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FOREIGN PORTFOLIO FLOWS AND EMERGING MARKETS: LESSONS FROM THAILAND

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FOREIGN PORTFOLIO FLOWS AND EMERGING MARKETS: LESSONS FROM THAILAND

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Dedication

I dedicate my work herein to Mum, Dad, and Ammy.

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Emerging markets are generally small and fairly illiquid. Thus, extreme price volatility is a matter of concern as a slight change in trading activity can assert significant pressure on prices. It comes as no surprise that the movement of foreign equity flows exert significant influences in emerging markets as they have tremendously increased over the last two decades subsequent to a general trend in continued liberalization around the world, especially in Asia Pacific. This research focuses on the effect of foreign flows on emerging market returns and addresses several empirical asset pricing issues in the Asia Pacific markets by using the data from the Thai stock exchange.

The dissertation provides a quantitative assessment on the impact of foreign portfolio flows on the Thai equity market before, during, and after the Asian financial crisis. The study investigates the differential impact of foreign equity flows on the pricing and volatility of the aggregate market and of two market segments; one consisting of

stocks that are favored by foreign investors and the other less favored. The empirical results reveal that the price pressure impact on the first segment is more positive. This finding corroborates with the fact that the flow betas which measure the exposure to unexpected foreign flows are mostly positive (negative) for stocks with high (low) foreign interest. The cross-sectional analysis finds that exposure to unexpected flows has a significant valuation impact for stocks in the first segment, but not for those in the second.

The study finds no evidence to suggest that foreign investors cause excess volatility in the market. Rather, it appears that the extraordinarily high volatility during the crisis period is related to domestic selling as foreign investors are net buyers, and thus liquidity providers during that period. Recognizing the importance of foreign flow in promoting trading activity, my study shows that the impact of foreign flow on market volatility may be erroneously magnified without controlling for market liquidity. These results hold in both market segments.

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Chapter 1: Introduction

Foreign portfolio flows exert a significant influence on emerging market returns.[1] Empirical evidence implies that foreign equity investment in developing countries helps reduce the costs of capital in these markets (see e.g. Bakaert and Harvey (2000), Henry (2000) and Chari and Henry (2002)). Yet there is a lingering debate on the role of foreign investors in emerging markets, both in terms of informational role of their trades and in terms of the effect of portfolio flows on local markets, especially during crises. In addition, the tendency for foreign equity investors in emerging markets to favor large and well-established local companies[2] creates a two-tier local market. Whether the segmentation limits the pervasiveness of market liberalization in different segments of the market remains an important issue largely unexplored.

The other important issue regarding foreign portfolio flows is its impact on market volatility. The mobility of foreign equity flows raises questions of whether rapid movement in equity flows could have exacerbated the market downfall and stirred wide-spread instability during the Asian financial and currency crisis in 1997.

The Thai Stock Exchange (SET) makes an interesting case for the study on the impact of foreign flow on an emerging market. Foreign investors are active and important participants in the Thai market. Between 1990-1996, the SET accumulated 9.47 billion US$ of foreign equity flows, which is worth 8% of total market capitalization in 1996.[3]

[1] For excellent reviews of recent literature on the impact of foreign portfolio flows on emerging markets, see Bekaert and Harvey (2003), Karolyi and Stulz (2002) and Stulz (1999).
[2] Aggarwal , Klapper, and Wysocki (2003) discuss preferences of foreign investors in emerging markets, Kang and Stulz (1997) for Japan and Dahlquist and Robertsson (2001) for Sweden.
[3] Data from IMF and Emerging Markets Factbook 2002

Foreign investors account for 30% of daily trading activity and own over 20% of the top size decile stocks. The data coverage between 1995-2002 also allows the study to examine the impact of flow on the local market in the pre-crisis, crisis, and post-crisis periods. In addition, the trading structure on the Thai Stock Exchange facilitates the study on segmentation as stocks that are in popular demand by foreign investors usually reach foreign ownership limit and trade on a separate "foreign board."

1.1 Existing Literature

Recent literature has examined the relationship between foreign equity flows and local market returns with an emphasis on detecting the trading behavior of foreign investors and making inferences on their comparative information advantage (or disadvantage) relative to local investors. Brennan and Cao (1997) postulate that foreign investors are less informed about the local market than domestic investors and propose a model that links the relationship between international portfolio flows and market returns to the difference information endowments among foreign and domestic investors. Their empirical test finds positive correlations between flows and both contemporaneous and lagged returns that are supportive of their notion of foreign investors' information disadvantage, especially in emerging markets.

The hypothesis that foreign investors have information disadvantage gain further support from a number of empirical papers that have documented positive feedback trading by foreign investors.[4] Starting with an early study by Bohn and Tesar (1996),

[4] Positive feedback trading is the practice of buying shares as prices move up and selling them when their prices come down. Such trading behavior is associated with information disadvantage because if the prices reflect conditional expectation based on weights of private and public information, then investors who are less informed (ie. the precision of private information is lower than public information) will weigh public information and hence form their demand based on past prices.

which examines the flow- return dynamics. However, the low frequency of quarterly and monthly data over a short period of time lacks the power to reveal the true dynamic relationship between flows and returns, a task that is made possible by recent availability of high frequency equity flow data.

A number of empirical papers have documented positive feedback trading by foreign investors. Choe, Kho, and Stulz (1999) detect strong positive feedback activity in Korea before the crisis, but not during the crisis. They discover that foreign sales do not lead to negative abnormal returns, which means that there is no evidence that foreign sales are destabilizing. In a similar vein, Kim and Wei (2002) reports evidence of positive feedback trading in the Korea market. Since they have disaggregated information on positions by foreign investors that are non-resident and those with subsidiaries in Korea, they are able to show that non-resident foreigners tend to engage in herding more than the foreign subsidiaries. Bonser-Neal, Jones, Linnan, and Neal (2002) examine foreign trading behavior in the Indonesian market between 1995-2000. They find no apparent evidence that foreign investors are responsible for market correction during the crisis or that they created high volatility levels. However, they do concur that with the aforementioned authors that foreign investors do herd. The existence of such behavior is not unique to emerging markets as Dahlquist and Robertsson (2003) work on the Swedish market show.

Adding to the list of literature on positive feedback trading is the work of Bekaert, Harvey, and Lumsdaine (2002), Griffin, Nardari, and Stulz (2002), and Richards (2002), among others. Using a novel database which comprises of individual emerging market

funds' country allocation, Borenzstein and Gelos (2000) finds that local market volatility is increasing in the level of herding measure in that market.

Despite fairly extensive evidence, the view that foreign investors engage in positive feedback trading and are less informed is without challenge. Froot, O'Connell, and Seasholes (2001) examine daily net portfolio flows into 44 countries between 1994 and 1998 using proprietary equity flow records of institutional investors. They report evidence that foreign flows forecast future returns and conclude that foreign investors have valuable private information. Froot and Ramadorai (2002) offer additional results using closed-end country funds to illustrate that the relationship between return and flow is not due to the price-pressure effect; rather it is because of flow forecasting future returns. Seasholes (2000) shows that foreign investors in Taiwan accumulate (sell-off) shares before positive (negative) earnings announcements and infers that foreign investors carry out informed trading and are not just chasing after returns. While these conclusions are consistent with the evidence presented by Grinblatt and Keloharju (2000) and Karolyi (2002) implying that foreign investors in Finland and Japan are outperforming resident investors, they seem to be at odds with the evidence of positive feedback trading by foreign investors.

Positive feedback trading literature is also related to empirical work on foreign flow and return volatility. The view that herding or positive feedback trading strategies impede price efficiency is consistent with the literature on speculative behavior of noise traders such as De Long, Shleifer, Summers, and Waldmann (1990). Their model shows that informed investors drive prices further away from fundamentals in anticipation of future price increase from rising demands of positive feedback traders (see Hamao and

Mei (2001) and Park and Park (1999)). Nevertheless, researchers have not been able to convincing demonstrate that foreign investors' feedback trading behavior has a destabilizing influence on the local market. A possible explanation for this is positive feedback trading merely reflects gradual portfolio rebalancing by foreign investors.

As most of these studies focus on inferring the behavior of foreign investors from portfolio flows and its implication for the volatility of local markets, the impact of foreign flows on valuations has not been clearly assessed. Although the work of Bekaert and Harvey (2000), Henry (2000), and Chari and Henry (2002), all of which favor market liberalization, touch on the valuation issue by showing that increased foreign participation leads to increase in stock prices, none have linked stock price sensitivity or exposure to foreign flow shock to return levels. In addition, the role of foreign flow in inducing market liquidity has not been explored. Thus, the link between highly correlated and highly persistent variables in the market, i.e., return, volatility, turnover, and flow has not been thoroughly researched. There is also limited research effort on foreign flow impact on different market segment.

The goal of this study is to fill in the gap to these research questions by using the experience of the Thai Stock Exchange, which is among the four Asian economies hit hardest by the crisis.

1.2 Research Questions and Contributions

In this dissertation, I analyze a rare dataset of daily foreign flows into Thailand to shed light on these issues. The dataset covers the period from January 1995 to May 2002,

which includes the Asian Financial Crisis in 1997 triggered by the devaluation of the Thai baht. This allows us to study the dynamic relationship between foreign flow on returns and in particular, the effect of the unexpected flows on market returns and returns of two market segments; one consisting of stocks that are favored by foreign investors and the other that is less favored.

The key research questions in this study are i) Do stocks in different market segment respond to flow shocks differently? ii) How does foreign equity flow affect valuation? iii) Does foreign equity flows cause excessive volatility during the crisis? iii) Do foreign equity flow promote market liquidity? iv) Are stocks' liquidity and return volatility determined by the level of foreign interest?

In answering these questions, the sequence of study are as follows. First, I examine not only the systematic impact of in times-series, but also the valuation effect of foreign flow on the cross-section of stock returns due to stocks' differential exposures to shocks in foreign flows. Second, I show that the return volatility in the market is primarily caused by unexpected flows. Positive feedback trading, which is associated with speculative herding behavior and found to be inherent in expected flows has insignificant impact on return volatility. Third, I provide evidence that stocks receiving high foreign interest have higher volatility and that foreign flows have an instrumental role in promotion of liquidity on the local market.

In this study, stocks with high foreign interest are separated in a sample of 25 stocks that has active trading on the foreign board (henceforth, FB25). Stocks with low

foreign interest stocks comprises of the remaining stocks in the market, which excludes 50 of the largest and most liquid ones (henceforth, X50).

To cope with the issue of endogeneity among variables, I use the vector autoregressive model (VAR) to model the highly correlated and highly persistent variables i.e. flows, turnover, volatility and return. The VAR analysis enables the study to compare the impact of flow on overall market return and value weighted returns of stocks in each market segment over time. In particular, comparisons can be made among the sub-periods during which the characteristics of foreign flows differ.

The cross-sectional analysis relates the differential exposure of individual stock to flow shocks and other pricing factors to valuation. I begin by estimating the time-series regression of the excess returns on flow shocks, excess local market return, and world market returns to obtain betas, which are individual stock return sensitivities to the factors. Then I estimate the cross-sectional regression of excess returns on the betas, controlling for other characteristics, namely size and turnover provides the association between exposure and valuation.

The VAR analysis shows a strong contemporaneous relationship between flows and market returns in Thailand and reveals that on the daily basis the bulk of return variations due to flows is actually caused by surprise in flows, i.e. unexpected flows. Moreover, the reactions to flow surprise in two market segments are different. The large stocks that are favored by foreign investors have much stronger contemporaneous responses than the market as a whole, whereas the smaller stocks are pretty much mute to shocks in foreign equity flows.

It is possible that segmentation of the market can lead to cross-sectional differences in required rates of return due to the exposure to the shocks of foreign flows. Because foreign flows are volatile and influence local market returns significantly, one would imagine that investors will demand a premium for bearing exposures to this risk. Yet for emerging markets, foreign capital inflows are a consequence of market liberalization that helps broaden investor bases, enhance risk sharing and hence reduce risk premium on stocks.[5] In this context, the sensitivity to shocks of foreign flow, which can be regarded as a proxy for foreign interest, should be desirable. The cross-sectional examination shows that there is a significant difference in exposures to foreign flow shocks between stocks favored by foreign investors indicated by their trading on the foreign board and those beyond the 50 largest stocks on the exchange with little foreign interest. FB25 stocks tend to have positive exposure indicating that their prices rise with increase in unexpected foreign flows. In contrast, X50 stocks incline to have negative exposure as they neither receive sufficient interest from foreign nor local investors since the crisis.

This difference is also reflected in the cross-sectional excess return attributable to such exposure. For the X50 group, I find that their exposure to foreign flows shocks have insignificant impact on excess returns. On the other hand, for the 25 largest stocks with trading on the foreign board, high exposure to foreign flow shocks is associated with higher returns. This effect is robust with the control of the local market beta, world

[5] Chari and Henry (2002) complete a multi-country cross-sectional study to show that market liberalization leads to a rise in stock prices. The explanatory variable is the difference between the covariance of the firm return with local market and covariance of firm return and world market. Although the covariance difference is the key explanatory variable that explains cross-sectional difference in risk-premia, it is a less direct way to capture the pricing impact induced by foreign trading activity.

market beta, size and turnover. To my knowledge this is the first piece of qualitative evidence that shows the valuation effect of foreign flow on different segments of an emerging market, even though the limited period our dataset covers prevents us from having a quantitatively accurate measure of the associated risk premium.

As existing literature has not examined the role of foreign equity flow in promotion of market liquidity, I use both bivariate and multivariate VAR models to study the direct impact of flow on volatility and through market liquidity.

The findings indicate that flow and volume are highly persistent variables and positively correlated variables. Excluding turnover from econometric analysis amplifies the impact of flow on volatility. The multivariate VAR analysis reveals that once market liquidity is included in the model, foreign flows have a much smaller contemporaneous impact on volatility and are much less persistent than reported in previous literature. I find that while as a large participant in a small market, foreign flows do have an impact on market volatility and liquidity, there is no evidence to indicate that foreign trades have a destabilizing effect on the market. This finding holds true even during the Asian financial crisis. Rather, the increased volatility during the crisis may be attributable to domestic selling. I also find that volatility is mainly driven by unexpected flows and not expected flows, which proxies for positive feedback trading.

I examine the dynamics of foreign flow and conditional volatility and find that turnover has an indispensable role in volatility forecast. Again, the bivariate VAR between flow and conditional volatility does not indicate that foreign net selling induces abnormal levels of volatility during the crisis period. Finally, I find that stocks with high

foreign interest have higher volatility and that foreign flows has an important role in promoting trading activity on the main board.

The rest of the dissertation is organized as follows. Chapter 2 describes the Thai equity market and the data sets used in this study. Chapter 3 describes the study on the effect of flow on market returns and empirical results and examines the implications for cross-sectional valuation of foreign flows. Chapter 4 discusses the impact of foreign flow on volatility and liquidity on the aggregate market and on different market segments. Finally, Chapter 5 concludes the study.

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Chapter 2: The Thai Stock Market and Sample Data

2.1 Market Background

The Stock Exchange of Thailand (SET) was established in 1975 and has always been dominated by local retail investors. The development of the nascent mutual fund industry has been hampered by regulatory barriers and deteriorated further after the Asian financial crisis. The decade-long rise in the Thai market in the 1980s was based on a solid foundation of economic growth. However, a speculative climate started to build in early 1990s as the fixed currency policy became inconsistent with the liberalization of foreign capital flows. The influx of foreign capital coupled with stable prices led to low domestic interest rates, which resulted in over-lending to non-productive sectors. Consequently, economic growth slowed down as infrastructure barriers impeded further expansions. Adding pressure to the pegged currency was declining export growth and tighter monetary policy, intended to curb inflation and current account deficit. This led to speculative attacks on the Thai baht starting in late 1995. The Bank of Thailand relented to heavy selling pressure on the Thai baht in July 1997 and the basket peg was abandoned.

The Thai market was virtually unknown to international investors until the mid-1980s when Merrill Lynch offered the first country fund for Thailand. Given the insignificant trading by local institutional investors, Figures 1a) and 1b) provides an overview of foreign investor and local retail trading activity in the Thai stock market over the sample period in Thai baht. Figures 1 c) and d) show the level of the SET index and the cumulative foreign and local net inflow, both in Thai baht during. The graphs reveal

that foreign investors are cumulative net buyers whereas local investors are net sellers throughout the entire sample period. Furthermore, foreign investors are clearly net buyers during the Asian financial crisis after unloading their holdings approximately one year before the devaluation in Thailand. To gauge the significance of foreign flows, Figure 2 is a plot of foreign net equity flows into Indonesia, Korea, and Thailand between 1995-1998 in billions US$ and as a percentage of total market capitalization.[6] Unlike Indonesia, Korea and Thailand did not see a net equity outflow after devaluation took place. Rather, foreign net inflows in 1997 amounted 6% and 17% of total market capitalization for Korea and Thailand respectively.

In order to keep the majority ownership of strategic industries in local hands, the Thai authorities place limits on foreign ownerships in local firms that range from 25% to 49%. Foreign investors wanting to acquire shares that have reached their maximal ownership limits must submit their orders on a separate "foreign" board to trade among foreign shareholders. Consequently, stock prices on the foreign board typically trade at a premium over those on the main board.[7] However, after June 2001, these limits are no longer binding as foreign investors are allowed to invest above the limit through a special investment vehicle called non-voting depository receipts (NVDRs) that affords full participation in dividends and rights issue without voting rights. Foreign investors wishing to trade shares with voting rights must continue to trade on the foreign board if the foreign limit in these shares has been reached. Figure 3 shows that foreign premium rises to its peak during the Asian financial crisis, but has since then fallen continuously as the price on foreign and local board slowly converged as consequence of waning foreign

[6] Among East Asian economies, Indonesia, Korea, and Thailand are among the highest recipients of foreign private flows. Data source from IMF.

[7] A riskless arbitrage is not feasible as the SET does not allow stocks purchased on the main board to be sold on the foreign board.

interest in the market and the introduction of NVDRs. The existence of foreign premium is indicative of the variation in the level of foreign investor interest in stocks. This ultimately creates a two-tiered market, one being more responsive to foreign flows than the other.

Concerned with wide gyrations in stock prices, the SET places a 30% daily limit on absolute price change based on previous day's closing. Prior to December 1, 1997, the limit was 10%. These daily price limits are found in a few other stock exchanges in Asia. Korea, for example, has a 15% limit while Taiwan uses a more stringent 7%. Figure 4 is a plot of volatility of daily market returns. Clearly there is clustering of volatilities around the crisis periods and the widening of daily price limit seems to have increased the price movement in the post-crisis period.

2.2 Data Description

The dataset in this study comes from the Stock Exchange of Thailand (SET). The dataset includes, on a daily basis, the stock market index level, market capitalization, trading volume, and buy/sell transaction amounts by three investor types: foreign, local institutional and local retail. The data on daily buy-sell positions by investor type combine trading activities of each investor type on the Main Board and Foreign Board.

Foreign equity flows dataset covers all foreign trades regardless their origins. It is imperative that foreign investment flows to host countries should be collected from final investment destinations to avoid a serious measurement error. This is because it is likely that a substantial amount of host country investment usually come from an intermediary

source where an investment regional office is located. To see the significance of this potential error, I compute the correlation between US investors' buy/sell data from the Treasury Department Bulletin, which has been used in some prior studies and the SET's total foreign buy/sell data. If the net positions from these two data sources are compared, then the correlation is only 40%.

The data coverage begins on January 5, 1995 and ends on May 29, 2002. To account for the structural changes in the Thai market over this time span, the study breaks up the data into three sub-samples throughout the analysis. The first is the pre-crisis period (Period 1: January 1995 to December 1996), the second is the crisis period (Period 2: June 1997 to May 1999), and finally the post-crisis period (Period 3: June 2000 to May 2002). The gaps between each sub-period are introduced to ensure clean structural breaks. Bekaert, Harvey, and Lumsdaine (2002) use an econometric technique to endogenously determine structural breaks in the data and demonstrate the importance of taking into account for correct inference.

The pre-crisis period covers the period of market stagnation leading up to the crisis as exports slowed and rumors of baht devaluation started to circulate the market towards the end of 1995. By this time, the Thai baht was allowed to float within a very narrow 0.5% trading band anchored by a basket of currencies, heavily weighted by the US dollar. Over this period, the local index shed 10% over this period. Eventually the baht was devalued and the fixed currency system was abandoned in July 1997, which triggered the Asian financial crisis. The index fell almost 40% and volatility was the highest during this crisis period. Despite the stability of inflation levels, the economy continued to be sluggish during the post-crisis period as the recapitalization process

continued at a snail pace due to commercial banks' “liquidity crunch.” Nevertheless, market liquidity measured by turnover (baht volume over market capitalization) has increased notably from 0.18% in the pre-crisis period to 0.45% in the post-crisis period.

To understand the price dynamics between the two trading boards and differential impacts foreign flow may have on stocks, I also obtain daily price levels and trading volumes on the foreign board for stocks in the SET 50 index from the SET. These stocks represent the largest and most liquid stocks on the exchange and hence are readily recognized by foreign investors. This forms the basis group in order to select stocks that have sufficient trading data on the foreign board for the study. In addition, I retrieve individual stock prices and trading data on the SET's main board as well as interest rates, foreign exchange rates, and the Morgan Stanley All Country World Index from Datastream.

Figure 5 contains two graphs depicting the evolution of the Thai market during the sample period. Figure 5(a) shows Baht/US$ exchange rate and the level of an index of 25 stocks traded on the foreign board as well as an index of stocks that are not the 50 largest stocks traded on SET, both in Thai baht. The three major events in the Thai market during this period are labeled on the graph, including the currency devaluation on July 2, 1997, an increase in the daily trading price limit from 10% to 30% on December 1, 1997, and finally the lifting of foreign ownership limits through introduction of NVDRs on June 11, 2001. Figure 5(b) shows the level of the SET index and the level of Morgan Stanley World Market Index, both in US dollars. This graph also shows the three sub-periods used in subsequent analyses: the pre-crisis period which runs from January

1995 to December 1996, the crisis period from June 1997 until May 1999[8], and the post-crisis period from June 2000 until the end of the sample period, May 2002.

Panel A of Table 1 provides the summary statistics of the Stock Exchange of Thailand. As shown, the market is predominantly retail based with local retail trading accounting for 63% of the average daily trading volume in the whole sample period. There is a clear improvement in liquidity as the daily turnover ratio has risen to 0.4% in the post crisis period from 0.17% in the pre-crisis period. Panel B presents daily and weekly correlations between the index return, its volatility (squared daily returns), market turnover (trading value scaled by previous period market cap) and foreign net flow (net foreign position scaled by previous period market cap)[9] for the whole sample period. All four variables are closely correlated with net foreign flow and the highest contemporaneous correlation of 0.38 is between net flow and return. The autocorrelations of the four variables show that foreign net flow and market turnover are very persistent variables at the daily frequency. Although not shown, it should be noted that the persistence of flow is progressively weaker as the market goes through the crisis and the trend continues in recent years. On the other hand, turnover is persistent throughout the entire sample period and seems to have strengthened over time. Daily volatilities of return are not very persistent and its autocorrelation diminishes after three days.

