Essay I: Cost of Information-Based Trading, Liquidity and Trader Type, Evidence from SET: Exploration of informed trading from bid-ask spread

Chapter I: Introduction

The questions of whether the foreign investors are informed traders have been studied extensively. See for example, Dvorak (2005), Choe et al. (2001), Grinblatt and Keloharju (2000), Kang and Stulz (1997), Seasholes (2000), Lee et al. (2001) and Stahel (2002). To explain the degree of informed trading in each trader type, early research focuses on the return gained by different trader types. This includes work done by Stahel (2002), Seasholes (2000) and Kang and Stulz (1997). Nonetheless, no research has been conducted to study the degree of informed trading by decomposing the components of bid-ask spread.

Extensive research on the components of the bid-ask spread are largely developed within the framework of quote-driven single (multiple) dealer markets where there are market makers who set up the clearing price. Over the past years, Electronic limit-order trading has received growing attention as more exchanges implement electronic public limit-order books in the order driven market. This market has a special characteristic in that there is no specific market maker and the orders are usually matched through anonymous electronic automated system. More research interest and models have been focused on various aspects of the order-driven market. A number of studies have examined various aspects of the order-driven market. Glosten (1994) constructs the model to estimate the component of the bid-ask spread in the order driven environment. He also asserts that the adverse selection cost is less in the order-driven market and the limit-order market will have a positive bid-ask spread arising from the possibility of trading on private information. Harris and Hasbrouck (1996) investigate the relative importance of market and limit orders. Ahn, Bae, and Chan (2001) analyze the interaction between transitory volatility and order flow composition in a limit-order

market. Sandas (2001) extends the model to incorporate discrete ticks and time priority rules. The model is used to predict that the book depth is inversely related to the adverse selection cost. Handa and Schwartz (1996), Rock (1996), Seppi (1997), Viswanathan and Wang (1998), Foucault (1999), Sandas (2001) and Grammig (2006) offer a variety of equilibrium models on limit-order trading.

Nonetheless, little research has been conducted to study the relationship between the adverse selection costs and trader type by using the spread decomposition in the order-driven market. Several research emphasize on the return measurement, volume of trade and volatility such as work done by Brenan and Cao (1997), Kang and Stulz (1997), Grinblatt and Kolaharju (2000). The unique data from SET allows us to explore the issue whether the foreign investors are better informed than the retail customers. There are two main reasons why studying asymmetric information among different trader types is interesting. First, the finding about asymmetric information in different trader type will allow the regulators to figure how to disseminate information to all trader type in the market more efficiently. With better information, investors will arrive at a better decision which leads to creating wealth. Second, the evidence will prompt the attention of the group of trader with less information to study more information and exercise careful consideration when trading the stocks.

With unique data on transaction price provided by SET, we are able to decompose the bid-ask spread classified by trader type. This allows us to answer the question of whether the foreign investors are informed traders. This paper contributes to additional literatures in several ways. First, the data classified by trader type helps us to obtain the actual outcome of the difference among different trader type. Easley and O'Hara (1987) and Lee (1992) use the trade size as a proxy for different groups of investors. Large trade size represents institutional investors while smaller trade size represents retail investors. In this paper, we offer an opportunity to explore the effectiveness of using these actual data against the proxies. Second, this paper attempts to discover the adverse selection cost in the order driven market setting classified by trader type. This offers distinct results from other previous literature. Third, this paper offers an opportunity to discover

the interaction among different group of traders when they submit the order and see the pattern of the price discovery through understanding of the adverse selection cost in the intertemporal setting. Fourth, the paper adopts a new way of looking at the asymmetric information cost in traders by decomposing the bid-ask spread. This paper is one of the first paper to fit the structural model with the exclusive data with trader's classification.

Using the unique data from Trade and Order file, we obtain the sample of transaction data of 50 stocks listed on the SET 50 index as of December 31, 2003. The data covers the period between January 1, 1999 and December 31, 2003. We investigate on the issue of the relationship between the adverse selection cost and the trader type (retail investors, institutional investors, foreigners and broker-owned portfolio). We find an evidence of large asymmetric information cost in the trade order flow initiated by the foreign investors. The degree of the cost is related to the size of the stocks measured by the market capitalization. The degree of the asymmetric information cost is high after the earnings announcement and before the dividend announcement. Foreign investors account for a substantial amount of asymmetric information in the event of earning announcement and dividend announcement. The result suggests that foreigner investors have better information either from trade order flow or better analytical skills. They tend to exhibit this information in the order flow. The paper is organized as follow: Chapter II presents the literature review on the theory and empirical models on the estimation of the components of bid-ask spread in the order-driven market in relationship to the trader type. Chapter III presents the research hypotheses. Chapter IV presents the data used in the study. Chapter V presents the methodology. Chapter VI presents empirical findings and Chapter VII presents the conclusion.

Chapter II: Literature Review

2.1 Theoretical models of asymmetric information and cost of information based trading

Theoretical models underlying the bid-ask spread can be categorized into Inventory models, Information-based models, Strategic trader models involving informed traders and Strategic trader models involving uninformed traders. (O'Hara (1997))

Upon developing these models, several researchers have attempted to identify the motivation of the bid-ask spread. From the literature, three costs underlying the bid-ask spread consist of the order processing cost, inventory control cost and adverse selection cost. Several early studies of cost of trading focuses the execution cost, including the brokerage cost and bid-ask spread. Demsetz (1968) was the first to introduce the idea that transaction costs arise as a natural outcome of the liquidity provider's business. He argued that the liquidity provider incurs order processing costs by supplying immediacy to the market and should be compensated in form of bid-ask spread. This represents the "order processing cost". He also asserted that the order processing cost is made up of exchange and clearing fees, bookkeeping and back office costs and market makers' time and effort.

Second component is the inventory cost. This cost arises from "Inventory models". This cost incurs when the market maker acquires a security from other market participants and incurs risk of holding inventory without regarding to the market imperfection such as asymmetric information. Garman(1976) shows the price impact of order flow on the price formation. Garman shows that the specialist will establish the bid-ask spread to equate the rate of his coming buy or sell orders. The specialist is assumed to maximize his expected profit per unit of time subject to avoidance of failure. Stoll (1978) and Ho and Stoll (1983) develops theoretical models of the bid-ask spread as a function of the market maker's optimization problems. They assert that the order flow

imbalances give rise to the inventory holding cost. The market maker incurs cost arising from the risk that he does not know how long to hold security and whether the security price may change during the holding period. The position of the market maker may deviate from the optimal position and the market maker sets up the bid-ask spread to compensate for that. When the deviation is greater, the inventory holding costs are larger and the bid-ask spread is wider. Ho and Stoll (1981) expands on the early work by introducing the model of spread based on both supply and demand of the market maker immediacy service and incorporates the effects of uncertainty about the timing of future transactions. Ho and Stoll (1983) extends to model to incorporate a multiple market maker setting the condition under the interdealer market. Theoretical studies that are based on this cost include Garman (1976), Stoll (1978), Amidhud and Mendelson (1980), Ho and Stoll (1981, 1983), Cohen, Maier, Schwartz, and Whitcomb (1981), and O'Hara and Oldfield (1986).

The third cost represents the adverse selection cost or cost of information-based trading. This gives rises to the second model on "Information-based cost model." This cost arises from the concept of asymmetric information. Some market participants, namely informed traders, have better information than a market maker or a noise trader. The market maker sets up the bid-ask spread to cushion against potential losses to informed traders. Copeland and Galai (1983) was the first one to model bid-ask spread as a function of the costs incurred by the market makers on the expected losses to the informed traders. Theoretical models of the components of the bid-ask spread predict a direct relationship between bid-ask spreads and the degree of informed trading risk faced by market makers. Glosten and Milgrom (1985) models the bid-ask spread in the presence of the heterogeneously-informed traders and predicts that the bid-ask spread will widen as the ratio of informed to uninformed trader increases. Easley and O'Hara (1987) argue that the effects do not come from the fraction of the informed trader but the fraction of trades that come from informed traders. This area of study has been done in Copeland and Galai (1983), Glosten and Milgrom (1985), Kyle (1985), Easley and O'Hara (1987), Admati and Pfeiderer (1988). All of the costs are combined together into the quoted bid-ask spread.

The third model also involves the adverse selection cost but adds complication into the informed trading risk. Kyle(1985) develops a model to show that the informed traders place their orders with strategy in order to mask their trades. This gives rise to the third model, "Strategic trader models involving informed traders." Holden and Subrahmanyam(1992) extends Kyle(1985) model to incorporate the competition among multiple risk-averse insiders with long-lived private information. This model shows that a unique general equilibrium exists where competition among multiple risk-averse insiders is associated with high trading volumes and the revelation of the private information. Then Admati-Pfleiderer (1988) develops a model based on the strategy undertaken by the uninformed traders. They classify the uninformed liquidity traders into nondiscretionary and discretionary liquidity traders. They argue that the discretionary liquidity traders will make decision based on the timing of their trades. They will satisfy their liquidity demands before the end of the day but have the choice to choose the timing during the day when to trade. Following the research on determination of bid-ask spread, Harris(1994), Angel (1997) and Harris (1996) emphasize on the effect of the share price from the relative bid-ask spread. Harris (1994) also develops model to forecast the effect of lowering bid-ask spread on the stock price and market depth.

Extensive researches in market microstructure have been developed within the quote-driven market settings. Handa, Schwartz and Tiwari (1998) assert that, unlike the quote driven market, liquidity provision in an order-driven market has received relatively little attention in the market microstructure literature. The new development towards order-driven market has prompted attention of researcher to focus more on the order-driven market. Brockman and Chung (1999) assert that Nasdaq offers a market-wide automatic matching limit order system to increase efficiency and transparency. London Stock Exchange implemented an order-driven limit order book market. Domowitz (1993) documents 35 financial markets that use limit order book systems. Several researchers have conducted study in the order-driven environment. Cohen, Maier, Schwartz and Whitcomb (1981) show that order-driven auction markets encourages the positive bid-ask spreads and that the free entry of the informal market makers will sustain

a viable securities market. Glosten (1994) shows that the existence of the adverse selection cost generates positive bid-ask spreads in an order-driven trading environment. The bid-ask spread represents the expected compensation for the costs of supplying immediacy. Handa, Schwartz and Tiwari (1998) assert that bid-ask spread are a natural property of order-driven trading because market participants are willing to pay for price certainty.

2.2 Theoretical models explaining the difference in asymmetric information and cost of information-based trading based on different type of traders

Early research focuses on asymmetric information in trades between large and small investors. Researchers on the impact of the information disclosure on the trading behavior of institutional investors (large traders) and retail investors (small traders) argue that the retail investors make smaller trades and are at an informational disadvantaged. Easley and O'Hara (1987) assert that the large trades, presumably originated by institutions are expected to be associated with greater adverse selection costs than small trades. Grossman and Stiglitz (1980) support that investors are likely to obtain a higher return if they are willing to spend time and resources to analyze and uncover the new information. In a capital market in which information is heterogeneous and information collection and processing are costly, small traders with limited resources are likely to be uninformed noise trade whereas the investors with large quantity or institutional investors are more likely to possess private information. Kraus and Stoll (1972) document the price pressure caused by institutional traders.

Lee (1992) uses small and large trade as a proxy for institutional investors and retail investors. They report that the reaction of retail investors to earnings announcement is weaker and slower. Chiyachantana et al. (2004) argues that regulation Fair Disclosure encourages the institutional investors to trade less because they possess less private information and retail investors will trade more as they have a better access to market information. Corwin and Lipson (2005) assert that the type of traders, especially institutional traders, is the primary determinants of commonality in order flow and return.

Kothare and Laux (1995) argue that the widening of the spreads is statistically explained by increases in institutional ownership and trading.

As more information is available, focuses of the research change to studies whether the foreign investors have better information than the retail domestic customers. The information advantage may arise from better company analysis or better access to the order flow. Theories support both sides. One supporting argument in favor of the domestic investors is that information does not have to travel over physical, linguistic, or cultural distances. Counter argument suggests that the foreign investors may possess information advantage because they have a significant amount of investment experience and expertise and resources.

2.3 Empirical studies related to asymmetric information and adverse selection cost

The empirical research has been done enormously. The empirical results reported in previous studies yield a large variation in their estimates of the bid-ask spread components. This is due to the use of different samples, different sampling periods and different estimation methods. Early empirical research has focused on the estimation of the components of the bid-ask spread in the quote driven market. This section briefly reviews some of the methodologies and findings.

In general, there are two classes of statistical models. The first one relies on the serial covariance properties of the observed transaction prices (Roll (1984), Choi, Salandro, and Shastri (1984), George, Kaul, and Nimalendran (1991), Stoll (1989), Lin (1992), Huang and Stoll (1994), Lin, Sanger, and Booth (1995)). George, Kaul, Nimalendran (1991) incorporates the time varying expected returns. The inventory cost is assumed to be zero. They estimate the average order processing cost of 87-92 percent while the adverse selection cost accounts for 8-13 percent.

Stoll (1989) develops a model to estimate the bid-ask components in the quote-driven market. They show that the order processing cost is 47 percent, the adverse selection cost is 43 percent and the inventory cost is 10 percent. Stoll also estimates the probability of trade reversals of 55 percent. Lin, Sanger and Booth (1995) extends the work of Stoll (1989), Lin (1992) and Huang and Stoll (1994) to estimate the components of bid-ask spread and order persistence. They argue that the adverse selection components account for 35 percent and there is a positive relationship between adverse selection and trade size and negative relationship between order processing and trade size. The probably of order persistence is as high as 66 percent.

The second class of models is based on the trade initiation indicator variable. This class includes the work done by Glosten and Harris (1988) and Madhavan, Richardson and Roomans (1997) and Huang and Stoll (1997). Glosten and Harris (1988) conduct one of the first empirical study to try to decompose the bid-ask spread into the transitory components and permanent components. The transitory components reflect the order processing costs and inventory holding costs while the permanent components reflect the adverse selection costs that arise from the information asymmetry between the market maker and informed traders. With the sample of 20 firms and ignored price discreteness, they show the estimation result of 80 percent and 20 percent being transitory and permanent components respectively. On the other hand, when the price discreteness is incorporated, they estimate 65 percent and 35 percent of the bid-ask spread representing the transitory and permanent components respectively. Huang and Stoll (1997) develop a spread component decomposition model using two-way and three-way decomposition approach. Two-way decomposition reveals that the order processing cost is 89 percent while the inventory holding cost and adverse selection accounts for 11 percent of the bid-ask spread. Three-way decomposition reveals that the order processing cost is 62.7 percent while the inventory holding cost is 28.7 percent and adverse selection accounts for 9.6 percent of the bid-ask spread.

Madhavan, Richardson and Roomans (1997) extends the Glosten and Harris (1988) model by proposing the four-parameter model to analyze the intraday patterns in

bid-ask spreads and other related variables and allow the order flow to be related to the bid-ask spread. The estimate the adverse selection cost components on an average across five intra day to be 43 percent of the spread and average order processing cost and inventory cost to be 57 percent of the spread.

Van Ness, Van Ness and Warr (2001) examine the performance of five commonly used spread decomposition models. Their assertion is that the model will be useful only if the adverse selection cost is highly correlated with other commonly accepted measures of asymmetric information such as analyst earnings' forecasts, growth measures of firms, research and development expenditures, intangible assets, volatility and leverage. Chung and Li (2003) report that the estimates of adverse selection cost of Glosten and Harris (1988) and Lin, Sanger and Booth (1995) are highly related to the estimated probability of information-based trading. Nonetheless, Glosten (1994) and Brown and Zhang (1997) conduct the empirical testing to compare the quote-driven and order-driven market and conclude that the limit order book market produces lower adverse selection cost.

2.4 Empirical studies related to asymmetric information and adverse selection cost in an order-driven market

Over the past year, many stock exchanges have turned to the electronic public limit order book system with and without explicit market maker. A number of studies, though limited, have examined various aspects of the limit order market such as liquidity, adverse selection cost, volatility, order flow etc. These include work done by Cohen, Maier, Schwartz, and Whitcomb (1981), Glosten (1994), Biais, Hillion, and Spatt (1995), Harris and Hasbrouck (1996), Handa and Schwartz (1996), Handa, Schwartz and Tiwari (1998), Rock (1996), Seppi (1997), Madhavan, Rooman and Richardson (1997), Viswanathan and Wang (1998), Foucault (1999), Ahn, Bae, and Chan (2001), Chung, Van Ness, and Van Ness (1999) and Kavajecz (1999), Sandas (2001) and Ahn, Cai, Hamao and Ho (2001).

Cohen, Maier, Schwartz, and Whitcomb (1981) establish the existence of the bid-ask spread in a limit order market when investors face transaction costs of assessing information, monitoring market, and conveying orders to the market. They show that order-driven auction market encourages the positive bid-ask spreads and that the free entry of the informal market makers will sustain a viable securities market. Glosten (1994) was the first to study the behavior of the bid-ask spread and its components in the limit order book market. He shows that the limit-order market will have a positive bid-ask spread arising from the possibility of trading on private information and it represents the expected compensation for the costs of supplying immediacy. Handa, Schwartz and Tiwari (1998) assert that bid-ask spread are a natural property of order-driven trading because market participants are willing to pay for price certainty.

Biais, Hillion, and Spatt (1995) offer an empirical analysis of the supply and demand of liquidity and interaction between the order book and order flow in the Paris Bourse. Harris and Hasbrouck (1996) investigate the relative importance of market and limit orders in the limit order book market. Handa and Schwartz (1996) argue that the bid-ask spreads are a natural property of order-driven trading because market participants are willing to pay for price certainty. Seppi (1997) extends the Glosten (1994) model and offer an equilibrium model in an order-driven market.

Ahn, Bae, and Chan (2001) analyze the interaction between transitory volatility and order flow composition in a limit-order market. Chung, Van Ness, and Van Ness (1999) and Kavajecz (1999) examine whether quoted spreads reflect the trading interest of specialists or limit-order traders. Ahn, Cai, Hamao and Ho (2001) estimates the components of the bid-ask spread in the limit-order book of the Tokyo Stock Exchange (TSE) which is an order driven market. They employ the framework developed by Madhavan, Richardson, and Roomans (1997) or MRR model to apply to the study of bid-ask components in an order driven market. They argue that, although they do not explicitly model the limit-order book, a limit-order trader can be interpreted as another market maker. They find out that the adverse selection and order handling cost components of the TSE exhibit U-shape patterns independently and the adverse selection

cost increases with trade size while order handling cost decreases with it. Angelidis and Benos (2005) employs the MRR model to apply to Athens Stock Exchange. They estimate the adverse selection cost, order handling cost and probability of the trade continuation (trade momentum). They also incorporate traded volume into the model. They find out that the adverse selection component exhibits U-shape patterns, while the cost component pattern depends on the stock price. For high priced stocks, the usual U-shape applies, while for low-priced ones, it is an increasing function of time, mainly due to the different magnitude of the order handling spread component. Sandas (2001) extends the methodology proposed by DeJong et al. (1996) and estimates a version of Glosten (1994) limit order book model allowing for real world features like discrete ticks and time priority rules. He shows that the price impact of the trade reflects their informational content.

