Market Efficiency and Momentum Strategy in China Stock Market after Year 2003

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Market Efficiency and Mean Aversion in China Stock Market after 2003

Abstract: we processed weak-form tests of efficient market hypothesis and examined whether momentum/contrarian strategy is profitable in China "A" stock market after 2003. It is assumed that the step-by-step financial liberalization realized according to the commitment made in the participation of World Trading Organization would change the efficiency of stock market in China. The results of the study indicate there is improvement in the size and liquidity of market in the financial liberalization. Stock index in Shanghai Exchange "A" shares behaves mean-reversion before year 2001 while mean-aversion after year 2003. However, this does not necessarily imply that momentum strategy is useful for the market during year 2003 to 2007. Conversely contrarian strategy performs much better than momentum. One possible reason is that stock index is usually affected by big-cap companies, while in momentum and contrarian strategy test more small-cap firms are selected to form portfolios as their prices waved in a larger range. Therefore the stock index and individual portfolios exhibit different characteristics in mean-aversion and reversion.

Keyword: Market Efficiency, Momentum and Contrarian Strategy, China Stock Market

1. Introduction

Under the efficient market hypothesis, the stock price is unpredictable and no abnormal returns can be obtained from the market. However, many recent researches have indicated an increasing number of stock market anomalies that diverge to the classic asset pricing model and efficient market hypothesis. Among them, mean-aversion and contrarian are two of the most attractive phenomena that are adopted in investment practices and investigated by many academies. Actually the raise of contrarian strategy can be dated back to the end of 1970s, when David Dreman, an American investment officer, took it as an investment philosophy in stock trading. However, it is until late 1980s that reversal effect was firstly documented in academic study by De Bondt and Thaler (1985). In their study the portfolios consisting of prior losing stocks are found to earn much more than those with prior "winner" in three years after portfolio formation. They also demonstrate that the reason might be attributed to the market overreaction. Consequently, Poterba and Summers (1988) show that stock returns are negatively autocorrelated over long horizon by using data from 18 stock markets. Later with another researcher Cutler (1989), they suggest that the basis of publicly available fundamental news is not sufficient to explain the movement of individual stock prices. Jegadeesh (1990) and Lehmann (1990) report return reversals exist within 1 and 6 month separately. Also Chopra et al., (1992) examine the persistence and stability of this kind of anomalies even after adjustment for size and beta in US stock market. Conrad and Kaul (1998) confirm that contrarian strategy in portfolio construction performs well in short and long term. Chou, Wei and Chung (2007) also document the possibility of utilizing reversals in Japan equity market on all horizons.

With contrast to reversals, momentum implies the prior "winner" portfolio continue to outperform the market while the "loser" proportion remains loss in observation period. Jegadeesh and Titman (1993) first raise this issue and provide evidence for return continuation in medium term (3 to 12 month) in US market. Conrad and Kaul (1998) provide additional support to this result. Meanwhile, Rouwenhorst (1998) and Doukas and McKnight (2005) present that the momentum phenomenon also remains in European market. Separately, Schiereck, De Bondt and Weber (1999), Carlos and Marhuenda (2003), and Mengoli (2004) indicate that the German, Spanish and Italian markets fit into the evidence by allowing for profitable utilization of contrarian trading.

Although there might be questions that this sort of excess profits earned in such quantitative portfolio selection is caused by the misuses of data mining technique in researches, the study is worthy of providing investor information in decision making if mean-reversion and momentum could be exploited, or not, in an emerging market such as China. From the view of application or practice, our study attempts to form a portfolio integrating the proxies that represent the essence of reversal and momentum effect and to inspect whether it works much better than the market or not.

On the other hand, we endeavor to examine the market efficiency in China's main stock market, or how far away it is from efficient. Being an emerging market established in less than twenty years, China stock market exhibits many characteristics implying inefficiency in previous researches. It is usually recapitulated as a "high return, high risk" market by many investors. While fundamental firm-specific factors, i.e., the earning-to-price ratio, dividend yield and liquidity are lack of power in explaining stock returns (Wang and Di, 2007). Also market segmentation with evidence of information diffusion between "A" shares and "B" shares is mentioned in Sjoo and Zhang (2000). Moreover, government intervention, the dominant position taken by individual investors, information asymmetry, and the prohibition of short sales are generally considered as the main reason preventing China stock market from being efficient. In this case, prices in China stock market are assumed to be predictable and constant excess return should be available for investors. For example, Kang, Liu and Ni (2002) document significant abnormal return from short-horizon contrarian and intermediate-horizon momentum strategies using data from 1993 to 2000.

However, there are limited literatures in relative aspect about China stock market have been published. Only Kang, Liu and Ni (2002) document significant abnormal return from short-horizon contrarian and intermediate-horizon momentum strategies using data from 1993 to 2000. Yet the exchange bourse in China was firstly in operation at the end of 1991. To evade the instability at the first few years of operation our study managed to extend research period from 2000 to 2007. Furthermore, China financial markets were in the process of gradual liberalization and have experienced prominent transformation since 2001, according to its commitment pledged in participation of World Trading Organization (WTO). Foreign direct investments in stock market, as well as the improvement of information asymmetry, are believed to affect the degree of efficiency. Intuitively, the effectiveness of momentum and contrarian strategies should be influenced at the same time. Therefore, our paper intends to detect the availability of those portfolio selection principles under new circumstance.

The remaining divisions of this paper are structured as follows. The next segment gives brief background information on China stock market and its liberalization after China's accession to WTO. Section 3 describes the data source and illustrates main methodologies employed. And part 4 gives out the results of empirical test and conclusions.

2. Financial Liberalization in China

China stock market is an emerging market in transformation. It is rarely believed that all the relevant information has been incorporated by stock prices in this kind of market. Therefore our concentration is not only on the market efficiency test, but also the application and capability of some specific investment strategy during the financial industry liberalization process in China.

In the early of 1990s, the stock market of the People's Republic of China (PRC) was established with the foundation of Shanghai Stock Exchange on Nov 26th1990 and operation on Dec 19th the same year. Later in 1991, Shenzhen Stock Exchange opened on April 11th. Since 1992, two categories of stocks, "A" share and "B" share have been traded simultaneously in the both stock exchange. Before February 19th, 2001, the two categories were segmented separately to investors: "A" share for investors in Mainland only and "B" share for foreign investors, but "B" share listed companies are generally eligible "A" share listed. Moreover, trading in "B" share is restricted severely due to the legal barriers and market capitalization. Individual investors are allowed to hold up to 25 percent of a firm's B shares, but the total foreign ownership of a firm cannot exceed 49 percent. Until June 2007, there were only 109 companies listed in "B" shares with total capitalization of 151.61 billion, comparing 14,048 billion of capitalization and 1,357 listed companies in "A" share markets.[1]

On December 11th 2001, China was finally accepted by WTO after years of negotiation. In order to be in consistent with other countries in the WTO, China has committed to undertake significant accession in moving its financial protection and opening its market to foreign investors through the elimination of many existing limitations on market access. With regard to equity industry, China made four sets of WTO commitments: (a) Enable foreign security firms to take part in the "B" share transaction directly rather than throughout the intermediate of Chinese institutions; (b) Approve qualified foreign security firms that locate in China to be the special membership in both Shanghai and Shenzhen Stock Exchange; (c) After December 11th 2003 foreign securities firms could be permitted to establish foreign-invested, PRC-domiciled securities companies which are to be authorized to undertake underwriting of "A" share, underwriting and trading of "B" share, overseas-listed "H" shares, government and corporate bonds (provided that foreign registered capital or equity investment could not exceed 33.3%); (d) Foreign investment in PRC-domiciled securities investment fund management firms are also supposed to be permitted, with foreign registered capital or equity investment in such fund managers not to exceed 33.3% initially and then, after December 11th 2004, not to exceed 49%

Consequently in June 2002, the China Securities Regulatory Commission (CSRC) proclaimed "Regulations on the Establishment of Securities Companies with Foreign Equity Participation" and "Regulations on the Establishment of Fund Management

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[1] According data compiled from monthly market overview of Shanghai and Shenzhen Stock Exchange (June 2007). http://www.sse.com.cn/ps/zhs/yjcb/ybtj/sse_stat_monthly_200706.pdf and http://www.sse.org.cn/main/images/2007/07/04/364719861938.html

Companies with Foreign Equity Participation", which are considered as the promising milestones officially in the integration of China equity market, although several systemic transformations such as the deduction in untradeable state-owned "A" shares have been take before. After forwards, several important laws and regulations, for instance, the Qualified Foreign Institutional Investors (QFII) scheme, were authorized and implemented in order to release constrains for foreign investors to participate in the major "A" share market of China. In April 2005, CSRC launched new reform to release its untradeable stated-owned shares onto the stock market. The market has been soaring at its fastest pace since then.