For the study of cross sections of returns in this paper, the criteria for sample selection is as follows. Starting from all stocks that are part of the SET index, I require stocks to have at least about 2 years (100 weeks) of observation for the entire sample

[8] The Asian financial crisis was further confounded by the credit crisis in 1998 led by the Russian default, which slowed the recovery in the region.

[9] Using the augmented Dickey-Fuller test and Phillips-Peron tests with and without time trend, the null hypothesis that volatility, turnover, and flow have unit roots is rejected.

period and 1 year (52 weeks) to be included in all sub-periods. Furthermore, I exclude stocks with turnover levels at the bottom 5% for each sample period and trim stocks with returns below (above) the 5(95) percentile. This brings down the number of total sample companies from 288 in the original file to 250 (full sample), 244(pre-crisis), 209 (crisis), and 194 (post-crisis). For the sample of SET 50 stocks with foreign board trading information on, elimination of insufficient and extreme observations as described above brings down the number of remaining companies to 25. Although this number may sound small relative to the total number of selected companies in our large sample, these 25 stocks make up 55% of total market capitalization and 31% of total market turnover. In the final step, I truncate returns below and above the 5 and 95 percentiles.

Table 2 are key statistics, which include average daily return and volatility of each market segment. All returns are negative in the pre-crisis period before recovering markedly during the post-crisis period with the exception of FB25 return. The negative return performance is due to abandonment of ownership limit in the latter half of the period. The X50 group is the worse performer during the crisis as it receives little support from foreign investors and local investors are selling out. As MB25 group dominates the SET, its correlation with the market return is 0.90. The correlation between FB25 and MB25 is 0.7 and becoming close to 0.9 in the final period during which premiums declined.

Table 3 summarizes key investor statistics for each of the three sub-sample periods. For each period, over 50% of the trading volume comes from local individual investors. The proportion of foreign investor trading is in the 30% range whereas local institutional trading has declined from 14% to around 6% after the crisis. The

significance of local investors trading volume suggests that they trade aggressively among themselves and with the foreign investors. Table 3 shows that foreign investors have accumulated 135.6 billion baht worth of Thai stocks for the entire sample period. For each of the sub-periods, their cumulative net buy is 61.5, 83.5, and 18.5 billion baht during the pre-crisis, crisis periods and post-crisis periods whereas local investors (retail and institutional) take offsetting cumulative positions.

Panel A of Table 4 presents the contemporaneous correlation matrix between market return, foreign net flow and other market variables. As seen from Panel A, return has the highest positive contemporaneous correlation with scaled net foreign flow (FFLOW). The relationship grows stronger as we move from daily to weekly frequency and is highest during the crisis period. Turnover (TURN), a common measure of liquidity, is positively and significantly related to the level of foreign net flow. This relationship appears to weaken during the crisis and strengthen in the post-crisis period.

In Panel B of Table 4, I report the daily and weekly autocorrelations. Daily return has positive autocorrelation in all sub-periods. FFLOW and TURN are much more persistent at both daily and weekly frequencies. In particular, net foreign flow is persistent for up to four weeks in the full sample. This pattern is strongest in the pre-crisis period and becomes progressively weaker as the market goes through the crisis and post-crisis periods. In recent years, the persistence lasts only for two weeks. This points to time-varying persistence in foreign equity flows, at least in one emerging market as the market develops.

On the other hand, scaled turnover (TURN), measure of market liquidity, is persistent beyond the four-week span throughout the entire sample period. If anything, the persistence has increased over the crisis and post-crisis period. Daily volatility of returns, however, is not very persistent and its autocorrelation diminishes after three days. All variables in the study have been tested for stationarity using the augmented Dickey-Fuller test.

The calculation of cross-serial correlations between foreign flows and market variables shows persistent lead-lag relationships between them. These results are not reported here, because the true dynamic nature of these relationships is better captured in a vector autoregression (VAR) framework, which is the methodology adopted in this paper.[10]

[10] Serial of other papers have also used this methodology in various forms. Among them are Bekaert, Harvey and Lumsdaine (2002), Froot, O'Connell and Seasholes (2001), Griffin, Nardari and Stulz (2002), and Richards (2002).

Chapter 3: The Effect of Foreign Flows on Market Returns

As East Asian economies work hard to revive their equity markets after the crisis of 1997, the need to mobilize new capital outside domestic markets remains an important economic agenda and so is the need to understand the behavior of foreign portfolio flows and their impact on domestic prices.

Extant evidence indicates a strong contemporaneous relationship between net inflow of foreign capital and market return. Griffin, Nardari, and Stulz (2003) and Richards (2002) confirm this result in their studies on emerging Asian equity markets. What is unsettled is the interpretation of this relationship and implications for the role of foreign investors in emerging markets. There are several competing hypotheses to explain this relationship. One hypothesis is that the participation of foreign investors in the market brings about a demand shift and hence a permanent price change. This broadening of investor base increases risk sharing opportunity and hence lowers the required rate of return. Theoretical arguments for this mechanism are provided by Merton (1987), Errunza and Losq (1985), and Eun and Janakiramanan (1986), and empirical work on the effect of liberalization on emerging markets is reported by Bekaert and Harvey (2000) and Henry (2000). Another hypothesis is the temporary price pressure effect due to market illiquidity in absorbing the extra demand and the resulting price change tends to be reversed in subsequent trading periods. In addition, the role of foreign investors in emerging market is also much debated, as they are alternately described as trend chasers (Cho, Kho, and Stulz (1999), Kim and Wei (2002), Bonser-Neal et al (2002)), informed traders (Seasholes (2000), Grinblatt and Keloharju (2000)) or investors with information

disadvantage (Brennan and Cao (1997)). The availability of daily data in recent years has made possible to provide power for discriminating these hypotheses.

In this section, I adopt both a times series and cross-sectional analysis to measure the impact of foreign flows on returns. I first complete the time series to determine whether the systematic impact of flow on price is significant and permanent and whether the impact differs across market segment. The purpose of the cross-sectional study is for find out whether differential price impact from the level of exposure to foreign flows shock matters for stocks' valuation.

3.1 Market Wide Price Impact

The methodology used in the time-series study is the vector autoregression procedure to characterize dynamic relationships between endogenous variables. The documented strong contemporaneous relationship between flow and return[11] has led to the use of structural specifications with contemporaneous endogenous variables in the system. In the bivariate structural VAR system of market return and foreign flow, the model follow the ordering of flow causing return as this makes intuitive sense especially for the high frequency daily data used in this study. The specification can also be found in Froot et al (2001).

Table 5 reports the results from the return equation of the bivariate VAR of market return and foreign flow. It confirms the strong contemporaneous effect foreign flow has on the market return in both daily and weekly frequencies, although it also

[11] For papers on the relationship between return and flow in a context other than emerging markets, see Warther (1995) for mutual fund flows, Sias, Starks and Titman (2001), and Boyer and Zheng (2002) for institutional flows.

shows that this effect is weakening through time as revealed in sub-period analyses. Moreover, there is a negative relationship between return and lagged flows, which is more significant at weekly intervals than daily intervals, that seems to indicate the presence of the price pressure effect. In addition, controlling for flows, the return becomes negatively autocorrelated, indicating a reversal that is stronger in the pre-crisis period than other periods. Note that in the pre-crisis period, there is a period of net outflow of foreign capital while in the crisis period, foreign capital flows strongly into the market. These results are indicative of the price pressure effect of foreign flow due to market illiquidity, especially because the effect is the strongest during the pre-crisis period when the market liquidity, as measure by turnover, is the lowest among the three sub-periods considered. However, in the whole sample period and all three sub-periods, the reversal is only partial, at most about a quarter of the initial price change, implying that much of the price change due to foreign flow may be permanent.

Recall that Table 2 shows significant pairwise correlations among return, volatility, turnover and flow, and high persistence of flow and turnover. To mitigate the concern that the relationship we have found above may be spurious because of missing variables, I perform a multivariate structural VAR by including the variables of volatility and turnover to the system of equations. The multivariate analysis provides a better examination of true channels of interactions between these variables. The four-variable structural VAR assumes that the order of causality starts from flow, turnover, volatility, to return.[12] The result of the four-variable VAR is reported in Table 6. To save

[12] Because the study utilizes high frequency daily data, I do not consider variables such as dividend yields and interest rates, as considered in Bekaert, Harvey and Lumsdaine (2002), as these variable are much more slow moving.

space, the table presents only the coefficients on returns and flows up to three lags.[13] With the presence of volatility and turnover in the model, the contemporaneous relationship between return and flow is much weakened, albeit still significant, but the indication of return reversal diminishes dramatically.

3.2 Price Impact in Market Segment

The study of price impact of foreign equity flows on the local market returns is not a straightforward exercise. As noted earlier that foreign participation in emerging markets are not evenly spread across the market. Foreign investors have typically invested in large and well-established firms in emerging markets (see Aggarwal, Klapper, and Wysocki (2003), Kang and Stulz (1997), and Dahlquist and Robertsson (2001)). It is plausible that returns of these companies will respond more strongly to foreign flows than smaller firms in the market, and thus create segmentation of the market.

Fortunately, the Thai market has a particular feature that permits this separation. On the Thai exchange, foreigners trade among themselves in shares that have reached their foreign ownership limits on a separate foreign board. These are typically shares consisting of large and well-established companies and hence preferred by foreign investors,[14] while the rest of the markets gets little interest from them. I select 25 stocks with active daily trading on the foreign board and another group of stocks that excludes the 50 largest and most liquid stocks on the exchange. Clearly the first group (FB25)

[13] The parameter estimates at longer lags are insignificant.

[14] Bailey and Jagtiani (1994) examine the determinants of the price premiums on the foreign board in early years.

represents stocks that are highly favored by foreign investors whereas the second group (X50) represents those that are less favored.

To see if this is the case, I use a structural VAR analysis of foreign flows and returns on a value-weighted portfolio of FB25. A similar analysis is completed for returns on a value-weighted portfolio of stocks on SET that excludes the largest 50 (X50). For the 25 foreign board-traded stocks, I examine both the returns on the foreign board (FB25) and on the main board (MB25). Over the whole sample period, the correlation between the return series of FB25 and MB25 is 0.73, while the correlation between MB25 and X50 is 0.62.

Panel A of Table 7 presents the result of structural VARs for returns on FB25, while the result for its returns on MB25 is in Panel B. Both results are quite similar in character to those for the overall market in Table 5, only stronger. Panel C presents the result for X50 where a substantially weakened contemporaneous relationship between portfolio return and flow. Moreover, there is no significant negative relationship between return and lagged flows or return reversal for the whole sample periods and all subperiods except the pre-crisis period. This implies that while there might be some foreign interest in some small firms in the pre-crisis period, such interest has been substantially curtailed in recent years during and after the Asian financial crisis. Furthermore, there is no evidence of price pressure due to foreign flows in this segment of the market even though this segment can be extremely illiquid.

As in the case of the market, a multivariate VAR shows how the impact of flow is filtered through channels of other variables. Since the flow variable collected represents

an aggregate of net foreign demand on the entire market, the bivariate VAR between the return of each market segment (ie. FB25, MB25, and X50) reveals the general dynamic relationship between segment return in response to aggregate net foreign demand as oppose to direct price pressure from foreign demand. Take for example, MB25 return also rises with increase in aggregate net flow not because of foreign investors direct purchase into those shares as their foreign ownership limits have already been reached but because of how net foreign demand affects other market variables. This points to an important observation that the study of flow impact on return includes both information effect and price effect due to foreign demand.

Table 8 reports the multivariate VAR of FB25, MB25 and X50 in Panels A, B, and C, respectively. All show that the contemporaneous relationship between return and flow is slightly weakened. It also confirms the finding from the bivariate model that foreign investor interest in smaller stocks has subsided after the crisis. As a matter of fact, price impact from foreign flows on all segments appear to have decline post-crisis as price reversals on lag flows is more substantial and significant in the large stocks.

3.3 Informativeness of Unexpected Flows

Unconditionally, flows are highly persistent. They also depend on both local and external returns. Therefore, they can be highly predictable. In addition, the price pressure effect identified above due to market illiquidity may mask deeper relationships between foreign flow and local market return. Hence, studying the effect of surprises in foreign flow on market return can provide more insight into the role of foreign investors. More specifically, if unexpected flow is treated as the portion that is responsive unpublicized information, then the ability of unexpected flow to forecast future returns well should

reflect trade by those privy to information unknown to other investors in the earlier period and thus should be treated as informed. The use of unexpected flows rather than flow levels is also advocated by Clark and Berko (1997) and Warther (1995), and examined in Bekaert, Harvey and Lumsdaine (2002) and Richards (2002).

I first compute unexpected shocks to foreign flow, U_t^f from the following autoregressive model at time *t* using data from a preceding window of 60 days for daily data and 20 weeks for weekly data. I do not include the lag terms of market returns in separating unexpected flow from actual flow because doing so will require the removal of the lags of market returns from the unexpected flow equation of the structural VAR model.

$$FLOW_t = \alpha_0 + \Sigma_{i=1}^{L} \gamma_i \cdot FLOW_{t-i} + U_t^f \qquad (3.1)$$

where *L* is 9 for daily data, and 4 for weekly data. As flow is a highly persistent variable, the choice in the number of lags is based on the LM test of the residual in Panel A of Table 9. I then carry out a bivariate VAR analysis of market return and unexpected flow for the entire market and by market segment.

As shown in Panel B of Table 9, there is still a strong relationship between return and contemporaneous surprise flow and the strength of this relationship is not much weaker than that of one between return and contemporaneous return in Table 5. I also find that unexpected flow consistently predicts next day's return, and return becomes positively autocorrelated in the presence of unexpected flow, clearly indicating that there is no return reversal or the price pressure effect from unexpected flows. For the whole

sample period, there is strongest indication that lagged unexpected flow may forecast future returns on the daily basis, as the evidence is much weaker on the weekly basis. This pattern is also present in the crisis period when foreign investors are net buyers of Thai equities, while none of the sub-periods sees any significant negative relations between return and lagged flows for subsequent five days or four weeks. In addition, the chi-square statistics for weekly frequencies rejects the null that all coefficients on all lags of surprise flow are zero at 5% confidence level in all sub-periods. Such finding is consistent with those in Clark and Berko (1997) and Richards (2002), who use unexpected flow in a simple OLS regression framework. The VAR framework accommodates the potential feedback effects between the return and the unexpected flow equations and longer sample period of daily data provides better power and allows completion of sub-period analyses to account for possible structural break points.

I have verified that unexpected flow is not autocorrelated and has no discernible relationship with lagged local returns. So it is unlikely that the result is a consequence of surprise capital flow being broken up trades or engaging in momentum or feedback trading. Hence it may be an implication that unexpected flow is response to new information.

To complete the picture, Panel C of Table 9 displays the result of a bivariate model between return and the expected flow ($FLOW_t - U_t^f$ from (3.1)). I find that the expected flow has insignificant contemporaneous price impact on market levels. Its lagged price impact is clearly not long lasting as it exhibits no clear trend and is marginal at best. Furthermore, the expected flows have an extremely limited power in explaining

the return dynamics as indicated by the R-squared of the regression, which is around 3% compared to as much as 12% for the unexpected flows for weekly full sample.

Not surprisingly, for FB25 returns in Table 10 also reports stronger relationships between portfolio return and unexpected flows, both contemporaneous and lagged. While the result for returns on MB25 is somewhat weaker, it is still stronger than that for the overall market shown in Table 9. The opposite is true for returns of portfolio X50, as the contemporaneous relationship is significantly reduced to only about half of that for the overall market index and becoming nonexistent in the post-crisis period. The relationship between return and lagged flows is also mitigated substantially.

Repeating the analysis using four-variable VAR models, for the market and each stock group shows that the inclusion of volatility and turnover in the structural model specification enhances the predictive power of unexpected flow at longer daily lags. The impact of flow surprise on returns in the four-variable model remains only at the contemporaneous level for weekly frequency. I show the impulse response functions of the overall market, FB25, and X50 with respect to unexpected flows are presented in the in Figure 3. In general, flow shocks have positive impact on price levels of stocks with high and low foreign interest. The effect of flow surprise on FB25 is most apparent in the full sample period where a one-standard-deviation shock leads to a 1.6% price increase of FB25 in 15 days, but only a 0.8% rise for X50. These results again suggest that the market may be segmented as foreign investors takes interest mainly in large firms. I investigate this implication for the effect of foreign flow on the cross section of returns in the next section.

To check if the predictability of unexpected flows exists when world returns and exchange rate changes are in the model, Table 11 reports the VAR model with these two new variables. Furthermore, to account for possible existence of other latent variables that could be influencing both returns and flows resulting in a common component between the error term and the regressors, I run the VAR model only with lag terms of unexpected flows.

Table 11 shows that after controlling for world return and foreign exchange rate change, the first lag of unexpected flow still have predictive power on market return on daily basis, although the size and significance is reduced. During the crisis, the first weekly lag of unexpected flow predicts market return. Previous period world returns also forecasts higher local market return, but this is apparent only on daily data.

An increase in aggregate net foreign demand is likely to raise foreign premiums (log of the ratio of foreign board price to main board price) as foreign interest is concentrated in FB25 stocks. An alternative way to measure the informativeness of unexpected flow is to study the VAR model between foreign premium and unexpected flows. Table 12 reports the result of the bivariate VAR model between foreign premium and unexpected flow with contemporaneous unexpected flow term in Panel A and without in Panel B. In both cases unexpected flow predicts future premium with significance although the result is stronger with the contemporaneous term. Moreover, unexpected flow seems to be able to forecast premium at longer lags, ie. beyond the first lag in the weekly horizon. The strongest evidence is during the crisis when up to 4 weeks of unexpected flows forecasts premium. Table 12 also shows that premium is very persistent at both daily and weekly frequencies. I also check if the unexpected flow is

also capable of predicting future return differential between the foreign board and main board. Although not reported, I find that unexpected flow also forecasts return differences on the two boards. On the other hand, expected flow have weaker influence on future premiums and return differentials.

A final point to note in this section is that the foreign ownership limit is no longer effectively binding after the introduction of NVDRs in June 2001.[15] As this policy change may alter the dynamics of flows and unexpected flows with the market, it is prudent to split the post-crisis sample to see if the existing analysis still holds. Using the four-variable VAR model, I repeat the analysis for the market and each segment. I find that the influence of unexpected flows on FB25 and MB25 remains significant, although reduced. However, unexpected flows no longer have significant impact on the X50 group, which is indicative that foreign investors' interest is becoming more concentrated in the larger and liquid segment of the market. A necessary check of robustness is to see if the analysis change using local returns in stead of US$ returns. I find that my conclusions do not alter when local returns is used in the models.

3.4 External Determinants of Foreign Flows

In this subsection, I measure the effect of some exogenous factors that may determine foreign flows, such as world returns and regional returns as well as the role of the exchange rate. Panel A of Table 13 shows that the previous day world return predicts an increase in foreign net flow. In particular, after the crisis a 1% increase in world returns leads to a 0.3% increase in net flow to the Thai market. There is no significant

[15] See Chapter 2, Section 2.1.

relationship between world returns and flow during the crisis and the weekly VAR numbers show that the relationship is very short term and dissipates within one week.

In Panel B, the Asia Pacific ex-Japan index is chosen as the exogenous market return factor. More interesting is that a positive Asian regional return seems to predict a negative flow into Thailand on the following day. This may reflect that foreign portfolio investors are chasing after returns and rebalance their regional portfolios very quickly.

As far as foreign exchange rates is concerned, the exchange rate between the Thai baht and US$ was limited to a narrow band before July 1997. After July 2, 1997, when the Thai baht was devalued, the currency was set to float freely. Through the VAR model, I find that the relationship between currency and foreign flows become more significant post-crisis. According to Table 13, depreciation in the Thai currency brings an increase in foreign flows evident after the devaluation. However, in the longer run the depreciation in the currency leads to a reversal of foreign flows out of the market. This is most clear in the weekly frequency in both Panel A, and Panel B.

A final point to note for this part is that, although external market returns are important in explaining Thai returns, they do not replace the predictability of local returns. Furthermore, their effect on foreign net flow into Thailand is dominated by the effect of local returns. In sum, the size and significance of local returns in predicting current foreign net flows are largely unchanged despite the inclusion of an external market index and currency change.

3.5 Exposure to Foreign Flows and Valuation Effect

The effect of market liberalization on the reduction of costs of capital in emerging markets is well documented in Bekaert and Harvey (2000) and Henry (2000). This is consistent with the result discussed above that increased foreign flow induces a permanent rise in prices. Most of previous studies have focused on aggregate market levels partly due to data limitation,[16] yet we have observed in the previous section that different segments of the market respond differently to the shocks in foreign portfolio flow, reflecting preferences in foreign equity holdings in emerging markets. This implies that the benefit of reduction in risk premium on stocks brought about by increased foreign flows is not shared evenly in a single emerging market, and therefore foreign flows will have a differential cross-sectional impact on stock returns across different segments of the market. I investigate this issue in this section.

Given the significant and systematic impact of foreign net purchases on emerging market returns, it is plausible to regard flow as a systematic factor in the market and use a factor model framework to assess the effect of foreign on the cross-section of returns. Moreover, as the study has earlier examined stocks' differential responses to foreign flow by groups based on their value-weighted returns, I now explore individual responses by measuring the flow beta or exposure to foreign flow shocks for individual stocks within each group.

[16] Dahlquist and Robertsson (2001, 2003) examine the relationship of reduction in costs of capital and firm characteristics in Sweden.

Using the shock to the flow factor from (3.1), the flow betas of individual stocks are calculated by regressing excess returns on unexpected flows in a single factor and multi-factor models:

$$R_{it} - R_{ft} = \alpha_i + \beta_i^F \cdot U_t^f + \eta_{it} \tag{3.2}$$

$$R_{it} - R_{ft} = \alpha_i + \beta_i^F \cdot U_t^f + \beta_t^M \cdot \left(R_t^M - R_{ft}\right) + \beta_i^W \left(R_t^W - R_{ft}\right) + \varepsilon_{it} \tag{3.3}$$

where R_{ft} is the Thai overnight interbank rate at time *t*, R_t^M is the SET index return, and R_t^W is the world market return.[17] The beta estimation is done on weekly and monthly data, although I show only the weekly estimates. For weekly estimates, I apply the Dimson (1979) correction in weekly local market beta to take into account for infrequent trading, using 2 weekly leads and lags. Using the betas from equation (3.3) I then complete a GLS cross-section regression of the average excess return over the sample period on all betas as well as on market capitalization (log) and turnover ratio (log) averaged over the sample period.

$$R_i^e = \alpha_i + \lambda_{1it} \cdot \beta_i^F + \lambda_{2i} \cdot \beta_i^M + \lambda_{3i} \cdot \beta_i^W + \lambda_{4i} \cdot \ln SIZE_i + \lambda_{5i} \cdot \ln TURN_i + \varsigma_i \tag{3.4}$$

where R_i^e is the excess return for stock *i*.

