors but not for foreign and institution investors. For the conventional wisdom, most institution investors usually use value-weighted average price (VWAP) to evaluate the trading performance when they send the trading orders to brokerage firms. Therefore, the institution investors can keep tracking whether they are front run by proprietary investors. This could be the reason why the proprietary investors do not front run the institution investors even the institution large orders tend to cause price impact (the abnormal returns according to each large order event are examined in Chapter 4.2). On the other hand, there is no evidence that the individual investors will use any method to track whether they are front run.

Table 4: The Proprietary Abnormal Volume around Large Order Events

Panel A: Individual Large Order Event

Event Day	Individual Large Buy		Individual Large Sell	
	Abnormal Volume	t-statistic	Abnormal Volume	t-statistic
-10	-0.0003	-0.225	-0.0025	-1.220
-9	-0.0007	-0.493	0.0034	1.660
-8	0.0004	0.306	0.0014	0.688
-7	-0.0004	-0.307	-0.0018	-0.873
-6	0.0000	0.001	-0.0002	-0.076
-5	-0.0018	-1.341	0.0025	1.220
-4	0.0004	0.286	-0.0002	-0.114
-3	0.0012	0.860	0.0018	0.870
-2	0.0033**	2.478	-0.0035*	-1.706
-1	0.0069***	5.151	-0.0001	-0.062
0	-0.0215***	-16.047	0.0178***	8.741
1	-0.0061***	-4.530	-0.0057***	-2.830
2	0.0015	1.087	-0.0012	-0.579
3	0.0007	0.547	0.0013	0.639
4	-0.0043	-3.242	0.0010	0.499
5	0.0000	-0.008	-0.0001	-0.068
6	0.0000	0.004	-0.0001	-0.030
7	-0.0034	-2.574	0.0007	0.335
8	-0.0021	-1.578	0.0003	0.130
9	-0.0009	-0.671	0.0008	0.396
10	0.0014	1.075	-0.0013	-0.656

Table 4: (Continued)

Panel B: Foreign Large Order Event

	Foreign Large Buy		Foreign Large Sell	
Event Day	Abnormal Volume	t-statistic	Abnormal Volume	t-statistic
-10	-0.0024*	-1.676	-0.0017*	-1.789
-9	0.0014	0.945	-0.0016*	-1.694
-8	0.0014	0.936	-0.0003	-0.330
-7	-0.0027*	-1.828	0.0000	-0.001
-6	0.0007	0.498	0.0013	1.347
-5	0.0014	0.977	-0.0025***	-2.692
-4	-0.0012	-0.831	-0.0003	-0.339
-3	0.0024*	1.661	0.0001	0.063
-2	-0.0030**	-2.043	-0.0006	-0.650
-1	0.0034**	2.356	-0.0008	-0.831
0	0.0002	0.144	0.0004	0.388
1	-0.0020	-1.344	-0.0019**	-1.987
2	-0.0003	-0.226	-0.0006	-0.628
3	0.0011	0.752	0.0017*	1.833
4	0.0003	0.181	-0.0009	-0.950
5	-0.0013	-0.864	0.0003	0.354
6	-0.0003	-0.230	0.0014	1.550
7	0.0003	0.223	0.0003	0.280
8	0.0007	0.472	0.0002	0.235
9	0.0003	0.173	-0.0027***	-2.939
10	-0.0006	-0.423	0.0012	1.262

Table 4: (Continued)

Panel C: Institution Large Order Event

	Institution Large Buy		Institution Large Sell	
Event Day	Abnormal Volume	t-statistic	Abnormal Volume	t-statistic
-10	-0.0009	-0.770	0.0015	1.013
-9	0.0002	0.129	-0.0017	-1.152
-8	-0.0008	-0.681	0.0014	0.961
-7	-0.0005	-0.439	0.0010	0.703
-6	0.0002	0.193	0.0027*	1.877
-5	0.0003	0.286	-0.0007	-0.499
-4	0.0015	1.260	-0.0006	-0.444
-3	-0.0009	-0.735	0.0024*	1.697
-2	0.0007	0.582	0.0040***	2.809
-1	0.0010	0.829	-0.0019	-1.292
0	0.0033***	2.751	0.0008	0.571
1	-0.0003	-0.238	0.0021	1.493
2	0.0011	0.917	-0.0021	-1.449
3	0.0010	0.808	0.0002	0.106
4	0.0012	0.997	-0.0021	-1.472
5	-0.0021*	-1.751	0.0006	0.412
6	0.0017	1.443	0.0007	0.457
7	-0.0016	-1.388	0.0008	0.562
8	0.0020*	1.678	0.0004	0.275
9	0.0014	1.154	-0.0001	-0.044
10	0.0003	0.223	-0.0009	-0.652

Table 4: (Continued)

Panel D: Insider Large Order Event

	Insider Large Buy		Insider Large Sell	
Event Day	Abnormal Volume	t-statistic	Abnormal Volume	t-statistic
-10	0.0224	1.978	0.0126	2.101
-9	0.0089	0.787	0.0076	1.271
-8	0.0049	0.436	0.0008	0.137
-7	0.0069	0.606	-0.0076	-1.269
-6	0.0040	0.350	0.0068	1.136
-5	0.0043	0.380	0.0024	0.399
-4	-0.0043	-0.377	0.0069	1.149
-3	0.0031	0.277	0.0024	0.399
-2	0.0234**	2.071	0.0064	1.068
-1	0.0464***	4.104	-0.0110*	-1.826
0	-0.0225**	-1.992	-0.0006	-0.099
1	0.0206*	1.819	0.0037	0.620
2	0.0036	0.315	-0.0108*	-1.806
3	0.0212*	1.877	-0.0058	-0.965
4	0.0287**	2.535	-0.0014	-0.238
5	-0.0036	-0.319	-0.0011	-0.182
6	-0.0059	-0.520	0.0010	0.172
7	0.0097	0.861	0.0013	0.214
8	-0.0150	-1.322	-0.0082	-1.373
9	-0.0001	-0.010	0.0149**	2.485
10	0.0059	0.517	0.0004	0.064

Table 4 reports the daily abnormal volume of proprietary investors in the event window, [-10, +10] trading days around the event date for each large order event type. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in the estimation window, [-30, -11] trading days before the event date, excluding earnings announcement weeks. The large buys(sells) of each investor type are defined as top 10% daily net buy(sell), as percentage of shares outstanding, of all daily trades in the sample period from March 29, 2007 to December 16, 2009. *, **, *** denote the two-tailed statistical significance at 10%, 5%, and 1% level, respectively.

Table 5: The Other Investors' Abnormal Volume around Large Order Events

Panel A: Individual Large Order Event

Event Day	Individual Large Buy		Individual Large Sell	
	Foreign Abnormal Volume	Institution Abnormal Volume	Foreign Abnormal Volume	Institution Abnormal Volume
-10	-0.0043	0.0006	-0.0069	-0.0066**
-9	0.0020	0.0084***	-0.0056	-0.0074**
-8	-0.0025	0.0038	-0.0126	-0.0017
-7	0.0078	0.0032	-0.0078	0.0003
-6	0.0174**	-0.0004	-0.0048	-0.0120***
-5	0.0100	0.0052**	-0.0145*	-0.0042
-4	0.0100	0.0052**	-0.0090	-0.0059*
-3	0.0150*	0.0096***	-0.0087	-0.0087***
-2	0.0173**	0.0091***	-0.0105	-0.0013
-1	0.0108	0.0057**	-0.0141*	-0.0080**
0	-0.1314***	-0.0570***	0.1285***	0.0507***
1	-0.0394***	-0.0128***	0.0417***	0.0087***
2	-0.0281***	-0.0011	0.0304***	-0.0024
3	-0.0202**	-0.0032	0.0178**	-0.0072**
4	-0.0060	-0.0045*	0.0141*	-0.0007
5	-0.0065	-0.0025	0.0081	0.0063*
6	-0.0096	0.0009	0.0091	-0.0041
7	-0.0062	-0.0014	-0.0001	0.0047
8	-0.0025	0.0081***	0.0046	0.0005
9	-0.0065	0.0069***	0.0115	0.0053
10	-0.0058	-0.0028	0.0137*	0.0005

Table 5: (Continued)

Panel B: Foreign Large Order Event

	Foreign Large Buy		Foreign Large Sell	
	Individual	Institution	Individual	Institution
Event Day	Abnormal Volume	Abnormal Volume	Abnormal Volume	Abnormal Volume
-10	0.0105	-0.0008	0.0030	0.0017
-9	0.0095	-0.0052**	-0.0028	-0.0001
-8	0.0104	-0.0022	0.0026	0.0005
-7	0.0127	0.0037	-0.0129	0.0016
-6	0.0074	-0.0042	-0.0125	0.0013
-5	0.0108	0.0066**	-0.0153*	-0.0022
-4	0.0084	-0.0004	-0.0117	0.0005
-3	0.0035	0.0036	-0.0155*	-0.0019
-2	0.0140*	0.0035	-0.0109	-0.0027
-1	0.0108	0.0066**	-0.0057	-0.0074**
0	-0.1480***	-0.0167***	0.1549***	0.0110***
1	-0.0436***	-0.0087***	0.0470***	0.0052*
2	-0.0340***	-0.0020	0.0303***	0.0028
3	-0.0172**	-0.0055**	0.0277***	-0.0002
4	-0.0098	-0.0036	0.0081	0.0012
5	-0.0095	0.0006	0.0053	0.0042
6	-0.0076	-0.0032	0.0081	0.0046
7	-0.0101	0.0070***	0.0087	0.0012
8	-0.0093	0.0012	-0.0028	0.0066**
9	-0.0133*	0.0008	0.0083	0.0064**
10	-0.0129	-0.0016	0.0059	0.0026

Table 5: (Continued)

Panel C: Institution Large Order Event

	Institution Large Buy		Institution Large Sell	
Event Day	Individual Abnormal Volume	Foreign Abnormal Volume	Individual Abnormal Volume	Foreign Abnormal Volume
-10	0.0039	0.0014	0.0066	-0.0126
-9	-0.0029	0.0015	0.0098	-0.0097
-8	0.0135*	-0.0066	-0.0032	-0.0008
-7	0.0005	-0.0005	-0.0153	0.0096
-6	-0.0020	0.0030	-0.0159	0.0057
-5	0.0030	0.0023	-0.0189*	0.0065
-4	0.0120	-0.0068	-0.0019	-0.0024
-3	0.0119	-0.0044	-0.0204**	0.0123
-2	0.0174**	-0.0083	-0.0310***	0.0144*
-1	0.0174**	-0.0138*	-0.0131	0.0075
0	-0.0991***	-0.0282***	0.0983***	0.0433***
1	-0.0245***	-0.0014	0.0197**	0.0114
2	-0.0032	-0.0048	0.0067	0.0113
3	-0.0026	-0.0045	0.0160	0.0050
4	-0.0027	-0.0112	0.0088	0.0102
5	-0.0042	0.0009	0.0032	0.0054
6	0.0032	-0.0036	0.0041	0.0024
7	0.0017	-0.0053	-0.0041	0.0083
8	0.0046	-0.0062	-0.0076	0.0095
9	-0.0131*	0.0008	-0.0051	0.0072
10	-0.0187**	0.0087	-0.0057	0.0096

