Determinants of Order Submissions: Evidence from Various Investor Groups in the Stock Exchange of Thailand

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Abstract

This study examines the determinants of the aggressiveness of order submissions by four investor groups (local individuals, foreign investors, local institutions, and brokers) in the Stock Exchange of Thailand, a pure limit order market. Based on an intraday data set during October-December 2009, the study finds that the state of the limit order book has significant impact on a trader's order submission decisions. Specifically, order submissions tend to be aggressive during the period of thick same-side market depth and thin opposite-side market depth. The impact of bid-ask spread and volatility on traders' order submission decisions, however, is inconclusive. Further, the study shows that foreign investors, local institutions, and brokers respond more strongly to the changes in both their own market depth and opposite market depth than individual investors do. Local institutions and brokers are more likely to submit the same-side aggressive orders than individual investors do. These two findings, coupled with the evidence that the spread is usually wider for an individual order than for other three groups, support the general notion that institutional investors (e.g., foreign investors, local institutions, and brokers) tend to be informed traders, while individuals are generally liquidity providers.

JEL classification: G11; G15

Keywords: Order Aggressiveness; Order Submission; Stock Exchange of Thailand; Limit Order Book; Investor Types.

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ปัจจัยที่มีผลต่อการส่งคำสั่งซื้อขาย : หลักฐานเชิงประจักษ์จากนักลงทุนกลุ่มต่างๆ ในตลาดหลักทรัพย์แห่งประเทศไทย

บทคัดย่อ

การศึกษานี้ศึกษาปัจจัยที่มีผลต่อระดับราคาในการส่งคำสั่งซื้อขายของนักลงทุน 4 กลุ่ม (นักลงทุนทั่วไปในประเทศ นักลงทุนต่างประเทศ สถาบันในประเทศ และบัญชีบริษัทหลักทรัพย์) ในตลาดหลักทรัพย์แห่งประเทศไทย ซึ่งเป็นตลาดที่ใช้คำสั่งซื้อขายที่ระบุราคา (Limit Order) เพียงอย่างเดียว จากข้อมูลระหว่างวันตั้งแต่เดือนตุลาคมถึงธันวาคม พ.ศ. 2552 การศึกษานี้พบว่า สถานะของบัญชีการเสนอซื้อขายหลักทรัพย์ (Limit Order Book) มีผลอย่างมีนัยสำคัญต่อการตัดสินใจส่งคำสั่งซื้อขายของนักลงทุน โดยพบว่า ระดับราคาของการส่งคำสั่งซื้อขายจะสูงขึ้นในช่วงที่ปริมาณหุ้นที่เสนอซื้อขายในฝั่งเดียวกันเพิ่มขึ้นและในช่วงที่ปริมาณหุ้นที่เสนอซื้อขายในฝั่งตรงข้ามลดลง การศึกษานี้ ไม่พบว่าส่วนต่างระหว่างราคาเสนอซื้อและราคาเสนอขายและความผันผวนของราคาหลักทรัพย์มีผลต่อการตัดสินใจส่งคำสั่งซื้อขาย นอกจากนี้ การศึกษานี้พบว่า นักลงทุนต่างประเทศ สถาบันในประเทศ และบัญชีบริษัทหลักทรัพย์ ตอบสนองมากกว่าต่อการเปลี่ยนแปลงในปริมาณหุ้นที่เสนอซื้อขายในฝั่งเดียวกันและฝั่งตรงข้าม เมื่อเทียบกับนักลงทุนทั่วไปในประเทศ สถาบันในประเทศและบัญชีบริษัทหลักทรัพย์มีแนวโน้มมากกว่าที่จะส่งคำสั่งซื้อขายที่มีระดับราคาสูงในด้านเดียวกันอย่างต่อเนื่องกัน และเมื่อประกอบผลการศึกษาทั้ง 2 อย่างหลังนี้เข้ากับผลการศึกษาที่แสดงว่าส่วนต่างระหว่างราคาเสนอซื้อและราคาเสนอขายมีแนวโน้มที่กว้างกว่าในช่วงที่นักลงทุนทั่วไปในประเทศส่งคำสั่งซื้อขายเมื่อเทียบกับนักลงทุนทั้ง 3 กลุ่มที่เหลือ นำไปสู่การสนับสนุนสมมติฐานที่ว่า นักลงทุนสถาบันใช้ข้อมูลข่าวสารในการซื้อขาย ในขณะที่นักลงทุนรายย่อยในประเทศซื้อขายเพื่อสภาพคล่องเท่านั้น