Before presenting the result of cross-sectional regression, Table 13 tabulates the characteristics of the betas. Focusing on the univariate betas, I find that flow beta

[17] The inclusion of the world market return is to account for increasing integration of the Thai capital market as noted in Bekaert and Harvey (1995), Carrieri, Errunza, and Hogan (2002).

estimated from univariate regression of excess return on flow shocks exhibits values that are greater than zero across all stock groups. The positive value is indicative that stocks receiving higher foreign interest have higher prices. Therefore, FB25 have larger average flow betas (0.47) than stocks on the main board represented by MB25 and X50 group whose average flow betas are only 0.32 and 0.13. The value of flow beta in the FB25 group's 75^{th} quantile is 0.15 (0.73 for univariate case). This number is much larger than all other main board segments, consistent with the results found in the previous section that foreign flows have stronger impact on the returns of large stocks. The local market beta and world market beta estimation are also larger for FB25 and MB25 stocks as they carry a large weight in of the market capitalization as well as they are more integrated with the world market.

Moving on to the distribution of the betas estimated from the multi-factor model, the flow beta exhibits a fairly wide range of values, both positive and negative. While a positive flow beta clearly suggests that the stock return responds positively to flow shocks. A negative flow beta can be interpreted as reallocation from stocks with relatively low foreign interest into those with high foreign interest. For all SET stocks in the sample the value of the flow beta is -0.1 and 0.03 at 25 and 75 percentiles, respectively, with the median at -0.03 at weekly frequency. Using equation (3.2) for estimation, only the median value of flow beta for the FB25 group is positive. For the rest of the market, the median is small and is close to zero indicating that the market absorbs most of the impact from flow shocks in the multivariate estimation for stocks traded on the main board. This result appears to hold for the world market beta as well and is consistent with previous finding that local market returns dominates other external determinants of stock returns.

Approximately half of the flow betas from multivariate estimation are significant at a 5% level. However, close to 90% of the flow betas from univariate estimation are significant at 5%.

The result from the multivariate regression in Panel A Table 14[18] indicates there is no significant relationship between exposure to the flow factor with the cross-section of stock returns for stocks on the main board while the pricing premium associated with high exposure to the flow factor for FB25 is positive and significant at 1.2% per week. On the other hand, the main board returns of the same 25 portfolio (MB25) show a different character. Once the exposure to the local market and world market returns is controlled for, foreign flow shocks have no discernible effect on the returns of these stocks. This makes intuitive sense because the foreign ownership limits for these stocks have been reached so trading on the main board in these stocks should not be influenced anymore by the comings and goings of foreign capitals as long as the ownership ceilings stay binding for these stocks. An interesting aspect from the sub-period analysis is that the pricing impact coefficient related to exposure to the flow beta for the market as a whole and for X50 stocks is negative and significant during the crisis period. The price impact coefficient is -0.6% per week for the market as a whole and -0.7% for the group of X50 stocks after controlling for the effect of local market beta, world market beta and other firm specific characteristics such as market capitalization and turnover.[19] This

[18] T-statistics in the table allow for the error-in-variables problem with the Shanken (1992) correction method.

[19] The premium on the local and world market beta is negative in most cases, though insignificant for the former and significant for the latter. The negative loading from the market beta is a consequence of estimating the cross-section regression during a sample period where the excess market returns are mostly negative. This result can be found also in the US market (see Chan and Lakonishok (1993) and Pentengill, Sundaram, and Mathur (1995)) as well as in emerging markets (see Classaens, Dasgupta, and Glen (1998) and Chui and Wei (1998). The argument for the negative premium is that realized return is used in place of expected return and therefore stocks with high beta, provide lower realized returns in periods when market excess return is negative.

implies that the risk premiums of stocks with high foreign interest and consequently positive flow betas, are on average reduced. In contrast, stocks receiving low foreign interest have negative flow betas, and thus experience increases in required rates of return.

Chapter 4: Dynamic Relationship Between Foreign Flows with Volatility and Liquidity

In response to growing concerns regarding foreign flow impact on volatility, several recent papers assess the impact of foreign flows on local market volatility by documenting herding and feedback trading behavior of foreign investors and examining whether foreign net flows are followed by large price swings in subsequent periods. Cho, Kho, and Stulz (1999) and Kim and Wei (2002) use disaggregated stock trading positions by investor types to find evidence of positive feedback trading by foreign investors in Korea. Bonser-Neal et al (2002), document similar patterns for Indonesia. Borensztein and Gelos (2000) use a novel database which comprises of individual emerging market funds' country allocations and find that local market volatility is increasing in the level of herding measure in that market. The view that herding or feedback trading strategies impede price efficiency is consistent with the literature on speculative behavior of noise traders such as De Long, Shleifer, Summers, and Waldmann (1990). Their model shows that informed investors drive prices further away from fundamentals in anticipation of future price increases from rising demands of positive feedback traders.

However, researchers have not been able to convincingly demonstrate that foreign investors' positive feedback trading behavior has a destabilizing influence on the local market. One possible explanation for this is that positive feedback trading merely reflects gradual portfolio balancing by the foreign investors. An alternative reason is that the foreign flow data is likely to be understated unless it is collected from the final investment destination. This is because a large amount of host country investment usually

comes from an intermediary source where a regional investment office is situated. For instance, most of the US and European investment in the Southeast Asian markets comes from Hong Kong and Singapore where many of the largest brokers locate their regional offices. Some prior studies use the US investment flow data from the Treasury Bulletin to proxy for foreign flows to an emerging market, thus understating the actual foreign flow to that market.

The link between liquidity and volatility has been documented in numerous empirical research. For instance, Tauchen and Pitts (1983), Schwert (1989), Gallant, Rossi, and Tauchen (1992), and Lee and Rui (2002) confirm the positive relation between volume and volatility. However, past literature says very little about the connection between foreign flow and trading volume.[20]

To understand the dynamics of flow and market trading activities, I use the vector autoregressive (VAR) models. I estimate a restricted bivariate VAR model between foreign flow and volatility, and then local flow and volatility. The structural equation includes a contemporaneous effect of flow on volatility. Details of the computation is provided in the appendix section.

In this study, volatility is computed from the squared of daily returns, r_{it}^2. In the case of weekly volatility, it is $\sigma_t^2 = \Sigma_{i=1}^5 r_{it}^2$. The fact that the SET imposes a daily price limit on individual stocks does not materially affect our analysis. Kim and Rhee (1997) conclude that price limits are not useful as stocks do not regain their normal volatility

[20] Bae, Chan, and Ng (2002) provides a cross-sectional study on how investibility of individual stocks affects the variations of return volatility. This study is based on a time-series approach using VAR models to examine how volatility difference in two stocks groups separated by the level of foreign interest.

quickly. Based on this reasoning, price limits should increase the chances that we will find destabilizing influence of foreign flows as the limit should create positive autocorrelation in volatility over a number of periods.

For the multivariate structural equation, I allow net flow to have contemporaneous impact on turnover, volatility, and return. Then turnover has contemporaneous affect on volatility and return, but not on flow. The ordering continues in this manner for volatility, which has a contemporaneous effect on return, but not on flow and turnover.

Furthermore, I separate flow into two components, expected flows and unexpected flows. The latter is obtained from the following autoregressive model at time *t* using data from a preceding window of 60 days for daily data, 20 weeks for weekly data as shown in equation (3.1).

The motivation for separating flows into these two components is that they represent different aspect of foreign demand. I find that expected flow is largely determined by past returns, whereas unexpected flow is less predictable. Based on this piece of evidence, it appears that the positive feedback trading activity is better captured by the portion of flow that is anticipated. In contrast, unexpected flows should have a more dominant role in price changes compared to expected flow as it is a better measure of response to new unexpected information not yet embedded in the price. Consequently, unexpected flow is likely to have a more pronounced impact on return volatility as well. This is verified in the analyses the sub-section below.

4.1 Bivariate Analysis

The bivariate VAR results are reported in Table 16. The top, middle, and bottom Panels show the bivariate relationship between the overall market volatility with foreign flows, expected flows, and unexpected flows respectively. Panel A shows that foreign net buying activity leads to larger volatility and the impact is mostly at the contemporaneous levels. Moreover, foreign flow net effect on volatility seems to be more significant at the daily frequency than weekly, indicating that the fluctuation in return levels caused by foreign flow is temporary. In the bivariate model using expected flow and unexpected flows in Panel B and Panel C, I find that expected flow clearly have a weaker influence on volatility. In the full sample period, a 1% increase in expected flow leads to a 0.23% increase in volatility while a 1% increase in unexpected flow raises volatility by almost 0.5%. Note that the coefficient on the contemporaneous expected flow is negative and significant during the pre-crisis period while the coefficient on unexpected flows is positive and significant. This signifies the positive feedback selling present in expected flows before the crisis, whereas unexpected flows appears to behave like contrarians. Unexpected flows also have a more prolonged impact on return volatility particularly during the crisis. As evident from the weekly analysis, a positive flow surprise at the third week lag during this period has a significant impact on volatility. In contrast, the coefficient on expected flows at the third week lag during this period is negative a significant. The combination of this evident suggests that while some of the foreign investors sold during the crisis, others are net buyers.

The next part of the study involves comparison between the two different market segments separated by the degree of foreign interest to examine whether high exposure to foreign flows causes higher return fluctuations. Panel A of Table 17 reports the bivariate

relationship between the volatility of high foreign interest stocks designated by the FB25 group with expected flows and unexpected flows. Foreign board volatility is based on a valued weighted return index of the 25 largest stocks that are actively traded. In Panel B is the bivariate result for the group representing stocks with low foreign interest, X50. As in the case of the whole market, unexpected flows have dominant impact on volatility compared to expected flows. In addition, the trading pattern which indicates that unexpected flows seem to represent buying activity during the crisis period as positive flow shocks at the third week is associated with higher volatility, whereas the coefficients on the expected flows is negative and significant. I also find that stocks with high exposure to foreign flows are more susceptible to higher return volatility. As seen from the table, a 1% increase in contemporaneous unexpected flow raises volatility levels of FB25 and X50 by 1.4% and 0.12% respectively at the daily frequency. The impact of unexpected flow at weekly frequency is much smaller, being 0.37% for FB25 and 0.098% for X50.

What is surprising in this exercise is that the contemporaneous foreign flows have a positive effect on volatility regardless of market segment. This means that net foreign buying activity is associated with higher volatility.[21] This effect is very weak in the pre-crisis period, but is particularly strong during the Asian financial crisis then subsiding, though still statistically significant, in the post-crisis period. The finding runs counter to the accusation that foreign capital flight is responsible for heightened market volatility in emerging markets. More importantly, the empirical result show that expected flow, which proxies for feedback behavior has insignificant impact on volatility. Rather, it is

[21] In contrast, net local selling activities (result not shown) is related to higher volatility.

unexpected flow that is causing volatility as it contains new information. Yet much of this is at the contemporaneous level.

While similar findings are reported in South Korea and Japan (Choe, Kho, and Stulz (1999)) and (Hamao and Mei (2001)), the Thai market volatility experience with foreign flow provides a stronger evidence against the contention that foreign investors are destabilizing emerging markets as foreign investors are much larger participants on the Thai stock exchange.

In addition to market volatility, I also examine the relationship between foreign flow and market turnover. Table 18 is the bivariate model between turnover with unexpected flows for the market, FB25 and X50 stock groups. As in the previous cases, unexpected flow has higher level of economic and statistical influence on turnover at both contemporaneous levels and at longer lags. For the full sample period, a 1% increase in contemporaneous unexpected flow leads to a 1.1%, 0.45%, and 0.86% in volatility for the entire market, FB25, and X50 respectively. The reason that the overall impact of unexpected flow on aggregate market is larger than X50 even though they are both main board trades is that unexpected flow impact on MB25 is the strongest, being 2.5%. As foreign investors can no longer technically invest in MB25 because they are the 25 stocks that have exceeded their foreign ownership limit, evidence that an in-coming flow shock can still have such positive influence on turnover means that local investors must increase their trading upon observed inflow. The other point to note is that an increase in foreign flows raises market liquidity and this role is enhanced particularly during the crisis period. These findings are also prevalent in weekly data.

4.2 Multivariate Analysis

Having established the relationship between flow and turnover and between flow and volatility, this sub-section proceeds with the multivariate VAR to clarify the true relationship between flow with return, volatility, and turnover. This is particularly important because all these variables are highly correlated. Furthermore, flow, volatility, and turnover are persistent throughout the entire sample period. The result of the four-variable VAR in given in Table 19.

After verifying that unexpected flow is more influential, I focus on unexpected flow impact on volatility via the multivariate specification. Furthermore, since the analysis for the aggregate market also applies for the case of FB25 and X50, we report only the volatility equation from the four variable structural model on market volatility. In Table 19, the behavior of market volatility has a similar pattern in its autocorrelation and its relationship with market return to that observed in the US and other developed markets.

During the crisis period, foreign flow does not exert a destabilizing effect on market volatility because it is domestic selling, rather than foreign selling, that led to increased volatility, consistent with our bivariate VAR results. Note that even this effect is diminished significantly as most of the effect in the bivariate analysis is actually channeled through market turnover. For example, a 1% increase in flow shock leads to a 0.48% increase in volatility during the crisis in the bivariate model.

However, after controlling for turnover in the multivariate model, the same increase in flow only results in a 0.2% increase in volatility. The reduced impact of flow

on volatility after controlling for turnover is apparent for all sub-periods and in weekly analysis as well. One interesting observation is that in the pre-crisis period, foreign outflow seems to have caused an increase in market volatility. This can be attributed to the period when foreign outflow coincides with market decline. However, there is no such evidence in later periods. Evidently, over the crisis period when the market plummeted that foreign investors have become relative more active and their net buying provided liquidity to the market. In addition, it is foreign net buying that drives volatility during the most bearish phase in the study. The result discussed here follows through when we look for the possibility of asymmetric volatility response from foreign buy relative to foreign sell. Typically, we expect foreign selling pressure to be more dominant during the crisis. Nevertheless, the foreign sell impact on volatility during the crisis is neither statistically nor economically significant.

Another piece of information that one can glean from this table is on market liquidity reflected in the relationship between contemporaneous volatility and turnover. If this relationship is placed in the context of a market depth measure *à la* Kyle (1985), then the market depth drops around half to 2.0 (1/0.5) during the crisis from 4.0 (1/0.25) its level in the pre-crisis period level, and has more than doubled from that level in recent years to 9.1 (1/0.11). This implies that liquidity has not only recovered from the crisis level, but also improved dramatically from the pre-crisis level. I repeat the multivariate analysis for foreign board return, volatility, and turnover and also find the impact of flow on volatility is substantially reduced. As in the case of the bivariate analysis, net foreign purchase exerts stronger influence on price moves on the foreign board during the crisis.

The first row in Figure 7 is the accumulated impulse response of volatility to flow shocks. It is only during the crisis period that flow shocks have an apparent influence on volatility as a one standard deviation shock leads to a 0.1% permanent rise in volatility level after the tenth day. Noting earlier that foreign net flow rescinded during the pre-crisis period as investors reduce their holdings in Thailand, however, the selling must be gradual as flow shocks have minimal affect on volatility in this period. In the second row of Figure 7 is the volatility response to turnover shocks. While turnover shock has a relatively stronger influence on volatility levels during the pre-crisis period, its impact on price change in other sub-periods is not very different from flow impact on price change. The final row is the responses of turnover to flow shocks, which remains fairly constant in all periods. The graphs highlight the significant and permanent influence of flow shocks on turnover that surpasses the levels of those shocks on volatility in the pre-crisis and crisis periods. However, the influence declines post-crisis as foreign net flow dwindles.

4.3 Alternative Measures of Volatility and Flow

This sub-section turns to the issue of robustness of results when different measures of volatility or flow are applied to the study. Model A is the same bivariate VAR specification as in Table 20 reproduced here for ease of comparison. We replace net daily flow with daily foreign buy and foreign sell in models B and C to pick up any possible asymmetric volatility response to buy and sell flows, but do not find the difference substantial. Though not shown, foreign buy do affect volatility much more significantly than foreign sell during the crisis period as foreign investors are active net buyers and liquidity providers during that period.

Wang (2003) use an OLS specification to study market volatility in Indonesia and Thailand and finds that contemporaneous aggregate foreign trading affects market volatility. Wang (2003) defines volatility as the difference between the log of daily high and log of daily low price and flow as aggregate trading activity by investor type.[22] I apply these alternative definitions of volatility and flow in model D to compare their economic impact and statistical significance to our original measures. In model D in table 20, I use a VAR specification[23] to assess how much the foreign investors' aggregate buying and selling activities affects the price spread. The model shows that daily aggregate foreign trading activity has an enormous impact on daily price spread with a very high level of significance. Specifically, a 1% increase in aggregate foreign flows increases the difference between log of daily high and low price by 5%. When analyzing the relationship between daily price spread and aggregate flows using the four variable VAR in model E, I find as before that the impact of flow on volatility has been channeled through turnover. In addition, aggregate foreign flow has insignificant contemporaneous affect on daily price spread during the crisis period.

Despite the persistence of foreign flow, the positive relationship between aggregate trading and spread is largely at the contemporaneous level. As it is shown that flow at longer lags have much smaller impact on volatility levels there is lack of evidence that persistent and active trading by foreign investors leads to continuing day-to-day price

[22] I also analyze models which include trading activities of local individuals and local institutional investors using simple OLS specification with t-statistics based on Newey-West adjustment for heteroscedasticity and autocorrelation and find that the aggregate flows of both foreign and local individual investors have substantial impact on daily price spread. However, during the crisis period, it is the local individual investors that have significant influence on volatility. The short-coming of the data is that I do not have inter-group transaction data to delineate how one particular type of transaction may have a dominant effect on volatility over the others.

[23] Using an OLS approach with Newey-West t-statistics gives very close estimates but with lower significance level.

gyrations. This reaffirms the result we have seen from the accumulated impulse response functions.

4.4 The Impact of Foreign Flows and Conditional Volatility

An alternative way to assess the dynamic relation among return, volatility, turnover, and net flow is to model time-varying volatility using ARCH-GARCH models. To do this, I first adopt the GARCH (1,1) specification for parsimony. The GARCH (1,1) is most widely used in financial data owing to its success in modeling volatility (see Engle (1991). The specification has also been used in modeling emerging markets volatility in Aggarwal, Inclan, and Leal (1999), and Park and Park (1999). The mean and volatility equations that I specify are as follows:

$$R_t = \mu + \varepsilon_t \qquad \varepsilon_t \mid \mathbf{I}_{t-1} \sim N(0, h_t) \qquad (4.1)$$

$$h_t = \omega_o + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}$$

In order to estimate the influence of turnover on volatility, I include the contemporaneous turnover in the conditional volatility equation above and find that the GARCH effect disappears. Therefore, I re-estimate conditional volatility based on an ARCH(1) model by including turnover in the variance equation as follows,

$$R_t = \mu + \varepsilon_t \qquad \varepsilon_t \mid \mathbf{I}_{t-1} \sim N(0, h_t) \qquad (4.2)$$

$$h_t = \omega_o + \alpha\tau_t + \beta h_{t-1}$$

Next, I use the conditional volatility from the GARCH (1,1) and ARCH(1) models to investigate the feedback relation between flow and volatility and then compare the result to the bivariate VAR model which uses squared of daily returns as measure of volatility in the previous subsection.

Table 21 presents the results from fitting the GARCH (1,1) and ARCH(1) models as well as the bivariate relationship between conditional volatility and flow. Panel A shows that in absence of turnover, the GARCH term is economically and statistically significant. The diagnostic LM statistics, TR^2 computed with the standardized residuals $\varepsilon_t / \sqrt{h_t}$ shows that there is no remaining ARCH effect in either specification.

In Panel B, using conditional volatility based on the GARCH(1,1), I find that the contemporaneous foreign net flow has a significant influence on volatility in all except the pre-crisis period. However, once turnover is controlled for, the contemporaneous flow has positive and significant influence on conditional volatility from the ARCH(1) model in all periods. Furthermore, the autoregressive terms of conditional volatility reduce notably in size and significance with turnover in the variance model in the full sample where a 1% increase in the previous period volatility leads to a 0.34% increase in volatility in the next period. Without turnover in the variance equation, a 1% increase in previous day volatility raises next day volatility by 1.1%. Thus, it is most likely that turnover has an important role in forecasting volatility consistent with empirical work on volatility-volume relationship. I do not find that foreign net flows beyond the first lag have any significant impact on volatility and conclude that even with a change in the model specification, there is lack of evidence that foreign net flows have lasting adverse repercussions on price volatility.

Chapter 5: Summary and Conclusion

The empirical investigation in this paper goes beyond documenting the herding and positive feedback behavior of foreign investors and examining the bivariate relationship between return volatility and foreign flow. The dissertation provides evidence of the effect of foreign flows on cross-section of asset prices and explores the impact of foreign flow on volatility via the market liquidity.

The study employs daily series of flows and returns in Thailand during the period between January 1995 and May 2002 and finds that the relationship between foreign flows and market returns is strongest for the group of large stocks favored by foreign investors while it is less significant or negative for the group of smaller stocks. This implies segmentation of the market due to differential foreign interests among stocks. According to the empirical results, stocks with high foreign interest have positive flow betas while those with low foreign interest typically have negative flow betas. The cross-sectional analysis shows that the exposure to foreign flows as measured by the flow beta of returns for stocks with high foreign interest in the market is associated with higher required rate of return. On the other hand, stocks with positive exposure to foreign interest in the second group receive reduction in pricing premium, a finding consistent with the literature on risk-sharing by investor-base broadening. Although this is only apparent during the crisis period. In other sub-periods, flow shocks have insignificant effect on valuation.

Despite being a large participant and an important liquidity provider in a small market, foreign investors do not create a destabilizing effect on the market even during the height of the financial crisis. In fact, the increased volatility and steep drop in liquidity during the crisis may be attributable to domestic selling. This conclusion is affirmed by both bivariate and multivariate VAR analyses, and is consistent with the evidence produced in Korean and Japanese markets in previous studies. The use of conditional volatilities to analyze foreign flow impact does not alter the result. Rather, it confirms the influential role of turnover in affecting market volatility.

The lessons learnt from this study is that stocks with high foreign interest responds more positively to flow shocks than those receiving low foreign interest. There is evidence that stocks in the less-favored segment become much less prone to price reversals after the crisis. It is possible that the Asian crisis has prompted investors to limit their investments in the larger and more visible stocks. Nonetheless, some stocks in the "less-favored" segment still have positive exposure to foreign shocks and hence enjoy increase in price levels. Whether the positive exposure of these firms is associated with firms that are better governed or that they are associated with international firms is an interesting avenue for future research.

The results also reveal that stocks with high level of foreign interest have higher volatility levels. In addition, the influence of foreign flows appears to have an instrumental role in promotion of liquidity on the main trading board, particularly for larger stocks that are in high foreign demand.

Going forward, for the market to grow, the regulators of Thai Stock Exchange should continue to introduce larger, more liquid, and more visible firms on the exchange to avoid potential problems of too much money chasing after too few stocks leading to large fluctuations in prices within a limited group that are in high demand.