Recent literatures on the empirical testing of the order-driven market have been developed through the extension of the model by Biais, Hillion, and Spatt (1995), Hall, Hautsch and Mcculloch (2003), Coppejans, Domowitz and Madhavan (2003), Cao, Hansch and Wang (2004), Grammig, Heinen and Reginfo (2004), Pascual and Veredas (2004) and Ronaldo (2004) employ the discrete choice and count data models to analyze the determinants of the order submission activity and the interaction of liquidity supply and demand processes in limit order markets. Beltran, giot and Grammig (2004) advocate a principal components approach to extract the common factors that explain the book depth. Gombers, Schweickert and Theissen (2004) and Degryse, DeJong, Ravenswaaij and Wuyts (2003) conduct an intra-day event studies to analyze the resiliency of limit order markets. Frey and Grammig (2006) extends the model by Glosten (1994) and Sandas (2001) to impose the average zero profit conditions which will increase the empirical performance. They also find out that the liquidity supply and adverse selection costs are inversely related.

Hasbrouck (1988, 1991a, b) develops a Vector Auto Regressive (VAR) model in which the prices and trade patterns are jointly modeled by a system of equations. The model allows for the interaction between securities traded and quote revisions. He argues

that the trade's information effect may be measured by the ultimate price impact of the trade innovation. He concludes that the impact is positive and concave function of the trade size. Large trade size causes the spread to be wider.

Another side of research attempts to develop other measurement of the adverse selection cost or the cost of information based trading. Easley, Kiefer, O'Hara (1997a) develops the Probability of informed trading (PIN) index to measure the information contents of trades by estimating the market maker's beliefs through trades. PIN measures the relative intensity of informed trading. Easley, Hvidkjaer and O'Hara (2000) apply PIN to interpret it as a ratio of orders arising from informed traders.

White and Ready (2006) develops the model to measure both probability of informed trading and the magnitude of the loss from informed trading. This aims to decompose the expected loss of informed trading into the probability and the amount of expected loss from informed trading. They use Maximum Likelihood method to separately estimate the probability and magnitude of private information and use the result to predict the future extreme returns.

Engle (2000) develops ACD (Autoregressive conditional duration) model to measure the waiting time between each executed order as a way to deal with high frequency data. Engle (2006) develops a model to measure the expected cost of trading and risk dimension of trading by constructing the LVAR (Liquidity value at risk)

Corwin and Lipson (2005) develops a model to examine the relative importance of each type of traders such as institutional traders and retail traders in driving the commonality in order flow returns and liquidity. They use the technique of Principal Component Analysis to analyze the common factors affecting order flow and liquidity. They find that the institutional trading are the primary determinants of commonality in order flow.

2.5 Empirical Research on asymmetric information based on different type of traders

Several empirical evidences provide mixed results. Choe, Kho, and Stulz (2001) using Korean data, and Hau (2001a) using German data find that foreigners are at a disadvantage. Seasholes (2000) using Taiwanese data, Grinblatt and Keloharju (2000) using Finnish data, and Froot and Ramadorai (2001) using a cross section of 25 countries make a convincing case that foreigners do better than local investors. Kang and Stulz (1997) using Japanese data find no difference in the performance of domestic and foreign investors.

Extensive studies have been employed to investigate on the issue to provide the evidence of better informed trading. The previous studies reveal several methods to explore the issues. Brenan and Cao (1997) investigate on the correlation between aggregate monthly capital inflow and stock returns. Kang and Stulz (1997) calculate average monthly excess returns earned by foreign investors in Japan. The return on the foreign portfolio is calculated as the foreign ownership weighted average of returns on Japanese stocks. This approach provides a measure of relative performance in terms of returns but the returns are measured monthly. Grinblatt and Kolaharju (2000) measure the performance of foreign and domestic investors by comparing a group's tendency to buy future winning stocks and sell future losing stocks.

Seasholes (2000) investigates that Taiwanese stock exchange. He looks at net foreign buying prior to positive and negative earnings surprises and he concludes that foreigners tend to buy prior to positive and sell prior to negative earnings surprises. He regresses the daily returns on the foreign portfolio on the market returns and finds out that foreigners generate above risk-adjusted returns and he uses a bivariate VAR of market returns and aggregate flows to find out whether foreign net inflows predict returns. He concludes that the foreign flows are related to the returns as a result of price pressure of foreign purchases.

Choe et al. (2001) find that foreign investors buy at higher and sell at lower intraday prices than foreigners. This method measures the information advantage in the short run but it cannot distinguish between information asymmetry and investment style. Froot, O'connell and Seasholes (2001) uses covariance matrix between net inflows and equity and currency return. Froot and Ramadorai (2001) attempt to distinguish between the information advantage and price pressure hypotheses. Using data on institutional equity flows from the United States to a cross section of 25 countries, they find that foreign purchases predict not only prices in foreign markets, but also prices of closed-end country funds and they conclude that the foreigners have better information than local investors.

Dennis (2002) looks at the issue between the ownership by the institution and informed traders. Stahel (2002) uses the return and volume relationship and conclude that the return autocorrelation following high trade volume and relates the conditional daily return autocorrelation to the informed trading. Lee, Liu, Roll and Subrahmanyam (2004) investigate the issue of informed trading in TSE and use marketable order imbalance method to measure the degree of informed trading. Dvorak (2005) proposes an information advantage hypothesis and tests it using the spectral decomposition techniques. Nonetheless, no research has been done in the attempt to decompose the bid-ask spread in the trading transaction to explore the components of asymmetric information based on different trader type. Rather than using the levels of volume and volatility or order imbalance as in previous work, we investigate the sensitivity of price to signed order flow which helps us to understand more about the components of the bid-ask spread.

2.6 Literature Review on the effect of news announcement

Effect of announcement on the trading price has been extensive. Kim and Verracchia (1994) suggest that public information releases may increase information asymmetry due to unequal ability to interpret the news. The information processing skills increase the precision of the public information release. Koski and Michaely (2000) find

out that the trades preceding dividend announcements have a larger than usual price impact. Green (2004) uses Madhavan, Rooman and Richardson (1997) model to decompose the bid-ask spread into the order processing cost and asymmetric information around the economic announcement in the bond market. He finds out that there is a significant increase in the information role of trading following economic announcements. The release of public information increases the level of information asymmetry in the bond market. He also finds that the sensitivity of prices to order flow is lower than usual before economic announcement. Cao et al. (2002) find out that the information asymmetry would be greater following more precise information releases.

Despite an extensive amount of research done on the information advantage of domestic or foreign investors, none has addressed the issue from the transactional level. In addition, structural models have been used to decompose the bid-ask spread into their components but yet, no research has integrated these models to explore the issue by trade type. This paper is the first to fit the structural model to address the issue of asymmetric information revealed by order flow classified by trader type at the transactional level.

Chapter III: Research Hypotheses

Theoretical research and empirical studies indicate the importance of the bid-ask spread in the order driven market and suggest the relationship between the adverse selection component and the order processing and inventory handling component of the bid-ask spread. Theory suggests the inverse relationship between these two classes of costs. This leads to our first hypothesis

Hypothesis 1

H_1: There is a statistically significant inverse relationship between the adverse selection cost component and the order processing and inventory handling component of the bid-ask spread in the Thai Stock market.

Grossman and Stiglitz (1980) support that, within a capital market where information is heterogeneous and information collection and processing are costly, small traders with limited resources are likely to be uninformed noise trade whereas the investors with large quantity or institutional investors are more likely to possess private information. This enlightens on the issue of Thai stock exchange whether the institutional investors and foreign investors who are regarded as informed traders really possess such advantageous information and utilize such information. This can be observed from the behavior of trading pattern. Chiyachantana et al.(2004) assert that the adverse selection component of the bid-ask spread is expected to be highly influenced by the types of traders. Easley and O'Hara (1987) assert that the large trades, presumably originated by institutions are expected to be associated with greater adverse selection costs than small trades. The issue of information asymmetry between domestic investors and foreign investors has been investigated extensively. With available information on the trades based on several trader types, this brings us to the second hypothesis.

Hypothesis 2

H_{2a}: There is a significant difference in the component of the bid-ask spread among different trader type.

H_{2b}: If the component of the bid-ask spread is different among different trader type, a higher portion of the adverse selection in the bid-ask spread is attributed to the trading by the foreign investors and institutional investors who are regarded as informed traders.

Green (2004) explores the issue of asymmetric information before and after the economic announcement and concludes that the level of asymmetric information seems to be present and is higher after the economic announcement. Kim and Verracchia (1994) suggest that public information releases may increase information asymmetry due to unequal ability to interpret the news. The information processing skills increase the precision of the public information release. Koski and Michaely (2000) find out that the trades preceding dividend announcements have a larger than usual price impact. This leads us to develop the third hypotheses:

Hypothesis 3

H_{3a}: The level of asymmetric information associated in the order flow is not the same between the period before and after the earning announcement.

H_{3b}: The level of asymmetric information associated in the order flow is not the same between the period before and after the dividend announcement.

H_{3c}: If the public information really increase asymmetric information, the there will be a difference in the level asymmetric information among different trader type.

Chapter IV: Data

The data used for the study consists of the transactional data for 50 stocks of the Stock Exchange of Thailand 50 Index (SET50) for the period of five years or 1,227 trading days between January 1, 1999 and December 31, 2003. Stocks listed in the SET50 index represent the stocks with the highest liquidity and largest market capitalization in the Stock Exchange of Thailand (SET). The 50 stocks account for 36 percent of total number of transaction. Foreign share in the trading volume averages 21.67 percent and Foreign share in the trading value averages 22.31 percent. Dvorak (2005) uses 30 most liquid stocks in Indonesia. There are two reasons of the use of only 50 most liquid stocks listed in the SET50 index. Firstly, it allows us to investigate information advantage for stocks with both high and low number of trades. Secondly, Bruce (2007) argues that some of the foreign institutions are not allowed to trade the stocks with low market capitalization and low liquidity. Using the stocks in the SET50 index helps us to investigate the issue of information advantage in the stocks that allow equal chance of trading for both domestic investors and foreign investors. Inclusion of the small-cap stocks with less liquidity would put downward bias on the degree of informed trading in the absence of foreign investors and institutional investors.

The Stock Exchange of Thailand offers a good opportunity to analyze the issue on the order-driven market because of its simplicity and transparency. SET has no market makers or specialists, no order processors as on the Tokyo Stock Exchange (Lehman and Modest 1994), no price change limits and no mandatory vs non-mandatory quotation periods as on London Stock Exchange (Abhyankar et al. 1997). Bid and ask orders are supplied to automated public limit order which are input and matched by using fully automated computerized trading system. In addition, another special unique characteristic of our data, unlike others, is the information on trades and quotes on a high frequency tick by tick data classified by trader type including Local investors, Foreign investors and Institution. Chiyachantana et al. (2004), Cready (1988), Cready and Mynatt (1991) and Seida ad Wempe (2001) classify the different trader type in the NYSE by using the share -based trade size as a proxy for institutional trading and retail investors'

trading. Lee (1992) proposes a firm-specific dollar based trade size as the proxy for both types of traders. None of the study has concluded the effectiveness of any proxies nor any discrepancies between using the proxy and using the actual data. Hence, our data are expected to produce a more accurate result

Regarding the market mechanism, SET has adopted an electronic limit order trading system that takes place in the automated auction system with time and price priority rule. Brokers submit the limit orders or marketable limit orders with price, quantity and instruction to buy or sell. The orders are submitted into the electronic order trading system to match with the waiting orders in the limit order book. All of the orders need to submit through the securities brokers who are the members of the SET. Three possible outcomes of the submitted orders are: (1) Successful executed trades (2) Waiting orders in the limit order book which may be left in the book until the closing or cancelled by the submitted customers (3) Automatic cancellation at the closing.

The transaction data is obtained from the exclusive database of SET. The database provides the data on the order and trade information on tick-by-tick basis. The exclusive data files provided by the SET are order file and deal file. In the order file, the data set contains all of the historical transactional limit buy order, limit sell order, market buy order and market sell order in terms of order price, order volume and order value for all stocks and all trading boards. It also provides the order submission date and time, type of trades submitting the order, type of orders, trading board type, order status (Matched or cancelled or remaining orders) and quantity of the orders matched and remaining quantity. In the deal file, the data set contains the historical transactional buyer-initiated and seller-initiated trades in terms of executed price, trade size and trade value for all stocks and all trading boards. It also provides the trading date and time, deal confirmation number, type of buyers and sellers who trade, type of orders, trading board type, buy order and sell order time and buy order number and sell order number.

On Nov 5, 2001, the Stock Exchange of Thailand has changed the mandatory tick size to increase the number of different tick sizes which aims to reduce cost of trading.

The selection of the data between 1999 and 2003 is aimed to cover pre and post tick size changes. In addition, the selection of the period of study is to study the data during the time when the trading volume in the market is high and low and stocks listed in SET 50 are considered highly liquid stocks with reasonable amount of percentage of free float. Our studies focus on continuous trading periods (10:00 a.m. – 12:30 p.m. (morning session) and 14:30 p.m. – 16:30 p.m. (afternoon session)) on main trading board.

In the Stock Exchange of Thailand with electronic limit order book system, it is worth noting that it is not allowed that the trade occurs between the quotes. Therefore the probability that the trade occurs between the bid-ask quotes is zero. Price change is based on the price change based on tick by tick. We follow the method used by MRR (1997) to consider the stocks with at least 250 observations for each trader type but our methodology does not estimate the parameter on a daily basis but rather pool all data sets and estimate the parameter over the longer range of time.

Although the SET has changed the components of the stock in the SET 50 index every six months, we use the stocks contained in SET 50 in 2003 to create a consistency in estimation over several years of study. It is also worth noting here that some stocks in the SET50 index list as of 2003 are delisted. Therefore, information on the historical earning announcement date and dividend announcement date is unable to obtain. Therefore, the data set used to estimate the parameter of the model with earning announcement and dividend announcement lacks some stocks.

4.1 Classification of buy and sell transactions in the market orders

In the MRR Model, the input requires a classification of trader's initiation. The deal file does not provide us the classification directly. To classify the trade as buyer-initiated or seller-initiated, we observe the deal time and the order submission time. Buyer-initiated trades are those trades in which deal price occur at the best quoted ask whereas seller-initiated trades are those trades in which deal price occurs at the best quoted bid. The deal file represents all the trades occurred at the best bid and best ask.

The deal file provides us with buy-order and sell-order submission time. Given the deal time and order submission time, we can define the buyer-initiated trade as the trades in which the buy order time takes place after the sell order time whereas the seller-initiated trade as the trades in which the sell order time takes place after the buy order time. We, then, match the buy-order submission time and sell-order submission time for each transaction. We do not use the tick test as in Hasbrouck (1991) since trade data is available. Lee and Ready (1991) and Blume and Goldstein (1992) suggests the method to match the quote and transactions in the absence of order submission time. Fortunately, the deal file provides the order submission time of the executed deals which helps us to determine the initiation type. Since the Stock Exchange of Thailand is a pure-order driven market without market makers, the trade should take place at either bid or ask price.

4.2 Exclusion of the call market transaction (Batch clearing)

The trading day on the SET is divided into morning (10:00-12:30 p.m. and afternoon (14:30-16:30 p.m.) sessions. At the opening transactions in the morning and the closing transactions in the afternoon sessions, the Stock Exchange of Thailand uses the system of the call market or batch clearing process to collect the incoming order and arrive at the opening price and closing price through a single auction process. Since we are conducting the empirical testing on the order-driven market, these call market transactions are excluded from the sample. Therefore, we do not include transactions made before and after the trading session. In addition, some large block trades may also take place during the time mentioned.

4.3 Exclusion of the foreign board and odd board and big lot orders

The database offers the trades and quotes in three markets, foreign board, main board and odd board. We select to work with the data from the main board that represents continuous auction throughout the day with highest order submission and trade while we exclude the data from the other boards to avoid the problem of non-

synchronous trade data. The number of trades on the main trading board represents 98.8 % of the total trading. Furthermore, the foreign board offers the different trading price from the main board. In the main board, there may be some small number of transactions that represent in-the-market big lot. The executed price for this big lot trade may not take place at either the bid or ask price at that current quote. The executed price may be outside of the bid-ask quote. Therefore, we shall exclude all trades made at the price other than bid-ask price.

4.4 Sample size

After we exclude the transactions during the call market and include only the transactions in the main trading board, there are 21,000,117 transactions over the period from January 1, 1999 to December 31, 2003. This represents 61,350 transaction days. The descriptive statistic of the sample is presented in the later section.

4.5 Descriptive Statistics

Table 1 presents the lists of all 50 stocks included in the study together with their corresponding industry, their market capitalization, average number of trade per day, total number of trades, percentage of total volume traded by foreigners, percentage of value traded by foreigners, percentage of foreign ownership as of the end of 2003. The stocks from the banking industry constitute the highest components accounting for about 20 percent followed by the finance and security industry and the telecommunication industry respectively. The size of the stocks classified by the average market capitalization varies from 3.46 billion baht to 517.49 billion baht. The average market capitalization of the stocks is 62.83 billion baht and the median is 26.63 billion baht while the range is 514.031 billion baht. The larger amount of the mean over the median suggests that the sample is skewed towards smaller size. This can be due to the fact that there are a few large capitalization stocks in the data set. We can observe that only 20 percent of the stocks in the sample have greater market capitalization than 100 billion baht.

Nonetheless, the variation in size ensures that we have got a good sample with various sizes.

Average number of transactions (trade) per firm is about 556,298 trades while the median is 501,543 trades. The standard deviation of the number of transaction is 299,082 trades which is about 60 percent of the mean. This large number shows that most of number trade lies within the range of one standard deviation. The largest number of trade lies most on the banking stocks such as NFS, TFB, KTB, etc. The percentage of number of transactions traded by the foreigners ranges from 1 percent to 90 percent. This suggests that there are stocks which are highly traded by foreigners while others are less popular. The percentage of volume and value traded by foreigners is between 5% and 56% with the mean percentage at about 21-22 percent but the high level of percentage of volume and value traded above 30 percent represents only 22 percent of the total amount and most of them are traded with large market capitalization stock. This evidence confirms that the foreign investors, esp. foreign institutions, are inclined to trade large capitalization stock with high liquidity. On the other hand, the foreign holding ranges from 0.5% to 86% with the mean of 38 percent.