คำสำคัญ: ระดับราคาในการส่งคำสั่งซื้อขาย การส่งคำสั่งซื้อขาย ตลาดหลักทรัพย์แห่งประเทศไทย บัญชีการเสนอซื้อขายหลักทรัพย์ นักลงทุนกลุ่มต่างๆ

1. Rationale and Significance

Liquidity is an important aspect of every financial market. Market participants benefit from liquid markets (Harris 2003). Traders can implement their trading strategies cheaply in liquid markets. Liquid stock exchanges can attract and retain traders, thereby helping maintain the competitiveness of the stock exchanges. Regulators also prefer liquid markets because such markets tend to be less volatile. Liquidity also affects assets' prices and expected returns. Studies (e.g., Amihud and Mendelson 1986; Acharya and Pedersen 2005) suggest that investors require higher expected return on less liquid assets to compensate them for the higher trading cost of these assets.

The Stock Exchange of Thailand (SET), like many other stock exchanges around the world, operates on a centralized, fully computerized order-driven trading system. The fully computerized limit order market is becoming more popular due mainly to its greater transparency to market participants, compared to dealer market systems. In an electronic limit order-driven market, liquidity is provided entirely by limit orders, which are electronically submitted by market participants to the computerized trading system (Bloomfield et al. 2005). By contrast, in the dealer or mixed trading systems of the US markets, liquidity is supplied by both dealers/specialists and public limit orders. Therefore, one of the main critical parts of the study on the limit order trading system usually focuses on how traders in the limit order market make their trade decision, which, in turn affect liquidity (O'Hara 2001). That is, when a trader decides to trade, she can choose to submit limit orders and thus supply liquidity to the market or place market orders and thus consume liquidity in the market.

This study examines the factors that affect investors' order submission decisions to provide deeper understanding of the demand for and supply of liquidity in a limit order book market, the Stock Exchange of Thailand (SET). In a pure limit order market, liquidity is supplied solely by the submission of limit orders, whereas the submission of market orders demands for liquidity. As a result, the analyses of traders' order submission decisions will be useful for market participants by providing insights into the order book conditions, under which traders prefer to submit limit orders and supply liquidity to the market or market orders and take liquidity from the market.

The study also separately investigates the order aggressiveness of the four investor groups in the Stock Exchange of Thailand – namely, local individuals, foreign investors, local institutions, and proprietary traders (i.e., brokers). The Stock Exchange of Thailand is considered

a retail investor-based limit order market (Phansatan et al. 2012; Pavabutr and Sirodom 2010). In 2009, local individuals account for approximately 60% of the baht volume of trades. However, the remaining three groups play a significant role too in the Thai stock market. In terms of baht volume of trades, foreign investors contribute about 20%, proprietary traders nearly 13%, and local institutions 7%. In addition, these four investor groups could differ in their motivations to trade (i.e., information-based versus liquidity-based), their levels of financial sophistication, and their vulnerability to psychologically biased investment decisions (Agarwal et al. 2009; Anand and Subrahmanyam 2008; Barber and Odean 2000; Grinblatt and Keloharju 2000; Phansatan et al. 2012). As a result, the separate investigation of the order submission decisions by these four investor groups should be worthwhile.

2. Research Objectives and Contributions

The study has the following research objectives, and contributes to the current literature on market microstructure in several ways.

