Short-horizon contrarian and momentum strategies in Asian markets: An integrated analysis*

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Abstract

In this paper, we test the profitability of short-term contrarian and momentum strategies, which take into account the effects of trading activity, size/value characteristics, and asymmetric investor responses to news for stock markets in Japan, Taiwan, Korea, Hong Kong, Malaysia, Thailand, and Singapore during 1990-2000. Except for the Taiwanese and Korean markets, "winner" ("loser") portfolios experience subsequent r*eversal (momentum)* of stock prices. Among actively traded stocks, significant *contrarian* profits can be obtained from only "winner" portfolios in Japan, while sizeable *momentum* profits from "loser portfolios" in both Japan and Hong Kong.

1. Introduction

There is a large body of literature empirically documenting the predictability of stock returns which give rise to the profitability of two distinct investment strategies – the so called *contrarian* and *momentum* strategies. DeBondt and Thaler (1985, 1987) and many other researchers[1] showed that mean-reversion in stock returns is so predictable that investors can beat the market with the contrarian strategy; i.e., selling recent "winner' stocks and buying recent "loser" stocks. Initially, the contrarian profits were represented as a long-run phenomenon. However, Jegadeesh (1990), Lehmann (1990), Chopra, Lakonishok, and Ritter (1992), and Nam, Pyun, and Averd (2003) showed that contrarian profits also exist in both short- (weekly) and long- (three to five year) horizons. In general, these researchers have attributed the contrarian profits to a price reversal induced by investors' overreaction to market news.

For the momentum strategy, Jegadeesh and Titman (1993, 2001) and Chan, Jegadeesh, and Lakonishok (1996) document that investors routinely underreact so that astute investors can exploit the momentum in stock prices at intermediate terms of three to six months by buying recent winners and selling recent losers, and, consequently, earning risk-adjusted abnormal returns. Investors' underreaction to market news is attributed as the prime source of the price momentum.

Hong and Stein (1999) and Barberis, et al. (1998) take the view that risk-adjusted excess returns from short-term price momentum arise from the investors' slow reaction or underreaction, while contrarian profit can be exploited when investors' overreaction is eventually corrected in the long run. To these writers, the long-term contrarian reversals and short-term momentum in stock returns coexist largely as the result of systematic violations of rational behavior by investors. From this analytical point of view, the momentum and contrarian profits can be traced to the common sequential components of the behavioral process with which investors digests new market information (George and Hwang, 2004). In this study, we evaluate the profitability of the contrarian and momentum trading strategies that are dependent on a set of information structures. More specifically, the two strategies are evaluated not only

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[1] The body of empirical studies relating to the contrarian strategy is large. To cite a few, see Poterba and Summers (1988), Chan (1988), Campbell and Hentschel (1992), Jones (1993), and Dissanaike (1996).

within the common time horizon of a short duration, but also by considering key market information, which is publicly available to investors such as the trading volume of the firm's stock, the size of the firm, and the response pattern of investors to market news. Our analytical approach illustrates how certain key exogenous variables can be integrated in a unified approach to the study of the contrarian and momentum strategies. We examine seven Asian stock markets—Japan, Taiwan, Korea, Hong Kong, Malaysia, Thailand, and Singapore—during the period between 1990 and 2000.

Previous research has dealt extensively with the contrarian and momentum strategies relating to Asian stock markets. However, these existing studies are mostly focused on whether stock returns are continuing in the short horizon (i.e., momentum) or reversing in the long run (i.e., contrarian). To date, to our knowledge, no study on Asian markets has analyzed both strategies concomitantly on an integrated basis, which is the focus of our present paper where we investigate rational behaviors of the investor that is related to publicly available information.

Our major findings are: (i) In general, "winner" stocks display subsequent price reversals while "loser" stocks show price momentum in all seven country markets except in Taiwan and Korea; (ii) contrarian profits measured by the lead-lag effect in the time-series are found in all seven markets and, on balance, are especially pronounced for "winner" stocks with higher trading volume; (iii) price momentum found in "loser" stocks in Japan, Hong Kong, Thailand and, to less extent, in Malaysia and Singapore, are unencumbered by problems associated with thin trading of stocks; (iv) contrarian (momentum) profits on winners (losers) adjusted for three-factor risks are found only in Japan while momentum profits on "loser" stocks are found only in Hong Kong; and (v) consistent with the literature, investor responses to good or bad news are asymmetric and statistically robust and this is reinforced by up- and down-market effects in all seven markets investigated. However, such price patterns are found to be consistent throughout the entire period of study only in Japan.