Table 2 Panel A presents the summary statistics of the aggregate deal file used in the study. The statistics were tabulated separately for all stocks and stocks listed in the SET50 index. The descriptive statistics show means, medians and standard deviation over the entire sample period. The number of transaction in the deal file totals 76,525,720 transactions. The average deal volume is 13,490 shares with the median of 4,700 shares. The much higher mean than the median represents skewness towards small-sized deals. The average deal price exhibits similar characteristic since the mean of 28 baht is much greater than the median of 12 baht per share. This shows that the aggregate investors prefer to trade the stock with relatively low price. The standard deviation for the price is relatively large which suggests that most the trade exist within the range of one standard deviation. The average deal value exhibits the same pattern as the average deal price in that the mean of 124,668 baht per deal is much larger than the median of 46,860 baht per deal. The investors prefer to trade with much smaller size of

the deal. For the stocks listed in the SET50 index, the average deal price is higher while the average deal volume is lower than all of the stocks. This is consistent with the characteristics of stocks in the SET50 index which have greater market capitalization and share price.

Table 2 Panel B presents the statistics of the number of deal, deal volume, deal price and deal value in our sample of 50 stocks grouped by each individual trader including retail domestic customers, foreign investors, domestic institution and broker-own portfolio together with statistic for the overall sample under study. To classify each deal into each trader's initiation, we compare the buy order time and sell order time. The total number of observation is 26,937,831 samples representing about 35 percent of the total number of transaction. In arriving at the final sample, we select the stocks listed in the SET50 index as of December 31, 2003 and we delete the deals around the call auction market during the beginning and closing of the market. In addition, we include only deals that take place in the main trading board and exclude the deals in the foreign board and odd board. Retail customers account for 78 percent representing the largest proportion of number of transaction while the foreign investors account for 16 percent. The greatest deal volume belongs to the deals submitted by the broker-own portfolio. The average deal volume of the retail customers is greater than the foreign investors probably due to the breakdown of the large orders into smaller orders. The average deal price is greatest for foreign investors and domestic institutional investors, showing that the institutional investors, either domestic or foreign, trade stock with large prize and large market capitalization. This is well greater than the overall average. The domestic retail customers produce the trade with smallest average price. The average deal value is large for the broker-owned portfolio and foreign investors while that of retail investor is relatively small.

In order to select the number of stocks included in our sample, we observe the behavior of stock trading in all trader type on each year. The summary is presented in table 3. In all of the years, the retail customers trade all of the stocks while the foreign investors trade majority of the stocks. The local institution and broker-own portfolio

trade less frequently and covers some stocks. As we explore on the stocks with high frequency of trading, there are less number of stocks traded. To ensure sufficient number of transactions in our sample, we select only stocks listed in the SET50 index which allows for enough transactions. We also compute the percentage of transactions of 50 stocks in the SET50 index. The foreign investors have relatively large percentage of trading of stocks in set50 index. In all of the years, more than 57 percent of the transactions by foreign investors trade stocks in the SET50 index.

We further diagnose the behavior of the price impact by computing the descriptive statistics of the change in the price of stocks in the sample. Table 4 Panel A presents the statistics on the average price change, variance of the change in price, average number of transaction per day for all transactions in the data set. The average variance of change in price is highly skewed where the median is much smaller. Table 3 Panel B provides statistics of the average variance of price change, average number of transaction and average volume per transaction. We follow MRR (1997) by computing the number for each stock and average them. It is clear that the size of the transaction traded by each group varies significantly and the domestic retail customers dominate the trades. Share volume and trading frequency are large for retail domestic customers while these for the institutional investors and broker-own portfolio has high average share volume with very small amount of transaction per day. The variance of change in price also varies significantly among different groups with retail customers mainly drive the variance whereas the institutional investors are least active. The average deal price is largest for the foreign investors and domestic institution which shows that the institution prefers to trade large sized-stocks.

Chapter V: Methodology

Our research measures the degree of informed trading by decomposing the components of bid-ask spreads and attributes the information asymmetric components. The framework developed by Madhavan, Richardson, and Roomans (1997) or MRR model can be readily applied to the study of bid-ask components in an order driven market such as the Stock Exchange of Thailand. The trade indicator models are appropriate for our purpose to investigate the intraday variations in spread components since they can be easily used to estimate different components for different times of the trading day by introducing time indicator variables. Ahn, Cai, Chee and Ho (2001) and Angelidis and Benos (2005) argue that although this model does not explicitly provide the model for the limit-order book, a limit-order trader can be interpreted as another market maker.

One caveat for this model is that this model ignores the inventory components unlike in Huang and Stoll's model which incorporates the inventory cost component of the spread separately. MRR model decomposes the spread into the permanent component due to information (adverse selection) and the transitory component. This classification approach has also been adopted in two-way decomposition model adopted by Huang and Stoll (1996). This method of decomposition seems to fit well with the order-driven market where the inventory costs are of a less important concern.

We briefly explain the MRR model used for estimating the components of bid-ask spread. Green(2004) asserts that the MRR allows the order flow to be auto-correlated. MRR model suggests that the impact of private information on transaction prices is modeled as an innovation in belief about true price and is a function of a trade initiation variable. The model examines the relationship between the transaction price changes and signed order flow. The investors tend to revise their quotes in response to information revealed in early trade. We denote the price of transaction at time t as Pt., and define Qt to be the buy-sell trade indicator variable for the transaction price. Qt = +1 if the transaction is buyer initiated and –1 if the trade is seller initiated. These buyer-initiated

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trades or seller-initiated trades have an impact on transaction prices through an impact on the unobserved true price of the stock. Transaction price changes include both effect of the information trading and the compensation for liquidity.

The change in transaction price can be described as:

$$\Delta P_t = \alpha (Q_t - Q_{t-1}) + \beta (Q_t - \rho Q_{t-1}) + u_t \qquad (1)$$

Let ΔP_t = Change in price

Q_t = Trade initiation variable

β = The coefficient of private information

α = The coefficient of the transitory element

Ω_{t-1} = Information set at time t-1

u_t = The impact of public information arrived randomly

ρ = The correlation coefficient of trade initiation variable

The first term captures the effect of bid-ask bounce, where $\alpha \geq 0$ denotes the liquidity suppliers' cost per share for supplying liquidity. The second term captures the effect of revision in belief and is the function of the trade initiation, where $\beta \geq 0$ measures the possible asymmetric information revealed by the trade at time t. Equation (1) extends the approach in Glosten and Milgrom (1985) and allows for the autocorrelation in order flows. Now the process on $(Q_t - \rho Q_{t-1})$ is AR(1). In the model, it assumes the true price of stocks depends on the innovation in the trade flow represented by this AR(1) process and depends on the new information arrival reflected in u_{t-1}.

The trade flow is autocorrelated since the continuations of the order are more likely to occur than reversal due to the fact that the informed traders may hide the orders or split the orders into smaller orders upon the trades.

Now, let π denote the probability of a trade continuation on the same side of the bid or ask. Then, the conditional expectation of a trader indicator at time t given Qt-1 is

$$E(Q_t|Q_{t-1}) = (1 - 2\pi)Q_{t-1} \equiv \rho Q_{t-1} \quad (2)$$

where ρ is the first-order autocorrelation of the trade initiation variable. In the absence of adverse selection ($\beta = 0$) and inventory and ordering processing costs ($\alpha = 0$), the model reduces to the classical case where prices follow a random walk. When the autocorrelation of trade indicators variable is zero ($\rho = 0$), the model reduces to the setting in Glosten and Milgrom (1985) which is

$$\Delta P_t = \alpha (Q_t - Q_{t-1}) + \beta (Q_t) + u_t \quad (3)$$

From equation 1: MRR formalizes their equation into:

$$\Delta P_t = (\alpha + \beta)Q_t - (\alpha + \rho\beta) Q_{t-1} + u_t \quad (4)$$

The three parameters (α, β, ρ) govern the behavior of transaction prices and quotes. The parameter β represents the adverse selection components. Green (2004) asserts that, when order flow is auto-correlated, only surprise portion of order flow reveals information. The parameter ρ, represents the first-order autocorrelation coefficient of order flow while the parameter α measures compensation for providing liquidity. MRR estimate the parameter using generalized method of moments (GMM), which imposes very weak distribution assumptions. The GMM procedure also easily accounts for the presence of conditional heteroskedasticity of an unknown form. Specifically, the expectation of the following four population moments is zero:

$$E[f(\Delta p_t, Q_t, Q_{t-1}, \alpha, \beta, \rho)] = 0 \quad (5)$$

$$
\begin{aligned}
E[f(\Delta p_t, Q_t, Q_{t-1}, \alpha, \beta, \rho)] &= E\left[Q_t Q_{t-1} - \rho Q_{t-1}^2 \right] = 0 \\
E[f(\Delta p_t, Q_t, Q_{t-1}, \alpha, \beta, \rho)] &= E\left[u_t - u_0 \right] = 0 \\
E[f(\Delta p_t, Q_t, Q_{t-1}, \alpha, \beta, \rho)] &= E\left[(u_t - u_0) Q_t \right] = 0 \\
E[f(\Delta p_t, Q_t, Q_{t-1}, \alpha, \beta, \rho)] &= E\left[(u_t - u_0) Q_{t-1} \right] = 0
\end{aligned}
\tag{6}
$$

The first equation is the definition of the autocorrelation of trade initiation variable. The second equation defines the drift term as average pricing error where as the third and fourth equation is the OLS estimation for Q_t and Q_{t-1}

5.1 Trade Impact with Trader type

The main focus of our paper is to measure the informational role of trades based on different type of traders. We follow Green (2004) procedures but augment the model to incorporate the indicator variable to account for the trader type. We modify the equation (4) by allowing the parameters to vary depending on different trader type. We include the interaction term into the model to distinguish the buy or sell transactions that are initiated by buyers or sellers. We allow the parameters to change in the model as follow:

$$
\begin{aligned}
\Delta P_t = {} & (\alpha_F + \beta_F) I_{F,t} Q_t + (\alpha_C + \beta_C) I_{C,t} Q_t + (\alpha_M + \beta_M) I_{M,t} Q_t \\
& + (\alpha_p + \beta_p) I_{P,t} Q_t - (\alpha_F + \rho_F \beta_F) I_{F,t} Q_{t-1} - (\alpha_C + \rho_C \beta_C) I_{C,t} Q_{t-1} \\
& - (\alpha_M + \rho_M \beta_M) I_{M,t} Q_{t-1} - (\alpha_P + \rho_P \beta_P) I_{P,t} Q_{t-1} + u_t
\end{aligned}
\tag{7}
$$

$I_{F,t}$, = 1 and $I_{C,t}$, $I_{M,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the foreign investors. $I_{C,t}$ = 1 and $I_{F,t}$, $I_{M,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the retail customers. $I_{M,t}$ = 1 and $I_{F,t}$, $I_{C,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the local institution and $I_{P,t}$ = 1 and $I_{F,t}$, $I_{C,t}$, $I_{M,t}$ = 0 if the buy or sell transaction is initiated by broker's own portfolio.

$$\text{Let} \quad u_t = \Delta P_t - (\alpha_F + \beta_F)I_{F,t}Q_t - (\alpha_C + \beta_C)I_{C,t}Q_t - (\alpha_M + \beta_M)I_{M,t}Q_t - (\alpha_P + \beta_P)I_{P,t}Q_t + (\alpha_F + \rho_F\beta_F)I_{F,t-1}Q_{t-1} + (\alpha_C + \rho_C\beta_C)I_{C,t}Q_{t-1} + (\alpha_M + \rho_M\beta_M)I_{M,t-1}Q_{t-1} + (\alpha_P + \rho_P\beta_P)I_{P,t-1}Q_{t-1} \quad (8)$$

Define

$$x_t = Q_t - \rho_F I_{F,t-1}Q_{t-1} - \rho_C I_{C,t-1}Q_{t-1} - \rho_M I_{M,t-1}Q_{t-1} - \rho_P I_{P,t-1}Q_{t-1} \quad (9)$$

γ = Constant terms

The following moment conditions following MRR and related to equation (7) exactly identify the parameter vector $P = (\gamma, \alpha_F, \alpha_C, \alpha_M, \alpha_P, \beta_F, \beta_C, \beta_M, \beta_P, \rho_F, \rho_C, \rho_M, \rho_P)$:

$$\begin{aligned}
E[\, x_t I_{F,t}Q_{t-1} \,] &= 0 \quad (10)\\
E[\, x_t I_{C,t}Q_{t-1} \,] &= 0\\
E[\, x_t I_{M,t}Q_{t-1} \,] &= 0\\
E[\, x_t I_{P,t}Q_{t-1} \,] &= 0\\
E[\, u_t - \gamma \,] &= 0\\
E[\, (u_t - \gamma)\, I_{F,t}Q_t] &= 0\\
E[\, (u_t - \gamma)\, I_{C,t}Q_t] &= 0\\
E[\, (u_t - \gamma)\, I_{M,t}Q_t] &= 0\\
E[\, (u_t - \gamma)\, I_{P,t}Q_t] &= 0\\
E[\, (u_t - \gamma)\, I_{F,t-1}Q_{t-1} \,] &= 0\\
E[\, (u_t - \gamma)\, I_{C,t-1}Q_{t-1}] &= 0\\
E[\, (u_t - \gamma)\, I_{M,t-1}Q_{t-1}] &= 0\\
E[\, (u_t - \gamma)\, I_{P,t-1}Q_{t-1} \,] &= 0
\end{aligned}$$

The first four moments determine the autocorrelation in the order flow for each type of traders namely, retail customers, foreigners, Local institutions and broker's own

portfolio. The remaining nine equations represent OLS equations. In estimating the parameters of the model, we follow Green (2004) by using the Parzen method with standard errors of the coefficients using Newey-West procedure and we test the statistical significance that compares the restricted and unrestricted GMM using the Log likelihood ratio test.

5.2 Trade around the Earning Announcement

Green (2004) documents the difference between trade impact before and after the earning announcement. The paper extends the idea to incorporate the trade impact before and after the earning announcement. We further generalize the MRR model in equation (4) to allow the parameter estimates to vary around the earning announcements. We add the interaction variable into the model to distinguish among the time before the earning announcement, after the earning announcement and the period with no earning announcement. Green (2004) assert that, if some traders are better informed and are better to determine the price impact of some economic news, either through superior information processing skills or from observation from order flows, theory suggests that the information al role of trading will increase following the economic announcements. We construct the model to measure the effect before earning announcement, after earning announcement and without earning announcement as follow:

$$\begin{aligned}\Delta P_t = {} & (\alpha_B + \beta_B)I_{B,t}Q_t + (\alpha_A + \beta_A)I_{A,t}Q_t + (\alpha_N + \beta_N)I_{N,t}Q_t \\ & - (\alpha_B + \rho_B\beta_B)I_{B,t}Q_{t-1} - (\alpha_A + \rho_A\beta_A)I_{A,t}Q_{t-1} \\ & - (\alpha_N + \rho_N\beta_N)I_{N,t}Q_{t-1} + u_t \end{aligned} \qquad (11)$$

$I_{N,t}$, = 1 and $I_{B,t}$, $I_{A,t}$ = 0 if the buy or sell transaction is initiated in the period without earning announcement. $I_{B,t}$, = 1 and $I_{N,t}$, $I_{A,t}$ = 0 if the buy or sell transaction is initiated in the period 5 days before earning announcement. $I_{A,t}$, = 1 and $I_{B,t}$, $I_{N,t}$ = 0 if the buy or sell transaction is initiated in the period 5 days after earning announcement.

$$\text{Let} \quad u_t = \Delta P_t - (\alpha_B + \beta_B)I_{B,t}Q_t - (\alpha_A + \beta_A)I_{A,t}Q_t - (\alpha_N + \beta_N)I_{N,t}Q_t + (\alpha_B + \rho_B\beta_B)I_{B,t-1}Q_{t-1} + (\alpha_A + \rho_A\beta_A)I_{A,t-1}Q_{t-1} + (\alpha_N + \rho_N\beta_N)I_{N,t-1}Q_{t-1} \tag{12}$$

$$x_t = Q_t - \rho_B I_{B,t-1}Q_{t-1} - \rho_A I_{A,t-1}Q_{t-1} - \rho_N I_{N,t-1}Q_{t-1} \tag{13}$$

$$\gamma = \text{Constant terms}$$

The following moment conditions following MRR and related to equation (11) exactly identify the parameter vector $P = (\gamma, \alpha_B, \alpha_A, \alpha_N, \beta_B, \beta_A, \beta_N, \rho_B, \rho_A, \rho_N)$:

$$\begin{aligned}
E[\, x_t I_{B,t}Q_{t-1} \,] &= 0 \\
E[\, x_t I_{A,t}Q_{t-1} \,] &= 0 \\
E[\, x_t I_{N,t}Q_{t-1} \,] &= 0 \\
E[\, u_t - \gamma \,] &= 0 \\
E[\, (u_t - \gamma)\, I_{B,t}Q_t] &= 0 \\
E[\, (u_t - \gamma)\, I_{A,t}Q_t] &= 0 \\
E[\, (u_t - \gamma)\, I_{N,t}Q_t] &= 0 \\
E[\, (u_t - \gamma)\, I_{B,t-1}Q_{t-1}] &= 0 \\
E[\, (u_t - \gamma)\, I_{A,t-1}Q_{t-1}] &= 0 \\
E[\, (u_t - \gamma)\, I_{N,t-1}Q_{t-1}] &= 0
\end{aligned} \tag{14}$$

The first four moments determine the autocorrelation in the order flow among three time period, before earning announcement, after earning announcement and no earning announcement. The remaining nine equations represent OLS equations. In estimating the parameters of the model, we follow Green (2004) by using the Parzen method with standard errors of the coefficients using Newey-West procedure and we test the statistical significance that compares the restricted and unrestricted GMM using the Log likelihood ratio test.

