

Short-horizon price pattern of thin and thick trading stocks in seven Pacific-Basin capital markets

Abstract

We provide collective evidence on the relation between trading activities and price pattern that gives rise to short-horizon contrarian/momentum profits in the Pacific-Basin capital markets. Our study includes Japan, Taiwan, Korea, Hong Kong, Malaysia, Thailand, and Singapore and covers the period of 1990 to 2000. Based on weekly WRSS portfolio formation scheme, we find the clear relations between trading activities and price pattern of which dynamics are different across countries. Interestingly, winner and loser stocks of each country also display different price pattern, suggesting the asymmetric reaction to good news and bad news. Decomposition of contrarian or momentum profits suggests that lead-lag effect might play an important role in price patterns found. However, pure time-series patterns are also found in many countries.

1. Introduction

Trading volume or activity is known to affect subsequent price patterns, and, thus, the profitability of contrarian/momentum investment strategies. Blume, Easley, and O'Hara (1994) develop a model that posits an information-signaling role of trading volume in return predictability. The main implication is that investors can profit from using volume in addition to historical price in predicting future price movements. Campbell, Grossman, and Wang (1993) also examine the relation between trading volume and predictable patterns in returns by modeling the interactions between noise traders and market makers. Conrad, Hameed, and Niden (1994) test the Campbell, Grossman, and Wang (1993) model using weekly returns and confirm that the winner/loser contrarian strategy is profitable only for thick securities. Lee and Swaminathan (2000) study US stocks and find that price momentum (reversal) dominates in the short-to-medium (long) term. In addition, high/low trading volume proxies for glamour/value characteristics.

Despite its importance, the relation between trading volume and short-horizon trading strategy based on price patterns in Asian markets has been studied in only Malaysian and Japanese market by Hameed and Ting (2000) and Bremer and Hiraki (1999) respectively. These authors find that contrarian profits are significantly higher for thick stocks.

The purpose of our study is to provide an integrated empirical evidence on the relation between trading volume/activity and the profitability of a short-horizon (weekly) momentum/contrarian strategy in "less studied" Pacific-Basin markets including Japan, Taiwan, Korea, Hong Kong, Malaysia, Thailand, and Singapore. The portfolio formation scheme used is the momentum version of Lo and Mackinlay (1990)'s "weighted relative strength scheme." Specifically, we take a long/short position in positive/negative excess

return (based on their 1-, 2-, and 4-week ranking period) stocks, with higher weight on more extreme performers. Such portfolios are observed 8 weeks afterwards.

In addition, we decompose such profits found into three components (cross-sectional risk, lead-lag effect, and price pattern) following the Jegadeesh and Titman (1995) approach. Next, we test whether such profits found survive after adjusting for three factor risks as in Fama and French (1993) model (such methodology can be alternatively interpreted as the investigation of size and value characteristics of portfolios formed).

In general, when winners and losers are combined in one portfolio, the relations between level of trading activities and price pattern do not yield a clear pattern. However, when we analyze winners and losers separately, clear patterns emerge.

For winner stocks, price reversals are found in most countries (overreaction to good news) especially for high volume stocks except in Korea (winners display price momentum: underreaction to good news). Taiwan winner stocks do not display clear price pattern through time. Low volume winners in Hong Kong and Thailand display price momentum. Monotonic relations are found in all countries except Taiwan.

Loser stocks display price momentum (underreaction to bad news) in five out of seven countries. We find price reversals in loser stocks (overreaction to bad news) in only Korea. Monotonic relations between trading volume and price pattern are also found among six countries (the exception is Taiwan). Both price momentum (five countries including Japan, Hong Kong, Malaysia, Thailand, and Singapore) and price reversal (Korea) are stronger in high volume loser stocks.

Decomposition of price pattern suggests that time-series patterns really exist in some countries. However, lead-lag effect seems to be high in general. In addition, Lee

and Swaminathan (2000) finding in the US stocks that trading volume proxies for value characteristic is rare in the Asian market.

The remainder of the paper is organized as follows. In the next section, we provide literature reviews on trading volume and short-horizon price pattern in Asia. In section 3, we describe our data and methodology. In section 4, we present our empirical results. Finally, in section 5, we conclude with a summary of findings and a discussion of implications and further researches.

2. Studies on the relation between trading volume/activities and price pattern

2.1 Trading volume and price patterns: Theory and US studies

The relation between trading volume and subsequent price patterns has been studied both theoretically and empirically. Blume, Easley, and O'Hara (1994) investigate the informational role of volume and its applicability for technical analysis by developing an equilibrium model in which aggregate supply is fixed and traders receive signals with different quality. In their analysis, trading volume indicates the quality or precision of information in past price movements. It is shown that traders who add trading volume measures in their technical analysis perform better than those who use only price measures. In other words, investors can profit from using volume information in addition to historical price information in predicting future price movement. They also suggest that the relation between past volume and prices is more pronounced for smaller and less widely followed firms. In sum, their model suggests an information-signaling role of trading volume in return predictability. Campbell, Grossman, and Wang (1993) also examine the relation between trading volume and predictable patterns in returns by modeling the interactions between noise traders and market makers. In their model, market makers are responsible for offsetting the fluctuating demand of noise traders and

are compensated by price movements in their favor. For example, if noise traders sell on average, current stock prices drop due to oversupply and provide higher returns for market makers when they sell those stocks later. By the same token, if noise traders buy on average, stock prices should rise over their fundamental values and revert afterwards to provide market makers with higher returns. Since the variations in the aggregate demand of the noise traders also generate higher level of trade, trading volume information can distinguish between price movements that are due to public information and those that reflect changes in expected returns. One important implication for the winner/loser contrarian investment strategy is that “price changes accompanied by high volume will tend to be reversed; this will be less true of price changes on days with low volume” (Blume, Easley, and O’Hara, 1994, p. 906).

On the empirical front, Conrad, Hameed, and Niden (1994) tests Campbell, Grossman, and Wang’s (1993) model on weekly returns to determine whether the winner/loser contrarian strategy is more profitable for high-transaction securities. Securities are classified as high-transaction (high volume) if their trading volumes during the studied period are higher than their historical averages. In general, they find that, based on weekly returns, the winner/loser contrarian strategy is profitable only for high-transaction securities, for which price reversals are experienced. As for low-transaction securities, returns are positively autocorrelated, suggesting the dominance of momentum strategy (price continuation). Overall, their empirical results confirm the Campbell, Grossman, and Wang (1993) model and show that trading volume is an important factor in return predictability and the contrarian investment strategy.

Lee and Swaminathan (2000) provide an integrated analysis of trading volume and medium-to-long horizon momentum trading strategies on NYSE/AMEX US stocks during 1965 to 1995 based on three to 12 month formation periods. These authors find

that price momentum dominates in the short-to-medium term, which is three months to three years long. At the same time, price reversal dominates in the long term, which is three to five years long. High (low) volume winners (losers) experience faster price reversals. In addition, high/low trading volume proxies for glamour/value characteristics. Firms with past high (low) volume exhibit glamour (value) characteristics and earn lower (higher) future returns over the next two years. These authors also show that analysts tend to over(under)-forecast long-term earning growth for high (low) volume stocks. This results in misperception among investors about firms' future earnings. Systematic negative (positive) surprises later occur to high (low) volume stocks. The more extreme performers, the more pronounced the phenomenon. Scott, Stumpp, and Xu (2003) question Lee and Swaminathan (2000) findings and show that, the relation between momentum and volume disappear after controlling for earnings-related news and a stock's growth rate.

2.5 *Studies on the relation between trading volume/activities and price pattern: Asia*

There are only two studies that provide the evidence on trading volume/activity and short-horizon price pattern in Asia. Hameed and Ting (2000) examine the relation between short-horizon return predictability and the level of trading activity (trading volume) in Malaysian stock market. Same as Conrad, Hameed, and Niden (1994) study, their study applies Lehmann (1990) methodology to form short-horizon winner/loser contrarian portfolios. However, they differentiate their study by the way they categorize stocks into high and low volume group. In stead of using the same criterion as in Conrad, Hameed, and Niden (1994) study, they propose two measures of trading to gauge the level of trading activity. The first measure is the average daily trading volume (in terms of number of shares) of the stock in the previous year before the study period (year t-1). The

second measure is the percentage of days a stock was traded in the previous year before the study period. Hameed and Ting (2000) claim that their trading volume measures better distinguish between actively and thinly traded stocks, which is important for the study in Pacific-Basin capital markets. In general, they find that the contrarian profits on actively and frequently traded stocks are significantly higher than that found in low trading activity stocks. They also show that such difference in behavior of price reversals between high and low trading activity stocks is not entirely subsumed by size effect. However, the volume-predictability relationship found is more pronounced for smaller firms. Finally, Hameed and Ting (2000) contribute such relation to the institutional arrangement in the Malaysian stock market (KLSE).

Bremer and Hiraki (1999) test the relation between lagged trading volume (week $t-1$) and the weekly contrarian profits. Consistent with the US results presented by Conrad, Hameed, and Niden (1994), price reversals (contrarian profits) in the following week is higher in high trading volume stocks.

3. Data and methodology

3.1 Data

This study covers seven Pacific-Basin capital markets--Japan, Taiwan, Korea, Hong Kong, Malaysia, Thailand, and, Singapore-- during the 1990-2000. All data, including daily returns on individual stocks and the markets, number of shares traded, number of shares outstanding, market capitalization, book value, and the risk-free rate are obtained from the Pacific-Basin Capital Markets (PACAP) database (although PACAP data is available beginning 1975, the earlier years' data are empty or contains a small number of stocks that make it meaningless in most countries). The availability of data is

different among countries and can be summarized as follows: Japan, 1990-2000; Taiwan, 1990-2000; Korea, 1990-1999; Hong Kong, 1990-1999; Malaysia, 1990-1999; Thailand, 1990-1999; and Singapore, 1990-1998.

Our study is based on weekly returns, which, to avoid the weekend effect documented by Keim and Stambaugh (1984) in the US, we measure from Wednesday close to the subsequent Wednesday close. Following other well-known studies in this field including Chordia and Swaminathan (2000), Jegadeesh and Titman (1993,2001), and others, we apply several data filters.

- Only common stocks are included.
- To avoid “penny stocks” effect, we exclude stocks of which closing price is less than 5 percentile of the whole sample during the week. This procedure is also suggested by Ball, Kothari, and Shanken (1995), who show that loser stocks are low-priced and exhibit skewed return distribution, also suggest this procedure. Jegadeesh and Titman (2001) also use this filter.
- We exclude stocks that have fewer than 90 observations during the previous year. This filter is used in Chordia and Swaminathan (2000).
- We exclude stocks that have missing returns during the formation week.
- We exclude the top 1% and bottom 1% extreme performers during the week. This is especially important for the “weighted relative strength scheme” (WRSS) portfolio formation scheme used in our study. Jegadeesh and Titman (2001) also use this procedure.

3.2 Methodology

3.2.1 Volume categorization

To evaluate whether price patterns differ among stocks of varying trading volume levels across seven Pacific-Basin capital markets, we categorize stocks into different trading volume levels. In this study, we use the turnover ratio (numbers of shares traded divided by number of shares outstanding) as the measure to classify stocks into high, medium, and low trading volume categories. The choice of turnover ratio rather than dollar or share trading volume is made to disentangle the effect of firm size from trading volume.

