Locals, Foreigners, and Multi-market Trading of Equities: Some Intraday Evidence

Warren Bailey

Cornell University

Johnson Graduate School of Management

Connie X. Mao

Temple University

The Fox School of Business and Management

Kulpatra Sirodom

Thammasat University

Faculty of Commerce and Accountancy

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Abstract

We study stock trading in Thailand, where binding foreign ownership limits fragment stock trading into distinct markets for locals and foreigners. Although barriers are significant, we observe substantial trading by foreigners on the local board and by locals on the foreign board. These cross-market traders tend to submit orders when liquidity is high and fill their orders at relatively beneficial prices. They trade on patterns in stock returns and prices across markets, and display profitable holding period returns and enhancements to price discovery that suggest informed trading. Our evidence echoes the features and predictions of classic theories of microstructure, information, and trading.

1. Introduction

This paper examines a unique equity market structure. In Thailand, regulators and individual companies impose limits on the fraction of a company's equity that can be held by foreigners.[1] When interest in Thailand's stock market and in emerging markets generally began to pick up in the middle 1980s, the fraction of shares owned by foreigners began to hit these limits for many listed companies. In late 1987, the stock exchange organized a formal market, the Alien Board, where foreigners could trade shares of companies that had reached their foreign ownership limit. Prices on the Alien Board typically exceed prices for otherwise identical shares restricted to local investors by a substantial premium.[2] Although trading is formally segmented into distinct boards for local investors and foreign investors, investors can cross to the "other" board, but at a cost. Thai investors can hold Alien Board shares, but must pay the price premium to do so. Foreign investors can buy Main Board shares, but lose cash and stock dividends, warrants, other distributions, and voting rights because foreigners cannot register such shares once the foreign ownership limit is reached. The trading system on both boards is electronic and order-driven. Broker screens display depth at the three best bid and ask prices, but do not reveal trader identity.

This unusual institutional setting helps us study some interesting issues at the intersection of a number of strands of the finance literature. First and foremost, what market and investor behaviors do we observe in a multiple market setting where some investors cross

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[1] Prior to the 1997 Asian crisis, all companies listed on the Thai exchange had to be legally "Thai", implying a maximum foreign ownership of 49%. The government imposed a tighter limit, 25%, in certain industries, such as banking. The heavily-traded companies in our sample were all listed prior to 1997.

[2] The price premium between the two boards cannot be arbitraged away. Once the foreign ownership limit has been reached, shares bought on the Main Board cannot be sold on the Alien Board. Shares bought on the Alien Board can be sold on the Main Board, but the typically substantial price premium would be lost. If a particular stock never reaches the foreign ownership limit or its foreign ownership drops below the limit, all trading occurs on the Main Board. Another aspect worth mentioning is that, when a local buys an Alien Board share, stock exchange records retain its status as eligible for trading on the Alien Board.

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between markets? As we describe in the next section and beyond, theoretical and empirical papers in the market microstructure literature and related areas inspire us to study the effects of liquidity and information on patterns of market activity in Thailand's multiple-market setting. Furthermore, our data includes some information about the identity of the trader standing behind each order. Specifically, we know whether each order is associated with a foreigner (almost certainly an institution), a Thai institution, a member of the stock exchange, or a Thai individual. Locals may benefit from access to more or better information about local companies, while institutional investors may benefit from more resources and experience.

We conduct a series of empirical tests with intraday records of orders and trades from Thailand in 1999. A summary of our findings is as follows. In spite of the costs to switching to the "other" market, foreigners account for fifteen percent of the trading volume on the Main Board, and Thai individuals account for forty-four percent of the trading volume on the Alien Board.[3] There is much evidence that liquidity is a driver of cross-market trading. Cross-market orders tend to be submitted at times of high liquidity (that is, low bid-ask spread and high depth) in the market to which investors cross, and, as a consequence, cross-market orders tend to be filled at relatively better prices. [4] Some evidence also suggests a relationship between information and cross-market trading. Cross-market traders appear to use market information to trade on mean-reversion in price differentials across the two boards and other patterns. Holding period returns based on cross-market trades appear particularly profitable, suggesting that some cross-market activity represents informed trading. Cross-market trading also appears to

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[3] Werner and Kleidon (1996) study British stocks cross-listed in London and New York, and suggest that some investors voluntarily segment themselves in one market, as does the "location of trade" literature (Froot and Dabera, 1999; Chan, Hameed, and Lau, 2003).

[4] Drudi and Massa (2005) study primary and secondary markets for Italian government bonds, and find that some dealers trade aggressively across markets in a manner that contributes to liquidity.

contribute to price discovery, again suggesting informed trading.[5] Thus, Thailand's fragmented

market structure displays a variety of investor behaviors that echo the assumptions and

implications of theoretical works on market microstructure and on information and capital

markets that we describe below.

The balance of this paper is organized as follows. Section 2 motivates our tests. Section

3 discusses the data, relevant institutional details of the Stock Exchange of Thailand, and some

of the basic calculations and transformations of the data needed for our tests. Section 4 presents

results while Section 5 is a summary and conclusion.

2. Motivation and overview of tests

To think about the phenomenon of parallel markets with access varying across different

types of traders, we start with some well-known theoretical works. In the multiple markets

model of Chowdhry and Nanda (1991), small uniformed investors cannot move across markets

while informed traders and large discretionary liquidity traders optimize where and how they

trade. In the Thai market, the frictions that impede crossing between the Main and Alien boards

depend on whether the trader is a local or foreigner, and are also likely to vary across individual

and institutional investors. In Madhavan (1995), informed investors and large liquidity traders

also benefit by spreading their trading across more than one market. A fragmented trading

environment may persist, rather than consolidating at a single venue. In Subrahmanyam (1991),

informed traders have information about individual securities or about market-wide performance.

As a consequence, discretionary liquidity traders may trade both individual stocks and stock

index futures to avoid the informed traders. In Admati and Pfleiderer (1988), discretionary

liquidity traders may choose to "swim with the sharks", that is, suffer some disadvantageous

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[5] Related empirical papers include studies of price discovery for stocks listed on more than one U.S. exchange
(Hasbrouck, 1995) or across equity and equity derivative markets (Chan, Chan, and Karolyi, 1991; Stephan and
Whaley, 1990; Easley, O'Hara, and Srinivas, 1998; Chan, Chung, and Fong, 2002.).

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trading with informed traders in order to enjoy greater liquidity. High liquidity also tends to attract informed traders, who seek to mask their information. While none of these models corresponds precisely to the Thai institutional setting, they provide intuition for motivating and interpreting our tests relating trading to liquidity and information.

Our tests focus on cross-market trading, that is, trading in shares that have reached the foreign ownership limit by foreigners on the Main Board and by locals on the Alien Board. First, after presenting and discussing summary statistics, we examine associations between liquidity and cross-market trading activity. Motivated by the theoretical papers described above, we seek to uncover patterns that reveal the forces underlying cross-market trading. Some investors may be willing to pay a cost to trade in the "other" market, in search of liquidity to minimize adverse price movements, or to mask their information. Therefore, we test whether cross-market trading in Thailand is associated with particularly high liquidity in the market investors cross to.

Second, we examine whether cross-market trading appears to be motivated by information. As argued by the theoretical models described above, both large liquidity traders and informed traders may benefit by spreading their trading across more than one market. To distinguish between these two types of traders, we examine the use of market information by cross-market traders, their long-term trading profits, and the effect of their cross-market trading on price discovery. Some cross-market traders may condition their trading strategies on market information, while other cross-market activity may consist of informed trading that results in larger trading profits and improved price discovery between the two markets.

Some of our tests parallel earlier studies of other markets. In a study of Canadian stocks that trade both in Canada and the U.S., Eun and Sabherwal (2003) find that price discovery is

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greatest in the market that has higher trading volume, liquidity, and proportion of informed trades. Bailey, Mao, and Sirodom (2005) find different responses to corporate news across dual boards in Singapore and Thailand. While Choe, Kho, and Stulz (2005) report that foreign investors in the Korean stock market trade at disadvantageous prices relative to local investors, other authors (Seasholes, 2000; Chang, 2003; Dvorak, 2005) report that foreigners enjoy superior performance.

3. Data and sample selection

3.1. Stock Exchange of Thailand data

The Stock Exchange of Thailand (SET) commenced operations under the name "Securities Exchange of Thailand" on April 30th 1975. Its predecessor, the Bangkok Stock Exchange, was founded in 1962 but faded away in the early 1970s due to low trading volume and poor stock performance. Starting in 1991, the SET has operated as a fully automated market that matches incoming orders on price and time priority. Minimum price increments, daily price limits, and circuit breakers are part of the market structure. Virtually all trading is based on ordinary limit orders, although other types of orders are permitted.[6] Additionally, a small amount of "upstairs trading" is reported through the SET computer system.[7]

Percentage limits on the amount of equity that can be registered by foreigners vary across listed firms. When foreign holdings of a particular firm reach their limit, trading commences on a second market, the Alien Board.[8] Prices on the Alien Board typically exceed those on the Main Board significantly. See Figure 1 which plots the capitalization-weighted average Alien Board

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[6] In January 1999, for example, 2,008,368 orders were submitted to the Main and Alien boards. Of these, 150 were "at-the-open" orders, 887 were market orders, 17 were "immediate or cancel" orders, and 7 were "fill-or-kill" orders. The rest were ordinary limit orders.

[7] In January 1999, for example, 386 "put through" trades were recorded.

[8] See Bailey and Jagtiani (1994) and Bailey, Chung, and Kang (1999) for details on the workings and price implications of markets that segment local and foreign trading.

premium for our sample.[9] In the context of our study, this premium may be thought of as the cost to a local of buying on the Alien Board. Similarly, lost distributions and voting rights are the cost to a foreigner of buying on the Main Board. [10]

The database used in our study is obtained from the SET. It includes records of orders and trades on the SET for the period of January 1, 1999 to December 31, 1999. Orders are time-stamped to indicate the time of arrival at the exchange while trades indicate the time the order was executed, the buy and sell orders it matches, the size and price of the trade, and other information. Each order and both sides of each trade are coded for the nationality and, for local investors, type of investor. Virtually all foreign investors are institutions while domestic investors are further classified as "member" (broker-members of SET), "finance" (banks, asset management companies, and other Thai financial institutions that are not exchange members), and "others" (Thai individuals). While our database reveals the type of investor associated with each order and trade, it does not include any identifiers for the individual investors involved in each transaction. Therefore, we cannot track the trades, holdings, or performance of individual investors.