5.3 Trade around the Dividend Announcement

Green (2004) documents the difference between trade impact before and after the earning announcement. The paper extends the idea to incorporate the trade impact before and after the dividend announcement. We further generalize the MRR model in equation (4) to allow the parameter estimates to vary around the earning announcements. We add the interaction variable into the model to distinguish among the time before the dividend announcement, after the dividend announcement and the period with no dividend announcement. Green (2004) argues that the dividend payment is an important economic event affecting the stock price. We construct the model to measure the effect before dividend announcement, after dividend announcement and without dividend announcement as follow:

$$\begin{aligned}\Delta P_t = {} & (\alpha_{BD} + \beta_{BD})I_{BD,t}Q_t + (\alpha_{AD} + \beta_{AD})I_{AD,t}Q_t \\ & + (\alpha_{ND} + \beta_{ND})I_{ND,t}Q_t - (\alpha_{BD} + \rho_{BD}\beta_{BD})I_{BD,t}Q_{t-1} \\ & - (\alpha_A + \rho_{AD}\beta_{AD})I_{AD,t}Q_{t-1} - (\alpha_{ND} + \rho_{ND}\beta_{ND})I_{ND,t}Q_{t-1} + u_t \end{aligned} \quad (15)$$

$I_{ND,t}$, = 1 and $I_{BD,t}$, $I_{AD,t}$ = 0 if the buy or sell transaction is initiated in the period without dividend announcement. $I_{BD,t}$, = 1 and $I_{ND,t}$, $I_{AD,t}$ = 0 if the buy or sell transaction is initiated in the period 5 days before dividend announcement. $I_{AD,t}$, = 1 and $I_{BD,t}$, $I_{ND,t}$ = 0 if the buy or sell transaction is initiated in the period 5 days after dividend announcement.

$$\begin{aligned}\text{Let } u_t = {} & \Delta P_t - (\alpha_{BD} + \beta_{BD})I_{BD,t}Q_t - (\alpha_{AD} + \beta_{AD})I_{AD,t}Q_t \\ & - (\alpha_{ND} + \beta_{ND})I_{ND,t}Q_t + (\alpha_{BD} + \rho_{BD}\beta_{BD})I_{BD,t-1}Q_{t-1} \\ & + (\alpha_{AD} + \rho_{AD}\beta_{AD})I_{AD,t-1}Q_{t-1} + (\alpha_{ND} + \rho_{ND}\beta_{ND})I_{ND,t-1}Q_{t-1} \end{aligned} \quad (16)$$

$$x_t = Q_t - \rho_{BD}I_{BD,t-1}Q_{t-1} - \rho_{AD}I_{AD,t-1}Q_{t-1} - \rho_{ND}I_{ND,t-1}Q_{t-1} \quad (17)$$

$$\gamma = \text{Constant terms}$$

The following moment conditions following MRR and related to equation (15) exactly identify the parameter vector $P = (\gamma, \alpha_{BD}, \alpha_{AD}, \alpha_{ND}, \beta_{BD}, \beta_{AD}, \beta_{ND}, \rho_{BD}, \rho_{AD}, \rho_{ND})$:

$$
\begin{aligned}
E[x_t I_{BD,t} Q_{t-1}] &= 0 \\
E[x_t I_{AD,t} Q_{t-1}] &= 0 \\
E[x_t I_{ND,t} Q_{t-1}] &= 0 \\
E[u_t - \gamma] &= 0 \\
E[(u_t - \gamma) I_{BD,t} Q_t] &= 0 \\
E[(u_t - \gamma) I_{AD,t} Q_t] &= 0 \\
E[(u_t - \gamma) I_{ND,t} Q_t] &= 0 \\
E[(u_t - \gamma) I_{BD,t-1} Q_{t-1}] &= 0 \\
E[(u_t - \gamma) I_{AD,t-1} Q_{t-1}] &= 0 \\
E[(u_t - \gamma) I_{ND,t-1} Q_{t-1}] &= 0
\end{aligned}
\qquad (18)
$$

The first four moments determine the autocorrelation in the order flow among three time period, before dividend announcement, after dividend announcement and no dividend announcement. The remaining nine equations represent OLS equations. In estimating the parameters of the model, we follow Green (2004) by using the Parzen method with standard errors of the coefficients using Newey-West procedure and we test the statistical significance that compares the restricted and unrestricted GMM using the Log likelihood ratio test.

5.4 Trade around the Earning Announcement Classified by Trader type

The paper extends the idea to incorporate the classification of trader type related to trade impact before and after the earning announcement. We further generalize the MRR model in equation (4) to allow the parameter estimates to vary around the earning announcements classified by trader type. We add the interaction variable into the equation (11) to distinguish among different trader type on the trade impact around

earning announcement. All four types of traders are incorporated into the model by introducing the interaction variables for each trader type into the equation (11). The model to measure the effect before earning announcement, after earning announcement and without earning announcement classified by trader type is as follow:

$$
\begin{aligned}
\Delta P_t = {} & (\alpha_{BF} + \beta_{BF})I_{F,t}I_{B,t}Q_t + (\alpha_{BC} + \beta_{BC})I_{C,t}I_{B,t}Q_t \\
& + (\alpha_{BM} + \beta_{BM})I_{M,t}I_{B,t}Q_t + (\alpha_{BP} + \beta_{BP})I_{P,t}I_{B,t}Q_t \\
& + (\alpha_{AF} + \beta_{AF})I_{F,t}I_{A,t}Q_t + (\alpha_{AC} + \beta_{AC})I_{C,t}I_{A,t}Q_t \\
& + (\alpha_{AM} + \beta_{AM})I_{M,t}I_{A,t}Q_t + (\alpha_{AP} + \beta_{AP})I_{P,t}I_{A,t}Q_t \\
& + (\alpha_{NF} + \beta_{NF})I_{F,t}I_{N,t}Q_t + (\alpha_{NC} + \beta_{NC})I_{C,t}I_{N,t}Q_t \\
& + (\alpha_{NM} + \beta_{NM})I_{M,t}I_{N,t}Q_t + (\alpha_{NP} + \beta_{NP})I_{P,t}I_{N,t}Q_t \\
& - (\alpha_{BF} + \rho_{BF}\beta_{BF})I_{F,t-1}I_{B,t}Q_{t-1} - (\alpha_{BC} + \rho_{BC}\beta_{BC})I_{C,t-1}I_{B,t}Q_{t-1} \\
& - (\alpha_{BM} + \rho_{BM}\beta_{BM})I_{M,t-1}I_{B,t}Q_{t-1} - (\alpha_{BP} + \rho_{BP}\beta_{BP})I_{P,t-1}I_{B,t}Q_{t-1} \\
& - (\alpha_{AF} + \rho_{AF}\beta_{AF})I_{F,t-1}I_{A,t}Q_{t-1} - (\alpha_{AC} + \rho_{AC}\beta_{AC})I_{C,t-1}I_{A,t}Q_{t-1} \\
& - (\alpha_{AM} + \rho_{AM}\beta_{AM})I_{M,t-1}I_{A,t}Q_{t-1} - (\alpha_{AP} + \rho_{AP}\beta_{AP})I_{P,t-1}I_{A,t}Q_{t-1} \\
& - (\alpha_{NF} + \rho_{NF}\beta_{NF})I_{F,t-1}I_{N,t}Q_{t-1} - (\alpha_{NC} + \rho_{NC}\beta_{NC})I_{C,t-1}I_{N,t}Q_{t-1} \\
& - (\alpha_{NM} + \rho_{NM}\beta_{NM})I_{M,t-1}I_{N,t}Q_{t-1} - (\alpha_{NP} + \rho_{NP}\beta_{NP})I_{P,t-1}I_{N,t}Q_{t-1} \\
& + u_t \qquad (19)
\end{aligned}
$$

$I_{N,t}$, = 1 and $I_{B,t}$, $I_{A,t}$ = 0 if the buy or sell transaction is initiated in the period without earning announcement. $I_{B,t}$, = 1 and $I_{N,t}$, $I_{A,t}$ = 0 if the buy or sell transaction is initiated in the period 5 days before earning announcement. $I_{A,t}$, = 1 and $I_{B,t}$, $I_{N,t}$ = 0 if the buy or sell transaction is initiated in the period 5 days after earning announcement. Furthermore, $I_{F,t}$, = 1 and $I_{C,t}$, $I_{M,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the foreign investors. $I_{C,t}$ = 1 and $I_{F,t}$, $I_{M,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the retail customers. $I_{M,t}$ = 1 and $I_{F,t}$, $I_{C,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the local institution and $I_{P,t}$ = 1 and $I_{F,t}$, $I_{C,t}$, $I_{M,t}$ = 0 if the buy or sell transaction is initiated by broker's own portfolio.

Let $u_t = \Delta P_t - (\alpha_{BF} + \beta_{BF})I_{F,t}I_{B,t}Q_t - (\alpha_{BC} + \beta_{BC})I_{C,t}I_{B,t}Q_t$

$$
\begin{aligned}
&- (\alpha_{BM} + \beta_{BM})I_{M,t}I_{B,t}Q_t - (\alpha_{BP} + \beta_{BP})I_{P,t}I_{B,t}Q_t \\
&- (\alpha_{AF} + \beta_{AF})I_{F,t}I_{A,t}Q_t - (\alpha_{AC} + \beta_{AC})I_{C,t}I_{A,t}Q_t \\
&- (\alpha_{AM} + \beta_{AM})I_{M,t}I_{A,t}Q_t - (\alpha_{AP} + \beta_{AP})I_{P,t}I_{A,t}Q_t \\
&- (\alpha_{NF} + \beta_{NF})I_{F,t}I_{N,t}Q_t - (\alpha_{NC} + \beta_{NC})I_{C,t}I_{N,t}Q_t \\
&- (\alpha_{NM} + \beta_{NM})I_{M,t}I_{N,t}Q_t - (\alpha_{NP} + \beta_{NP})\, I_{P,t}I_{N,t}Q_t \\
&+ (\alpha_{BF} + \rho_{BF}\beta_{BF})I_{F,t-1}I_{B,t-1}Q_{t-1} + (\alpha_{BC} + \rho_{BC}\beta_{BC})I_{C,t-1}I_{B,t-1}Q_{t-1} \\
&+ (\alpha_{BM} + \rho_{BM}\beta_{BM})I_{M,t-1}I_{B,t-1}Q_{t-1} + (\alpha_{BP} + \rho_{BP}\beta_{BP})I_{P,t-1}I_{B,t-1}Q_{t-1} \\
&+ (\alpha_{AF} + \rho_{AF}\beta_{AF})I_{F,t-1}I_{A,t-1}Q_{t-1} + (\alpha_{AC} + \rho_{AC}\beta_{AC})I_{C,t-1}I_{A,t-1}Q_{t-1} \\
&+ (\alpha_{AM} + \rho_{AM}\beta_{AM})\, I_{M,t-1}I_{A,t-1}Q_{t-1} + (\alpha_{AP}+\rho_{AP}\beta_{AP})I_{P,t-1}I_{A,t-1}Q_{t-1} \\
&+ (\alpha_{NF} + \rho_{NF}\beta_{NF})I_{F,t-1}I_{N,t-1}Q_{t-1} + (\alpha_{NC} + \rho_{NC}\beta_{NC})I_{C,t-1}I_{N,t-1}Q_{t-1} \\
&+ (\alpha_{NM} + \rho_{NM}\beta_{NM})I_{M,t-1}I_{N,t-1}Q_{t-1} + (\alpha_{NP}+\rho_{NP}\beta_{NP})\, I_{P,t-1}I_{N,t-1}Q_{t-1}
\end{aligned}
\tag{20}
$$

$$
\begin{aligned}
x_t = \; & Q_t - \rho_{BF}\, I_{F,t-1}I_{B,t-1}Q_{t-1} - \rho_{BC}\, I_{C,t-1}I_{B,t-1}Q_{t-1} - \rho_{BM}\, I_{M,t-1}I_{B,t-1}Q_{t-1} \\
& - \rho_{BP}\, I_{P,t-1}I_{B,t-1}Q_{t-1} - \rho_{AF}\, I_{F,t-1}I_{A,t-1}Q_{t-1} - \rho_{AC}\, I_{C,t-1}I_{A,t-1}Q_{t-1} \\
& - \rho_{AM}\, I_{M,t-1}I_{A,t-1}Q_{t-1} - \rho_{AP}\, I_{P,t-1}I_{A,t-1}Q_{t-1} - \rho_{NF}\, I_{F,t-1}I_{N,t-1}Q_{t-1} \\
& - \rho_{NC}\, I_{F,t-1}I_{N,t-1}Q_{t-1} - \rho_{NM}\, I_{M,t-1}I_{N,t-1}Q_{t-1} - \rho_{NP}\, I_{P,t-1}I_{N,t-1}Q_{t-1}
\end{aligned}
\tag{21}
$$

γ = Constant terms

The following moment conditions following MRR and related to equation (19) exactly identify the parameter vector $P = (\gamma, \alpha_{BF}, \alpha_{BC}, \alpha_{BM}, \alpha_{BP}, \alpha_{AF}, \alpha_{AC}, \alpha_{AM}, \alpha_{AP}, \alpha_{NF}, \alpha_{NC}, \alpha_{NM}, \alpha_{NP}, \beta_{BF}, \beta_{BC}, \beta_{BM}, \beta_{BP}, \beta_{AF}, \beta_{AC}, \beta_{AM}, \beta_{AP}, \beta_{NF}, \beta_{NC}, \beta_{NM}, \beta_{NP}, \rho_{BF}, \rho_{BC}, \rho_{BM}, \rho_{BP}, \rho_{AE}, \rho_{AC}, \rho_{AM}, \rho_{AP}, \rho_{NF}, \rho_{NC}, \rho_{NM}, \rho_{NP})$:

$$
\begin{aligned}
E[\, x_t I_{F,t-1}I_{B,t-1}Q_{t-1} \,] &= 0 \\
E[\, x_t I_{C,t-1}I_{B,t-1}Q_{t-1} \,] &= 0 \\
E[\, x_t I_{M,t-1}I_{B,t-1}Q_{t-1} \,] &= 0 \\
E[\, x_t I_{P,t-1}I_{B,t-1}Q_{t-1} \,] &= 0 \\
E[\, x_t I_{F,t-1}I_{A,t-1}Q_{t-1} \,] &= 0
\end{aligned}
\tag{22}
$$

$$E[\, x_t I_{C,t-1} I_{A,t-1} Q_{t-1} \,] = 0$$

$$E[\, x_t I_{M,t-1} I_{A,t-1} Q_{t-1} \,] = 0$$

$$E[\, x_t I_{P,t-1} I_{A,t-1} Q_{t-1} \,] = 0$$

$$E[\, x_t I_{F,t-1} I_{N,t-1} Q_{t-1} \,] = 0$$

$$E[\, x_t I_{C,t-1} I_{N,t-1} Q_{t-1} \,] = 0$$

$$E[\, x_t I_{M,t-1} I_{N,t-1} Q_{t-1} \,] = 0$$

$$E[\, x_t I_{P,t-1} I_{N,t-1} Q_{t-1} \,] = 0$$

$$E[\, u_t - \gamma \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t} I_{B,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{C,t} I_{B,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{M,t} I_{B,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{P,t} I_{B,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t} I_{B,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{C,t} I_{A,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{M,t} I_{A,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{P,t} I_{A,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t} I_{A,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{C,t} I_{N,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{M,t} I_{N,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{P,t} I_{N,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t} I_{N,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t-1} I_{B,t-1} Q_{t-1} \,] = 0$$

$$E[\, (u_t - \gamma) I_{C,t-1} I_{B,t-1} Q_{t-1} \,] = 0$$

$$E[\, (u_t - \gamma) I_{M,t-1} I_{B,t-1} Q_{t-1} \,] = 0$$

$$E[\, (u_t - \gamma) I_{P,t-1} I_{B,t-1} Q_{t-1} \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t-1} I_{A,t-1} Q_{t-1} \,] = 0$$

$$E[\, (u_t - \gamma) I_{C,t-1} I_{A,t-1} Q_{t-1} \,] = 0$$

$$E[\, (u_t - \gamma) I_{M,t-1} I_{A,t-1} Q_{t-1} \,] = 0$$

$$E[\, (u_t - \gamma) I_{P,t-1} I_{A,t-1} Q_{t-1} \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t-1} I_{N,t-1} Q_{t-1} \,] = 0$$

$$E\left[(u_t - \gamma) I_{C,t-1} I_{N,t-1} Q_{t-1}\right] = 0$$

$$E\left[(u_t - \gamma) I_{M,t-1} I_{N,t-1} Q_{t-1}\right] = 0$$

$$E\left[(u_t - \gamma) I_{P,t-1} I_{N,t-1} Q_{t-1}\right] = 0$$

The first twelve moments determine the autocorrelation in the order flow among three time period, before earning announcement, after earning announcement and no earning announcement. The remaining twenty five equations represent OLS equations. In estimating the parameters of the model, we follow Green (2004) by using the Parzen method with standard errors of the coefficients using Newey-West procedure and we test the statistical significance that compares the restricted and unrestricted GMM using the Log likelihood ratio test.