The remainder of this article is organized as follows. A brief survey of related literature is presented in the next section followed by the description of data used in Section 3. Section 4 discusses the

methodology while Section 5 presents the findings. A summary and concluding remarks are found in the final section.

2. Related Literature

The literature on stock market anomaly in the form of "contrarian" and "momentum" portfolios is largely attributable to the seminal work of DeBondt and Thaler (1985). They show that during the period from the 1920s through to the 1980s, abnormal profits are obtained in the U. S. stock markets from the portfolio strategy that buys (short sells) stocks that had been extreme bottom (top) performers during a period of three immediate preceding years. Many researchers such as DeBondt and Thaler (1987), Jones (1993), and others attribute such long-horizon contrarian profits to the 'price reversal' induced by market overreaction. Jegadeesh (1990), Lehmann (1990), Chopra, Lakonishok, and Ritter (1992) subsequently showed that such contrarian profits exist in both short (weekly)- and long (three to five year)-horizon. Wongchoti and Pyun (2005) provide evidence that risk-adjusted long-horizon contrarian profits still exist in non S&P500 stocks with high trading volume. As for the intermediate horizon (3 to 12 months), Jegadeesh and Titman (1993, 2001) show that the momentum strategy of buying winners and selling losers yields abnormal returns, which cannot be explained by the conventional risk-return framework. In their view, under-reaction to good or bad news is primarily attributable to the "price momentum."

Several researchers turn to international markets for "out of sample" tests for momentum strategy. Rouwenhorst (1998) finds significant price momentum for an intermediate time horizon for stocks in twelve European countries during the period between 1980 and 1995. Rouwenhorst (1999) also discovers significant price momentum based on a six-month performance of the stocks in 17 of the 20 emerging markets worldwide studied for the period spanning from the 1980s to the 1990s. However, studying six Pacific Basin markets during the period between 1981 and 1994, Hameed and Yuanto (2002) do not find "momentum profits" within three to eight month observation periods. On the other hand, Chui, Titman, and Wei (2003) examine a longer study period (1975 to 2000) and report significant momentum profits for seven out of the eight Pacific Basin countries. In particular, they find significant momentum profits in

stocks of small-capitalization, low book-to-market ratio, and high turnover companies. Similarly, Kang, Liu, and Ni (2002) find the intermediate horizon price momentum in the Chinese market between 1993 and 2000.

It is interesting to note that Fung, Leung, and Patterson (1999) study the profitability of trading rule based on one-day price performance[2] in six Pacific Basin markets during the period between 1980 and 1993. In general, they find that daily winners (losers) exhibit price momentum (reversal) during the ensuing one to five trading days, and that daily trading volume add useful information in predicting subsequent changes in stock prices. However, the momentum profits they found disappeared when transaction costs were taken into account.

The profitability of contrarian strategy is generally attributed to the so called "price reversal" or "market overreaction." In addition to the studies mentioned at the beginning of this section, Baytas and Cakici (1999) also find significant contrarian profits in all G-7 country markets they studied between 1982 and 1991. Similarly, Kang, Liu, and Ni (2002) and Gaunt (2000) found significant short-horizon price reversals in the Chinese and Australian markets, respectively. However, both studies note that such price patterns may not be exploitable since "losers" in their studies largely represent small and probably, illiquid stocks. Bowman and Iverson (1998) also document the weekly price reversals in New Zealand during the period between 1967 and 1986 where contrarian profits are robust in relation to risk, size, and bid-ask bounce effects. Empirical studies done on other individual markets such as the UK, Greece, Germany, and others are also provided by several researchers (see Scott, Stumpp, & Xu, 2003; Brouwer, Van Der Put, & Veld, 1997; Dissanaike, 2002; Gregory, Harris, & Michou, 2001; Weimin, & Strong, 1999; Chan, & Hameed, 2000; Schiereck, De Bondt, & Weber, 1999).