It is generally assumed that such financial liberalization improves market conditions for efficiency because local and global investors are supposed to have more access to information and the market is supposed to be more transparent due to the systemic reforms. Research by Bekaert and Harvey (2002) find that generally equity flow on emerging market increases by 1.4% of market capitalization after liberalization. Then there would be a spur in stock prices upon announcement of market integration, followed by a mild price appreciation until the liberalization is implemented, as shown in figure 1.

Furthermore, one-year's interval, that is a year before and a year after the breaking point, is presumed due to the fact that market opening is usually a gradual process with a pre-period of high expected return and a post-period of moderate asset inflation. Notwithstanding on the other hand, it is also sometimes argued that information inefficiency is more prevailing in an internationalized market than in a closed market, as the information asymmetry problem, agent-principal conflicts might be more severe with the process of liberalization. Based on these arguments, this paper explores whether portfolio formation strategy is still profitable in China stock market after its liberalization. It arbitrarily takes June 2002 as the breaking point of financial liberalization and focus on investigating the market and individual stock performance after year 2003.

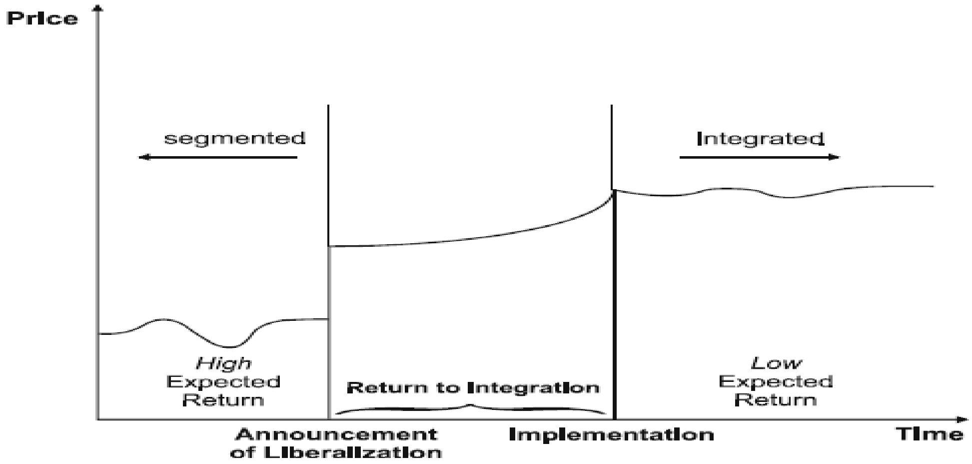

Figure 1: Market Integration and Assets Pricing, source from Bekaert and Harvey (2002)

3. Data and Methodology

3.1. Methodology

Basically logarithm continuously compounded return is employed in our tests, thus its additive properties can be employed in our analysis.

3.1.1. Market Efficient Tests

According to Fama (1970), if the stock indices follow a random walk process, then markets is asserted to be weak form efficient. This is given by

$$p_t = \alpha p_{t-1} + \beta + \varepsilon_t$$

where p_t is the logarithm of the stock index at time t, and α, β are coefficient and drift parameters that can be estimated.

The random walk hypothesis requires that 1) α=1, implying $p_t = p_{t-1} + \beta + \varepsilon_t$. Hence the presence of one unit root in logarithm stock price is a necessary condition that results random walk. 2) estimation residuals ε_t are assumed to have zero mean and independent to each other, that is, $\varepsilon_t \sim NID\left(0, \sigma^2\right)$. We therefore first examine the indices series by unit root and autocorrelation tests.

In general if stock prices are found to be integrated at 1st order and the estimated innovations are normally distributed, we can say that the series follows random walk and the information affects market efficiently. However, a number of papers, have found the properties of time-varying volatility in financial time series and normally distributed stock prices, or lognormally distributed logarithm stock prices, would deviate to the independent and identical distribution due to the presence of heteroscedasticity. To eliminate such errors in test results and obtain a more precisely formulated test on the market efficiency, we then examine the predictability of stock returns using Lo and MacKinlay (1988) signal variance ratio tests, which investigate the correlation between return variances of different time intervals. By denoting *k*-interval cumulative return for indices:

$$r_t(k) \equiv p_t - p_{t-k} = LnP_t - LnP_{t-k}$$

The variance ratio *VR* (*k*) is defined as:

$$VR(k) = \frac{Var[r_t(k)]}{kVar[r_t(1)]} = 1 + 2\sum_{j=1}^{k-1}(1 - \frac{j}{k})\rho_j$$

where $Var[r_t(\cdot)]$ is the variance of returns in any *k* intervals, and ρ_j is the j^{th} serial correlation coefficient. The observations intervals *k* are in general 2, 4, 8, 12, 24, 48 for weekly sample, and 3, 5, 10, 20, 40, 60, 120, 240 for daily sample.

Since the Random Walk Hypothesis suggest that the increments are uncorrelated over all lags, the series follow a random walk if *VR* (*k*) =1 is holding for all *k*. Alternatively, *VR* (*k*) greater than one implies momentum dynamic and values that are less than one implies mean reversion.

In estimating the unbiased estimator of variances, given:

$$\widehat{Var[r_t(k)]} = \frac{1}{m}\sum_{j=k}^{nk}(p_j - p_{j-k} - k\widehat{\mu})^2 ,$$

in which $\widehat{\mu}$ is the Maximum likelihood estimator of mean μ :

$$\widehat{\mu} = \frac{1}{nk}\sum_{j=1}^{nk}(p_j - p_{j-1}) = \frac{1}{nk}(p_{nk} - p_0) ,$$

and $m = (nk - k + 1)(1 - \frac{k}{nk})$.

Particularly we can get the unbiased estimator for one-period variance:

$$\widehat{Var[r_t(1)]} = \frac{1}{nk-1}\sum_{j=1}^{nk}(p_j - p_{j-1} - \widehat{\mu})^2$$

Adopting above unbiased estimators, we can get the test statistic derived by Lo and MacKinlay (1988):

$$\overline{M}_r(k) \equiv \frac{\widehat{Var[r_t(k)]}}{k\widehat{Var[r_t(1)]}} - 1$$

which is asymptotically distributed as

$$\sqrt{nk}\,\overline{M}_r(k)/\sqrt{\widehat{\theta}_1} \sim N(0,1)$$

under the null hypothesis of a homoskedastic increments random walk. Where,

$$\widehat{\theta}_1 = \frac{2(2k-1)(k-1)}{3k}$$

Also under the assumption that the time-varying volatilities might cause the implausible rejection of random walk hypothesis, we computed the second test statistic, heteroskedasticity-consistent test, with asymptotically distribution as:

$$\sqrt{nk}\,\overline{M}_r(k)/\sqrt{\widehat{\theta}_2} \sim N(0,1)$$

Estimator of $\widehat{\theta}_2$ is: $\widehat{\theta}_2 = \sum_{j=1}^{k-1}\left[\frac{2(k-j)}{k}\right]^2 \cdot \widehat{\delta}(j)$ and

$$\widehat{\delta}(j) = \frac{\sum_{t=j+1}^{nk}(p_t - p_{t-1} - \widehat{\mu})^2(p_{t-j} - p_{t-j-1} - \widehat{\mu})^2}{\left[\sum_{t=1}^{nk}(p_t - p_{t-1} - \widehat{\mu})^2\right]^2}$$

Both homoskedastic and heteroskedasticity-consistent tests results are compared in our study.

3.1.2. Momentum and Contrarian Strategy Tests

To examine whether abnormal returns can be produced by momentum and contrarian strategy in China stock market, we use the portfolio formation method of and Jegadeesh and Titman (1993, 2001). Each strategy is simulated based on ranking stock performance over past *n* formation period, selecting five individual stocks for “winner” group and another five for “loser” group, observing average return of each group over *m* holding period. Following the classification of observation periods in market efficient tests, *n* and *m* equal to 1, 2, 4, 8, 12, 24, 48 for weekly data and 1, 3, 5, 10, 20, 40, 60, 120, 240 for daily data separately.

Again the definition of cumulative return is adapted on individual stocks’ performance comparison. Abnormal returns are assessed by the market-adjusted excess return which is calculated using Shanghai Exchange index for "A" shares. Therefore, for any formation period *n*, the cumulative market-adjusted excess return of stock *i* at time t is R*i,t* :

$$\widehat{CAR}_{i,t}(p) = (LnP_{i,t} - LnP_{i,t-p}) - (LnP_{m,t} - LnP_{m,t-p})$$

Similarly the return of portfolio after *m* period of holding is:

$$\widehat{CAR}_{i,t}(q) = (LnP_{i,t+q} - LnP_{i,t}) - (LnP_{m,t+q} - LnP_{m,t})$$

Every "Winner" groups are constructed by the equally-weighted stocks that have highest five, while "loser" groups consist of equally-weighted stocks with bottom lowest five cumulative returns, in each formation period. When several stocks are ranked at the same levels in formation period, single stock is chosen stochastically for each level but ensure that the selected one is unique among the portfolio component. One week (or one day in daily data) between the portfolio formation period and the holding period is skipped, in order to avoid some of the bid-ask spread and lagged reaction effects. Our final calculations contain average market-adjusted excess return of "winner" and "loser" group, as well as that of "winner-minus-loser" group, in holding period, and states related *t*-statistics with null hypothesis that the mean return of each group in holding period is equal to zero. To be consistent with the presence of both heteroskedasticity and autocorrelation in overlapping returns, Newey-West standard errors are used to compute the t-statistics[2].