During each year, stocks are categorized into three categories: high, medium, and low according to their daily average turnover ratio during the previous year. The top, medium, and bottom one-third are categorized into high, medium, and low trading volume group, respectively. As mentioned, following Chordia and Swaminathan (2000), a firm must have at least 90 daily observations of the trading volume in year $t-1$ to be included in the sample.

Note that our volume categorization is different from Conrad, Hameed, and Niden (1994) who classify stocks into high and low volume groups based on whether the trading volume in the formation period is higher or lower than its historical average, respectively. Our categorization also differs from Lee and Swaminathan (2000) who categorize trading volume based on the formation period (one to four quarters). We argue that our trading volume measure is more appropriate in distinguishing trading volume levels. For example, a stock classified as high (low) volume in Conrad, Hameed, and Niden (1994)'s methodology could represent thinly (heavily) traded stock in the particular week. This is especially true when thin trading is prevalent such as in Pacific-Basin capital markets.

3.2.2 Trading strategies

We test the relation between trading volume and price pattern as reflected in the magnitude of short horizon (weekly) contrarian/momentum profits. In general, researchers find that investment strategies formed on higher trading volume experience more pronounced contrarian profits, but these findings are not thoroughly documented in the seven Pacific-Basin markets.

The formation of momentum portfolio used in our study is the momentum version of “weighted relative strength scheme (WRSS)” as originally proposed by Lo and Mackinlay (1990). WRSS represents the investment strategy of buying stocks in proportion to their returns over the ranking period. As a result, one will take a long position in positive-return stocks, with higher weight on top performers. At the same time, he/she will take a short position in negative-return stocks, with higher weight on bottom performers. In other words, the winner stocks during period t are the stocks that outperform the market ($R_{i,t} - R_m > 0$, where $R_{i,t}$ is the return of stock i during formation period t and R_m is the return of the market during the same period) and the loser stocks are the stocks that underperform the market. During each study period t , each stock is assigned a weight of

$$w_{i,t} = \frac{1}{N} (r_{i,t-1} - \bar{r}_{t-1}) \quad (1)$$

where $r_{i,t-1}$ is the return of stock i during the ranking period $t-1$, \bar{r}_{t-1} is the market return at time $t-1$, and N is the number of stocks in the sample. The momentum profit, denoted as π_t , can be measured as

$$\pi_t = \frac{1}{N} \sum_{i=1}^N r_{i,t} (r_{i,t-1} - \bar{r}_{t-1}) \quad (2)$$

In this respect, the positive (negative) number represents price momentum (reversal). Lo and Mackinlay (1990) have shown that the above representation yields insights on the decomposition of momentum profits. In this study, we base our portfolio on one, two and four-week formation period. We multiply profits by 1,000 for better presentation.

To provide a measure of return that is essential for decomposition of profits and three-factor model methodologies, we also calculate momentum/contrarian returns (To save space, results are not presented but available upon request) . Assuming that portfolio weights sum up to zero (that is market return really represents the equally weighed average of all stocks in the sample), the return can be calculated by dividing the momentum profit by the total dollar investment long (and short) in the zero-cost strategy given by I_t .

$$I_t = \frac{1}{2} \sum_{i=1}^N |W_{i,t}| \quad (3)$$

where $W_{i,t}$ is the weight of stock i in the portfolio as given by equation (1) during the observation period t .

The performance of the trading strategy is then evaluated over each of the eight subsequent weeks. However, the performance of the portfolio during the first week following the formation week must be interpreted with caution since it potentially reflects thin trading. To be conservative, we interpret our results starting on week two. The momentum profit at observation week k ($k = 1, \dots, 8$) can be presented as:

$$\pi_{j,t}(k) = \sum_{i=1}^{N_j} W_{i,t} r_{i,t+k-1} \quad (4)$$

where $j = L, W$, and C for loser, winner, and contrarian portfolio respectively, $W_{i,t}$ is the weight of individual stock in the portfolio, and N_j is the number of stocks in each portfolio during each formation week t .

The momentum return at observation week k ($k = 1, \dots, 8$) is simply:

$$R_t(k) = \frac{(\pi_t(k))}{I_t} \quad (5)$$

where $\pi_t(k)$ is the momentum (contrarian) profit of the portfolio during the observation week k , and I_t is the total dollar investment long (and short) in the zero-cost strategy given by equation (3).

We use the terms overreaction, price reversal, and contrarian interchangeable.

Following previous studies, we expect to see a monotonic pattern in the relation between trading volume and momentum/contrarian profitability in each country. Recall that conventional studies suggest that contrarian profit should be higher in the high trading volume stocks while the low volume stocks should experience momentum profits. In this study, however, we argue that there is a possibility that the monotonic patterns are not the same across all countries due to different market sentiments. We also further argue that winners and losers may show different pattern since there might be asymmetric reaction to good news (winners) and bad news (losers).

3.2.3 Decomposition of momentum/contrarian profits

Conrad and Kaul (1998), among others, show that momentum profits reflect cross-sectional risk caused by the momentum portfolio formation procedure. Lo and Mackinlay (1990) also attribute contrarian profits to lead-lag effects, rather than the time pattern of extreme performers. As a result, it is essential to decompose momentum profits into different components and check for the portion of such profits exploitable by the investment strategy. Under the WRSS portfolio scheme, the decomposition of momentum or contrarian profits can be represented as follows:

$$\text{Expected momentum profits: } (\pi^m) = \sigma_{\mu}^2 + \delta\sigma_f^2 + \Omega \quad (6)$$

(subscription m stands for momentum)

The first term, σ_{μ}^2 , represents the part of momentum profit that compensate for cross-sectional risk among stocks. The second term, $\delta\sigma_f^2$, stands for the lead-lag effect as analyzed by Lo and Mackinlay(1990). Finally, Ω , is the correlation or time pattern of stocks that display market inefficiency exploitable by trading strategies such as momentum or contrarian.

Jegadeesh and Titman (1995) develop a framework to investigate all three components as follows.

$$\text{Run the regression: } r_{i,t} = \mu_i + b_{0,i}f_t + b_{1,i}f_{t-k} + \varepsilon_{i,t} \quad (7)$$

where $r_{i,t}$ is return of securities i during period t,

f_t is the common factor as proxied by the demeaned market return during period t

f_{t-k} is the common factor as proxied by the demeaned market return during period $t - k$, and k is the observation period ($k = 1 - 8$)

Then, each component can be calculated as follows.

$$\text{Cross-sectional risk: } \sigma_{\mu}^2 = \frac{1}{N} \sum_{i=1}^N (\mu_i - \bar{\mu})^2 \quad (8)$$

$$\text{Lead-lag effect: } \delta = \frac{1}{N} \sum_{i=1}^N (b_{0,i} - \bar{b}_0)(b_{1,i} - \bar{b}_1) \quad (9)$$

$$\text{Time-series pattern: } \Omega = \frac{1}{N} \sum_{i=1}^N \text{Cov}(\varepsilon_{i,t}, \varepsilon_{i,t-1}) \quad (10)$$

where μ_i is the regression intercept of stock i

$\mu - \text{bar}$ is the mean of regression intercept of all stocks in the sample

$b_{0,i}$ is the regression coefficient b_0 of stock i

$b_0 - \text{bar}$ is the mean of regression coefficient b_0 of all stocks in the sample

$b_{1,i}$ is the regression coefficient b_1 of stock i

$b_1 - \text{bar}$ is the mean of regression coefficient b_1 of all stocks in the sample

In this study, we apply the above methodology to study the difference in the decomposition of momentum/contrarian profits among stocks of varying trading volume levels. We investigate this issue on the second observation week ($k=2$). As in Jegadeesh

and Titman (1995), the decomposition is applied initially to the portfolio of the combination of losers and winners, but not separately.

It should be noted that the above methodology possess a major potential drawback, that is a stock has to exist during the whole study period to be included in the sample. In this study, this framework presents an additional complication. To prevent stocks from shifting volume categories, we categorize an individual stock into high, medium, or low volume if it falls into a specific category more than 60% of the whole time (e.g. for 100-week study period, a stock is categorized into high volume stocks if it falls into high volume group at least 60 weeks).

3.2.4 Sensitivity of high and low volume momentum/contrarian returns to Fama and French (1993) three-factor model

In their breakthrough work, Lee and Swaminathan (2000) show that high volume winner stocks represent glamour (low B/M) stocks while low volume losers represent value (high B/M) stocks.

Following Fama and French's (1993,1995) interpretation, the value characteristic represents financial risk. A portfolio of with positive (negative) value factor loadings (above 0.3) represents a portfolio of high(low) book-to-market stocks. For example, value stocks represent firms that have hard time raising funds during financial downturns. As a result, these stocks generate higher return to compensate for such higher risk.

Following the above analysis, it can be argued that momentum/contrarian profits reflect the characteristics of stocks selected in the momentum portfolios. As a result, the adjusted profit of such an investment strategy could disappear after taking into account the risk caused by Fama and French (1993) three factor sensitivities.

To investigate this issue, we apply the Fama and French (1993) three-factor model to winners' and losers' momentum returns of stocks with different trading volume levels.

As in Fama and French (1993) model, expected excess return of a security compensate for its sensitivity to three risk factors: market, size, and book-to-market ratio and can be represented as follows.

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_i(r_{m,t} - r_{f,t}) + \gamma_i \text{SMB} + v_i \text{HML} + \epsilon_{i,t} \quad (11)$$

where

- $r_{i,t}$ = return of the stock or portfolio i during period t
- $r_{m,t}$ = return of the market during period t
- $r_{f,t}$ = risk free rate during period t
- SMB** = the average return on the three small portfolios
minus the average return on the three big portfolios
= $1/3(\text{Small Value} + \text{Small Neutral} + \text{Small Growth})$
- $1/3(\text{Big value} + \text{Big Neutral} + \text{Big Growth})$
- HML** = the average return on the two value portfolios minus
the average return on the two growth portfolios
= $1/2(\text{Small Value} + \text{Big Value})$
- $1/2(\text{Small Growth} + \text{Big Growth})$

A firm is categorized as big (small) if its market capitalization during the previous year is in the top (bottom) 50%. We use June through May years. Market capitalization is calculated as the product of closing price and number of shares outstanding year t. As for value categorization, a stock is categorized based on its book-to-market ratio on

December of the previous year (year $t-1$). Book-to-market ratio is simply calculated as total shareholder's equity divided by market value.

Note that the interpretation of the three-factor Fama and French model (1993) is still controversial. For example, Daniel and Titman (1997) argue that size and value characteristics explain excess returns, but do not represent risks, the so-called "characteristic model". Nevertheless, we expect that the above methodology will shed additional light on characteristics of momentum/contrarian portfolio of stocks with different trading volume levels.

4. Empirical results

4.1 The relation between trading volume and short-horizon contrarian/momentum profits

Table 1 to 7 summarize the relation between trading volume and profitability of WRSS contrarian/momentum profits based on one-, two-, and four-week formation periods on Japan, Taiwan, Korea, Hong Kong, Malaysia, Thailand, and Singapore respectively.

4.1.1 Japan

The results on Japanese capital market are given in Table 1. Panel A, B, and C present results when the formation periods are one, two, and four weeks, respectively. In general, the momentum portfolio which combine both winners and losers (shown as 'total' in Table 1) yield negative profits in most of the eight subsequent weeks. In other words, profits will be realized during the observation period if investors implement contrarian trading strategy instead. These contrarian profits (price reversals) are stronger as the length of formation period increase. For example, on the second observation week ($k=2$), the contrarian profits on high volume stocks are 0.024, 0.049, and 0.147 when the

formation periods are 1,2, and 4 weeks, respectively. However, the monotonic relation between trading volume and such price reversal is not clear through time.