The record of orders and trades supplied by the SET covers 58 of the more active issues listed on the SET, and 45 of these show activity on both the Main Board and the Alien Board. We restrict our sample to the 25 most active of these stocks, to ensure that we have sufficient data for analysis and, in particular, many time periods when both the Main and Alien Board listings are active. These 25 firms account for about 96% of total market capitalization, 90% of

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[9] In our sample, 82% of Alien Board price premiums are positive (with a mean of 25.8%), 15% are exactly zero, and only 3% are negative (with a mean of -1.39%). We detail commissions and bid-ask spreads in Section 4.4.2 below. Transactions cost are sufficiently large that small negative foreign premiums cannot be arbitraged profitably. Furthermore, short sales were not permitted in 1999.

[10] In the ten year period from December 1989 to December 1999, the dividend yield on a cap-weighted index of all Main Board shares was about 2.5 percent. Towards the end of that period, the index dividend yield declined to about 1 percent, in part due to the Asian Crisis.

total trading volume, 90% of the total number of trades, and over 94% of total value traded on the Main Board.

To construct our sample of intra-day trading, we divide each trading day into 18 fifteen-minute intervals from 10:00 a.m. to 16:30 p.m., treating the time interval of 12:30 p.m. to 14:45 p.m. as a single interval containing the lunch break. We exclude overnight intervals from our analysis.[11]

3.2. Computing quotes

Our data consist of trades and orders, not trades and quotes as in the TAQ database of U.S. intraday stock market trading. Some of our tests require an intraday measure of liquidity. We use the sequence of orders and trades to construct the "book" and, therefore, the bid, ask, and depth (measured with the number of shares that can be traded at the current best bid and ask) at every point in time during the day for each stock on each board.

3.3. Computing relative price ratios

We also examine how well particular classes of investors fill their orders. Following Choe, Kho, and Stulz (2005), we first compute the volume-weighted average price for all purchases of stock i on a day d, A_i^d. We then compute the volume-weighted average price for the purchases of a particular investor type j of stock i on a day d, $B_{i,j}^d$. Finally, we compute the price ratio, $B_{i,j}^d / A_i^d$, for all purchases (or sales) by investor of type j for stock i on day d. A price ratio greater (less) than one for the purchases (sales) of a particular type of investor suggests that this investor type buys (sells) on average at a price above (below) the average price on that day. Holding everything else equal, investor X is at disadvantage relative to investor Y for purchases (sales) if investor X buys (sells) at a higher (lower) price ratio than investor Y.

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[11] Results are similar whether or not overnight returns are included in the tests that use intraday data. Note that other tests of trader performance rely on daily returns.

3.4. Computing price-setting order imbalances

Some of our tests require measures of the extent to which certain types of investors are buying versus selling. For each 15 minute interval for each of our 25 stocks on each board, we compute "price-setting" order imbalances by investor type by subtracting the price-setting sell volume from the price-setting buy volume, and then normalizing by the stock's average 15-minute price-setting volume over the sample period. We attribute a trade initiated by an investor type to that investor type. A "price-setting buy" (sell) trade for foreign investors, for example, is a trade where the buy (sell) order of the foreign investors came after the sell-side (buy-side) order that it is matched to, and hence made the trade possible. We may also describe "price-setting orders" as "marketable limit orders".

3.5. Holding period returns following purchases and sales

If investors are informed, the stocks they buy will, on average, outperform those they sell. To measure this, we follow Odean (1999) and compute cumulative stock returns over horizons of four months (82 trading days) and one year (245 trading days) following a transaction. Returns are calculated from the PACAP (Pacific Basin Capital Markets Research Center) daily return files for Thailand. The average return on a stock bought (sold) over the T trading days subsequent to the purchase (sale) is calculated as:

$$R_{P,T} = \frac{\sum_{i=1}^{N} \sum_{t=1}^{T} (1 + R_{j_i, t_i + t})}{N} - 1,$$ (1)

where $R_{j,t}$ is the PACAP daily return for stock j on date t, each purchase (sale) transaction of a stock is indexed with a subscript i, i=1 to N. Note that return calculations begin the day after a purchase or a sale so as to avoid incorporating the bid-ask spread into returns. If the same stock is bought (sold) by the same type of investor on the same day, each purchase (sale) is treated as a

separate transaction. Following Odean (1999), we report tests of the statistical significance of the difference between returns following purchases and returns following sales. Given the potential for biased inference due to dependence across the returns in such a procedure, we also present results of an alternative technique (detailed below) for robustness.

4. Empirical results

4.1. Summary statistics

Table 1 presents summary statistics on trading activity. Panel A summarizes total trading activity. On the Alien Board, foreigners are the most active investors, with over 1.3 million trades in 1999 representing more than 54 percent of total trading volume and over 72 percent of trading value. Thai individuals ("others") are the second most active group of investors on the Alien Board, accounting for forty-four percent of the trading volume. With foreigners and Thai individuals accounting for more than 98 percent of Alien Board activity, trading by the two other categories, exchange members and finance-related firms, is negligible. On the Main Board, Thai individuals are the most active investors with more than 79 percent of Main Board activity by volume and almost 70 percent by value. Foreigners are the second most active investors on the Main Board, accounting for fifteen percent of the trading volume. Thai individuals and foreigners collectively account for more than 90 percent of Main Board activity. Again, stock exchange members and finance-related Thai companies represent only a small fraction of trading activity. This is consistent with the small presence of institutional investors like mutual funds and pension funds in Thailand, as in other developing economies.[12]

Panel A also summarizes trading activity by buys versus sells. We concentrate on Thai individuals and foreigners because they comprise the bulk of trading activity. On the Alien

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[12] See, for example, Dvorak (2005) on Indonesia.

Board, foreigners account for about 53 percent of buy volume and 56 percent of sell volume while "others" account for about 45 percent of buys and 42 percent of sells, implying that local individuals have been slightly more keen buyers than foreigners. Based on trading value, however, foreign buys and sells loom even larger, consistent with trading by Thai individuals in smaller lots. The pattern is similar on the Main Board, although Thai individuals dominate with almost 80 percent of activity by volume or value.

Panel B summarizes price-setting and non price-setting trades. Although foreign investors dominate the Alien Board, Thai individuals account for more than 26 percent of price-setting trading value and 44 percent of price-setting trading volume, which is quite significant. Foreign investors often trade on the Main Board as well, though not quite to the same extent as Thai individuals entering the Alien Board. Submission of price-setting orders may indicate investors who are aggressive, impatient, or non-discretionary liquidity investors, as in Admati and Pfleiderer (1988). Submission of non price-setting orders may indicate discretionary liquidity investors or investors who act as informal market-makers.

On the Alien Board, orders are split almost evenly between price-setting and non price-setting across all investor types. In contrast, only 42% of the orders of members trading on the Main Board are non price-setting, suggesting that their demand for immediacy is high and they do not largely emulate market makers.[13] Interestingly, foreigners who cross to the Main Board also seem to be relatively impatient, with only 45 percent non price-setting volume compared to about 50 percent on the Alien Board. It suggests that cross-market foreign investors might be aggressive or non-discretionary liquidity investors, who, in spite of the cost of losing voting rights, dividend, and other distributions, cross to the "other" market in search of more favorable order execution.

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[13] Orders of stock exchange members are their proprietary trades, not orders executed for other investors.

Next, we examine whether particular types of securities attract a specific investor clientele. In Table 2, we present statistics on the fraction of trading value by investor type across securities classified by different characteristics.[14] For example, the first row in the table shows that the "finance" category of investor accounts for 15.78 percent of Main Board trading in large cap stocks but only 7.44 percent of Main Board trading in small cap stocks, and the p-value of 0.025 indicates the difference is highly statistically significant. This indicates that finance investors are more focused on large cap stocks. So are foreign investors. In contrast, others (that is, Thai individuals) prefer small stocks. On the Alien Board however, there is no such effect. On the Main Board, heavy analyst coverage attracts foreigners while others prefer low analyst coverage stocks, but no such effects are observed on the Alien Board. Foreigners like stocks with a relatively high foreign ownership limit on both markets. "Member" investors have a strong preference for trading stocks with higher leverage, although leverage seems to have no impact on the trading choices of other types of investors. High turnover attracts (repels) members and others (finance and foreigners) on the Main Board, and attracts (repels) others (foreigners) on the Alien Board. Thai individuals prefer to trade stocks with high return volatility on both boards, while foreigners have a preference for low return volatility. In addition, "member" and "other" investors have a strong preference for trading bank stocks. Lagged stock returns seem to have no impact on trading preference. Again, it is evident that the choice of stock characteristics and trading venue varies substantially across different types of investors.

4.2. Liquidity and trading

In this section, we offer evidence on several dimensions of the relationship between liquidity and trading. In Admati and Pfleiderer (1988), informed investors seek to execute their trades at times when the market is liquid and active to minimize market impact and to prevent

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[14] We repeat the analysis using the fraction of trading volume, and the results are qualitatively similar.

other market participants inferring their information. Liquidity traders seek to minimize both the cost of trading and the potential for adverse selection. In our context, we hypothesize that our cross-market investors seek to execute their trades at times and places when liquidity is relatively higher, that is, the bid-ask spread is lower and depth is higher.

4.2.1. Spread, depth, and cross-market trading

For our first test, we identify, for each sample firm, five fifteen-minute time periods when trading activity of a particular type of investor on the Main (Alien) Board is particularly heavy. We also identify five fifteen-minute time periods when this trading activity is particularly light.[15] If our hypothesis is correct, we should find that liquidity (proxied with quoted spread and depth) is particularly high in the "other" market just before the heavy cross-market trading events, and liquidity is particularly low in the "other" market just before the small cross-market trading events.