Table 5: (Continued)

Panel D: Insider Large Order Event

	Insider Large Buy		Insider Large Sell	
Event Day	Foreign Abnormal Volume	Institution Abnormal Volume	Foreign Abnormal Volume	Institution Abnormal Volume
-10	-0.0119	-0.0005	-0.0381***	0.0214*
-9	0.0299	0.0060	-0.0003	0.0177
-8	0.0157	0.0328***	0.0081	-0.0139
-7	0.0099	0.0180**	-0.0045	-0.0119
-6	-0.0414*	-0.0187**	-0.0110	0.0451***
-5	0.0028	0.0287***	-0.0199*	0.0075
-4	-0.0185	0.0050	0.0134	-0.0283**
-3	0.0025	0.0344***	0.0235**	0.0174
-2	0.0073	-0.0240***	0.0256**	-0.0008
-1	-0.0092	-0.0119	0.0075	0.0177
0	-0.0400	-0.0279***	-0.0389***	0.0392***
1	-0.0031	0.0207**	0.0603***	0.0709***
2	0.0002	0.0375***	-0.0153	0.0314**
3	-0.0085	0.0168**	0.0004	0.0133
4	-0.0188	-0.0067	0.0200*	-0.0083
5	-0.0022	0.0134*	0.0126	0.0065
6	0.0073	-0.0013	-0.0022	-0.0484***
7	0.0057	0.0307***	0.0318***	0.0116
8	0.0029	0.0175**	0.0196*	0.0137
9	-0.0167	0.0649***	0.0082	0.0054
10	0.0065	0.0458***	-0.0284**	-0.0223*

Table 5 reports the daily abnormal volume of other investors in the event window, [-10, +10] trading days around the event date for each large order event type. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in the estimation window, [-30, -11] trading days before the event date, excluding earnings announcement weeks. The large buys(sells) of each investor type are defined as top 10% daily net buy(sell), as percentage of shares outstanding, of all daily trades in the sample period from March 29, 2007 to December 16, 2009. *, **, *** denote the two-tailed statistical significance at 10%, 5%, and 1% level, respectively.

Figure 1: The Trading Patterns around the Individual Large Buy Event

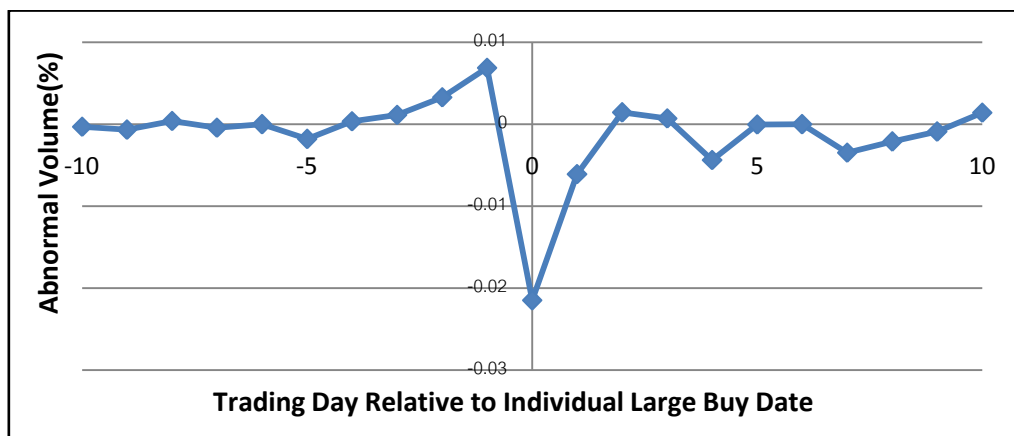Figure 1A: The Proprietary Trading Pattern around the Individual Large Buy Event

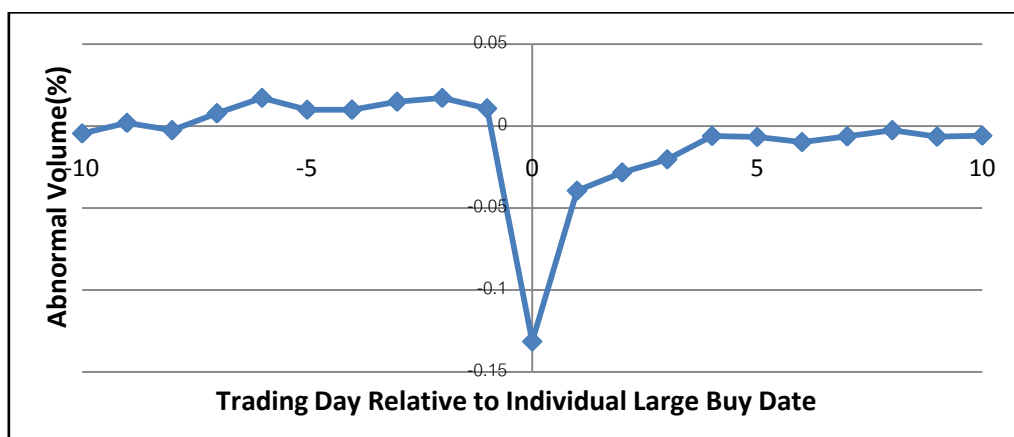Figure 1B: The Foreign Trading Pattern around the Individual Large Buy Event

Figure 1: (Continued)

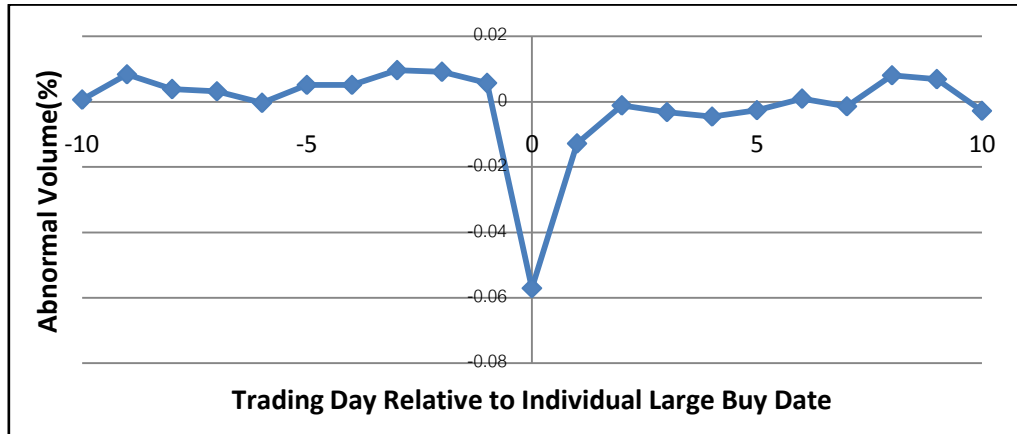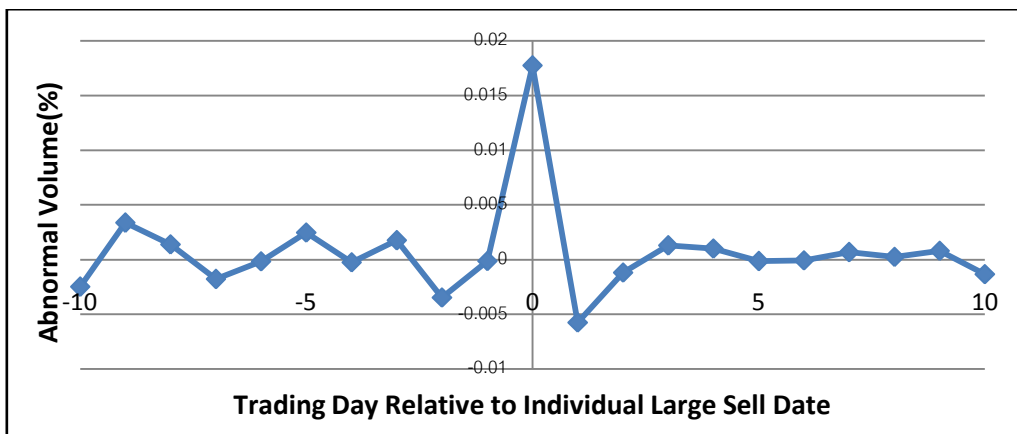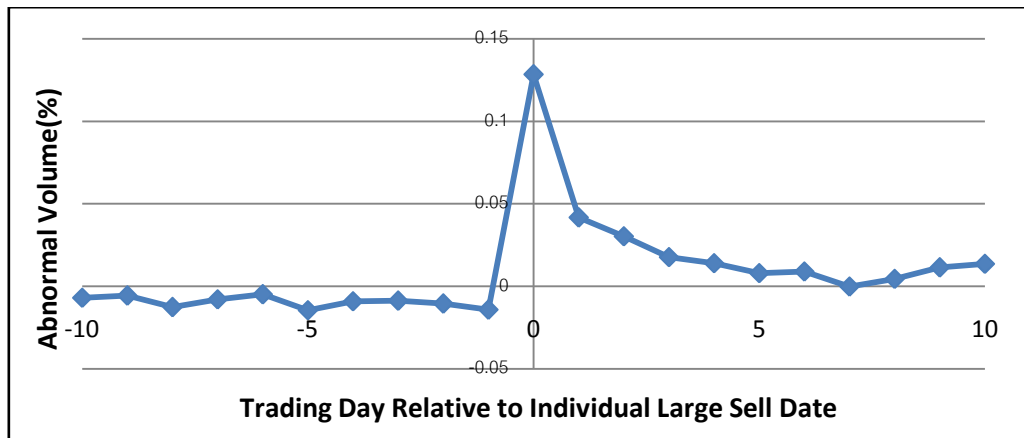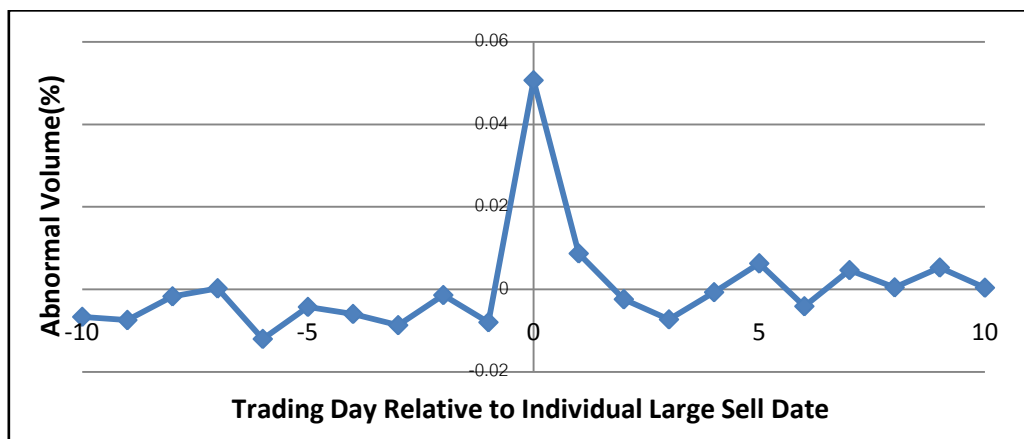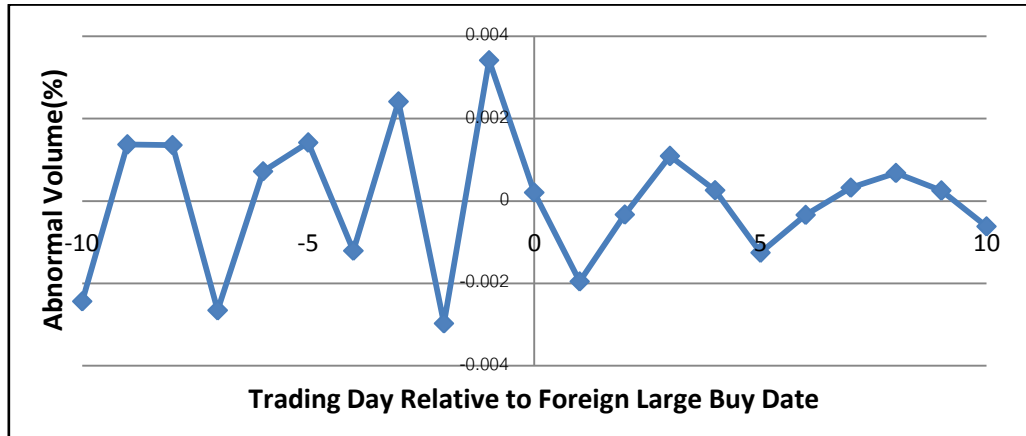Figure 1C: The Institution Trading Pattern around the Individual Large Buy Event