As for studies relating to contrarian/momentum profits in Asian markets which have incorporated trading activity of stocks as an information variable, Bremer and Hiraki (1999) test the relation between lagged trading volume and the weekly contrarian profits in the Japanese capital market. Fung, Leung, and

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[2] Trading rules based on extremely short formation period are strongly subject to non-synchronous trading problems as noted by Lo and MacKinlay (1990).

Patterson (1999) use trading volume of the lagged trading day, while Hameed and Yuanto (2002) and Chui, Titman, and Wei (2003) utilize trading volume during the six-month formation period. Hameed and Ting (2000) examine the relation between short-horizon (weekly) return predictability and the level of trading activity (trading volume) in the Malaysian stock market and find contrarian profits on actively traded stocks to be significantly higher than low trading activity stocks. It should be noted that "winner" stocks and "loser" stocks are not analyzed separately in these studies.

Another key variable often documented in the analysis of contrarian strategy is the investors' asymmetric reactions to good news as opposed to bad news. For instance, Nam, Pyun, and Kim (2003) show that it takes longer for positive returns and shorter for negative returns to reverse in the nine Pacific Basin markets they studied. Yeh and Lee (2000) document asymmetric impact of good news and bad news on future volatility in Taiwan and Hong Kong. McQueen, Pinegar, and Thorley (1996) report delayed reaction to good news especially among small stocks. Lee and Swaminathan (2000) develop a "momentum life cycle model" where stocks go through a cycle of investor favoritism where they experience high volume and a large number of analysts following the stocks and *vice versa*, i.e., they are neglected when they experience low volume with few analysts following them. In short, winners and losers do not necessarily evoke the same investor responses, nor do they share similar patterns in price movements.[3]

3. Data

This study covers the stock markets in Japan, Taiwan, Korea, Hong Kong, Malaysia, Thailand, and Singapore from 1990 to 2000. All data, including daily returns on individual stocks and each country's market, 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.

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[3] It should be noted that the price continuations (reversals) in daily winners (losers) reported by Fung, Leung, and Patterson (1999) are questionable for its study period. During the 1980 and 1993 period, which is a up-market period, the higher proportion of daily return of stocks observed should be positive. As a result, by design, it is a foregone conclusion that there be price momentum on positive-return stocks and price reversals on negative-return stocks.

Although the PACAP data start from 1975, the data for the years prior to 1990 are often neither consistent nor standardized for many countries. Due to data availability issues, the period of study varies among the seven individual countries 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.

This study uses weekly returns computed from Wednesday close to the subsequent Wednesday close to avoid the weekend effect documented by Keim and Stambaugh (1984). Following Chordia and Swaminathan (2000), Jegadeesh and Titman (1993, 2001), and others, we apply data selection criteria as follows: Only common stocks are included; to avoid penny stocks, we exclude stocks with a closing price that is within the less than five percentile band of the whole sample during the week;[4] as suggested by Chordia and Swaminathan (2000), stocks that have fewer than 90 observations during the previous year are omitted; stocks that have missing returns during the formation week(s) are also excluded. Additionally, following Jegadeesh and Titman (2001)'s approach, we exclude the top 1% and bottom 1% of performers during a given week. This is especially important for the weighted relative strength (WRSS) portfolio formation scheme used in this study. Descriptive statistics on our sample stocks are presented in Table 1.

[Insert Table 1 here]

4.   Methodology

The portfolio formation procedure used is the momentum version of Lo and Mackinlay's (1990) weighted relative strength scheme (WRSS). Specifically, we take a long/short position in positive/negative excess return stocks (based on their 1-, 2-, and 4-week ranking period[5]), with a higher weight assigned to more extreme performers. These portfolios are observed after an eight week period.

For further analyses, we decompose profits into three components, cross-sectional risk, lead-lag effect, and price pattern, following the Jegadeesh and Titman (1995) approach. Finally, we test whether

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[4] This procedure is suggested by Ball, Kothari, and Shanken (1995), who show that loser stocks are low-priced and exhibit skewed return distributions. Jegadeesh and Titman (2001) also use this filter.