5.5 Trade around the Dividend Announcement Classified by Trader type

The paper extends the idea to incorporate the classification of trader type related to trade impact before and after the dividend announcement. We further generalize the MRR model in equation (4) to allow the parameter estimates to vary around the dividend announcements classified by trader type. We add the interaction variable into the equation (15) to distinguish among different trader type on the trade impact around dividend announcement. All four types of traders are incorporated into the model by introducing the interaction variables for each trader type into the equation (15). The model to measure the effect before dividend announcement, after dividend announcement and without dividend announcement classified by trader type is as follow:

$$\begin{aligned}
\Delta P_t = {} & (\alpha_{BDF} + \beta_{BDE}) I_{F,t} I_{BD,t} Q_t + (\alpha_{BDC} + \beta_{BDC}) I_{C,t} I_{BD,t} Q_t \\
& + (\alpha_{BDM} + \beta_{BDM}) I_{M,t} I_{BD,t} Q_t + (\alpha_{BDP} + \beta_{BDP}) I_{P,t} I_{BD,t} Q_t \\
& + (\alpha_{ADF} + \beta_{ADE}) I_{F,t} I_{AD,t} Q_t + (\alpha_{ADC} + \beta_{ADC}) I_{C,t} I_{AD,t} Q_t \\
& + (\alpha_{ADM} + \beta_{ADM}) I_{M,t} I_{AD,t} Q_t + (\alpha_{ADP} + \beta_{ADP}) I_{P,t} I_{AD,t} Q_t \\
& + (\alpha_{NDF} + \beta_{NDE}) I_{F,t} I_{ND,t} Q_t + (\alpha_{NDC} + \beta_{NDC}) I_{C,t} I_{ND,t} Q_t \\
& + (\alpha_{NDM} + \beta_{NDM}) I_{M,t} I_{ND,t} Q_t + (\alpha_{NDP} + \beta_{NDP}) I_{P,t} I_{ND,t} Q_t \\
& - (\alpha_{BDF} + \rho_{BDF} \beta_{BDE}) I_{F,t-1} I_{BD,t} Q_{t-1} - (\alpha_{BDC} + \rho_{BDC} \beta_{BDC}) I_{C,t-1} I_{BD,t} Q_{t-1}
\end{aligned}$$

$$- (\alpha_{BDM}+\rho_{BDM}\beta_{BDM})I_{M,t-1}I_{BD,t}Q_{t-1}-(\alpha_{BDP}+\rho_{BDP}\beta_{BDP})I_{P,t-1}I_{BD,t}Q_{t-1}$$
$$- (\alpha_{ADF}+\rho_{ADF}\beta_{ADF})I_{F,t-1}I_{AD,t}Q_{t-1}-(\alpha_{ADC}+\rho_{ADC}\beta_{ADC})I_{C,t-1}I_{AD,t}Q_{t-1}$$
$$- (\alpha_{ADM}+\rho_{ADM}\beta_{ADM})I_{M,t-1}I_{AD,t}Q_{t-1}-(\alpha_{ADP}+\rho_{ADP}\beta_{ADP})I_{P,t-1}I_{AD,t}Q_{t-1}$$
$$- (\alpha_{NDF}+\rho_{NDF}\beta_{NDF})I_{F,t-1}I_{ND,t}Q_{t-1}-(\alpha_{NDC}+\rho_{NDC}\beta_{NDC})I_{C,t-1}I_{ND,t}Q_{t-1}$$
$$- (\alpha_{NDM}+\rho_{NDM}\beta_{NDM})I_{M,t-1}I_{ND,t}Q_{t-1}-(\alpha_{NDP}+\rho_{NDP}\beta_{NDP})I_{P,t-1}I_{ND,t}Q_{t-1}$$
$$+ u_t \qquad (23)$$

$I_{ND,t}$, = 1 and $I_{BD,t}$, $I_{AD,t}$ = 0 if the buy or sell transaction is initiated in the period without dividend announcement. $I_{BD,t}$, = 1 and $I_{ND,t}$, $I_{AD,t}$ = 0 if the buy or sell transaction is initiated in the period 5 days before dividend announcement. $I_{AD,t}$, = 1 and $I_{BD,t}$, $I_{ND,t}$ = 0 if the buy or sell transaction is initiated in the period 5 days after dividend announcement. . Furthermore, $I_{F,t}$, = 1 and $I_{C,t}$, $I_{M,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the foreign investors. $I_{C,t}$ = 1 and $I_{F,t}$, $I_{M,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the retail customers. $I_{M,t}$ = 1 and $I_{F,t}$, $I_{C,t}$, $I_{P,t}$= 0 if the buy or sell transaction is initiated by the local institution and $I_{P,t}$ = 1 and $I_{F,t}$, $I_{C,t}$, $I_{M,t}$ = 0 if the buy or sell transaction is initiated by broker's own portfolio.

Let u_t =

$$\Delta P_t - (\alpha_{BDF} + \beta_{BDF})I_{F,t}I_{BD,t}Q_t - (\alpha_{BDC} + \beta_{BDC})I_{C,t}I_{BD,t}Q_t$$
$$- (\alpha_{BDM} + \beta_{BDM})\, I_{M,t}I_{BD,t}Q_t - (\alpha_{BDP} + \beta_{BDP})I_{P,t}I_{BD,t}Q_t$$
$$- (\alpha_{ADF} + \beta_{ADF})I_{F,t}I_{AD,t}Q_t - (\alpha_{ADC} + \beta_{ADC})I_{C,t}I_{AD,t}Q_t$$
$$- (\alpha_{ADM} + \beta_{ADM})I_{M,t}I_{AD,t}Q_t - (\alpha_{ADP} + \beta_{ADP})I_{P,t}I_{AD,t}Q_t$$
$$- (\alpha_{NDF} + \beta_{NDF})I_{F,t}I_{ND,t}Q_t - (\alpha_{NDC} + \beta_{NDC})I_{C,t}I_{ND,t}Q_t$$
$$- (\alpha_{NDM} + \beta_{NDM})I_{M,t}I_{ND,t}Q_t - (\alpha_{NDP} + \beta_{NDP})I_{P,t}I_{ND,t}Q_t$$
$$+ (\alpha_{BDF}+\rho_{BDF}\beta_{BDF})I_{F,t-1}I_{BD,t-1}Q_{t-1}$$
$$+ (\alpha_{BDC}+\rho_{BDC}\beta_{BDC})I_{C,t-1}I_{BD,t-1}Q_{t-1}$$
$$+ (\alpha_{BDM}+\rho_{BDM}\beta_{BDM})I_{M,t-1}I_{BD,t-1}Q_{t-1}$$
$$+ (\alpha_{BDP}+\rho_{BDP}\beta_{BD})_P I_{P,t-1}I_{BD,t-1}Q_{t-1}$$
$$+ (\alpha_{ADF}+\rho_{ADF}\beta_{ADF})I_{F,t-1}I_{AD,t-1}Q_{t-1}$$
$$+ (\alpha_{ADC}+\rho_{ADC}\beta_{ADC})\, I_{C,t-1}I_{AD,t-1}Q_{t-1}$$
$$+ (\alpha_{ADM}+\rho_{ADM}\beta_{ADM})I_{M,t-1}I_{AD,t-1}Q_{t-1}$$

$$+ (\alpha_{ADP}+\rho_{ADP}\beta_{ADP})I_{P,t-1}I_{AD,t-1}Q_{t-1}$$
$$+ (\alpha_{NDF}+\rho_{NDF}\beta_{NDF})I_{F,t-1}I_{ND,t-1}Q_{t-1}$$
$$+ (\alpha_{NDC}+\rho_{NDC}\beta_{NDC})I_{C,t-1}I_{ND,t-1}Q_{t-1}$$
$$+ (\alpha_{NDM}+\rho_{NDM}\beta_{NDM})I_{M,t-1}I_{ND,t-1}Q_{t-1}$$
$$+ (\alpha_{NDP}+\rho_{NDP}\beta_{NDP})I_{P,t-1}I_{ND,t-1}Q_{t-1} \quad (24)$$

$$x_t = Q_t - \rho_{BDF}I_{F,t-1}I_{BD,t-1}Q_{t-1} - \rho_{BDC}I_{C,t-1}I_{BD,t-1}Q_{t-1} - \rho_{BDM}I_{M,t-1}I_{BD,t-1}Q_{t-1}$$
$$- \rho_{BDP}I_{P,t-1}I_{BD,t-1}Q_{t-1} - \rho_{ADF}I_{F,t-1}I_{AD,t-1}Q_{t-1} - \rho_{ADC}I_{C,t-1}I_{AD,t-1}Q_{t-1}$$
$$- \rho_{ADM}I_{M,t-1}I_{AD,t-1}Q_{t-1} - \rho_{ADP}I_{P,t-1}I_{AD,t-1}Q_{t-1} - \rho_{NDF}I_{F,t-1}I_{ND,t-1}Q_{t-1}$$
$$- \rho_{NDC}I_{F,t-1}I_{ND,t-1}Q_{t-1} - \rho_{NDM}I_{M,t-1}I_{ND,t-1}Q_{t-1} - \rho_{NDP}I_{P,t-1}I_{ND,t-1}Q_{t-1} \quad (25)$$

γ = Constant terms

The following moment conditions following MRR and related to equation (23) exactly identify the parameter vector $P = (\gamma, \alpha_{BDF}, \alpha_{BDC}, \alpha_{BDM}, \alpha_{BDP}, \alpha_{ADF}, \alpha_{ADC}, \alpha_{ADM}, \alpha_{ADP}, \alpha_{NDF}, \alpha_{NDC}, \alpha_{NDM}, \alpha_{NDP}, \beta_{BDF}, \beta_{BDC}, \beta_{BDM}, \beta_{BDP}, \beta_{ADF}, \beta_{ADC}, \beta_{ADM}, \beta_{ADP}, \beta_{NDF}, \beta_{NDC}, \beta_{NDM}, \beta_{NDP}, \rho_{BDF}, \rho_{BDC}, \rho_{BDM}, \rho_{BDP}, \rho_{ADF}, \rho_{ADC}, \rho_{ADM}, \rho_{ADP}, \rho_{NDF}, \rho_{NDC}, \rho_{NDM}, \rho_{NDP})$:

$$E[x_t I_{F,t-1}I_{BD,t-1}Q_{t-1}] = 0 \quad (26)$$
$$E[x_t I_{C,t-1}I_{BD,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{M,t-1}I_{BD,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{P,t-1}I_{BD,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{F,t-1}I_{AD,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{C,t-1}I_{AD,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{M,t-1}I_{AD,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{P,t-1}I_{AD,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{F,t-1}I_{ND,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{C,t-1}I_{ND,t-1}Q_{t-1}] = 0$$
$$E[x_t I_{M,t-1}I_{ND,t-1}Q_{t-1}] = 0$$

$$E[\, x_t I_{P,t-1} I_{ND,t-1} Q_{t-1} \,] = 0$$

$$E[\, u_t - \gamma \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t} I_{BD,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{C,t} I_{BD,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{M,t} I_{BD,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{P,t} I_{BD,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t} I_{AD,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{C,t} I_{AD,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{M,t} I_{AD,t} Q_t] = 0$$

$$E[\, (u_t - \gamma) I_{P,t} I_{AD,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t} I_{ND,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{C,t} I_{ND,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{M,t} I_{ND,t} Q_t] = 0$$

$$E[\, (u_t - \gamma) I_{P,t} I_{ND,t} Q_t \,] = 0$$

$$E[\, (u_t - \gamma) I_{F,t-1} I_{BD,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{C,t-1} I_{BD,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{M,t-1} I_{BD,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{P,t-1} I_{BD,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{F,t-1} I_{AD,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{C,t-1} I_{AD,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{M,t-1} I_{AD,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{P,t-1} I_{AD,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{F,t-1} I_{ND,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{C,t-1} I_{ND,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{M,t-1} I_{ND,t-1} Q_{t-1}] = 0$$

$$E[\, (u_t - \gamma) I_{P,t-1} I_{ND,t-1} Q_{t-1}] = 0$$

The first twelve moments determine the autocorrelation in the order flow among three time period, before earning announcement, after earning announcement and no earning announcement. The remaining twenty five equations represent OLS equations.

In estimating the parameters of the model, we follow Green (2004) by using the Parzen method with standard errors of the coefficients using Newey-West procedure and we test the statistical significance that compares the restricted and unrestricted GMM using the Log likelihood ratio test.

Chapter VI: Empirical Findings

Components of the Effective Spread and Asymmetric Information classified by Trader type

If the foreign investors possess superior information through better information or better observation of the order flow, the coefficient of asymmetric information should be greater. Table 5 presents summary statistics on the mean of individual parameter estimates governing the stochastic process for transaction price changes across 50 stocks listed in the Set50 index. The table presents the mean coefficient estimate for order processing cost (α), information asymmetric cost or adverse selection cost (β) and the autocorrelation of the order flow (ρ). From the table, the mean of asymmetric information cost is 0.0429 which is much larger than that of the retail customers. This suggests that the foreign investors may possess more informed trades than the retail customers. In addition, the broker-owned portfolio exhibits the highest degree of informed trading. On the other hand, the mean of order processing cost for the retail customer is largest and more than twice of the ordering cost for the foreign investors. For the foreign investors, the order processing cost is relatively small as compared to asymmetric information cost. The order processing cost for the broker-owned portfolio is also large. From this observation, we can observe the inverse relationship between the order processing cost and asymmetric information cost.

We also perform the Chi-squared statistic for the log-likelihood ratio test (LR test) that β for different group of investors is equal or not. The average p-value over the sample is 0.0001. We will reject the hypothesis that the asymmetric information cost does not differ among different type of traders. The rejection leads us to conclude that there is a difference in asymmetric information cost across all trader type. The β represents magnitudes of the cost as signal in the order flow. The high β represents better information that the foreign investors have over the retail customers. Order flow contains more information for the foreign investors who may have a better access to information. In addition, to the LR test, for each of the coefficient estimate, we also conduct standard

t-test to test significance of all parameters. The test indicates that all of the parameters are statistically significantly different from 0 with p-values less than 0.0001. The autocorrelation of order flow (ρ) across all types of traders are quite similar and are positive ranging from 0.70 to 0.76. LR test suggests that they are statistically significantly different. This suggests that there has been great autocorrelation in the order flow.

In addition, MRR (1997) point out that the coefficient estimates of the model provide estimates in real number. The gross effective spread can be computed by $2(\alpha + \beta)$. Therefore, we compute the percentage of the asymmetric information cost from the gross effective spread. The result shows that the foreign investors exhibit a very strong asymmetric information component about 54 percent of the total spread. The retail customers exhibit the weakest level of this cost. It is worth mentioning here that the other groups also exhibit great degree of asymmetric information.

Lee, Liu, Roll and Subrahmanyam (2004) use the market capitalization to compute the weighted average order imbalance. They argue that the market value weighted should better reflect the average over several stocks in the sample with various sizes. We apply this method to compute the weighted average order processing cost (α) and information asymmetric cost (β). The result in Table 5 Panel B presents the market value weighted coefficient estimates. All coefficients estimates have increased. The asymmetric information cost increases for the foreign investors and retail customers to 0.0770 and 0.0280. The percentage of asymmetric information in the effective spread increases to 63 percent for the foreign investors. The result for each individual stock is presented in appendix A. The interesting finding is that, for all stocks, the beta coefficients that represent the asymmetric information cost are higher for the foreign investors than for the retail customers. This evidence strongly confirms the previous result that the foreign investors are better informed than the retail local customers. To ensure our robustness of the result, we estimate the model parameter for each year from 1999 to 2003 which is shown in table 6. The detail of the estimate can be found in Appendix B to F. We find a strong consistent trend that the foreign investors incurs

higher cost of asymmetric information across several years even though the degree of informed trading is not similar in every year. The broker-owned portfolio represents the group with the highest degree of asymmetric information. The degree of asymmetric information for all groups of traders decreases over the year and is minimum in 2003. This corresponds to the time of high volume of trading. This suggests less degree of asymmetric information in the order flow during the time of high frequency of trading.

From the estimates that we have done for each stocks, we further study the factors that might be related to the asymmetric cost. Lee, Liu, Roll and Subrahmanyam (2004) suggest the relationship between the market capitalization and the market order imbalance which is their proxy for informed trading. Kang and Stulz (1997) document the relationship between the foreign portfolio equity ownership and the informed trading of foreigners. Brennan and Henry (1997) document the relationship between informed trading and international portfolio investment flows. We group the stocks based on the market capitalization, foreign turnover (value), foreign ownership into three groups, high, medium and low. We use foreign turnover as the proxy for the liquidity. Each of the group contains approximately same number of stocks. Then, we compute the simple average of α and β for each group. The result is tabulated in table 7. The percentage of asymmetric information cost is highest at 32.30% for retail customers for the stocks with small market capitalization. The percentage seems to vary depending on the size of the stocks. Foreign investors exhibit high degree of asymmetric information across all type of market capitalization. Broker-owned portfolio exhibits the greatest degree of asymmetric information in the stocks with low market capitalization. In all groups of stocks, foreign investors exhibit the largest degree of asymmetric information.

For the foreign investors, the stocks with highest foreign turnover exhibit the highest degree of asymmetric information of 71.86 percent. In all other type of traders, the highest degree of asymmetric information exists with the stocks with low foreign turnover. This suggests that the group of stocks traded by foreign investors and other group of traders might differ. Therefore, the relationship between asymmetric

information cost and liquidity is still inconclusive. In addition, the order processing cost for all groups of investors tends to increase following the foreign turnover.

In the transactions traded by all groups of traders, the stocks with highest degree of foreign holding exhibit highest level of asymmetric information cost. The cost for foreign investors, domestic institution and broker-own portfolio exhibits high degree of information asymmetry at 74.63 percent, 61.52 percent and 60.68 percent respectively.

Information Asymmetry and Earning Announcement

Green (2004) argues that if some traders are better at determining the precise impact of economic news on price, either through superior information processing skills or access to customer order flow, theory suggests that the informational role of trading will increase following the economic announcement. Our study focuses on the behavior of each stock before and after the earning announcement. We augment the MRR (1997) model to incorporate the event before and after the earning announcement and observe the difference in the degree of asymmetric information. Table 8 Panel A presents the coefficient estimates for the sample of all stocks under study 5 days before and 5 days after earning announcement. For each of the coefficient estimate, we also conduct standard t-test to test significance of all parameters. The test indicates that all of the parameters are statistically significantly different from 0 with p-values less than 0.0001. The adverse selection parameter (β) has changed from 0.0304 to 0.0485 which represents an increase of 59.5 percent over the period before the earning announcement. The result corresponds to the result reported in Green (2004). On the hand, the order processing cost tends to decrease after the announcement. The percentage of asymmetric information costs increases from 32.45 percent to 36.02 percent and higher than 30.53 percent over the period with no earning announcement. The Chi-squared statistic for the log likelihood ratio test of the restriction rejects the hypothesis that the coefficient estimate is similar and it shows the p-value of 0.0001. The increase in asymmetric information cost suggests that the order flow contains small amount of information before the announcement and much more afterwards.

The autocorrelation of the order flow (ρ) varies little from 0.7194 to 0.7011. Smaller autocorrelation suggests that there is less chance that the order will be broken down into different trades. Table 8 Panel B computes the coefficient using the market capitalization as the weight for each stock. It is obvious that all of the average coefficient estimates are higher than the simple average. The asymmetric information cost becomes highest after the earning announcement to 0.0643 and the percentage of information asymmetry of 36.02 percent. The order processing cost becomes smallest after the earning announcement. The results correspond to the theory that suggests an increase in the asymmetric information following the announcement. We can conclude that after the earning announcement, the degree of information asymmetry increases as the information is more implicit in the order flow. Then, we try to understand the factors that may be related to the information asymmetry. We group the stocks based on the market capitalization, foreign turnover (value), foreign ownership into three groups, high, medium and low. Each of the group contains approximately same number of stocks. Then, we compute the simple average of α and β for each group. The result is tabulated in table 9. The preliminary result suggests that the asymmetric information tends to increase following the earning announcement regardless of the market capitalization, foreign turnover and foreign ownership. In all events, stocks with the low market capitalization tend to have higher degree of information asymmetry. For example, in the period after the earning announcement, the coefficient estimate is 0.0713 representing 78.03 percent of total spreads. As company size becomes larger, the percentage dissipates. In all of the events, the information asymmetry seems to dominate the order processing cost. High information asymmetry may arise from the fact that the small cap firm can easily announce a surprise in earning that represents large deviation from the analyst forecast. This is less likely in the large cap companies. In addition, the percentage of information asymmetry after the earning announcement is highest for all sizes of stocks. This confirms the strong information implicit in the trade in all stocks with various sizes.

