Conducting Event Studies
With Asia-Pacific
Stock Market Data

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1. Introduction

"Tall oaks from little acorns grow." Pioneering event studies by Ball and Brown (1968) and Fama, Fisher, Jensen, and Roll (1969) planted seeds of financial research that flourish decades later.[1] Indeed, Kothari and Warner (2005) report that, "The number of published event studies easily exceeds 500 and continues to grow."[2] Along with this growth, event study methodology has advanced in many directions. However, the basic design of an event study has changed little since Ball and Brown (1968) and Fama, Fisher, Jensen, and Roll (1969). Reviews of the most pertinent methodological issues and advances may be found in Campbell, Lo, and MacKinlay (1997), MacKinlay (1997), and recently Khotari and Warner (2005).

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[1] MacKinlay (1997) points out that the first published event study appears to be James Dolley, "Characteristics and procedure for common stock split-ups," *Harvard Business Review* (1933).

[2] "To quantify the enormity of the event study literature, we conducted a census of event studies published in 5 leading journals: the *Journal of Business* (JB), *Journal of Finance* (JF), *Journal of Financial Economics* (JFE), *Journal of Financial and Quantitative Analysis* (JFQA), and the *Review of Financial Studies* (RFS). We began in 1974, the first year the JFE was published. …for the years 1974 through 2000. The total number of papers reporting event study results is 565. Since many academic and practitioner oriented journals are excluded, these figures provide a lower bound on the size of the literature. The number of papers published per year increased in the 1980's, and the flow of papers has since been stable. The peak years are 1983 (38 papers), 1990 (37 papers), and 2000 (37 papers). All five journals have significant representation. The JFE and JF lead, with over 200 papers each." …Khotari and Warner (2005).

Lockstep with advances in event study test design has been a keen interest in studies evaluating the effectiveness of event studies in realistic settings. Typically these studies use Monte Carlo simulations with daily security returns data from the Center for Research in Security Prices (CRSP) database to evaluate the performance of event study test procedures. The best known paper in this genre is Brown and Warner (1985). Other well-known, contemporaneous contributions include Bernard (1987), Collins and Dent (1984), Dyckman, Philbrick, and Stephan (1984), and Jain (1986). Subsequent contributions commonly cited in the literature include Barber and Lyon (1997), Boehmer, Musumeci, and Poulsen (1991), Campbell and Wasley (1993), Corrado (1989), and Lyon, Barber, and Tsai (1999).

Investigations of event study methodology and indeed most financial markets research have traditionally focused on United States securities markets. However, strong global economic growth has brought an explosion of securities trading on international exchanges and *pari passu* a rising tide of research focused on global financial markets. Despite this upsurge, investigations of event study methodology with non-U.S. securities market data in the genre of Brown and Warner (1985) are essentially non-existent. In this study, we address this deficiency by investigating the performance of standard event study test procedures with security returns data from the Asia-Pacific stock markets. Such an investigation is belatedly warranted for at least two reasons: 1) financial research is increasingly directed towards the burgeoning security markets of the Asia-Pacific region, which includes the world's second largest national economy and two most populous countries, and 2) reliable statistical inferences based on Asia-Pacific security returns data are difficult as this data is more severely non-normally distributed than New York Stock Exchange returns data and often more so than NASDAQ returns data.[3]

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[3] "There is no study for Japanese security markets evaluating the empirical properties of test statistics for event studies, suggesting that our test statistics ought to be interpreted with caution, especially in the cases where the parametric and non-parametric test statistics lead to different conclusions. … In many ways, the Tokyo Stock Exchange is more similar to NASDAQ than to the NYSE. In particular, there is no specialist and bid-ask spreads tend to be wider than on the NYSE." (Kang and Stulz, 1996)

The importance of robustness issues posed by event studies using NASDAQ security returns data was first emphasized by Campbell and Wasley (1993). They show that NASDAQ returns data depart more severely from statistical normality than do New York Stock Exchange returns data and that nonparametric tests provide more reliable inferences in this setting. In this study, we find that robustness issues investigated in Campbell and Wasley (1993) often apply *a fortiori* to event studies based on Asia-Pacific security market returns data.

The remainder of this paper is organized as follows. Section 2 provides comparative statistical descriptions of security returns data from the major Asia-Pacific and United States stock markets. Section 3 reviews the market model, which constitutes the most popular basis for event study test design. This section also provides comparative statistical descriptions of market model excess returns obtained from Asia-Pacific and United States markets. Section 4 presents the parametric and nonparametric test statistics whose performance with Asia-Pacific security returns data is evaluated. Section 5 reports test statistic performance from Monte Carlo simulation experiments, including test specification with no abnormal performance introduced and test power with abnormal performance introduced. In Section 5, we also examine the impact on test specification that results from clustered event dates and an increases in return variance on an event date. Finally, we summarize our conclusions in Section 7.

2. Asia-Pacific and United States stock market daily returns

For this study, we obtain all available daily security price data for the major Asia-Pacific stock markets over the 10-year period 1995-2004 from Datastream. We also obtain all daily security price data for the major United States markets over the same period from the Center for Research in Security Prices (CRSP) at the University of Chicago. We delete prices records for all securities with more than 250 non-zero, non-missing returns.

Table 1 summarizes some basic information for this trimmed data population. The first two columns list the eleven countries and fifteen stock exchanges from which the data are culled. The third column states the number of securities represented by each stock market and the fourth column states the total number of daily returns available in each market. Column five states the number of zero returns included in each population.