Insert Table 1 here

Realizing that the total portfolio, which combine both winners and losers, could yield noisy relation between trading volume and price pattern due to asymmetric reaction in both direction and magnitude to good or bad news (e.g. market overreaction to bad news and market underreaction to good news for conservative market and so on), we turn to interpret our results on winners and losers separately.

Japan's winner stocks display price reversals (contrarian profits) throughout seven subsequent weeks in the observation period for all formation period schemes (one, two, and four weeks). Contrarian profits increase with the formation period lengths (e.g. for the second-week observation period on high volume stocks, the contrarian profits are reported as 0.053, 0.0845, and 0.1442 per week for 1-, 2-, and 4-week formation period portfolio respectively. The weekly contrarian profits in all volume groups and all formation period scheme decrease as weeks go on. Importantly, the monotonic relation between trading volume and weekly contrarian profitability of winner stocks is reasonably clear in Japan. In general, we find that the contrarian profits (price reversals) are higher in the high volume stocks. For example, Table 1, Panel A report the contrarian profits during the second observation week for high-,medium-,and low-volume stocks as 0.053, 0.037, and 0.017, respectively. On the third observation week, the contrarian profits on high-,medium-,and low-volume stocks are 0.052, 0.026, and 0.011, respectively. Such monotonic relation can be seen across all formation periods (one, two,

and four week) and most of the subsequent weeks during the observation period ($k = 2 - 8$).

Loser stocks in Japan display the opposite price pattern from winner stocks. Mostly, we find momentum profits (price momentum) starting on the second week observation period in all formation periods (one, two, and four weeks) scheme. Unlike winner stocks, the price momentums found in loser stocks tend to maintain their magnitude throughout the seven subsequent weeks, especially for high volume stocks when portfolios are formed on four-week returns. Consistent with our hypothesis, we observe a clear monotonic relation between trading volume and momentum profits in most of the subsequent observation weeks. In specific, momentum profit as well as momentum returns increase with the trading volume. For example, Panel A of Table 1 reports the momentum profits on the fourth observation period when portfolios are formed on one-week return as 0.032, 0.017, and 0.011 respectively. The same pattern can also be seen in other observation weeks.

4.1.2 Taiwan

The results on Taiwanese capital market are given in Table 2. Panel A, B, and C present results when the formation periods are one, two, and four weeks, respectively.

Insert Table 2 here

When winners and losers are combined into one portfolio, high volume stocks generate high momentum profits during the first few weeks but reverse fast beyond that. During these few weeks momentum profits is higher in high volume stocks. For example, The second-week momentum profits when portfolios are formed based on one-week

return (see Table 2, Panel A) are 0.098, 0.013, and -0.02 for high-, medium-, and low-volume stocks, respectively. When portfolios are formed based on two-week returns, the magnitude of the profits increase and the monotonic relation persists. As seen on Panel B, the second-week observation period show the momentum profits of 0.209, 0.052, and 0.013, for high-, medium-, and low-volume stocks respectively. On the other hand, when portfolios are formed on four-week return, the momentum profits in the second observation week turn into contrarian profits, which increase with trading volume. As shown in Panel C, contrarian profits are 0.40, 0.332, and 0.114, for high-, medium-, and low-volume stocks respectively. Same as what we find in Japan, the longer the formation period, the stronger the subsequent price pattern, either price reversals or price momentums. For example, if we consider high volume stocks, momentum (contrarian) profits on the second-week observation period are 0.098, 0.209, and (-0.40) for momentum portfolios constructed on the one-, two-, and four-week returns respectively. In general, momentum profits seem to be more persistent in lower volume stocks. As for later weeks, momentum profits are clearly higher in the lower volume stocks. In other words, we observe monotonic relations between trading volume and price pattern but these relations reverse quickly through time and fluctuate.

Opposite to what is found in Japan, winner stocks in Taiwan mostly experience price momentum during the observation period in all formation period schemes (one, two, and four weeks). The persistence of price momentum is stronger for medium and low volume stocks. In high volume stocks, price pattern experience some fluctuation through time (price reversals take place in the fourth to sixth week). The relation between trading volume and momentum profits seems to vary through time. During the second observation week, price momentum is higher in high volume stocks across all formation period schemes. However, the pattern is getting noisy beyond the second week.

Loser stocks in Taiwan yield mixed results. Both contrarian and momentum profits are found through the seven subsequent observation weeks. In general, there is no clear relation between trading volume and price pattern.

4.1.3 Korea

The results on Korean capital market are given in Table 3. Panel A, B, and C present results when the formation periods are one, two, and four weeks, respectively. The price patterns for combined portfolios of losers and winners are strong but highly varied through time. For 1-week formation period, we find price momentum, which tends to be more persistent and higher in high volume stocks. However, when portfolio is formed based on 2-week returns, price momentum is higher in the low volume stocks from the second to sixth subsequent week. Momentum profits are found mostly and this is more pronounced for low volume stocks. The patterns based on 4-week return formation period are mixed.

Insert Table 3 here

Same as in Taiwan, Korea's winner stocks display price momentum. This price momentum tends to be more persistent and stronger in high volume stocks. The magnitude of momentum profit increases with the formation period length. However, the monotonic relation is unclear through time and gets worse with the longer formation period (2 and 4 week). For example, in the case of 2-week formation period, there are many subsequent weeks where momentum profits are higher in low volume stocks.

Price pattern of loser stocks in Korea is mixed. On 1-week formation period, price reversals are higher and clear through time only in high volume stocks. On the 2- and 4-week formation period scheme, the pattern becomes noisy.

In sum, the relation between trading volume and price pattern in Korea is noisy and fluctuate largely through time. The only observation we can make is that price momentum is stronger and more persistent through seven observation weeks in high volume winner stocks.

4.1.4 Hong Kong

The results on Hong Kong capital market are given in Table 4. Panel A, B, and C present results when the formation periods are one, two, and four weeks, respectively.

Insert Table 4 here

When losers and winners are combined into one portfolio, price pattern in Hong Kong stocks lean towards price momentum, which is stronger in high volume stocks. However, these pattern fluctuate and dependant on the length of formation period. Two-week formation scheme show the strongest pattern of relation between trading volume and price pattern. For example, the second week momentum profits of high-,medium-, and low-volume stocks are reported as 0.059, 0.017, and -0.109, respectively (see Table 4, Pabel B). As found in other countries, the magnitude of price pattern increase with the length of formation period.

Hong Kong's winner stocks generally experience short-horizon price reversals in all formation week lengths (one, two, and four weeks). Same as in Japan, the magnitude of contrarian profits is higher as we increase the length of formation period. The

monotonic relation between trading volume is very clear throughout seven subsequent weeks in the observation period. To be more specific, contrarian profits (price reversals) increase with trading volume. In fact, based on one week formation period, low volume stocks even generate clear price momentum. For example, in Table 4, Panel A, during the second observation week, contrarian profits are reported as 0.065 and 0.026 in high- and medium-volume stocks. At the same time, momentum profits in low volume stocks are reported as 0.048. However, in terms of returns, the relations become mixed beyond the one-week formation period scheme.

Loser stocks in Hong Kong also display a clear monotonic relation between trading volume and price pattern. In specific, we find price momentum, which is stronger with trading volume. Momentum profits are found in high and medium trading volume stocks. On the other hand, low volume experience price reversals (contrarian profits). These findings are consistent across all lengths of formation period scheme in our study and confirmed in form of “return”. For example, based on one-week formation period, the momentum (contrarian) profits during the second observation week is reported as 0.09, 0.023, and (0.034) for high-, medium-, and low-volume stocks respectively. This pattern persist throughout the seven subsequent weeks (see Table 4, Panel A). When we expand the formation period to two weeks, the patterns found are still similar. As shown in Table 4, Panel B, the momentum (contrarian) profits on the second observation week are reported as 0.18, 0.06, and (0.017) respectively. Again, this pattern persists through all subsequent weeks. As for four-week formation period, loser stocks experience even stronger price momentum, which is higher in the high volume stocks. Panel C of Table 4 reports momentum profits 0.325, 0.161, and 0.061 for high-, medium-, and low-volume stocks respectively.

4.1.5 Malaysia

The results on Malaysian capital market are given in Table 5. Panel A, B, and C present results when the formation periods are one, two, and four weeks, respectively.

Insert Table 5 here

When we consider winners and losers together in one portfolio, the pattern is quite mixed, highly fluctuate through time and dependant on the length of formation period. When the formation period is one week, price reversals are found on the second week during observation period and higher for high volume stocks (see Table 5, Panel A). On the third and fourth week, however, price momentums emerge and are higher for high volume stocks. From the fifth week onwards, price reversals return and tend to be higher for high volume stocks. The shifts between price momentum and price reversals can also be seen when formation periods are expanded to two and four weeks. The noisy pattern is strongest when the formation period is two weeks (see Table 5, Panel B).

Based on one-week formation period, winner stocks in Malaysia generate price reversals (contrarian profits). These price reversals are stronger for higher volume stocks. For example, during the second observation week, when the formation period is one week, contrarian profits are reported as 0.139, 0.048, and 0.022 for high-, medium-, and low-volume stocks respectively. This pattern can also be observed during the fifth to eighth week during the observation period (see Table 5, Panel A). The results on two-week formation period display weaker pattern. Table 5, Panel B report the results. The clear pattern can be seen in only the fifth and seventh week. When we extend the formation period to four weeks, the relation becomes even noisier and fluctuate

substantially through time. However, the magnitude of price patterns clearly increase with the length of formation periods.

Malaysia's loser stocks also display a monotonic relation between trading volume and price pattern. High volume losers display price momentum. Medium volume losers experience mixture of price momentum and price reversals through time while low volume losers display rather price reversals. For example, when the formation period is one week, Panel A of Table 5 reports the momentum (contrarian) profits of high-, medium-, and low-volume loser stocks as 0.006, (0.003), and (0.015), respectively. The same monotonic relation can be observed until the sixth week during the observation period. These results are robust as we expand the formation period to two weeks. Panel B of Table 5 shows the momentum profits of for high-, medium-, and low-volume loser stocks as 0.049, (0.007), and (0.052), respectively. This pattern persists in almost every subsequent weeks during the observation period. When the formation period is based on four-week return, the same pattern also persist but is more varied through time (see Table 5, Panel C).

4.1.6 Thailand

The results on Thailand's capital market are given in Table 6. Panel A, B, and C present results when the formation periods are one, two, and four weeks, respectively. Combined portfolios of Thailand stocks express price pattern towards momentum, which tends to be stronger in the lower volume stocks, especially on the four-week formation period. However, this pattern is dependant on the length of formation period and fluctuates through time.

Insert Table 6 here

Winner stocks in Thailand display some relation between trading volume and price pattern when portfolios are formed based on 1- and 2-week returns. Based on profit numbers, price pattern fluctuate through time. However, price pattern goes toward price reversals for higher volume stocks and price momentums especially for lower volume stocks. On 4-week formation scheme, the relation becomes very noisy.