First, the study aims at providing the descriptive statistics of order aggressiveness by all investors in the SET. The study then further provides the separate descriptive statistics of order aggressiveness of each investor group, and examines whether there exist any systematic differences in the aggressiveness of order submissions among the four investor groups.

Second, the study examines the information content of a limit order book in the Stock Exchange of Thailand, a purely limit order-driven market. Specifically, the study analyzes whether and how the state of the limit order book (e.g., depth and spread) affects a trader's order submission decision. Specifically, the study investigates the relationship between the state of the limit order book and the trader's order choices in terms of aggressiveness level. In addition to examining the factors that affect investors' order aggressiveness, the study also investigates whether these factors have similar impact on the order submission strategies of each of the four investor groups.

So far, Duong et al. 2009 has been the only study that differentiates between individual and institutional investors' orders when analyzing the relationship between the state of the limit order book and the aggressiveness level of traders' order choices in the Australia stock market. However, none has been done in emerging markets. Therefore, our study differs from Duong et al. 2009 by analyzing the factors that affect the order aggressiveness of four investor groups in one of the main emerging stock markets, the Stock Exchange of Thailand.

The study therefore includes the order aggressiveness levels of local individuals, foreign investors, local institutions, and proprietary traders. The results of this study are expected to provide an insight into both the similarities and the differences in the demand for and supply of liquidity by the four investor groups in the Stock Exchange of Thailand, a pure limit order driven market**.** The results of the study also have implication on traders' formulation of their trading strategies in order to reduce the price impact cost, and also on the regulator's policy in order to enhance the resiliency of the trading system. Our study helps add on the burgeoning study on the information content of the state of the limit order book by providing empirical evidence on such topic in the Stock Exchange of Thailand, an emerging stock market. Finally, our study helps add to the scarce existing studies on market microstructure area in the Thai stock market.

3. Literature Review and Hypothesis Development

3.1 Theoretical and Empirical Literature on Limit Order Markets

So far, limit order markets have been analyzed in various ways. Static equilibrium models (e.g., Glosten 1994) are usually based on the existence of asymmetric information. Recent studies, however, focus on the dynamic aspects of a limit order book, but usually without asymmetric information. A pioneering work of the literature on dynamic equilibrium models of limit order markets is by Cohen et al. 1981. In this model, traders decide between market versus limit orders, and their decisions depend on their expectations on the movement of the asset price. Recent research focuses on multi-period dynamic equilibrium models. In these dynamic models, limit order markets are represented as sequential bargaining games. Multi-period dynamic equilibrium models include, for example, Foucault 1999, Handa et al. 2003, Foucault et al. 2005, and Parlour 1998. All these models imbed an order submission decision in a variation of a sequential bargaining problem, and formulate the order decision as a discrete choice problem (i.e., a market versus limit order).

These dynamic models are in part motivated by the empirical evidence on order submissions by Biais et al. 1995. According to their study, each order is classified based on its aggressiveness level, and the level is ranked from the most aggressive (i.e., large market orders) to the least aggressive (i.e., limit orders with prices behind the best quotes). Two main findings are reported in their study. First, order submission decisions are influenced by the state of the limit order book. A wide bid-ask spread is generally associated with the

submission of limit orders that improve the best quotes, but discourages the submission of market orders. Second, order submissions tend to be auto-correlated. In other words, orders with a particular aggressiveness level are likely to be followed by orders with similar aggressiveness level – so called a "diagonal effect". Subsequent studies in other markets (Griffiths et al. 2000 in Toronto Stock Exchange; Ranaldo 2004 in Swiss Stock Exchange) also provide empirical evidence in support of these two main findings.