Notice that the proportion of zero returns varies widely. At one extreme, over 58 percent of returns from the Jakarta Stock Exchange (JSX) are zeros. At the other extreme, only about 5 percent of returns from the Shen Zhen Stock Exchange (SZSE) are zeros. Interestingly, both Chinese exchanges have smaller proportions of zero returns than the New York Stock Exchange (NYSE).

2.1 Empirical distributions of daily security returns

Table 2 provides detailed statistical descriptions of the security return populations represented in Table 1. For each security in each market, we calculate an average daily return, a daily return standard deviation, and coefficients of daily return skewness and kurtosis. Statistics reported in Panel A correspond to daily arithmetic returns, while statistics in Panel B correspond to daily logarithmic returns. Arithmetic returns and logarithmic returns are computed as follows:

$$\text{Arithmetic returns:} \quad R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

$$\text{Logarithmic returns:} \quad LR_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

Columns two, three, and four of Table 2 report the mean and the 97.5%-ile and 2.5%-ile for each statistic listed in column one. This pattern is repeated in columns five, six, and seven. For example, from Panel A the mean of 1,159 arithmetic return averages from securities traded on the Australian Stock Exchange (ASX) is.00169 and the 97.5%-ile and 2.5%-ile are .00580 and -.00040, respectively. From Panel B, the mean of 1,159 logarithmic return coefficients of kurtosis is 58.809 and the 97.5%-ile and 2.5%-ile are 260.83 and 7.1453, respectively. It is well known that $R_t \approx LR_t + \frac{LR_t^2}{2}$, and so all means of arithmetic return averages in Panel A are greater than the corresponding means of logarithmic return averages in Panel B.

Table 2 reveals that all return populations are dominated by securities with non-normally distributed returns. All 2.5%-ile values for coefficients of kurtosis are greater than 3, the exact kurtosis of all normal distributions. All mean kurtosis values are greater than 10. It is interesting to note that all mean skewness values based on arithmetic returns are positive, except for a negative mean skewness value from New York Stock Exchange (NYSE) security returns. Positive skewness is reduced for logarithmic returns and often becomes negative. In the case of NYSE, the negative mean skewness value of -.14127 obtained from arithmetic returns becomes an extreme negative mean skewness value of -2.2020 obtained from logarithmic returns.

Not all Asia-Pacific stock markets examined here have returns data that deviate from normality more severely than do returns data from the New York Stock Exchange. For example, mean NYSE kurtosis values are larger than mean kurtosis values from both Chinese stock exchanges and the stock exchanges of Japan, Korea, Malaysia, and Singapore. Indeed, mean NYSE kurtosis values are greater than those from the American Stock Exchange (AMEX) and NASDAQ for data from the era 1995-2004.

3. Abnormal performance measures

3.1 Market model excess returns

An event study measures the impact of a specific event on the market values of a collection of firms. Beginning with Fama, Fischer, Jensen, and Roll (1969), excess returns from the market model have become the standard return measure used in event studies to assess an event's impact on security prices. In this study, we specify market model excess returns in the conventional way. Let $ER_{i,h}$ denote a market model excess return for security *i* on day *h* as specified in equation (1) below, where $R_{i,h}$ and $RM_{i,h}$ represent the underlying security raw return and synchronized market index return, respectively. The parameters a_i and b_i are regression intercept and slope estimates, respectively, obtained from a least-squares regression of raw returns on contemporaneous market index returns over an estimation period.

$$ER_{i,h} = R_{i,h} - a_i - b_i \times RM_{i,h} \qquad (1)$$

Define day '0' as a hypothetical event date for a given security. A 200-day estimation period beginning on day -204 and ending on day -5 in event time is used to estimate market model parameters for each security/event date combination. In all simulation experiments reported below, security/event date combinations are randomly selected *without* replacement from returns' populations listed in Table 1. Sampling is restricted to estimation periods with sufficient data to obtain reasonable market model parameter estimates. Specifically, we restrict sampling to estimation periods satisfying $200 - N_{M_i} - N_{Z_i} \geq 150$, where N_{M_i} is the number of missing returns and N_{Z_i} is the number of zero returns in the 200-trading day estimation period. However, we define the number of available returns as $m_i = 200 - N_{M_i}$, which includes any zero returns.

Within each event period, there are $n_i = N_{E_i} - N_{M_i}$ available returns, where N_{E_i} is the number of trading days in the event period and N_{M_i} is the number of missing returns in the event period. We require that the event date return is non-missing and non-zero.

Let the average excess return over an event period with n_i returns be represented by $\overline{ER}_{n_i}$ and let $PE\left(\overline{ER}_{n_i}\right)$ denote a prediction standard error. Prediction standard error is specified in equation (2) below, where $\overline{RM}_i$ represents the average market index return during the estimation period and SE_{m_i} denotes the standard error from the estimation period regression with m_i returns (Green, 2003; Salinger, 1992).

$$PE\left(\overline{ER}_{n_i}\right) = \frac{SE_{m_i}}{\sqrt{n_i}}\sqrt{1+\frac{n_i}{m_i}+\frac{n_i\left(\frac{1}{n_i}\sum_{h\in n_i} RM_{h,i}-\overline{RM}_i\right)^2}{\frac{m_i}{m_i-1}\sum_{h\in m_i}\left(RM_{h,i}-\overline{RM}_i\right)^2}} \tag{2}$$

Under the null hypothesis of no abnormal performance and assuming identical, independent, normally distributed data, the ratio of $\overline{ER}_{n_i}$ to $PE\left(\overline{ER}_{n_i}\right)$ is known to be distributed as Student-t with $m_i - 2$ degrees of freedom.