[5] Profitability on investment based on stock performance during extremely short (daily) and intermediate horizon (3 to 12 months) in Pacific Basin markets have been studied by Fung, Leung, and Patterson (1999), Hameed and Yuanto (2002), and Chui, Titman, and Wei (2003).

profits survive after adjusting for size and value as in the Fama and French (1993) model. This latter method offers additional insights into size and value characteristics of portfolios formed.

4.1 Trading activity

To evaluate whether momentum and contrarian profits differ among stocks of varying trading activity levels across seven Pacific-Basin capital markets, we categorize stocks by trading volumes based on the turnover ratio (numbers of shares traded divided by number of shares outstanding). The choice of the turnover ratio rather than dollar or share trading volume is made in order to disentangle the effect of firm size from trading volume. For each year under study, stocks are categorized into the top (high), middle (medium), and bottom (low) thirds based on the daily average turnover ratio during the previous year. As suggested by Chordia and Swaminathan (2000), we require that a firm has at least 90 daily observations of trading volume in year t-1 to be included in the sample. We 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. Our categorization also differs from Lee and Swaminathan (2000) who categorize trading volume based on the formation period (one to four quarters). Along with Hameed and Ting (2000), we argue that this trading volume measure is more appropriate in distinguishing trading activity levels. For example, a stock classified as high (low) volume using the Conrad, Hameed, and Niden (1994) methodology could represent a thinly (heavily) traded stock in a particular week. This is especially true where thin trading is prevalent such as in Pacific-Basin capital markets.

4.2 Portfolio formation and Trading strategy

As mentioned, we use the momentum version of WRSS as proposed by Lo and MacKinlay (1990) for the formation of momentum portfolios. WRSS represents the investment strategy of buying stocks in proportion to their returns over the ranking period. Using this method, the investor takes a long position in positive-return stocks, with higher weight on top performers. At the same time, the investor

takes a short position in negative-return stocks, with higher weight on bottom performers. 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 under-perform the market. During each study period t, each stock is assigned a weight of

$$w_{i,t} = \frac{1}{N}(r_{i,t-1} - \bar{r}_{t-1})$$ (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 profit, denoted as π_t, is

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

If $(r_{i,t-1} - \bar{r}_{t-1}) > 0$ the stock is classified as a winner, otherwise it is considered a loser. A momentum strategy involves taking a long position for winners and a short position for losers. A positive return on a long position and a negative return on a short position both produce a profit. Hence, a positive value for expression (2) indicates momentum profit. On the other hand, a contrarian portfolio has a short position for winners and a long position for losers. A negative value of expression (2) reflects a profit.

We construct portfolios based on one-, two-, and four-week formation periods, but because the results are qualitatively the same, we report results only for the one-week formation period. We multiply profits by 1,000 for ease of presentation. The performance of the trading strategy is evaluated over each of the eight subsequent weeks. However, the performance of the portfolio during the first week immediately following the formation week must be interpreted with caution since it might reflect price patterns induced by non-synchronous trading. The momentum profit at observation week k (k = 1,…,8) is:

$$\pi_{j,t}(k) = \sum_{i=1}^{N_j} W_{i,t} r_{i,t+k-1}$$ (3)

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 represents the number of stocks in each portfolio during each formation week t.

4.3 Decomposition of contrarian/momentum 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 displayed by 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:

$$(\pi^m) = \sigma^2_{\mu} + \delta\sigma^2_{f} + \Omega \tag{4}$$

where the superscript m stands for momentum.

The first term, σ^2_{μ}, represents the part of momentum profit that compensates for cross-sectional risk among stocks. The second term, $\delta\sigma^2_{f}$, 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 strategies.