Figure 1 shows the trading pattern of proprietary, foreign and institution investors in [-10, +10] trading days around the individual large buy event. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in [-30, -11] trading days, excluding earnings announcement weeks.

Figure 2: The Trading Patterns around the Individual Large Sell Event

Figure 2A: The Proprietary Trading Pattern around the Individual Large Sell Event

Figure 2: (Continued)

Figure 2B: The Foreign Trading Pattern around the Individual Large Sell Event

Figure 2C: The Institution Trading Pattern around the Individual Large Sell Event

Figure 2 shows the trading pattern of proprietary, foreign and institution investors in [-10, +10] trading days around the individual large sell event. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in [-30, -11] trading days, excluding earnings announcement weeks.

Figure 3: The Trading Patterns around the Foreign Large Buy Event

Figure 3A: The Proprietary Trading Pattern around the Foreign Large Buy Event

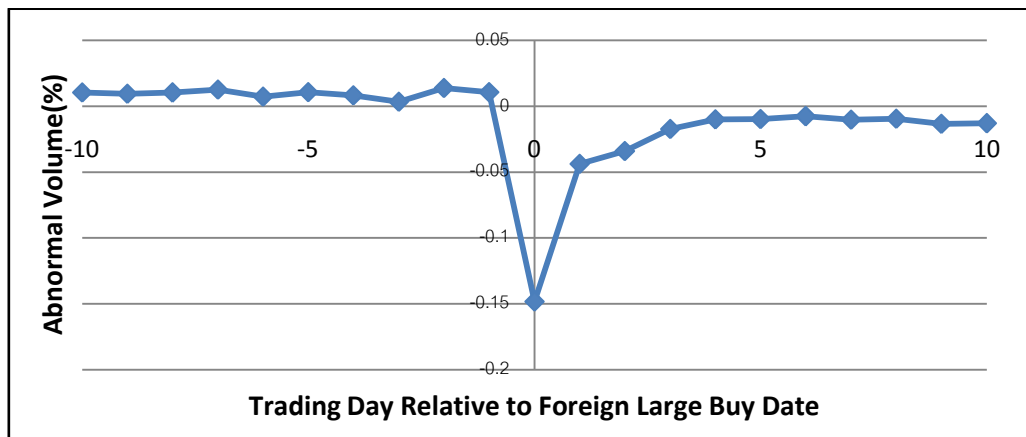Figure 3B: The Individual Trading Pattern around the Foreign Large Buy Event

Figure 3: (Continued)

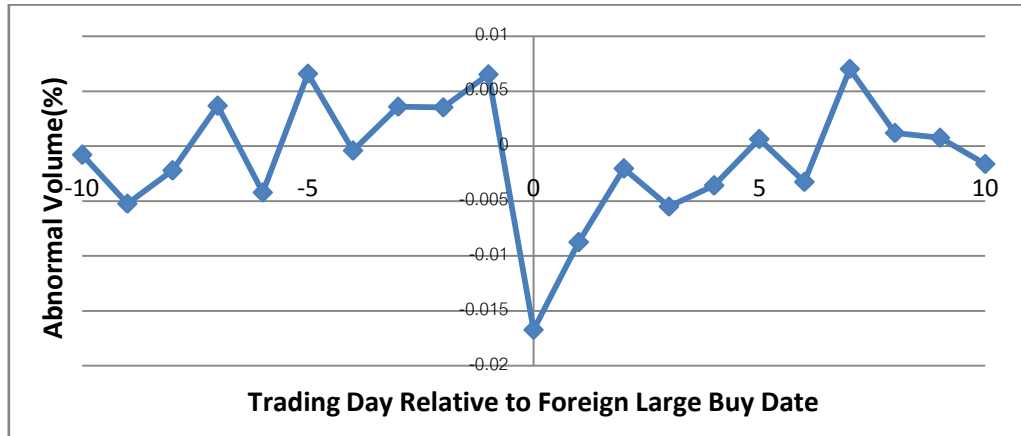Figure 3C: The Institution Trading Pattern around the Foreign Large Buy Event

Figure 3 shows the trading pattern of proprietary, individual and institution investors in [-10, +10] trading days around the foreign large buy event. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in [-30, -11] trading days, excluding earnings announcement weeks.

Figure 4: The Trading Patterns around the Foreign Large Sell Event

Figure 4A: The Proprietary Trading Pattern around the Foreign Large Sell Event
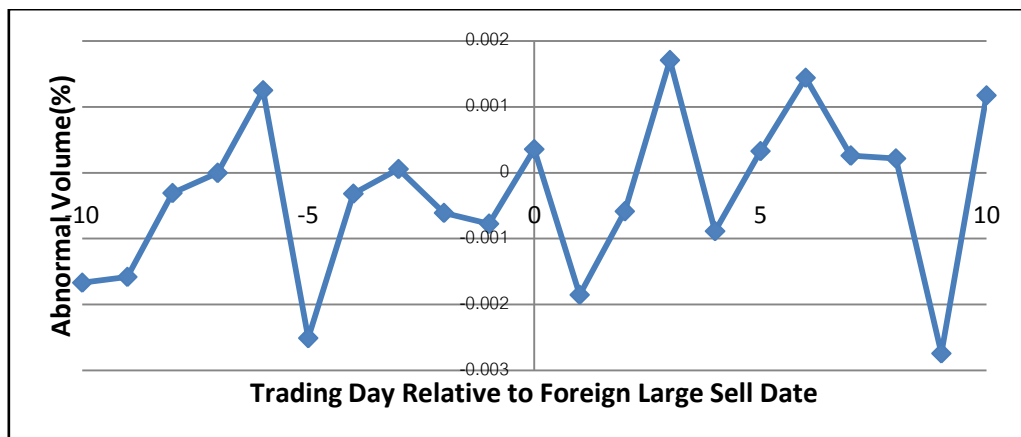
Figure 4: (Continued)

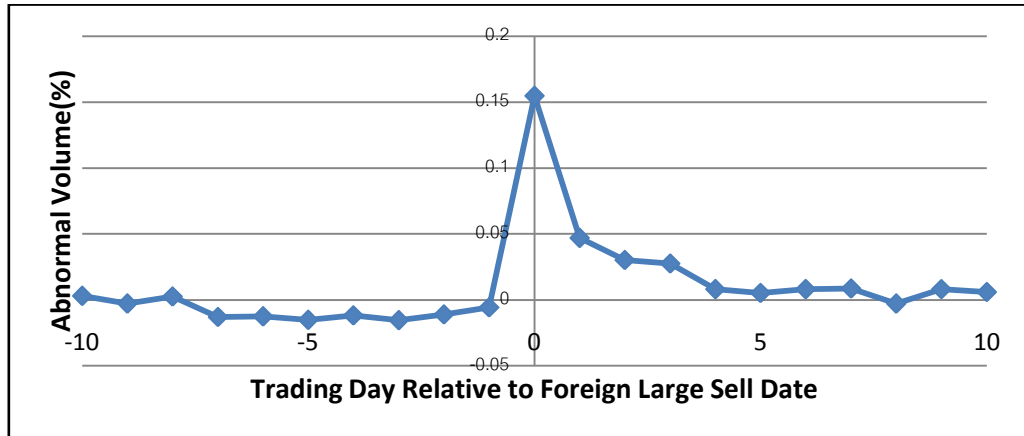Figure 4B: The Individual Trading Pattern around the Foreign Large Sell Event

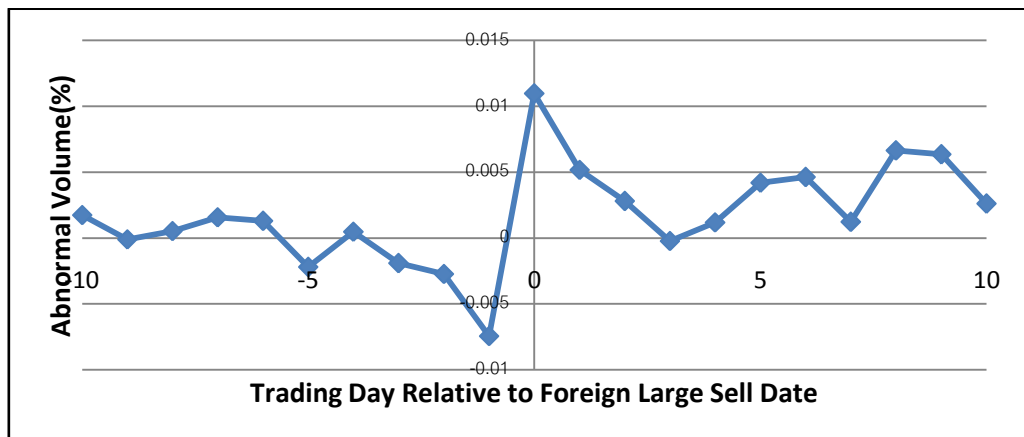Figure 4C: The Institution Trading Pattern around the Foreign Large Sell Event

Figure 4 shows the trading pattern of proprietary, individual and institution investors in [-10, +10] trading days around the foreign large sell event. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in [-30, -11] trading days, excluding earnings announcement weeks.