3.2 Empirical distributions of excess returns

Table 3 provides summary statistics describing application of the market model based on 50,000 security/event date combinations randomly selected without replacement from each of the stock markets listed in Table 1. Stock markets are listed in column one and their corresponding market indexes are listed in column two. Value weight indexes are the major published indexes for each market indicated by their ticker symbols. Equal weight indexes are indicated by *EW*. We use the CRSP Equal Weight Index published by the Center for Research in Security Prices at the University of Chicago as the equal weight index for the New York Stock Exchange. We construct all other equal weight indexes from the returns data represented in Table 1. Notice that returns data from Indonesia, Singapore, and Thailand are aggregated to permit sampling without replacement. However, while their equal weight and value weight indexes are indicated by *EW* and *VW*, returns from each market are always matched to their proper market index.

Table 3 reveals contrasts among the distributions of market model excess returns drawn from the various Asia-Pacific and United States stock markets. The largest excess return standard deviations are obtained from the India stock market, 6.66% and 7.17% for equal weight and value weight indexes, respectively. The smallest excess return standard deviations are obtained from the China stock market, 1.99% and 2.04% for the equal weight and value weight Shanghai indexes, respectively, and 2.08% and 2.11% for the equal weight and value weight Shen Zhen indexes, respectively. Skewness coefficients range from -4.581 for the New York Stock Exchange equal weight index to 3.202 for the Taiwan equal weight index. Coefficients of kurtosis range from 14.27 obtained from the Japan value weight index to 246.0 obtained from an aggregation of Singapore, Thailand, and Indonesia excess returns obtained from equal weight indexes.

Table 4 summarizes the properties of excess return distributions reported in prior studies of event study methodology based on daily security returns from the New York and American Stock Exchanges (NYSE/ASE) and the NASDAQ stock market. Brown and Warner (1985) report a standard deviation of 2.53% and coefficients of skewness and kurtosis of 1.01 and 6.80, respectively, for a large sample of NYSE/ASE market model excess returns. Campbell and Wasley (1993) report a standard deviation of 3.43% and coefficients of skewness and kurtosis of .96 and 16.98, respectively, for NASDAQ market model excess returns. Similarly, Cowan (1992) reports a standard deviation of 2.591% and skewness and kurtosis of .51092 and 3.22653, respectively, for NYSE/ASE excess returns along with a standard deviation of 3.381% and skewness and kurtosis of .64159 and 9.33155, respectively, for NASDAQ excess returns. A more recent study by Dombrow, Rodriguez, and Sirmans (2000) reports a standard deviation of 3.04% and skewness and kurtosis values of 1.94 and 28.38, respectively, for NYSE/ASE excess returns and a standard deviation of 4.1685% and skewness and kurtosis coefficients of 2.061 and 35.878, respectively, for NASDAQ excess returns.

Comparing values reported in Table 4 with those in Table 3 indicates that departures from statistical normality for the United States stock markets were rather more severe in the 1995-2004 period compared to findings in earlier studies. Specifically, coefficients of kurtosis for the American Stock Exchange and the New York Stock Exchange reported in Table 3 are much larger than any reported in Table 4. In addition, skewness coefficients reported in Table 3 for the New York Stock Exchange are all negative, whereas in Table 4 they are all positive.

Notice that average betas reported in Table 3 obtained from application of the market model based on value weight indexes are often much less than one. The reason for this is found in Table 5, which reports correlations and slope coefficients from regressions of equal weighted market indexes on value weight market indexes.

Columns one and five in Table 5 list the various stock markets. Columns two and six list the ticker symbols for their corresponding value weight market indexes. Columns three and seven state correlations ($\rho_{EW/VW}$) and columns four and eight state slope coefficients ($\beta_{EW/VW}$) obtained from regressions of equal weight daily index returns on value weight daily index returns in each stock market. Regressing an equal weight index on a value weight index yields the average slope coefficient from separate regressions of each individual security's returns on the value weight index.

Table 5 reveals that regressions of equal weight index returns on value weight index returns typically yield slope coefficients substantially less than one. The only slope coefficients in Table 5 that are close to one in value are those from the Shanghai and Shen Zhen stock exchanges. Table 5 also reveals that correlations between equal weight and value weight index returns vary widely, ranging from a low of 0.0683 in the case of Korea to a high of 0.9883 in the case of China's Shen Zhen exchange.

Most event studies based on CRSP returns data use either the S&P 500 index or the CRSP Equal Weighted Index, which are often considered interchangeable. However, Campbell and Wasley (1993) recommend using the NASDAQ equal weight market index in event studies using NASDAQ returns.[4] The typically low average correlations reported in Table 3 obtained from market model regressions using value weight indexes indicate that equal weight indexes are expected to outperform value weight indexes in event studies.

4. Event study test statistics

We examine a battery of test statistics forming a representative set of standard event study test procedures. Summary descriptions of these event study procedures as implemented in a commercial software package are provided in Cowan (2002).