The Foucault 1999 model analyzes the effect of "picking off" risk (Copeland and Galai 1983) on the equilibrium proportion of limit and market orders. According to Foucault, when the systematic risk of a stock increases, limit order traders then face higher adverse selection risk - risk of trading against informed investors. As a result, to protect herself from higher expected loss to informed investors, the coming trader places a less aggressive order (e.g., place lower (higher) bid (ask) price for a buy (sell) order and/or reduce her order size), causing the bid-ask to widen. Market orders then become more expensive to use, thereby encouraging the coming traders to use limit orders. Thus, higher asset price volatility will be accompanied by wider bid-ask spread and an increase (decrease) in the proportion of limit order (market order) submissions. As a result, the price volatility influences a trader's order choice between market and limit orders through spread and depth.

Handa, et al. 2003 extends the Foucault 1999 model, and derives another prediction. Their prediction is as follows. The spread is expected to be greater in balanced markets than in unbalanced markets, where balanced (unbalanced) markets are defined as markets with equal (unequal) numbers of high private-value buyers and low private-value sellers. The scarce side in an unbalanced market has greater market power, and thereby allowing them to make the most gains from trade, and force the long-queue opposite side to place more aggressive limit orders. Consequently, spreads in unbalanced markets should be tighter. The empirical evidence from CAC40 stocks on the Paris Bourse confirms these predictions.

Parlour 1998 develops a dynamic model of the evolution of the limit order book. The main intuition of this model is that a trader's optimal trading strategy depends on the state of the limit order book and his/her beliefs about the trading strategies of those who follow. As a result, systematic patterns in prices and order submissions arise endogenously in equilibrium. For example, there exists autocorrelation of transactions and order flow submissions (i.e., diagonal effect). Market buy (sell) orders become more likely after market buy (sell) orders. Further, according to the Parlour's equilibrium model, both the same-side and opposite-side

market depths can influence traders' decision on the choice of order submission, namely, market versus limit orders. An increase in the bid-side (ask-side) market depth of the order book decreases the probability that a buy (sell) trader will submit a limit order; whereas an increase in the ask-side (bid-side) market depth of the order book increases the probability that a buy (sell) trader will submit a limit order.

Foucault et al. 2005 model is aimed to provide theoretical predictions about the properties of order submissions and trades over time. Their model shows that the frequency of trades is negatively related to the spread. The reasons are as follows. When the bid-ask spread is narrow, both patient and impatient investors tend to use aggressive orders; however, when the spread is wide, only impatient investors will use aggressive orders. Their model gives rise to the resiliency concept, as measured by the probability that sufficient limit orders will come to the market to narrow the current wide spread.

3.2 Determinants of Order Aggressiveness and Hypothesis Development

When traders are making decisions to trade a security, they can choose to submit limit orders or submit market orders. This order choice represents the trade-off between the benefits and costs of each alternative. Market orders result in an immediate order execution, but incur the execution cost (i.e., bid-ask spread and potentially price impact cost). By contrast, a trader can use a limit order for a better trade price at the risk of non-execution. That is, limit orders, if executed, receive better prices than market orders do, but, if not executed, are associated with opportunity costs (i.e., due to the security price moving away from the limit order prices). Since the price of a limit order is fixed over time, the submitted limit order can become mispriced at some point in time and then be executed generally by informed traders. Frequent monitoring and revising the submitted limit order may be needed, but it is a costly process. This is due to adverse selection risk associated with limit order submission, usually referred to as "picking-off" risk by the existing studies (Copeland and Galai 1983, Foucault 1999). Therefore, the trade-offs among execution probability, execution price, and adverse selection risk have a significant impact on traders' order choice decisions.

Parlour 1998 developed a one-tick dynamic model of a purely limit order market in an absence of asymmetric information. In Parlour's model, a trader can choose either to trade or not to trade. If a trader chooses to trade, he/she can either submit a market order and execution guaranteed, or a limit order for a better price with the accompanying non-execution risk. A limit order will only be executed if there are enough opposite market

orders arrive in the future. When a trader makes an order choice decision, she therefore takes into account how her order will affect the order choice decisions of the future traders. The model posits that when a trader submits a limit order, the probability of the order execution depends both on the current state of the limit order book (e.g., market depth or shares available to trade with on both sides of the limit order book) and on the trader's belief about the intensity of the future arrival of market orders over the remainder of the day. As a result, such execution probability then determines a current trader's order choice decision (e.g., market versus limit orders).