Table 1: Market Statistics for the Stock Exchange of Thailand (SET)

Panel A is a summary of daily market statistics for full sample and sub-periods. Turnover is trading value divided by previous period market capitalization. Flow is foreign net flow divided by previous period market capitalization. The break-down of net trading value by investor type is based on the period average. The SET separates trading into foreign investors, local institutional, and local retail. Panel B is a summary of daily (weekly) correlation and autocorrelation statistics for full sample and sub-periods. Weekly statistics are in parentheses.:

Panel A	**Full Sample Jan 95-May 02**	**Pre-crisis Jan 95-Dec 96**	**Crisis Jun 97-May 99**	**Post-crisis Jun 00-May 02**
Market Statistics				
Avg $ return (%)	-0.09 (-0.46)	-0.11 (-0.47)	-0.12(-0.57)	0.03 (0.09)
Std $ return (%)	2.24 (5.42)	1.31(3.31)	3.35 (7.91)	1.67 (4.12)
Turnover (%)	0.28 (1.40)	0.17 (0.84)	0.29 (1.42)	0.39 (1.95)
Std turnover (%)	0.21 (0.94)	0.10 (0.39)	0.21 (0.91)	0.25 (1.15)
Avg Flow (%)	0.003 (0.016)	0.003 (0.015)	0.011 (0.054)	0.001 (0.007)
Std (Flow) (%)	0.03 (0.114)	0.03 (0.09)	0.04 (0.118)	0.03 (0.09)
No. of observations daily	1809	487	487	490
No. of observations weekly	369	99	97	101
Trading Statistics				
Avg Market Volume (THB bn)	5.40 (26.76)	5.81(28.65)	4.01 (19.44)	6.24 (30.94)
Avg Foreign Net Flow (THB mn)	74.5 (340.1)	126.4 (582.4)	171.5 (757.8)	37.8 (183.6)
% Foreign investors	29	30	36	21
% Local institutions	8	13	6	4
% Local retail	63	57	57	74

Panel B				
	Return	**Volatility**	**Turnover**	**Net foreign flow**
Full sample Correlation				
Return	1.00	0.24 (0.32)	0.29 (0.44)	0.38 (0.49)
Volatility		1.00	0.25 (0.30)	0.22 (0.33)
Turnover			1.00	0.31 (0.30)
Net foreign flow				1.00
Full sample autocorrelation				
Daily Lag 1	0.193 (0.149)	0.266 (0.260)	0.805 (0.726)	0.555 (0.478)
Daily Lag 2	0.013 (0.150)	0.168 (0.202)	0.682 (0.631)	0.355 (0.348)
Daily Lag 3	0.006 (0.09)	0.142 (0.192)	0.626 (0.527)	0.278 (0.209)
Daily Lag 4	0.022 (-0.02)	0.045 (0.077)	0.588 (0.433)	0.238 (0.112)
Daily Lag 5	-0.015	0.068	0.569	0.233

Table 2: Market Statistics for the Stock Exchange of Thailand (SET)

This table is a summary of daily and weekly market statistics for full sample and sub-periods for different stock groups. FB25 are 25 stocks with active trading on the foreign board. MB25 are the same 25 stocks in the previous group traded on the main board. X50 consists of the remainder of the market that excludes 50 largest and most actively traded stocks on the exchange. Weekly statistics are in parentheses.

Market Segment Statistics	**Full Sample Jan 95-May 02**	**Pre-crisis Jan 95-Dec 96**	**Crisis Jun 97-May 99**	**Post-crisis Jun 00-May 02**
Avg $ Return				
FB25 (%)	-0.13 (-0.6)	-0.08 (-0.45)	-0.16 (-0.36)	-0.10 (-0.53)
MB25 (%)	-0.07 (-0.34)	-0.13 (-0.65)	-0.03 (-0.03)	0.10 (0.49)
X50 (%)	-0.04 (-0.33)	-0.11 (-0.58)	-0.10 (-0.60)	0.14 (0.38)
Std $ Return				
FB25 (%)	3.54 (7.63)	2.05 (4.53)	5.38 (11.36)	2.66 (5.87)
MB25 (%)	3.12 (6.87)	1.72 (3.83)	4.68 (10.32)	2.48 (5.48)
X50 (%)	2.8 (4.57)	1.11 (2.51)	2.97 (6.64)	1.75 (4.08)
Turnover				
FB25 (%)	0.13 (0.48)	0.04 (0.11)	0.10 (0.38)	0.10 (0.88)
MB25 (%)	0.88 (4.11)	0.38 (1.78)	1.41 (6.58)	1.41 (4.76)
X50 (%)	0.48 (1.37)	0.20 (0.74)	0.57 (1.56)	0.57 (1.73)
Std Turnover				
FB25 (%)	0.14 (0.48)	0.03 (0.11)	0.07 (0.38)	0.07 (0.88)
MB25 (%)	1.02 (4.11)	0.24 (1.78)	1.47 (6.58)	1.47 (4.76)
X50 (%)	0.66 (1.37)	0.16 (0.74)	0.63 (1.56)	0.63 (1.73)

Table 3: Investor Statistics

The Stock Exchange of Thailand (SET) classifies investors into 3 categories: local retail, local institutional, and foreign. The trading activity data by investor type combines the trading on both local and foreign boards

Cumulative Billions of Baht	**Full 01/95-05/02**	**Pre-Crisis 01/95-12/96**	**Crisis 06/97-05/99**	**Post-Crisis 06/00-05/02**
Foreign	135.6	61.5	83.5	18.5
Local Institution	-51.6	-20.1	-14.8	-6.0
Local Retail	-84.1	-41.5	-68.7	-12.5
% Trade				
Foreign	29%	30%	36%	21%
Local Institution	8%	13%	6%	4%
Local Retail	63%	57%	57%	74%

Table 4: Correlation and autocorrelation

Panel A of this table provides the Pearson correlation of all variables under study at daily and weekly frequencies as well as for different sub-periods. Turnover (TURN) is computed from total value of shares traded divided by average period market capitalization. Foreign net flow (FFLOW) is net flow divided by average period market capitalization. Daily volatility (VARET) is derived from the squared daily return while weekly volatility is computed from the variance of return over the past 5 trading days. Panel B is the autocorrelation for all variables used in vector autoregressive models

Panel A		**Daily**					**Weekly**			
Variables	**RET**	**VARET**	**TURN**	**FFLOW**	**No of Obs**	**RET**	**VARET**	**TURN**	**FFLOW**	**No of Obs**
Full Sample (01/95-05/02)										
RET	1.00	0.29	0.24	0.34	1808	1.00	0.29	0.35	0.50	369
VARET		1.00	0.18	0.15			1.00	0.11	0.19	
TURN			1.00	0.37				1.00	0.34	
FFLOW				1.00					1.00	
Pre-crisis (01/95-12/96)										
RET	1.00	-0.05	0.25	0.48	486	1.00	0.09	0.29	0.60	99
VARET		1.00	0.28	-0.06			1.00	0.29	-0.13	
TURN			1.00	0.52				1.00	0.56	
FFLOW				1.00					1.00	
Crisis (06/97-05/99)										
RET	1.00	0.48	0.34	0.41	486	1.00	0.53	0.54	0.62	96
VARET		1.00	0.41	0.37			1.00	0.43	0.48	
TURN			1.00	0.42				1.00	0.32	
FFLOW				1.00					1.00	
Post-crisis (06/00-05/02)										
RET	1.00	0.02	0.25	0.24	489	1.00	-0.20	0.42	0.46	101
VARET		1.00	0.21	0.16			1.00	0.18	0.16	
TURN			1.00	0.47				1.00	0.57	
FFLOW				1.00					1.00	

Panel B			**Daily**					**Weekly**	
Variable	**Lag1**	**Lag2**	**Lag3**	**Lag4**	**Lag5**	**Lag1**	**Lag2**	**Lag3**	**Lag4**
Full Sample (01/95-05/02)									
RET	0.154	0.048	0.005	-0.001	-0.002	0.124	0.135	0.057	-0.034
VARET	0.283	0.183	0.173	0.053	0.046	0.260	0.202	0.192	0.077
TURN	0.806	0.675	0.609	0.574	0.556	0.751	0.617	0.497	0.393
FFLOW	0.582	0.365	0.281	0.219	0.225	0.539	0.405	0.268	0.181
Pre-crisis (01/95-12/96)									
RET	0.163	0.121	-0.025	-0.057	-0.043	-0.040	0.044	-0.142	-0.040
VARET	0.096	0.075	0.113	-0.019	0.141	0.221	0.079	0.126	0.048
TURN	0.729	0.562	0.473	0.434	0.421	0.694	0.441	0.304	0.153
FFLOW	0.619	0.363	0.279	0.190	0.231	0.612	0.479	0.328	0.287
Crisis (06/97-05/99)									
RET	0.207	-0.009	0.011	0.018	0.005	0.205	0.276	0.115	-0.048
VARET	0.244	0.121	0.115	-0.036	-0.038	0.106	0.071	0.064	-0.082
TURN	0.803	0.652	0.569	0.535	0.487	0.691	0.617	0.440	0.252
FFLOW	0.562	0.379	0.278	0.276	0.272	0.458	0.335	0.218	-0.006
Post-crisis (06/00-05/02)									
RET	0.066	0.109	0.027	-0.004	-0.021	0.104	-0.051	0.027	-0.140
VARET	0.307	0.273	0.123	0.142	0.057	0.084	-0.040	0.009	-0.006
TURN	0.831	0.711	0.660	0.613	0.590	0.736	0.614	0.487	0.379
FFLOW	0.466	0.288	0.195	0.100	0.026	0.270	0.176	0.014	-0.096

Table 5: Bivariate VAR of Return with Foreign Flow

This table shows the results from the bivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies. Return is daily and weekly US$ market return on the SET index while flow is the daily and weekly net foreign position scaled by previous period market capitalization. The ordering of the variables in the VAR runs from flow to return. Error terms are assumed to be contemporaneously correlated but intertemporally uncorrelated.

Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Intercept	-0.001	**-0.002*** **	-0.002	0.001	-0.002	**-0.011*** **	-0.003	0.005
t-stat	-1.05	**-3.01**	-1.17	1.15	-1.18	**-3.70**	-0.42	1.39
Return								
Lag1 (b1)	**-0.049** **	**-0.177*** **	-0.004	-0.050	-0.044	**-0.380*** **	0.091	-0.134
t-stat	**-1.97**	**-3.51**	-0.07	-1.02	-0.83	**-3.50**	0.88	-1.15
Lag2 (b2)	0.006	0.031	-0.057	**0.089***	**0.1***	-0.102	0.095	-0.001
t-stat	0.23	0.62	-1.19	**1.85**	**1.85**	-0.88	0.91	-0.01
Lag3 (b3)	-0.040	-0.002	-0.057	0.031	0.070	-0.157	0.045	0.004
t-stat	-1.59	-0.05	-1.20	0.64	1.30	-1.32	0.44	0.04
Lag4 (b4)	-0.035	-0.021	-0.036	-0.039	-0.001	-0.077	0.084	-0.065
t-stat	-1.42	-0.44	-0.76	-0.81	-0.01	-0.76	0.82	-0.59
Lag5 (b5)	**0.057** **	-0.030	**0.099** **	-0.029				
t-stat	**2.33**	-0.64	**2.09**	-0.60				
Flow								
Lag0 (c0)	**0.308*** **	**0.407*** **	**0.363*** **	**0.141*** **	**0.296*** **	**0.330*** **	**0.292*** **	**0.209*** **
t-stat	**15.54**	**13.93**	**8.53**	**4.75**	**14.05**	**9.28**	**6.97**	**5.53**
Lag1 (c1)	-0.028	**-0.057***	-0.053	0.018	**-0.076*** **	-0.024	-0.078	**(-0.084)***
t-stat	-1.26	**-1.69**	-1.10	0.54	**-2.74**	-0.46	-1.44	**-1.77**
Lag2 (c2)	-0.020	-0.015	0.048	**-0.067** **	-0.042	0.052	-0.047	0.007
t-stat	-0.89	-0.48	0.99	**-2.06**	-1.50	0.95	-0.86	0.14
Lag3 (c3)	0.004	**-0.084*** **	0.006	0.007	-0.003	-0.036	0.058	-0.001
t-stat	0.19	**-2.64**	0.13	0.22	-0.12	-0.67	1.04	-0.03
Lag4 (b4)	-0.007	0.020	0.029	-0.013	-0.030	-0.032	**-0.119** **	-0.001
t-stat	-0.30	0.61	0.59	-0.39	-1.19	-0.75	**-2.26**	-0.01
Lag5 (b5)	**-0.041** **	-0.027	**-0.092** **	-0.008				
t-stat	**-2.14**	-1.02	**-2.18**	-0.28				
Adjrsq	0.141	0.318	0.168	0.054	0.363	0.581	0.400	0.231

*, **, *** Significance at 10%, 5%, and 1%

Table 6: Multivariate VAR of Market Return

Presented here are results from the multivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies, respectively. Up to 3 of the lags are reported. Return is daily and weekly local market return in US$ on the SET Index while unexpected flow is the daily and weekly residual from autoregression of scaled net flow (net foreign position scaled by the previous period market capitalization) and 5 (4) lags of its own lag and return lags. The ordering of the variables in the multivariate VAR runs from flow, turnover, volatility, and return. Turnover is trading value divided by total market capitalization. Only return and flow terms are reported. Error terms are assumed contemporaneously correlated but intertemporally uncorrelated

Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Intercept	**-0.003*** **	-0.001	**-0.006** **	-0.0005	**-0.012*** **	-0.014	-0.025	0.016
t-stat	**-2.77**	-0.95	**-2.14**	-0.25	**-6.58**	-1.45	-1.45	1.18
Return								
Lag1 (b1)	**-0.058** **	**-0.147** **	-0.046	**-0.112** **	**-0.093*** **	**-0.408*** **	0.016	**-0.328** **
t-stat	**-2.36**	**-2.79**	-0.93	**-2.20**	**-5.58**	**-3.44**	0.14	**-2.40**
Lag2 (b2)	0.039	0.060	-0.011	**0.112** **	**0.084*** **	-0.118	-0.055	-0.028
t-stat	1.57	1.16	-0.23	**2.16**	**4.79**	-0.94	-0.44	-0.19
Lag3 (b3)	-0.028	-0.023	-0.033	-0.027	**0.063*** **	**-0.281** **	0.037	0.069
t-stat	-1.12	-0.45	-0.68	-0.54	**3.54**	**-2.14**	0.29	0.49
Flow								
Lag0 (e0)	**0.233*** **	**0.377*** **	**0.165*** **	**0.127*** **	**0.253*** **	**0.303*** **	**0.218*** **	**0.163*** **
t-stat	**11.76**	**11.17**	**3.67**	**4.38**	**7.40**	**7.57**	**4.20**	**3.66**
Lag1 (e1)	0.001	-0.056	0.037	0.020	**-0.066*** **	-0.033	-0.088	-0.083
t-stat	0.04	-1.58	0.76	0.63	**-7.53**	-0.60	-1.46	-1.47
Lag2 (e2)	-0.021	-0.008	0.066	-0.050	**-0.038*** **	0.080	0.006	-0.018
t-stat	-0.96	-0.23	1.35	-1.59	**-4.20**	1.34	0.09	-0.30
Lag3 (e3)	-0.007	**-0.086**	-0.039	0.009	0.009	-0.028	0.047	0.016
t-stat	-0.33	**-2.61**	-0.80	0.29	1.00	-0.47	0.76	0.27
Adjrsq	0.225	0.304	0.299	0.185	0.644	0.575	0.374	0.265

*, **, *** Significance at 10%, 5% and 1%

Table 7: Bivariate VAR of Return with Flow by Market Segment

Presented here are results from the bivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies for SET25, the 25 largest and most liquid stocks that foreign investors trade, on the foreign board and main board in Panel A and Panel B. The last Panel C is the result of same VAR model from SETX50 sample, which excludes the largest 50 stocks on the exchange. Up to 3 of the lags are reported. Return is daily and weekly local market return in US$ on the SET Index while net flow is the daily and weekly net foreign position scaled by the previous period market capitalization. Turnover is trading value divided by previous period total market capitalization. Error terms are assumed contemporaneously correlated but intertemporally uncorrelated.

Panel A	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Return								
Lag1 (b1)	**-0.047****	-0.060	-0.059	-0.014	**-0.152*****	**-0.362*****	-0.145	-0.113
t-stat	**-1.93**	-1.23	-1.26	-0.29	**-2.84**	**-3.20**	-1.40	-1.06
Lag2 (b2)	**-0.053****	-0.014	**-0.096****	-0.043	**0.166*****	**-0.215***	**0.253****	**0.194***
t-stat	**-2.18**	-0.30	**-2.05**	-0.91	**3.08**	**-1.87**	**2.40**	**1.81**
Lag3 (b3)	**-0.05****	-0.032	**-0.084***	-0.014	0.066	**-0.218****	0.038	0.065
t-stat	**-2.17**	-0.67	**-1.78**	-0.30	1.22	**-1.96**	0.36	0.61
Flow								
Lag0 (c0)	**0.500*****	**0.543*****	**0.525*****	**0.269*****	**0.429*****	**0.445*****	**0.364*****	**0.318*****
t-stat	**15.82**	**15.88**	**9.16**	**3.89**	**11.98**	**10.53**	**5.40**	**3.51**
Lag1 (c1)	-0.037	**-0.089****	-0.059	0.043	-0.061	-0.025	-0.043	-0.081
t-stat	-1.10	**-2.16**	-0.90	0.57	-1.37	-0.37	-0.54	-0.76
Lag2 (c2)	**-0.088****	-0.035	-0.035	**-0.130***	**-0.109****	0.057	-0.122	-0.129
t-stat	**-2.63**	-0.88	-0.54	**-1.70**	**-2.39**	0.82	-1.50	-1.18
Lag3 (c3)	0.035	**-0.084****	0.045	0.088	-0.064	-0.040	-0.017	-0.070
t-stat	1.05	**-2.12**	0.68	1.14	-1.42	-0.59	-0.21	-0.64
Adjrsq	0.138	0.393	0.167	0.026	0.306	0.614	0.292	0.144

*, **, *** Significance at 10%, 5% and 1%

Panel B Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Return								
Lag1 (b1)	**-0.050****	**-0.177*****	-0.008	-0.069	-0.031	**-0.412*****	0.042	-0.098
t-stat	**-2.02**	**-3.54**	-0.17	-1.42	-0.58	**-3.79**	0.40	-0.86
Lag2 (b2)	-0.006	-0.029	-0.065	**0.093***	**0.098***	-0.114	0.122	0.035
t-stat	-0.22	-0.60	-1.37	**1.90**	**1.83**	-1.00	1.17	0.30
Lag3 (b3)	**-0.049****	-0.041	-0.076	0.041	0.086	-0.111	0.074	0.028
t-stat	**-1.96**	-0.86	-1.59	0.84	1.59	-1.02	0.70	0.24
Flow								
Lag0 (c0)	**0.347*****	**0.423*****	**0.416*****	**0.176*****	**0.355*****	**0.363*****	**0.372*****	**0.262*****
t-stat	**16.01**	**14.26**	**8.83**	**5.41**	**14.38**	**10.90**	**7.41**	**5.58**
Lag1 (c1)	-0.038	**-0.057***	-0.063	0.015	**-0.092****	-0.029	-0.062	**-0.118****
t-stat	-1.55	**-1.65**	-1.18	0.43	**-2.82**	-0.55	-0.93	**-2.00**
Lag2 (c2)	-0.027	-0.007	0.036	**-0.077****	-0.045	0.011	-0.050	-0.003
t-stat	-1.12	-0.20	0.67	**-2.15**	-1.34	0.21	-0.74	-0.05
Lag3 (c3)	-0.003	**-0.097*****	0.013	-0.011	-0.013	-0.056	0.039	-0.009
t-stat	-0.12	**-3.00**	0.24	-0.30	-0.40	-1.08	0.57	-0.15
Adjrsq	0.145	0.323	0.174	0.068	0.374	0.612	0.429	0.233

*, **, *** Significance at 10%, 5%, and 1%

Panel C Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Return								
Lag1 (b1)	-0.008	**-0.147*****	0.011	-0.017	-0.006	**-0.315*****	**0.193***	0.008
t-stat	-0.31	**-2.98**	0.24	-0.36	-0.10	**-2.85**	**1.88**	0.07
Lag2 (b2)	0.025	0.059	-0.038	**0.085***	**0.126****	-0.003	0.048	-0.092
t-stat	1.02	1.21	-0.81	**1.81**	**2.34**	-0.02	0.46	-0.81
Lag3 (b3)	-0.029	0.011	-0.036	-0.008	**0.092***	-0.038	0.107	0.020
t-stat	-1.19	0.24	-0.75	-0.16	**1.70**	-0.31	1.02	0.18
Flow								
Lag0 (c0)	**0.193*****	**0.366*****	**0.236*****	0.030	**0.180*****	**0.302*****	**0.190*****	0.033
t-stat	**11.09**	**12.27**	**6.34**	1.32	**11.08**	**7.93**	**6.52**	1.55
Lag1 (c1)	-0.013	-0.047	-0.033	0.013	**-0.04****	-0.022	**-0.062***	-0.019
t-stat	-0.67	-1.39	-0.78	0.52	**-2.04**	-0.42	**-1.71**	-0.78
Lag2 (c2)	0.004	-0.007	0.062	-0.019	-0.013	0.026	0.007	0.011
t-stat	0.20	-0.21	1.50	-0.75	-0.66	0.48	0.17	0.46
Lag3 (c3)	0.015	**-0.069**	0.025	0.022	-0.005	-0.059	0.017	0.004
t-stat	0.78	**-2.16**	0.61	0.87	-0.25	-1.09	0.46	0.18
Adjrsq	0.090	0.275	0.123	0.001	0.277	0.494	0.405	-0.041

*, **, *** Significance at 10%, 5%, and 1%

Table 8: Multivariate VAR of Return by Market Segment

This tables presents the estimates from the multivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies. Up to 3 of the lags are reported. Return is daily and weekly value weighted market return in US$ on the return of FB25, MB25 and X50 stocks in Panel A, B, and C, respectively. Unexpected flow is the daily and weekly residual from autoregression of scaled net flow and 5 (4) lags of its own lag and return lags. The ordering of the variables in the multivariate VAR runs from flow, turnover, volatility, and return. Only return and flow terms are reported. Error terms are assumed contemporaneously correlated but intertemporally uncorrelated.