Figure 5: The Trading Patterns around the Institution Large Buy Event

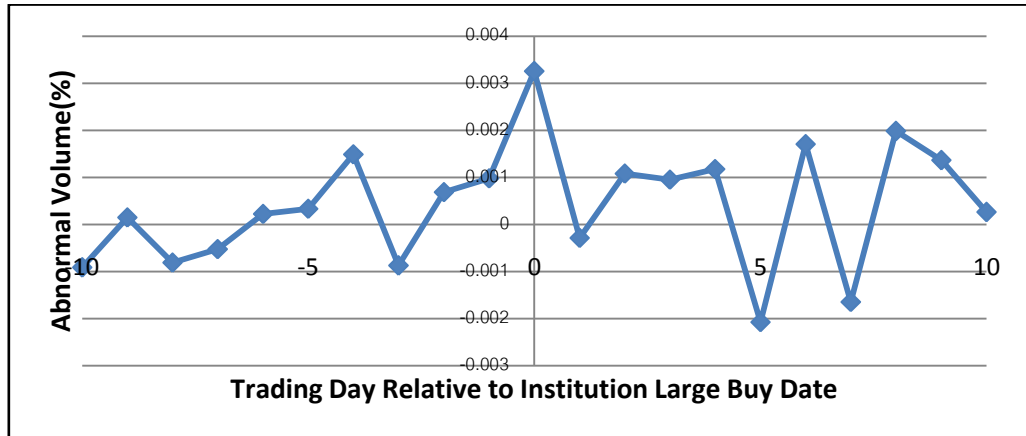Figure 5A: The Proprietary Trading Pattern around the Institution Large Buy Event

Figure 5B: The Individual Trading Pattern around the Institution Large Buy Event
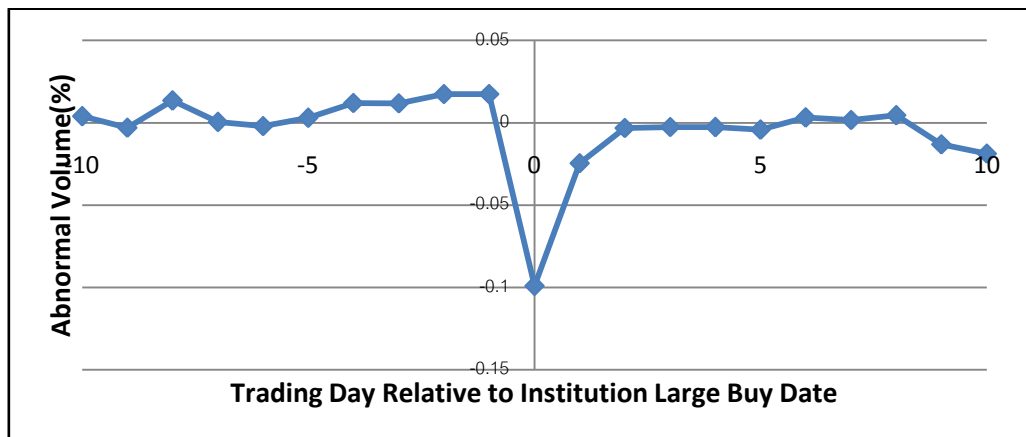
Figure 5: (Continued)

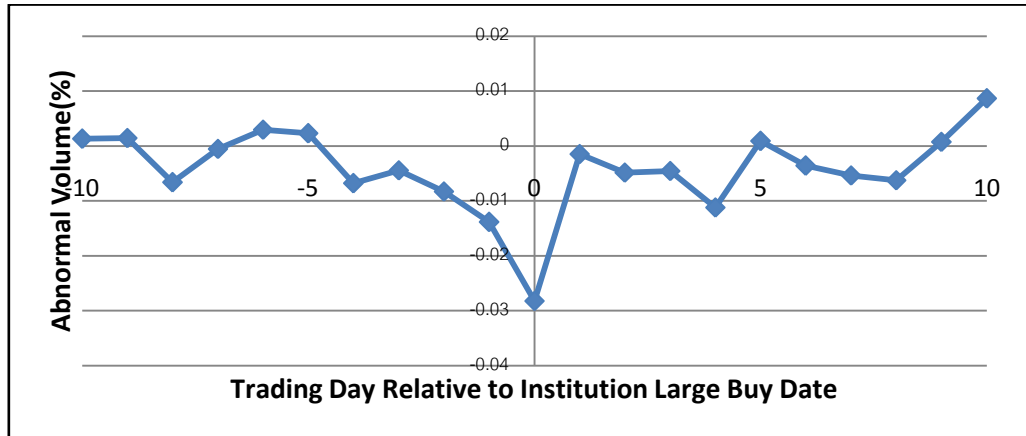Figure 5C: The Foreign Trading Pattern around the Institution Large Buy Event

Figure 5 shows the trading pattern of proprietary, individual and foreign investors in [-10, +10] trading days around the institution large buy event. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in [-30, -11] trading days, excluding earnings announcement weeks.

Figure 6: The Trading Patterns around the Institution Large Sell Event

Figure 6A: The Proprietary Trading Pattern around the Institution Large Sell Event

Figure 6: (Continued)

Figure 6B: The Individual Trading Pattern around the Institution Large Sell Event
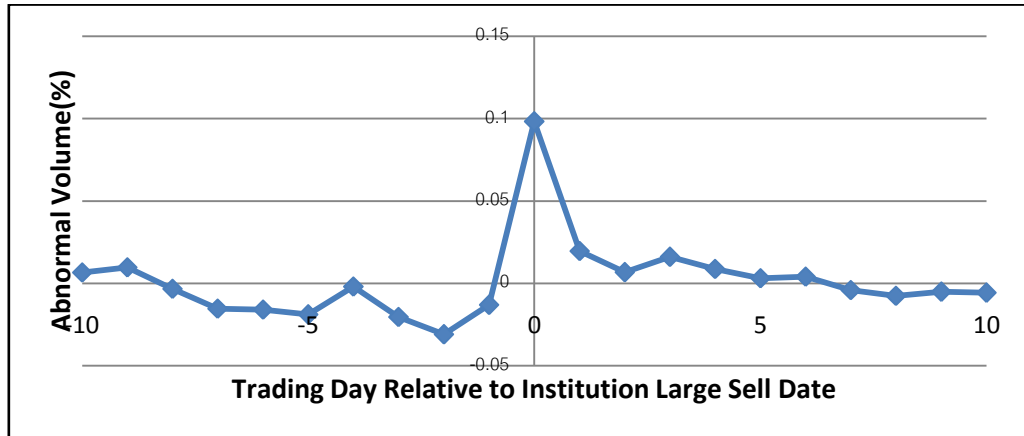
Figure 6C: The Foreign Trading Pattern around the Institution Large Sell Event
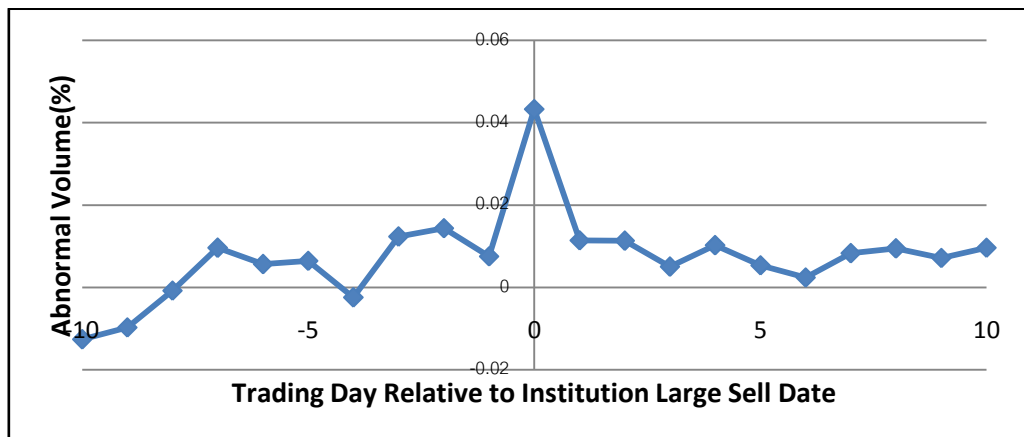
Figure 6 shows the trading pattern of proprietary, individual and foreign investors in [-10, +10] trading days around the institution large sell event. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in [-30, -11] trading days, excluding earnings announcement weeks.

Figure 7: The Trading Patterns around the Insider Large Buy Event

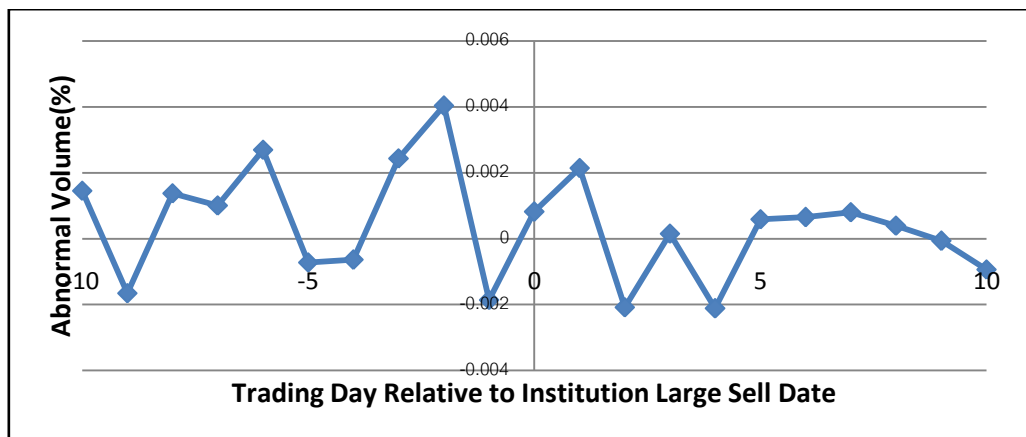Figure 7A: The Proprietary Trading Pattern around the Insider Large Buy Event

Figure 7B: The Foreign Trading Pattern around the Insider Large Buy Event
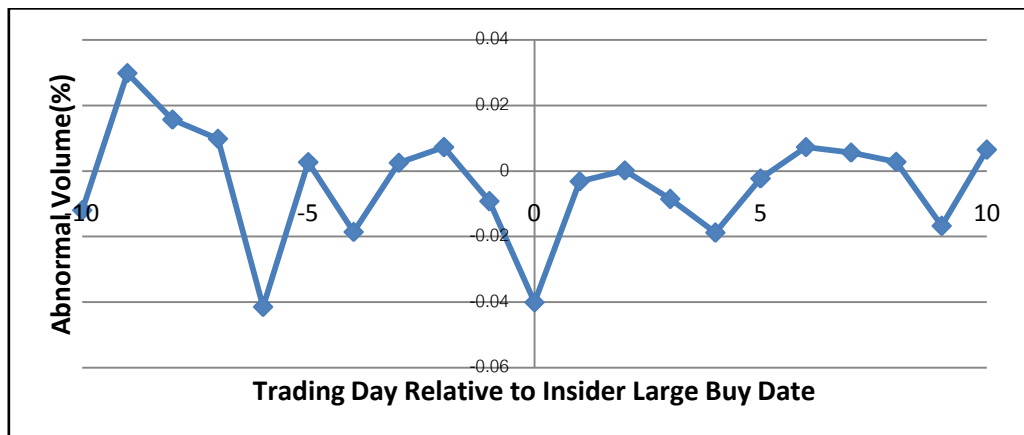
Figure 7: (Continued)

Figure 7C: The Institution Trading Pattern around the Insider Large Buy Event

Figure 7 shows the trading pattern of proprietary, foreign and institution investors in [-10, +10] trading days around the insider large buy event. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in [-30, -11] trading days, excluding earnings announcement weeks.