Table 3 presents the results of a test of this proposition. When the cross-market trades of foreigners on the Main Board are extremely heavy, the bid-ask spread (depth) is significantly smaller (larger) than the spread (depth) when foreign trading on the Main Board is very light.[16] The difference is significantly different from zero. In contrast, we do not observe a significant difference in the bid-ask spread and depth between heavy and light trading events of foreigners on the Alien Board. We find similar results for the trading of Thai investors (finance, members, and "others") on the Alien Board. All four types of investors tend to trade heavily across markets when liquidity has been favorable in the "other" market. Thus, we find evidence supporting our hypothesis: cross-market orders tend to be placed at times of high market liquidity.

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[15] These extreme events are not clustered at a particular time of day.
[16] "Depth" equals the sum of bid depth and ask depth, where bid (ask) depth is the number of shares that can be sold (bought) at the bid (ask) price.

While Table 3 supports our hypothesis that cross-market trades are motivated by higher liquidity, our univariate analysis cannot address the potential confounding effect of other factors that affect cross-market trading. Therefore we take an additional approach to uncover the motivation for investors to cross markets. To measure the extent of cross-market trading, we compute the daily fraction of Main (Alien) Board trading activity (volume or turnover) due to market-crossing foreign (Thai individual) investors.[17] The resulting daily fraction is regressed (cross section and time series) on explanatory variables including proxies for Main Board market index returns, firm size, the Alien Board price premium, dividend yield, the spread between Alien and Main Board price volatility, and the spread between Alien and Main Board bid-ask spread. To control for causality running from cross-market trading to liquidity, we compute the price volatility and bid-ask spread from the previous 30 days.

Panel A of Table 4 presents summary statistics. The extent of cross-market trading is measured by the daily trading volume (value) of foreign (Thai individual) investors on the Main (Alien) Board divided by total trading volume (value) of foreign (Thai individual) investors on both boards. The average fraction of cross-market trading volume (value) of foreigners on the Main Board is 0.572 (0.548) with large standard deviations. The average fraction of cross-market trading volume (value) of Thai individuals on the Alien Board is, at 0.215 (0.235), smaller than what is found for foreigners. This suggests that more than half (a quarter) of Main (Alien) Board trading is due to foreigners (Thai individuals). The Alien Board price premium averages about 20 percent as does its standard deviation. The average dividend yield in our sample is about 2 percent. The mean difference in average daily volatility of the previous 30 days indicates that the Alien Board typically has higher stock price variation than the Main Board. There is also a

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[17] We focus on foreigners and Thai individuals since they account for more than 90% of trading on the two boards.

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substantial difference in bid-ask spreads between the two markets, with, on average, significantly higher transaction costs on the Alien Board.

Panel B of Table 4 presents the results of pooled OLS regressions. Looking across the columns allows us to compare and contrast what foreigners are doing on the Main Board to what Thai individuals are doing on the Alien Board. The coefficient estimates on the Main Board index return are not statistically significant in any specification. The coefficient estimates on market capitalization are significantly negative for cross-market trading of foreign investors, but significantly positive for cross-market trading of Thai individuals. This indicates that foreigners are more likely to be a big presence in Main Board trading of relatively small firms while Thai individuals are more likely to trade the largest Alien Board listings. The coefficient estimates on the Alien Board premium are negative and significant in all the specifications. This suggests that foreigners remain on the Alien Board when the general level of interest in that board (reflected in the premium) is high while Thai individuals avoid the Alien Board when the extra cost of buying shares there (the premium) is high. This result suggests that the Alien Board price premium is considered a cost by Thai individuals who trade on the Alien Board. Otherwise, we would observe no significant relation between the fraction of cross-market trading of Thai individuals and the Alien Board price premium.

The dividend yield is significantly negatively related to the fraction of cross-market trading by foreigners on the Main Board. Recall that foreign investors forgo any dividend when they buy Main Board shares for which the foreign ownership limit is binding.[18] Therefore, the negative slope on dividend yield supports our argument that the loss of the dividend is a significant cost to foreigners who trade on the Main Board. In contrast, the extent of cross-market trading of Thai individuals is not significantly related to the dividend yield. The

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[18] During the period we study, these "lost" dividends would go to the custodian bank.

coefficients on volatility difference indicate that higher Alien Board volatility keeps foreigners trading there (rather than crossing to the Main Board), and attracts Thai individuals to the Alien Board.

Most importantly, the bid-ask spread difference is positively and significantly related to the fraction of cross-market trading by foreigners. This indicates that poor Alien Board liquidity (that is, a relatively high bid-ask spread) prompts foreigners to trade on the Main Board. Similarly, the negative slopes on the bid-ask spread difference for Thai individuals on the Alien Board suggests that lower liquidity on the Alien Board repels Thai individuals from trading there.[19] Thus, the results of Table 4 confirm that liquidity is an important driver of cross-market trading. We also confirm that the cost of crossing boards is likely significant to investors: Thai individuals are less likely to cross to the Alien Board at times when they have to pay a high premium to buy there.

4.2.2. Effectiveness in filling orders

Next, we examine the price ratios of Choe, Kho, and Stulz (2005) as described above. Relative to the average buy (sell) price for a particular stock and day, we determine which type of investor typically pays (receives) a relatively low (high) price, implying a well timed and executed trade. If traders cross to the "other" market to exploit better liquidity, we would expect that cross-market trades are associated with better transaction prices (lower price when they buy and higher price when they sell). Table 5 presents summary statistics on relative price ratios by board and type of investor.

Panel A presents results for trading on the Main Board. For both buy and sell transactions, foreigners and members trade, on average, at disadvantageous prices relative to the

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[19] To check robustness, we follow Choe, Kho, and Stulz (2005) and estimate Fama - MacBeth regressions. They yield similar results, suggesting that our findings are not driven by the artifacts of the OLS error structure.

average trade. Foreigners buy at significantly higher prices than financial institutions and Thai individuals but do significantly better than members. Foreigners sell at significantly lower prices than other types of investors. It is particularly mysterious that the trades of stock exchange members are executed at relatively disadvantageous prices.

Unreported tables (available on request) decompose these results based on trade size, where "small" is less than 36,000 baht, "medium" is between 36,000 and 120,000 baht, "large" is anything above that, and the average exchange rate in 1999 was just under 38 baht per U.S. dollar. The price disadvantage of foreigners relative to financial institutions and Thai individuals persists in every trade size sub sample. Foreigners buy at significantly better prices than members for small and medium size trades. Members buy at worse prices than financial institutions and Thai individuals for all size trades. However, their sales are no different from financial institutions, and their price disadvantage relative to Thai individuals only appears for small and medium size trades.

Panel B presents results for trading on the Alien Board. For buy orders, foreigners and members trade at higher prices than average. For sell orders, foreigners and members trade at prices not significantly different than average. Across the four types of investors, members trade at the worst prices while foreigners buy (sell) at significantly higher (lower) prices than financial institutions and Thai individuals. Other unreported results (available upon request) indicate that patterns across trade size groups are similar to those reported for the Main Board and described above.

Panel C summarizes differences in price ratios comparing trading by the four types of investors across the two boards. Note that, due to the Alien Board price premium, stock prices are significantly different across Main and Alien boards but this is not an issue as prices are

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scaled by the average of all trades on the particular board. Foreigners buy (sell) at relatively lower (higher) prices on the Main Board relative to the Alien Board. That is, foreigners trade at better prices when they cross into the Main Board. Mirroring the foreigners, financial institutions and Thai individuals trade at better prices when they cross onto the Alien Board. In contrast, members trade at a similar disadvantage on both boards. Other unreported results (available upon request) suggest that these patterns are particularly strong for medium and large size trades.

In summary, Table 5 confirms that some investors appear to move between markets to achieve advantageous prices, particularly in filling relatively large orders. These results support our hypothesis that cross-market trading is, in part, liquidity driven.

4.3. Information and trading

The previous results document associations between liquidity and trading behavior on and across the two boards. In particular, it appears that some investors select the time and venue of their trading activity to minimize trading costs. Switching between boards may not only optimize trading costs but may also help mask informed trades. In this section, we examine how cross-market trades are related to market information and whether the profitability and contribution to price discovery of cross-market trades are consistent with informed trading.

4.3.1. Trading on market information

We begin by examining whether patterns in cross-market trading are consistent with two types of trading strategies. First, some investors may trade across the two markets, or use information from both, to exploit persistence or reversal in stock returns with "momentum" or "contrarian" trading. Second, some investors may trade across the two markets to exploit abnormally high or low Alien Board premiums. If, for example, the Alien Board premium is abnormally high, an investor may buy Main Board shares and sell Alien Board shares in the hope

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of earning an abnormal return if Alien Board premium shrinks later. Alternatively, if the Alien Board premium is abnormally low, an investor may buy Alien Board shares and sell Main Board shares in the hope of earning an abnormal return if the Alien Board premium widens later. To test for these two effects, we relate price-setting order imbalances to return and to the Alien Board premium.