3.2. Data

Daily and weekly index on common "A" shares trading in Shanghai Exchange during the interval of January 1993 to June 2007, that is 3804 working days and 758 working weeks, are collected from Thomson Datastream (TDS) to examine the efficiency of Shanghai market. The study concentrates on Shanghai Stock Exchange

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[2] According to "Introduction to Econometrics" (2nd edition) by Stock and Watson, the truncation parameter *m* is calculated following a rule of thumb that m equals to the integer of $0.75 \cdot N^{1/3}$, where N is the number of observations.

because it is much more preeminent than Shenzhen regarding to the market capitalization, turnover and number of listed securities etc. And most of the time China “A” share and “B” share markets response synchronously to macroeconomic information. For purpose of reference, contemporary price indices of Dow Jones Industrials of United States and Hang Seng Complex of Hong Kong from January 1993 to June 2007 are used in market efficient test as well, in which the former is believed as developed market and the latter is highly correlated to China markets in most cases.

Individual stock prices in Shanghai “A” share market from June 2003 to June 2007 are used in investment strategy tests. Also weekly and daily data are tested. All the prices have been adjusted for dividends, splits and seasoned equity offerings. With regard to the predictable influence of aftermarket price support in initial public offering, as well as the implementation of medium and long term strategies, only 486 companies that have been listed before May 2003 are included. As TDS repeats last trading data point during public holidays while market is actually closed, we handle this case as information missing and replace those duplicated data by the first quota after holidays.

4. Empirical Results

4.1. Descriptive Analysis

It is generally assumed that financial liberalization increases the size and liquidity of stock market. Figure 2 graphs the visual movement of Shanghai weekly “A” share index. It is clear that there is a decrease tendency after 2000 while a fierce boost since the mid of 2006. According to the figure of liberation described by Bekaert and Harvey (2002), it is no doubt that the spike taken place at the end of 2006 represents the actual announcement of liberalization that is adhered to a great extent of asset price appreciation.

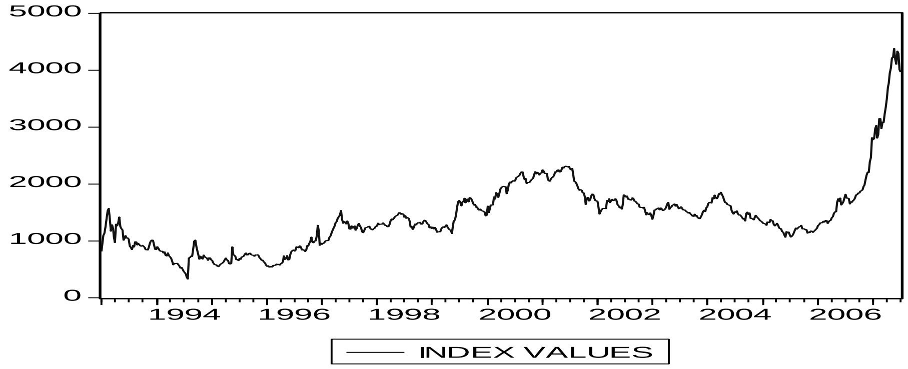

Figure 2: Weekly Shanghai "A" Share Market Performance during Jan 1993 to Jun 2007

For further study, we measured market size by the annually average value of market capitalization and the ratio of market capitalization to Gross Domestic Product (GDP), while annually turnover value and market turnover ratio which is defined as the trading value divided by market capitalization are considered as the indicators of market liquidity. We can see increase in the absolute value of market capitalization after year 2002, but the increase lags behind the national economic development. However the improvement in turnover ratio and ratio of floating market capitalization to total market capitalization implies more liquidity has been led into the market and the positive outcome of state-owned share transformation. (see Table1):

Year	Market Cap. (Billion Yuan)	Market Cap./GDP (%)	Turnover Value (Billion Yuan)	Turnover Ratio (%)	Floating Market Cap. (Billion Yuan)	Floating/Total Mkt Cap (%)
2002	4294.34	35.68	2799.05	65.18	1248.46	29.07
2003	4157.13	30.48	3211.53	77.25	1317.85	31.70
2004	4257.20	26.56	4233.40	99.44	1168.86	27.46
2005	3316.86	17.77	3166.31	95.46	1063.05	32.05
2006	5023.79	23.99	9046.88	180.08	1881.86	37.46

Table 1: Market Characteristics of China Stock Market of Year 2002-2006. Data comes from Thomson Datastream except floating market capitalization which is collected from the annually and monthly publication of Shanghai and Shenzhen Exchange.

Table 2 provides descriptive statistics for the returns of the three price indices: Shanghai “A” share, Dow Jones Industrials of United States and Hang Seng Complex of Hong Kong during the same sample period. Throughout the whole sampling period, both weekly and daily market returns of Shanghai “A” share exhibit larger mean and volatility than those corresponding of Hong Kong and United States, which indicates that the feature of market is higher return while more risks. Also it displays obvious "fat tail" comparing with the other two markets. Its kurtosis values (59.92 in weekly and 27.39 in daily) are much greater than those in Hong Kong and United States. All the characteristics reveal that Shanghai "A" share market is far away from those developed markets. In spite of that, the market appeared to perform much better after year 2001. It was generally in losing ground during event period while average return and volatility improved distinctly afterwards. Also its kurtosis reduced greatly close to the normal distribution.

Also it is obvious that Shanghai "A" share's daily fluctuation in before-event period is much higher than the other two markets, although this fluctuation was somehow flatted in weekly scale. From another point of view, it indicates that focus on short-term manipulation with holding period less than one week might gain higher return, as well as more risk, than those long-term investment, for instance keeping stocks more than one month.

Another observation of interest is the change in the Jarque-Bera test result. Except the tiny improvement in pre-event and post-event period of Shanghai weekly index, which might even be caused by small-sample error (can be partially convinced from the performance of Shanghai daily index), almost all the p-values are close to zero and upset the null hypothesis that sample data follows normal distribution. This implies that the traditional statistic tests results, test of serial correlation and unit-root tests for instance, might be insufficient to explain the market efficiency.

4.2. Unit Root Tests

In our research Augmented Dickey-Fuller (ADF) and Dickey-Fuller (DF) tests are applied to examine the presence of unit root in logarithm stock indices. Including trends or not does not change the results prominently. But for the purpose of simplicity, only test equations that include intercept while no trend are reported in the paper finally. The outcomes are summarized in Table 3. The null hypothesis that series has one unit root could not be rejected in Dow Jones Industrials and Hang Seng Complex at both daily and weekly basis in both ADF and DF tests. The significant rejection in 1st difference tests suggest that returns of each index is stationary. The cases in Shanghai “A” share index are not as unique as the other two markets. Generally, both the weekly and daily prices can not reject of null hypothesis, but their returns behave the opposite in DF test. The insignificant in Dickey-Fuller test at 1st order difference gives a hint that the weekly data probably should be integrated at even higher order. The little difference between the DF and the ADF in this case suggests that the more parsimonious model is to be preferred.

4.3. Residual Autocorrelation Tests

Since the existence of a unit root is only a necessary, but not a sufficient, indication for the unpredictability of stock behavior, we applied autocorrelation tests on regression residuals to detect whether the error terms are uncorrelated. We adapted three different types of autocorrelation tests, i.e. Durbin-Watson statistics, Serial Correlation Lagrange Multiplier tests and Ljung-Box Q-statistics tests. The results are found in Table 4. Again weekly data of the Shanghai “A” Share Index display independence in estimated residuals under estimator:

$$p_t = \alpha p_{t-1} + \beta + \varepsilon_t$$

But its daily data robustly reject the null hypothesis that no autocorrelation exists in residuals at 3rd and 4th order in Q-statistics tests, which implies somehow inefficient of markets. Also clues of improvement can be found by comparing its results in before-event period and after-event period, especially in the Lagrange Multiplier tests and Ljung-Box Q-statistics tests. Another point worth of notifying is the rejection in weekly Dow Jones Industrial, which is, in later variance ratio, proved to be the effect of time-varying volatility.

4.4. Variance Ratio Tests

Table 5 provides more numerical empirical results, Variance Ratio, for the three markets’ efficiency examination from observation period of year 1993 to 2007. Under the null hypothesis of random walk the variance ratio should equal to one and the test statistics are asymptotically normally distributed. Thus the higher probability value calculated according to normal distribution, less significant the test statistics is, and the null hypothesis can not be rejected.