Specifically, Parlour 1998 indicates that an increase in market depth (i.e., depth at the best quotes) on the buy side (sell side) decreases the execution probability of buy (sell) limit orders and, through crowding out mechanism, induces incoming traders to place buy (sell) market orders. The crowding out of those limit buy (sell) orders is rationally anticipated by sellers (buyers), and therefore limit sell (buy) orders become more advantageous than market sell (buy) orders. These arguments lead to the following hypotheses;

Hypothesis 1: An increase in market depth on one side of the book *increases* the incoming order aggressiveness on the *same* side of the book.

Hypothesis 2: An increase in market depth on one side of the book *reduces* the incoming order aggressiveness on the *opposite* side of the book.

In contrast to the Parlour's model, where there is only one tick or only one price step, on the Stock Exchange of Thailand (and other limit order driven markets), there exists other multiple price quotes away from the best quotes, and large market orders can walk up the book. Therefore, other price quotes away from the best quotes also need to be taken into consideration. Handa et al. 2003 indicate that in unbalanced markets, where buyers outnumber sellers or vice versa, the scarce type of traders has greater market powers, allowing these traders to extract most of the gain from trade. For example, a bid (sell) order imbalance (i.e., thicker depth on the buy (sell) side than on the sell (buy) side) gives rise to a high level of competition among all buyers. Such competition results in the increases (decreases) in bid (ask) prices to approach to the best ask (bid) price. In such imbalance market, the execution probability of limit buy (sell) orders is low, but high for limit sell (buy) orders. As a result, market buy orders become more likely. These lead to the following hypothesis.

Hypothesis 3: the larger the depth at the own side relative to the opposite side, the higher the aggressiveness of the incoming order

Foucault 1999 develops a dynamic model of traders' order submission decisions and the resulting price formation in a limit order market. In Foucault model, investors differ in their valuations on the security price. The implication of the model is that, traders face a greater risk of trading against informed traders (i.e., adverse selection risk or "picked-off" risk) in stocks with higher price volatility. Thus, traders will require a larger compensation (i.e., larger spread) for the higher adverse selection risk in more volatile stocks (see also Copeland and Galai 1983). This in turn results in a higher cost for market orders, and therefore higher rate of limit order submissions Therefore, according to Foucault's model, the stock price volatility, spread, and the limit order submission rate are all positively related. Lo et al. 2002 also report that as price volatility is higher, the execution probability of a limit order increases, thereby reducing order aggressiveness. All these arguments lead to the following hypotheses;

Hypothesis 4: the higher the price volatility, the weaker the order aggressiveness.

Hypothesis 5: the wider the spread, the weaker the order aggressiveness.

Previous studies [e.g., Al-Suhaibani and Kryzanowski 2000; Biais et al. 1995; Griffiths et al 2000; Ranaldo 2004] show that order submissions are autocorrelated – that is, orders with a particular level of aggressiveness tend to be followed by orders with similar aggressiveness levels. Parlour 1998's model also suggest order continuations are more likely than order reversals. That is, market buy (sell) orders are more likely to be followed by market buy (sell) orders than by market sell (buy) orders. The reasoning is as follows; after a market buy order, the ask side market depth becomes thinner; if the next trader is a seller, a limit sell order is more likely to be executed and is therefore preferred to be used over a market sell order. Therefore, in Parlour's model, the continuation in market buy orders is because the sellers substitute limit sell orders for market sell orders. Consistent with the idea of the diagonal effect, Griffith et al. 1998 and Griffith et al. 2000 also provide empirical evidence indicating that order flows in the Toronto Stock Exchange exhibit autocorrelation in aggressive orders. All these arguments lead to the following hypothesis;

Hypothesis 6: An aggressive buy (sell) order tends to be followed by another aggressive buy (sell) order.