Our model specification follows Griffin, Harris, and Topaloglu (2003). Since Griffin, Harris, and Topaloglu (2003) deal with only one stock market, we modify their specification to incorporate the parallel trading we study. For each board and two dominant investor types, the excess price-setting buy-sell imbalance (subtracted by the time-series mean) is regressed on lagged aggregate excess price-setting buy-sell imbalances from both boards,[20] lagged cumulative returns from both boards,[21] and the lagged Alien Board premium. For each type of investor and each stock, we estimate a system of two-equations as follows.

$$Netbuy_{j,t}^{M} = a_1 + b_1^{M} Netbuy_{t-1}^{M} + b_1^{A} Netbuy_{t-1}^{A} + g_1^{M} R_{t-1,t-6}^{M} + g_1^{A} R_{t-1,t-6}^{A} + h_1((P_{t-1}^{A} - P_{t-1}^{M})/P_{t-1}^{M}) \quad (2)$$

$$Netbuy_{j,t}^{A} = a_2 + b_2^{M} Netbuy_{t-1}^{M} + b_2^{A} Netbuy_{t-1}^{A} + g_2^{M} R_{t-1,t-6}^{M} + g_2^{A} R_{t-1,t-6}^{A} + h_2((P_{t-1}^{A} - P_{t-1}^{M})/P_{t-1}^{M}) \quad (3)$$

$Netbuy_{j,t}^{M}$ and $Netbuy_{j,t}^{A}$ are price-setting imbalances for the jth investor type on the Main and Alien boards respectively at time t, and $Netbuy_{t}^{M}$ and $Netbuy_{t}^{A}$ are the price-setting imbalances aggregated over all investors on each board at time t. The other explanatory variables are cumulative returns over the previous five 15-minute intervals on each board, and the lagged

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[20] SET quotes show the depths at the three best bid and ask prices but do not identify the trader types for the orders. Therefore, we assume traders condition on the aggregate price-setting buy-sell imbalance only.

[21] Pairs of related explanatory variables (lagged buy-sell imbalances and cumulative returns from both boards) may induce multicolinearity. However, our results are robust to estimating specifications with reduced numbers of variables or with orthogonalized variables.

Alien Board price premium. The above two equations are jointly estimated for each of the 25 sample firms, and the results of the individual estimates are summarized in Table 6.

The slope coefficients on lagged aggregate buy-sell imbalances indicate whether the current buy-sell imbalance is correlated with the previous aggregate imbalance from either board. The slope coefficients on lagged cumulative returns reveal momentum or contrarian trading strategies. The inclusion of lagged buy-sell imbalances and lagged cumulative returns from both boards allows us to see whether trading activity is related to behavior on the other board, implying that traders use information from both markets. The slope coefficients on the Alien Board premium can be interpreted in at least two ways. If investors trade on their belief that the Alien Board premium is mean-reverting, the slope coefficient on the Alien Board premium for Main (Alien) Board buy-sell imbalances would be positive (negative) as investors buy (sell) Main (Alien) Board shares to explore this profitable opportunity. Alternatively, if a large Alien Board premium reflects heightened demand for Alien Board shares relative to Main Board shares, we would observe the opposite. The slope coefficient on the Alien Board premium for Main (Alien) Board buy-sell imbalance would be negative (positive).

The results of these regressions are reported in Table 6. Foreigners' buy-sell imbalances are typically positively correlated only with lagged imbalances on their traded board, not the other board. In contrast, Thai individuals' buy-sell imbalances are positively correlated with lagged imbalances from both boards. This suggests that Thai individuals make use of information on relative buying pressure from both boards to guide their trading while foreigners do not. On both Main and Alien Boards, foreigner's buy-sell imbalances are typically positively correlated with lagged cumulative returns from both boards. This indicates that foreigners tend to be momentum traders, and they use returns information from both boards to guide the direction

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of their trading. In contrast, Thai individual buy-sell imbalances display contrarianism in the form of negative slopes on the particular board's lagged cumulative return. These results echo prior findings (for example, Grinblatt and Keloharju, 2000; Froot, O'Connell, and Seasholes, 2001; Kaniel, Saar, and Titman, 2004) that institutional investors (such as our foreign investors) tend to pursue momentum strategies while individuals are often contrarians. Furthermore, the buy-sell imbalances of the Thai individuals on either board are less dependent on the lagged cumulative returns on the other board, suggesting that they do not use return information from both markets to the extent that foreigners do.

Comparing slope coefficients on the Alien Board premium across investor types and boards, we find that the foreign buy-sell imbalance on the Main Board increases with the Alien Board premium. This is consistent with the "risk arbitrage" story outlined above and our earlier findings that investors who trade across the two markets are particularly aggressive: when the Alien Board premium increases, aggressive foreign investors cross onto the Main Board to buy relatively underpriced shares there. Similarly, the table shows that Thai individuals tend to cross to the Alien Board and sell shares when the Alien Board premium is high, perhaps indicating that they are selling relatively overpriced shares.

On balance, these results indicate that some cross-market trading may be motivated by patterns of persistence or reversal in stock returns or in the price spread between Main and Alien boards. The results also suggest that some traders condition these aggressive trades on information from both boards.

4.3.2. Longer-run trading performance

If some cross-market traders sometimes cross to the "other" market to mask their informed trading, we would expect higher profits to be associated with cross-market trades. For

this purpose, we next assess the longer-horizon returns on the trades of different types of investors using two methods. First, we follow Odean (1999) and compute cumulative returns after stock purchases and sales over four month and twelve month horizons. The difference between cumulative returns following purchases and cumulative returns following sales is a measure of whether these trades are profitable or not. If the difference is significantly positive and larger than one round of transaction costs, these trades reflect buying stocks with higher future returns and selling stocks with lower future returns, suggesting good timing or useful information.

To assess these returns, we must understand the relevant market frictions. Across our sample, the average bid-ask spread is 1.27% on the Main Board and 1.97% on the Alien Board. Brokerage commissions on the SET are capped at ½ % of the value of ordinary shares traded on either board. Retail investors (such as our Thai individuals) pay the full ½ %. Local institutions can negotiate and pay approximately 0.2%. Foreigners indirectly obtain an even lower rate, about 0.1 %, by negotiating reduced fees for access to research and databases. Thus, the average total cost of a round-trip trade for local individuals is 2.27% on the Main Board and 2.97% on the Alien Board, 1.67% on the Main Board and 2.37% on the Alien Board for members and financial institutions, and 1.47% on the Main Board and 2.17% on the Alien Board for foreigners.

Panel A of Table 7 presents cumulative return results across Main Board and Alien Board, buying and selling, and our four types of investors. On the Main Board, for both 82 day (that is, four months) and 245 day (that is, 12 months) horizons,[22] the average subsequent return to stocks bought by financial institutions is substantially less than the average subsequent return to stocks sold. The differences are minus five percent and minus 9.35 percent respectively, not

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[22] Given the level of trading costs in this market, it is not likely that high-frequency "day trading" at intraday horizons is profitable.

including transactions costs. This suggests that Thai institutional investors do not possess useful information, echoing some of the findings of Odean (1999) for U.S. discount brokerage customers.[23] However, on the Alien Board, finance investor returns subsequent to buys exceed returns subsequent to sells by 3.09 percent and 2.04 percent for the 82 and 245 day holding periods respectively. It suggests that some of the finance group perform well when they cross to trade on the Alien Board. Given the transaction costs outlined earlier (1.67 percent on the Main Board and 2.37 percent on the Alien Board), however, these Alien Board trades may not be significantly profitable.

For foreign investors crossing to the Main Board, returns subsequent to buys significantly exceed returns subsequent to sells by 2.14 percent and 5.14 percent for holding periods of 82 days and 245 days respectively, suggesting that those foreigners who cross onto the Main Board are good at picking stocks and timing their trades. Even after subtracting a transactions cost of 1.47 percent, foreigners typically enjoy significant profits trading on the Main Board. On the Alien Board, however, foreign performance is close to zero for both horizons. Thus, certain foreigners appear to profit from crossing to the Main Board.

For members, returns on stocks bought exceed those on stocks sold at the 245 day horizon on the Main Board but underperform on the Alien Board, suggesting that members who trade across the two markets are not particularly informed. In contrast, trades by Thai individuals (that is, "others") underperform on the Main Board net of transactions costs but overperform slightly on the Alien Board, at least before considering transactions costs. Similar to financial institutions, however, the holding period returns might not be large enough to cover transaction costs.

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[23] Odean (1999) reports strongly significant differences between returns on buys and returns on sells of -1.36%, -3.31%, and -3.32% at horizons of 84, 252, and 504 trading days respectively, suggesting that average trades are not profitable at all.

We repeat the analysis using market adjusted returns rather than raw returns. Specifically, the contemporaneous return on the value-weighted index of the Thai stock market is subtracted from each stock return series.[24] The table shows that results on market adjusted returns are similar to those of raw returns. We have apparently detected a class of investors, particularly foreigners, who pick stocks and time their trades effectively as they cross market to trade.

The cumulative returns in the method of Odean (1999) are essentially buy-and-hold returns following a buy or sell trading event. While accurately capturing investors' buy-and-hold returns for a time period, Mitchell and Stafford (2000) show that this method may be subject to severe bias due to positive cross-correlation of firm-event returns. To address this concern, we adopt an alternative method, the calendar-time portfolio approach detailed in Mitchell and Stafford (2000), to measure post trade performance. Starting from the first trading day of our sample period, for each type of trader on each board, we form two portfolios, "buy" and "sell", that include all stocks bought or sold respectively on that day. This yields a total of sixteen portfolios. On the second trading day, each portfolio is rebalanced to reflect the trading that occurred on the second day. We repeat this process for each trading day through the end of our sample period. The positions resulting from each order are retained in the portfolios for either 4 or 12 months. Then we compute the daily value-weighted return of all stocks in each portfolio for each trading day.

Results are reported in Panel B of Table 7.[25] The results based on portfolio returns are generally consistent with those based on cumulative returns following Odean (1999). Financial institutions and Thai locals earn significantly positive profits on the Alien Board (cross-market

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[24] Results based on CAPM adjusted returns are qualitatively similar to those based on market-adjusted returns.
[25] Please note that the magnitude of portfolio returns in Panel B is much smaller than that of cumulative returns in Panel A. This is because Panel A reports the average of cumulative returns over 82 or 245 trading days following each transaction, while Panel B reports the average of value-weighted daily returns of each portfolio containing stocks bought or sold during the previous 82 or 245 trading days.

trading) following their buy and sell trades, but break even or lose when they trade on the Main Board. Cross-market trades by foreigners on the Main Board earn significantly positive profits, while their Alien Board trades often earn insignificant profits. Members appear different from the other three types of investors. They earn higher profits from trading on the Main Board than from trading on the Alien Board.

In summary, we find that cross-market trades by foreigners, financial institutions, and Thai locals are more profitable than trades conducted on "their own board". This again confirms that there is something different about cross-market trading.