Panel A of this table reports the results based on one week return, while panel B is based on daily returns. The observations intervals are in general 2-week, 4-week, 8-week, 12-week, 24-week, 48-week. Consequently the observation lags *k*=2, 4, 8, 12, 24, 48 (trading weeks) in panel A and *k*=10, 20, 40, 60, 120, 240 (trading days) in panel B separately. But for daily data, as shown above, the volatility in extremely short-term should not be omitted. We therefore estimated variance ratios for intervals 3-day and 5-day (1 week) as well in Panel B. The estimates of variance ratios are in the first row corresponding to market name. Homoskedasticity and heteroskedasticity test statistics are reported beneath each ratio.

In weekly panel, the random walk hypothesis can not be rejected at the usual 5% significant level for all the three markets, except the variance ratio for *k*=1, i.e. one-week in United States. However, the rejection might arise because of the time changing in variances, as the 0.1374 probability of heteroscedasticity is not significant in statistics. This probably can explain the rejection in its autocorrelation tests. The hypothesis also can not be rejected in daily panel for Hang Seng and Dow Jones Industrial. Moreover, both daily and weekly data signals that Hong Kong market has variance ratios larger than one and United States' are less than one. Following the definition of variance ratio that

$$VR(k) = \frac{Var[r_t(k)]}{kVar[r_t(1)]} = 1 + 2\sum_{j=1}^{k-1}(1 - \frac{j}{k})\rho_j$$

VR (k) greater than one implies positive serial correlation of r_t and values that are less than one implies negative autocorrelation. Hence Hong Kong market can be characterized as a stationary, mean-averting market, while United States is stationary but mean-reverting. However, for Shanghai market during the whole observation period from 1993 to 2007, the situation is much more complicated than the other two markets. Although test results are not significant in statistic, both daily and weekly data indicate that the variance ratios for the market are generally greater than one within one month's but less than one if more than one month of lags are detected. Moreover, the insignificance of test results implies that abnormal return might not be feasible by pure mean aversion-and-reversion strategy. The difference between homoskcedasticity and heteroscedasticity values also suggests that time-varying volatilities drive markets deviate to conventional efficient market hypothesis.

Table 6 provides the variance ratios computed for pre- and post-event periods in Shanghai market. Still relative weak evidences against the random walk are found, especially in the pre-event period. But post-event study, i.e. the observation period from 2003 to 2007, displays the daily and weekly data deliver similar information that the random walk hypothesis can not be rejected for lags less than 2 month, but later on the random walk hypothesis may not be supported. With the increasing observed lags, market appears to be more and more diverge from one even in heteroscedasticity test, where time-varying volatilities have been excluded.

The estimated variance ratios of Shanghai “A” share index greater than one suggest mean aversion is one important characteristic in Shanghai stock market after June 2003. The increasing variance ratios indicate the extension magnitude of mean aversion tends to increase with the number of observation intervals. Also note that at each aggregation level k variance ratios increase from pre-event period to post-event period. A plausible reason for increasing serial correlation might be the relaxation in liquidity control. Resulted from the loose of the government regulation in foreign direct investment, the cash-in flow by foreign investment banks and fund management companies positively affected market traded value and turnover ratio. Also reformations to release untradeable stated-owned shares onto the stock market after 2001 enlarged the market capitalization. Nevertheless, the “big jump” from negative serial correlation in pre-event period to positive ones in post-event period, especially for larger observation intervals, questions us if the market is adjusted too fast, or financial assets bubble is coming into being? This is probably another question of interest can be discovered in the future.

4.1. Momentum and Contrarian Strategy Tests

We process the momentum and contrarian strategy tests using the data from June 2003 to June 2007, after China participated into WTO. The results suggest that momentum strategy is not a profitable investment strategy in the post-liberation stage in China stock market. As shown in Table 7, nearly all the portfolios, no matter the relative strength “winner” or “loser” in formation periods, prove to be significant negative return at 5% statistic level after market return is subtracted. Some of them present positive returns but are not significant in statistics. For most of the parts loss is increasing with holding period extends. Therefore purely buying and holding a group of stocks according to their previous performance only results less than market return actually.

And in the “Zero cost” portfolios, which are long in winner assets and short in loser, also present excess returns less than zero. It signals that contrarian strategy is profitable with the existence of short-selling. Their significant levels improve with the increasing of holding periods. Weekly base shows significance after holding periods of more than 2 month, and daily base is significant within all the holding periods at 10% statistic level. The result diverges to that we concluded from the market efficient hypothesis tests, which indicates that the market is mean-aversion after 2003. One possible explanation is that composited stock index is employed in random walk tests while individual stock prices are observed and chosen according to their fluctuation level in momentum and contrarian portfolio formation. Stock index is usually affected by the price movement of big-cap shares which are difficult to manipulate. But prices of small-size firms are commonly much easier to be controlled and waved in a certain range. To find out numerical evidence to our suspicion, we investigated firms selected in portfolio formation and compared them with constituents composing SSE 180 Index which is also a benchmark reflecting Shanghai stock market for investment and financial innovation. The results are given in Table 8. Winner group usually contains more constituents than the loser. But for the most part, constituents occupy less than half of all the companies picked out in momentum and contrarian strategy tests.

Portfolio Formation Period	Number of Firms in Each Group	Winner Group		Loser Group	
		Number of Constituents	%	Number of Constituents	%
1 week	1055	212	20.09	221	20.95
2 week	1050	239	22.76	216	20.57
1 month	1040	267	25.67	194	18.65
2 month	1020	312	30.59	160	15.69
3 month	1000	340	34.00	132	13.20
6 month	940	348	37.02	146	15.53
1 year	820	423	51.59	92	11.22

Table 8: Proportion of constituents in portfolio selection

5. Summary and Conclusion

We worked on the weak-form tests of efficient market hypothesis and examined whether momentum/contrarian strategy is profitable in China "A" stock market after. Altogether the results of the study indicate that improvement can be found in the size and liquidity of market. Using both weekly and daily samples, we found that stock index in Shanghai Exchange "A" shares behaves insignificant mean-reversion before year 2001 while significant mean-aversion after year 2003. However, this does not necessarily imply that momentum strategy is useful for the market during year 2003 to 2007. Conversely contrarian strategy performs much better than momentum. One possible reason is that stock index is usually influenced by big-cap companies, while in momentum and contrarian strategy test more small-cap firms are selected to form portfolios as their prices waved in a larger range. Therefore the stock index and individual portfolios exhibit different characteristics in mean-aversion and reversion.

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Table 2: Descriptive Statistics of Stock Indices

The sample period is from 1st January 1993 to 6th July 2007. Break point for Shanghai market is 4th June 2002. Therefore, event window is set from the beginning of June 2001 to the end of May 2003. Before that is the pre-event window while after that is the post-event window. The pre-event window serves as the estimation window that provides reference to the analysis on the impact of financial integration to market performance.

Panel A: Market index results for a weekly base observation period

	9301-0706			**9301-0105**	**0106-0205**	**0206-0305**	**0306-0706**
	Shanghai	**Hongkong**	**United States**	**Shanghai**			
Mean	0.0021	0.0019	0.0019	0.0023	-0.0073	0.0008	0.0042
Median	0.0000	0.0027	0.0034	0.0008	-0.0031	0.0000	0.0007
Maximum	0.7563	0.1392	0.0809	0.7563	0.0878	0.1041	0.1331
Minimum	-0.2319	-0.1992	-0.1538	-0.2319	-0.0825	-0.0749	-0.0754
Std. Dev.	0.0534	0.0346	0.0212	0.0651	0.0309	0.0293	0.0312
Skewness	4.2532	-0.3854	-0.7405	4.0196	0.2063	0.6115	0.5299
Kurtosis	59.9182	6.0019	7.6556	46.7878	4.2031	5.3078	4.7033
Jarque-Bera	104467.2	303.0	752.8	36171.4	3.5	14.8	35.7
Probability	0.0000	0.0000	0.0000	0.0000	0.1733	0.0006	0.0000
Studentized Stat.	18.4920	9.7719	11.0571	15.1726	5.5079	6.1127	6.6763

Panel B: Market index results for a daily base observation period

	9301-0706			**9301-0105**	**0106-0205**	**0206-0305**	**0306-0706**
	Shanghai	**Hongkong**	**United States**	**Shanghai**			
Mean	0.0004	0.00036	0.00037	0.0005	-0.0015	0.0002	0.0009
Median	0.0000	0.00000	0.00026	0.0000	-0.0002	0.0000	0.0001
Maximum	0.3085	0.17247	0.06155	0.3085	0.0940	0.0884	0.0790
Minimum	-0.1843	-0.14735	-0.07455	-0.1843	-0.0651	-0.0306	-0.0926
Std. Dev.	0.0229	0.01576	0.00977	0.0275	0.0163	0.0125	0.0143
Skewness	1.4073	0.05876	-0.27421	1.3921	0.6856	1.7758	-0.3849
Kurtosis	27.3841	13.70278	8.29487	22.3058	9.4906	13.6618	7.7647
Jarque-Bera	94924.9	18048.5	4464.2	34796.7	478.6	1368.1	1034.7
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Studentized Stat.	21.4959	20.2930	13.9343	17.9191	9.7285	9.5468	12.0301

Table 3: Unit Root Tests Results for Market Indices

Logarithm weekly and daily indices are tested for the presence of unit root using both Augmented Dickey-Fuller (ADF) and Dickey-Fuller (DF) tests with intercept but no trends. Also first difference of logarithm data are tested in the same methods. Test critical values at 5% significant level.