4.1 Parametric T-tests

We employ two widely-used parametric test statistics in our simulation experiments. The first is the classic parametric *T*-test proposed in Patell (1976) and Dodd and Warner (1983) and commonly referred to as the Patell *T*-test. We denote this test statistic by T_P.

$$T_P = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{\sqrt{n_i} \times \overline{ER}_{n_i}}{PE\left(\overline{ER}_{n_i}\right)} \tag{3}$$

$$\overline{ER}_{n_i} = \frac{1}{n_i} \sum_{h \in n_i} ER_{i,h}$$

Under the null hypothesis of no abnormal security price performance, test statistic T_P in equation (3) is asymptotically distributed as standard normal.

The second parametric *T*-test is similar to T_P above, but includes an adjustment to control for a shift in the cross-sectional variance of event date excess returns. This test was independently proposed in Sanders and Robins (1991) in Boehmer, Musumeci, and Poulsen (1991). We denote this test statistic by T_P^*.

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[4] "Using other indices (CRSP NYSE/ASE value-weighted, CRSP NYSE/ASE equal-weighted, CRSP NASDAQ value-weighted, and NASDAQ Composite) to generate market model abnormal returns can lead to either rejection of the null hypothesis too often in the absence of abnormal performance or lower rejection rates in the presence of abnormal performance." (Campbell and Wasley, 1993)

$$T_P^* = \frac{\sum_{i=1}^{N} \frac{\sqrt{n_i} \times \overline{ER}_{n_i}}{PE\left(\overline{ER}_{n_i}\right)}}{\sqrt{N \times Var\left(\sqrt{n} \times \overline{ER}_n / PE\left(\overline{ER}_n\right)\right)}} \tag{4}$$

$$Var\left(\sqrt{n} \times \overline{ER}_n / PE\left(\overline{ER}_n\right)\right) = \frac{1}{N-1} \sum_{i=1}^{N} \left(\frac{\sqrt{n_i} \times \overline{ER}_{n_i}}{PE\left(\overline{ER}_{n_i}\right)} - \frac{1}{N} \sum_{j=1}^{N} \frac{\sqrt{n_j} \times \overline{ER}_{n_j}}{PE\left(\overline{ER}_{n_j}\right)} \right)^2$$

Under the null hypothesis, test statistic T_P^* in equation (4) above is asymptotically distributed as standard normal.

Previous studies evaluating the performance of the Patell (1976) test in event studies using daily stock returns include Brown and Warner (1985), Boehmer, Musumeci, and Poulsen (1991), Campbell and Wasley (1983), Corrado (1989), Corrado and Zivney (1992), Cowan and Sergeant (1996), Hamill, Opong, and McGregor (2002), Lee and Varela (1997), Maynes and Rumsey (1993), and Seiler (2000). Studies evaluating event study test statistics with the addition of a cross-sectional variance adjustment include Boehmer, Musumeci, and Poulsen (1991), Corrado and Zivney (1992), Cowan and Sergeant (1996), Giacotto and Sfridis (1996), Higgins and Petersen (1998), and Seiler (2000).

4.2 Bootstrap test

The bootstrap assesses the statistical significance of a test statistic from the empirical distribution of the data used to compute it. The bootstrap procedure is here used to assess the statistical significance of the test statistic T_P specified in equation (3) directly from the set of N event-date standardized excess returns. The bootstrap test has three simple steps:

1) Compute the test statistic T_P specified in equation (3).
2) Using random sampling *with* replacement from the set of N event date standardized excess returns $\overline{ER}_{n_i} / PE\left(\overline{ER}_{n_i}\right)$, iteratively compute the test statistic 1,000 times. Denote these 1,000 bootstrapped test statistics by $\tilde{T}_P^k$.

3) Rank the statistics $\tilde{T}_P^k$ from smallest to largest and compute the percentile of T_P in the population of the 1,000 $\tilde{T}_P^k$. A percentile less than α/2 or greater than 1-α/2 leads to rejection of the null hypothesis with a confidence level of 1-α.

By construction, the bootstrap distribution comprising the 1,000 statistics $\tilde{T}_P^k$ accounts for any shift in the event-date returns variance and so obviates a cross-sectional variance adjustment. For notational convenience, we denote the bootstrap test by T_B. The bootstrap test returns a *p*-value theoretically distributed as uniform on the unit interval (0,1). For convenience, we convert these to *Z*-values via an inverse normal transformation, i.e., $Z = \Phi^{-1}\left(p\right)$.

Prior studies evaluating the performance of bootstrap tests in event studies include Hamill, Opong, and McGregor (2002), Kramer (2001), and Lyon, Barber, and Tsai (1999). An excellent general reference on the bootstrap is Efron and Tibshirani (1993).

4.3 Nonparametric rank test

The next test statistic is the nonparametric rank test introduced in Corrado (1989) and later refined in Corrado and Zivney (1992). Let $r\left(ER_{i,h}\right)$ denote the rank of the excess return $ER_{i,h}$ within a sample of m_i+n_i excess returns for the ith security; that is, m_i excess returns from the estimation period plus n_i excess returns from the event period. Under the null hypothesis, each rank $r\left(ER_{i,h}\right)$ is a uniform random drawing *without* replacement from the integers 1 through n_i+m_i. Hence, the mean and variance of $\sum_{h\in n_i} r\left(ER_{i,h}\right)$ are $n_i\left(\frac{n_i+m_i+1}{2}\right)$ and $n_i m_i\left(n_i+m_i+1\right)/12$, respectively (Hettmansperger, 1984). This variance does not account for tied excess return values. However, for market model excess returns ties are quite rare since they are broken by contemporaneous market index returns, which are almost never yield tied values within a given test period.[5]

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[5] Lehman (1975) provides expressions for the reduction in variance when ties are handled by the method of assigning an average rank.