4.3.3. Cross-market trading and price discovery

In previous sections, we have found that cross-market activity is associated with interesting patterns in terms of the timing and profitability of those trades. In this section, we test whether the presence of cross-market trading alters patterns in price discovery across the two boards. Following Hotchkiss and Ronen (2002) and Griffin, Harris, and Topoluglu (2003), we estimate two-equations jointly for stock returns over each 15-minute interval on the Alien Board and Main Board as follows:

$$R_t^A = a_1 + \sum_{i=1}^{3} b_{i1}^M R_{t-i}^M + \sum_{i=1}^{3} b_{i1}^A R_{t-i}^A + h_1 HIGH + \sum_{i=1}^{3} g_{i1}^M R_{t-i}^M * HIGH + \sum_{i=1}^{3} g_{i1}^A R_{t-i}^A * HIGH, \quad (4)$$

$$R_t^M = a_2 + \sum_{i=1}^{3} b_{i2}^M R_{t-i}^M + \sum_{i=1}^{3} b_{i2}^A R_{t-i}^A + h_2 HIGH + \sum_{i=1}^{3} g_{i2}^M R_{t-i}^M * HIGH + \sum_{i=1}^{3} g_{i2}^A R_{t-i}^A * HIGH, \quad (5)$$

where R_t^A and R_t^M are stock returns on the Alien and Main boards respectively at time t. In addition to the three lags of returns from both boards, we incorporate a dummy variable, HIGH, that indicates times when cross-market trading volume (or percent of total trading volume) is in the top quintile. Interactive terms equal the product of the high cross-market dummy times the

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lagged returns. The above two equations are jointly estimated for each of the 25 sample firms and summarized in Table 8.

Panel A reports regressions that capture the impact on price discovery of Thai individuals crossing to the Alien Board. The slope coefficients for the lagged returns indicate that there is positive feedback between the two markets, and a good deal of negative serial correlation in both. The slope dummy terms show that, when there are many orders from Thai individuals submitted to the Alien Board, feedback from Alien Board returns to Main Board returns strengthens significantly. This is indicated by the large number of significant positive coefficients for HIGH times lags of Alien Board returns in equation (5). Lags of Alien Board returns also become more significant for Alien Board returns themselves, equation (4). These effects are smaller when cross-market activity is measured as a fraction of total activity, although the heightened impact of Alien Board returns on subsequent Main Board returns remains prominent. Thus, when cross-market activity by Thai individuals trading on the Alien Board rises, Alien Board returns become more significant to subsequent returns on both boards. Furthermore, the enhancement of price discovery seems unidirectional, since we do not observe any increase in price discovery from the Main Board to the Alien Board.

Panel B reports regressions that capture the impact on price discovery of foreign investors crossing to the Main Board. When foreigners cross onto the Main Board either in significant numbers or in significant proportion, Main Board returns become much more significant in explaining subsequent Alien Board returns. This result is revealed by the large number of significant positive coefficients for HIGH times lags of Main Board returns in equation (4). Thus, cross-market trading in either direction seems to be associated with

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enhanced transmission of information, in addition to being relatively profitable and cleverly timed. While Admati and Pfleiderer (1988) analyze market timing of both informed and uninformed traders, our finding of enhanced price discovery suggests that cross-market trades are associated with informed traders, rather than uninformed traders seeking liquidity.

In summary, we find evidence that some investors cross to the other market to exploit superior information, in addition to seeking liquidity. These investors are found among both local and foreign investor groups.

5. Summary and Conclusions

We study an interesting institutional arrangement, parallel markets for trading of stocks by foreign and local investors in Thailand. A summary of our major findings is as follows. Our summary statistics indicate that the extent of trading across the two boards is surprisingly large. Our liquidity-related tests indicate that cross-market orders tend to be submitted when liquidity is relatively favorable in the "other" market, and, as a consequence, these orders are filled at relatively better prices. Our information-related tests indicate that cross-market traders use market information to trade on return patterns like persistence and reversal, and on mean-reversion in the spread between Alien and Main board prices. Holding period returns following cross market trades are particularly profitable, suggesting that some cross-market orders represent informed trading. Finally, cross-market trades are associated with heightened price discovery, suggesting that cross-market traders are informed investors and their trades contribute to transmitting information into the market.

The structure of stock trading in Thailand permits us to contribute unique new evidence on the workings of multi-market equity trading. Our results illustrate some of the features and

implications of market microstructure models such as the role of liquidity and the extent to which informed investors appear to trade strategically. We also contribute to the ongoing debate about whether foreign investors are at a disadvantage relative to local investors. While previous studies disagree about whether locals or foreigners have better information and trading skill, we document profitable cross-market trading by both locals and foreigners.

While cross-market trading is an aggressive trading strategy that is, in some ways, costlier than remaining on one's "own" board, cross-market traders appear to skillfully exploit liquidity. Some of these traders may also be informed traders. Furthermore, their aggressive trading contributes to market efficiency by accelerating the incorporation of information into prices. While we lack information such as individual investor identifiers and characteristics to study trader motivations and performance in greater detail, our evidence appears consistent with a well-functioning financial market in the sense of Grossman and Stiglitz (1980).

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Table 1. Summary Statistics on Trading Activity by Investor Type and Board

Investor types include Thai finance-related companies (banks, finance companies, insurance companies, institutional investors), stock exchange members, Thai "others" (that is, individuals), and foreigners. The sample includes the 25 most liquid stocks as measured by the number of trades from 1 January 1999 to 31 December 1999. A buy-side (sell-side) price-setting trade for an investor is a trade where the buy (sell) order of the investor came after the sell-side (buy-side) order and hence made the trade possible. Trades that could not be classified account for 9.28% and 8.23% of total trading values on Alien and Main board respectively.

Panel A: Summary statistics on trades

Board	Investor type	Number	All trades: Fraction of total trading volume	Fraction of total trading value	Number	Buy trades: Fraction of total trading volume	Fraction of total trading value	Number	Sell trades: Fraction of total trading volume	Fraction of total trading value
Alien	Finance	12224	0.0049	0.0056	5588	0.0052	0.005	6636	0.0046	0.0063
Alien	Foreign	1322672	0.544	0.7247	653355	0.5311	0.723	669317	0.5569	0.7264
Alien	Member	20938	0.0134	0.0113	8977	0.0125	0.0105	11961	0.0143	0.012
Alien	Others	831054	0.4378	0.2585	425524	0.4512	0.2616	405530	0.4243	0.2553
Main	Finance	293552	0.037	0.0717	136521	0.0372	0.0716	157031	0.0368	0.0719
Main	Foreign	877216	0.1494	0.212	423726	0.1506	0.2136	453490	0.1482	0.2105
Main	Member	62636	0.0183	0.0174	30738	0.0184	0.0172	31898	0.0183	0.0176
Main	Others	4306700	0.7953	0.6989	2179067	0.7938	0.6977	2127633	0.7968	0.7001

Panel B: Summary statistics on price-setting and non-price setting trades

Board	Investor type	Number of price-setting trades	Fraction of total price-setting trading volume	Fraction of total price-setting trading value	Number of non price-setting trades	Fraction of total non price-setting trading volume	Fraction of total non price-setting trading value
Alien	Finance	5091	0.0045	0.0052	12224	0.53921	0.53487
Alien	Foreign	628133	0.5439	0.7217	1322672	0.49637	0.49951
Alien	Member	11074	0.0139	0.0116	20938	0.48325	0.48559
Alien	Others	406971	0.4377	0.2614	831054	0.50451	0.50123
Main	Finance	133254	0.0349	0.0648	293552	0.52054	0.53934
Main	Foreign	463783	0.1621	0.2289	877216	0.45487	0.45449
Main	Member	35928	0.0211	0.0196	62636	0.42406	0.44127
Main	Others	2089685	0.7819	0.6867	4306700	0.50882	0.51089

Table 2. Summary Statistics on Trading Activity Conditional on Firm Characteristics

This table reports the fraction of trading value for each type of investor on each board conditional on firm characteristics. Investor types include Thai finance-related companies (banks, finance companies, insurance companies, institutional investors), stock exchange members, Thai "others" (that is, individuals), and foreigners. The fraction of trading value equals daily trading value of each type of investors on the Main (Alien) Board divided by daily total trading value on the Main (Alien) Board by all investors, then averaged over all days in 1999. Market cap is Main Board stock price at end of 1998 times shares outstanding. Number of analysts is end of 1998 for analysts providing annual earnings forecasts. Foreign ownership limit is the fraction of shares foreigners may hold, and varies across firms. Bank dummy equals one if the firm is in the banking industry and zero otherwise. Leverage is total debt divided by total assets at end of 1998. Cumulative return and return volatility are computed with Main board prices across 1998. Stock turnover is trading volume divided by shares outstanding for 1998. Large (or high) value of firm characteristics is defined as above the median. There is a cross-section of 25 firms. Standard t-tests are conducted to examine the difference and p-values are reported in parentheses. "Others" category represents Thai individuals.