With regards to the foreign turnover, the result is mixed. The company with high turnover exhibits large asymmetric information cost of 43.92 percent while the degree is largest for the company with lowest turnover after the earning announcement. In the period of no earning announcement, the degree is highest (66.17%) with the medium turnover. Nonetheless, the information asymmetry increases after the earning announcement while the order processing cost is lower. This corresponds to the result by Green (2004). Then, we analyze the degree of asymmetric information with relationship to the foreign ownership. The result supports the increase in the degree of asymmetric information following the announcement of earning in all of the companies with various foreign ownerships. But the result for each size of ownership is mixed.

Earning Announcement and Trader Type

We further investigate on the issue of traders' response to the earning announcement. We focus on the order processing cost and asymmetric information cost for foreign investors and domestic retail customers. Table 10 presents asymmetric information cost. (Details of all parameters are provided in Appendix G) The adverse selection cost of 0.0892 is greatest after the earning announcement for the foreign investors. This amount is almost twice of the costs in the period of no earning announcement. The result is consistent with Green (2004) on the effect of asymmetric information after the announcement. For the retail customers, the degree of asymmetric information is strongest before the earning announcement but the amount is very small. Then if we consider the percentage of the cost within the effective spread, for the foreign investors, the highest degree of asymmetric information arises before the earning announcement whereas the retail customers have the largest information asymmetry after the earning announcement. This suggests contradicting result to the absolute term. The autocorrelation suggests the high correlation in the order flow after the earning announcement for the foreign investors and before the earning announcement for the retail customers. The order processing cost for the foreign investors are smaller than that of the retail customers. Green (2004) argues that the negative order processing may arise from the competitive bidding for the order.

Information Asymmetry and Dividend Announcement

Table 11 presents the parameter estimates for the coefficients representing the order processing cost and information asymmetry for the event before and after the dividend announcement. For each of the coefficient estimate, we also conduct standard t-test to test significance of all parameters. The test indicates that all of the parameters are statistically significantly different from 0 with p-values less than 0.0001. The adverse selection parameter (β) has increased to 0.0331 or 53.09% of total spread before the dividend announcement. However, the degree of information asymmetry vanishes after the dividend announcement. The increase in the asymmetric information before the announcement of the dividend may arise from the expectation of the investors on the dividend. After the announcement, the asymmetric cost tends to dissipate. During the period before dividend payment the coefficient of order processing cost decreases. The percentage of information asymmetry increases before the dividend announcement and decreases afterwards. Nonetheless the degree after the announcement is still larger than in the period with no announcement. In addition, during such period, the autocorrelation of the order flow also increases. Table 11 Panel B shows the weighted average coefficient based on market capitalization. The information asymmetry coefficient exhibits the largest amount of 0.0563 or 49.49% of total spread before the dividend announcement and dissipates afterwards.

Table 12 identifies the possible related factor to asymmetric information. We classify the order processing cost and asymmetric information cost based on market capitalization, foreign turnover and foreign ownership. The asymmetric information cost is highest before the dividend announcement for stocks in all groups. This suggests that the investors create the expectation about the company dividend and this information is inherited in the order flow. For the period before announcement and after announcement, the cost tends to be high for the large cap and small cap stocks. The result also shows that the degree of asymmetric information is highest for stocks with high foreign turnover in the events of the medium and low turnover. This suggests that the expectation about

the dividend is well forecasted in the stocks with more liquidity or high foreign turnover. The level of cost is high for the stocks with high and low foreign turnover. The degree of asymmetric information seems to be mixed for all stocks with various foreign ownerships. However, the information asymmetry still dominates in the period before the dividend announcement in all stocks with various foreign ownerships.

Dividend Announcement and Trader type

We investigate on the issue of traders' response to the dividend announcement. The result is presented in table 13. (Details of all parameters are provided in Appendix H) We focus on the order processing cost and asymmetric information cost for foreign investors and domestic retail customers. The adverse selection cost of 0.0432 is greatest before the dividend announcement for the foreign investors. This amount has increased a bit as compared to the period of no announcement. For the retail customers, the degree of asymmetric information is strongest before the dividend announcement but the amount is very small as compared to the ordering cost. The discrepancies may stem from the fact that the foreign investors respond to the dividend announcement in the order flow. Then if we consider the percentage of the cost within the effective spread, for the foreign investors, the highest degree of asymmetric information arises before the dividend announcement whereas the retail customers have the largest information asymmetry before the dividend announcement. The autocorrelation suggests the high correlation in the order flow after the dividend announcement for the foreign investors and before the dividend announcement for the retail customers. The order processing cost for the foreign investors are smaller than that of the retail customers. In conclusion, the cost of asymmetric information exhibits clearly among the foreign investors while it is relatively small for the retail customers. Foreign investors are concerned more about dividend after the announcement.

Chapter VII: Conclusion

Our research finds out that the foreign investors are indeed informed traders and incur higher cost of asymmetric information. The degree of informed trading varies year by year with relatively consistent pattern. The asymmetric information shows an inverse relationship with the order processing cost in all of the trader type. The retail customers incur the lowest cost of informed trading. The foreigners may possess better information that the retail customers do not have access or cannot analyze or they can see the irregularities in the order flow. They are willing to trade on that information and pay the asymmetric information cost and this is revealed in the order flow. Our finding supports previous literature which endorses the better information that foreign investors possess. We further investigate the characteristic underlying the degree of informed trading and find out that the highest degree of informed trading occur with stock with large market capitalization and high foreign turnover. This supports our contention about the better information that the foreign investors have.

In addition, we find out that the degree of informed trading is not similar before and after the news announcement. We investigate two scheduled announcement, earning announcement and dividend announcement. The adverse selection parameter (β) has changed from 0.0304 to 0.0485 after the earning announcement which represents an increase of 59.5 percent. The result corresponds to the result reported in Green (2004). On the hand, the order processing cost tends to decrease after the announcement. The percentage of asymmetric information costs increases from 32.45 percent to 36.02 percent and higher than 30.53 percent over the period with no earning announcement. On the other hand, the adverse selection parameter (β) has increased to 0.0432 or 74% of total spread before the dividend announcement. However, the degree of information asymmetry vanishes after the dividend announcement. This also occurs with the retail customers but not the local institutions or broker-owned portfolio. When we investigate the issue further, we find out that the foreign investors incur the highest cost of informed trading as compared to other trader type.

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Table I
Summary of Securities in the Sample

The sample includes the fifty most liquid and largest stocks contained in the SET50 index as of December 31, 2003.The sample period covers between January 1, 1999 and December 31, 2003. Market capitalization is as of the end of 2003.

Industry	Name	Market Cap. Mill THB	Avg daily no of trade	Total No of trades	% transaction by foreigners	% volume by foreign	% value by foreign	% foreign holding
Agriculture	CPF	25,162	447	548,745	37.62%	21.16%	19.75%	23.67%
	TUF	26,632	134	164,393	4.59%	33.46%	33.85%	35.40%
Banking	BAY	40,218	744	914,495	36.91%	14.67%	15.29%	25.98%
	BBL	208,064	682	838,329	61.40%	38.06%	36.75%	29.58%
	BOA	34,137	423	520,459	2.50%	55.22%	56.07%	80.77%
	BT	107,528	594	397,656	2.58%	7.02%	6.34%	3.42%
	DTDB	8,841	322	369,482	20.13%	14.29%	12.99%	65.52%
	IFCT	7,966	397	488,351	17.97%	14.02%	12.78%	14.91%
	KTB	70,275	878	1,079,230	50.42%	18.01%	17.64%	6.39%
	SCB	173,968	537	659,389	24.54%	18.46%	18.96%	35.54%
	TFB	153,014	912	1,120,963	16.47%	18.86%	19.49%	27.56%
	TMB	59,325	1098	1,346,636	25.05%	6.65%	6.83%	3.44%
Building Material	SCC	304,800	311	382,608	24.17%	37.28%	41.97%	13.88%
	SCCC	57,000	133	163,197	14.27%	29.84%	32.06%	74.68%
Chemical	TPI	107,530	863	1,049,781	21.66%	6.80%	7.49%	10.29%
	TPIPL	23,345	356	435,230	7.42%	5.60%	5.24%	0.54%
	VNT	15,983	403	495,651	15.43%	19.02%	19.35%	51.53%
Electronics	CCET	10,066	118	86,720	19.93%	28.32%	28.79%	85.99%
	DELTA	31,485	250	306,978	8.38%	42.28%	44.01%	83.40%
	HANA	9,828	361	443,626	9.61%	28.85%	32.34%	75.16%
Energy	BANPU	34,595	324	398,188	9.94%	22.88%	27.70%	22.98%
	EGCOMP	47,382	236	289,436	11.65%	25.10%	22.74%	29.42%
	PTT	517,491	1006	510,922	15.02%	37.99%	34.22%	7.13%
	PTTEP	86,117	488	599,567	23.73%	42.48%	45.21%	14.68%
	RATCH	71,050	358	278,180	4.03%	21.91%	20.87%	2.18%
Entertainment	BEC	45,200	246	302,123	54.00%	55.22%	56.07%	17.55%
	GRAMMY	10,000	139	165,947	90.60%	25.63%	28.03%	15.01%
	MAJOR	9,403	331	131,600	1.22%	14.15%	14.22%	5.31%
	UBC	21,291	327	401,290	16.16%	24.56%	25.61%	40.80%
Finance & Security	ASL	3,460	789	968,689	9.98%	6.84%	6.69%	0.54%
	AST	11,639	222	272,026	4.24%	11.25%	12.59%	43.21%
	CNS	5,054	250	306,709	33.81%	13.64%	13.03%	44.23%
	KGI	7,876	1352	859,842	7.96%	5.60%	5.27%	30.45%
	KK	15,889	711	873,223	18.18%	16.25%	17.85%	29.00%
	NFS	22,264	1070	1,315,526	37.31%	12.10%	12.26%	34.10%
	SPL	5,173	505	620,474	60.28%	19.21%	22.53%	1.85%
	TISCO	23,309	577	709,369	16.34%	21.44%	22.74%	50.89%
Property	GOLD	7,433	351	430,770	6.66%	18.73%	17.51%	44.44%
	ITD	51,568	540	657,460	8.18%	14.25%	15.13%	10.88%
	LH	87,423	413	507,435	11.11%	40.30%	37.03%	31.71%
	QH	4,228	503	617,770	28.19%	15.87%	17.39%	15.29%
Telecommunication	ADVANC	249,774	234	287,368	12.07%	34.85%	39.48%	36.23%
	JASMIN	8,089	493	573,768	3.00%	7.85%	9.69%	0.88%
	SATTEL	14,656	457	561,820	5.63%	9.14%	10.02%	4.88%
	SHIN	113,888	565	694,618	20.37%	15.09%	15.45%	9.91%
	TA	26,970	515	633,271	10.66%	21.08%	20.51%	31.53%
	TT&T	14,190	652	800,991	39.08%	8.05%	8.84%	18.22%
	UCOM	13,040	382	469,226	9.59%	8.00%	8.20%	32.51%
Transportation	BECL	19,250	393	482,442	23.68%	23.41%	25.08%	21.65%
	THAI	63,350	216	282,925	16.00%	32.75%	35.52%	8.29%
Mean		62,832	495	556,298	20.59%	21.67%	22.31%	28.07%
Median		26,632	423	501,543	16.08%	18.94%	19.42%	24.83%
Stdev		93,195	277	299,082	17.96%	12.53%	12.92%	23.28%
Max		517,491	1352	1,346,636	90.60%	55.22%	56.07%	85.99%
Min		3,460	118	86,720	1.22%	5.60%	5.24%	0.54%

Table II
Summary Statistics of Deal File

Trade statistics on the Stock Exchange of Thailand(SET) were computed from January 1,1999 through December 31, 2003, for 1,277 days, for the fifty most active and largest stocks listed in the SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 and December 31, 2003. Panel A presents the statistics which were tabulated for all stocks in SET and stocks listed in SET50 index. Panel B presents the statistics for each trader type including retail customers foreign investors, local institution and brokerage owned portfolio. Means, medians and standard deviation are computed over the entire sample period.

Panel A: Deal file					
	Mean	Median	Stdev	Max	Min
Stocks in SET					
Deal volume	13,490	4,700	46,452	10,000,000	1
Deal price (baht)	28	12	67	1,412	0
Deal value	124,668	46,860	284,716	238,821,675	1
Number of deals	76,525,720				
Stocks in SET50 index					
Deal volume	9,691	3,000	26,849	3,000,000	100
Deal price (baht)	41	19	80	1,412	1
Deal value	154,444	59,375	335,973	1,291,000	2,300
Number of deals	26,937,831				
Panel B: Deal File Classified by Trader Type					
Stocks in SET50 index					
Retail Customers					
Deal volume	10,006	3,000	27,750	100,000	100
Deal price (baht)	32	17	57	1,412	1
Deal value	137,408	54,000	300,640	1,291,000	100
Number of deals	21,000,177				
Foreign Investors					
Deal volume	8,853	2,500	24,134	3,000,000	100
Deal price (baht)	74	30	124	1,406	1
Deal value	215,273	86,000	441,790	40,885,000	100
Number of deals	4,305,469				
Local Institution					
Deal volume	7,277	2,000	20,009	2,000,000	100
Deal price (baht)	72	32	72	1,406	2
Deal value	193,913	79,230	386,019	1,720,000	200
Number of deals	1,346,472				
Broker-owned portfolio					
Deal volume	12,392	4,900	31,041	2,000,000	100
Deal price (baht)	45	22	94	1,406	1
Deal value	238,859	88,000	481,586	32,200,000	240
Number of deals	285,713				

Table III

Number of stocks traded classified by trader type

The table provides the summary of the number of stocks traded on each year classified by trader type. The data covers the period from January 1, 1999 to December 31, 2003, 1,277 trading days. The table presents number of transactions, percentage of transactions,number of stocks,number of stocks with more than 5,000 transactions and number of stocks with more than 12,500 transactions per year.The table presents the data for each trader type including foreign investors, retail customers, local institution and broker owned portfolio.

	1999	2000	2001	2002	2003	All years
Foreign investors						
Number of transactions	1,228,994	764,514	815,129	1,402,661	2,440,243	6,651,541
% of transactions	11%	10%	7%	9%	8%	9%
No. of stocks	415	358	344	368	402	
No. of stocks with more than 5,000 transaction per year	69	51	43	77	121	
No of stocks with more than 12,500 transaction per year	54	43	40	70	80	
% of transactions in SET50	65.81%	82.62%	67.79%	64.39%	57.76%	
Retail customers						
Number of transactions	9,412,098	6,654,861	10,141,037	13,750,808	27,174,695	67,133,499
Percentage of transactions	84%	85%	87%	84%	88%	88%
No. of stocks	424	389	378	387	415	
No. of stocks with more than 5,000 transaction per year	151	145	206	218	262	
No of stocks with more than 12,500 transaction per year	132	130	160	201	234	
% of transactions in SET50	38.80%	39.78%	36.67%	28.15%	26.17%	
Local institution						
Number of transactions	279,004	241,427	240,848	478,512	971,329	2,211,120
Percentage of transactions	3%	3%	2%	3%	3%	3%
No. of stocks	223	181	207	241	309	
No. of stocks with more than 5,000 transaction per year	21	16	13	37	57	
No of stocks with more than 12,500 transaction per year	2	1	0	5	18	
% of transactions in SET50	66.65%	80.72%	78.32%	60.35%	50.49%	
Broker-owned portfolio						
Number of transactions	74,995	49,198	65,168	99,824	240,375	529,560
Percentage of transactions	1%	1%	1%	1%	1%	1%
No. of stocks	312	274	288	302	345	
No. of stocks with more than 5,000 transaction per year	1	0	0	0	4	
No of stocks with more than 12,500 transaction per year	0	0	0	0	0	
% of transactions in SET50	63.17%	62.69%	46.90%	52.88%	51.65%	
All type of traders						
Number of transactions	10,995,091	7,710,000	11,262,182	15,731,805	30,826,642	76,525,720
Percentage of transactions	100%	100%	100%	100%	100%	100%
No. of stocks	424	389	378	387	415	
No. of stocks with more than 5,000 transaction per year	151	145	206	218	262	
No of stocks with more than 12,500 transaction per year	132	130	160	201	234	
% of transactions in SET50	42.69%	45.46%	39.87%	32.52%	29.63%	

Table IV
Descriptive Statistics for the change in price of stocks

The table provides descriptive statistics on the average price change,the variance of the transaction price changes (in THB), the average number of transactions per day, average volume per transaction, and average price. The sample covers period from January 1,1999 to December 31,2003 for 1,277 days. Panel A provides summary statistics for 50 stocks listed in the SET50 index as of December 31, 2003. Panel B provides mean estimates classified by trader type including estimates on foreign investors,retail customers, local institution and broker owned portfolio.The average is obtained from all stocks in SET50 index. Panel C provides summary statistics for variance of price change classified by trader type. The statistics are computed from the average of the variance in price change of stocks listed in SET50 index.