The rank test statistic is calculated by summing event date excess return ranks standardized by their means and standard deviations as specified in equation (5) below. We denote this rank test statistic as T_R.

$$T_R = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{\sum_{h \in n_i} r\left(ER_{i,h}\right) - n_i\left(\frac{n_i + m_i + 1}{2}\right)}{\sqrt{n_i m_i \left(n_i + m_i + 1\right)/12}} \tag{5}$$

Corrado and Zivney (1992) propose a refinement to the rank test. This refinement accounts for an event-induced increase in the return variance during an event period. Let $SER_{i,h}$ denote the excess return series for the i^{th} security standardized as specified in equation (6) immediately below, where $Var\left(\sqrt{n} \times \overline{ER}_n / PE\left(\overline{ER}_n\right)\right)$ was defined earlier in equation (4). Note that only excess returns in the event period are affected.

$$SER_{i,h} = \begin{cases} ER_{i,h} & for\ h \in m_i \\ \dfrac{ER_{i,h}}{\sqrt{Var\left(\sqrt{n} \times \overline{ER}_n / PE\left(\overline{ER}_n\right)\right)}} & for\ h \in n_i \end{cases} \tag{6}$$

Let $r\left(SER_{i,h}\right)$ denote the rank of the standardized excess return $SER_{i,h}$ within the sample of m_i+n_i excess returns for the i^{th} security. The ranks $r\left(SER_{i,h}\right)$ are then used to compute the rank test statistic T_R^* specified in equation (7) immediately below.

$$T_R^* = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{\sum_{h \in n_i} r\left(SER_{i,h}\right) - n_i\left(\frac{n_i + m_i + 1}{2}\right)}{\sqrt{n_i m_i \left(n_i + m_i + 1\right)/12}} \tag{7}$$

Under a null hypothesis of no abnormal performance, the rank test statistics T_R and T_R^* are asymptotically distributed as standard normal. Previous studies evaluating the performance of rank tests in event studies include Affleck-Graves, Callahan, and Ramanan (2000), Campbell and Wasley (1993, 1996), Corrado (1989), Corrado and Zivney (1992), Cowan (1992), and Higgins and Petersen (1998). Various refinements to the rank test have been suggested by Cowan and Sergeant (1996), Dombrow, Rodriguez, and Sirmans (2000), Giacotto and Sfridis (1996), Hamill, Opong, and McGregor (2002), Maynes and Rumsey (1993), and Seiler (2000).

4.4 Nonparametric sign test

Brown and Warner (1985) show that a sign test assuming symmetry in the distribution of excess returns yields a poorly specified test. With few exceptions, skewness values reported in Table 3 for the excess return distributions of Asia-Pacific and United States security markets are severe. Two generalizations of the sign test that allow for non-symmetric excess return distributions have been proposed. Let $s\left(ER_{i,h}-x_i\right)$ denote the sign of the difference between the excess return $ER_{i,h}$ and an arbitrary value x_i and let p_i^+ denote the proportion of positive signs from the estimation period for security *i*.

$$p_i^+ = \frac{1}{m_i}\sum_{h\in m_i} s\left(ER_{i,h}-x_i\right) \qquad s\left(ER_{i,h}-x_i\right)=\begin{cases}1 & \text{if } ER_{i,h}>x_i\\ 0 & \text{otherwise}\end{cases} \tag{8}$$

The first generalization of the sign test was proposed in McConnell and Muscarella (1985) and Lummer and McConnell (1989) and its performance was formally investigated in Cowan (1992). This sign test sets $x_i = 0$ by using the mean of the m_i excess returns in the estimation period, which is zero by construction in the market model. The parameter p_i^+ then represents the proportion of excess returns in the estimation period that are greater than zero. The second generalization of the sign test proposed in Corrado and Zivney (1992) sets $p_i^+ = .5$ by setting x_i to the sample median of the m_i excess returns in the estimation period. In both cases, the sign test statistic is calculated as specified in equation (9) below. We denote the mean-based sign test by $\overline{T}_S$ and the Corrado-Zivney median-based sign test by $\hat{T}_S$.

$$T_S = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{\sum_{h \in n_i} s\left(ER_{i,h} - x_i\right) - n_i p_i^+}{\sqrt{n_i p_i^+ \left(1 - p_i^+\right)}} \tag{9}$$

For $\overline{T}_S$, the parameter p_i^+ is determined by setting $x_i = 0$. For $\hat{T}_S$, the parameter x_i is determined by setting $p_i^+ = .5$. Under the null hypothesis of no abnormal performance, both sign test statistics are asymptotically distributed as standard normal.

Prior studies assessing the performance of these sign test statistics with United States stock market data include Corrado and Zivney (1992), Cowan (1992), Cowan and Sergeant (1996), Giacotto and Sfridis (1996), Hamill, Opong, and McGregor (2002), and Seiler (2000).

5. Test statistic performance

5.1 Test specification with no abnormal performance introduced

Table 6 summarizes the empirical specification of the test statistics across Asia-Pacific and United States stock markets obtained from Monte Carlo simulations of 1,000 event study tests in each market. Each simulated event study includes 50 securities. The 50,000 security/event date combinations from each market are randomly selected without replacement. Returns data from Indonesia, Singapore, and Thailand are aggregated to allow sampling without replacement. Upper tail and lower tail tests are indicated by +0% and -0%, respectively. Each test statistic is calibrated to a theoretical 5-percent Type-I error rate in each tail. Panel A of Table 6 reports results based on market model excess returns obtained using equal weight indexes, while Panel B reports results obtained using value weight indexes.