Same as in winner stocks, the relation between trading volume and price pattern in Thailand's loser stocks is seen only in 1- and 2-week formation scheme. Price patterns found are mostly price momentum, stronger in the higher volume stocks. On 1-week formation scheme, contrarian profits are found in low volume stocks.

4.1.7 Singapore

The results on Singapore's capital market are given in Table 7. Panel A, B, and C present results when the formation periods are one, two, and four weeks, respectively. The total momentum portfolio in Singapore fluctuate through time. For example, based on the one-week formation period (see Table 7, Panel A), high-volume stocks yield momentum profits while medium- and low-volume stocks yield contrarian profits during the second and third week during the observation period. However, such pattern reverses in the fourth week. The unclear patterns are also seen for two- and four-week formation period. (see Table 7, Panel A and B)

Insert Table 7 here

Singapore's winner stocks of low and medium volume groups display price pattern that fluctuates through time. In general, price reversals are more persistent and stronger in high volume winners, especially for one- and four-week formation period. The monotonic relation can also be observed but reverse and fluctuate quickly afterwards.

Loser stocks in Singapore also show a monotonic pattern between trading volume and price pattern. High volume stocks exhibit price momentum. Price pattern is mixed in medium volume group. At the same time, low volume stocks experience price reversals (contrarian profits). For example, according to Table 7, Panel A, the third week momentum (contrarian) profits on high-, medium-, and low-volume stocks are reported as 0.018, (0.035), and (0.078), respectively. The same pattern can be observed up to the seventh observation week. When the portfolio is constructed based on the two-week return, the pattern is still the same, with the stronger magnitude (see Table 7, Panel B). For example, the momentum (contrarian) profits on the third observation week, based on two-week formation period, are 0.062, (0.004), and (0.075), respectively. Same as in one-week formation period, the pattern is clear up to the seventh week of the observation period. As for the four-week formation period portfolios, the pattern is clear up to the fourth observation week.

4.1.8 Summary

In sum, the findings are consistent with our conjectures. That is, the monotonic relation between trading volume and the profitability of contrarian/momentum profits from winner and loser stocks are found in most countries. Also, these relations are not the same across all countries. Interestingly, in almost every country, we find that losers and winners seem to exhibit different subsequent price pattern in most cases, implying that there are asymmetric reaction to good news and bad news. Finally, the relation between

trading volume and price pattern retains as we extend the formation period. In most cases, the magnitude of price pattern increase with the length of formation periods.

When losers and winners are combined, the price patterns as well as their relation to trading volume appear noisy in many countries. However, when we analyze winners and losers separately, the clear patterns emerge.

Winner stocks display price reversals in most countries (overreaction to good news) especially for high volume stocks except in Korea and Taiwan (winners display price momentum: underreaction to good news). Low volume winners in Hong Kong and Thailand display price momentum. Monotonic relations are found in all countries except Taiwan.

As for loser stocks price momentum is found (underreaction to bad news) in five out of seven countries. Only in Korea that we find price reversals in loser stocks (overreaction to bad news). Monotonic relations between trading volume and price pattern are also found among six countries (the exception is Taiwan). Both price momentum (five countries) and price reversal (Korea) are stronger in high volume loser stocks.

Table 8 summarizes our findings in this section.

Insert Table 8 here

4.2 *Decomposition of momentum/contrarian profits in different trading volume stocks*

We implement the methodology that decomposes momentum/contrarian (positive/negative) returns into the cross-sectional risk (σ_{μ}^2), lead-lag effect (δ), and time-

series pattern (Ω) on high, medium, and low volume stocks. The first term (σ_{μ}^2) represents the cross-sectional variance of expected returns. This component is always positive and increase (decrease) momentum (contrarian) profits. As for the second component, the conventional Lo and Mackinlay (1990) lead-lag effect posits that δ is negative and contributes to contrarian profits. The last term, time-series pattern (Ω) is negative (positive) if prices of stocks in the market overreact (underreact) to firm-specific news and corrections (momentum) occur during the observation period. Table 9 presents the results on all seven countries. The analyses are based only on the combined portfolio (winners and losers) of 1-week formation period scheme during *the second observation week* ($k=2$). It should be noted that the methodology used explain only one (out of seven) observation weeks. As a result, there is a limitation for representativeness. Table 9 presents the results.

Insert Table 9 here

According to our methodology, the biggest portion of contrarian profits found in Japanese stocks represents the lead-lag effect. Such lead-lag effect is especially strong in the first week after the formation week, consistent with Lo and Mackinlay (1990) suggestion (the results of the first week observation period are not shown in the paper but is available upon request). On the second week, the lead-lag effect is still strong and highest in low volume stocks. Cross-sectional risks reduce contrarian profits, especially in low volume stocks. Importantly, the time series pattern does yield contrarian profits on all trading volume groups. However, the relation between trading volume and time-series

pattern is inconsistent with the pattern we find in section 4.1. In specific, contrarian-contributed time-series pattern is highest in the low volume stocks.

For Taiwan stocks, time-series pattern found is consistent with our findings in section 4.1. Namely, time-series patterns (Ω) yield momentum profits in high and medium volume stocks and contrarian profits in low volume stocks. The consistent monotonic relation can also be observed. A portion of momentum profits found in high and medium volume stocks represents cross-sectional risk, which is higher in the medium volume stocks. As for low volume stocks, cross-sectional risk reduce their contrarian return. Lead-lag effect, on the other hand, reduce momentum profits in high and medium volume stocks. Low volume stocks display positive number for δ , which is unconventional for the lead-lag effect.

In Korea, time-series pattern (Ω) is also consistent with the findings in the previous section. In specific, Ω yields price momentum and it is higher in high volume stocks than in low volume stocks. Cross-sectional risk also explains a portion of momentum profits and it is highest in low volume stocks. On the other hand, lead-lag effect yields price reversals (reduce momentum profits). In other words, momentum profits in Korea are shown to survive the lead-lag effect.

In Hong Kong, momentum profits found in the previous section could mostly represent the country's unconventional lead-lag effect. This finding is consistent with Kang, Lui, and Ni (2002) when they also find unique (positive) lead-lag structure in China during 1993 to 2000. Time-series pattern (Ω) itself seems to represent price reversals instead in stead of price momentum. Such price reversals are stronger for higher volume stocks. The monotonic relation can be observed. Cross-sectional risk also explains a portion of momentum profits found and it is highest in medium volume stocks.

In Malaysia, part of contrarian returns as found in section 4.1 really reflect time-series pattern (Ω). Consistent with Hameed and Ting (2000) finding, such time-series pattern is stronger for higher volume stocks (monotonic relation). Lead-lag effect still play an important role in explaining the contrarian returns, but no monotonic pattern is found. The lead-lag effect is highest for low volume stocks. Cross-sectional risks reduce contrarian profits, especially in the medium volume stocks.

As for Thailand, the momentum profits found in section 4.1 for high volume stocks mostly represent the unconventional lead-lag effect (same as in Hong Kong and China). Another part of such momentum profits can also be explained by cross-sectional risks. As for medium volume stocks, momentum profits only compensate for cross-sectional risks while lead-lag effect and time-series pattern yield price reversals. Similar to high volume stocks, momentum profits in low volume stocks found in section 4.1 represents the unconventional lead-lag structure and cross sectional risks. In general, the time-series patterns (Ω) in Thailand actually reflect price reversals, higher in the low volume stocks (the monotonic relation is not clear in the second observation week ($k=2$)).

Finally, The time-series pattern (Ω) in Singapore displays price reversals, higher in the high volume stocks. This is consistent with the findings in section 4.1 when we find momentum profits in high volume stocks and contrarian profits in medium and low volume stocks. The conventional lead-lag effect also indicates price reversals across all trading volume groups. Such effect is stronger for the lower volume stocks. Cross-sectional risk contribute to momentum profits, highest in the medium volume stocks.

4.3 Sensitivity to Fama and French (1993) three factor risks

We investigate the sensitivity of momentum/contrarian returns of stocks with different trading volume groups and present the results in Table 10. Please note that our analysis is based on only the second observation week when the portfolio is formed on 1-week return.

Insert Table 10 here

For Japan, the results confirm that contrarian returns on the winner stocks found in previous section survive after adjusting for three factor risks. High and medium contrarian returns are significant and reported as 0.30% per week. Low volume contrarian return is less and reported as 0.20% per week. Unlike Lee and Swaminathan (2000) findings on the US data, high volume winner stocks do not exhibit value characteristic. Its HML (High minus Low) loading is 0.164 and significant at 0.01 level, suggesting that high-volume winner stocks could represent mild value (high B/M) stocks. Momentum returns found in loser stocks survive risk adjustment only in high volume stocks. SMB (Small minus Big) loading suggests that momentum portfolio of high volume stocks exhibit the characteristic of large capitalization stocks.

In Taiwan, momentum's abnormal return on winner stocks is insignificant in all trading volume groups after adjusting for three factor risks. However, the monotonic pattern between trading volume and momentum return still remains. Winner stocks exhibit glamour (low B/M) characteristic in all volume categories but significant only in medium volume stocks. Contrarian return in loser stocks survive risk adjustment in only low volume group. High volume losers exhibit mild "value" characteristic. However, the

explanatory power of three-factor model on Taiwan's momentum/contrarian returns is very small.

In Korea, momentum return found in winner stocks disappear after adjust for three factor risks. Consistent with Lee and Swaminathan (2000) finding on the US stocks, high volume winners in Korea exhibit clear and significant glamour characteristic (negative HML loading). Contrarian abnormal returns on loser stocks, on the other hand, survive three-factor risk adjustment. However, the explanatory power of three-factor model on Korea's loser stocks is very minimal.

In Hong Kong, abnormal contrarian returns on winner stocks of high and medium volume survive risk adjustment. Size (SMB) loading is significant on high volume winner portfolios. In the context of WRSS portfolio scheme used in our study, it implies that extreme performers (higher weight in the WRSS portfolio) exhibit size characteristics of medium capitalization firms (SMB loading of 0 to 0.5). Surprisingly, medium volume winners exhibit glamour stock characteristics while high volume winners do not. Loser stocks' momentum abnormal returns survive risk adjustment only in high volume stocks. Medium volume losers exhibit growth characteristics.

In Malaysia, none of abnormal returns based on contrarian/momentum strategy survives three-factor risk adjustment. The major risk factor that explains the contrarian/momentum returns turns out to be market (beta) risk. Significant value loading is found in only medium volume loser and loser-winner portfolio. In specific, medium volume loser and loser-winner portfolio exhibit value characteristics. This finding is opposite to what we mention above for Hong Kong capital market.

In Thailand, abnormal returns based on momentum strategy are significant only among loser stocks, which is highest in low volume stocks. The magnitude of risk-adjusted abnormal return decreases with trading volume. The high- and low-volume

winner stocks exhibit value characteristics while loser stocks in these extreme volume categories display glamour characteristic.

In Singapore, both contrarian returns on winner stocks and momentum returns on loser stocks do not survive three-factor risk adjustment. High volume loser portfolios exhibit growth characteristic while low volume losers exhibit positive size loading.