Panel A	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Return								
Lag1 (b1)	-0.009	**-0.111*** **	-0.011	-0.065	**-0.072***	**-0.373*** **	0.052	-0.069
t-stat	-0.35	**-2.24**	-0.22	-1.31	**-1.67**	**-3.04**	0.43	-0.54
Lag2 (b2)	0.012	0.012	-0.016	0.044	**0.228*** **	**-0.276** **	0.172	**0.291** **
t-stat	0.49	0.24	-0.34	0.90	**5.25**	**-2.39**	1.42	**2.05**
Lag3 (b3)	**-0.042***	-0.039	-0.029	0.013	**0.077***	**-0.384*** **	-0.038	0.038
t-stat	**-1.73**	-0.82	-0.62	0.27	**1.74**	**-3.42**	-0.30	0.25
Flow								
Lag0 (c0)	**0.373*** **	**0.594*** **	**0.362*** **	**0.156*** **	**0.392*** **	**0.411*** **	**0.384*** **	**0.231*** **
t-stat	**14.77**	**14.61**	**6.90**	**4.15**	**14.85**	**8.69**	**5.22**	**2.96**
Lag1 (c1)	-0.003	**-0.091***	0.006	0.048	**-0.092*** **	-0.010	-0.066	**-0.189***
t-stat	-0.10	**-1.88**	0.11	1.18	**-2.80**	-0.13	-0.76	**-1.96**
Lag2 (c2)	**-0.071*** **	-0.021	-0.007	**-0.092** **	**-0.088*** **	**0.128***	-0.036	-0.041
t-stat	**-2.52**	-0.46	-0.12	**-2.26**	**-2.63**	**1.68**	-0.41	-0.40
Lag3 (c3)	0.022	**-0.129*** **	0.020	-0.017	-0.012	-0.003	0.025	0.056
t-stat	0.78	**-2.78**	0.34	-0.42	-0.36	-0.04	0.29	0.55
Adjrsq	0.280	0.414	0.387	0.361	0.626	0.628	0.399	0.182

*, **, *** Significance at 10%, 5%, and 1%

Panel B Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Return								
Lag1 (b1)	-0.035	**-0.117**	-0.063	**-0.123**	0.013	**-0.370**	0.146	**-0.238**
t-stat	-1.40	**-2.25**	-1.27	**-2.40**	0.31	**-3.12**	1.25	**-1.73**
Lag2 (b2)	**0.062**	0.011	0.009	**0.143**	**0.092**	-0.080	-0.065	-0.036
t-stat	**2.47**	0.22	0.17	**2.74**	**2.10**	-0.65	-0.55	-0.24
Lag3 (b3)	-0.019	-0.054	-0.032	0.033	**0.088**	-0.193	0.057	0.045
t-stat	-0.77	-1.09	-0.65	0.65	**1.98**	-1.55	0.46	0.30
Flow								
Lag0 (c0)	**0.231**	**0.421**	**0.148**	**0.123**	**0.285**	**0.342**	**0.258**	**0.206**
t-stat	**10.42**	**12.61**	**3.03**	**3.66**	**13.27**	**8.87**	**4.15**	**4.04**
Lag1 (c1)	0.014	**-0.077**	0.064	**0.068**	**-0.086**	-0.052	-0.108	**-0.186**
t-stat	0.57	**-2.12**	1.21	**1.87**	**-3.25**	-0.90	-1.51	**-2.66**
Lag2 (c2)	-0.023	0.008	0.056	-0.057	-0.012	0.035	0.082	0.007
t-stat	-0.95	0.24	1.05	-1.56	-0.46	0.56	1.12	0.10
Lag3 (c3)	-0.002	**-0.084**	0.014	-0.028	-0.019	-0.046	0.035	-0.030
t-stat	-0.07	**-2.43**	0.26	-0.78	-0.71	-0.78	0.49	-0.42
Adjrsq	0.197	0.314	0.289	0.198	0.637	0.584	0.510	0.317

*, **, *** Significance at 10%, 5%, and 1%

Panel C Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Return								
Lag1 (b1)	-0.027	**-0.134*****	-0.031	-0.074	-0.063	**-0.389*****	0.148	-0.074
t-stat	-1.10	**-2.63**	-0.65	-1.53	-1.23	**-3.09**	1.26	-0.60
Lag2 (b2)	**0.043***	**0.095***	0.016	**0.095***	**0.110****	-0.027	-0.109	-0.151
t-stat	**1.76**	**1.88**	0.34	**1.98**	**2.14**	-0.20	-0.90	-1.21
Lag3 (b3)	-0.023	-0.015	-0.023	-0.030	**0.102****	-0.124	0.198	0.046
t-stat	-0.93	-0.29	-0.47	-0.65	**1.98**	-0.89	1.57	0.36
Flow								
Lag0 (c0)	**0.171*****	**0.328*****	**0.113*****	**0.050*****	**0.161*****	**0.261*****	**0.167*****	0.019
t-stat	**9.95**	**10.30**	**3.00**	**2.23**	**10.09**	**5.93**	**4.54**	0.84
Lag1 (c1)	-0.022	-0.047	0.027	0.015	**-0.037***	-0.004	**-0.130*****	-0.019
t-stat	-1.18	-1.38	0.66	0.60	**-1.95**	-0.07	**-3.09**	-0.76
Lag2 (c2)	-0.005	0.003	0.049	-0.029	-0.020	0.037	0.026	-0.002
t-stat	-0.26	0.08	1.20	-1.13	-1.01	0.62	0.60	-0.06
Lag3 (c3)	0.013	**-0.070****	-0.011	0.017	0.008	-0.033	-0.063	0.008
t-stat	0.68	**-2.18**	-0.28	0.65	0.41	-0.56	-1.37	0.32
Adjrsq	0.150	0.300	0.260	0.117	0.401	0.476	0.382	0.043

*, **, *** Significance at 10%, 5%, and 1%

Table 9: Bivariate VAR of Market Return with Unexpected Flows and Expected Flows

Presented here are results from the bivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies. Return is US$ daily and weekly local market return on the SET index while unexpected flow is the daily (weekly) residual from the autoregression of net flow (net foreign position scaled by previous period market capitalization). The ordering of the variables in the VAR runs from flow to return. Error terms are assumed to be contemporaneously correlated but intertemporally uncorrelated. Panel A is the LM test statistics for autoregression the residual from the AR model of flow at different lag lengths. The bivariate VARs of return with unexpected flow, and expected flow are in Panels B, and C respectively.

Panel A		**Daily**			**Weekly**	
Autoregression of Flow	**AR(7)**	**AR(9)**	**AR(11)**	**AR(1)**	**AR(4)**	**AR(6)**
Adj Rsq	0.374	0.376	0.377	0.239	0.241	0.254
LM(1) p-value	0.067	0.108	0.391	0.008	0.098	0.858
H0: No autocorrelation						

Panel B	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Intercept	0.00002	-0.00003	0.0011	0.0003	-0.0004	-0.002	0.002	0.005
t-stat	0.03	-0.05	0.66	0.38	-0.18	-0.51	0.35	1.36
Return								
Lag1 (b1)	**0.081*****	**-0.118****	**0.164*****	-0.027	-0.019	**-0.302****	0.068	-0.111
t-stat	**3.26**	**-2.29**	**3.48**	-0.55	-0.34	**-2.41**	0.65	-0.99
Lag2 (b2)	-0.028	**0.170*****	**-0.100****	**0.103****	**0.101***	0.102	0.073	-0.013
t-stat	-1.14	**3.28**	**-2.10**	**2.15**	**1.84**	0.78	0.71	-0.11
Lag3 (b3)	-0.008	0.028	0.027	-0.001	0.046	-0.050	0.033	0.050
t-stat	-0.34	0.53	0.56	-0.02	0.85	-0.39	0.33	0.45
Unexpected Flow								
Lag0 (c0)	**0.251*****	**0.333*****	**0.312*****	**0.133*****	**0.224*****	**0.274*****	**0.223*****	**0.165*****
t-stat	**13.08**	**12.23**	**7.35**	**5.23**	**11.37**	**7.09**	**6.17**	**4.95**
Lag1 (c1)	**0.078*****	**0.121*****	**0.075***	**0.058****	0.024	0.045	0.043	-0.003
t-stat	**3.89**	**3.78**	**1.67**	**2.17**	1.05	0.87	1.00	-0.09
Lag2 (c2)	0.013	-0.029	0.021	0.010	0.006	0.024	0.020	0.006
t-stat	0.63	-0.90	0.47	0.38	0.27	0.47	0.45	0.14
Lag3 (c3)	0.017	-0.049	-0.006	0.039	-0.001	-0.023	0.062	-0.046
t-stat	0.85	-1.51	-0.14	1.43	-0.05	-0.47	1.44	-1.19
Adjrsq	0.120	0.293	0.147	0.059	0.277	0.461	0.330	0.195

*, **, *** Significance at 10%, 5% and 1%

Panel C	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Intercept	-0.001	-0.001	-0.001	0.001	-0.0001	-0.011	0.005	0.007
t-stat	-0.88	-0.96	-0.65	0.68	-0.03	-2.38	0.64	1.71
Return								
Lag1 (b1)	**0.184*****	**0.137****	**0.256*****	0.058	0.073	-0.182	0.138	0.052
t-stat	**7.50**	**2.53**	**5.43**	1.24	1.28	-1.47	1.28	0.47
Lag2 (b2)	-0.028	**0.202*****	**-0.113****	**0.122****	**0.096***	0.125	**0.178***	-0.084
t-stat	-1.13	**3.47**	**-2.32**	**2.56**	**1.66**	1.00	**1.64**	-0.72
Lag3 (b3)	-0.005	0.004	0.016	0.021	0.006	**-0.270****	0.074	0.007
t-stat	-0.21	0.07	0.33	0.44	0.11	**-2.13**	0.69	0.06
Expected Flow								
Lag0 (c0)	0.017	-0.018	0.003	0.006	-0.007	0.014	-0.032	-0.049
t-stat	0.57	-0.38	0.04	0.16	-0.19	0.20	-0.48	-0.69
Lag1 (c1)	0.004	-0.078	0.031	-0.008	0.003	0.072	-0.042	0.060
t-stat	0.11	-1.63	0.41	-0.21	0.07	1.04	-0.63	0.84
Lag2 (c2)	0.021	-0.007	0.028	0.018	0.035	0.097	0.043	-0.005
t-stat	0.69	-0.15	0.36	0.50	0.95	1.30	0.64	-0.06
Lag3 (c3)	-0.009	0.057	-0.022	-0.008	-0.008	0.057	-0.055	0.049
t-stat	-0.30	1.17	-0.28	-0.24	-0.23	0.86	-0.81	0.74
Adjrsq	0.030	0.041	0.048	-0.001	-0.004	0.089	-0.018	-0.037

*, **, *** Significance at 10%, 5% and 1%

Table 10: Bivariate Structural VAR of Return with Unexpected Flow by Market Segment

This table shows the impact of unexpected foreign flows on returns by market segment, FB25, MB25, and X50 in Panels A, B, and C, respectively. Up to 3 lags of the bivariate VAR model are reported from a full model with 5 lags for daily and 4 lags for weekly frequencies. The ordering of the variables in the VAR runs from unexpected flow to return. Error terms are assumed contemporaneously correlated but intertemporally uncorrelated.

Panel A	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Return								
Lag1 (b1)	0.034	0.043	0.069	-0.004	-0.060	-0.210	-0.117	-0.061
t-stat	1.40	0.85	1.47	-0.08	-1.10	-1.63	-1.08	-0.58
Lag2 (b2)	**-0.060****	0.038	**-0.109****	-0.027	**0.235*****	-0.074	**0.346*****	**0.205****
t-stat	**-2.44**	0.77	**-2.35**	-0.59	**4.29**	-0.59	**3.20**	**1.97**
Lag3 (b3)	**-0.050****	-0.003	-0.066	-0.022	0.022	-0.186	-0.006	0.067
t-stat	**-2.05**	-0.06	-1.41	-0.46	0.40	-1.52	-0.06	0.64
Unexpected Flow								
Lag0 (c0)	**0.387*****	**0.441*****	**0.461*****	**0.232*****	**0.314*****	**0.383*****	**0.261*****	**0.252****
t-stat	**14.14**	**13.97**	**8.59**	**4.04**	**8.84**	**7.52**	**4.16**	**3.07**
Lag1 (c1)	**0.125*****	**0.143*****	**0.122****	**0.123****	**0.087****	0.053	**0.153****	0.107
t-stat	**4.32**	**3.71**	**2.11**	**2.07**	**2.20**	0.77	**2.23**	1.20
Lag2 (c2)	-0.014	-0.039	-0.011	-0.004	-0.017	0.052	0.034	-0.082
t-stat	-0.47	-1.00	-0.19	-0.06	-0.44	0.75	0.48	-0.92
Lag3 (c3)	**0.0640****	-0.015	0.046	**0.120****	**-0.068***	0.006	-0.017	**-0.166***
t-stat	**2.19**	-0.38	0.79	**2.01**	**-1.73**	0.09	-0.25	**-1.88**
Adjrsq	0.122	0.366	0.154	0.024	0.213	0.460	0.256	0.130

*, **, *** Significance at 10%, 5%, and 1%

Panel B Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Return								
Lag1 (b1)	**0.076*** **	**-0.124** **	**0.156*** **	-0.032	0.047	**-0.227* **	0.001	0.008
t-stat	**3.05**	**-2.40**	**3.31**	-0.67	0.86	**-1.86**	0.01	0.08
Lag2 (b2)	-0.037	**0.106** **	**-0.104** **	**0.103** **	**0.151** **	0.111	**0.279** **	0.029
t-stat	-1.49	**2.04**	**-2.17**	**2.15**	**2.76**	0.90	**2.49**	0.26
Lag3 (b3)	-0.020	-0.028	0.004	-0.001	0.082	-0.139	0.129	0.102
t-stat	-0.81	-0.53	0.08	-0.02	1.50	-1.14	1.17	0.93
Unexpected Flow								
Lag0 (c0)	**0.280*** **	**0.341*** **	**0.353*** **	**0.154*** **	**0.249*** **	**0.283*** **	**0.224*** **	**0.225*** **
t-stat	**13.53**	**12.24**	**7.66**	**5.52**	**9.30**	**7.31**	**4.01**	**5.07**
Lag1 (c1)	**0.083*** **	**0.132*** **	0.076	**0.065** **	**0.060** **	-0.009	**0.183*** **	0.002
t-stat	**3.79**	**4.03**	1.56	**2.21**	**1.98**	-0.16	**3.03**	0.05
Lag2 (c2)	0.012	-0.014	0.016	0.011	0.023	-0.014	0.070	0.003
t-stat	0.55	-0.43	0.34	0.37	0.76	-0.27	1.10	0.05
Lag3 (c3)	0.018	-0.034	0.000	0.036	-0.008	0.003	0.026	-0.055
t-stat	0.80	-1.01	0.00	1.19	-0.27	0.05	0.42	-1.07
Adjrsq	0.125	0.286	0.154	0.066	0.224	0.496	0.264	0.209

*, **, *** Significance at 10%, 5%, and 1%

Panel C Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Return								
Lag1 (b1)	**0.132*** **	-0.074	**0.228*** **	-0.050	0.035	**-0.330** **	0.028	0.129
t-stat	**5.36**	-1.44	**4.84**	-1.07	0.65	**-2.65**	0.24	1.18
Lag2 (b2)	-0.023	**0.163*** **	**-0.108** **	**0.101** **	**0.155*** **	-0.004	**0.205* **	0.064
t-stat	-0.93	**3.18**	**-2.23**	**2.17**	**2.83**	-0.03	**1.84**	0.58
Lag3 (b3)	0.023	0.029	**0.080* **	0.018	**0.147** **	0.029	**0.195* **	0.059
t-stat	0.93	0.57	**1.65**	0.39	**2.74**	0.22	**1.81**	0.53
Unexpected Flow								
Lag0 (c0)	**0.166*** **	**0.290*** **	**0.214*** **	**0.061*** **	**0.122*** **	**0.246*** **	**0.112*** **	**0.056** **
t-stat	**9.83**	**10.23**	**5.66**	**3.14**	**6.67**	**6.59**	**2.85**	**2.74**
Lag1 (c1)	**0.055*** **	**0.103*** **	0.048	0.025	**0.053** **	0.063	**0.117*** **	0.017
t-stat	**3.13**	**3.23**	1.23	1.27	**2.69**	1.31	**2.88**	0.79
Lag2 (c2)	0.013	-0.009	0.011	0.017	**0.043** **	0.049	**0.096** **	0.013
t-stat	0.75	-0.29	0.29	0.85	**2.19**	1.01	**2.28**	0.61
Lag3 (c3)	0.012	-0.029	-0.004	0.026	0.001	-0.049	0.041	0.001
t-stat	0.71	-0.89	-0.10	1.30	0.04	-1.06	0.95	0.04
Adjrsq	0.092	0.234	0.127	0.019	0.177	0.410	0.242	0.069

*, **, *** Significance at 10%, 5%, and 1%

Table 11: Multivariate VAR with Exogeneous Variables

Presented here are results from the multivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies of local market return in US$ with unexpected flow. The model include two other exogeneous variables, world returns computed from the Morgan Stanley All Country Index, and change in foreign exchange rate (THB/US$). To avoid the possibility of latent variables problems, the contemporaneous unexpected flow is excluded. The parameters on lagged returns are not shown.

Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Unexpected Flow								
Lag1 (c1)	**0.034***	**0.060***	0.019	**0.045***	0.052	-0.069	**0.207*****	-0.026
t-stat	**1.72**	**1.64**	0.42	**1.71**	1.62	-0.99	**3.14**	-0.47
Lag2 (c2)	-0.005	-0.003	0.014	-0.005	0.022	0.034	0.034	0.020
t-stat	-0.25	-0.07	0.33	-0.18	0.69	0.47	0.48	0.38
Lag3 (c3)	0.004	-0.027	0.001	0.013	0.021	-0.021	0.084	-0.039
t-stat	0.22	-0.73	0.03	0.5	0.68	-0.31	1.2	-0.74
World Return								
Lag1 (b1)	**0.163*****	0.176	**0.287****	-0.015	0.196	0.278	0.320	0.274
t-stat	**2.89**	1.44	**2.24**	-0.18	1.31	0.73	0.9	1.29
Lag2 (b2)	0.080	0.148	0.102	**0.140***	0.102	0.399	0.197	0.075
t-stat	1.4	1.22	0.8	**1.71**	0.69	1.04	0.54	0.34
Lag3 (b3)	**0.123****	-0.018	**0.213***	0.117	-0.121	-0.473	-0.085	-0.106
t-stat	**2.14**	-0.15	**1.64**	1.41	-0.81	-1.25	-0.23	-0.5
FXC								
Lag1 (b1)	-0.007	0.436	0.050	0.217	-0.122	0.645	**-0.629***	0.491
t-stat	-0.09	0.72	0.35	0.95	-0.6	0.32	**-1.81**	0.73
Lag2 (b2)	**0.424*****	-0.453	**0.322****	0.286	**0.344***	0.765	**0.730****	-0.319
t-stat	**5.03**	-0.75	**2.22**	1.25	**1.65**	0.38	**1.98**	-0.47
Lag3 (b3)	**-0.166***	-0.742	-0.173	-0.172	-0.221	-0.177	-0.308	-0.584
t-stat	**-1.96**	-1.23	-1.19	-0.75	-1.06	-0.09	-0.81	-0.88
Adj Rsq	0.064	0.025	0.095	0.008	0.038	0.003	0.199	-0.051

*, **, *** Significance at 10%, 5%, and 1%

Table 12 : Bivariate VAR of Foreign Board Premium with Unexpected Flow

Presented here are results from the bivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies. The foreign premium is computed from the log of the ratio of foreign board price to local board price. The model in Panel A assumes ordering of the variables in the VAR runs from flow to return. Error terms are assumed to be contemporaneously correlated but intertemporally uncorrelated. Panel B omits contemporaneous unexpected flows.

Panel A	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Intercept	**0.004*** **	0.007	**0.015*** **	**0.003***	**0.009** **	0.019	**0.105**	0.005
t-stat	**3.67**	1.76	**4.23**	**1.83**	**2.44**	1.60	**6.14**	1.48
Premium								
Lag1 (b1)	**0.534*** **	**0.378*** **	**0.611*** **	**0.472*** **	**0.447*** **	**0.564*** **	-0.045	**0.481*** **
t-stat	**22.37**	**7.70**	**13.29**	**10.30**	**8.11**	**4.56**	-0.50	**4.42**
Lag2 (b2)	**0.130*** **	**0.186*** **	-0.0004	**0.196*** **	**0.253*** **	0.115	0.073	**0.424*** **
t-stat	**4.82**	**3.57**	-0.01	**3.90**	**4.15**	0.84	0.81	**3.63**
Lag3 (b3)	**0.103*** **	**0.088***	**0.154*** **	0.066	**0.107***	0.208	-0.016	-0.013
t-stat	**3.79**	**1.67**	**2.83**	1.29	**1.76**	1.52	-0.19	-0.11
Lag4 (b4)	**0.085*** **	**0.165*** **	-0.010	**0.109** **	**0.104***	-0.024	0.115	0.019
t-stat	**3.13**	**3.19**	-0.18	**2.17**	**1.87**	-0.19	1.54	0.18
Lag5 (b5)	**0.110*** **	**0.131*** **	**0.132*** **	**0.117** **				
t-stat	**4.60**	**2.67**	**2.84**	**2.57**				
Unexpected Flow								
Lag0 (c0)	**0.097*** **	**0.110** **	**0.117*** **	**0.032** **	**0.063*** **	0.045	**0.086*** **	**0.023** **
t-stat	**7.23**	**2.38**	**4.51**	**2.42**	**5.65**	1.53	**5.19**	**2.23**
Lag1 (c1)	**0.052*** **	0.001	**0.073*** **	**0.031** **	**0.021***	0.028	**0.076*** **	0.015
t-stat	**3.85**	0.03	**2.77**	**2.35**	**1.78**	0.94	**4.01**	1.38
Lag2 (c2)	0.018	0.014	0.020	0.017	**0.021***	-0.002	**0.104*** **	0.001
t-stat	1.31	0.31	0.74	1.25	**1.77**	-0.07	**5.13**	0.12
Lag3 (c3)	**0.037*** **	**0.142*** **	0.034	**0.030** **	-0.012	0.030	**0.040***	**0.022** **
t-stat	**2.73**	**3.08**	1.32	**2.21**	-1.05	1.02	**1.98**	**2.03**
Lag4 (b4)	0.020	0.073	0.027	0.015	-0.004	0.021	0.031	-0.001
t-stat	1.49	1.57	1.03	1.12	-0.34	0.74	1.61	-0.13
Lag5 (b5)	-0.014	0.016	0.006	0.001				
t-stat	-1.03	0.35	0.24	0.05				
Adjrsq	0.839	0.684	0.721	0.856	0.703	0.594	0.564	0.819

*, **, *** Significance at 10%, 5%, and 1%

Panel B Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Intercept	**0.005*** **	**0.009** **	**0.015*** **	**0.003** **	**0.011*** **	0.019	**0.109*** **	**0.006***
t-stat	**4.1**	**2.13**	**4.08**	**1.97**	**2.86**	1.57	**4.52**	**1.76**
Premium								
Lag1 (b1)	**0.537*** **	**0.367*** **	**0.630*** **	**0.467*** **	**0.493*** **	**0.559*** **	0.171	**0.463*** **
t-stat	**22.20**	**7.47**	**13.5**	**10.14**	**8.67**	**4.48**	1.40	**4.27**
Lag2 (b2)	**0.141*** **	**0.187*** **	0.0196	**0.198*** **	**0.189*** **	0.1000	-0.0628	**0.453*** **
t-stat	**5.13**	**3.58**	0.36	**3.91**	**3.02**	0.72	-0.49	**3.91**
Lag3 (b3)	**0.089*** **	**0.087***	**0.119** **	0.064	0.086	0.219	-0.113	-0.049
t-stat	**3.25**	**1.64**	**2.18**	1.25	1.36	1.58	-0.96	-0.42
Lag4 (b4)	**0.084*** **	**0.164*** **	-0.006	**0.110** **	**0.125** **	-0.020	0.117	0.032
t-stat	**3.06**	**3.13**	-0.11	**2.17**	**2.16**	-0.15	1.09	0.31
Lag5 (b5)	**0.105*** **	**0.131*** **	**0.122** **	**0.119*** **				
t-stat	**4.3**	**2.63**	**2.58**	**2.61**				
Unexpected Flow								
Lag1 (c1)	**0.052*** **	0.003	**0.073*** **	**0.029** **	0.019	0.028	**0.071*** **	0.014
t-stat	**3.78**	0.06	**2.72**	**2.2**	1.58	0.92	**2.65**	1.27
Lag2 (c2)	0.015	0.021	0.015	0.014	**0.024***	0.002	**0.106*** **	0.001
t-stat	1.09	0.46	0.57	1.05	**1.94**	0.08	**3.63**	0.08
Lag3 (c3)	**0.034*** **	**0.143*** **	0.034	**0.026***	-0.007	0.026	0.041	**0.025** **
t-stat	**2.45**	**3.07**	1.27	**1.93**	-0.59	0.89	1.4	**2.27**
Lag4 (b4)	0.020	0.075	0.029	0.013	-0.003	0.016	**0.049***	-0.003
t-stat	1.44	1.60	1.1	0.97	-0.26	0.56	**1.76**	-0.3
Lag5 (b5)	-0.008	0.015	0.005	0.006				
t-stat	-0.6	0.32	0.2	0.42				
Adjrsq	0.834	0.681	0.710	0.854	0.676	0.586	0.332	0.814

*, **, *** Significance at 10%, 5%, and 1%

Table 13 : External Determinants of Foreign Flows

Presented here are results from the multivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies. World return is computed from the Morgan Stanley All Country World Index. The Asian index comes from MSCI excludes the Japanese market FXC is foreign exchange rate change of THB/US$. The models with World and Asia-ex Japan returns are in Panel A and Panel B, respectively.