Jegadeesh and Titman (1995) have developed a framework to investigate all three components**.** Using OLS, they estimate:

$$r_{i,t} = \mu_i + b_{0,i}f_t + b_{1,i}f_{t-k} + \varepsilon_{i,t} \tag{5}$$

where $r_{i,t}$ is the 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, where k is the observation period (k = 1 – 8); $\varepsilon_{i,t}$ is a random error term; and b_0 and b_1 are the parameters to be estimated. Then, each component can be calculated as follows:

Cross-sectional risk:
$$\sigma_\mu^2 = \frac{1}{N}\sum_{i=1}^{N}(\mu_i - \overline{\mu})^2 \tag{6}$$

Lead-lag effect:
$$\delta = \frac{1}{N}\sum_{i=1}^{N}(b_{0,i} - \overline{b}_0)(b_{1,i} - \overline{b}_1) \tag{7}$$

Time-series pattern:
$$\Omega = \frac{1}{N}\sum_{i=1}^{N}Cov(\varepsilon_{i,t}, \varepsilon_{i,t-1}) \tag{8}$$

where μ_i is the regression intercept of stock I; $\overline{\mu}$ is the mean of regression intercept of all stocks in the sample; $b_{0,i}$ is the regression coefficient b_0 of stock I; $\overline{b}_0$ is the mean of regression coefficient b_0 of all stocks in the sample; $b_{1,i}$ is the regression coefficient b_0 of stock I; $\overline{b}_1$ 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. To avoid the potentially strong lead-lag effects due to non-synchronous trading during the observation week, we investigate the issue for the second observation week (k=2) instead. Following Jegadeesh and Titman (1995)'s study, the decomposition is applied initially to the combined portfolio of the losers and winners, and not calculated separately.

It should be noted that the above methodology possesses a major potential drawback because a stock must exist during the whole study period in order 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 for more than 60% of the whole study period (e.g., for 100-week study period, a stock is categorized into high volume stocks if it falls into the high volume group for at least 60 weeks).

4.4 Three factor risk adjustment

An important robustness check on the profitability of any trading strategy is risk adjustment. Documented contrarian/momentum profits may simply reflect the risk characteristics of stocks induced by

the way portfolios are constructed. To investigate whether contrarian/momentum profits found in our study survive risk adjustment, we apply the widely used Fama and French (1993) three-factor model to winners' and losers' returns of stocks in each trading activity groups.

Adopting the Fama and French (1993) model, expected excess returns of a security/portfolio compensate for its sensitivity to three risk factors: market, size, and book-to-market ratio and can be estimated as follows:

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_i(r_{m,t} - r_{f,t}) + \gamma_i SMB + \nu_i HML + \varepsilon_{i,t} \tag{9}$$

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 less the average return on the three big portfolios = 1/3(Small Value + Small Neutral + Small Growth) – 1/3(Big Value + Big Neutral + Big Growth); HML = the average return on the two value portfolios minus the average return on the two growth portfolios = 1/2(Small Value + Big Value) – 1/2(Small Growth + Big Growth); $\varepsilon_{i,t}$ is a random error term, and α, β, γ, and ν are the parameters to be estimated.

A firm is categorized as big or small if its market capitalization during the previous year is in the top or bottom 50%, respectively. We use the period June through May to represent one year. Market capitalization is calculated as the product of closing price and number of shares outstanding in year t. For the value categorization, a stock is categorized based on its book-to-market ratio on December of the previous year (t-1). Book-to-market ratio is computed as the total shareholder's equity divided by the market value.

5. Empirical findings

5.1 Profitability of trading strategies

Table 2, Panels A to G, report the subsequent weekly profits of WRSS portfolios up to eight weeks in Japan, Taiwan, Korea, Hong Kong, Malaysia, Thailand, and Singapore, respectively. Evaluated as combined portfolios of winners and losers, trading strategies based on past performance in the region do not yield significant profit. Among actively traded stocks, significant contrarian profits during the first

observation week can be found only in Japan and Singapore. In Japan, such contrarian profits tend to increase with the length of the formation period.[6] For example, contrarian profits on four-week and one-week formation periods are 0.2554 and 0.1487, respectively. Beyond the first observation week, the contrarian profits of the combined strategy in Japan and Singapore lose their significance altogether. Considering also the fact that the instantaneous observation week is prone to non-synchronous trading, we conclude that significant profits based on a combined strategy of short-term winners and losers are not achievable.