5. Conclusion

In this study, we provide collective evidence on the relation between trading activities and return predictability in the seven Pacific-Basin capital markets, which is motivated by several reasons. First, in spite of extensive studies in the US market, relatively little is done to investigate the role of volume in short-horizon return predictability in Asian markets. Second, although there are several multi-country studies that document short-horizon return predictability in Pacific-Basin capital markets, the trading volume is not taken into account. Lo and Mackinlay (1990) and Bodoukh, Richardson, and Whitelaw (1994) argue that some part of contrarian profits found in the US represents non-synchronous or thin trading problem. This should be especially important to the validity of short-horizon contrarian/momentum profitability in Pacific-Basin countries since thin trading problem is stronger in these markets. So far, the relation between trading volume and return predictability is studied in only Malaysian and Japanese market by Hameed and Ting (2000) and Bremer and Hiraki (1999) respectively, who find that contrarian profits are significantly higher on actively traded (high volume) stocks. Third, the dynamics of market sentiments can be different among countries, making it even more interesting to perform a cross-country study that analyzes such relation. Fourth, previous studies do not provide either decomposition of momentum/contrarian profits into cross-sectional risk, lead-lag effect, and price pattern or

study its relation to size and value characteristics as done by Jegadeesh and Titman (1995) and Lee and Swaminathan (2000). We intend to fill this gap.

In general, we find the evidence of monotonic relation between trading activities and return predictability (price pattern) in most of Pacific-Basin countries. Interestingly, such relationships are different among countries and among winners and losers. Through the decomposition of profit, we also show that time-series price patterns really exist across countries. The finding of Lee and Swaminathan (2000) in the US market that high volume winner stocks represent glamour stocks is found in only Korea.

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Table 1 (JAPAN)

The relation between trading volume and contrarian/momentum profit/return in Japan. Negative (positive) numbers represent contrarian (momentum) profits/returns. Panel A, B, and C represent the results based on the formation period of 1, 2, and 4 weeks respectively. To avoid misinterpretation due to non-synchronous trading, all analyses should be based on the second week and beyond for conservatism.

Panal A: Formation Period = 1 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|------------|------------|------------|-----------|------------|------------|-----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.0838*** | -0.0530*** | -0.0517*** | -0.0498*** | -0.0366** | -0.0384*** | -0.0225 | -0.0134 |
| | Loser | -0.0649*** | 0.0290 | 0.0225* | 0.0320*** | 0.0252* | 0.0241* | 0.0344*** | 0.0517*** |
| | Total | -0.1487*** | -0.0240 | -0.0292 | -0.0178 | -0.0115 | -0.0144 | 0.0119 | 0.0383** |
| Medium | Winner | -0.0944*** | -0.0370*** | -0.0258 | -0.0215*** | -0.0173* | -0.0199*** | -0.0240*** | -0.0103 |
| | Loser | -0.0910*** | 0.0012 | 0.0069 | 0.0170*** | 0.0089 | 0.0081 | 0.0078 | 0.0198*** |
| | Total | -0.1854*** | -0.0358*** | -0.0189 | -0.0045 | -0.0084 | -0.0118 | -0.0161 | 0.0095 |
| Low | Winner | -0.0959*** | -0.0171* | -0.0106 | -0.0012 | -0.0039 | -0.0148* | -0.0135 | -0.0110 |
| | Loser | -0.0937*** | 0.0018 | -0.0041 | 0.0116 | 0.0076 | -0.0041 | 0.0009 | 0.0090 |
| | Total | -0.1896*** | -0.0153 | -0.0146 | 0.0104 | 0.0038 | -0.0189* | -0.0126 | -0.0020 |

Panal B: Formation Period = 2 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|------------|-----------|-----------|----------|------------|-----------|-----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.0905* | -0.0845*** | -0.0468* | -0.0770 | -0.0613* | -0.0483* | -0.0071 | -0.0487** |
| | Loser | -0.0545* | 0.0354 | 0.0489** | 0.0328 | 0.0203 | 0.0475 | 0.0583*** | 0.0398 |
| | Total | -0.1450* | -0.0491 | 0.0021 | -0.0443 | -0.0411 | -0.0008 | 0.0512 | -0.0089 |
| Medium | Winner | -0.0985*** | -0.0615*** | -0.0278* | -0.0369* | -0.0261 | -0.0306* | -0.0202 | -0.0167 |
| | Loser | -0.0835*** | 0.0061 | 0.0292*** | 0.0108 | 0.0107 | 0.0110 | 0.0161 | 0.0121 |
| | Total | -0.1820*** | -0.0554* | 0.0013 | -0.0260 | -0.0155 | -0.0196 | -0.0041 | -0.0046 |
| Low | Winner | -0.1069*** | -0.0147 | -0.0199 | 0.0107 | -0.0263* | -0.0536*** | -0.0033 | -0.0242 |
| | Loser | -0.1003*** | 0.0056 | 0.0034 | 0.0427*** | -0.0022 | -0.0068 | 0.0196 | 0.0360** |
| | Total | -0.2072*** | -0.0091 | -0.0164 | 0.0534* | -0.0284 | -0.0605*** | 0.0163 | 0.0118 |

Panal C: Formation Period = 4 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|-----------|------------|---------|-----------|---------|----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.1744*** | -0.1442 | -0.1466** | -0.1419 | -0.0205 | -0.0780* | 0.0003 | -0.0092 |
| | Loser | -0.0810 | -0.0028 | 0.0365 | 0.0818 | 0.0873 | 0.0276 | 0.0673 | 0.0873 |
| | Total | -0.2554*** | -0.1470 | -0.1101 | -0.0601 | 0.0668 | -0.0504 | 0.0676 | 0.0780 |
| Medium | Winner | -0.1261*** | -0.0668 | -0.0903** | -0.1010*** | -0.0219 | -0.0283 | -0.0239 | 0.0031 |
| | Loser | -0.0945*** | -0.0081 | 0.0437 | 0.0352 | -0.0038 | 0.0117 | 0.0384 | 0.0432 |
| | Total | -0.2206*** | -0.0749 | -0.0466 | -0.0658 | -0.0257 | -0.0166 | 0.0146 | 0.0463 |
| Low | Winner | -0.1388*** | 0.0303 | -0.0607 | -0.0353 | -0.0500 | -0.0677** | 0.0131 | 0.0074 |
| | Loser | -0.0910*** | 0.0535 | 0.0272 | 0.0482 | -0.0242 | 0.0168 | 0.0311 | 0.0736** |
| | Total | -0.2298*** | 0.0839 | -0.0335 | 0.0129 | -0.0742 | -0.0509 | 0.0442 | 0.0811 |

***, **, * Significance at 1%, 2%, and 5%

Table 2 (TAIWAN)

The relation between trading volume and contrarian/momentum profit/return in Taiwan. Negative (positive) numbers represent contrarian (momentum) profits/returns. Panel A, B, and C represent the results based on the formation period of 1, 2, and 4 weeks respectively. To avoid misinterpretation due to non-synchronous trading, all analyses should be based on the second week and beyond for conservatism.

Panal A: Formation Period = 1 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|-----------|--------|---------|----------|---------|---------|-----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.0508 | 0.1232*** | 0.0538 | -0.0071 | -0.0081 | -0.0239 | 0.0237 | -0.0466 |
| | Loser | 0.0089 | -0.0249 | 0.0190 | -0.0494 | -0.0754* | -0.0545 | -0.0235 | -0.1132* |
| | Total | 0.0597 | 0.0983 | 0.0727 | -0.0565 | -0.0835 | -0.0784 | 0.0002 | -0.1598** |
| Medium | Winner | 0.0129 | 0.0519 | 0.0068 | -0.0004 | 0.0133 | 0.0120 | 0.0041 | -0.0074 |
| | Loser | -0.0016 | -0.0390 | 0.0356 | -0.0003 | 0.0024 | -0.0075 | -0.0315 | -0.0479 |
| | Total | 0.0113 | 0.0129 | 0.0425 | -0.0006 | 0.0158 | 0.0045 | -0.0274 | -0.0553 |
| Low | Winner | 0.0779 | 0.0204 | 0.0588 | 0.0276 | 0.0330 | 0.0164 | 0.0083 | -0.0045 |
| | Loser | -0.0525 | -0.0408 | 0.0025 | -0.0037 | 0.0016 | -0.0286 | -0.0433 | -0.0322 |
| | Total | 0.0254 | -0.0205 | 0.0613 | 0.0239 | 0.0346 | -0.0122 | -0.0350 | -0.0368 |

Panal B: Formation Period = 2 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|---------|---------|---------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.0409 | 0.2133 | 0.0044 | 0.0319 | -0.0834 | 0.0279 | -0.0188 | -0.0138 |
| | Loser | -0.0505 | -0.0047 | -0.0772 | -0.1126 | -0.0413 | -0.0168 | -0.1021 | -0.3075 |
| | Total | -0.0095 | 0.2086 | -0.0729 | -0.0807 | -0.1247 | 0.0111 | -0.1209 | -0.3214 |
| Medium | Winner | 0.0430 | 0.0511 | 0.0197 | 0.0129 | 0.0073 | 0.0470 | -0.0589 | 0.0149 |
| | Loser | -0.0219 | 0.0011 | 0.0429 | 0.0185 | 0.0103 | 0.0038 | -0.0707 | -0.0975 |
| | Total | 0.0212 | 0.0523 | 0.0626 | 0.0314 | 0.0176 | 0.0508 | -0.1296 | -0.0826 |
| Low | Winner | 0.0557 | 0.0273 | 0.1440 | 0.0457 | 0.0471 | 0.0123 | -0.0546 | 0.0432 |
| | Loser | 0.0259 | -0.0139 | 0.0453 | 0.0371 | -0.0147 | -0.0328 | -0.1154 | -0.0242 |
| | Total | 0.0816 | 0.0135 | 0.1893* | 0.0828 | 0.0325 | -0.0206 | -0.1700 | 0.0190 |

Panal C: Formation Period = 4 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|------------|---------|---------|---------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.1434 | 0.0498 | 0.1181 | -0.1031 | -0.1564 | -0.2672 | 0.3672 | 0.1346 |
| | Loser | -0.1068 | -0.4500 | 0.0132 | -0.0660 | -0.1147 | -0.3967 | 0.1583 | 0.0807 |
| | Total | 0.0366 | -0.4003 | 0.1313 | -0.1691 | -0.2711 | -0.6640 | 0.5255 | 0.2153 |
| Medium | Winner | 0.2141 | -0.1267 | 0.0513 | -0.0686 | -0.0173 | 0.0122 | 0.0197 | 0.0332 |
| | Loser | -0.0633 | -0.2053*** | 0.0682 | -0.0171 | 0.0394 | 0.1571 | -0.1847 | -0.0571 |
| | Total | 0.1508 | -0.3320*** | 0.1196 | -0.0857 | 0.0222 | 0.1693 | -0.1650 | -0.0239 |
| Low | Winner | 0.1062 | -0.0280 | 0.0484 | -0.1651 | 0.0060 | 0.0641 | -0.0303 | -0.1371 |
| | Loser | 0.0938 | -0.0858 | -0.0281 | -0.0296 | 0.1314 | 0.2815 | -0.1405 | -0.1299 |
| | Total | 0.2000 | -0.1138 | 0.0203 | -0.1947 | 0.1373 | 0.3456 | -0.1708 | -0.2670 |

***, **, * Significance at 1%, 2%, and 5%

Table 3 (KOREA)

The relation between trading volume and contrarian/momentum profit/return in Korea. Negative (positive) numbers represent contrarian (momentum) profits/returns. Panel A, B, and C represent the results based on the formation period of 1, 2, and 4 weeks respectively. To avoid misinterpretation due to non-synchronous trading, all analyses should be based on the second week and beyond for conservatism.