Figure 8: The Trading Patterns around the Insider Large Sell Event

Figure 8A: The Proprietary Trading Pattern around the Insider Large Sell Event
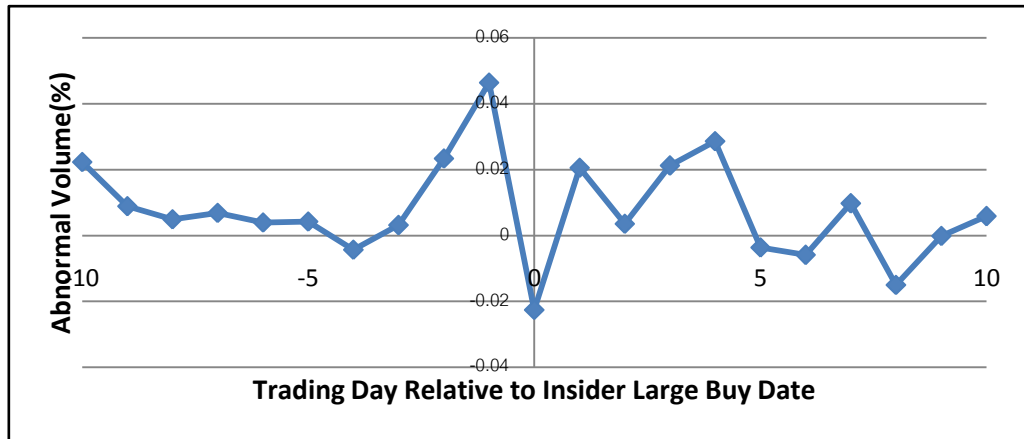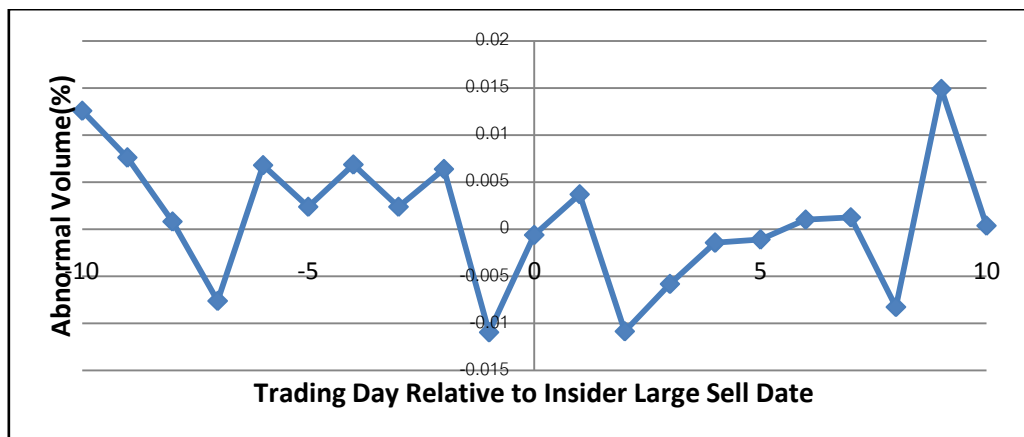
Figure 8: (Continued)

Figure 8B: The Foreign Trading Pattern around the Insider Large Sell Event

Figure 8C: The Institution Trading Pattern around the Insider Large Sell Event

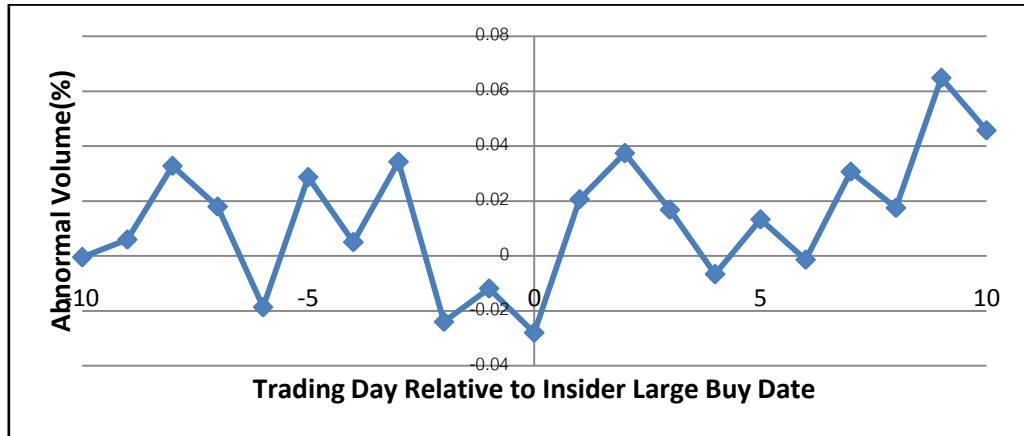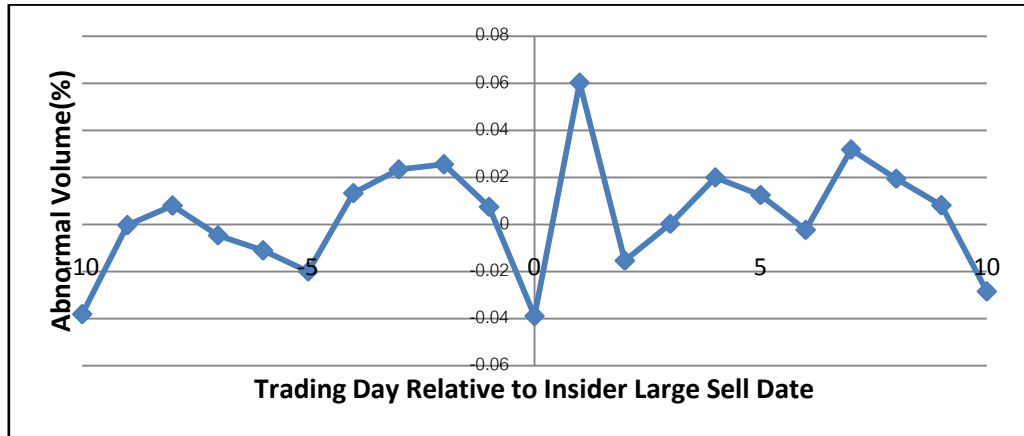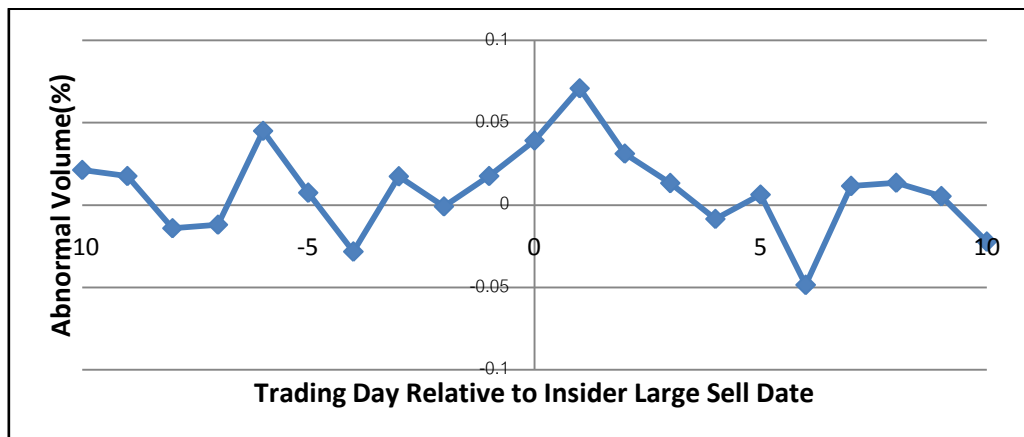Figure 8 shows the trading pattern of proprietary, foreign and institution investors in [-10, +10] trading days around the insider large sell event. As percentage of shares outstanding, the daily abnormal volume is the daily net volume minus the expected daily net volume in [-30, -11] trading days, excluding earnings announcement weeks.

4.1.2 Regression-Based Tests

Table 6 reports the mean coefficients and t-statistics of the regressions for large order events of each investor type. Panel A in table 6 shows the mean coefficients and t-statistics for the individual large order event. The mean coefficients of dummy variable ILT are 0.0042 and -0.0021 for individual large buy event and individual large sell event, respectively. The ILT is statistically significant at 1% level for individual large buy event, and is statistically significant at 10% level for individual large sell event. In other words, the proprietary investors have positive abnormal volume in [-3,-1] trading days before individual large buy date, and they have negative abnormal volume in [-3,-1] trading days before individual large sell date. This suggests that the proprietary investors increase trading activities in the same direction with both impending individual large buys and impending individual large sells. The regression results of both individual large buy event and individual large sell event are consistent with the event study results.

Panel B in table 6 shows the mean coefficients and t-statistics for the foreign large order event. For foreign large buy event, the mean coefficient of dummy variable ILT is 0.0039 which is statistically significant at 10% level. This suggests that proprietary investors increase their trading activities in [-3,-1] in the same direction with impending foreign large buys. In this case, the regression result is inconsistent with event study result. The event study result(Table 4 panel B) is more comprehensive because it accounts for the proprietary daily trading pattern, but the ILT in the regression accounts for aggregate 3 days before the event date. The ILT becomes positive because the average magnitude of each day (from the event study) in [-3,-1] is positive. However, the result from the event study suggests that the proprietary investors act as liquidity providers. For the foreign large sell event, the mean coefficient of dummy variable ILT is statistically insignificant. This suggests that the proprietary investors do not response to impending foreign large sell event.

Panel C in table 6 shows the mean coefficients and t-statistics for the institution large order event. The ILT are statistically insignificant for institution large buy event and institution large sell event. This suggests that the proprietary investors do not

response to impending institution large buys and institution large sells. The regression results of the institution large buy event and institution large sell event are consistent with the event study results.

Panel D in table 6 shows the mean coefficients and t-statistics for the insider large order event. The ILT are statistically insignificant for both insider large buy event and insider large sell event. This suggests that the proprietary investors do not response to impending insider large buy event and insider large sell event. Although the regression results are inconsistent with the event study results, the event study results are more precise because they account for the proprietary daily trading pattern.