[Insert Table 2 here]

Acknowledging the potential asymmetric reaction to good news and bad news, we further analyze profits found for winners and losers separately. Except for Taiwan and Korea, winners display price reversals while losers display price continuation for most of the observation periods. Price reversals among winners found in Japan, Hong Kong, Malaysia, Thailand, and Singapore are quite persistent through eight observation weeks. However, significant price reversals beyond the first observation week are found only in Japan, especially when formation periods are one or two weeks. Winner stocks in Korea display persistent price momentum, but these momentum profits are not significant in any observation week. Stocks that perform well in Taiwan and Thailand display price momentum that lasts for only one to three weeks. It is also worth noting that price reversals beyond the first observation week in Japan, Hong Kong, Malaysia increase with trading volume/activity as predicted by the Campbell, Grossman, and Wang (1993) model. Taking into account both significance and trading activity, contrarian profits on winner stocks can be obtained only in Japan.

Among loser stocks, except in Taiwan and Korea, price momentum is found. Ignoring the first observation week when non-synchronous trading problems can cause misleading interpretation, momentum profits are statistically and economically significant only for Japan and Hong Kong. To a lesser extent, momentum profits can also be found in Thailand and Singapore. Loser stocks in Korea and

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[6] The results from the 2 and 4 week formation period are not reported but are available upon request from the authors.

Taiwan display persistent price reversals. However, such reversals are statistically insignificant throughout the observation period.

There is one possible limitation of the price momentum (reversal) in losers (winners) found in our study. Specifically, such findings can be the result of down market effects during the study period. For example, if most of weekly returns in the study are negative, it is natural to observe a subsequent negative return for winners (price reversals) and losers (price momentum). Nevertheless, we believe that our findings are robust against the down-market effect since about half of the market returns in our study are positive. The number of negative weekly returns for each country are as follows: Japan, 310 out of 626; Taiwan, 288 out of 620; Korea, 283 out of 570; Malaysia, 260 out of 574; Hong Kong, 218 out of 574; Thailand, 258 out 574; and Singapore, 249 out of 534.

5.2 Do contrarian/momentum returns found really reflect time-series patterns?

We implement the methodology that decomposes momentum/contrarian (positive/negative) returns into the cross-sectional risk (σ^2_μ), lead-lag effect (δ), and time-series pattern (Ω) on stocks with different levels of trading activities. The first term (σ^2_μ) represents the cross-sectional variance of expected returns. This component is always positive and increases (decreases) momentum (contrarian) profits. 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 overreacts (underreacts) to firm-specific news and corrections (momentum) occur during the observation period. Table 3 presents the results for all seven countries. The analyses are based only on the combined portfolio (winners and losers) for one-week formation periods during the second observation week (k =2).

[Insert Table 3 here]

According to our methodology, the biggest portion of contrarian profits found in Japanese stocks represents the lead-lag effect, which is strongest in thinly traded stocks. Importantly, the time series

pattern yields contrarian profits for all trading volume groups. For Taiwanese stocks, the time-series patterns are consistent with our previous findings. Time-series patterns (Ω) yield momentum profits in high and medium volume stocks and contrarian profits in low volume stocks. A portion of momentum profits found in high and medium volume stocks represents cross-sectional risk, which is higher in the medium volume stocks. The lead-lag effect, on the other hand, reduces momentum profits in high and medium volume stocks. Low volume stocks display positive numbers for δ, which is unusual for the lead-lag effect. In Korea, the time-series pattern (Ω) yields price momentum and is higher in high volume stocks than in low volume stocks. Cross-sectional risk also explains a portion of momentum profits and is found to be highest in low volume stocks. In Hong Kong, momentum profits reported in the previous section may mostly represent the country's unusual lead-lag effect. This finding is consistent with Kang, Lui, and Ni (2002) who also find a unique (positive) lead-lag structure in China during 1993 to 2000. The time-series pattern (Ω) itself seems to represent price reversals instead of price momentum. Such price reversals are stronger for thickly traded stocks. Cross-sectional risk also explains a portion of momentum profits found and is highest in medium volume stocks. Malaysia's contrarian returns partly reflect time-series patterns (Ω). Consistent with Hameed and Ting's (2000) finding, such time-series patterns are stronger for higher volume stocks. Lead-lag effects still play an important role in explaining contrarian returns. 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 for high volume stocks mostly represent the unusual lead-lag effect, just as we had found for Hong Kong and China. Another part of momentum profits can be explained by cross-sectional risks. For medium volume stocks, momentum profits only compensate for cross-sectional risks while lead-lag effects and time-series patterns yield price reversals. Similar to high volume stocks, momentum profits in low volume stocks represent the unusual lead-lag structure and cross sectional risks. In general, the time-series patterns (Ω) in Thailand actually reflect price reversals, which are higher in inactively traded stocks. Finally, the time-series pattern (Ω) in Singapore displays price reversals, which is higher in the high volume stocks. The