	Main Board				Alien Board			
	Finance	Foreigner	Member	Others	Finance	Foreigner	Member	Others
Large market cap	0.1578	0.3303	0.0146	0.4974	0.0063	0.7723	0.0099	0.2115
Small market cap	0.0744	0.2170	0.0106	0.6980	0.0086	0.6539	0.0107	0.3268
Difference	0.0834	0.1133	0.0039	-0.2006	-0.0023	0.1184	-0.0008	-0.1153
P-value	(0.025)	(0.034)	(0.132)	(0.022)	(0.484)	(0.163)	(0.712)	(0.179)
Large analyst following	0.1429	0.3424	0.0137	0.5010	0.0084	0.7447	0.0116	0.2353
Small analyst following	0.0881	0.2058	0.0115	0.6946	0.0067	0.6793	0.0092	0.3047
Difference	0.0548	0.1366	0.0022	-0.1936	0.0017	0.0654	0.0023	-0.0694
P-value	(0.145)	(0.036)	(0.409)	(0.031)	(0.612)	(0.449)	(0.299)	(0.418)
High foreign ownership limit	0.1475	0.3639	0.0083	0.4804	0.0104	0.7873	0.0088	0.1935
Low foreign ownership limit	0.0924	0.2097	0.0154	0.6825	0.0056	0.6597	0.0114	0.3234
Difference	0.0551	0.1541	-0.0071	-0.2021	0.0049	0.1276	-0.0025	-0.1299
P-value	(0.162)	(0.026)	(0.006)	(0.027)	(0.156)	(0.035)	(0.259)	(0.107)
High leverage	0.0843	0.2254	0.0168	0.6736	0.0058	0.6595	0.0116	0.3232
Low leverage	0.1422	0.3138	0.0106	0.5353	0.0092	0.7580	0.0092	0.2236
Difference	-0.0580	-0.0885	0.0062	0.1383	-0.0034	-0.0986	0.0024	0.0996
P-value	(0.114)	(0.161)	(0.122)	(0.115)	(0.302)	(0.254)	(0.278)	(0.246)
High turnover	0.0544	0.1618	0.0148	0.7691	0.0060	0.5719	0.0114	0.4107
Low turnover	0.1698	0.3725	0.0105	0.4472	0.0090	0.8389	0.0094	0.1428
Difference	-0.1154	-0.2108	0.0043	0.3219	-0.0030	-0.2670	0.0021	0.2679
P-value	(0.001)	(0.001)	(<0.001)	(<0.001)	(0.371)	(0.002)	(0.361)	(0.001)
High stock return	0.1265	0.2452	0.0125	0.6158	0.0059	0.7051	0.0096	0.2794
Low stock return	0.1033	0.2955	0.0126	0.5887	0.0090	0.7159	0.0111	0.2641
Difference	0.0233	-0.0503	-0.0001	0.0271	-0.0031	-0.0107	-0.0015	0.0153
P-value	(0.539)	(0.429)	(0.979)	(0.761)	(0.351)	(0.899)	(0.504)	(0.857)
High return volatility	0.0680	0.1717	0.0147	0.7456	0.0075	0.6517	0.0102	0.3306
Low return volatility	0.1573	0.3634	0.0105	0.4688	0.0076	0.8157	0.0106	0.1661
Difference	-0.0893	-0.1917	0.0042	0.2768	-0.0002	-0.1640	-0.0003	0.1645
P-value	(0.013)	(0.001)	(0.108)	(0.001)	(0.962)	(0.045)	(0.883)	(0.044)
Bank	0.0571	0.1878	0.0201	0.7349	0.0067	0.5494	0.0142	0.4297
Non-bank	0.1025	0.2978	0.0101	0.5596	0.0078	0.7617	0.0091	0.2214
Difference	-0.0454	-0.1099	0.0100	0.1753	-0.0010	-0.2123	0.0050	0.2083
P-value	(0.126)	(0.092)	(0.001)	(0.054)	(0.813)	(0.089)	(0.023)	(0.043)

Table 3. Liquidity Around the Largest versus Smallest Trades by Board and Investor Type

For each stock, we select the ten fifteen-minute intervals with the five largest and five smallest trading volumes for each type of investor on each board. Investor types include Thai finance-related companies (banks, finance companies, insurance companies, institutional investors), stock exchange members, Thai "others" (that is, individuals), and foreigners. We then compute the average spread and depth over window (-3, -1) for each event, and compare the mean spread and mean depth of the 5 largest and the 5 smallest trading events. Spread and depth are computed as (ask – bid)/(ask + bid)/2 and (bid depth + ask depth) respectively (where bid (ask) depth is the number of shares that can be sold (bought) at the bid (ask) price), and then standardized by subtracting the average and dividing by the average for all observations for the same stock over the entire sample period. Standard t-tests are conducted to examine the difference and p-values are reported in parentheses.

Investor	Trading volume	Extreme Trading Events on Main Board				Extreme Trading Events on Alien Board			
		Main Board		Alien Board		Main Board		Alien Board	
		Spread	Depth	Spread	Depth	Spread	Depth	Spread	Depth
Finance	Largest	-0.0798	0.5616	-0.0946	0.1442	0.0262	0.0489	-0.1897	0.4569
Finance	Smallest	-0.0971	0.2978	0.0291	-0.1146	0.0024	-0.0175	0.0684	-0.1005
	Difference	0.0173	0.2638	-0.1237	0.2588	0.0238	0.0664	-0.2581	0.5574
	p-value	(0.098)	(0.224)	(0.139)	(0.075)	(0.524)	(0.475)	(<0.001)	(<0.001)
Foreigner	Largest	-0.1108	1.0625	0.0478	0.1614	-0.0737	0.3719	-0.1420	0.5847
Foreigner	Smallest	0.0179	-0.0556	0.0735	0.2018	0.0814	-0.0079	-0.0590	-0.0497
	Difference	-0.1287	1.1181	-0.0257	-0.0404	-0.1551	0.3798	-0.0830	0.6343
	p-value	(<0.001)	(<0.001)	(0.794)	(0.439)	(<0.001)	(<0.001)	(0.049)	(0.003)
Member	Largest	-0.0662	0.3719	-0.1163	0.0123	-0.1136	0.3264	-0.2583	0.8438
Member	Smallest	-0.1039	0.0930	0.0290	-0.0226	-0.0095	0.0123	-0.0655	-0.1876
	Difference	0.0377	0.2788	-0.1454	0.0350	-0.1042	0.3141	-0.1929	1.0314
	p-value	(0.093)	(0.076)	(0.118)	(0.698)	(0.003)	(<0.001)	(<0.001)	(<0.001)
Others	Largest	-0.1139	0.3813	-0.1513	0.3795	-0.1477	0.5870	-0.3244	0.7329
Others	Smallest	0.0527	0.0434	-0.0011	0.0924	0.0393	0.0357	-0.0330	-0.0813
	Difference	-0.1666	0.3379	-0.1502	0.2872	-0.1870	0.5513	-0.2915	0.8142
	p-value	(0.063)	(0.089)	(0.235)	(0.386)	(0.001)	(<0.001)	(<0.001)	(<0.001)

Table 4. Explaining the Proportion of Cross-Market Trading

Panel A presents summary statistics on variables used in regressions. Daily fraction of cross-market trading volume (value) equals trading volume (value) of foreign (Thai individual) investors on the Main (Alien) Board divided by total trading volume (value) by foreign (Thai individual) investors on both boards. Daily market cap is closing Main Board stock price times shares outstanding. Alien Board premium is Alien Board price minus Main Board price, scaled by Main Board price, using prices from the last 15-minute interval in the day that has trading volume on both boards. Dividend yield is the amount of annual dividend divided by year-end stock price. Volatility difference is the average of previous 30 daily difference in volatilities between Alien and Main boards, where daily volatility is computed as (high - low)/(high + low)/2. Bid-ask spread difference is the average of previous 30 daily difference in bid-ask spread between the Alien and Main boards, where daily bid-ask spread is (ask -bid)/(ask + bid)/2 observed prior to market close. In Panel B, the daily fraction of Main (Alien) Board trading activity due to foreign (Thai individual) investors is regressed on the explanatory variables previously described. OLS regressions pool all trading days in 1999 and all 25 companies. T-statistics are reported below each coefficient estimate.

Panel A. Summary statistics for regression variables.

Variable	Foreign trading on Main Board				Thai individual trading on Alien Board			
	Nobs	Mean	Median	Std dev	Nobs	Mean	Median	std dev
Fraction of trading volume	4360	0.5723	0.5480	0.3329	4247	0.2147	0.1633	0.1963
Fraction of trading value	4360	0.5478	0.5018	0.3429	4247	0.2353	0.1876	0.2046
Main Board index total return	4360	0.0024	0.0006	0.0232	4247	4247	0.0029	0.0007
Log of market capitalization	4360	16.7255	16.6696	1.3181	4247	16.9409	17.1084	1.2958
Alien Board premium	4360	0.2142	0.1135	0.2369	4247	0.2047	0.1072	0.2290
Dividend yield	4360	0.0207	0	0.611	4247	0.0197	0	0.0549
Alien – Main volatility difference	4360	0.1295	0.0790	0.6093	4247	0.1918	0.1352	0.5123
Alien – Main bid-ask spread difference	4360	2.0480	0.8250	3.3415	4247	1.3714	0.6687	2.0656

Panel B. Regressions explaining the extent of cross-market trading

	Fraction of Main Board trading due to foreigners by:		Fraction of Alien Board trading due to Thai individuals by:	
	Volume	Value	Volume	Value
Intercept	0.598	0.608	0.279	0.251
	9.381	9.626	6.452	5.520
Main Board index return	0.126	0.103	0.135	0.149
	0.705	0.582	1.116	1.173
Log of market capitalization	-0.007	-0.007	0.000	0.002
	-1.750	-1.954	-0.135	0.650
Alien Board premium	-0.044	-0.099	-0.265	-0.197
	-2.213	-5.007	-19.035	-13.475
Dividend yield	-0.188	-0.172	0.133	0.126
	-3.170	-2.753	1.713	1.628
Alien – Main volatility difference	-0.285	-0.285	0.154	0.169
	-26.028	-26.234	20.860	21.854
Alien – Main bid-ask spread difference	0.026	0.027	-0.022	-0.024
	9.493	9.862	-10.849	-11.293
Adjusted R^2	0.222	0.259	0.194	0.184
Number of observations	3986	3986	3843	3843

Table 5. Relative Price Ratios by Board, Investor Type, and Buyer versus Seller

For each board, stock, type of investor, and type of trade (buy or sell), we compute the daily volume-weighted average price at which trades occur, scale by the average price across all types of investors, average over all days in the sample, and multiply by 100. T-statistics examine whether the ratios are significantly different from 100 or differ across types of investors. Investor types include Thai finance-related companies (banks, finance companies, insurance companies, institutional investors), stock exchange members, Thai "others" (that is, individuals), and foreigners.