The existing literature in both developed and emerging markets documents that institutional and foreign investors are better informed and more financially sophisticated, while individual investors tend to be psychologically biased when making trading decisions and thus generally lost from trading. Froot et al. 2001 show that foreign investors follow momentum trading strategies and their trades are information-based. Their result also shows that foreign investment flows can predict subsequent positive stock returns. Grinblatt and Keloharju 2000 report that foreign investors in the Finnish stock market are better informed, and therefore generally outperform domestic investors. Also, institutional investors are often documented in many studies to possess superior information, resulting in their better trade performance. For example, Barber et al. 2008 find that in the Taiwanese stock market, institutional investors, due to their information and trading cost advantages, earn superior returns.

Anand and Subrahmanyam 2008 investigate whether the market intermediaries in the Toronto Stock Exchange trade on information. Their results show that market intermediaries' trades for their proprietary accounts contribute a majority of price discovery, as measured by the information share (Hasbrouck 1995). Anand and Subrahmanyam conclude that intermediaries can conduct effective, frequent information-based trades, because they incur lower transaction costs.

By contrast, studies indicate that individual traders usually have relatively poor trading performance. For example, Barber and Odean 2000 examine the individual investors' trades from a U.S. discount brokerage firm. After adjusting for trading costs incurred, individual investors are found to earn poor net returns. The poor performance by individual investors is explained by their excessive trading, due mainly to their overconfidence. Barber et al. 2008 examine the trade performance of both individual investors and other several institutional investors in the Taiwanese stock market, and find that individual investors underperform by about 3.8%.

In the Stock Exchange of Thailand, there are four investor types, namely, individual investors, foreign investors, local institutions, and proprietary traders (i.e., brokers/intermediaries). As suggested by the existing literature, foreign investors, institutional investors, and proprietary traders are therefore expected to possess informational advantage, while individual investors

tend to be psychologically biased when making trading decisions. Therefore, if a high proportion of information-based trading is a primary characteristic of the trades by these three institutional investors, then significant, systematic differences in trading behaviors between these institutional investors and individual investors are expected. These lead to the following hypothesis;

Hypothesis 7: all four investor types' order submission decisions are different.

Specifically, following Biais et al. 1995, Griffiths et al. 2000, Hamao and Hasbrouck 1995, and Ranaldo 2004, these differences in trading behaviors are empirically tested through the following three aspects; the response of order aggressiveness to the depth on both sides of a limit order book, order autocorrelation, and bid–ask spread.

Following Ranaldo 2004, it is suggested that informed traders tend to monitor both sides of the market when making order choice decision, and respond more promptly to the changes in the depth on both sides of the book. Following the literature on the performance of various investor groups, it is therefore expected that foreign investors, local institutions, and brokers will respond more strongly to the changes in the book depth. In addition, following Biais et al. 1995, Griffiths et al. 2000, Hamao and Hasbrouck 1995, and Ranaldo 2004, informed traders are likely to submit aggressive orders in continuation. That is, the orders submitted by informed traders will have a higher probability of continuation than those submitted by liquidity traders do. As a result, we expect the orders submitted by institutional investors (i.e., foreign investors, local institutions, and brokers) tend to have high autocorrelation in order types than those submitted by individual investors. Finally, since liquidity traders (i.e., individuals) have a high risk of transacting against informed traders, and studies (e.g., Foucault 1999) show that spread size is a proxy for such risk, it is expected that the spread size for an incoming order from individual investors should be larger than it is for an incoming orders from the remaining three types of institutional investors.

4. Market Architecture of the Stock Exchange of Thailand

The trading system of the SET is built on a consolidated electronic limit order book environment, without any market maker. During the regular trading session, namely 10.00 – 12.30 in the morning session and 14.30-16.30 in the afternoon session, buy and sell orders are