Panal A: Formation Period = 1 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|----------|---------|---------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.0731 | 0.2012 | 0.1429 | 0.1488 | 0.1967 | 0.1374 | 0.1330 | 0.0092 |
| | Loser | -0.3212*** | -0.0817 | -0.1128 | 0.0111 | -0.0010 | -0.0487 | -0.0150 | -0.0511 |
| | Total | -0.2481 | 0.1194 | 0.0301 | 0.1599 | 0.1957 | 0.0886 | 0.1180 | -0.0419 |
| Medium | Winner | 0.0352 | 0.0911 | -0.2913 | 0.2554 | -0.0205 | -0.1505 | 0.0569 | -0.0631 |
| | Loser | -0.1815 | -0.0688 | -0.0722 | -0.0364 | 0.0121 | 0.0289 | 0.0869 | 0.0590 |
| | Total | -0.1463 | 0.0223 | -0.3634* | 0.2189 | -0.0084 | -0.1216 | 0.1439 | -0.0041 |
| Low | Winner | 0.0328 | 0.0579 | -0.0418 | 0.0713 | -0.0147 | 0.0676 | 0.0843 | -0.0190 |
| | Loser | -0.1936*** | -0.0207 | 0.0047 | 0.1141 | -0.0304 | -0.0045 | 0.1043 | -0.0328 |
| | Total | -0.1609 | 0.0372 | -0.0371 | 0.1854 | -0.0451 | 0.0631 | 0.1886 | -0.0518 |

Panal B: Formation Period = 2 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|---------|---------|---------|-----------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.5021 | 0.2778 | 0.4178 | 0.4501 | 0.7646 | 0.3776 | 0.0248 | 0.5946 |
| | Loser | -0.4852 | -1.0386 | -0.4152 | 0.0267 | -0.4125 | 0.0792 | -0.2508 | 0.0710 |
| | Total | 0.0169 | -0.7607 | 0.0026 | 0.4768 | 0.3521 | 0.4568 | -0.2260 | 0.6656 |
| Medium | Winner | -0.0863 | -0.0941 | 0.2060 | 0.4136 | 0.1430 | 0.5232 | -0.0167 | 0.5731 |
| | Loser | -0.5739* | -0.2206 | -0.1579 | 0.1569 | -0.4188 | -0.0454 | 0.2382 | -0.1724 |
| | Total | -0.6602 | -0.3147 | 0.0481 | 0.5704 | -0.2758 | 0.4779 | 0.2215 | 0.4007 |
| Low | Winner | 0.0787 | 0.7582 | 0.3065 | 0.3666 | 1.2275 | 0.9174*** | 0.2273 | 0.2686 |
| | Loser | 0.0226 | -0.2871 | -0.0428 | -0.0922 | 0.0195 | 0.2207* | -0.7558 | 0.0944 |
| | Total | 0.1013 | 0.4711 | 0.2638 | 0.2743 | 1.2470 | 1.1381*** | -0.5285 | 0.3630 |

Panal C: Formation Period = 4 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|---------|---------|---------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.1129 | 0.1033 | 0.4412 | 1.9828 | -0.1982 | -0.0051 | 0.0616 | 0.8854 |
| | Loser | -0.1387 | -0.3591 | -0.0188 | 0.0416 | 0.1140 | 0.1457 | -0.1259 | -0.0495 |
| | Total | -0.0258 | -0.2559 | 0.4223 | 2.0244 | -0.0842 | 0.1407 | -0.0643 | 0.8358 |
| Medium | Winner | 0.1389 | -0.2515 | -0.2183 | 0.1211 | -0.1016 | 0.0880 | -0.0402 | -0.0158 |
| | Loser | -0.0107 | -0.2158 | -0.0860 | 0.1000 | 0.0188 | 0.0543 | 0.0415 | -0.0378 |
| | Total | 0.1282 | -0.4673 | -0.3044 | 0.2210 | -0.0828 | 0.1423 | 0.0013 | -0.0536 |
| Low | Winner | 0.1524 | -0.3314 | -0.3185 | -0.0268 | -0.0697 | 0.3354* | 0.0256 | 0.2938* |
| | Loser | -0.1668 | -0.3461 | 0.0006 | -0.0019 | -0.0569 | 0.0636 | -0.0802 | 0.1122 |
| | Total | -0.0144 | -0.6775 | -0.3179 | -0.0287 | -0.1267 | 0.3991 | -0.0546 | 0.4061* |

***, **, * Significance at 1%, 2%, and 5%

Table 4: (HONG KONG)

The relation between trading volume and contrarian/momentum profit/return in Hong Kong. Negative (positive) numbers represent contrarian (momentum) profits/returns. Panel A, B, and C represent the results based on the formation period of 1, 2, and 4 weeks respectively. To avoid misinterpretation due to non-synchronous trading, all analyses should be based on the second week and beyond for conservatism.

Panal A: Formation Period = 1 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|-----------|-----------|---------|---------|-----------|----------|----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.0270 | -0.0649 | -0.0594 | -0.0895 | -0.0232 | -0.0898** | -0.0741 | -0.0444 |
| | Loser | -0.0438 | 0.0899*** | 0.1182*** | 0.0591 | 0.0636* | 0.1091*** | 0.0393 | 0.0576 |
| | Total | -0.0168 | 0.0250 | 0.0588 | -0.0303 | 0.0404 | 0.0193 | -0.0348 | 0.0132 |
| Medium | Winner | -0.0537* | -0.0261 | -0.0348 | -0.0353 | -0.0186 | -0.0452** | 0.0055 | 0.0281 |
| | Loser | -0.0931*** | 0.0226 | 0.0533*** | 0.0093 | 0.0223 | 0.0028 | 0.0040 | 0.0168 |
| | Total | -0.1468*** | -0.0035 | 0.0185 | -0.0259 | 0.0037 | -0.0424 | 0.0095 | 0.0448 |
| Low | Winner | 0.0218 | 0.0476 | 0.0315 | 0.0147 | 0.0229 | 0.0321 | -0.0029 | 0.0583** |
| | Loser | -0.1082*** | -0.0339 | -0.0202 | -0.0102 | -0.0115 | -0.0261 | -0.0467* | -0.0105 |
| | Total | -0.0864 | 0.0138 | 0.0113 | 0.0045 | 0.0114 | 0.0060 | -0.0495 | 0.0478 |

Panal B: Formation Period = 2 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|-----------|---------|---------|----------|------------|---------|----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.0234 | -0.1196 | -0.1557 | -0.0597 | -0.0992 | -0.1948*** | -0.0558 | -0.1251* |
| | Loser | -0.0018 | 0.1794*** | 0.1428* | 0.1170* | 0.0993 | 0.1480*** | 0.0727 | 0.1082* |
| | Total | -0.0252 | 0.0597 | -0.0129 | 0.0573 | 7.07E-05 | -0.0468 | 0.0169 | -0.0168 |
| Medium | Winner | -0.1232*** | -0.0429 | -0.0866 | -0.0564 | -0.0650 | -0.0365 | 0.0017 | -0.0089 |
| | Loser | -0.1181*** | 0.0603 | 0.0435 | 0.0244 | 0.0057 | 0.0244 | 0.0367 | 0.0327 |
| | Total | -0.2413*** | 0.0173 | -0.0431 | -0.0321 | -0.0593 | -0.0121 | 0.0383 | 0.0239 |
| Low | Winner | 0.0269 | -0.0918 | -0.0421 | -0.0004 | -0.0107 | 0.0647 | -0.0166 | 0.0433 |
| | Loser | -0.1560*** | -0.0170 | 0.0014 | -0.0009 | -0.0428 | -0.0142 | -0.0463 | 0.0355 |
| | Total | -0.1291 | -0.1088 | -0.0407 | -0.0013 | -0.0535 | 0.0505 | -0.0629 | 0.0788 |

Panal C: Formation Period = 4 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|---------|-----------|---------|------------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.1568 | -0.4228 | -0.2923 | 0.0172 | -0.1766 | -0.5197* | -0.1513 | -0.0339 |
| | Loser | 0.0755 | 0.3254* | 0.3572* | 0.4299*** | 0.1593 | -0.0084 | 0.2410 | 0.1793 |
| | Total | -0.0813 | -0.0974 | 0.0649 | 0.4472*** | -0.0172 | -0.5281 | 0.0897 | 0.1454 |
| Medium | Winner | -0.1512 | -0.0909 | -0.1510 | -0.1265 | -0.0626 | -0.2808*** | -0.1256 | -0.0032 |
| | Loser | -0.1352 | 0.1614 | 0.1165 | 0.0845 | 0.1710 | 0.0601 | 0.0157 | 0.0704 |
| | Total | -0.2864* | 0.0705 | -0.0344 | -0.0421 | 0.1083 | -0.2207 | -0.1099 | 0.0672 |
| Low | Winner | 0.0439 | -0.1381 | -0.1204 | -0.1697 | -0.0785 | -0.0041 | -0.0048 | -0.0248 |
| | Loser | 0.0209 | 0.0610 | -0.0849 | -0.1254 | -0.0557 | 0.2422 | 0.0201 | -0.1428 |
| | Total | 0.0648 | -0.0770 | -0.2053 | -0.2951 | -0.1342 | 0.2381 | 0.0154 | -0.1676 |

***, **, * Significance at 1%, 2%, and 5%

Table 5: (MALAYSIA)

The relation between trading volume and contrarian/momentum profit/return in Malaysia. Negative (positive) numbers represent contrarian (momentum) profits/returns. Panel A, B, and C represent the results based on the formation period of 1, 2, and 4 weeks respectively. To avoid misinterpretation due to non-synchronous trading, all analyses should be based on the second week and beyond for conservatism.

Panal A: Formation Period = 1 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|----------|---------|-----------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.0944 | -0.1391 | 0.0991 | -0.0731 | -0.1457** | -0.0422 | -0.0664 | -0.0258 |
| | Loser | 0.0066 | 0.0057 | 0.0126 | 0.1069* | 0.0637 | 0.0419 | 0.0030 | -0.0032 |
| | Total | -0.0879 | -0.1334 | 0.1116 | 0.0339 | -0.0820 | -0.0002 | -0.0634 | -0.0290 |
| Medium | Winner | -0.1265*** | -0.0485 | 0.0470 | -0.0116 | -0.0407 | -0.0303 | -0.0097 | -0.0254 |
| | Loser | -0.0140 | -0.0026 | -0.0040 | 0.0204 | 0.0113 | 0.0011 | -0.0113 | 0.0276 |
| | Total | -0.1405*** | -0.0511 | 0.0430 | 0.0087 | -0.0294 | -0.0292 | -0.0209 | 0.0022 |
| Low | Winner | -0.0981*** | -0.0223 | -0.0059 | -0.0204 | -0.0313 | -0.0049 | -0.0004 | 0.0067 |
| | Loser | -0.0634 | -0.0146 | -0.0602* | -0.0254 | -0.0015 | -0.0295 | 0.0026 | 0.0102 |
| | Total | -0.1615*** | -0.0369 | -0.0661 | -0.0458 | -0.0328 | -0.0343 | 0.0023 | 0.0169 |