In each panel of Table 6, rejection rates outside the interval (3.5%, 6.5%) are shown in boldface and the total number of such rejections for each statistic are reported in the next-to-last row. An appendix shows that if any test statistic has four or more rejection rates outside the interval (3.5%, 6.5%), then we can reject the hypothesis of a correctly specified test with more than 99% confidence.

The last row in each panel of Table 6 reports rejection rate standard deviations from a theoretical expected value of 5 percent for each test statistic. An appendix shows that under a null hypothesis of a correctly specified test statistic, the probability of a standard deviation less than one percent is more than 99%. Hence, if a test statistic has a standard deviation greater than one percent, we can reject the hypothesis of a correctly specified test with more than 99% confidence.

Based on the confidence intervals specified immediately above, Panel A of Table 6 reveals that in simulations based on market model excess returns obtained using logarithmic returns and equal weight indexes only the sign test statistic $\overline{T}_S$ is free of statistically significant misspecification. It has less than four rejection rates outside the interval (3.5%, 6.5%) and a rejection rate standard deviation less than one percent. All other test statistics exhibit statistically significant misspecification. Panel B of Table 6 reports that in simulations based on market model excess returns obtained using logarithmic returns and value weight indexes, all test statistics exhibit statistically significant misspecification. Hence viewed as a whole, the test specification results reported in Table 6 argue for the use of an equal weight index to construct market model excess returns. Finally, Panel C of Table 6 reports results based on arithmetic returns and equal weight indexes which show that all test statistics exhibit statistically significant misspecification.

Evidence presented in Table 6 regarding test misspecification should be tempered with the realization that the null hypothesis being tested is strong. The null that each test statistic is correctly specified in every market is a particularly difficult hurdle. We should notice that almost half of all instances of test misspecification occur in lower tail tests performed with data from the stock markets of Hong Kong, Malaysia, Thailand-Singapore-Indonesia (TH/SG/ID), and NASDAQ. Indeed, test misspecification generally appears to be predominantly a lower-tail phenomenon. Furthermore, all test statistics have little trouble dealing with New York Stock Exchange (NYSE) data, in particular with event study tests based on market model excess returns obtained using the CRSP equal weight index. This is consistent with results reported in prior studies by Brown and Warner (1989), Boehmer, Musumeci, and Poulsen (1993), Campbell and Wasley (1993), Corrado (1989), and Jain (1986) showing that standard event study test statistics are generally well-specified with NYSE daily returns data. Test misspecification also appears to be minimal with returns data from the stock markets of Japan, Korea, and Taiwan. For the other Asia-Pacific stock markets represented in Table 6 and also for the American Stock Exchange (AMEX), we cannot escape the conclusion that some degree of test misspecification is common and that test statistic confidence intervals should not be accepted literally.

5.2 Test specification with clustered event dates

It was shown above that the choice of market index used to implement market model event study tests has a perceptible effect on test statistic specification. In this section we show that the choice of market index has a particularly strong effect on test statistic specification when event dates are clustered.

Table 7 summarizes the empirical specification of the test statistics across all markets based on Monte Carlo simulations of 1,000 event study tests in each market when event dates in each individual event study are clustered. Each simulated event study includes 50 securities. The 50,000 security/event date combinations in each market are randomly selected without replacement, but in any given event study all event dates are clustered to within a few days of each other. Upper tail and lower tail tests are indicated by +0% and -0%, respectively. Panel A of Table 7 reports results obtained with logarithmic returns and equal weight indexes and Panel B reports results obtained with logarithmic returns and value weight indexes.

All panels in Table 7 reveal that event date clustering almost always yields severe test statistic misspecification. Both the number of rejection rates outside the interval (3.5%, 6.5%) and the magnitudes of rejection rate standard deviations reported in all panels of Table 7 are much larger than were reported in Table 6 for event dates without clustering. Additionally, Panel B of Table 6 reveals that the misspecification is particularly severe in market model tests based on value weight indexes and further argues against the use of value weight indexes in event studies.

5.3 Test specification with an event date variance increase

Brown and Warner (1985) provided an early alert to potential test misspecification in event studies impacted by an event-induced increase in returns variance. Test procedures explicitly accounting for an increased event-day variance are investigated in Boehmer, Musumeci, and Poulsen (1991) and Corrado and Zivney (1992), who both suggest using a variance adjustment based on a cross section of event period excess returns similar to procedures implemented in Charest (1978), Mikkelson (1981), and Penman (1982). In this section, we investigate the effect of an event-induced variance increase on each test statistic. To simulate an event-induced variance increase, we follow the procedure suggested in Brown and Warner (1985) and add the day-5 return to the day-0 return for each security in each event study portfolio.

$$R_{i,0}^{*} = R_{i,0} + R_{i,5}$$

Table 8 reports test rejections rates with a doubled event date return variance. Table 8 reveals that in the presence of a doubled event-day return variance, all test statistics exhibit statistically significant misspecification. However, the test statistic least affected by the variance increase is the Corrado and Zivney (1993) ranks test (T_R^*) with an event date variance adjustment. The most severely affected test statistic is the parametric *T*-test (T_P), which makes no adjustment for an event date variance increase.