Panel A	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Flow								
Lag1 (b1)	**0.355*** **	**0.354*** **	**0.342*** **	**0.347*** **	**0.290*** **	**0.203***	0.188	0.200
t-stat	**15.13**	**8.29**	**7.33**	**7.33**	**5.26**	**1.79**	1.57	1.61
Lag2 (b2)	**0.057** **	-0.054	0.073	0.057	**0.260*** **	**0.237** **	**0.305** **	**0.260** **
t-stat	**2.28**	-1.18	1.49	1.14	**4.55**	**1.97**	**2.46**	**2.04**
Lag3 (b3)	**0.077*** **	0.155	0.038	0.072	**0.099***	0.083	0.110	-0.112
t-stat	**3.08**	3.45	0.76	1.44	**1.73**	0.70	0.90	-0.87
Local Return								
Lag0 (c0)	**0.415*** **	**0.747*** **	**0.431*** **	**0.320*** **	**1.212*** **	**1.679*** **	**1.285*** **	**1.113*** **
t-stat	**14.94**	**12.96**	**8.37**	**4.51**	**14.17**	**9.30**	**7.17**	**5.01**
Lag1 (c1)	**0.407*** **	**0.619*** **	**0.302*** **	**0.538*** **	0.117	**0.858*** **	-0.203	**0.732*** **
t-stat	**13.43**	**9.12**	**5.30**	**7.30**	1.01	**3.14**	-0.81	**2.59**
Lag2 (c2)	-0.033	0.064	-0.045	-0.012	**-0.508*** **	-0.314	**-0.646*** **	-0.256
t-stat	-1.03	0.88	-0.74	-0.15	**-4.39**	-1.08	**-2.45**	-0.85
Lag3 (c3)	-0.025	0.033	-0.052	0.034	**-0.370*** **	-0.187	-0.226	-0.128
t-stat	-0.77	0.46	-0.88	0.44	**-3.15**	-0.65	-0.82	-0.42
World Return								
Lag1 (b1)	**0.322*** **	**0.302***	0.220	**0.449*** **	-0.072	-0.130	0.201	-0.057
t-stat	**4.91**	**1.86**	1.53	**3.87**	-0.33	-0.25	0.38	-0.14
Lag2 (b2)	**-0.287*** **	**-0.500*** **	-0.195	**-0.329*** **	**0.405***	0.142	0.788	0.138
t-stat	**-4.31**	**-3.00**	-1.35	**-2.80**	**1.88**	0.27	1.51	0.35
Lag3 (b3)	0.015	-0.239	-0.073	0.175	0.140	0.323	0.093	0.060
t-stat	0.22	-1.43	-0.49	1.46	0.65	0.62	0.18	0.16
FXC								
Lag1 (b1)	**-0.215** **	-0.264	-0.131	-0.533	**0.904*** **	-2.989	0.629	1.863
t-stat	**-2.17**	-0.36	-0.74	-1.62	**2.84**	-1.40	0.96	1.53
Lag2 (b2)	**0.302*** **	0.612	0.186	0.462	-0.458	-1.874	-0.804	-0.180
t-stat	**2.98**	0.85	1.02	1.39	-1.42	-0.87	-1.22	-0.15
Lag3 (b3)	-0.100	-0.098	-0.023	-0.249	-0.502	0.800	-0.246	**-2.873** **
t-stat	-0.97	-0.14	-0.12	-0.75	-1.55	0.37	-0.38	**-2.29**
Adj Rsq	0.485	0.638	0.479	0.361	0.547	0.733	0.540	0.361

*, **, *** Significance at 10%, 5%, and 1%

Panel B Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Flow								
Lag1 (b1)	**0.356*** **	**0.340*** **	**0.345*** **	**0.332*** **	**0.305*** **	**0.231*** **	0.151	**0.253** **
t-stat	**14.97**	**7.76**	**7.35**	**6.94**	**5.52**	**2.00**	1.24	**2.14**
Lag2 (b2)	**0.057** **	-0.069	0.072	0.059	**0.235*** **	**0.204** *	**0.290** **	0.197
t-stat	**2.27**	-1.50	1.45	1.16	**4.08**	**1.70**	**2.36**	1.63
Lag3 (b3)	**0.072*** **	**0.165*** **	0.036	0.063	**0.097** *	0.076	0.135	-0.120
t-stat	**2.86**	**3.61**	0.72	1.26	**1.68**	0.64	1.06	-1.00
Local Return								
Lag0 (c0)	**0.434*** **	**0.735*** **	**0.446*** **	**0.335*** **	**1.217*** **	**1.668*** **	**1.247*** **	**1.120*** **
t-stat	**15.75**	**12.75**	**8.96**	**4.68**	**14.28**	**9.71**	**6.77**	**5.81**
Lag1 (c1)	**0.440*** **	**0.595*** **	**0.356*** **	**0.559*** **	0.164	**0.780*** **	-0.227	**0.99*** **
t-stat	**13.86**	**8.31**	**6.01**	**7.22**	1.40	**2.62**	-0.88	**3.65**
Lag2 (c2)	**-0.058** *	0.073	-0.059	-0.037	**-0.482*** **	-0.094	**-0.460** *	-0.233
t-stat	**-1.71**	0.94	-0.94	-0.45	**-4.12**	-0.31	**-1.70**	-0.83
Lag3 (c3)	**-0.059** *	0.067	**-0.110** *	0.013	**-0.317*** **	-0.205	-0.169	-0.106
t-stat	**-1.74**	0.87	**-1.77**	0.16	**-2.67**	-0.68	-0.60	-0.37
Asia ex-Japan								
Lag1 (b1)	**-0.003** **	0.005	**-0.006** **	-0.001	-0.006	0.0002	0.011	**-0.021** **
t-stat	**-2.37**	0.91	**-2.41**	-0.23	-1.27	0.01	0.97	**-2.81**
Lag2 (b2)	0.0001	-0.007	0.00012	-0.00001	0.007	-0.018	0.002	**0.012** *
t-stat	0.06	-1.34	0.05	0.00	1.56	-1.06	0.21	**1.73**
Lag3 (b3)	**0.003** **	-0.004	0.003	0.004	-0.004	0.015	-0.005	-0.008
t-stat	**1.99**	-0.76	1.39	1.40	-0.86	0.91	-0.49	-1.17
FXC								
Lag1 (b1)	**0.215** **	0.299	**0.296** **	-0.070	**0.979*** **	-3.331	0.656	**2.138** *
t-stat	**2.42**	0.42	**2.12**	-0.21	**3.55**	-1.43	1.22	**1.77**
Lag2 (b2)	0.145	0.565	**0.258** *	0.010	-0.076	-0.530	-0.201	-0.300
t-stat	1.49	0.78	**1.64**	0.03	-0.26	-0.23	-0.35	-0.24
Lag3 (b3)	-0.053	-0.099	0.031	-0.114	-0.262	-0.060	-0.524	**-2.386** **
t-stat	-0.54	-0.14	0.19	-0.33	-0.89	-0.03	-0.96	**-2.02**
Adj Rsq	0.476	0.635	0.484	0.330	0.547	0.736	0.538	0.444

*, **, *** Significance at 10%, 5%, and 1%

Table 14: Distributions of Betas

This table provides a summary of flow, local beta market beta, and world market beta statistics for each stock group, all SET, FB25, MB25, and SETx50. The flow beta is the stock price sensitivity to foreign flow shock estimated from weekly and monthly frequency data for the full sample period. All weekly betas are estimated with Dimson adjustment using 2 lead terms and 2 lag terms in addition to the contemporaneous term. The estimation for the betas is based on a multivariate regression model $R_{it} - R_{ft} = \alpha_i + \beta_i^F U_t^f + \beta_t^M \left(R_{mt} - R_{ft}\right) + \beta_t^W \left(R_t^W - R_{ft}\right) + \varepsilon_{it}$ and from univariate model, $R_{it} - R_{ft} = \gamma_i + \beta_i^j X_t + \eta_{it}$ The proportion significant indicates the percentage of significant beta for each stock group. Weekly return standard deviation is in percentages

		Beta Distribution						
				Quantiles			Proportion Significan	
		Mean	Std	25%	Med	75%	5%	1%
				Flow Beta				
SET All	Multivariate	-0.034	0.125	-0.101	-0.030	0.029	0.48	0.22
	Univariate	0.169	0.121	0.088	0.172	0.244	0.86	0.72
FB25	Multivariate	0.082	0.224	-0.029	0.083	0.151	0.48	0.20
	Univariate	0.467	0.204	0.342	0.522	0.733	0.96	0.80
MB25	Multivariate	-0.019	0.063	-0.055	-0.007	0.018	0.28	0.20
	Univariate	0.320	0.087	0.263	0.317	0.371	1.00	1.00
SETx50	Multivariate	-0.042	0.130	-0.116	-0.039	0.028	0.51	0.22
	Univariate	0.132	0.120	0.051	0.134	0.202	0.76	0.62
				Local Market Beta				
SET All	Multivariate	0.914	0.474	0.571	0.842	1.249	0.48	0.22
	Univariate	0.852	0.437	0.536	0.775	1.130	0.99	0.97
FB25	Multivariate	1.234	0.600	0.731	1.541	1.707	0.96	0.96
	Univariate	1.382	0.530	1.008	1.550	1.710	1.00	1.00
MB25	Multivariate	1.241	0.440	1.355	1.576	1.720	1.00	1.00
	Univariate	1.242	0.386	0.869	1.320	1.503	1.00	1.00
SETx50	Multivariate	0.842	0.523	0.512	0.782	1.150	0.96	0.91
	Univariate	0.759	0.444	0.448	0.689	0.977	0.96	0.94
				World Market Beta				
SET All	Multivariate	-0.299	0.595	-0.626	-0.306	0.044	0.53	0.28
	Univariate	-0.157	0.603	-0.519	-0.157	0.188	0.66	0.36
FB25	Multivariate	-0.010	0.923	-0.260	-0.138	0.178	0.28	0.24
	Univariate	0.396	0.780	0.021	0.256	0.656	0.80	0.44
MB25	Multivariate	-0.031	0.353	-0.264	-0.072	0.130	0.56	0.2
	Univariate	0.279	0.464	-0.044	0.332	0.604	1.00	0.68
SETx50	Multivariate	-0.307	0.688	-0.635	-0.286	0.078	0.57	0.27
	Univariate	-0.207	0.635	-0.529	-0.177	0.166	0.57	0.17

Table 15: Cross-section Regression of Pricing Factors

This table provides results of the cross-section GLS regression of excess return in local currency on various factors for each stock group. Flow beta is the stock's sensitivity to foreign flow surprise. Local market beta and world market beta is the stock's sensitivity relative to the SET index and the MSCI, All Country World Index, respectively. The betas used is derived from multi-factor regression (3.3). To account for non-synchronous trading the Dimson correction is applied. P-value adjusts for joint significance. T-statistics are adjusted for errors-in-variables as in Shanken (1992).

	Flow beta	Local Market beta	World Market beta	lnSize	lnTurnover	p-value	Adj Rsq	No. of companies
SET All								
Full Sample	-0.0141	-0.0102	**-0.0018*** **	**0.0007*** **	**0.0011*** **	<0.0001	0.297	250
Jan 95-May 02	(-0.22)	(-0.11)	**(-5.34)**	**(3.26)**	**(4.1)**			
Period 1	0.0116	0.0047	**-0.0007*** **	**-0.0006*** **	-0.0002	<0.0001	0.3097	244
Jan 95-Dec 96	(-0.29)	(-0.04)	**(-12.34)**	**(3.56)**	(0.72)			
Period 2	**-0.0064***	-0.0042	**0.0011*** **	0.0006	**0.0010** **	0.0002	0.0851	209
Jun 97-May 99	**(-1.99)**	(-0.67)	**(3.28)**	(1.62)	**(2.59)**			
Period 3	-0.0005	-0.0015	**-0.0026*** **	-0.0002	-0.0001	0.0017	0.0691	194
Jun 00-May 02	(-0.75)	(-0.85)	**(-3.09)**	(-0.69)	(-0.54)			
FB25								
Full Sample	**0.0125*** **	**-0.0013**** **	**-0.0010*** **	0.0012	**0.0017** **	0.0120	0.2864	25
Jan 95-May 02	**(4.55)**	**(-3.66)**	**(-7.10)**	(1.08)	**(2.31)**			
MB25								
Full Sample	0.0084	**-0.0089*** **	**-0.0024*** **	**0.0009***	**0.001** **	<0.0001	0.7804	25
Jan 95-May 02	(0.50)	**(-0.89)**	**(-3.67)**	**(1.65)**	**(2.37)**			
SET x50								
Full Sample	-0.0174	-0.0109	**-0.0019*** **	0.0002	**0.0011*** **	<0.0001	0.2984	211
Jan 95-May 02	(-0.22)	(-0.11)	**(-5.34)**	(0.67)	**(3.31)**			

*, **, *** Significance at 10%, 5%, and 1%

Table 16: Bivariate Structural VAR of Market Volatility with Flow, Expected Flow, and Unexpected Flow

Presented here are results from the bivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies. Market volatility is squared of daily returns. The ordering of the variables in the VAR runs from flow types to volatility. Error terms are assumed to be contemporaneously correlated but intertemporally uncorrelated. Panel A, B, C is the VAR model between market volatility with flow, expected flow, and unexpected flow, respectively.

Panel A	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Intercept	**0.023*** **	**0.012*** **	**0.056*** **	**0.013*** **	**0.02*** **	**0.012*** **	**0.059*** **	**0.021*** **
t-stat	**8.84**	**5.33**	**6.25**	**4.97**	**4.70**	**3.72**	**3.54**	**3.43**
Volatility								
Lag1 (b1)	**0.228*** **	**0.09***	**0.131*** **	**0.221*** **	**0.214*** **	**0.194***	0.102	0.060
t-stat	**9.59**	**1.99**	**2.78**	**4.75**	**4.02**	**1.78**	0.93	0.56
Lag2 (b2)	**0.091*** **	0.043	0.065	**0.195*** **	**0.106*** *	-0.028	-0.035	-0.054
t-stat	**3.74**	0.95	1.38	**4.11**	**1.96**	-0.26	-0.32	-0.49
Lag3 (b3)	**0.12*** **	**0.095*** *	**0.109*** *	-0.008	**0.138*** *	0.065	0.075	0.031
t-stat	**4.92**	**2.10**	**2.34**	-0.16	**2.55**	0.63	0.68	0.28
Flow								
Lag0 (c0)	**0.445*** **	0.058	**1.378*** **	**0.173*** *	**0.134*** **	-0.006	**0.363*** **	0.036
t-stat	**5.14**	0.73	**7.08**	**2.35**	**4.03**	-0.24	**4.92**	1.03
Lag1 (c1)	-0.143	-0.146	-0.255	-0.013	-0.050	0.006	-0.078	0.025
t-stat	-1.48	-1.63	-1.16	-0.16	-1.35	0.21	-0.93	0.60
Lag2 (c2)	-0.108	0.076	**-0.461***	-0.058	-0.004	0.021	-0.0002	0.049
t-stat	-1.12	0.86	**-2.09**	-0.69	-0.10	0.79	0.00	1.14
Lag3 (c3)	0.069	-0.095	**0.437***	-0.018	-0.049	-0.032	-0.094	-0.025
t-stat	0.72	-1.09	**1.99**	-0.22	-1.30	-1.21	-1.12	-0.58
Adjrsq	0.112	0.033	0.168	0.124	0.122	0.002	0.184	-0.041

*, **, *** Significance at 10%, 5%, and 1%

Panel B	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Intercept	**0.024*** **	**0.012*** **	**0.056*** **	**0.013*** **	**0.022*** **	**0.011*** **	**0.067*** **	**0.021*** **
t-stat	**8.77**	**4.94**	**5.68**	**4.99**	**4.92**	**3.03**	**3.62**	**3.58**
Volatility								
Lag1 (b1)	**0.234*** **	0.077	**0.203*** **	**0.235*** **	**0.213*** **	**0.302** **	0.089	0.085
t-stat	**9.61**	1.58	**4.24**	**5.11**	**3.84**	**2.44**	0.78	0.79
Lag2 (b2)	**0.083*** **	0.071	0.045	**0.185*** **	**0.106***	-0.104	0.051	-0.026
t-stat	**3.34**	1.45	0.91	**3.91**	**1.90**	-0.83	0.46	-0.24
Lag3 (b3)	**0.106*** **	**0.090***	0.079	-0.013	**0.108***	-0.022	0.052	0.013
t-stat	**4.24**	**1.83**	1.62	-0.28	**1.93**	-0.17	0.46	0.12
Expected Flow								
Lag0 (c0)	**0.233** **	**-0.182***	0.518	0.108	0.029	**-0.086*** **	0.050	0.016
t-stat	**2.08**	**-1.75**	1.62	1.26	0.68	**-2.71**	0.49	0.26
Lag1 (c1)	-0.064	0.035	-0.160	0.001	0.014	0.012	0.050	-0.045
t-stat	-0.548	0.319	-0.479	0.008	0.313	0.334	0.482	-0.717
Lag2 (c2)	0.076	-0.084	0.209	0.038	0.047	0.032	0.053	0.020
t-stat	0.65	-0.76	0.62	0.44	1.06	0.87	0.51	0.32
Lag3 (c3)	0.046	-0.117	0.193	-0.032	**-0.143*** **	**-0.080** **	**-0.268** **	-0.006
t-stat	0.39	-1.07	0.57	-0.37	**-3.24**	**-2.39**	**-2.61**	-0.09
Adjrsq	0.103	0.058	0.068	0.116	0.104	0.168	0.010	-0.083

*, **, *** Significance at 10%, 5%, and 1%

Panel C	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Intercept	**0.024*** **	**0.0102*** **	**0.066*** **	**0.013*** **	**0.023*** **	**0.007*** **	**0.079*** **	**0.022*** **
t-stat	**8.95**	**4.68**	**6.76**	**5.00**	**5.19**	**2.29**	**4.46**	**3.75**
Volatility								
Lag1 (b1)	**0.227*** **	**0.081***	**0.180*** **	**0.230*** **	**0.203*** **	**0.256** **	0.045	0.029
t-stat	**9.44**	**1.67**	**3.89**	**4.96**	**3.70**	**2.08**	0.40	0.27
Lag2 (b2)	**0.097*** **	0.077	0.069	**0.192*** **	**0.101*** **	-0.006	-0.009	-0.065
t-stat	**3.92**	1.56	1.46	**4.04**	**1.82**	-0.05	-0.08	-0.61
Lag3 (b3)	**0.122*** **	**0.092***	**0.115*** **	-0.009	0.087	0.147	-0.042	0.013
t-stat	**4.95**	**1.88**	**2.45**	-0.20	1.57	1.15	-0.40	0.12
Unexpected Flow								
Lag0 (c0)	**0.485*** **	**0.150** **	**1.132*** **	0.086	**0.145*** **	0.031	**0.249*** **	0.052
t-stat	**6.59**	**1.96**	**6.18**	1.35	**5.28**	1.25	**4.00**	1.63
Lag1 (c1)	0.099	-0.037	0.234	0.035	0.016	0.028	0.043	**0.057***
t-stat	1.32	-0.49	1.23	0.54	0.54	1.14	0.64	**1.69**
Lag2 (c2)	-0.067	0.062	-0.120	-0.012	0.029	0.006	0.098	0.045
t-stat	-0.90	0.81	-0.63	-0.18	1.00	0.24	1.47	1.31
Lag3 (c3)	0.087	0.032	0.222	0.038	**0.049***	-0.013	**0.164** **	0.007
t-stat	1.17	0.42	1.17	0.58	**1.71**	-0.52	**2.45**	0.19
Adjrsq	0.122	0.055	0.139	0.117	0.159	0.100	0.188	-0.011

*, **, *** Significance at 10%, 5%, and 1%

Table 17: Bivariate Structural VAR of Market Segment Volatility with Expected Flow, and Unexpected Flow

Presented here are results from the bivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies. Market segment (FB25 and X50) volatility is squared of value-weighted daily returns. The ordering of the variables in the VAR runs from flow types to volatility. Error terms are assumed to be contemporaneously correlated but intertemporally uncorrelated. Panel A, and B, is the VAR model of FB25 and X50 volatility. Only the parameters on the expected/unexpected flows are reported.