Panal B: Formation Period = 2 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|---------|------------|------------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.2771** | -0.1441 | 0.1320 | -0.2612* | -0.3232*** | -0.0807 | -0.1957 | 0.0696 |
| | Loser | -0.1454 | 0.0492 | 0.2117* | 0.2211 | 0.0222 | 0.0219 | 0.0281 | 0.1212 |
| | Total | -0.4225** | -0.0948 | 0.3437 | -0.0401 | -0.3010* | -0.0588 | -0.1675 | 0.1908 |
| Medium | Winner | -0.1837 | -0.0377 | 0.0936 | -0.0449 | -0.1318 | -0.0248 | -0.1184 | 0.0293 |
| | Loser | -0.1341* | -0.0074 | 0.0424 | 0.0482 | -0.0314 | -0.0453 | 0.0920* | 0.0738 |
| | Total | -0.3179** | -0.0451 | 0.1360 | 0.0033 | -0.1632 | -0.0701 | -0.0264 | 0.1031 |
| Low | Winner | -0.0916 | -0.0902 | -0.0181 | -0.1045*** | -0.0293 | -0.0298 | 0.0100 | 0.0262 |
| | Loser | -0.1096* | -0.0521 | -0.1557 | -0.0050 | -0.0401 | -0.0050 | 0.0603 | -0.0901 |
| | Total | -0.2012*** | -0.1424 | -0.1737 | -0.1095 | -0.0695 | -0.0349 | 0.0703 | -0.0639 |

Panal C: Formation Period = 4 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|----------|---------|-----------|----------|---------|---------|----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.1029 | 0.1879 | 0.3855 | -0.6170** | -0.8516 | 0.1699 | -0.3178 | -0.0045 |
| | Loser | 0.1647 | -0.0583 | 0.1585 | 0.2214 | -0.0844 | 0.1419 | 0.0419 | 0.0690 |
| | Total | 0.0618 | 0.1295 | 0.5440 | -0.3957 | -0.9360* | 0.3118 | -0.2760 | 0.0646 |
| Medium | Winner | -0.1676 | 0.0415 | 0.0661 | -0.1273 | -0.5412 | 0.0549 | 0.0275 | -0.0091 |
| | Loser | -0.0309 | 0.0146 | 0.0814 | -0.0193 | -0.1385 | 0.0083 | 0.1520 | 0.0815 |
| | Total | -0.1985 | 0.0562 | 0.1475 | -0.1466 | -0.6796 | 0.0632 | 0.1795 | 0.0725 |
| Low | Winner | -0.2290 | -0.0225 | -0.1069 | -0.1215 | -0.0965 | 0.0348 | 0.0312 | -0.2506* |
| | Loser | -0.1007 | -0.3344* | -0.2352 | -0.0886 | -0.1070 | -0.0093 | 0.2218 | -0.2565 |
| | Total | -0.3297 | -0.3569 | -0.3420 | -0.2101 | -0.2035 | 0.0255 | 0.2530 | -0.5070* |

***, **, * Significance at 1%, 2%, and 5%

Table 6: (THAILAND)

The relation between trading volume and contrarian/momentum profit/return in Thailand. Negative (positive) numbers represent contrarian (momentum) profits/returns. Panel A, B, and C represent the results based on the formation period of 1, 2, and 4 weeks respectively. To avoid misinterpretation due to non-synchronous trading, all analyses should be based on the second week and beyond for conservatism.

Panal A: Formation Period = 1 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|-----------|-----------|---------|---------|-----------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.0831 | 0.0352 | -0.0089 | -0.0713 | -0.1279 | 0.0179 | -0.0868 | -0.0634 |
| | Loser | 0.0728 | 0.1199*** | 0.1652*** | 0.0818 | 0.0588 | 0.0706 | 0.0649 | 0.0763 |
| | Total | 0.1559 | 0.1551 | 0.1564 | 0.0105 | -0.0691 | 0.0884 | -0.0219 | 0.0129 |
| Medium | Winner | 0.0847 | 0.0115 | -0.0242 | -0.0498 | -0.0582 | -0.0403 | 0.0027 | -0.0370 |
| | Loser | -0.0011 | 0.0423 | 0.0601 | 0.0047 | 0.0447 | 0.0984*** | 0.0266 | 0.0337 |
| | Total | 0.0837 | 0.0538 | 0.0359 | -0.0451 | -0.0134 | 0.0581 | 0.0293 | -0.0033 |
| Low | Winner | 0.2500 | 0.0360 | 0.0024 | 0.1639 | -0.0235 | 0.0281 | -0.0919 | -0.0861 |
| | Loser | -0.0181 | -0.0596 | -0.0464 | -0.0625 | 0.0273 | -0.0415 | -0.0175 | 0.0048 |
| | Total | 0.2319 | -0.0236 | -0.0440 | 0.1014 | 0.0038 | -0.0134 | -0.1094 | -0.0813 |

Panal B: Formation Period = 2 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|-----------|---------|----------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.3058 | 0.2144 | -0.0068 | -0.1734 | -0.1218 | -0.1981 | 0.0042 | -0.2272 |
| | Loser | 0.2370** | 0.0975 | 0.2402*** | 0.0448 | 0.0283 | 0.0786 | 0.1916 | 0.1294 |
| | Total | 0.5428*** | 0.3119 | 0.2334 | -0.1286 | -0.0935 | -0.1195 | 0.1957 | -0.0978 |
| Medium | Winner | 0.2067* | -0.0195 | -0.0575 | -0.4209 | -0.1029 | -0.1715 | -0.0099 | -0.1428 |
| | Loser | 0.1162 | 0.0107 | 0.0983 | -0.0273 | 0.2049** | 0.1632* | 0.1174 | 0.0781 |
| | Total | 0.3229* | -0.0089 | 0.0409 | -0.4482 | 0.1021 | -0.0083 | 0.1075 | -0.0647 |
| Low | Winner | 0.0341 | 0.4099 | 0.4927 | 0.0625 | 0.1265 | -0.1788 | 0.1649 | -0.1244 |
| | Loser | -0.3914 | -0.0355 | -0.0296 | -0.0604 | 0.0587 | -0.0556 | 0.0504 | -0.0753 |
| | Total | -0.3572 | 0.3744 | 0.4632 | 0.0022 | 0.1852 | -0.2344 | 0.2153 | -0.1996 |

Panal C: Formation Period = 4 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|---------|---------|-----------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | 0.3728 | 0.1537 | 0.2691 | -0.1604 | 0.0974 | -0.0566 | -0.0178 | -0.4956 |
| | Loser | 0.1880 | -0.1797 | 0.0339 | 0.1712 | 0.4696** | 0.1826 | 0.2465 | -0.0809 |
| | Total | 0.5608 | -0.0261 | 0.3030 | 0.0108 | 0.5670 | 0.1260 | 0.2286 | -0.5765 |
| Medium | Winner | 0.0909 | -0.8048 | -0.0043 | -0.2557 | 0.0395 | 0.1993 | 0.0361 | -0.1413 |
| | Loser | 0.0746 | -0.7140 | 0.4573 | 0.3542 | 0.2814 | 0.3070 | 0.4724 | 0.0726 |
| | Total | 0.1655 | -1.5188 | 0.4530 | 0.0985 | 0.3209 | 0.5063 | 0.5085 | -0.0687 |
| Low | Winner | -0.1463 | 0.0480 | 0.3652 | -0.5459 | -0.6718** | 0.7921 | -0.2266 | 0.0249 |
| | Loser | 0.0443 | 0.9957 | -0.1936 | -0.4949 | 0.3038 | 0.3026 | 0.0792 | 0.0626 |
| | Total | -0.1020 | 1.0437 | 0.1716 | -1.0409 | -0.3680 | 1.0947 | -0.1475 | 0.0875 |

***, **, * Significance at 1%, 2%, and 5%

Table 7: (SINGAPORE)

The relation between trading volume and contrarian/momentum profit/return in Singapore. Negative (positive) numbers represent contrarian (momentum) profits/returns. Panel A, B, and C represent the results based on the formation period of 1, 2, and 4 weeks respectively. To avoid misinterpretation due to non-synchronous trading, all analyses should be based on the second week and beyond for conservatism.

Panal A: Formation Period = 1 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|----------|-----------|---------|-----------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.0419 | -0.0010 | -0.0055 | -0.0571** | -0.0266 | -0.0181 | -0.0130 | 0.0145 |
| | Loser | -0.0507 | 0.0169 | 0.0237 | 0.0394* | 0.0328* | 0.0230 | 0.0056 | 0.0179 |
| | Total | -0.0926* | 0.0159 | 0.0182 | -0.0178 | 0.0061 | 0.0049 | -0.0073 | 0.0324 |
| Medium | Winner | -0.0039 | 0.0168 | -0.0274 | -0.0037 | 0.0306 | 0.0670*** | -0.0080 | -0.0173 |
| | Loser | -0.1049*** | -0.0199 | -0.0078 | 0.0167 | -0.0019 | -0.0091 | -0.0034 | -0.0049 |
| | Total | -0.1088*** | -0.0031 | -0.0351 | 0.0131 | 0.0287 | 0.0579* | -0.0114 | -0.0222 |
| Low | Winner | -0.0062 | -0.0132 | -0.0488 | 0.0282 | -0.0150 | -0.0096 | -0.0024 | -0.0341 |
| | Loser | -0.0759*** | -0.0003 | -0.0295 | -0.0050 | -0.0348 | -0.0259 | -0.0218 | 0.0096 |
| | Total | -0.0821 | -0.0135 | -0.0784* | 0.0231 | -0.0498 | -0.0354 | -0.0242 | -0.0245 |

Panal B: Formation Period = 2 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|----------|---------|-----------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.0635 | 0.0017 | -0.0704* | -0.0813 | 0.0186 | -0.0442 | 0.0276 | -0.0208 |
| | Loser | 0.0166 | 0.0453 | 0.0621* | 0.0520 | 0.0647* | 0.0077 | 0.0260 | -0.0062 |
| | Total | -0.0469 | 0.0470 | -0.0083 | -0.0293 | 0.0833 | -0.0365 | 0.0536 | -0.0270 |
| Medium | Winner | 0.0329 | 0.0059 | -0.0856 | 0.0378 | 0.0832 | 0.0254 | 0.0081 | -0.0696 |
| | Loser | -0.1105*** | -0.0038 | -0.0044 | 0.0294 | -0.0040 | -0.0094 | 0.0059 | -0.0125 |
| | Total | -0.0776 | 0.0020 | -0.0900 | 0.0672 | 0.0791 | 0.0160 | 0.0141 | -0.0821 |
| Low | Winner | -0.0202 | -0.0081 | 0.0179 | 0.0058 | -0.0110 | 0.0041 | -0.1163 | -0.0232 |
| | Loser | -0.0856** | -0.0306 | -0.0749 | 0.0280 | -0.1571** | 0.0008 | -0.0207 | 0.0238 |
| | Total | -0.1057 | -0.0387 | -0.0570 | 0.0338 | -0.1682 | 0.0049 | -0.1370 | 0.0006 |