In summary, most regression results are consistent with the event study results except the results of foreign large buy event, insider large buy event and insider large sell event. The ILT in the regression approach accounts for aggregate abnormal volume 3 days prior to the event date, while the event study accounts for daily abnormal volume. Therefore, this paper is based primarily on the event study results because they are more precise than regression results.

Table 6: The Regression Result

Panel A: Individual Large Order Event

Independent Variable	Individual Large Buy		Individual Large Sell	
	Coefficient	t-statistic	Coefficient	t-statistic
$Intercept$	0.0020	0.371	0.0012	0.163
$Return_t$	0.1779***	9.781	0.2078***	8.692
$Return_{t-1}$	0.0028	0.163	0.0210	1.282
$HILO_t$	0.0009	1.300	0.0000	0.011
$HILO_{t-1}$	-0.0014***	-2.896	-0.0003	-0.526
ILT	0.0042***	3.072	-0.0021*	-1.838

Table 6: (Continued)

Panel B: Foreign Large Order Event

	Foreign Large Buy		Foreign Large Sell	
Independent Variable	Coefficient	t-statistic	Coefficient	t-statistic
$Intercept$	-0.0066	-1.174	-0.0036	-0.818
$Return_t$	0.1872***	7.578	0.1473***	8.627
$Return_{t-1}$	-0.0074	-0.417	-0.0053	-0.390
$HILO_t$	0.0012**	2.136	0.0011*	1.957
$HILO_{t-1}$	-0.0005	-1.138	-0.0008*	-1.888
ILT	0.0039*	1.899	0.0008	0.830

Panel C: Institution Large Order Event

	Institution Large Buy		Institution Large Sell	
Independent Variable	Coefficient	t-statistic	Coefficient	t-statistic
$Intercept$	-0.0066	-1.196	-0.0041	-0.800
$Return_t$	0.1697***	8.476	0.2231***	10.438
$Return_{t-1}$	0.0221	1.289	0.0327*	1.827
$HILO_t$	0.0011***	2.742	0.0012***	2.686
$HILO_{t-1}$	-0.0006*	-1.788	-0.0010***	-2.753
ILT	-0.0005	-0.577	0.0008	0.849

Panel D: Insider Large Order Event

	Insider Large Buy		Insider Large Sell	
Independent Variable	Coefficient	t-statistic	Coefficient	t-statistic
$Intercept$	0.0087	0.348	0.0347	1.343
$Return_t$	0.0149	0.418	0.1664**	2.180
$Return_{t-1}$	0.0677	1.193	-0.0287	-0.264
$HILO_t$	0.0006	0.413	0.0008	0.502
$HILO_{t-1}$	-0.0009	-0.462	-0.0051	-1.383
ILT	-0.0023	-0.321	-0.0102	-1.037

Table 6 reports the mean coefficients and t-statistics of the regressions for each large order event type. Each regression is run for particular event in each large order event type that is shown as follow:

$$V_{t,i} = \beta_{1,i} + \beta_{2,i}Ret_{t,i} + \beta_{3,i}Ret_{t-1,i} + \beta_{4,i}HILO_{t,i} + \beta_{5,i}HILO_{t-1,i} + \beta_{6,i}ILT_{t,i} + u_{t,i}$$

The large buys(sells) of each investor type are defined as top 10% daily net buy(sell), as percentage of shares outstanding, of all daily trades in the sample period from March 29, 2007 to December 16, 2009. The event dummy variable ILT is set to be "1" if the day is in the event window [-3, -1], and is set to be "0" if the day is in the estimation

window [-30, -11]. V_t is the proprietary's daily net volume. Ret_t is daily stock return. Ret_{t-1} is the one-day-lagged RET. $HILO_t$ is the firm's intraday stock price volatility which is the logarithm of the highest stock price to the lowest stock price of the day. $HILO_{t-1}$ is the one-day-lagged HILO. ILT is the impending-large-trade dummy variable. *, **, *** denote the two-tailed statistical significance at 10%, 5%, and 1% level, respectively.

4.2 Abnormal Stock Returns around Other Investors' Large Order Events

Table 7 shows the abnormal stock returns and t-statistics in [-10, +10] trading days around the event date to show whether the proprietary investors gain from front running, on average, during the period of other investors' large order events. The abnormal returns defined as value-weighted market-adjusted returns. Additionally, the cumulative abnormal returns (CAR) in the same window with table 7 are also plotted in Figure 9.

Panel A in table 7 reports the abnormal stock returns for the individual large order event. For the individual large buy event (Fig. 9A), the CAR keeps increasing from day -7 to -2. But the CAR decreases sharply on the event date and keeps decreasing for the next 2 days. This suggests that front running individual large buys is risky because the abnormal return reverses dramatically on the event date. However, the proprietary investors have daily positive abnormal volumes 4 days before individual large buy date and reverse their trades to sell on the event date. Although the proprietary investors gain on average several days before the event date, their profits on the event date are inconclusive. They can either gain from selling before decreasing in price on the event date or encounter with loss on the day of high negative abnormal return. For the individual large sell event (Fig. 9B), the CAR is small negative before the event date, but it increases dramatically on the event date. The proprietary trading pattern according to individual large sell event shows that the proprietary investors have the negative abnormal volumes 2 days before the event date, but have the positive abnormal volume on the event date. Although the proprietary investors loss several days before the event date when they sell stocks at the lowest price in [-10, +10] trading days, their profits on the event date are inconclusive. They can either gain from buying stocks before increasing in price or loss from buying back their stocks at higher price on the day of high positive abnormal return.

Panel B in table 7 reports the abnormal stock returns for the foreign large order event. For the foreign large buy event(Fig. 9C), the CAR is at the same level from day -10 to -2. It starts increasing on day -1, and peaks on the event date. Finally, the CAR after the event date is at the same level with that on event date. The CAR according to foreign large buy event suggests the lucrative benefits for front runners. However, the proprietary trading pattern shows that they act as liquidity providers before and after the event date, rather than front run foreign large buys. For the foreign large sell event(Fig. 9D), the CAR increases every day from day -10 to -2 and decreases a little bit on day -1. Then, it decreases sharply on the event date according to foreign large sells. Like the CAR according to foreign large buy event, the CAR according to foreign large sell event also suggests the lucrative benefits for front runners. However, the proprietary trading pattern shows no evidence of front running foreign large sells.

Panel C in table 7 reports the abnormal stock returns for the institution large order event. For the institution large buy event(Fig. 9E), the CAR decreases from day -5 to -2 but increases a little bit on day -1. It increases sharply on the event date. The CAR according to institution large buy event suggests the lucrative benefits for front runners. However, the proprietary trading pattern shows no evidence of front running institution large buys. For the institution large sell event(Fig. 9F), the CAR increases from day -10 to -1 on average. Then, it decreases sharply on the event date. The CAR temporary decreased from day 0 to 8. And it rises to the same level of day -1 on day 9 and 10. The CAR according to institution large sell event affects the temporary price impact which benefits front runners for short interval. However, the proprietary trading pattern shows no evidence of front running institution large sells.

Panel D in table 7 reports the abnormal stock returns for the insider large order event. For the insider large buy event(Fig. 9G), the CAR increases on day -2 but decreases on day -1 and 0. The proprietary investor trading pattern shows the evidence of front running because they have the significantly positive abnormal volumes 2 days before the event date and have the significantly negative abnormal volume on the event date. Although the CAR suggests that they loss on the event date, they can make the benefits on day 1. Even in worst case, the proprietary abnormal volumes of [-2, 0]

trading days could generate profits for [-2, 1], [-2, 5], [-2, 10] periods. Therefore, the proprietary investors gain from front running insider large buys. For the insider large sell event(Fig. 9H), the CAR increases sharply from day -3 to 0, decreases a little bit for the next 2 days, and increases on average for day 3 to 10. The proprietary investor trading pattern shows the evidence of front running because they have the significantly negative abnormal volume just the day before the event date. However, the CAR suggests that they not only have no profits from front running but also lose the opportunities to gain according to increasing CAR on average in [0, +5] or [0, +10] periods.

In summary, the benefits from front running according to individual large order event are inconclusive. According to insider large order event, the proprietary investors gain on average from front running insider large buy event but they lose opportunities to make profits due to front running insider large sell event. Additionally, although the proprietary trading pattern shows no evidence of front running foreign large order event and institution large order event, the CAR according to these events suggest the lucrative benefits for front runners. The CAR according to foreign large buy event, foreign large sell event, and institution large buy event affect the permanent price impact, while CAR according to the institution large sell event affects the temporary price impact.

Table 7: The Abnormal Return around the Large Order Events

Panel A: Individual Large Order Event

Event Day	Individual Large Buy		Individual Large Sell	
	Abnormal Return	t-statistic	Abnormal Return	t-statistic
-10	0.0005	0.270	0.0005	0.511
-9	0.0001	0.059	-0.0009	-0.828
-8	0.0001	0.073	-0.0002	-0.238
-7	0.0010	0.511	-0.0004	-0.418
-6	0.0009	0.478	0.0000	-0.007
-5	0.0019	1.011	-0.0003	-0.283
-4	0.0019	1.000	-0.0003	-0.304
-3	0.0033*	1.705	-0.0013	-1.251
-2	0.0013	0.669	-0.0027**	-2.573
-1	-0.0013	-0.702	0.0040***	3.798
0	-0.0175***	-9.149	0.0201***	19.252
1	-0.0019	-1.017	0.0016	1.570
2	-0.0002	-0.128	-0.0001	-0.078
3	0.0020	1.045	0.0006	0.609
4	0.0029	1.518	0.0007	0.649
5	0.0024	1.268	0.0009	0.894
6	0.0025	1.335	0.0005	0.462
7	0.0007	0.355	-0.0018	-1.707
8	0.0029	1.505	-0.0002	-0.214
9	-0.0008	-0.425	0.0012	1.189
10	0.0011	0.551	0.0021	2.059

Table 7: (Continued)

Panel B: Foreign Large Order Event

	Foreign Large Buy		Foreign Large Sell	
Event Day	Abnormal Return	t-statistic	Abnormal Return	t-statistic
-10	-0.0009	-0.609	0.0006	0.369
-9	-0.0009	-0.663	0.0012	0.688
-8	0.0007	0.463	0.0004	0.226
-7	0.0000	-0.023	0.0015	0.857
-6	0.0010	0.726	0.0015	0.841
-5	0.0000	0.004	0.0014	0.809
-4	0.0000	-0.007	0.0021	1.226
-3	-0.0002	-0.141	0.0031*	1.800
-2	-0.0004	-0.267	0.0004	0.241
-1	0.0050***	3.559	-0.0019	-1.096
0	0.0167***	11.839	-0.0139***	-8.029
1	0.0020	1.407	-0.0019	-1.089
2	0.0005	0.330	-0.0005	-0.287
3	0.0000	-0.003	0.0019	1.090
4	0.0017	1.193	0.0027	1.542
5	-0.0005	-0.320	0.0016	0.921
6	-0.0018	-1.307	0.0020	1.138
7	0.0001	0.099	0.0005	0.314
8	-0.0002	-0.124	0.0024	1.363
9	0.0012	0.845	0.0003	0.199
10	0.0008	0.602	-0.0001	-0.052