Panel A: Overall sample					
	Mean	SD	Median	Max	Min
Average price change	0.000030	0.0003	0.0000	0.0009	(0.0009)
Variance of Change in price	0.1472	0.6381	0.0057	4.4543	0.0001
Average Volume /transaction	7,681	6,211	5,957	33,411	989

Panel B: Mean Estimates by trader type					
	Foreign investor	Retail customer	Local institution	Broker owned po	All investors
Observations	4,305,469	21,000,177	1,346,472	285,713	26,937,831
Average Variance of Change in price	0.0563	0.0771	0.0373	0.0969	0.1424
Average No of Transactions /day	3,372	16,445	1,054	224	21,095
Average Volume /transaction	8,853	10,006	7,277	12,392	9,632

Table V

Components of bid-ask spread by trader type

The table summarizes the result of our model for GMM estimates of the parameter of components of the bid-ask spread from the transaction price change.We use trade data in the 50 most liquid stocks on the Stock Exchange of Thailand listed in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 to December 31, 2003 Indicator variable allows the the model paramter to vary depending on different trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain results presented here. Panel A presents average parameter classified by trade initiation group including foreign investors(F),retail customer (C), local Institution (M) and broker owned portfolio (P). The parameter presents three parameters α represents order processing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow. Also shown are the average standard errors of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Panel A

Decomposition of spread components

Order processing cost								
	α_F		α_C		α_M		α_P	LR p-value $\alpha_F = \alpha_C = \alpha_M = \alpha_P$
	0.0243		0.0678		0.0329		0.0437	0.0001
	0.002		0.001		0.002		0.010	
Asymmetric Information cost								
	β_F		β_C		β_M		β_P	$\beta_F = \beta_C = \beta_M = \beta_P$
	0.0429	(54%)	0.0173	(20%)	0.0295	(52%)	0.0464 (51%)	0.0001
	0.001		0.001		0.002		0.009	
Autocorrelation in order flow								
	ρ_F		ρ_C		ρ_M		ρ_P	$\rho_F = \rho_C = \rho_M = \rho_P$
	0.7374		0.7092		0.7230		0.7672	0.0001
	0.003		0.002		0.000		0.013	

Panel B

Decomposition of spread components (Weighted Average)

Order processing cost								
	α_F		α_C		α_M		α_P	
	0.0448		0.1248		0.0664		0.0717	
Asymmetric Information cost								
	β_F		β_C		β_M		β_P	
	0.0770	(63%)	0.0280	(18%)	0.0460	(41%)	0.0668 (48%)	

*Please see appendix A for details of parameter estimates for each stock

Table VI

Components of bid-ask spread by trader type classified by years

The table summarizes the result of our model for GMM estimates of the parameter of components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 to December 31, 2003 Indicator variable allows the the model paramter to vary depending on different trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain results presented here. Panel A presents average parameter classified by trade initiation group including foreign investors(F),retail customer (C), local Institution (M) and broker owned portfolio (P). The parameter presents three parameters α represents order processing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow. Also shown are the average standard errors of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Asymmetric Information cost								
Year 1999								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0703	(50%)	0.0469	(26%)	0.0609	(86%)	0.0597	(38%)	0.0001
0.005		0.004		0.009		0.036		
Year 2000								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0533	(52%)	0.0288	(25%)	0.0471	(60%)	0.0752	(60%)	0.0001
0.008		0.003		0.067		0.030		
Year 2001								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0266	(37%)	0.0160	(18%)	0.0184	(34%)	0.0322	(31%)	0.0001
0.002		0.001		0.006		0.020		
Year 2002								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0290		0.0195		0.0179		0.0458		0.0001
0.002	(48%)	0.002	(25%)	0.003	(36%)	0.046	(54%)	
Year 2003								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0269		0.0062		0.0145		0.0289		0.0001
0.002	(36%)	0.001	(11%)	0.003	(29%)	0.009	(39%)	

*Please see appendix B - F for details of parameter estimates for each year

Table VII

Components of bid-ask spread by trader type and characteristics of stocks

The table summarizes the result of our model for GMM estimates of the component of the bid-ask spread from transaction price change classified by trader type, grouped by market capitalization, foreign turnover and foreign ownership. The sample uses the stocks listed in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 and December 2003. The parameter of each stock is ranked based on market capitalization foregin turnover and foreign ownership and classified into group of low, medium, and high.

	Market Capitalization			Foreign Turnover			Foreign Ownership		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Retail Customers									
Order processing cost	0.0304	0.0715	0.1035	0.0269	0.0408	0.1399	0.0695	0.0667	0.0672
Asymmetric Information cost	0.0145	0.0129	0.0249	0.0092	0.0076	0.0362	0.0171	0.0109	0.0238
% information of total	32.30%	15.26%	19.41%	25.56%	15.70%	20.53%	19.75%	14.08%	26.16%
Foreign Investors									
Order processing cost	0.0113	0.0243	0.0381	0.0143	0.0210	0.0383	0.0274	0.0270	0.0187
Asymmetric Information cost	0.0245	0.0424	0.0630	0.0163	0.0180	0.0978	0.0428	0.0311	0.0549
% information of total	68.42%	63.62%	62.33%	53.16%	46.03%	71.86%	60.95%	53.57%	74.63%
Domestic Institution									
Order processing cost	0.017	0.0320	0.0502	0.0098	0.0287	0.0619	0.0422	0.0334	0.0236
Asymmetric Information cost	0.020	0.0285	0.0502	0.0145	0.0136	0.0624	0.0282	0.0225	0.0378
% information of total	53.60%	47.13%	50.00%	59.71%	32.22%	50.21%	40.11%	40.24%	61.52%
Broker Own Port									
Order processing cost	0.0100	0.0563	0.0663	0.0075	0.0283	0.0986	0.0439	0.0442	0.0431
Asymmetric Information cost	0.0416	0.0414	0.0569	0.0304	0.0187	0.0929	0.0382	0.0341	0.0666
% information of total	80.69%	42.36%	46.21%	80.17%	39.81%	48.51%	46.50%	43.56%	60.68%

Table VIII

Effect of Earning Announcements on Prices and Components of the Effective Spread

The table summarizes the result of our model for GMM estimates the parameter of the components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand listed in SET50 index as of December 31, 2003.The data covers the period between January 1,1999 to December 30, 2003. Indicator variable allows the the model paramters to vary depending on time of earning announcement. Paramters are estimated for each stock using the whole sample.Parameter estimates are averaged across various stocks to obtain the result presented here. Panel A presents the average parameter classified by the trade initiation group including no earning annoucement (N), before earning announcement (B) and after earning announcement (A). The table presents three parameters a asymmetric information cost and ρ represents the correlation between the order flow. Also shown are the average standard error of each parameter estimate. In addition,the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Panel A Decomposition of spread components						
Order processing cost						LR p-value
α_N		α_B		α_A		$\alpha_N = \alpha_B = \alpha_A$
0.0512		0.0483		0.0385		0.0001
0.001		0.006		0.005		
Asymmetric Information cost						
β_N		β_B		β_A		$\beta_N = \beta_B = \beta_A$
0.0504	(31%)	0.0304	(32%)	0.0485	(36%)	0.0001
0.001		0.005		0.004		
Autocorrelation in order flow						
ρ_N		ρ_B		ρ_A		$\rho_N = \rho_B = \rho_A$
0.7302		0.7194		0.7011		0.0001
0.002		0.011		0.010		
Panel B: Decomposition of spread components (Weighted Average)						
Order processing cost						
α_N		α_B		α_A		
0.0913		0.0862		0.0629		
Asymmetric Information cost						
β_N		β_B		β_A		
0.0472	(34%)	0.0506	(37%)	0.0643	(51%)	

Table IX

The Effect of earning announcement, components of bid-ask spread and characteristics of stocks

The table summarizes the result of our model for GMM estimates of the component of the bid-ask spread from transaction price change classified by trader type and grouped by market capitalization, foreign turnover and foreign ownership for period before earning annoucement,after earning announcement and no earning annoucement.The sample uses the stocks listed in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 and December 2003. The parameter of each stock is ranked based on market capitalization foregin turnover and foreign ownership and classified into group of low, medium, and high.

	Market Capitalization			Foreign Turnover			Foreign Ownership		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Before Earning Announcement									
Order processing cost	0.0237	0.0440	0.0792	0.0186	0.0368	0.0925	0.0633	0.0395	0.0416
Asymmetric Information cost	0.0255	0.0261	0.0402	0.0105	0.0109	0.0724	0.0310	0.0201	0.0406
% information of total	51.76%	37.21%	33.64%	36.20%	22.81%	43.92%	32.85%	33.76%	49.39%
After Earning Announcement									
Order processing cost	0.0201	0.0373	0.0595	0.0180	0.0323	0.0671	0.0439	0.0335	0.0380
Asymmetric Information cost	0.0713	0.0249	0.0494	0.0581	0.0111	0.0784	0.0861	0.0196	0.0392
% information of total	78.03%	40.02%	45.37%	76.34%	25.50%	53.89%	66.23%	36.93%	50.75%
Without Earning Announcement									
Order processing cost	0.025	0.0504	0.0801	0.0252	0.0393	0.0918	0.0659	0.0455	0.0416
Asymmetric Information cost	0.085	0.0272	0.0375	0.0110	0.0769	0.0641	0.0294	0.0845	0.0363
% information of total	77.35%	35.11%	31.90%	30.44%	66.17%	41.10%	30.83%	65.00%	46.63%

Table X

Effect of Earning Announcement on Prices and Component of Spread Classified by Trader Type

The table summarizes the result of our model for the GMM estimates the parameter of the components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand (SET) listed in the SET50 index as of December 31, 2003. The data covers the period between January 1,1999 to December 30, 2003. Indicator variable allows the model parameter to vary on time of earning anncuncement and trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain result.The table presents simple mean of parameter classified by trade initiation group including no earning annoucement , before earning announcement and after earning announcement and classfied by the trade initiation group including foreign investors (F), retailed customers, local institution (m) and broker-owned portfolio (p). The table presents three parameters α represents orderprocessing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow. Also shown are the average standard error of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for the Loglikelihood ratio tests that compare restricted and unrestricted GMM criterion functions. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Decomposition of spread components								
Asymmetric Information cost								
No earning announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0456	(53%)	0.0185	(20%)	0.0307	(51%)	0.0516	(56%)	0.0001
0.002		0.001		0.067		0.311		
Before earning announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0555	(76%)	0.0313	(28%)	0.0359	(51%)	0.0643	(42%)	0.0001
0.037		0.015		0.006		0.046		
After earning announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0892	(56%)	0.0263	(30%)	0.0391	(71%)	0.054	(38%)	0.0001
0.030		0.007		0.006		0.057		

Table XI

Effect of Dividend Announcements on Prices and Components of Effective Spread

The table summarizes the result of our model for GMM estimates the parameter of the components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand listed in SET50 index as of December 31, 2003.The data covers the period between January 1,1999 to December 30, 2003. Indicator variable allows the the model paramters to vary depending on time of dividend announcement. Paramters are estimated for each stock using the whole sample.Parameter estimates are averaged across various stocks to obtain the result presented here. Panel A presents the average parameter classified by the trade initiation group including no dividend annoucement (ND), before dividend announcement(BD) and after dividend announcement(AD). The table presents three parameters a asymmetric information cost and ρ represents the correlation between the order flow. Also shown are the average standard error of each parameter estimate. In addition,the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Panel A						
Decomposition of spread components						
Order processing cost						LR p-value
α_{ND}		α_{BD}		α_{AD}		$\alpha_{ND} = \alpha_{BD} = \alpha_{AD}$
0.0517		0.0348		0.0439		0.0001
0.001		0.009		0.006		
Asymmetric Information cost						
β_{ND}		β_{BD}		β_{AD}		$\beta_{ND} = \beta_{BD} = \beta_{AD}$
0.0279	(28%)	0.0331	(53%)	0.0275	(30%)	0.0001
0.001		0.005		0.004		
Autocorrelation in order flow						
ρ_{ND}		ρ_{BD}		ρ_{AD}		$\rho_{ND} = \rho_{BD} = \rho_{AD}$
0.7332		0.7340		0.7226		0.0001
0.002		0.013		0.011		
Panel B						
Decomposition of spread components (Weighted Average)						
Order processing cost						
α_{ND}		α_{BD}		α_{AD}		
0.0910		0.0575		0.0597		
Asymmetric Information cost						
β_{ND}		β_{BD}		β_{AD}		
0.0460	(34%)	0.0563	(49%)	0.0521	(47%)	

Table XII

The Effect of dividend announcement, components of bid-ask spread and characteristics of stocks

The table summarizes the result of our model for GMM estimates of the component of the bid-ask spread from transaction price change classified by trader type and grouped by market capitalization,foreign turnover and foreign ownership for period before dividend annoucement,after dividend announcement and no dividend annoucement. The sample uses stocks listed in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 and December 2003. The parameter of each stock is ranked based on market capitalization foregin turnover and foreign ownership and classified into group of low, medium, and high.

	Market Capitalization			Foreign Turnover			Foreign Holding		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Before Dividend Announcement									
Order processing cost	0.0182	0.0344	0.0505	0.0046	0.0302	0.0672	0.0290	0.0426	0.0327
Information cost	0.0237	0.0275	0.0470	0.0202	0.0101	0.0665	0.0405	0.0211	0.0374
% information of total	56.62%	44.44%	48.17%	81.59%	25.12%	49.73%	58.21%	33.06%	53.32%
After Dividend Announcement									
Order processing cost	0.0245	0.0491	0.0573	0.0224	0.0308	0.0763	0.0360	0.0558	0.0403
Information cost	0.0176	0.0231	0.0410	0.0097	0.0107	0.0599	0.0335	0.0172	0.0317
% information of total	41.76%	31.98%	41.72%	30.11%	25.86%	43.98%	48.15%	23.59%	43.99%
Without Dividend announcement									
Order processing cost	0.025	0.0513	0.0766	0.0250	0.0389	0.0885	0.0584	0.0563	0.0411
Information cost	0.019	0.0292	0.0354	0.0100	0.0099	0.0614	0.0274	0.0212	0.0346
% information of total	42.15%	36.29%	31.61%	28.67%	20.19%	40.95%	31.93%	27.33%	45.71%

Table XII

Information share: Controlling for proportion of number of transaction and volume traded

The table summarizes the result of the information share estimates using Hasbrouck (1995). We use the trades of the stocks listed on SET 50 index on the Stock Exchange of Thailand (SET) as of December 31, 2003.The data covers between January 01, 2003 and December 31, 2003. Information shares are calculated for each stock each trading day included in the sample. We use average transaction price within each five minutes range (54 samples per day). There are 10,950 trading days in the sample.The estimates are averaged across stock days and presented for each stock. Results are summarized based on simple average, volume weighted average and average based on the number of transactions. We follow the method by Anand and Subrahmanyam (2008) to divide each information share by the proportion of the transaction and volume traded. The results are presented below.

Panel A: Information share Divided by the proportion of transaction					
	Local retail investors		Foreign investor		Difference
	Min	Max	Min	Max	
Mean	0.44	0.79	2.90	5.00	3.34***
Median	0.44	0.76	2.06	3.71	2.29
Stdev	0.09	0.15	2.18	3.89	2.92
Max	0.72	1.28	11.78	19.28	14.53
Min	0.29	0.52	0.77	1.24	0.59

Panel B: Information share Divided by the volume traded					
	Local retail investors		Foreign investor		Difference
	Min	Max	Min	Max	
Mean	0.50	0.89	2.40	4.14	2.58***
Median	0.46	0.80	1.58	2.82	1.57
Stdev	0.14	0.26	2.01	3.59	2.60
Max	0.97	1.72	10.99	17.99	13.14
Min	0.32	0.56	0.61	1.02	0.38

***,**,* indicate that the Wilcoxon rank test statistic for the two sample test of difference of means of midpoint of upper and lower bounds of local retail investors and foregin investors is significant at the 1%, 5% and the 10% level respectively.

Appendix A

Parameter Estimates by Individual Stock

Stock	α_F	β_F	α_C	β_C	α_M	β_M	α_P	β_P	ρ_F	ρ_C	ρ_M	ρ_P
ADVANC	0.011	0.169	1.026	1.070	0.024	0.105	0.078	0.082	0.690	0.669	0.643	0.710
ASL	0.024	0.014	0.030	0.009	0.012	0.019	0.026	0.012	0.761	0.766	0.728	0.822
AST	0.012	0.043	0.031	0.033	0.005	0.036	-0.192	0.264	0.583	0.631	0.544	0.919
BANPU	0.026	0.028	0.052	0.015	0.029	0.020	0.021	0.039	0.741	0.728	0.737	0.757
BAY	0.026	0.006	0.036	0.002	0.026	0.004	0.030	0.008	0.840	0.797	0.854	0.819
BBL	0.052	0.026	0.101	0.007	0.062	0.016	0.043	0.034	0.805	0.743	0.804	0.792
BEC	0.084	0.142	0.294	0.023	0.140	0.098	0.234	0.181	0.720	0.711	0.728	0.677
BECL	0.011	0.011	0.024	0.003	0.009	0.009	0.016	0.017	0.784	0.756	0.776	0.828
BOA	0.084	0.142	0.294	0.023	0.140	0.098	0.234	0.181	0.719	0.711	0.728	0.677
BT	0.013	0.008	0.023	0.004	0.010	0.010	0.016	0.005	0.787	0.781	0.911	0.714
CCET	0.005	0.021	0.027	0.015	-0.001	0.021	-0.023	0.095	0.542	0.063	0.535	0.796
CNS	0.010	0.040	0.030	0.033	0.009	0.036	0.028	0.038	0.579	0.634	0.547	0.671
CPF	0.010	0.030	0.030	0.010	0.017	0.019	0.016	0.019	0.767	0.746	0.807	0.835
DELTA	0.010	0.147	0.106	0.040	0.025	0.091	0.115	0.064	0.695	0.718	0.736	0.662
DTDB	0.013	0.005	0.019	0.003	0.014	0.006	0.006	0.024	0.739	0.745	0.818	0.961
EGCOMP	0.027	0.025	0.069	0.010	0.019	0.023	0.028	0.032	0.706	0.693	0.699	0.739
GOLD	0.005	0.009	0.014	0.001	0.008	0.005	0.019	0.008	0.705	0.738	0.743	0.661
GRAMMY	0.002	0.069	0.038	0.059	0.006	0.053	0.030	0.049	0.635	0.641	0.645	0.726
HANA	0.015	0.104	0.110	0.036	0.031	0.068	0.083	0.088	0.674	0.758	0.654	0.708
IFCT	0.019	0.007	0.030	0.004	0.013	0.008	0.023	0.017	0.782	0.768	0.809	0.872
ITD	0.015	0.040	0.054	0.014	0.026	0.023	0.030	0.030	0.720	0.755	0.752	0.772
JASMIN	0.007	0.014	0.014	0.006	0.007	0.010	0.017	0.012	0.713	0.738	0.742	0.777
KGI	0.006	0.001	0.007	0.001	0.001	0.006	0.005	0.003	0.794	0.794	0.956	0.861
KK	0.030	0.018	0.054	0.010	0.031	0.014	0.055	0.012	0.788	0.764	0.792	0.725
KTB	0.040	0.008	0.057	0.002	0.030	0.010	0.039	0.013	0.859	0.758	0.875	0.868
LH	0.013	0.018	0.032	0.012	0.016	0.014	0.021	0.020	0.753	0.708	0.744	0.714
MAJOR	0.017	0.022	0.048	0.011	0.006	0.022	0.029	0.034	0.721	0.727	0.691	0.747
NFS	0.026	0.007	0.037	0.001	0.024	0.005	0.024	0.009	0.865	0.827	0.787	0.839
PTT	0.091	0.026	0.164	0.002	0.131	0.007	0.066	0.042	0.896	0.789	0.874	0.875
PTTEP	0.071	0.103	0.229	0.015	0.126	0.063	0.135	0.097	0.793	0.778	0.776	0.767
QH	0.008	0.006	0.016	0.003	0.005	0.005	0.018	0.006	0.768	0.762	0.780	0.726
RATCH	0.025	0.011	0.053	0.001	0.031	0.006	0.027	0.021	0.835	0.786	0.811	0.904
SATTEL	0.013	0.017	0.030	0.008	0.009	0.015	0.024	0.018	0.700	0.745	0.701	0.789
SCB	0.031	0.017	0.056	0.007	0.032	0.011	0.029	0.022	0.791	0.742	0.781	0.798
SCC	0.082	0.365	0.396	0.140	0.195	0.201	0.233	0.278	0.729	0.708	0.707	0.749
SCCC	0.045	0.120	0.162	0.081	0.048	0.093	0.197	0.164	0.659	0.643	0.585	0.681
SHIN	0.042	0.070	0.074	0.033	0.020	0.055	0.047	0.060	0.776	0.757	0.745	0.809
SPL	0.014	0.020	0.040	0.011	0.167	0.016	0.043	0.019	0.744	0.752	0.723	0.694
TA	0.011	0.015	0.030	0.007	0.014	0.015	0.021	0.021	0.732	0.725	0.735	0.736
TFB	0.052	0.018	0.077	0.004	0.050	0.014	0.042	0.021	0.864	0.796	0.867	0.847
THAI	0.009	0.039	0.060	0.017	0.008	0.025	0.049	0.038	0.646	0.642	0.616	0.608
TISCO	0.017	0.016	0.032	0.009	0.023	0.009	0.028	0.012	0.796	0.760	0.784	0.771
TMB	0.022	0.003	0.027	0.001	0.015	0.008	0.025	0.005	0.840	0.810	0.907	0.843
TPI	0.012	0.009	0.020	0.003	0.006	0.011	0.015	0.008	0.763	0.778	0.820	0.803
TPIPL	0.014	0.021	0.024	0.012	0.005	0.015	0.018	0.018	0.655	0.687	0.623	0.727
TT&T	0.012	0.004	0.014	0.002	0.005	0.004	0.013	0.005	0.772	0.771	0.728	0.800
TUF	0.013	0.047	0.048	0.023	0.011	0.026	0.063	0.032	0.641	0.065	0.650	0.644
UBC	0.003	0.019	0.016	0.012	0.003	0.013	0.015	0.021	0.645	0.676	0.602	0.639
UCOM	0.010	0.022	0.020	0.014	0.001	0.015	0.021	0.018	0.642	0.687	0.590	0.741
VNT	0.006	0.007	0.015	0.004	0.005	0.006	0.009	0.008	0.721	0.737	0.690	0.762