Panel A: Unit Root Test using weekly data

	9301-0706			**9301-0105**	**0106-0205**	**0206-0305**	**0306-0706**
	Shanghai	**Hongkong**	**United States**	**Shanghai**			
ADF(level)	-0.9500	-2.0663	-1.6622	-1.2605	-1.6271	-1.6724	1.9221
Critical Value	-2.8651	-2.8651	-2.8651	-2.8679	-2.9188	-2.9200	-2.8749
ADF(1st diff.)	-27.1614*	-26.7429*	-29.8948*	-20.8203*	-6.5656*	-6.6330*	-13.7607*
Critical Value	-2.8651	-2.8651	-2.8651	-2.8679	-2.9200	-2.9212	-2.8750
DF(level)	0.1166	0.6361	1.4123	-0.6715	-0.1985	-1.6896	1.8370
Critical Value	-1.9412	-1.9412	-1.9412	-1.9415	-1.9472	-1.9474	-1.9423
DF(1st diff.)	-0.6433	-26.7154*	-2.6167*	-1.3727	-6.5413*	-5.9909*	-5.6320*
Critical Value	-1.9413	-1.9412	-1.9412	-1.9416	-1.9474	-1.9475	-1.9423

Panel B: Unit Root Test using daily data

	9301-0706			**9301-0105**	**0106-0205**	**0206-0305**	**0306-0706**
	Shanghai	**Hongkong**	**United States**	**Shanghai**			
ADF(level)	-0.7752	-2.2596	-1.6706	-1.1330	-1.6919	-1.6412	1.9357
Critical Value	-2.8621	-2.8621	-2.8621	-2.8627	-2.8725	-2.8725	-2.8640
ADF(1st diff.)	-25.1408*	-33.1368*	-61.8025*	-48.0232*	-16.2881*	-15.0976*	-32.6902*
Critical Value	-2.8621	-2.8621	-2.8621	-2.8627	-2.8727	-2.8727	-2.8641
DF(level)	0.1749	0.4614	1.4072	-0.4625	0.3079	-1.3635	1.8498
Critical Value	-1.9409	-1.9409	-1.9409	-1.9410	-1.9421	-1.9421	-1.9411
DF(1st diff.)	-1.5053	-4.1869*	-59.2010*	-1.4254	-14.9874*	-14.0016*	-2.5908*
Critical Value	-1.9409	-1.9409	-1.9409	-1.9410	-1.9421	-1.9421	-1.9411

Table 4: Autocorrelation Tests Results for Market Indices

Logarithm weekly and daily indices are tested using Durbin-Watson (DW), Lagrange multiplier (LM), and Ljung-Box Q-statistics tests with null hypothesis that the null hypothesis that there is no autocorrelation in estimated residuals. Autocorrelations of the equation residuals up to 4^{th} lags are presented with underlines. Presume significant rejection level at 5%.

Panel A: Residuals Autocorrelation Test using weekly data

		9301-0706			**9301-0105**	**0106-0205**	**0206-0305**	**0306-0706**
		Shanghai	**Hongkong**	**United States**	**Shanghai**			
DW Stat.		1.9546	1.9395	2.1688	1.9650	1.8636	1.8074	1.9448
F value of LM		0.9933	2.3255	3.1432*	0.7744	0.7860	0.8999	0.3417
	Prob.	*0.3708*	*0.0984*	*0.0437*	*0.4616*	*0.4614*	*0.4133*	*0.7110*
Autocorrelation Order								
1st		0.0180	0.0300	-0.0850	0.0130	0.0580	0.0940	0.0080
	Q Value	0.2541	0.6696	5.5513*	0.0716	0.1833	0.4900	0.0126
	Prob.	*0.6140*	*0.4130*	*0.0180*	*0.7890*	*0.6690*	*0.4840*	*0.9110*
2nd		-0.0460	0.0700	0.0390	-0.0580	-0.1630	-0.1530	0.0710
	Q Value	1.8333	4.4367	6.7302*	1.5403	1.6667	1.7976	1.0972
	Prob.	*0.4000*	*0.1090*	*0.0350*	*0.4630*	*0.4350*	*0.4070*	*0.5780*
3rd		0.0490	-0.0130	-0.0050	0.0390	-0.0040	0.1130	0.0920
	Q Value	3.7003	4.5639	6.7493	2.2308	1.6678	2.5314	2.9590
	Prob.	*0.2960*	*0.2070*	*0.0800*	*0.5260*	*0.6440*	*0.4700*	*0.3980*
4th		0.0090	0.0150	-0.0440	0.0060	0.1380	-0.0510	-0.0240
	Q Value	3.7650	4.7333	8.2590	2.2476	2.7884	2.6840	3.0878
	Prob.	*0.4390*	*0.3160*	*0.0830*	*0.6900*	*0.5940*	*0.6120*	*0.5430*

(Continuation of Table 4)

Panel B: Residuals Autocorrelation Test using daily data

		9301-0706		9301-0105	0106-0205	0206-0305	0306-0706
	Shanghai	Hongkong	United States	Shanghai			
DW Stat.	2.0380	1.9513	2.0111	2.0488	2.0309	1.8781	2.0062
F value of LM	1.5834	2.9254	1.5320	1.5303	0.4787	0.3883	0.0511
Prob.	*0.2054*	*0.0538*	*0.2162*	*0.2167*	*0.6202*	*0.6786*	*0.9502*
Autocorrelation Order							
1st	-0.0200	0.0250	-0.0060	-0.0250	-0.0160	0.0550	-0.0030
Q Value	1.5162	2.3642	0.1202	1.3749	0.0660	0.7916	0.0120
Prob.	*0.2180*	*0.1240*	*0.7290*	*0.2410*	*0.7970*	*0.3740*	*0.9130*
2nd	0.0210	-0.0300	-0.0280	0.0280	-0.0590	0.0020	-0.0090
Q Value	3.2324	5.6725	3.0503	3.1416	0.9714	0.7927	0.1024
Prob.	*0.1990*	*0.0590*	*0.2180*	*0.2080*	*0.6150*	*0.6730*	*0.9500*
3rd	0.0570	0.0790	-0.0180	0.0620	-0.0610	0.0400	0.0480
Q Value	15.5560*	29.5740*	4.2905	11.7300*	1.9607	1.2113	2.6102
Prob.	*0.0010*	*0.0000*	*0.2320*	*0.0080*	*0.5810*	*0.7500*	*0.4560*
4th	0.0410	-0.0220	-0.0020	0.0410*	0.0040	0.0960	0.0410
Q Value	21.9660*	31.3340*	4.2996	15.3950	1.9650	3.6850	4.3878
Prob.	*0.0000*	*0.0000*	*0.3670*	*0.0040*	*0.7420*	*0.4500*	*0.3560*

Table 5: Variance Ratio Test for horizontal comparison

Numbers that decorated with underlines are the result of variance ratio test, VR (k). Homoskedasticity and heteroskedasticity test statistics are reported beneath each VR (k). Corresponding *p*-values are calculated and presented in Italic font style. Presume significant rejection level at 5%.

Panel A: Variance Ratio at weekly base

Observation Period		**Number *k* of base observations (lags) aggregated to form variance ratio**					
199301-200706		2week	4week	8week	12week	24week	48week
Shanghai		1.0135	0.9766	0.9136	0.8554	0.8297	0.7678
	Z-Ho.	0.3721	-0.3435	-0.8036	-1.0615	-0.8552	-0.8111
	Prob.	*0.7098*	*0.7313*	*0.4216*	*0.2885*	*0.3924*	*0.4173*
	Z-He.	0.2265	-0.2093	-0.4852	-0.6450	-0.5586	-0.5933
	Prob.	*0.8208*	*0.8342*	*0.6275*	*0.5189*	*0.5764*	*0.5530*
Hong Kong		1.0279	1.1046	1.1411	1.1820	1.0543	1.2051
	Z-Ho.	0.7690	1.5380	1.3126	1.3354	0.2725	0.7166
	Prob.	*0.4419*	*0.1240*	*0.1893*	*0.1817*	*0.7852*	*0.4736*
	Z-He.	0.6431	1.3087	1.1051	1.1134	0.2245	0.5977
	Prob.	*0.5202*	*0.1906*	*0.2691*	*0.2655*	*0.8224*	*0.5500*
United States		0.9172	0.9165	0.8291	0.7625	0.7098	0.7872
	Z-Ho.	-2.2789*	-1.2285	-1.5893	-1.7427	-1.4573	-0.7435
	Prob.	*0.0227*	*0.2193*	*0.1120*	*0.0814*	*0.1450*	*0.4572*
	Z-He.	-1.4854	-0.8597	-1.1840	-1.3472	-1.1979	-0.6362
	Prob.	*0.1374*	*0.3900*	*0.2364*	*0.1779*	*0.2310*	*0.5246*