5.4 Test power with abnormal performance introduced

Table 9 reports results obtained from all test statistics after introducing abnormal security price performance of ±3/4% to each event date return in each event study simulation experiment. Each of the 1,000 test simulations in each market is based on a portfolio of 50 security/event date combinations randomly selected without replacement. All test statistics are calibrated to a theoretical 5-percent Type I error rate in both upper and lower tails.

Average rejection rates reported in Table 9 for each test statistic across the thirteen markets reveal that the two nonparametric rank test statistics (T_R, T_R^*) and the IGARCH test statistic (T_G^*) yield the highest test power with rejection rates of 76.0%, 72.8%, and 72.8%, respectively. The least powerful test in these simulations is the mean-based sign test statistic ($\overline{T}_S$) with a rejection rate of 62.8%.

6. Summary and conclusions

We have examined the specification and power of standard event study tests likely to be utilized in event studies using daily security returns from the major Asia-Pacific stock markets. Monte Carlo simulation experiments reveal that standard event study test statistics typically exhibit some misspecification under the null hypothesis. This was found to be the case for both parametric and nonparametric tests. Test misspecification was particularly severe with clustered event dates or a doubled event date returns variance.

Appendix A

In 1,000 event study tests calibrated to a one-tail Type-I error rate of five percent, the number of times a correctly specified test statistic rejects a true null hypothesis is distributed as a binomial random variable, i.e., $B(r;.05;1{,}000)$, where r is the number of rejections and .05 is the probability of a rejection. The binomial probability that the number of rejections is within the interval $35 \le r \le 65$ is 97.577%. Thus, with 97.577% confidence a rejection rate outside the interval (3.5%, 6.5%) indicates an instance of a misspecified test. Of course, a correctly specified test yields such instances with a probability of 2.423% = (1-.97577)% and across 26 independent tests the probability of realizing no such instances is $.5285 = .97577^{26}$.

Let n count the total number of one-tail rejection rates (both upper and lower tail) in a given column of Table 6 lying outside the interval (3.5%, 6.5%). The random variable n follows approximately a binomial distribution, i.e., $B(n;.02423;20)$. This distribution is approximate because upper tail and lower tail rejections are not independent, since within a given stock market they are obtained from the same simulation. However, the dependence is negligible.[6]

The binomial distribution $B(n;.02423;22)$ yields a 99.878% probability of observing three or less rejection rates ($n \le 3$) outside the interval (3.5%, 6.5%) under a null hypothesis of a correctly specified test statistic. To account for simultaneous

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[6] To demonstrate, the probability that lower and upper tail rejection rates r_L, r_U are less or equal to K_L, K_U, respectively, is,

$$\Pr\left(r_L \le K_L, r_U \le K_U\right) = \sum_{m=0}^{K_L+K_u} \binom{M}{m} p^m \left(1-p\right)^{M-m} \sum_{n=\max(0,m-K_L)}^{\min(m,K_U)} \binom{m}{n} q^n \left(1-q\right)^{m-n}$$

where $p = .1$ is the two-tail rejection probability and $q = .5$ is the probability that a given two-tail rejection occurs in a specific tail. This formula only counts combinations of n and $m-n$ where $0 \le n \le K_U$ and $0 \le m-n \le K_L$. With $K_L = 35$ and $K_U = 65$ we calculate,

$$\begin{aligned} &\Pr\left(35 \le r_L \le 65, 35 \le r_U \le 65\right) \\ &\quad = \Pr\left(r_L \le 65, r_U \le 65\right) + \Pr\left(r_L \le 35, r_U \le 35\right) - \Pr\left(r_L \le 35\right) - \Pr\left(r_U \le 35\right) \\ &\quad = .951741 \end{aligned}$$

and,

$$\Pr\left(35 \le r_L \le 65\right) \times \Pr\left(35 \le r_U \le 65\right) = .952118$$

Since the latter probability is only .000377 larger than the former, we see that the dependence between r_L and r_U is negligible.

inference across eight tests statistics we apply Bonferroni's inequality, which yields a lower bound of 99.024% = 1 – 8×(1-.99878) for the probability of observing three or less rejection rates ($n \leq 3$) outside the interval (3.5%, 6.5%) across all eight test statistics. Hence, if any test statistic yields four or more rejection rates outside the interval (3.5%, 6.5%) we can reject the hypothesis of a correctly specified test with at least 99.024% confidence.

In decimal form, rejection rate standard deviations are computed as

$$\sigma_r = \sqrt{\sum_{k=1}^{26} \frac{(r_k - .05)^2}{26}}$$

Since each rejection rate has an expected value of .05 and a variance of .05×.95/1,000, the following statistic is distributed as chi-square with 26 degrees of freedom.

$$\frac{26 \times \sigma_r^2}{1{,}000 \times .05 \times .95} = \sum_{k=1}^{26} \frac{(r_k - .05)^2}{1{,}000 \times .05 \times .95} \sim \chi^2(26)$$

Thus, under the null hypothesis of a correctly specified test a standard deviation σ_r greater than one occurs with a probability of .00082. Applying Bonferroni's inequality to account for simultaneous inferences across eight test statistics yields a lower bound of 99.344% = 1 – 8×.00082 for the probability of observing a standard deviation σ_r less than one across all eight test statistics. Hence, if any test statistic yields a standard deviation σ_r greater than one we can reject the hypothesis of a correctly specified test with at least 99.344% confidence.