Panal C: Formation Period = 4 week

| | | Observation week (k) | | | | | | | |
|--------|--------|----------------------|---------|----------|---------|----------|---------|---------|---------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | Winner | -0.0772 | -0.1394 | -0.1393 | -0.0692 | 0.0634 | -0.1252 | 0.0405 | -0.0539 |
| | Loser | 0.0792 | 0.0876 | 0.0454 | 0.0124 | -9.2E-05 | 0.0878 | 0.0603 | -0.0811 |
| | Total | 0.0020 | -0.0518 | -0.0939 | -0.0568 | 0.0633 | -0.0374 | 0.1008 | -0.1350 |
| Medium | Winner | -0.3225* | 0.1046 | 0.1097 | 0.0442 | -0.0607 | -0.2137 | 0.3081 | -0.1135 |
| | Loser | -0.0561 | -0.0466 | 0.0562 | 0.0145 | 0.0961 | -0.0091 | 0.0081 | -0.0205 |
| | Total | -0.3786* | 0.0580 | 0.1659 | 0.0587 | 0.0354 | -0.2228 | 0.3162 | -0.1340 |
| Low | Winner | -0.1781 | 0.1160 | 0.2167 | 0.0597 | -0.0986 | 0.0007 | -0.1865 | -0.0449 |
| | Loser | -0.1065 | -0.2509 | -0.4790* | -0.0564 | -0.1845 | 0.1831 | -0.0650 | -0.2774 |
| | Total | -0.2845* | -0.1348 | -0.2622 | 0.0032 | -0.2831 | 0.1838 | -0.2515 | -0.3224 |

***, **, * Significance at 1%, 2%, and 5%

Table 8
 Summary findings of the relation between trading volume and price pattern in seven Pacific-Basin capital markets.

| | Winners | Losers | Total |
|------------------|--|-------------------------------------|--|
| Japan | Contrarian (H > L) | Momentum (H > L) | -Contrarian: K = 1 - 6 (H > L) -Momentum: k = 7 - 8 (H > L) |
| Taiwan | Momentum (Unclear) | Mixed (Unclear) | Momentum (H > L but high volume revert fast through time) |
| Korea | Momentum (H > L) | Contrarian (H > L) | Unclear (strongly dependant on the length of formation period) |
| HongKong | Contrarian (H > L) (Momentum in Low) | Momentum (H > L) | Momentum (towards momentum, H > L) (however, dependant on the length of formation period) |
| Malaysia | Contrarian (H > L) | Momentum (H > L) | Mixed (fluctuate and strongly dependant on the length of formation period) |
| Thailand | Contrarian (fluctuated) (H: Contrarian) (L: Momentum) | -Momentum: High -Contrarian: Low | Momentum (towards momentum, L > H overall) (however, dependant on the length of formation period and fluctuate through time) |
| Singapore | Contrarian (rather) (H > L) | -Momentum: High -Contrarian: Low | Mixed |

Table 9

Decomposition of contrarian/momentum profits in stocks with different trading volume on seven Pacific-Basin capital markets. The numbers are based on the second observation week ($k=2$) when the portfolio is formed based on formation 1-week returns.

| | | Components of profit | | |
|-----------|--------|----------------------|-----------------|---------------------|
| | | σ_{μ}^2 | δ | Ω |
| | | Cross-sectional risk | Lead-lag effect | Time-series pattern |
| Japan | High | 0.000043 | -0.004561 | -0.000187 |
| | Medium | 0.000020 | -0.009998 | -0.000176 |
| | Low | 0.000191 | -0.032878 | -0.000230 |
| Taiwan | High | 0.000033 | -0.001537 | 0.000016 |
| | Medium | 0.000247 | -0.023731 | 6.02E-7 |
| | Low | 0.000026 | 0.002542 | -0.000080 |
| Korea | High | 0.000012 | -0.002836 | 0.000498 |
| | Medium | 0.000023 | -0.002112 | 0.000224 |
| | Low | 0.000037 | -0.005008 | 0.000343 |
| Hong Kong | High | 0.000368 | 0.195859 | -0.000195 |
| | Medium | 0.000659 | 0.238085 | -0.000165 |
| | Low | 0.000390 | 0.094540 | -0.000120 |
| Malaysia | High | 0.000041 | -0.002435 | -0.000220 |
| | Medium | 0.000116 | -0.000568 | -0.000204 |
| | Low | 0.000050 | -0.034040 | -0.000136 |
| Thailand | High | 0.000131 | 0.004246 | -0.000065 |
| | Medium | 0.000118 | -0.003276 | -0.000149 |
| | Low | 0.000242 | 0.027778 | -0.000119 |
| Singapore | High | 0.000040 | -0.005316 | -0.000270 |
| | Medium | 0.000178 | -0.013366 | -0.000107 |
| | Low | 0.000038 | -0.037262 | -0.000114 |

Table 10

The sensitivity of contrarian/momentum returns of stocks with varying trading volume on the three-factor risks. Alpha (α) represents the abnormal return after adjusting for three factor risks. SMB loading represents sensitivity to size factors (negative loading represents portfolios of large-size firms: 0- 0.5 represents portfolios of medium-size firms: > 0.5 represents portfolios of small-size firms). HML loading represents sensitivity to value factors (negative loading represents portfolios of growth (glamour: low B/M) firms: positive, especially over 0.3 represents portfolios of value (cheap: high B/M) firms).

| | | α | β | γ | ν | Adj R ² | |
|-------------|-------------|-------------|-----------|-------------|-------------|--------------------|-------|
| | | | | SMB Loading | HML Loading | | |
| Japan | High-winner | -0.003*** | -0.208*** | 0.047 | 0.164*** | 0.133 | |
| | High-loser | 0.002*** | -0.105*** | -0.067* | 0.027 | 0.086 | |
| | Total | -7.59E-4 | -0.368*** | -0.006 | 0.243*** | 0.230 | |
| | Med.-winner | -0.003*** | -0.141*** | -0.023 | 0.043 | 0.129 | |
| | Med.-loser | 1.54E-4 | -0.042*** | -0.047 | -0.006 | 0.037 | |
| | Total | -0.003*** | -0.155*** | -0.062 | 0.019 | 0.136 | |
| | Low-winner | -0.002*** | -0.024 | -0.060 | -0.039 | 0.012 | |
| | Low-loser | 6.14E-5 | -0.021 | 0.029 | -0.067 | 0.003 | |
| | Total | -0.001* | -0.021 | -0.025 | -0.111* | 0.007 | |
| | Taiwan | High-winner | 0.002 | 0.045 | 0.031 | -0.063 | 0.004 |
| | | High-loser | -0.002 | -0.117*** | -0.112* | 0.127*** | 0.068 |
| | | Total | 0.002 | -0.106* | -0.146 | 0.124* | 0.019 |
| Med.-winner | | 3.62E-4 | -0.017 | 0.049 | -0.087*** | 0.013 | |
| Med.-loser | | -0.001 | -0.072*** | -0.040 | 0.030 | 0.020 | |
| Total | | 7.22E-4 | -0.097*** | -5.94E-4 | -0.042 | 0.013 | |
| Low-winner | | 1.02E-4 | 0.016 | -0.078 | -0.044 | 0.001 | |
| Low-loser | | -0.002* | -0.020 | -0.014 | 0.011 | 0.000 | |
| Total | | -0.001 | -0.003 | -0.073 | -0.020 | 0.000 | |
| Korea | | High-winner | 5.30E-5 | 0.048 | -0.042 | -0.266*** | 0.020 |
| | | High-loser | -0.003*** | 0.023 | -0.013 | -0.057 | 0.000 |
| | | Total | -0.001 | 0.044 | -0.030 | -0.287*** | 0.010 |
| | Med.-winner | -0.002 | 0.024 | -0.012 | -0.102 | 0.000 | |
| | Med.-loser | -0.004*** | 0.082*** | -0.019 | 0.017 | 0.019 | |
| | Total | -0.004* | 0.077 | 0.001 | -0.027 | 0.003 | |
| | Low-winner | -0.001 | 0.019 | -0.175*** | -0.091 | 0.024 | |
| | Low-loser | -0.002 | 0.011 | 0.044 | 0.066 | 0.001 | |
| | Total | -0.001 | 0.029 | -0.109 | 0.049 | 0.000 | |

Table 10: (continued)

| | | α | β | γ | ν | Adj R ² |
|-----------|-------------|-----------|-----------|-------------|-------------|--------------------|
| | | | | SMB Loading | HML Loading | |
| Hong Kong | High-winner | -0.004*** | -0.128*** | 0.181*** | -0.011 | 0.045 |
| | High-loser | 0.005*** | -0.258*** | 0.035 | 0.063 | 0.148 |
| | Total | 0.002 | -0.487*** | 0.219*** | 0.099 | 0.190 |
| | Med.-winner | -0.003*** | 0.038 | -0.014 | -0.231*** | 0.029 |
| | Med.-loser | 0.002 | -0.109*** | -0.049 | -0.104*** | 0.119 |
| | Total | 6.37E-4 | -0.072* | -0.032 | -0.201*** | 0.057 |
| | Low-winner | 7.73E-4 | -0.036 | 0.083 | 0.132 | 0.000 |
| | Low-loser | 8.74E-4 | -0.052 | -0.035 | -0.084 | 0.010 |
| | Total | 2.45E-4 | -0.029 | -0.020 | 0.086 | 0.000 |
| Malaysia | High-winner | -0.004 | -0.347*** | 0.042 | 0.015 | 0.201 |
| | High-loser | 0.001 | -0.174*** | 0.045 | -0.071 | 0.145 |
| | Total | -0.002 | -0.644*** | 0.164 | -0.027 | 0.297 |
| | Med.-winner | -0.003 | -0.361*** | 0.059 | 0.090 | 0.267 |
| | Med.-loser | 8.41E-4 | -0.140*** | 0.020 | 0.071* | 0.144 |
| | Total | -2.00E-4 | -0.194*** | 0.136 | 0.214*** | 0.355 |
| | Low-winner | -0.002 | -0.148*** | 0.024 | 0.062 | 0.034 |
| | Low-loser | -0.001 | 0.023 | 0.068 | 0.016 | 0.009 |
| | Total | -0.002 | -0.041 | 0.067 | 0.079 | 0.000 |
| Thailand | High-winner | -0.008 | 1.118*** | -0.682* | -0.491* | 0.300 |
| | High-loser | 0.011 | -0.548 | -0.171 | 0.155 | 0.370 |
| | Total | 8.89E-4 | 0.169 | -0.413 | -0.361 | 0.000 |
| | Med.-winner | -0.007 | 0.865* | 0.085 | 0.007 | 0.130 |
| | Med.-loser | 0.012* | -0.682*** | -0.125 | 0.176 | 0.410 |
| | Total | 0.002 | -0.516 | -0.005 | -0.322 | 0.025 |
| | Low-winner | 0.006 | 0.928* | -0.383 | -0.28 | 0.080 |
| | Low-loser | 0.016*** | -0.683*** | 0.031 | 0.129 | 0.390 |
| | Total | 0.017 | -0.114 | 0.036 | -0.238 | 0.000 |
| Singapore | High-winner | -0.003 | 0.155 | 0.057 | 0.140 | 0.037 |
| | High-loser | 7.91E-4 | -0.041 | -0.076 | -0.122* | 0.100 |
| | Total | -0.001 | 0.041 | -0.038 | -0.035 | 0.000 |
| | Med.-winner | 2.95E-4 | -0.018 | 0.154 | -0.026 | 0.011 |
| | Med.-loser | -9.38E-6 | -0.105 | 0.089 | 0.077 | 0.037 |
| | Total | 7.79E-4 | -0.148 | 0.228* | 0.036 | 0.056 |
| | Low-winner | -0.006 | -0.192 | -0.282 | -0.361 | 0.070 |
| | Low-loser | 0.003 | -0.448*** | 0.247* | 0.176 | 0.318 |
| | Total | 0.002 | -0.495* | 0.035 | 0.175 | 0.149 |