Table 7: (Continued)

Panel C: Institution Large Order Event

	Institution Large Buy		Institution Large Sell	
Event Day	Abnormal Return	t-statistic	Abnormal Return	t-statistic
-10	0.0000	-0.007	0.0015	1.065
-9	0.0008	0.469	0.0016	1.131
-8	-0.0001	-0.069	-0.0007	-0.482
-7	-0.0006	-0.344	0.0009	0.629
-6	0.0003	0.205	0.0006	0.406
-5	-0.0011	-0.673	-0.0004	-0.288
-4	-0.0008	-0.497	0.0036**	2.559
-3	-0.0021	-1.237	0.0037***	2.614
-2	-0.0019	-1.162	0.0053***	3.792
-1	0.0011	0.689	0.0028**	2.037
0	0.0094***	5.648	-0.0045***	-3.255
1	0.0040**	2.422	-0.0007	-0.513
2	0.0008	0.452	-0.0013	-0.931
3	0.0012	0.693	-0.0005	-0.364
4	0.0001	0.041	0.0020	1.428
5	-0.0005	-0.290	0.0003	0.186
6	-0.0007	-0.437	0.0005	0.386
7	0.0003	0.206	0.0012	0.882
8	-0.0010	-0.597	0.0015	1.095
9	0.0014	0.830	0.0013	0.937
10	0.0021	1.242	0.0003	0.191

Table 7: (Continued)

Panel D: Insider Large Order Event

	Insider Large Buy		Insider Large Sell	
Event Day	Abnormal Return	t-statistic	Abnormal Return	t-statistic
-10	-0.0133**	-2.162	0.0039	0.587
-9	0.0087	1.405	-0.0002	-0.026
-8	0.0023	0.372	-0.0066	-0.985
-7	-0.0024	-0.382	0.0097	1.443
-6	-0.0021	-0.336	-0.0013	-0.187
-5	0.0083	1.341	-0.0032	-0.473
-4	0.0187***	3.042	-0.0055	-0.816
-3	-0.0052	-0.845	0.0103	1.536
-2	0.0024	0.382	0.0225***	3.353
-1	-0.0081	-1.311	0.0079	1.185
0	-0.0051	-0.831	0.0132**	1.971
1	0.0297***	4.823	-0.0011	-0.158
2	0.0029	0.475	-0.0020	-0.300
3	0.0003	0.047	0.0029	0.437
4	0.0149**	2.419	0.0050	0.745
5	0.0016	0.264	0.0040	0.592
6	-0.0005	-0.079	0.0035	0.519
7	0.0046	0.754	0.0067	1.006
8	0.0039	0.632	0.0054	0.805
9	0.0027	0.435	-0.0033	-0.486
10	0.0106*	1.727	-0.0068	-1.018

Table 7 reports value-weighted market-adjusted abnormal returns and t-statistics in the event window, [-10, +10] trading days around the event date for each large order event type. The large buys(sells) of each investor type are defined as top 10% daily net buy(sell), as percentage of shares outstanding, of all daily trades in the sample period from March 29, 2007 to December 16, 2009.*, **, *** denote the two-tailed statistical significance at 10%, 5%, and 1% level, respectively.

Figure 9: The Cumulative Abnormal Returns (CAR) around Large Order Events

Figure 9A: The CAR around the Individual Large Buy Event
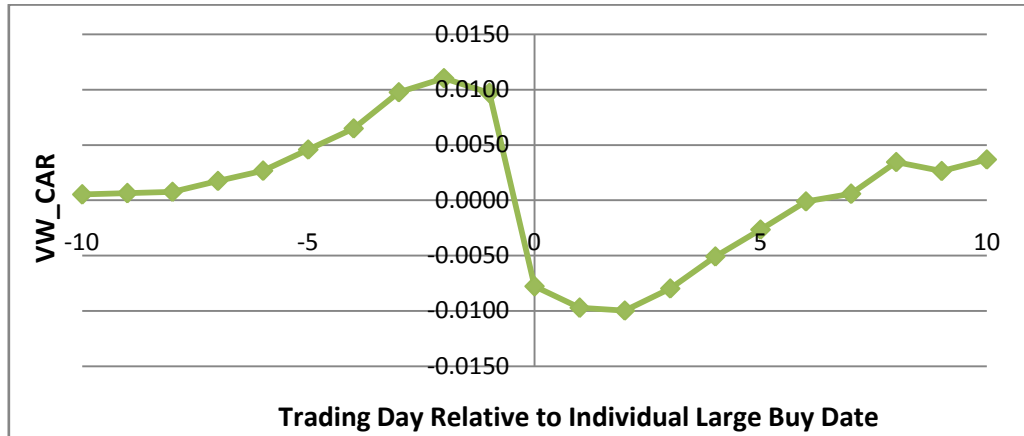

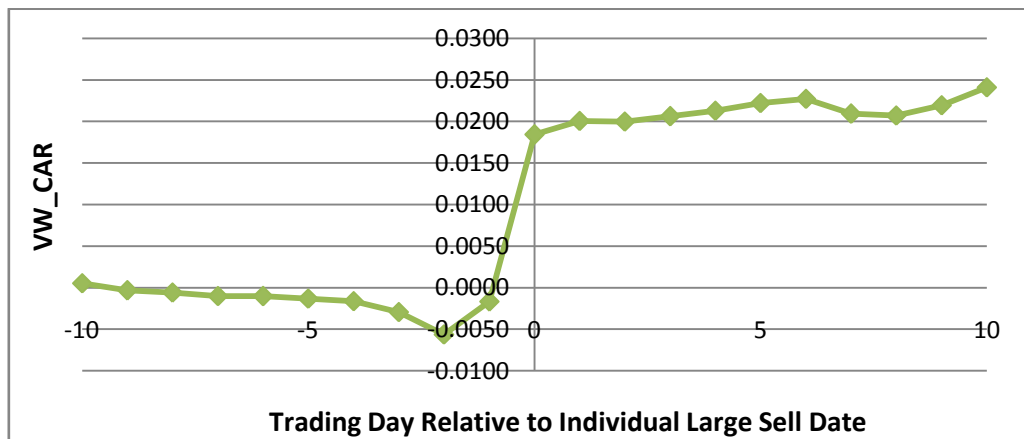Figure 9B: The CAR around the Individual Large Sell Event

Figure 9: (Continued)

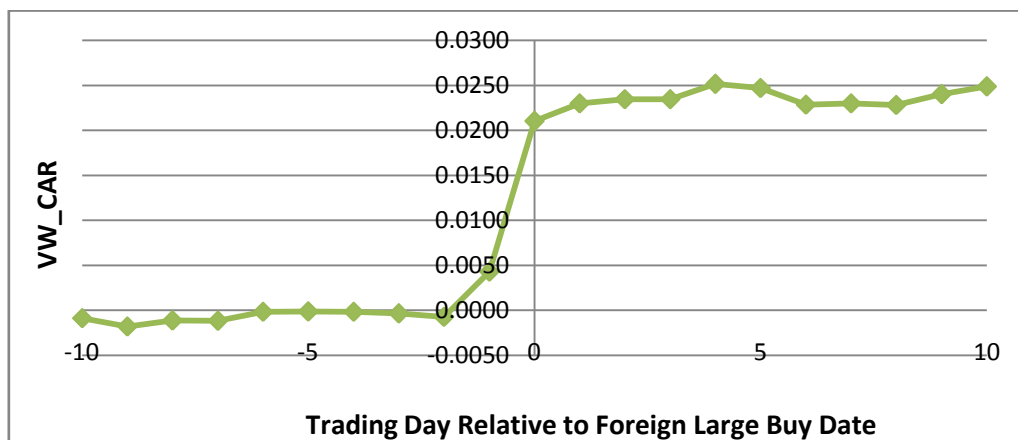Figure 9C: The CAR around the Foreign Large Buy Event

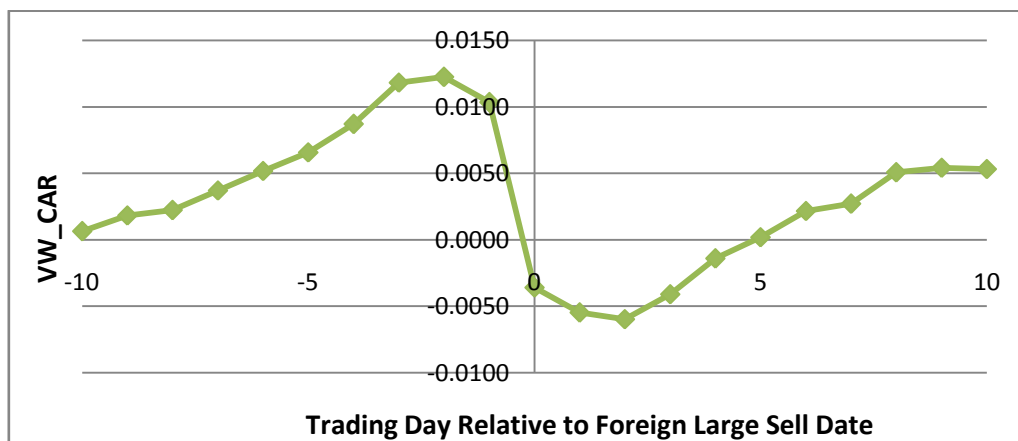Figure 9D: The CAR around the Foreign Large Sell Event

Figure 9: (Continued)

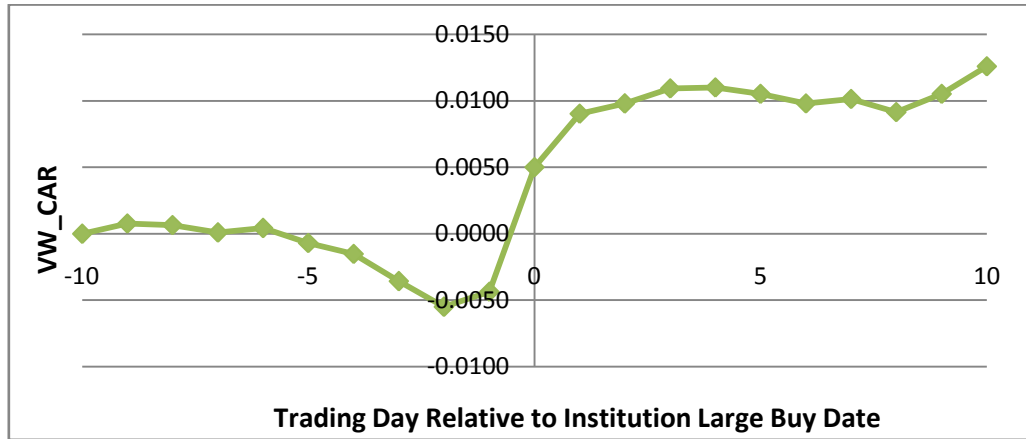Figure 9E: The CAR around the Institution Large Buy Event