Panel A	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
FB25 VAR Model 1								
Expected Flow								
Lag0 (b0)	**0.867****	-0.137	**2.306****	0.228	0.110	-0.137	0.016	-0.009
t-stat	**2.30**	-0.57	**2.04**	0.68	0.95	-1.58	0.08	-0.05
Lag1 (b1)	0.659	-0.096	1.737	0.237	0.038	-0.028	0.165	-0.164
t-stat	1.68	-0.38	1.47	0.69	0.32	-0.29	0.77	-0.96
Lag2 (b2)	-0.107	-0.190	-0.045	-0.105	0.027	0.089	-0.023	0.164
t-stat	-0.27	-0.75	-0.04	-0.31	0.23	0.87	-0.11	0.96
Lag3 (b3)	0.328	-0.152	0.519	0.110	**-0.270****	**-0.255*****	**-0.566*****	0.008
t-stat	0.84	-0.60	0.45	0.32	**-2.35**	**-2.67**	**-2.78**	0.05
Adj Rsq	0.031	0.038	0.017	-0.009	0.117	0.103	0.071	0.002
FB25 VAR Model 2								
Unexpected Flow								
Lag0 (c0)	**1.351*****	0.186	**3.061*****	0.343	**0.372*****	0.014	**0.487*****	**0.190***
t-stat	**5.43**	1.06	**4.60**	1.38	**5.28**	0.20	**4.07**	**2.03**
Lag1 (c1)	0.181	0.047	0.490	0.015	0.076	0.092	0.044	**0.156***
t-stat	0.72	0.27	0.72	0.06	1.02	1.38	0.34	**1.64**
Lag2 (c2)	0.384	0.045	0.903	0.246	0.031	-0.038	0.169	-0.016
t-stat	1.53	0.26	1.35	0.97	0.42	-0.56	1.31	-0.17
Lag3 (c3)	0.218	0.090	0.818	-0.040	0.072	0.015	**0.324*****	0.014
t-stat	0.87	0.51	1.23	-0.16	0.98	0.22	**2.49**	0.15
Adjrsq	0.039	0.032	0.049	-0.004	0.176	-0.007	0.227	0.058

*, **, *** Significance at 10%, 5%, and 1%

Panel B Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
X50 VAR Model 1								
Expected Flow								
Lag0 (b0)	0.040	-0.014	0.107	-0.004	0.049	**-0.070****	0.093	-0.0001
t-stat	0.41	-0.12	0.38	-0.07	1.37	**-2.07**	1.11	-0.002
Lag1 (b1)	0.136	-0.180	**0.501***	-0.025	-0.045	-0.006	-0.044	-0.026
t-stat	1.33	-1.48	**1.72**	-0.40	-1.21	-0.17	-0.52	-0.42
Lag2 (b2)	0.027	-0.065	0.174	0.005	0.058	0.050	0.060	0.019
t-stat	0.26	-0.53	0.59	0.08	1.55	1.30	0.71	0.31
Lag3 (b3)	-0.074	0.029	-0.286	0.013	**-0.078****	**-0.097*****	-0.130	-0.016
t-stat	-0.72	0.23	-0.97	0.21	**-2.09**	**-2.68**	-1.53	-0.27
Adj Rsq	0.117	0.041	0.080	0.206	0.113	0.139	-0.013	-0.085
X50 VAR Model 2								
Unexpected Flow								
Lag0 (c0)	**0.122***	-0.048	0.263	0.033	**0.098*****	0.017	**0.175*****	0.026
t-stat	**1.84**	-0.56	1.54	0.71	**4.24**	0.63	**3.45**	0.83
Lag1 (c1)	0.009	0.098	0.057	-0.007	**0.053****	0.036	**0.113****	0.031
t-stat	0.14	1.15	0.33	-0.15	**2.20**	1.35	**2.11**	0.92
Lag2 (c2)	**0.119***	0.008	**0.370****	-0.008	0.001	-0.002	0.046	0.038
t-stat	**1.81**	0.09	**2.19**	-0.17	0.05	-0.06	0.85	1.15
Lag3 (c3)	0.076	-0.024	**0.327***	0.019	0.026	0.005	**0.107****	-0.002
t-stat	1.15	-0.28	**1.93**	0.41	1.10	0.18	**1.98**	-0.06
Adjrsq	0.117	0.034	0.088	0.207	0.153	0.055	0.166	-0.057

*, **, *** Significance at 10%, 5%, and 1%

Table 18: Bivariate Structural VAR of Turnover with Unexpected Flow

Presented here are results from the bivariate vector autoregression (VAR) with 5 lags for daily and 4 lags for weekly frequencies. The ordering of the variables in the VAR runs from unexpected flows to turnover. Error terms are assumed to be contemporaneously correlated but intertemporally uncorrelated. The parameters reported come from three separate VAR models each using turnover of the market, FB25, and X50. Only the parameters on the unexpected flows are shown.

Variables	Daily Jan 95-May 02	Daily Jan 95-Dec 96	Daily Jun 97-May 99	Daily Jun 00-May 02	Weekly Jan 95-May 02	Weekly Jan 95-Dec 96	Weekly Jun 97-May 99	Weekly Jun 00-May 02
Market VAR Model 2								
Unexpected Flow								
Lag0 (b0)	**1.156*** **	**1.616*** **	**1.696*** **	**1.279*** **	**2.548*** **	**1.736*** **	**2.053*** **	**4.140*** **
t-stat	**14.12**	**10.47**	**11.12**	**5.62**	**9.47**	**4.97**	**5.02**	**5.47**
Lag1 (b1)	**0.310*** **	**0.427** **	0.166	**0.777*** **	**-0.788** **	0.094	**0.959** **	-0.709
t-stat	**3.59**	**2.46**	0.97	**3.30**	**-2.41**	0.22	**2.08**	-0.81
Lag2 (b2)	**0.191** **	0.219	0.198	0.413	-0.481	0.210	0.029	0.532
t-stat	**2.21**	1.26	1.16	1.73	-1.44	0.49	0.06	0.60
Lag3 (b3)	**0.183** **	0.023	0.225	**0.547*** **	-0.200	-0.227	0.297	-0.936
t-stat	**2.13**	0.13	1.33	**2.30**	-0.64	-0.60	0.64	-1.06
Adj Rsq	0.705	0.654	0.727	0.724	0.657	0.653	0.636	0.658
FB25 VAR Model 2								
Unexpected Flow								
Lag0 (c0)	**0.450*** **	**0.086**	**0.374*** **	**0.899*** **	**0.762*** **	-0.017	**0.488*** **	**1.913*** **
t-stat	**7.16**	**1.92**	**5.71**	**6.20**	**6.69**	-0.31	**3.65**	**5.48**
Lag1 (c1)	**-0.151** **	**-0.154*** **	**0.162** **	**0.533*** **	-0.057	**0.104**	0.159	-0.257
t-stat	**-2.15**	**-3.05**	**2.40**	**3.49**	-0.47	**1.92**	1.12	-0.64
Lag2 (c2)	-0.092	0.044	0.014	**0.294**	0.017	0.012	0.015	0.076
t-stat	-1.31	0.88	0.20	**1.90**	0.14	0.21	0.11	0.19
Lag3 (c3)	0.035	0.054	0.076	**0.384** **	-0.193	0.011	0.034	-0.651
t-stat	0.49	1.07	1.14	**2.47**	-1.60	0.20	0.24	-1.63
Adjrsq	0.663	0.262	0.490	0.590	0.604	0.344	0.407	0.485
X50 VAR Model 2								
Unexpected Flow								
Lag0 (c0)	**0.868*** **	**0.503** **	0.266	**2.010*** **	**1.590*** **	**1.022** **	**1.333*** **	**2.215*** **
t-stat	**4.78**	**1.93**	1.63	**3.61**	**5.38**	**2.45**	**4.42**	**2.44**
Lag1 (c1)	**0.515*** **	**0.496**	0.251	**1.242** **	0.309	**1.267*** **	0.422	-0.153
t-stat	**2.84**	**1.90**	1.55	**2.24**	0.99	**2.93**	1.28	-0.16
Lag2 (c2)	0.170	0.137	0.253	0.201	0.379	0.165	0.254	1.517
t-stat	0.94	0.52	1.55	0.36	1.22	0.37	0.76	1.56
Lag3 (c3)	**0.448*** **	-0.306	0.165	**1.863*** **	-0.051	0.333	-0.103	0.048
t-stat	**2.48**	-1.17	1.03	**3.35**	-0.17	0.76	-0.30	0.05
Adjrsq	0.542	0.507	0.621	0.418	0.574	0.453	0.595	0.478

*, **, *** Significance at 10%, 5%, and 1%

Table 19: Volatility Equation of Multivariate VAR

This table presents the volatility equation from the multivariate VAR. The four variable system consists of return, volatility, turnover, and flow equations in this particular ordering. The system is exactly identified with Choleski factorization. The VAR model includes 5 lags for daily and 4 lags for weekly frequencies. Up to 3 of the lags are reported. Error terms are assumed to be contemporally correlated but intertemporally uncorrelated.

Market VAR	**Daily**	**Daily**	**Daily**	**Daily**	**Weekly**	**Weekly**	**Weekly**	**Weekly**
Variables	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Return								
Lag1 (b1)	0.013	**-0.350*** **	-0.060	**-0.776*** **	**-0.188** **	-0.010	-0.322	-0.194
t-stat	0.10	**-2.30**	-0.20	**-5.29**	**-2.30**	-0.12	-1.41	-1.29
Lag2 (b2)	-0.131	0.040	-0.075	**-0.457*** **	-0.103	**-0.412*** **	-0.101	0.006
t-stat	-1.04	0.26	-0.26	**-2.98**	-1.24	**-4.81**	-0.44	0.04
Lag3 (b3)	-0.129	-0.157	-0.387	-0.053	-0.124	**-0.164***	-0.289	-0.159
t-stat	-1.02	-1.02	-1.32	-0.36	-1.51	**-1.85**	-1.30	-1.13
Volatility								
Lag1 (c1)	**0.203*** **	-0.001	0.065	**0.173*** **	**0.232*** **	**0.309** **	**0.211***	-0.061
t-stat	**8.23**	-0.02	1.31	**3.62**	**4.16**	**2.43**	**1.79**	-0.46
Lag2 (c2)	**0.123*** **	**0.108** **	0.079	**0.164*** **	0.076	**0.369*** **	-0.094	**0.300** **
t-stat	**4.87**	**2.13**	1.60	**3.37**	1.34	**2.85**	-0.77	**2.41**
Lag3 (c3)	**0.133*** **	**0.109** **	**0.154*** **	-0.048	**0.140** **	0.194	0.074	0.020
t-stat	**5.27**	**2.16**	**3.10**	-0.97	**2.46**	1.53	0.60	0.16
Turnover								
Lag0 (d0)	**0.243*** **	**0.211** **	**0.539*** **	**0.118*** **	**0.032*** **	**0.020** **	**0.081*** **	0.005
t-stat	**11.56**	**9.53**	**10.14**	**9.37**	**4.78**	**2.29**	**4.70**	1.01
Lag1 (d1)	**-0.185*** **	**-0.087*** **	**-0.318***	**-0.076*** **	**-0.015***	-0.004	-0.036	0.004
t-stat	**-7.22**	**-3.18**	**-4.72**	**-4.60**	**-1.84**	-0.41	-1.63	0.57
Lag2 (d2)	0.005	-0.031	0.001	0.011	-0.015	0.031	-0.018	-0.010
t-stat	0.18	-1.14	0.02	0.65	-0.01	-0.01	-0.01	-0.01
Lag3 (d3)	-0.004	-0.013	0.038	-0.012	**-1.59***	**-0.680** **	-0.496	-1.271
t-stat	-0.13	-0.48	0.56	-0.71	**-1.74**	**2.86**	-0.69	-1.47
Unexpected Flow								
Lag0 (e0)	**0.213*** **	-0.115	**0.341***	0.057	**0.086*** **	0.009	0.094	0.040
t-stat	**2.75**	-1.40	**1.79**	0.91	**2.94**	0.35	1.39	1.02
Lag1 (e1)	0.081	-0.074	0.204	0.095	0.028	-0.020	-0.006	**0.080***
t-stat	1.01	-0.80	1.05	1.46	0.87	-0.60	-0.08	**1.82**
Lag2 (e2)	-0.040	0.005	-0.089	0.055	0.022	0.103	0.092	-0.090
t-stat	-0.50	0.06	-0.46	0.83	0.08	0.05	0.17	0.04
Lag3 (e3)	0.077	0.085	0.037	0.036	2.659	**1.500*** **	2.356	**0.891** **
t-stat	0.96	0.92	0.19	0.55	0.69	**3.09**	1.25	**-2.03**
Adjrsq	0.185	0.228	0.290	0.274	0.224	0.294	0.336	-0.026

Table 20: Alternative Measures of Volatility and Foreign Flow

This table presents the results from the vector autoregressions (VARs) between alternative measures of main board volatility and scaled foreign flow. In model A, we reproduce the bivariate VAR between volatility (squared daily returns) and scaled net foreign flow as found in Table 12 for ease of comparison. In models B and C, flow is daily foreign buy and daily foreign sell scaled by market cap, respectively. Model D is bivariate VAR between volatility which is measured by the difference between the log of the SET index daily high and the log of the index daily low and daily aggregate foreign flow scaled by market capitalization. The last model E extends model D to a four variable VAR. Only the volatility equation is reported. The VAR model include five lags. Up to 3 of the lags are reported. Error terms are assumed to be contemporaneously correlated but intertemporally uncorrelated.

	A	**B**	**C**	**D**	**E**
Dependent Var	**Jan 95-May 02**	**Jan 95-May 02**	**Jan 95-May 02**	**Jan 95-May 02**	**Jan 95-May 02**
Intercept	**0.023*** **	**0.015*** **	**0.018*** **	**0.469*** **	**0.469*** **
t-stat	**8.84**	**3.34**	**3.58**	**6.64**	**6.46**
Volatility					
Lag1 (b1)	**0.228*** **	**0.179*** **	**0.193*** **	**0.229*** **	**0.221*** **
t-stat	**9.59**	**7.45**	**8.05**	**9.68**	**9.14**
Lag2 (b2)	**0.091*** **	**0.123*** **	**0.110*** **	**0.129*** **	**0.137*** **
t-stat	**3.74**	**5.04**	**4.52**	**5.33**	**5.52**
Lag3 (b3)	**0.12*** **	**0.140*** **	**0.129*** **	**0.254**	**0.250*** **
t-stat	**4.92**	**5.73**	**5.31**	**10.75*** **	**10.36**
Foreign Flow					
Lag0 (c0)	**0.445*** **	**0.826*** **	**0.941*** **	**5.184*** **	**3.322*** **
t-stat	**5.14**	**15.13**	**14.02**	**14.05**	**5.04**
Lag1 (c1)	-0.143	**-0.496*** **	**-0.567*** **	**-2.467*** **	**-1.913** **
t-stat	-1.48	**-7.47**	**-7.32**	**-5.52**	**-2.52**
Lag2 (c2)	-0.108	-0.071	-0.029	0.219	0.956
t-stat	-1.12	-1.06	-0.37	0.49	1.26
Lag3 (c3)	0.069	-0.017	-0.094	**-0.96** **	**-1.28***
t-stat	0.72	-0.25	-1.21	**-2.14**	**-1.69**
Adjrsq	0.112	0.2003	0.1889	0.3502	0.3556

Table 21: Vector Autoregression of Conditional Volatility and Net Investor Flow

This table presents the results from the bivariate vector autoregression (VAR) between conditional volatility and scaled net foreign flow. Panel A reports the ARCH and GARCH parameters from fitting GARCH (1,1) (columns 2-5) and ARCH(1) (columns 6-9) models. Scaled turnover is included in the ARCH (1) specification. In Panel B, the VAR models include five lags for daily and 4 lags for weekly frequencies. Up to 3 of the lags are reported. Input for conditional volatility come from estimates in Panel A. Scaled net flow is foreign net flow divided by average period market capitalization. Error terms are assumed to be contemporaneously correlated but intertemporally uncorrelated. Diagnostic LM statistics, TR^2 is computed with standardized residuals, $\varepsilon_t / \sqrt{h_t}$.

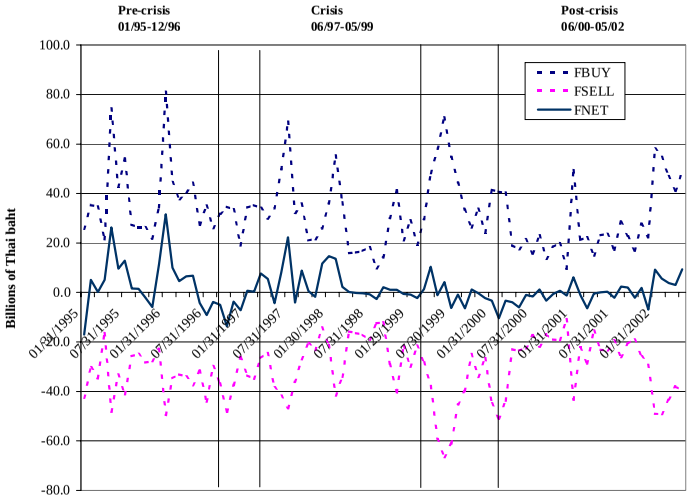
	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily
Dependent Var	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**	**Jan 95-May 02**	**Jan 95-Dec 96**	**Jun 97-May 99**	**Jun 00-May 02**
Panel A								
Intercept	**0.001*** **	0.0002	**0.039*** **	**0.005** **	**0.01*** **	1.05*10^-6	**0.01** **	**0.01*** **
t-stat	**4.96**	1.41	**4.7**	**2.17**	**10.13**	0	**2.39**	**4.67**
ARCH1	**0.138*** **	**0.042888**	**0.266*** **	**0.1253*** **	**0.238*** **	0.0387	0.0695	**0.1246*** **
t-stat	**9.31**	**3.33**	**4.77**	**2.92**	**8.39**	0.8	1.32	**2.65**
GARCH 1	**0.836*** **	**0.947*** **	**0.246** **	**0.663*** **				
t-stat	**49.69**	**51.75**	**2.03**	**5.39**				
TURN					**0.064*** **	**0.094*** **	**0.208*** **	**0.031*** **
t-stat					**11.11**	**7.39**	**7.64**	**5.45**
Pr > Chisq	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0936	0.0354
TR^2 (p-value)	1.93 (0.16)	0.16 (0.691)	0.17 (0.679)	0.0005 (0.98)	1.42 (0.232)	3.64 (0.057)	5.44 (0.019)	0.32 (0.57)
Panel B								
Intercept	**0.003****	**0.0004** **	**0.048*** **	**0.005*** **	**0.019*** **	**0.004*** **	**0.009*** **	**0.006*** **
t-stat	**5.89**	**2.28**	**8.93**	**6.31**	**13.42**	**5.58**	**3.43**	**5.48**
Conditional Volatility								
Lag1 (b1)	**1.058*** **	**1.022*** **	**0.384*** **	**0.888*** **	**0.346*** **	**0.624*** **	**0.749*** **	**0.485*** **
t-stat	**44.97**	**22.19**	**8.31**	**19.36**	**14.67**	**14.05**	**16.48**	**10.45**
Lag2 (b2)	**-0.101*** **	-0.022	0.046	0.043	**0.064** **	-0.074	**-0.104**	0.065
t-stat	**-2.95**	-0.34	0.93	0.70	**2.56**	-1.41	**-1.82**	1.26
Lag3 (b3)	0.034	0.047	**0.089***	**-0.141** **	**0.110*** **	**0.090**	**0.109**	0.015
t-stat	0.99	0.72	**1.83**	**-2.32**	**4.41**	**1.71**	**1.90**	0.30
Foreign Flow								
Lag0 (c0)	**0.052*** **	0.003	**0.223*** **	**0.026*** **	**0.202*** **	**0.156*** **	**0.486*** **	**0.093*** **
t-stat	**4.43**	0.86	**4.48**	**2.84**	**8.92**	**10.23**	**12.63**	**7.13**
Lag1 (c1)	**0.027** **	-0.002	**0.254*** **	0.012	0.027	**-0.078*** **	**-0.167*** **	**0.026***
t-stat	**2.01**	-0.49	**4.51**	1.20	1.04	**-4.38**	**-3.52**	**1.73**
Lag2 (c2)	-0.016	-0.005	-0.089	-0.004	-0.033	0.022	-0.024	-0.008
t-stat	-1.25	-1.28	-1.54	-0.38	-1.31	1.24	-0.50	-0.56
Lag3 (c3)	-0.018	0.003	**-0.119** **	-0.008	-0.030	-0.010	-0.022	-0.003
t-stat	-1.40	0.74	**-2.08**	-0.81	-1.16	-0.55	-0.46	-0.23
Adjrsq	0.889	0.592	0.340	0.730	0.255	0.624	0.713	0.560

*, **, *** Significance at 10%, 5%, and 1%

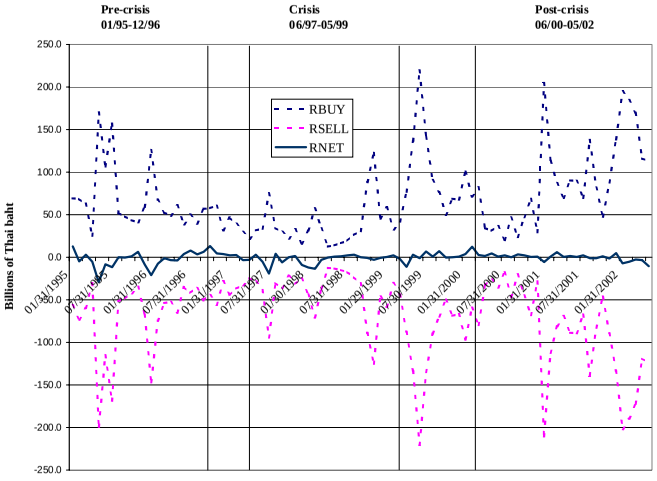
Figure 1: Trading Activities by Foreign and Local Investors

The graph depicts buy/sell and net trading activities on monthly and cumulative basis. Trading value is denominated in billions of Thai baht. The data is split into 3 sub-sample periods, pre-crisis (January 1995-December 1996), crisis (June 1997-May 1999) and post-crisis (June 2000-May 2002). The SET index is on the right hand side scale of graphs c) and d). Local trading positions are retail trading activities only. Local institutional investors account for less than 10% of total market trades in entire sample.