conventional lead-lag effect also indicates price reversals across all trading volume groups. This effect is stronger for the lower volume stocks. Cross-sectional risk contributes to momentum profits, which is highest in the medium volume stocks. In general, we conclude that part of contrarian and momentum profits survive the decomposition of profits and indeed reflect the time-series patterns of stock returns.

5.3 Sensitivity to Fama and French's (1993) three factor risks

We investigate whether the contrarian/momentum returns found in our study survive three-factor risk adjustment. Sensitivity of momentum/contrarian returns of winner/loser portfolios with different level of trading activities also present additional insights into the characteristics of winners and losers. The results are presented in Table 4. Note that our analysis is based only on the second observation week when the portfolio is formed on one-week returns.

Insert Table 4 here

For Japan, the results confirm that contrarian returns on the winner stocks found in the previous section survive after adjusting for three factor risks. Contrarian returns on actively traded stocks of 0.30% per week are significant, but the low volume contrarian return is 0.20% per week, which is also statistically significant. Unlike the Lee and Swaminathan (2000) findings on US data, high volume winner stocks do not exhibit a value characteristic. With an HML (High minus Low) loading of 0.164, which is significant at the 0.01 level, high-volume winner stocks are value stocks. Momentum returns found in loser stocks survive risk adjustment only in high volume stocks. The SMB (Small minus Big) loading indicates that momentum portfolios of high volume stocks exhibit the characteristic of large capitalization stocks. Taiwan's abnormal return on winner stocks is insignificant in all trading volume groups after adjusting for three factor risks. Winner stocks exhibit a glamour (low B/M) characteristic in all volume categories but only the medium volume category was found to be statistically significant. Contrarian returns in loser stocks survive risk adjustment only in inactive stocks. 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 returns found in winner stocks

disappeared after adjusting for three factor risks. Consistent with Lee and Swaminathan's (2000) finding for US stocks, high volume winners in Korea exhibit a clear and significant glamour characteristic (negative HML loading). On the other hand, contrarian abnormal returns on loser stocks survive three-factor risk adjustment. Nevertheless, the explanatory power of the three-factor model for Korea's loser stocks is very minimal. For Hong Kong, abnormal contrarian returns for winner stocks of high and medium volume survive risk adjustment. The size (SMB) loading is significant for high volume winner portfolios. In the context of WRSS, extreme performers with higher weight in the WRSS portfolio exhibit size characteristics of medium capitalization firms. Their loadings are 0 to 0.5 SMB. 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. For Malaysia, none of the abnormal returns based on contrarian/momentum strategy survives three-factor risk adjustment. The major risk factor that explains the contrarian/momentum returns is market or beta risk. Significant value loadings are found only for the medium volume loser and loser-winner portfolios. Specifically, medium volume loser and loser-winner portfolios exhibit value characteristics. This finding is opposite to that found in Hong Kong. In Thailand, abnormal returns based on momentum strategy are significant only among loser stocks and are highest in low volume stocks. The magnitude of risk-adjusted abnormal return decreases with trading volume. The high- and low-volume winners exhibit value characteristics, while winner stocks display the glamour characteristic. Finally, Singapore's contrarian returns on winner stocks and momentum returns on loser stocks do not survive three-factor risk adjustment. High volume loser portfolios exhibit the growth characteristic while low volume losers exhibit positive size loading.