(Continuation of Table 5)

Panel B: Variance Ratio at daily base

Observation Period		**Number *k* of base observations (lags) aggregated to form variance ratio**							
199301-200706		3day	1week	2week	4week	8week	12week	24week	48week
Shanghai		0.9865	1.0542	1.0863	1.0886	0.9986	0.9500	0.9069	0.8286
	Z-Ho.	-0.5581	1.5199	1.5721	1.0963	-0.0121	-0.3478	-0.4554	-0.5912
	Prob.	*0.5768*	*0.1285*	*0.1159*	*0.2729*	*0.9903*	*0.7280*	*0.6488*	*0.5544*
	Z-He.	-0.2296	0.5843	0.6136	0.4746	-0.0060	-0.1834	-0.2668	-0.3904
	Prob.	*0.8184*	*0.5590*	*0.5395*	*0.6351*	*0.9952*	*0.8545*	*0.7896*	*0.6962*
Hong Kong		1.0130	1.0583	1.0285	1.0924	1.1033	1.1506	1.0216	1.1653
	Z-Ho.	0.5358	1.6375	0.5192	1.1429	0.8867	1.0483	0.1055	0.5699
	Prob.	*0.5921*	*0.1015*	*0.6036*	*0.2531*	*0.3752*	*0.2945*	*0.9160*	*0.5687*
	Z-He.	0.2363	0.7573	0.2572	0.6323	0.5475	0.6817	0.0729	0.4218
	Prob.	*0.8132*	*0.4489*	*0.7970*	*0.5272*	*0.5840*	*0.4954*	*0.9419*	*0.6732*
United States		0.9750	0.9447	0.8807	0.8634	0.7822	0.7200	0.6740	0.7501
	Z-Ho.	-1.0332	-1.5528	-2.1729*	-1.6901	-1.8690	-1.9493	-1.5946	-0.8615
	Prob.	*0.3015*	*0.1205*	*0.0298*	*0.0910*	*0.0616*	*0.0513*	*0.1108*	*0.3890*
	Z-He.	-0.6914	-1.0310	-1.4617	-1.1658	-1.3430	-1.4390	-1.2318	-0.6971
	Prob.	*0.4893*	*0.3025*	*0.1438*	*0.2437*	*0.1793*	*0.1502*	*0.2180*	*0.4857*

Table 6: Variance Ratio Test for vertical comparison

Numbers that decorated with underlines are the result of variance ratio test, VR (k). Homoskedasticity and heteroskedasticity test statistics are reported beneath each VR (k). Corresponding *p*-values are calculated and presented in Italic font style. Presume significant rejection level at 5%.

Panel A: Variance Ratio at weekly base

Market	**Number *k* of base observations (lags) aggregated to form variance ratio**					
Shanghai	2week	4week	8week	12week	24week	48week
Observation Period						
199301-200106	0.9977	0.9301	0.8178	0.7050	0.5953	0.4796
Z-Ho.	-0.0488	-0.7814	-1.2890	-1.6467	-1.5457	-1.3829
Prob.	*0.9611*	*0.4346*	*0.1974*	*0.0996*	*0.1222*	*0.1667*
Z-He.	-0.0322	-0.5116	-0.8456	-1.0967	-1.1187	-1.1294
Prob.	*0.9743*	*0.6089*	*0.3978*	*0.2728*	*0.2633*	*0.2587*
200306-200706	1.0605	1.2477	1.6763*	2.0768*	2.9222*	4.2959*
Z-Ho.	0.8835	1.9322	3.3368	4.1917	5.1195	6.1083
Prob.	*0.3770*	*0.0533*	*0.0008*	*0.0000*	*0.0000*	*0.0000*
Z-He.	1.0547	1.9148	3.0637	3.7914	4.7519	5.9601
Prob.	*0.2916*	*0.0555*	*0.0022*	*0.0001*	*0.0000*	*0.0000*

Panel B: Variance Ratio at daily base

Market	**Number *k* of base observations (lags) aggregated to form variance ratio**							
Shanghai	3day	1week	2week	1month	2month	3month	6month	1year
Observation Period								
199301-200106	0.9849	1.0603	1.0985	1.0839	0.9283	0.8287	0.6951	0.5632
Z-Ho.	-0.4752	1.2896	1.3670	0.7908	-0.4684	-0.9084	-1.1360	-1.1473
Prob.	*0.6346*	*0.1972*	*0.1716*	*0.4291*	*0.6395*	*0.3637*	*0.2560*	*0.2513*
Z-He.	-0.2164	0.5481	0.5899	0.3788	-0.2557	-0.5316	-0.7395	-0.8436
Prob.	*0.8287*	*0.5836*	*0.5553*	*0.7048*	*0.7982*	*0.5950*	*0.4596*	*0.3989*
200306-200706	0.9930	1.0416	1.0426	1.2287	1.6334*	2.0210*	2.8233*	4.0793*
Z-Ho.	-0.1528	0.6197	0.4121	1.5016	2.8845	3.7725	4.7336	5.6353
Prob.	*0.8786*	*0.5355*	*0.6803*	*0.1332*	*0.0039*	*0.0002*	*0.0000*	*0.0000*
Z-He.	-0.1194	0.4825	0.3288	1.2463	2.4490	3.2640	4.2830	5.4058
Prob.	*0.9050*	*0.6295*	*0.7423*	*0.2127*	*0.0143*	*0.0011*	*0.0000*	*0.0000*

Table 7: Momentum and Contrarian Strategy Test for Individual Stocks

The strategy is simulated based on *p*-month logarithm return and held for *q* months. Numbers that decorated with underlines are the average excess returns of portfolios within holding periods of *q*. Heteroskedasticity and autocorrelation *t*-statistics are reported under each mean value. Corresponding p-values are calculated and presented in Italic font style. The truncation parameter *m* in calculating Newey-West standard errors are 4 for weekly data and 7 for daily data.

Panel A: Abnormal Return from Portfolio Selection on weekly basis

Market			**Number *q* of base observations (lags)for portfolio holding period**						
		Shanghai	1 week	2 week	1 month	2 month	3 month	6 month	1 year
Formation Period *(p)*									
1 w	**W**	Mean	-0.0034	-0.0094	-0.0278	-0.0392	-0.0561	-0.1063	-0.1673
		T-stat.	-1.2533	-2.0000	-3.4317	-3.1036	-3.4925	-5.8263	-8.6859
		Prob.	*0.2115*	*0.0468*	*0.0007*	*0.0022*	*0.0006*	*0.0000*	*0.0000*
	L	Mean	-0.0091	-0.0142	-0.0198	-0.0319	-0.0506	-0.0803	-0.1667
		T-stat.	-3.2921	-2.7676	-2.3293	-2.4576	-3.2141	-3.9021	-8.8008
		Prob.	*0.0012*	*0.0062*	*0.0208*	*0.0148*	*0.0015*	*0.0001*	*0.0000*
	W-L	Mean	0.0014	-0.0041	-0.0266	-0.0462	-0.0648	-0.1399	-0.1607
		T-stat.	0.3445	-0.5357	-2.4840	-2.4792	-2.4548	-3.0488	-2.3063
		Prob.	*0.7308*	*0.5927*	*0.0138*	*0.0140*	*0.0150*	*0.0026*	*0.0224*
2 w	**W**	Mean	-0.0032	-0.0109	-0.0280	-0.0443	-0.0668	-0.1022	-0.1794
		T-stat.	-1.1976	-2.3367	-3.3933	-3.7320	-4.5375	-4.5628	-10.0221
		Prob.	*0.2324*	*0.0204*	*0.0008*	*0.0002*	*0.0000*	*0.0000*	*0.0000*
	L	Mean	-0.0107	-0.0170	-0.0226	-0.0362	-0.0511	-0.0866	-0.1694
		T-stat.	-3.2160	-2.9246	-2.4860	-2.5675	-3.0064	-3.9054	-7.6110
		Prob.	*0.0015*	*0.0038*	*0.0137*	*0.0110*	*0.0030*	*0.0001*	*0.0000*
	W-L	Mean	0.0030	-0.0029	-0.0243	-0.0474	-0.0758	-0.1304	-0.1710
		T-stat.	0.6084	-0.3572	-2.0401	-2.3188	-2.6601	-2.7755	-2.2537
		Prob.	*0.5436*	*0.7213*	*0.0426*	*0.0214*	*0.0085*	*0.0061*	*0.0256*
1m	**W**	Mean	-0.0040	-0.0092	-0.0243	-0.0404	-0.0554	-0.0963	-0.1727
		T-stat.	-1.5820	-1.8814	-3.0823	-3.4209	-3.5566	-3.8355	-8.4513
		Prob.	*0.1152*	*0.0613*	*0.0023*	*0.0008*	*0.0005*	*0.0002*	*0.0000*
	L	Mean	-0.0068	-0.0114	-0.0138	-0.0269	-0.0448	-0.0977	-0.1718
		T-stat.	-1.9556	-1.8056	-1.3224	-1.5703	-2.1813	-4.4275	-6.9101
		Prob.	*0.0519*	*0.0725*	*0.1875*	*0.1179*	*0.0304*	*0.0000*	*0.0000*
	W-L	Mean	-0.0016	-0.0068	-0.0296	-0.0537	-0.0721	-0.1149	-0.1638
		T-stat.	-0.3512	-0.8355	-2.2434	-2.3117	-2.3656	-2.3656	-2.0396
		Prob.	*0.7258*	*0.4044*	*0.0260*	*0.0218*	*0.0190*	*0.0191*	*0.0431*
2 m	**W**	Mean	-0.0084	-0.0131	-0.0212	-0.0396	-0.0579	-0.0757	-0.1349
		T-stat.	-3.5882	-3.0856	-3.1203	-3.2162	-3.7878	-2.9458	-5.8965
		Prob.	*0.0004*	*0.0023*	*0.0021*	*0.0015*	*0.0002*	*0.0037*	*0.0000*