Panel A: Main Board

	Buyers				Sellers			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	Foreigner	Member	Finance	Others	Foreigner	Member	Finance	Others
Average price ratio	100.07	100.159	99.8552	99.9229	99.9717	99.9798	100.079	100.083
(t-test: $H_0 = 100$)	(6.80)	(5.36)	(-8.55)	(-13.63)	(-7.42)	(-0.67)	(3.83)	(14.25)
Difference of price ratio from (1)		-0.1061	0.2224	0.1534		-0.09626	-0.16282	-0.1695
(t-test: $H_0 = 0$)		(-3.10)	(9.60)	(11.59)		(-2.72)	(-5.79)	(-12.33)
Difference of price ratio from (2)			0.26616	0.22825			0.00691	-0.0983
(t-test: $H_0 = 0$)			(5.88)	(7.48)			(0.13)	(-3.20)
Difference of price ratio from (3)				-0.0507				-0.0155
(t-test: $H_0 = 0$)				(-2.55)				(-0.67)

Panel B: Alien Board

	Buyers				Sellers			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	Foreigner	Member	Finance	Others	Foreigner	Member	Finance	Others
Average price ratio	100.122	100.232	99.5797	99.8282	99.9625	99.96	100.222	100.167
(t-test: $H_0 = 100$)	(1.71)	(4.06)	(-4.87)	(-7.73)	(-0.53)	(-0.84)	(2.48)	(9.32)
Difference of price ratio from (1)		-0.2035	0.46824	0.2105		0.00075	-0.25859	-0.19332
(t-test: $H_0 = 0$)		(-3.41)	(4.68)	(6.41)		(0.01)	(-2.57)	(-6.86)
Difference of price ratio from (2)			0.72183	0.38764			-0.40524	-0.20857
(t-test: $H_0 = 0$)			(4.08)	(7.16)			(-2.11)	(-3.98)
Difference of price ratio from (3)				-0.2852				0.17816
(t-test: $H_0 = 0$)				(-3.22)				(1.71)

Panel C: Cross-market

	Buyers				Sellers			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	Foreigner	Member	Finance	Others	Foreigner	Member	Finance	Others
Main Board price ratio minus Alien Board price ratio	-0.0821	-0.1840	0.2638	0.0950	0.0428	0.0834	-0.1961	-0.0776
(t-test: $H_0 = 0$)	(-4.72)	(-1.93)	(2.72)	(4.22)	(2.65)	(1.13)	(-1.48)	(-4.20)

Table 6. Explaining Excess Price-Setting Buy-Sell Imbalances

This table reports estimates s of a two-equation system to explain 15-minute excess price-setting buy-sell imbalances of foreigners and Thai individuals on the two boards. A buy-side (sell-side) price-setting trade occurs when the buy (sell) order comes after the sell-side (buy-side) order and hence made the trade possible. Price-setting buy-sell imbalance is computed as (price-setting buy volume – price-setting sell volume)/total price-setting volume. Excess buy-sell imbalance is computed by subtracting the time-series mean for each of the 25 stocks.

$$Netbuy_{j,t}^{M} = \mathbf{a}_1 + \mathbf{b}_1^{M}\, Netbuy_{t-1}^{M} + \mathbf{b}_1^{A}\, Netbuy_{t-1}^{A} + \mathbf{g}_1^{M} R_{t-1,t-6}^{M} + \mathbf{g}_1^{A} R_{t-1,t-6}^{A} + \mathbf{h}_1((P_{t-1}^{A} - P_{t-1}^{M})/P_{t-1}^{M}) \qquad (2)$$

$$Netbuy_{j,t}^{A} = \mathbf{a}_2 + \mathbf{b}_2^{M}\, Netbuy_{t-1}^{M} + \mathbf{b}_2^{A}\, Netbuy_{t-1}^{A} + \mathbf{g}_2^{M} R_{t-1,t-6}^{M} + \mathbf{g}_2^{A} R_{t-1,t-6}^{A} + \mathbf{h}_2((P_{t-1}^{A} - P_{t-1}^{M})/P_{t-1}^{M}) \qquad (3)$$

The dependent variables, $Netbuy_{j,t}^{M}$ and $Netbuy_{j,t}^{A}$, are price-setting imbalances for the jth investor type on the Main and Alien boards respectively.

Explanatory variables are lags of the price-setting imbalance aggregated over all investors on the Main board ($Netbuy_{t}^{M}$) and Alien board ($Netbuy_{t}^{A}$), cumulative returns over the previous five 15-minute intervals on each board, and the lagged Alien Board price premium. These two equations are jointly estimated for each of the 25 sample firms, and the table summarizes results of the individual estimates.

	Dependent variable is:											
	Foreign investor buy-sell imbalance on:						Thai individual buy-sell imbalance on:					
	Main Board			Alien Board			Main Board			Alien Board		
	Average slope	Fraction positive	Fraction negative	Average Slope	Fraction positive	Fraction negative	Average slope	Fraction positive	Fraction negative	Average slopes	Fraction positive	Fraction negative
Intercept	-0.1600	0.15	0.40	-0.0496	0.05	0.35	0.0366	0.18	0.14	0.1164	0.55	0.05
Lagged Main Board buy-sell imbalance	0.1294	0.65	0.00	0.0025	0.00	0.10	0.4581	1.00	0.00	0.0873	0.45	0.00
Lagged Alien Board buy-sell imbalance	-0.0320	0.00	0.05	0.0516	0.30	0.05	0.0777	0.68	0.00	0.4223	1.00	0.00
Cumulative Main Board (-6, -1) return	1.7079	0.45	0.00	0.5832	0.05	0.00	-2.6684	0.00	0.45	0.7506	0.32	0.09
Cumulative Alien Board (-6, -1) return	2.2645	0.35	0.00	1.5973	0.45	0.00	-0.8923	0.05	0.14	-4.9924	0.00	0.82
Lagged Alien Board price premium	2.3981	0.50	0.00	1.6209	0.15	0.05	-1.4020	0.00	0.18	-1.7157	0.00	0.59

Table 7. Returns Following Stock Purchases or Sells by Board, Investor Type

This table reports cumulative returns (Panel A) and portfolio returns (Panel B) following each buy or sell trade. In Panel A, we follow Odean (1999) and compute cumulative returns (82 days or 245 days) beginning with the day after each buy or sell trade. In Panel B, we compute portfolio returns as follows. Starting from the first trading day of our sample period, for each type of trader on each board, we form two buy and sell stock portfolios including all stocks bought or sold on that day respectively. On the second trading day, each portfolio is rebalanced to reflect trading on the second day. We repeat this for each trading day until the end of our sample period. The shares from each order are kept in the portfolios for either 4 or 12 months. We then compute value-weighted returns of all stocks in each portfolio on each trading day. The difference in returns associated with buy trades versus sell trades is a measure of the effectiveness or informedness of the particular type of investor (Odean, 1999). Investor types include Thai finance-related companies (banks, finance companies, insurance companies, institutional investors), stock exchange members, Thai "others" (that is, individuals), and foreigners. For foreigners trading on the Main Board, we compute cumulative returns using capital gains only since their holdings would be unregistered and, therefore, not eligible to receive distributions. Days are measured in trading days, not total calendar days. "Nobs" in Panel A is the number of trades in the category. Market-adjusted returns are computed as the difference between raw returns and the contemporaneous returns on the value-weighted index of the Thai stock market. P-values from a standard test of the difference are reported in parentheses.

Panel A. Average Cumulative Percentage Returns

| | | | Main Board | | | | | Alien Board | | | |
| | | | Raw returns | | Market-adjusted returns | | | Raw returns | | Market-adjusted returns | |
Investor	Action	Nobs	82 days	245 days	82 days	245 days	Nobs	82 days	245 days	82 days	245 days
Finance	Buy	136521	-2.5010	-11.8040	-2.8260	-7.7380	5588	13.5980	4.0570	10.7620	9.7910
Finance	Sell	157031	2.4940	-2.4530	1.5660	0.7470	6636	10.5060	2.0133	8.3350	6.6750
	Difference		-4.9950	-9.3510	-4.3920	-8.4850		3.0920	2.0437	2.4270	3.1160
	p-value		(<0.001)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(0.015)
Foreigner	Buy	423726	4.6730	1.0090	4.3100	11.2840	653355	6.7620	3.4740	2.9180	2.4400
Foreigner	Sell	453490	2.5360	-4.1350	1.1700	5.2960	669317	7.3150	3.1340	3.0660	1.8410
	Difference		2.1370	5.1440	3.1400	5.9880		-0.5530	0.3400	-0.1480	0.5990
	p-value		(<0.001)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(0.003)	(0.008)	(<0.001)
Member	Buy	30738	2.4780	-14.8980	-0.6180	-11.9930	8977	-0.8490	-15.0940	-5.0650	-13.9860
Member	Sell	31898	2.2520	-18.3990	-1.1920	-14.7030	11961	2.2500	-14.8100	-1.0720	-13.6460
	Difference		0.2260	3.5010	0.5740	2.7100		-3.0990	-0.2840	-3.9930	-0.3400
	p-value		(0.472)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(0.049)	(<0.001)	(0.601)
Others	Buy	2179067	1.5360	-16.8830	-0.3210	-14.0140	425524	-1.9870	-18.9300	-5.6350	-19.1930
Others	Sell	2127633	1.5950	-16.8860	-0.0570	-13.9190	405530	-3.3760	-19.5770	-6.3900	-19.3550
	Difference		-0.0590	0.0030	-0.2640	-0.0950		1.3890	0.6470	0.7550	0.1620
	p-value		(0.162)	(0.947)	(<0.001)	(0.035)		(<0.001)	(<0.001)	(<0.001)	(0.136)

Table 7. Returns Following Stock Purchases or Sells by Board, Investor Type (continued)