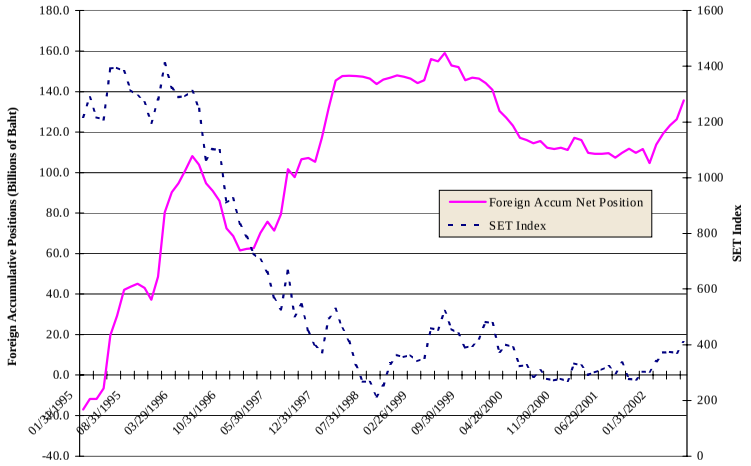
a) Foreign Trading Activities



b) Local Trading Activities



c) Foreign Cumulative Net Positions



d) Local Cumulative Net Positions

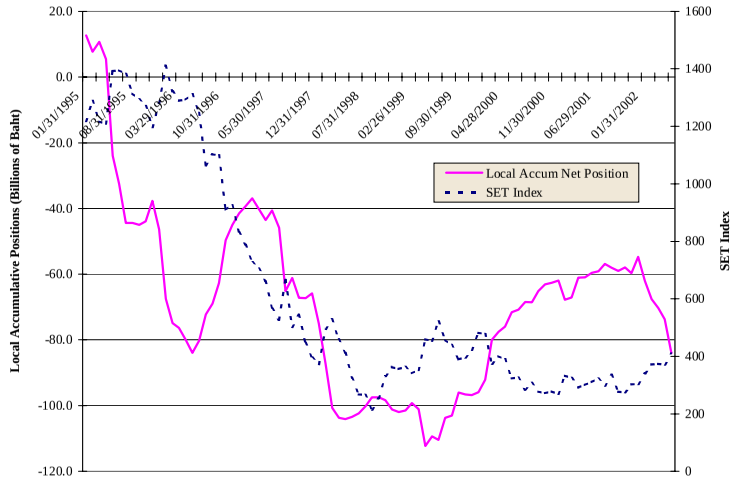
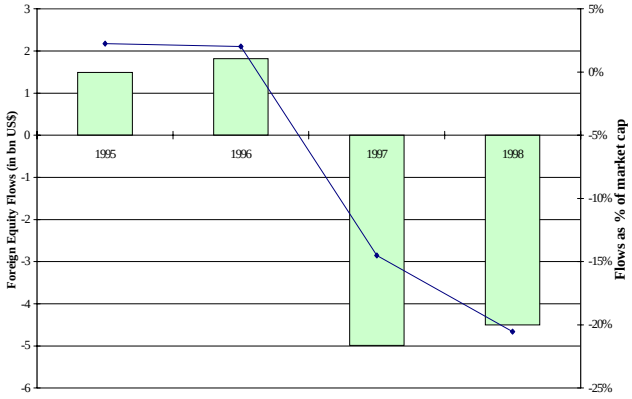


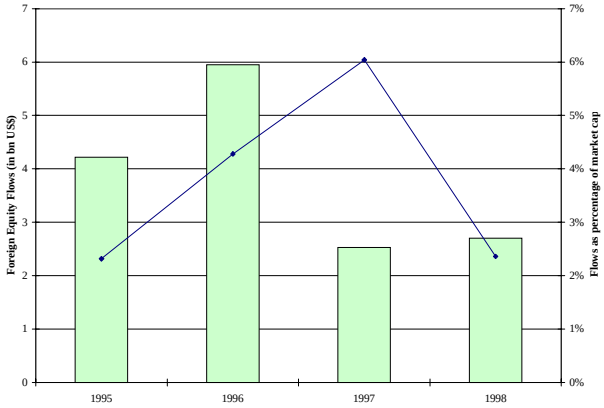
Figure 2: Foreign Equity Flows to East Asia

The graphs depict foreign equity flow in US$ billions into Indonesia, Korea, and Thailand between 1995-1998 and as percentage of total market capitalization for that year-end. Data comes from IMF.

a) Foreign Equity Flows to Indonesia



b) Foreign Equity Flows to Korea



c) Foreign Equity Flows to Thailand

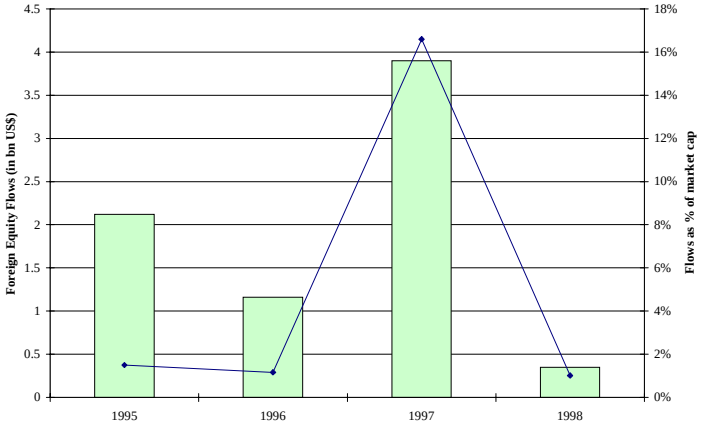


Figure 3: Average Daily Foreign Board Premium

The graphs depict the time series plot of daily foreign premium computed from the natural log of the ratio of foreign price to main board price.

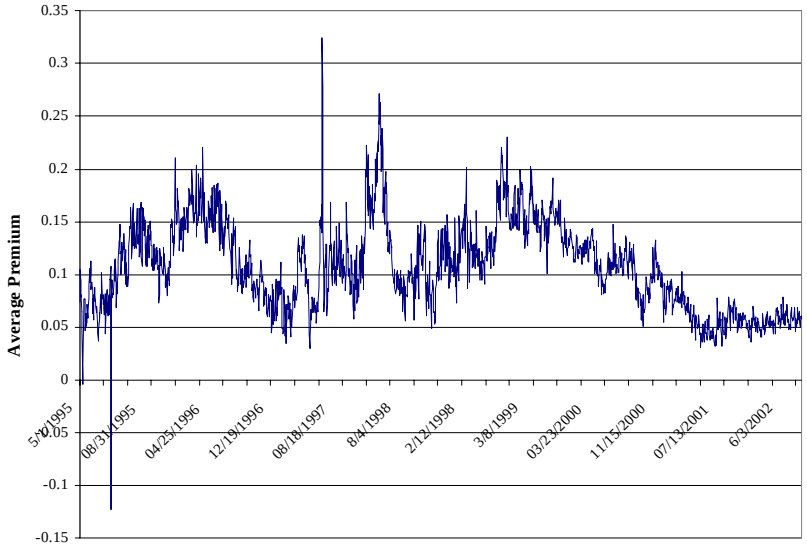


Figure 4: Daily Volatility (Percentage of Squared of daily returns)

This is the daily volatility computed from squared of daily market returns over the sample period.

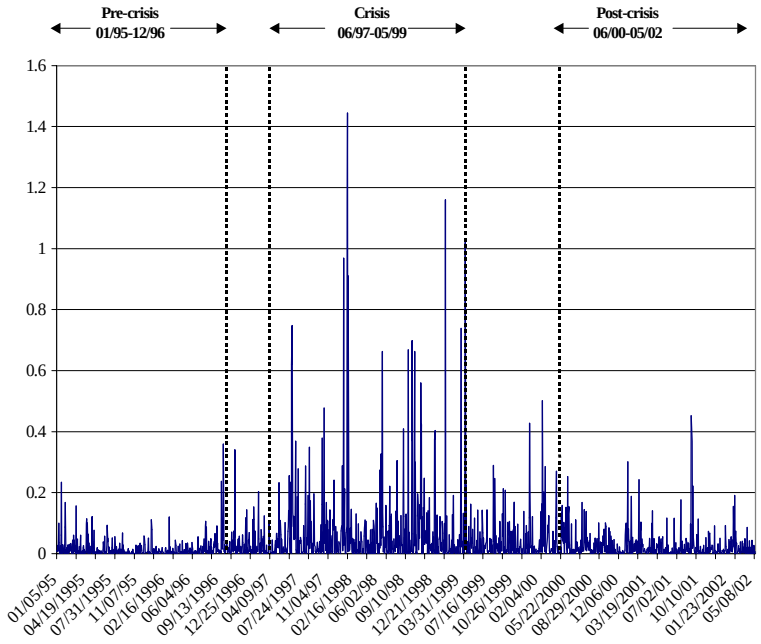
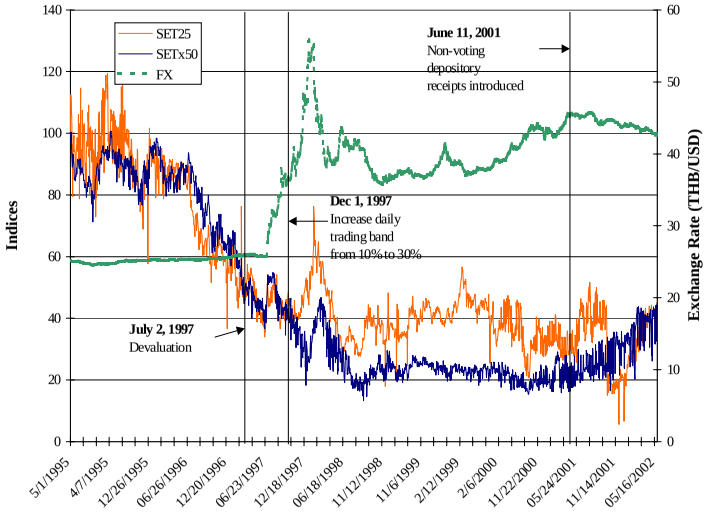


Figure 5: Stock Exchange of Thailand (SET) Indices

Figure 5a) is a plot of value-weighted FB25 and the X50 indices in local currency terms. The FB25 is comprised of the largest and most liquid stocks traded by foreign investors. The X50 is the portfolio of stocks without the 50 largest stocks. The FB25 index is computed from foreign board prices whereas the X50 is based on the main board price. Figure 5b) is the overall market SET index in US$ and the Morgan Stanley All Country World Index with base date January 1995. The sub-periods corresponds to those used in the paper to represent pre-crisis (period1), crisis (period2), and post-crisis (period3).

a) SET25 and SETx50 indices in local currency terms



b) SET and All Country World Index

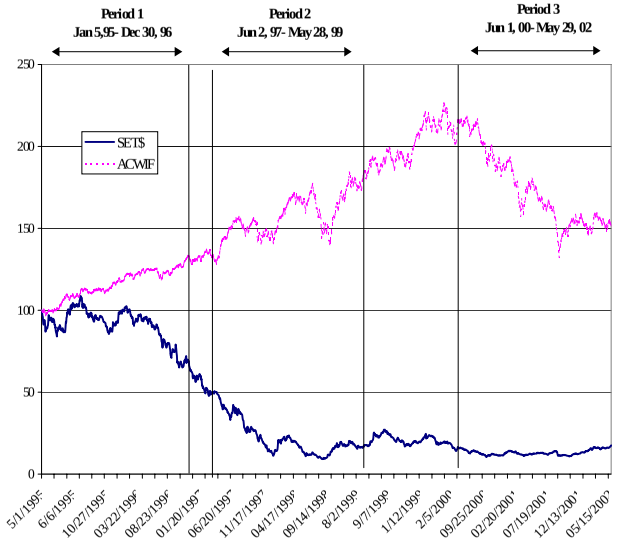


Figure 6 Accumulative Impulse Response Functions by Market Segment

The following figures are accumulative impulse response plots of one standard deviation shock in net flow for each period from the four -variable VAR. The x-axis is the number of days. The flow innovations are based on Choleski factorization with ordering of variables running from flow, turnover, volatility, and return. The dotted lines are 95% confidence band computed with Monte Carlo simulation. The dotted lines are 95% confidence band computed with Monte Carlo simulation.

Full Sample (01/95-05/02) Pre-Crisis (01/95-12/96) Crisis (06/96-05/99) Post-Crisis (06/00-05/02)

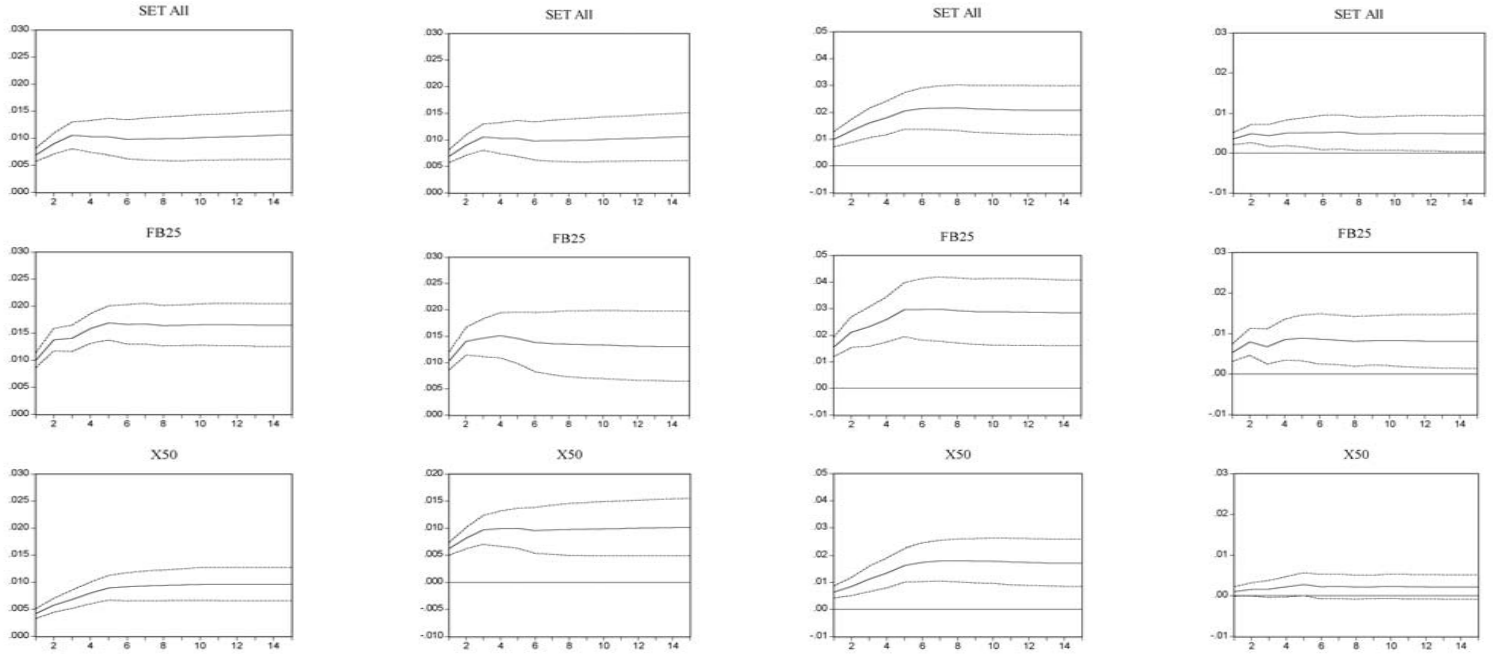
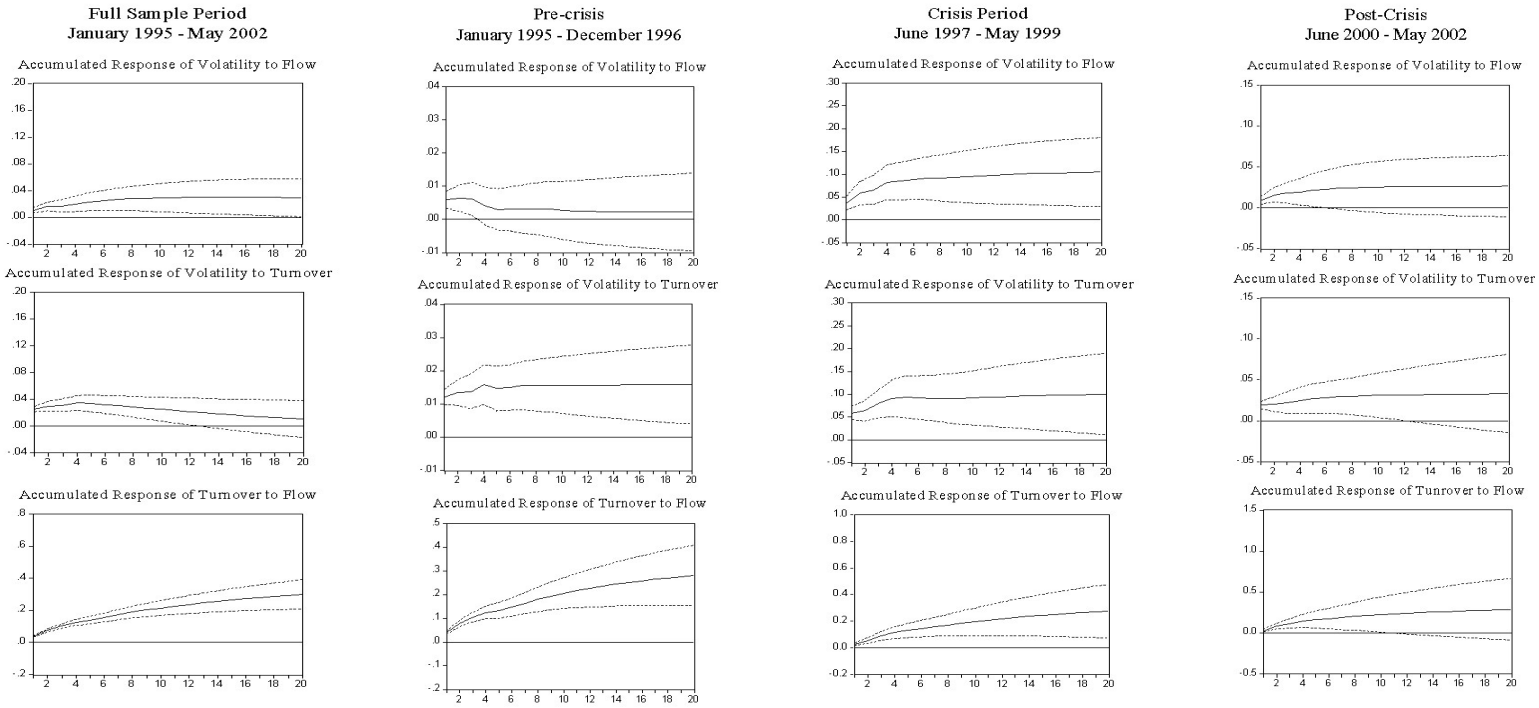


Figure 7 Accumulative Impulse Response Functions of Volatility and Turnover

The figures below are accumulative response plots from four-variable VAR for full sample and all sub-periods as indicated. The y-axis is the variable response to one standard deviation shock. The x-axis is the number of days. The flow and turnover innovations are based on Choleski factorization with ordering of variables running from flow, turnover, volatility, and return. The dotted lines are 95% confidence band computed with Monte Carlo simulation (300 iterations).



Appendix A: Vector Autoregression Estimation Procedures

In a simple VAR system, a variable is explained in terms of its own lags and lag values of other variables and the error terms of each equation in system are uncorrelated white noise, we can use OLS. As contemporaneous turnover, and volatility is important in our system, adjustments need to be made so that the system captures the feedback affects and still be exactly identified.

Thus, a triangular decomposition is used with net foreign flow (unexpected flow) at bottom of ordering to allow it to be source of common shock throughout the system. The structural two equation model between return and flow has the following identification,

$$r_t = \alpha^1 + c^1 \cdot f_t + \Sigma_{i=1}^{L} \gamma_{11i} \cdot r_{t-i} + \Sigma_{i=1}^{L} \gamma_{12i} \cdot f_{t-i} + \varepsilon_t^1$$
$$f_t = \alpha^2 + \Sigma_{i=1}^{L} \gamma_{11i} \cdot r_{t-i} + \Sigma_{i=1}^{L} \gamma_{12i} \cdot f_{t-i} + \varepsilon_t^2$$

The two equation structural model can be alternatively presented by

$$\begin{bmatrix} 1 & -c^1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} r_t \\ f_t \end{bmatrix} = \begin{bmatrix} \alpha^1 \\ \alpha^2 \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} r_{t-1} \\ f_{t-1} \end{bmatrix} + \ldots + \begin{bmatrix} \gamma_{1L} & \gamma_{1L} \\ \gamma_{2L} & \gamma_{2L} \end{bmatrix} \begin{bmatrix} r_{t-L} \\ f_{t-L} \end{bmatrix} + \begin{bmatrix} \varepsilon_t^1 \\ \varepsilon_t^2 \end{bmatrix}$$

Define $P = \begin{bmatrix} 1 & -c \\ 0 & 1 \end{bmatrix}$

Then multiplying through the system by P^{-1}, we obtain the reduced form equation and recover the structural parameters afterwards. The reduced form system estimated is,

$$\begin{bmatrix} r_t \\ f_t \end{bmatrix} = \begin{bmatrix} \alpha^1 \\ \alpha^2 \end{bmatrix} + \begin{bmatrix} b_{11}(L) & b_{12}(L) \\ b_{21}(L) & b_{22}(L) \end{bmatrix} \begin{bmatrix} r_{t-L} \\ f_{t-L} \end{bmatrix} + \begin{bmatrix} e_t^1 \\ e_t^2 \end{bmatrix}$$

$$\begin{bmatrix} e_t^1 \\ e_t^2 \end{bmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \text{var}\left(e_t^1\right) & \text{cov}\left(e_t^1, e_t^2\right) \\ \text{cov}\left(e_t^2, e_t^1\right) & \text{var}\left(e_t^2\right) \end{pmatrix}\right]$$

A four-equation model can be estimated in similar fashion by imposing the triangular restriction on the structural equation systems, estimating the reduced form equations, then recovering the structural parameters. The choice of the number of lags to use in the VAR models is determined by the Akaike Information Criteria (AIC). We adopt 5 lags for daily frequencies and 4 lags for weekly.

Appendix B: Estimation of Market Beta When Shares Have Infrequent Trading

The percentage of trading days of shares at the bottom of turnover deciles of the Thai Stock Exchange is between 40-50%. To accommodate for non-synchronous trading, the study uses the Dimson (1979) method of beta correction.

The Dimson beta is basically an aggregation of coefficient methods. The derivation of the adjusted beta assumes that at time *t*, the probability of asset having traded in *t-i* $(i \geq 0)$ is θ_i. The asset trade at least once every *n* period. The other assumption is that the proportion of the market portfolio traded in period *t-i* is ϕ_i. Therefore, $\Sigma_{i=0}^{n}\theta_i = \Sigma_{i=0}^{n}\phi_i = 1$.

Now let the observed price $\hat{P}_t = \Sigma_{i=0}^{n}\theta_i P_{t-i} + u_{pt}$ and thus observed returns $\hat{R}_t = \Sigma_{i=0}^{n}\theta_i R_{t-i} + u_{rt}$. Similarly, the market return is $\hat{M}_t = \Sigma_{i=0}^{n}\theta_i M_{t-i} + u_{mt}$.

Then consider the market model which includes observed leading, contemporaneous, and lagged returns, $\hat{R}_t = \hat{a} + \Sigma_{-n}^{n}\hat{\beta}_k \hat{M}_{t+k} + \varepsilon_t$, Dimson (1979) show that the true market risk of a security, $\hat{\beta}_i$ can be obtained from $\Sigma_{k=-n}^{n}\hat{\beta}_k$. The intuition is the observed covariance between stock return and market return is related to stock trading frequency, this results in an upward bias in the betas of frequently traded shares and downward bias in infrequently traded shares.

For shares that are infrequently traded, the leading beta coefficient will be small compared to the lagged coefficient. Including lagged coefficients becomes more

important when infrequently traded shares are being regressed on value weighted index that is dominated by few large stocks. The method of coefficient aggregation raises the beta of the infrequently traded stocks while lowering those with frequent trade that dominates the index.

Appendix C: Accounting for Error-in-Variables in Cross-Sectional Statistics

Estimation of the cross-sectional regression as in equation (3.4) is subject to two econometric problems. First, the error terms are likely to be autocorrelated and heteroscedastic. Second, the betas are estimated with errors. To solve the first problem, the usual approach is to estimate the betas with OLS and obtain the residuals vector, $\varepsilon_t = \left[\varepsilon_t^1, \varepsilon_t^2, ...\varepsilon_t^N\right]$ for all stocks from *1* to *N*.

Next, compute the weighting matrix $\Sigma = E\left(\varepsilon_t \varepsilon_t'\right)$ and estimate equation (3.4) with GLS using this weighting matrix. Then to account for beta estimation errors, Shanken (1992) suggested that the t-statistics of the pricing premium be adjusted by incorporating the factor variance, Σ_f when computing the variance of the premiums.

Finally, the variance of the premiums, $\sigma^2(\lambda)$ to be used in corrected t-statistics is computed from $\sigma^2(\lambda) = \frac{1}{T}\left[\left(\beta' \Sigma^{-1} \beta\right)^{-1} \cdot \left(1 + \lambda' \Sigma_f^{-1} \lambda\right) + \Sigma_f\right]$

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