	L	Mean	-0.0080	-0.0135	-0.0171	-0.0286	-0.0450	-0.1134	-0.1937
		T-stat.	-1.9773	-1.8534	-1.3243	-1.3407	-1.7458	-4.2143	-6.4690
		Prob.	*0.0494*	*0.0653*	*0.1869*	*0.1816*	*0.0825*	*0.0000*	*0.0000*
	W-L	Mean	-0.0051	-0.0091	-0.0244	-0.0533	-0.0773	-0.0804	-0.1095
		T-stat.	-0.9452	-0.9429	-1.4684	-1.9411	-2.1054	-1.4949	-1.3034
		Prob.	*0.3457*	*0.3468*	*0.1436*	*0.0537*	*0.0366*	*0.1367*	*0.1944*
3 m	**W**	Mean	-0.0073	-0.0153	-0.0288	-0.0484	-0.0536	-0.0583	-0.1229
		T-stat.	-2.9624	-3.2747	-3.6766	-3.5221	-3.0923	-2.1266	-5.7023
		Prob.	*0.0034*	*0.0013*	*0.0003*	*0.0005*	*0.0023*	*0.0349*	*0.0000*
	L	Mean	-0.0048	-0.0065	-0.0074	-0.0132	-0.0230	-0.0913	-0.1689
		T-stat.	-0.9651	-0.7469	-0.4700	-0.5418	-0.7941	-3.0995	-4.9781
		Prob.	*0.3357*	*0.4560*	*0.6389*	*0.5886*	*0.4282*	*0.0023*	*0.0000*
	W-L	Mean	-0.0075	-0.0188	-0.0428	-0.0794	-0.0980	-0.0846	-0.1273
		T-stat.	-1.1798	-1.6745	-2.1393	-2.5520	-2.6087	-1.5002	-1.4685
		Prob.	*0.2395*	*0.0956*	*0.0337*	*0.0115*	*0.0098*	*0.1354*	*0.1441*
6 m	**W**	Mean	-0.0050	-0.0096	-0.0136	-0.0147	-0.0095	-0.0157	-0.0853
		T-stat.	-1.6043	-1.6050	-1.4212	-1.0377	-0.5188	-0.4775	-2.6253
		Prob.	*0.1103*	*0.1102*	*0.1570*	*0.3008*	*0.6046*	*0.6336*	*0.0096*
	L	Mean	-0.0001	-0.0016	-0.0067	-0.0156	-0.0209	-0.0706	-0.1074
		T-stat.	-0.0182	-0.1742	-0.4638	-0.8040	-0.8944	-2.7632	-2.9970
		Prob.	*0.9855*	*0.8619*	*0.6434*	*0.4224*	*0.3723*	*0.0064*	*0.0032*
	W-L	Mean	-0.0103	-0.0187	-0.0291	-0.0431	-0.0524	-0.0570	-0.1672
		T-stat.	-1.7651	-1.7994	-1.6587	-1.6344	-1.5400	-1.0013	-1.7376
		Prob.	*0.0792*	*0.0736*	*0.0989*	*0.1039*	*0.1254*	*0.3182*	*0.0845*
1 y	**W**	Mean	-0.0010	-0.0020	-0.0039	-0.0032	0.0087	0.0140	-0.0657
		T-stat.	-0.3312	-0.3369	-0.3590	-0.1670	0.3381	0.3371	-1.7858
		Prob.	*0.7409*	*0.7367*	*0.7201*	*0.8676*	*0.7358*	*0.7366*	*0.0768*
	L	Mean	-0.0001	-0.0036	-0.0081	-0.0098	-0.0210	-0.0354	-0.0466
		T-stat.	-0.0133	-0.5205	-0.6718	-0.5146	-0.9370	-1.3091	-0.9975
		Prob.	*0.9894*	*0.6035*	*0.5027*	*0.6076*	*0.3503*	*0.1927*	*0.3206*
	W-L	Mean	-0.0065	-0.0095	-0.0197	-0.0447	-0.0492	-0.1050	-0.2967
		T-stat.	-1.1752	-0.9620	-1.1445	-1.8203	-1.5238	-1.7058	-2.5188
		Prob.	*0.2416*	*0.3375*	*0.2541*	*0.0707*	*0.1297*	*0.0903*	*0.0132*

(Continuation of Table 7)

Market			**Number *q* of base observations (lags)for portfolio holding period**								
		Shanghai	1 day	3 day	1 week	2 week	1 month	2 month	3 month	6 month	1 year
Formation Period (*p*)											
1d	**W**	Mean	-0.0022	-0.0049	-0.0097	-0.0140	-0.0275	-0.0445	-0.0616	-0.1126	-0.1883
		T-stat.	-2.5487	-2.7846	-3.8088	-3.5642	-4.5769	-5.3065	-5.6812	-9.8539	-15.6800
		Prob.	*0.0110*	*0.0055*	*0.0001*	*0.0004*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	L	Mean	-0.0030	-0.0070	-0.0087	-0.0154	-0.0249	-0.0343	-0.0488	-0.0934	-0.1636
		T-stat.	-4.1945	-4.0221	-3.3508	-3.8617	-4.1529	-4.1650	-3.8396	-8.3968	-13.7125
		Prob.	*0.0000*	*0.0001*	*0.0008*	*0.0001*	*0.0000*	*0.0000*	*0.0001*	*0.0000*	*0.0000*
	W-L	Mean	0.0000	-0.0007	-0.0058	-0.0084	-0.0225	-0.0514	-0.0740	-0.1353	-0.1793
		T-stat.	-0.0343	-0.3297	-1.8875	-1.7587	-3.0488	-4.6895	-4.3772	-5.0791	-4.0391
		Prob.	*0.9727*	*0.7417*	*0.0594*	*0.0789*	*0.0024*	*0.0000*	*0.0000*	*0.0000*	*0.0001*
3d	**W**	Mean	-0.0005	-0.0039	-0.0069	-0.0104	-0.0262	-0.0470	-0.0660	-0.1121	-0.1893
		T-stat.	-0.6357	-2.1181	-2.6556	-2.6495	-4.3182	-5.8260	-6.6044	-9.3076	-14.9055
		Prob.	*0.5251*	*0.0344*	*0.0080*	*0.0082*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	L	Mean	-0.0015	-0.0036	-0.0058	-0.0141	-0.0215	-0.0335	-0.0480	-0.0955	-0.1792
		T-stat.	-2.1157	-2.0046	-2.2345	-3.5802	-3.6021	-4.0562	-3.9141	-7.8647	-13.4147
		Prob.	*0.0346*	*0.0453*	*0.0257*	*0.0004*	*0.0003*	*0.0001*	*0.0001*	*0.0000*	*0.0000*
	W-L	Mean	0.0000	-0.0031	-0.0058	-0.0062	-0.0247	-0.0549	-0.0795	-0.1333	-0.1650
		T-stat.	0.0446	-1.3135	-1.6916	-1.0983	-2.9703	-4.4904	-4.5055	-4.7448	-3.5514
		Prob.	*0.9644*	*0.1893*	*0.0910*	*0.2724*	*0.0030*	*0.0000*	*0.0000*	*0.0000*	*0.0004*
1w	**W**	Mean	-0.0018	-0.0052	-0.0071	-0.0097	-0.0273	-0.0464	-0.0669	-0.1152	-0.1899
		T-stat.	-2.5767	-2.8667	-2.6106	-2.3309	-4.3961	-5.5660	-6.4145	-9.2097	-13.9769
		Prob.	*0.0101*	*0.0042*	*0.0092*	*0.0200*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	L	Mean	-0.0004	-0.0026	-0.0060	-0.0169	-0.0222	-0.0357	-0.0507	-0.0964	-0.1770
		T-stat.	-0.4564	-1.4149	-2.2211	-3.9279	-3.3516	-4.0698	-4.0948	-7.2853	-12.2813
		Prob.	*0.6482*	*0.1574*	*0.0266*	*0.0001*	*0.0008*	*0.0001*	*0.0000*	*0.0000*	*0.0000*
	W-L	Mean	-0.0024	-0.0054	-0.0058	-0.0026	-0.0252	-0.0523	-0.0780	-0.1360	-0.1683
		T-stat.	-2.5207	-2.0999	-1.4917	-0.3884	-2.7342	-3.9983	-4.1164	-4.6037	-3.5684
		Prob.	*0.0119*	*0.0360*	*0.1361*	*0.6978*	*0.0064*	*0.0001*	*0.0000*	*0.0000*	*0.0004*
2w	**W**	Mean	-0.0019	-0.0038	-0.0060	-0.0079	-0.0265	-0.0451	-0.0658	-0.1117	-0.1940
		T-stat.	-2.5997	-2.0360	-2.1639	-1.8227	-4.1611	-5.3495	-6.4469	-8.0237	-13.5468
		Prob.	*0.0095*	*0.0420*	*0.0307*	*0.0687*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	L	Mean	-0.0011	-0.0050	-0.0092	-0.0174	-0.0235	-0.0346	-0.0512	-0.1030	-0.1807
		T-stat.	-1.6799	-2.7835	-3.3329	-3.6078	-3.1793	-3.4120	-4.1239	-7.1157	-11.0507
		Prob.	*0.0933*	*0.0055*	*0.0009*	*0.0003*	*0.0015*	*0.0007*	*0.0000*	*0.0000*	*0.0000*
	W-L	Mean	-0.0017	-0.0016	-0.0016	-0.0006	-0.0234	-0.0526	-0.0771	-0.1270	-0.1701
		T-stat.	-1.6104	-0.5644	-0.3500	-0.0796	-2.3158	-3.5890	-3.8498	-4.1305	-3.4844
		Prob.	*0.1076*	*0.5726*	*0.7264*	*0.9365*	*0.0208*	*0.0003*	*0.0001*	*0.0000*	*0.0005*
1m	**W**	Mean	-0.0018	-0.0049	-0.0080	-0.0127	-0.0279	-0.0438	-0.0640	-0.1148	-0.1890