Panel B. Average Value-Weighted Portfolio Daily Percentage Returns

		Main Board				Alien Board			
		Raw returns		Market-adjusted returns		Raw returns		Market-adjusted returns	
Investor	Action	82 days	245 days	82 days	245 days	82 days	245 days	82 days	245 days
Finance	Buy	0.0944	-0.0092	-0.0324	-0.0341	0.1526	0.0136	0.0254	-0.0133
Finance	Sell	0.1084	0.0011	-0.0184	-0.0251	0.1298	0.0070	0.0093	-0.0159
	Difference	-0.0140	-0.0103	-0.0140	-0.0090	0.0228	0.0067	0.0161	0.0026
	p-value	(0.038)	(0.052)	(0.013)	(0.283)	(0.004)	(0.039)	(0.003)	(0.274)
Foreigner	Buy	0.1035	0.0002	0.0048	0.0030	0.1783	0.0579	0.0511	0.0197
Foreigner	Sell	0.0678	-0.0229	-0.0308	-0.0197	0.1711	0.0566	0.0427	0.0184
	Difference	0.0358	0.0231	0.0357	0.0228	0.0072	0.0013	0.0084	0.0013
	p-value	(0.001)	(0.003)	(0.003)	(0.007)	(0.042)	(0.231)	(0.055)	(0.573)
Member	Buy	0.1264	-0.0108	-0.0001	-0.0356	0.0897	-0.0099	-0.0298	-0.0471
Member	Sell	0.0975	-0.0249	-0.0293	-0.0498	0.1284	-0.0081	0.0079	-0.0444
	Difference	0.0290	0.0141	0.0291	0.0142	-0.0387	-0.0018	-0.0377	-0.0028
	p-value	(0.042)	(0.134)	(0.033)	(0.228)	(0.001)	(0.313)	(0.008)	(0.372)
Others	Buy	0.0999	-0.0243	-0.0266	-0.0493	0.1442	-0.0027	0.0167	-0.0451
Others	Sell	0.1075	-0.0204	-0.0190	-0.0453	0.1209	-0.0147	-0.0072	-0.0573
	Difference	-0.0076	-0.0039	-0.0075	-0.0039	0.0233	0.0119	0.0239	0.0122
	p-value	(0.034)	(0.225)	(0.028)	(0.292)	(0.003)	(0.018)	(0.007)	(0.010)

Table 8. Cross-Market Trading and Price Discovery

This table presents results of a two-equation system for stock returns on the Main and Alien boards as following.

$$R_t^A = a_1 + \sum_{i=1}^{3} b_{i1}^M R_{t-i}^M + \sum_{i=1}^{3} b_{i1}^A R_{t-i}^A + h_1 HIGH + \sum_{i=1}^{3} g_{i1}^M R_{t-i}^M * HIGH + \sum_{i=1}^{3} g_{i1}^A R_{t-i}^A * HIGH , \qquad (4)$$

$$R_t^M = a_2 + \sum_{i=1}^{3} b_{i2}^M R_{t-i}^M + \sum_{i=1}^{3} b_{i2}^A R_{t-i}^A + h_2 HIGH + \sum_{i=1}^{3} g_{i2}^M R_{t-i}^M * HIGH + \sum_{i=1}^{3} g_{i2}^A R_{t-i}^A * HIGH , \qquad (5)$$

where R_t^A and R_t^M are stock returns on the Alien and Main board respectively. The dependent variable in the first equation is the Alien Board return over 15-minute trading intervals and the dependent variable in the second equation is the Main Board return over the same time interval. Independent variables are three lags of Main Board returns and three lags of Alien Board returns, a dummy variable, HIGH, indicating times of high cross-market trading volume (or percent of total trading volume), and slope dummy terms equal to the product of the high cross-market dummy times the lagged returns. HIGH is set to one for 15-minute intervals with cross-market trading in the top quintile and zero otherwise. Estimation is conducted for each of the 25 sample firms, and the table summarizes results of individual regressions. Panel A reports the impact of Thai individuals crossing to the Alien Board and Panel B foreign investors crossing to the Main Board.

Panel A. Price discovery conditional on heavy cross-market trading by Thai individuals

	High cross-market trading volume in shares						High cross-market trading volume as fraction of total trading volume					
	Equation 1 for Alien Board return			Equation 2 for Main Board return			Equation 1 for Alien Board return			Equation 2 for Main Board return		
	Average coefficient	Percentage of positive coefficients	Percentage of negative coefficients	Average coefficients	Percentage of positive coefficients	Percentage of negative coefficients	Average coefficient	Percentage of positive coefficients	Percentage of negative coefficients	Average coefficients	Percentage of positive coefficients	Percentage of negative coefficients
Constant	-0.0003	0.00	0.20	0.0000	0.00	0.25	0.0002	0.20	0.05	0.0002	0.10	0.10
Main Board return {-1}	0.0263	0.30	0.00	-0.3614	0.00	0.90	0.0507	0.35	0.00	-0.3380	0.00	0.95
Main Board return {-2}	0.0335	0.15	0.00	-0.1416	0.00	0.50	0.0420	0.15	0.00	-0.1120	0.00	0.50
Main Board return {-3}	0.0531	0.10	0.00	-0.0704	0.00	0.35	0.0405	0.10	0.00	-0.0448	0.00	0.35
Alien Board return {-1}	-0.1293	0.00	0.50	0.1028	0.40	0.00	-0.1169	0.00	0.55	0.1255	0.65	0.00
Alien Board return {-2}	-0.0651	0.00	0.30	0.0727	0.35	0.00	-0.0329	0.05	0.20	0.0875	0.50	0.00
Alien Board return {-3}	-0.0504	0.00	0.10	0.0300	0.10	0.00	-0.0111	0.00	0.00	0.0507	0.35	0.00
HIGH dummy	0.0014	0.20	0.00	0.0008	0.20	0.00	-0.0001	0.00	0.06	0.0002	0.05	0.00
HIGH * Main Board return {-1}	0.0319	0.10	0.00	0.0630	0.20	0.00	0.0530	0.00	0.00	0.1228	0.00	0.13
HIGH * Main Board return {-2}	0.0051	0.00	0.00	0.0436	0.10	0.00	-0.0270	0.00	0.00	0.0183	0.00	0.00
HIGH * Main Board return {-3}	0.0006	0.00	0.10	0.0259	0.05	0.00	0.0214	0.05	0.00	0.0642	0.05	0.00
HIGH * Alien Board return {-1}	0.1596	0.40	0.05	0.0755	0.30	0.00	0.0293	0.05	0.25	0.0612	0.25	0.00
HIGH * Alien Board return {-2}	0.2068	0.35	0.00	0.0513	0.15	0.00	-0.0103	0.00	0.00	0.0241	0.15	0.00
HIGH * Alien Board return {-3}	0.1065	0.25	0.00	0.0543	0.15	0.00	0.0243	0.06	0.05	0.0484	0.10	0.00

Table 8. Cross-Market Trading and Price Discovery (continued)

Panel B. Price discovery conditional on heavy cross-market trading by foreigners

	High cross-market trading volume in shares						High cross-market trading volume as fraction of total trading volume					
	Equation 1 for Alien Board return			Equation 2 for Main Board return			Equation 1 for Alien Board return			Equation 2 for Main Board return		
	Average coefficient	Percentage of positive coefficients	Percentage of negative coefficients	Average coefficient	Percentage of positive coefficients	Percentage of negative Coefficients	Average coefficient	Percentage of positive coefficients	Percentage of negative coefficients	Average coefficient	Percentage of positive coefficients	Percentage of negative coefficients
Constant	0.0002	0.10	0.05	0.0002	0.05	0.05	0.0002	0.15	0.05	0.0003	0.15	0.10
Main Board return {-1}	0.0557	0.25	0.00	-0.3454	0.00	0.95	0.0494	0.30	0.00	-0.3476	0.00	0.95
Main Board return {-2}	0.0470	0.20	0.00	-0.1279	0.00	0.55	0.0346	0.15	0.00	-0.1254	0.00	0.50
Main Board return {-3}	0.0404	0.10	0.00	-0.0401	0.05	0.35	0.0397	0.15	0.00	-0.0349	0.05	0.30
Alien Board return {-1}	-0.0968	0.00	0.50	0.1430	0.55	0.00	-0.1081	0.00	0.50	0.1323	0.70	0.00
Alien Board return {-2}	-0.0447	0.00	0.30	0.1170	0.50	0.00	-0.0305	0.00	0.20	0.1065	0.45	0.00
Alien Board return {-3}	-0.0026	0.00	0.00	0.0392	0.25	0.00	-0.0149	0.00	0.05	0.0399	0.30	0.00
HIGH dummy	0.0002	0.05	0.05	0.0002	0.00	0.00	0.0000	0.00	0.05	0.0002	0.00	0.10
HIGH * Main Board return {-1}	0.0515	0.40	0.00	0.0349	0.10	0.05	0.0320	0.25	0.00	-0.0268	0.05	0.10
HIGH * Main Board return {-2}	0.0250	0.25	0.00	0.0352	0.10	0.00	0.0284	0.15	0.05	-0.1968	0.10	0.05
HIGH * Main Board return {-3}	0.0244	0.15	0.00	0.0042	0.00	0.05	0.0135	0.10	0.00	0.0089	0.05	0.05
HIGH * Alien Board return {-1}	-0.0588	0.00	0.10	-0.0301	0.00	0.10	-0.0308	0.10	0.00	0.0572	0.10	0.00
HIGH * Alien Board return {-2}	0.0285	0.15	0.00	-0.0679	0.00	0.05	-0.0976	0.10	0.05	-0.1362	0.00	0.15
HIGH * Alien Board return {-3}	-0.0222	0.00	0.00	0.0278	0.00	0.00	0.0507	0.05	0.05	0.0486	0.05	0.00

Figure 1. The average Alien Board premium

The Alien Board premium equals the Alien Board price minus the Main Board price, scaled by the Main Board price. For each day in 1999 and for each of the 25 stocks in our sample, we compute this ratio using the latest 15-minute interval in the day that has trading volume on both boards. The stock exchange symbols for the 25 firms are ADVANC, B-LAND, BANPU, BAY, BBL, CPF, EGCOMP, HANA, KTB, LH, MAKRO, NATION, NFS, PIZZA, PTTEP, RCL, SCB, SCC, SCCC, SHIN, SUC, TA, TFB, TMB, and UCOM. The plot shows the daily capitalization-weighted average of the individual firm premiums.