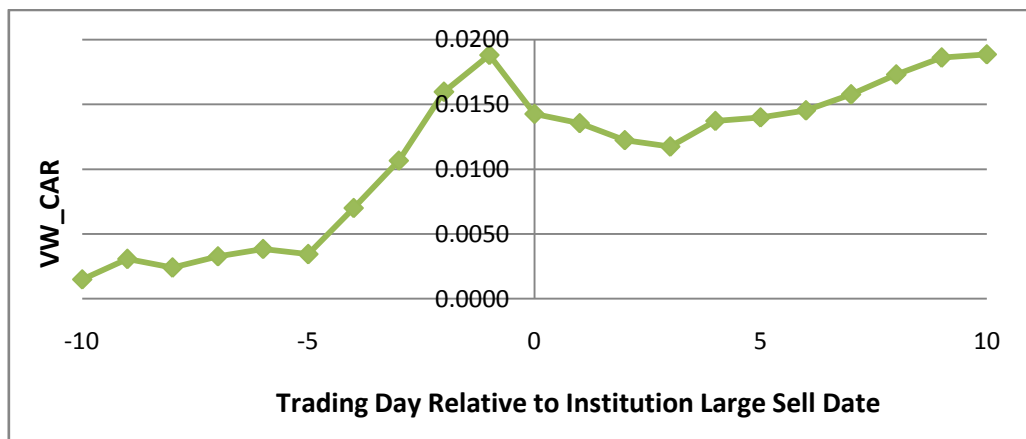Figure 9F: The CAR around the Institution Large Sell Event

Figure 9: (Continued)

Figure 9G: The CAR around the Insider Large Buy Event
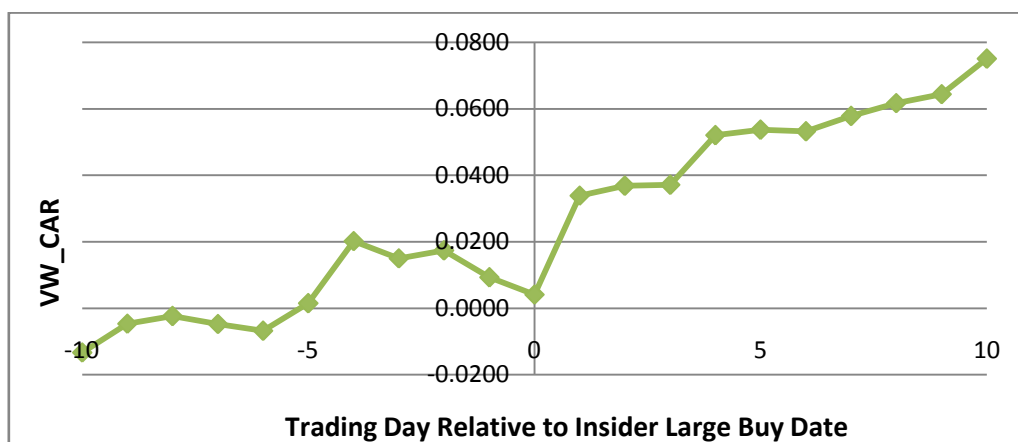
Figure 9H: The CAR around the Insider Large Sell Event
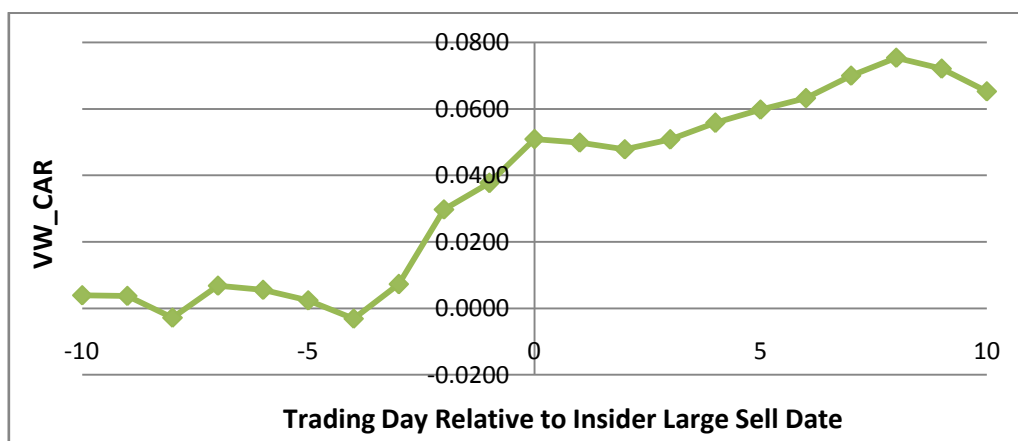
Figure 9 shows the value-weighted cumulative abnormal returns (VW_CAR) in [-10, +10] trading days around each large order event type. The abnormal returns are market-adjusted returns.

4.3 Other Explanations

According to the research question, the results from event study and regression methodologies are not sufficient to clearly answer the research question. There are other explanations that can explain the proprietary trading ahead of other investors' large orders. Therefore, the other explanations are excluded as follow.

4.3.1 Earnings Announcement

The earnings announcement is the important factor driving the volumes in the market. So the events within [-15, +15] trading days of the earnings announcement are excluded from our sample events for 2 reasons. First, the proprietary investors might trade based on the anticipation of the earnings announcement. Therefore, the significant trades of proprietary investors leading others' large orders, in earnings announcement period, cannot be concluded whether they front run or not. Second, the events in non-earnings-announcement period are better to detect front running large orders than those in earnings-announcement period. If there's no new information and proprietary investor type persistently trade ahead of other investors' large orders, this can be the evidence for front running of proprietary investors, acting as a group.

4.3.2 Reverse Causality

Instead of front running, this explanation suggests that other investors trade in response to the proprietary investors' trades. However, this is not reasonable because the proprietary trades in each stock are not publicly announced. There is only a report of daily net buy value and net sell value of each investor type in the market. So, other investors could not know what proportion that the proprietary investors invest in each stock. On the other hand, the proprietary investors can have others' trade information if there is the information leakage in the same brokerage firm due to the conflict of interest.

CHAPTER V

CONCLUSION

Using intraday data from the Stock Exchange of Thailand during 2007 to 2009, the proprietary trading pattern is investigated around other investors' large order events to examine whether they front run other investors. For the individual large order event, the event study result shows that the proprietary investors have significantly positive abnormal volumes 2 days prior to the individual large buy date, and have significantly negative abnormal volume 1 day prior to the individual large sell date. This suggests that the proprietary investors trade ahead of them. The evidence is consistent with the hypothesis 1. Additionally, the trading patterns of foreign and institution investors around individual large order event suggest no evidence of front running individual large orders.

For the foreign large order event, the event study result shows that the proprietary investors act as liquidity providers prior to the foreign large buy date, and have insignificant abnormal volume prior to the foreign large sell date. This suggests that proprietary investors do not trade ahead of foreign large orders. This is inconsistent with the hypothesis 2. Additionally, the trading patterns of individual and institution investors suggest no evidence of front running foreign large orders.

For the institution large order event, the event study result shows that the proprietary investors have insignificantly positive abnormal volume prior to the institution large buy date, and have insignificantly negative abnormal volume prior to the institution large sell date. This suggests that the proprietary investors do not trade ahead of institution large orders. The evidence is inconsistent with the hypothesis 3. Additionally, the trading patterns of individual and foreign investors suggest no evidence of front running institution large orders.

For the insider large order event, the event study result shows that the proprietary investors have significantly positive abnormal volumes 2 days prior to the insider large buy date and have significantly negative abnormal volume 1 day prior to

the insider large sell date. This suggests that the proprietary investors trade ahead of them. The evidence is consistent with the hypothesis 4. Additionally, the trading patterns of foreign and institution investors suggest no evidence of front running insider large orders.

For the robustness, the regression approach is also used in this paper. Most regression results are consistent with the event study results except the results of foreign large buy event, insider large buy event and insider large sell event. The ILT of the regression approach accounts for aggregate abnormal volume 3 days prior to the event date, while the event study accounts for daily abnormal volume. Therefore, this paper is based primarily on the event study results because they are more precise than regression results.

The benefits from front running individual large orders are inconclusive, but the benefits from front running insider large orders are separated into 2 cases. First, the proprietary investors gain from the abnormal volumes ahead of insider large buys. Second, the proprietary investors not only have no benefits but also lose the opportunities to make profits from increasing CAR on average in [0, +5] or [0, +10] periods. Additionally, although the proprietary trading pattern shows no evidence of front running foreign large order event and institution large order event, the CAR according to these events suggest the lucrative benefits for front runners. The CAR according to foreign large buy event, foreign large sell event, and institution large buy event affect the permanent price impact, while CAR according to the institution large sell event affects the temporary price impact.

Unfortunately, the limitation of data allows testing at the aggregate proprietary investors. Therefore, the specific proprietary investor could not be matched with the large orders from the specific broker. There is a possibility that the large orders and the proprietary orders come out from different brokerage firms. If so, they do not front run others' investors. However, the result can explain the trading pattern of proprietary investors as a group.

Other possible explanations of the proprietary abnormal volume ahead of other investors are ruled out. Except the one that the proprietary investors are informed traders, so they move before the large orders of other investors. However, there are many events for each large order event type, ranging from 110 to 2192 events. It is hard to convince that the proprietary investors could be informed traders and always trade before other investors for all events in each large order event type. If the proprietary investors persistently trade ahead other investors' large orders for most of events, the front running is strong enough to explain this phenomenon rather than the informed traders.

Front running, or parasitic trading, is unfair to other market participants who trade based on their own skills. When the investors are front run, they would trade at the inferior prices or can trade for fewer stocks at their acceptable price. In other words, the front runners suck the liquidity out of the market before the investors can trade. In turn, when the investors have no incentive to trade due to higher trading cost from front runners, the price is not adjusted to the fair price or it is slowly adjusted to the fair price. Finally, the market is far from efficiency.

This study does not cover how the proprietary investors front run but provide the evidence of front running through the investigation of proprietary trading pattern. The way to front run is either to trade ahead of client orders or to convince the client to trade the same stock that the proprietary investors have already traded. The empirical studies often suggest that there are the information leakages of analyst recommendations, which are consistent with the latter. The further study about the proprietary trading patterns around the analyst recommendations could answer whether there is the leakage of information. If so, it could provide stronger evidence of front running.

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Biography

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นักลงทุนประเภทบริษัทหลักทรัพย์มีการลงทุนดัดหน้าค าสั่งซื้ อขายขนาดใหญ่ของนักลงทุน ประเภทอื่นหรือไม่? นายวีระชัย ตั้งวิจิตรสกุล

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