		T-stat.	-2.7795	-2.9537	-3.1653	-3.1061	-4.5403	-5.0147	-6.0922	-7.4097	-12.4733
		Prob.	*0.0055*	*0.0032*	*0.0016*	*0.0020*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	L	Mean	-0.0005	-0.0020	-0.0043	-0.0094	-0.0138	-0.0261	-0.0396	-0.1078	-0.1884
		T-stat.	-0.7259	-0.9906	-1.3494	-1.7090	-1.6623	-2.2178	-2.7027	-7.4108	-10.8518
		Prob.	*0.4681*	*0.3221*	*0.1775*	*0.0878*	*0.0968*	*0.0268*	*0.0070*	*0.0000*	*0.0000*
	W-L	Mean	-0.0022	-0.0059	-0.0087	-0.0135	-0.0347	-0.0607	-0.0885	-0.1271	-0.1602
		T-stat.	-2.1082	-1.9898	-1.9250	-1.8477	-3.2297	-3.7567	-3.8652	-3.9859	-3.2949
		Prob.	*0.0353*	*0.0469*	*0.0545*	*0.0650*	*0.0013*	*0.0002*	*0.0001*	*0.0001*	*0.0010*
2m	**W**	Mean	-0.0029	-0.0067	-0.0107	-0.0171	-0.0274	-0.0483	-0.0648	-0.0908	-0.1562
		T-stat.	-5.0967	-4.5147	-4.8652	-4.9589	-5.4066	-5.4858	-6.1215	-5.5385	-9.7791
		Prob.	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	L	Mean	-0.0003	-0.0013	-0.0032	-0.0075	-0.0118	-0.0263	-0.0258	-0.1140	-0.1994
		T-stat.	-0.3287	-0.5786	-0.8945	-1.2076	-1.2026	-2.0248	-1.3896	-6.7363	-9.3555
		Prob.	*0.7425*	*0.5630*	*0.3713*	*0.2275*	*0.2294*	*0.0432*	*0.1650*	*0.0000*	*0.0000*
	W-L	Mean	-0.0036	-0.0085	-0.0127	-0.0202	-0.0373	-0.0673	-0.1065	-0.0990	-0.1222
		T-stat.	-3.3551	-2.7505	-2.6416	-2.4736	-2.8890	-3.6771	-3.7121	-2.8367	-2.3530
		Prob.	*0.0008*	*0.0061*	*0.0084*	*0.0136*	*0.0040*	*0.0002*	*0.0002*	*0.0047*	*0.0189*
3 m	**W**	Mean	-0.0019	-0.0053	-0.0083	-0.0155	-0.0316	-0.0532	-0.0590	-0.0705	-0.1544
		T-stat.	-3.2881	-3.5966	-3.6634	-4.3253	-5.7185	-5.7530	-5.0491	-4.2531	-9.4769
		Prob.	*0.0010*	*0.0003*	*0.0003*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	L	Mean	0.0003	-0.0001	-0.0008	-0.0024	-0.0050	-0.0146	-0.0038	-0.1035	-0.1710
		T-stat.	0.2579	-0.0398	-0.1765	-0.3319	-0.4547	-0.9609	-0.1806	-6.3750	-7.9858
		Prob.	*0.7966*	*0.9683*	*0.8599*	*0.7400*	*0.6495*	*0.3369*	*0.8567*	*0.0000*	*0.0000*
	W-L	Mean	-0.0032	-0.0084	-0.0130	-0.0243	-0.0495	-0.0863	-0.1262	-0.0888	-0.1555
		T-stat.	-2.5979	-2.3968	-2.3922	-2.5916	-3.4917	-4.3338	-4.0625	-2.5823	-3.0817
		Prob.	*0.0095*	*0.0167*	*0.0169*	*0.0097*	*0.0005*	*0.0000*	*0.0001*	*0.0100*	*0.0021*
6m	**W**	Mean	-0.0022	-0.0055	-0.0080	-0.0117	-0.0168	-0.0193	-0.0192	-0.0296	-0.0957
		T-stat.	-3.1748	-3.0952	-2.9379	-2.6944	-2.4601	-2.0090	-1.5965	-1.4217	-4.5253
		Prob.	*0.0016*	*0.0020*	*0.0034*	*0.0072*	*0.0141*	*0.0449*	*0.1108*	*0.1555*	*0.0000*
	L	Mean	0.0004	0.0003	-0.0006	-0.0021	-0.0047	-0.0134	0.0147	-0.0894	-0.1037
		T-stat.	0.4243	0.0994	-0.1416	-0.2701	-0.4106	-0.9806	0.5869	-5.6857	-4.3073
		Prob.	*0.6714*	*0.9209*	*0.8874*	*0.7872*	*0.6815*	*0.3271*	*0.5575*	*0.0000*	*0.0000*
	W-L	Mean	-0.0037	-0.0092	-0.0134	-0.0218	-0.0362	-0.0536	-0.1012	-0.0569	-0.1824
		T-stat.	-2.9482	-2.6071	-2.4297	-2.3531	-2.6389	-2.9085	-2.8329	-1.6343	-3.1843
		Prob.	*0.0033*	*0.0093*	*0.0153*	*0.0188*	*0.0085*	*0.0037*	*0.0047*	*0.1026*	*0.0015*
1y	**W**	Mean	-0.0008	-0.0016	-0.0023	-0.0021	-0.0031	0.0039	0.0145	0.0024	-0.0815
		T-stat.	-1.2451	-0.8323	-0.7737	-0.4287	-0.3839	0.2804	0.8696	0.0997	-3.6748
		Prob.	*0.2135*	*0.4055*	*0.4393*	*0.6683*	*0.7011*	*0.7793*	*0.3848*	*0.9206*	*0.0003*
	L	Mean	0.0004	-0.0001	-0.0011	-0.0028	-0.0025	-0.0096	0.0637	-0.0252	-0.0330
		T-stat.	0.5267	-0.0410	-0.3330	-0.4780	-0.2751	-0.8296	3.2886	-1.6422	-1.0958
		Prob.	*0.5985*	*0.9673*	*0.7392*	*0.6328*	*0.7833*	*0.4070*	*0.0011*	*0.1010*	*0.2737*
	W-L	Mean	-0.0024	-0.0051	-0.0074	-0.0125	-0.0279	-0.0439	-0.1357	-0.1392	-0.3446
		T-stat.	-2.0000	-1.4971	-1.3747	-1.3816	-2.1373	-2.6490	-4.2666	-3.5345	-4.7307
		Prob.	*0.0459*	*0.1348*	*0.1696*	*0.1675*	*0.0329*	*0.0083*	*0.0000*	*0.0004*	*0.0000*

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