Appendix B

Components of bid-ask spread by trader type classified by years

The table summarizes the result of our model for GMM estimates of the parameter of components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 to December 31, 2003 Indicator variable allows the the model paramter to vary depending on different trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain results presented here.Panel A presents average parameter classified by trade initiation group including foreign investors(F),retail customer (C), local Institution (M) and broker owned portfolio (P). The parameter presents three parameters α represents order processing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow. Also shown are the average standard errors of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Panel A: Year 1999								
Decomposition of spread components								
Order processing cost								LR p-value
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0246		0.0892		0.0081		0.1962		0.0001
0.005		0.005		0.010		0.038		
Asymmetric Information cost								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0703	(50%)	0.0469	(26%)	0.0609	(86%)	0.0597	(38%)	0.0001
0.005		0.004		0.009		0.036		
Autocorrelation in order flow								
ρ_F		ρ_C		ρ_M		ρ_P		$\rho_F = \rho_C = \rho_M = \rho_P$
0.5733		0.5752		0.5818		0.6039		0.0001
0.006		0.004		0.013		0.032		
Panel B:								
Decomposition of spread components (Weighted Average)								
Order processing cost								
α_F		α_C		α_M		α_P		
0.0328		0.1438		0.0150		0.0983		
Asymmetric Information cost								
β_F		β_C		β_M		β_P		
0.1299	(80%)	0.0845	(37%)	0.0946	(86%)	0.0993	(50%)	

Appendix C

Components of bid-ask spread by trader type classified by years

The table summarizes the result of our model for GMM estimates of the parameter of components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 to December 31, 2003 Indicator variable allows the the model paramter to vary depending on different trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain results presented here.Panel A presents average parameter classified by trade initiation group including foreign investors(F),retail customer (C), local Institution (M) and broker owned portfolio (P). The parameter presents three parameters α represents order processing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow.Also shown are the average standard errors of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Panel A: Year 2000

Decomposition of spread components

Order processing cost								LR p-value
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0152		0.0527		0.0132		0.0415		0.0001
0.009		0.003		0.067		0.034		
Asymmetric Information cost								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0533	(52%)	0.0288	(25%)	0.0471	(60%)	0.0752	(60%)	0.0001
0.008		0.003		0.067		0.030		
Autocorrelation in order flow								
ρ_F		ρ_C		ρ_M		ρ_P		$\rho_F = \rho_C = \rho_M = \rho_P$
0.6427		0.6241		0.6791		0.6662		0.0001
0.006		0.004		0.014		0.027		

Panel B:

Decomposition of spread components (Weighted Average)

Order processing cost							
α_F		α_C		α_M		α_P	
0.0137		0.0715		0.0188		0.0780	
Asymmetric Information cost							
β_F		β_C		β_M		β_P	
0.0879	(87%)	0.0483	(40%)	0.0721	(79%)	0.0864	(53%)

Appendix D

Components of bid-ask spread by trader type classified by years

The table summarizes the result of our model for GMM estimates of the parameter of components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 to December 31, 2003 Indicator variable allows the the model paramter to vary depending on different trader type. Parameters are estimated for each stock using whole sample.These paramter estimates are averaged across various stocks to obtain results presented here.Panel A presents average parameter classified by trade initiation group including foreign investors(F),retail customer (C), local Institution (M) and broker owned portfolio (P). The parameter presents three parameters α represents order processing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow. Also shown are the average standard errors of each parameter estimates.In addition, the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Panel A: Year 2001								
Decomposition of spread components								
Order processing cost								LR p-value
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0217		0.0458		0.0230		0.0415		0.0001
0.003		0.002		0.006		0.020		
Asymmetric Information cost								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0266	(37%)	0.0160	(18%)	0.0184	(34%)	0.0322	(31%)	0.0001
0.002		0.001		0.006		0.020		
Autocorrelation in order flow								
ρ_F		ρ_C		ρ_M		ρ_P		$\rho_F = \rho_C = \rho_M = \rho_P$
0.6979		0.6738		0.7275		0.7253		0.0001
0.007		0.003		0.012		0.033		
Panel B:								
Decomposition of spread components (Weighted Average)								
Order processing cost								
α_F		α_C		α_M		α_P		
0.0354		0.0836		0.0401		0.0679		
Asymmetric Information cost								
β_F		β_C		β_M		β_P		
0.0560	(61%)	0.0335	(29%)	0.0374	(48%)	0.0628	(48%)	

Appendix E

Components of bid-ask spread by trader type classified by years

The table summarizes the result of our model for GMM estimates of the parameter of components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 to December 31, 2003 Indicator variable allows the the model paramter to vary depending on different trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain results presented here.Panel A presents average parameter classified by trade initiation group including foreign investors(F),retail customer (C), local Institution (M) and broker owned portfolio (P). The parameter presents three parameters α represents order processing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow. Also shown are the average standard errors of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Panel A: Year 2002								
Decomposition of spread components								
Order processing cost								LR p-value
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0175		0.0481		0.0271		0.0239		0.0001
0.002		0.002		0.003		0.046		
Asymmetric Information cost								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0290	(48%)	0.0195	(25%)	0.0179	(36%)	0.0458	(54%)	0.0001
0.002		0.002		0.003		0.046		
Autocorrelation in order flow								
ρ_F		ρ_C		ρ_M		ρ_P		$\rho_F = \rho_C = \rho_M = \rho_P$
0.6941		0.6799		0.6909		0.7793		0.0001
0.007		0.004		0.013		0.024		
Panel B:								
Decomposition of spread components (Weighted Average)								
Order processing cost								
α_F		α_C		α_M		α_P		
0.0288		0.1156		0.0696		0.0597		
Asymmetric Information cost								
β_F		β_C		β_M		β_P		
0.0738	(72%)	0.0439	(28%)	0.0350	(34%)	0.0750	(56%)	

Appendix F

Components of bid-ask spread by trader type classified by years

The table summarizes the result of our model for GMM estimates of the parameter of components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand in SET50 index as of December 31, 2003. The data covers the period between January 1, 1999 to December 31, 2003 Indicator variable allows the the model paramter to vary depending on different trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain results presented here.Panel A presents average parameter classified by trade initiation group including foreign investors(F),retail customer (C), local Institution (M) and broker owned portfolio (P). The parameter presents three parameters α represents order processing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow.Also shown are the average standard errors of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for Loglikelihood ratio tests that compare the restricted and unrestricted GMM criterion functions. Panel B reports the weighted average parameter. The weight is the market capitalization of the stock at the end of 2003.

Panel A: Year 2003								
Decomposition of spread components								
Order processing cost								LR p-value
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0281		0.0641		0.0382		0.0360		0.0001
0.002		0.001		0.003		0.010		
Asymmetric Information cost								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0269	(36%)	0.0062	(11%)	0.0145	(29%)	0.0289	(39%)	0.0001
0.002		0.001		0.003		0.009		
Autocorrelation in order flow								
ρ_F		ρ_C		ρ_M		ρ_P		$\rho_F = \rho_C = \rho_M = \rho_P$
0.7405		0.7108		0.7359		0.7737		0.0001
0.005		0.003		0.009		0.018		

Panel B:							
Decomposition of spread components (Weighted Average)							
Order processing cost							
α_F		α_C		α_M		α_P	
0.0620		0.1325		0.0904		0.0622	
Asymmetric Information cost							
β_F		β_C		β_M		β_P	
0.0461	(43%)	0.0054	(4%)	0.0206	(19%)	0.0517	(45%)

Appendix G

Effect of Earning Announcement on Prices and Component of Spread Classified by Trader Type

The table summarizes the result of our model for the GMM estimates the parameter of the components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand (SET) listed in the SET50 index as of December 31, 2003. The data covers the period between January 1,1999 to December 30, 2003. Indicator variable allows the model parameter to vary on time of earning announcement and trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain result.The table presents simple mean of parameter classified by trade initiation group including no earning annoucement , before earning announcement and after earning announcement and classfied by the trade initiation group including foreign investors (F), retailed customers, local institution (m) and broker-owned portfolio (p). The table presents three parameters α represents orderprocessing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow. Also shown are the average standard error of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for the Loglikelihood ratio tests that compare restricted and unrestricted GMM criterion functions. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Decomposition of spread components								
Order processing cost								LR p-value
No earning announcement								
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0239		0.0685		0.0298		0.0409		0.0001
0.002		0.002		0.003		0.051		
Before earning announcement								
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0159		0.0578		0.0342		0.087		0.0001
0.030		0.015		0.025		0.033		
After earning announcement								
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
-0.0242		0.0517		0.0162		0.0866		0.0001
0.032		0.008		0.115		0.330		
Asymmetric Information cost								
No earning announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0456	(53%)	0.0185	(20%)	0.0307	(51%)	0.0516	(56%)	0.0001
0.002		0.001		0.067		0.311		
Before earning announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0555	(76%)	0.0313	(28%)	0.0359	(51%)	0.0643	(42%)	0.0001
0.037		0.015		0.006		0.046		
After earning announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0892	(56%)	0.0263	(30%)	0.0391	(71%)	0.054	(38%)	0.0001
0.030		0.007		0.006		0.057		

Decomposition of spread components (Cont.)

Autocorrelation in order flow

No earning announcement

ρ_F	ρ_C	ρ_M	ρ_P	$\rho_F = \rho_C = \rho_M = \rho_P$
0.7375	0.7326	0.7373	0.7680	0.0001
0.003	0.002	0.003	0.024	

Before earning announcement

ρ_F	ρ_C	ρ_M	ρ_P	$\rho_F = \rho_C = \rho_M = \rho_P$
0.7345	0.7500	0.6483	0.7511	0.0001
0.028	0.023	0.019	0.112	

After earning announcement

ρ_F	ρ_C	ρ_M	ρ_P	$\rho_F = \rho_C = \rho_M = \rho_P$
0.7901	0.7412	0.7981	0.7865	0.0001
0.022	0.014	0.003	0.029	

Appendix H

Effect of Dividend announcement on Prices and Component of Spread Classified by Trader Type

The table summarizes the result of our model for the GMM estimates the parameter of the components of the bid-ask spread from the transaction price change.We use trades data in the 50 most liquid stocks on the Stock Exchange of Thailand (SET) listed in the SET50 index as of December 31, 2003. The data covers the period between January 1,1999 to December 30, 2003. Indicator variable allows the model parameter to vary on time of earning announcement and trader type. Parameters are estimated for each stock using whole sample. These paramter estimates are averaged across various stocks to obtain result.The table presents simple mean of parameter classified by trade initiation group including no dividend annoucement , before dividend announcement and after dividend announcement and classfied by the trade initiation group including foreign investors (F), retailed customers, local institution (m) and broker-owned portfolio (p). The table presents three parameters α represents orderprocessing cost, β represents the asymmetric information cost and ρ represents the correlation between order flow. Also shown are the average standard error of each parameter estimates. In addition, the table provides the restriction test and Chi-square p-values for the Loglikelihood ratio tests that compare restricted and unrestricted GMM criterion functions. Also provided is the percentage of asymmetric information cost as percentage of bid-ask spread in parentheses.

Decomposition of spread components								
Order processing cost								LR p-value
No dividend announcement								
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0248		0.0682		0.0327		0.0667		0.0001
0.002		0.002		0.003		0.070		
Before dividend announcement								
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0151		0.0512		0.0324		0.072		0.0001
0.045		0.010		0.025		0.046		
After dividend announcement								
α_F		α_C		α_M		α_P		$\alpha_F = \alpha_C = \alpha_M = \alpha_P$
0.0316		0.0618		0.0338		0.0732		0.0001
0.034		0.008		0.027		0.062		
Asymmetric Information Cost								
No dividend announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0447	(64%)	0.0193	(22%)	0.0302	(48%)	0.0699	(51%)	0.0001
0.002		0.002		0.025		0.052		
Before dividend announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0432	(74%)	0.0269	(35%)	0.0240	(43%)	0.0457	(38%)	0.0001
0.024		0.018		0.003		0.028		
After dividend announcement								
β_F		β_C		β_M		β_P		$\beta_F = \beta_C = \beta_M = \beta_P$
0.0434	(58%)	0.0113	(15%)	0.0274	(45%)	0.049	(39%)	0.0001
0.039		0.010		0.003		0.031		

Decomposition of spread components (Cont.)				
Autocorrelation in order flow				
No dividend announcement				
ρ_F	ρ_C	ρ_M	ρ_P	$\rho_F = \rho_C = \rho_M = \rho_P$
0.7423	0.7330	0.7434	0.7785	0.0001
0.003	0.002	0.016	0.037	
Before dividend announcement				
ρ_F	ρ_C	ρ_M	ρ_P	$\rho_F = \rho_C = \rho_M = \rho_P$
0.7207	0.7405	0.6654	0.7382	0.0001
0.050	4.042	0.007	0.017	
After dividend announcement				
ρ_F	ρ_C	ρ_M	ρ_P	$\rho_F = \rho_C = \rho_M = \rho_P$
0.7953	0.7468	0.7954	0.8229	0.0001
0.056	0.014	-0.030	0.023	

Essay II : Cost of Information-Based Trading, Liquidity and Trader Type : Exploration of price discovery by trader type

Chapter I: Introduction

The question of whether the foreign investors are informed traders who have better information has been controversial. Some researchers explore the return gained by foreign investors. These include work done by Stahel (2002), Seasholes (2000) and Kang and Stulz (1997). Lee, Liu, Roll and Subrahmanyam (2004) propose the investigation of the marketable order imbalance to explore whether the foreigners are informed traders or not. Dvorak (2005) use the spectral decomposition to decompose the return by trader type in the Jarkarta market. Little research has been done to explore this issue from the price discovery point of view at the transactional data level in the electronic trading market. Due the confidentiality nature of the transaction data, this imposes limitation for the researchers to explore this issue from the transactional level. Price discovery is process in which the price is revealed through the trade of informed traders who possess special information about the stock or who obtain better access through order flow that alters the value of the asset. The issue of which type of trader is informed trader helps to better understand the process of price process. In this paper, we use the confidential deal file provided by the SET to explore the issue at the transactional level. Hasbrouck (1995) provides an econometric method to explore the price discovery of the same stocks traded in several exchanges simultaneously. We augment the method to explore the price discovery of a stock traded by several traders. The objective is to explore the degree of the contribution to price discovery by each trader type and answer to question who is the informed trader in the Stock exchange of Thailand and which factors are behind the price informativeness.

This paper contributes to additional literatures in several ways. Firstly, the data classified by trader type helps us to obtain the actual outcome of the difference among different trader type from the transactional level. Lee (1992) uses the trade size as a proxy for different groups of investors. Large trade size represents institutional investors

while smaller trade size represents retail investors. In this paper, we offer an opportunity to explore the effectiveness of using these actual data against the proxies. Secondly, this paper attempts to discover the price discovery for each trader type which is investigated at the transactional level. Thirdly, the paper adopts a new way of looking at the asymmetric information cost in traders by exploring on the contribution to price discovery. We focus on the investigation of the contribution of the price discovery by each trader type, especially retail investors and foreign investors.

We use the transactional data from the Trade file of the 50 most liquid and largest stocks listed in the SET50 index as of December 31, 2003. The Stock Exchange of Thailand is the electronic market with two trading systems. Before the market open in the morning and after the market closes in the evening, the call auction is implemented for each stock. Between 10:00 a.m. and 16:00 a.m., the market adopts the electronic auction market which trades based on time and price priority rule. The buy and sell marketable limit order is automatically matched anonymously.

We find an evidence of strong price discovery in the foreign investors and across stocks. The average information share of retail customers is about 44 to 45 percent whereas the average information share of the foreign investors is about 54 to 55 percent. The information share of the retail customer and foreign investors ranges from 30 percent to 70 percent. Out of 50 stocks, there are only 12 stocks (24 percent) in which the retail customers account for higher information share than the foreigners. The result of finding in the table indicates that the foreign investors are the major contributor to the price discovery of the share and are considered more informed traders. In addition, after we account for the volume of shares traded and number of transactions as in Anand and Subrahmanyam (2005), the information share of the foreign investors are stronger. This is due to the fact that the price discovery of the foreign investors is high even though the volume traded is smaller and number of trade is smaller. The information share of foreign investors is larger than that of the retail customers in every classification. The information share is larger for the companies with large market capitalization and high amount of foreign turnover and the information share grouped by foreign ownership does

not produce much different outcome. The paper is organized as follow: Chapter II presents the literature review on the theory and empirical models on the estimation of the information share in relationship to the trader type. Chapter III presents our research hypotheses. Chapter IV provides data. Chapter V presents the methodology used in the study. Chapter VI presents empirical findings. Chapter VII presents the conclusion.