6.   **Conclusions**

Using data for seven Pacific-Basin capital markets during 1990 to 2000, we provide a test on the profitability of contrarian and momentum strategies. Existing studies in the region focus on extremely short formation periods such as daily returns studied by Fung, Leung, and Patterson (1999) and

intermediate horizon formation periods such as the three to twelve months used by Hameed and Yuanto (2002) and Chui, Titman, and Wei (2003). In contrast to previous work, our study is the first to provide empirical evidence of trading strategies based on past price performance for one, two, and four weeks. In addition, we also consider important factors including trading activities, asymmetric reaction to good and bad news, decomposition of profits, and three-factor risk adjustment in our analyses.

Consistent with Hameed and Yuanto (2002) and Fung, Leung, and Patterson (1999), we find that trading strategies based on past price patterns are not effectively profitable in most Pacific Basin markets. During 1990 to 2000, we find that trading strategies that combine both winners and losers fail to produce significant profits that last for more than a week. In five out of seven countries, winners display price reversal patterns. However, contrarian profits are significant and persistent in Japan. Losers, on the other hand, display price momentum. Nevertheless, momentum profits are persistent and significant only in Japan and Hong Kong. The decomposition of profits and three-factor risk adjustment also confirm the statistically significant profits found in Japan and Hong Kong.

To implement trading strategies that employ price reversal (momentum) in winner (loser) stocks, short selling is required. Charoenrook and Daouk (2004) report that short selling is relatively more feasible in Japan and Hong Kong. In Singapore, while short selling is not prohibited there are no institutional arrangements to facilitate short selling. Short selling was found to be feasible in Malaysia only during 1996. In Thailand, short-selling was allowed only from 2001. The effect of short selling constraints on contrarian/momentum trading is left for future research.

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Table 1. Number of stocks, by year and country.

This table shows the number of stocks included in our study for each country and year. The means across the years is also presented.

Year	Japan	Korea	Taiwan	Hong Kong	Malaysia	Thailand	Singapore
1990	1,510	620	177	263	225	180	139
1991	1,501	645	197	287	263	228	133
1992	1,484	653	224	350	311	281	135
1993	1,536	652	252	407	371	316	159
1994	1,561	672	273	458	411	350	178
1995	1,579	673	312	451	474	368	194
1996	1,619	701	344	501	545	409	207
1997	1,670	725	373	564	649	380	234
1998	1,688	736	397	582	686	332	257
1999	1,760	705	435	591	680	315	-
2000	1,860	-	454	-	-	-	-
Mean	1,615	678	312	445	461	316	182

Table 2. The relation between trading volume and contrarian and momentum returns.

In this table, we present the momentum and contrarian profits with the former being positive and the latter being negative. Results are presented for Japan (Panel A), Taiwan (Panel B), Korea (Panel C), Hong Kong (Panel D), Malaysia (Panel E), Thailand (Panel F), and Singapore (Panel G). Winners are stocks that had a return greater than the market return during week t-1. High, Middle, and Low are the top, middle, and bottom third of firms according to trading volume during the previous year.

		Observation week (k)							
		1	2	3	4	5	6	7	8
Panel A: JAPAN									
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*
Middle	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
Panel B: TAIWAN									
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*
Middle	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
Panel C: KOREA									
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
Middle	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
Panel D: HONG KONG									
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
Middle	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

Table 2 (continued).

| | | Observation week (k) | | | | | | | |
		1	2	3	4	5	6	7	8
Panel E: MALAYSIA									
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
Middle	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
Panel F: THAILAND									
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
Middle	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
Panel G: SINGAPORE									
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
Middle	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

** Significant at 1% level. * Significant at 5% level.

Table 3. Decomposition of contrarian and momentum profits.

We present the 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 one-week returns. There are three components: cross-sectional risk, lead-lag effect, and time-series pattern. These are presented in columns 3-5, respectively.

		Components of profit		
		σ^2_μ Cross-sectional risk	δ Lead-lag effect	Ω 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 4. Sensitivity of contrarian and momentum returns to three-factor risks.

This table presents 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 to 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 SMB Loading	ν HML Loading	Adj. R^2
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 4: (continued)

		α	β	γ SMB Loading	ν HML Loading	Adj. R²
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