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Table 1: Asia-Pacific and United States stock market raw return populations

Daily raw return populations from securities traded in the major Asia-Pacific and United States stock markets over the 10-year period 1995-2004. These data exclude securities with less than 250 available returns.

Country	Exchange	Number of securities	Number of returns	Number of zero returns
Australia	ASX	1,159	2,246,368	1,055,719
China	SSE	465	736,086	43,127
-	SZSE	350	648,806	32,916
-	HKEX	907	1,700,167	640,482
India	NSE	845	1,780,256	465,804
Indonesia	JSX	259	545,957	318,693
Japan	TSE	1,409	3,211,524	446,810
Korea	KRX	575	917,879	124,665
Malaysia	KLSE	584	1,231,881	387,258
Singapore	SGX	372	673,670	244,084
Taiwan*	TSEC	689	1,228,320	154,434
Thailand	SET	379	818,837	364,794
United States	AMEX	1,487	1,829,202	371,781
-	NASDAQ	8,854	10,825,780	1,668,246
-	NYSE	3,867	6,312,894	755,408

* The governments of the Peoples Republic of China and the Republic of China both recognize Taiwan as a part of China.

Table 2: Asia-Pacific and United States daily stock return distributions

Summary statistical measures of daily security returns in the major Asia-Pacific and United States stock markets over the period 1995-2004. Statistics describe distributions of return averages, standard deviations, and coefficients of skewness and kurtosis.

	Mean	97.5%-ile	2.5%-ile	Mean	97.5%-ile	2.5%-ile
			Panel A: Arithmetic returns			
	Australia			*Malay*sia		
Averages	.00169	.00580	-.00040	.00033	.00150	-.00071
Std. Devs.	.06134	.16976	.01373	.03605	.06153	.01725
Skewness	3.9500	26.145	-1.5559	2.0110	12.068	-.61055
Kurtosis	122.22	963.36	7.3379	48.491	363.38	7.3574
	Shanghai			*Singapore*		
Averages	.00007	.00111	-.00147	.00054	.00226	-.00088
Std. Devs.	.02534	.03208	.01722	.03800	.07664	.01569
Skewness	.64510	2.4074	-.29030	1.4646	7.3990	-.88554
Kurtosis	12.228	42.003	4.1800	36.032	233.35	4.5020
	Shen Zhen			*Taiwan*		
Averages	.00020	.00119	-.00109	.00068	.00259	-.00138
Std. Devs.	.02645	.03492	.01902	.04371	.07626	.02193
Skewness	.61517	2.9531	-.56609	4.0612	19.066	-4.2584
Kurtosis	14.366	84.281	4.7424	136.45	612.60	14.974
	Hong Kong			*Thailand*		
Averages	.00058	.00263	-.00156	.00250	.00699	-.00018
Std. Devs.	.04663	.09305	.01776	.08833	.21785	.03110
Skewness	2.5403	21.257	-1.4945	11.660	33.772	.51735
Kurtosis	79.505	723.31	5.7173	347.46	1457.5	29.959
	India			*AMEX*		
Averages	.00271	.00815	.00003	.00104	.00550	-.00154
Std. Devs.	.07967	.18706	.03101	.04511	.14470	.00841
Skewness	9.3227	30.251	.43562	1.4984	17.385	-6.3080
Kurtosis	258.65	1172.1	6.1261	53.404	432.06	4.0356
	Indonesia			*NASDAQ*		
Averages	.00150	.00501	-.00017	.00142	.00739	-.00290
Std. Devs.	.05844	.11525	.02383	.06310	.18812	.01861
Skewness	2.3242	14.168	-.40863	1.7932	20.368	-4.5120
Kurtosis	62.953	463.90	6.8667	59.261	548.35	4.5491
	Japan			*NYSE*		
Averages	.00037	.00193	-.00024	.00040	.00226	-.00169
Std. Devs.	.02853	.04612	.01632	.02823	.07620	.00750
Skewness	.82590	3.0369	-.37954	-.14127	10.792	-9.9411
Kurtosis	15.706	52.927	5.0078	67.838	424.89	4.4487
	Korea					
Averages	.00034	.00294	-.00224			
Std. Devs.	.05169	.07996	.03391			
Skewness	1.6623	18.381	-.55458			
Kurtosis	49.234	632.42	3.2376			

Table 2 continued

	Mean	97.5%-ile	2.5%-ile	Mean	97.5%-ile	2.5%-ile
			Panel B: Logarithmic returns			
	Australia			*Malaysia*		
Averages	-.00027	.00166	-.00281	-.00054	.00097	-.00171
Std. Devs.	.05503	.10964	.01374	.03496	.05923	.01706
Skewness	-.40356	4.3465	-7.4518	.44716	3.7879	-3.7039
Kurtosis	58.809	260.83	7.1453	33.868	180.57	7.0563
	Shanghai			*Singapore*		
Averages	-.00026	.00073	-.00172	-.00029	.00152	-.00216
Std. Devs.	.02474	.03184	.01718	.03728	.07032	.01569
Skewness	.33336	1.4571	-.47199	.10319	2.4235	-5.8601
Kurtosis	10.670	36.930	4.1882	30.200	213.11	4.4738
	Shen Zhen			*Taiwan*		
Averages	-.00015	.00080	-.00138	-.00027	.00127	-.00208
Std. Devs.	.02630	.03388	.01901	.04186	.06534	.02182
Skewness	.17708	1.3463	-1.0015	-.73377	7.6394	-9.0182
Kurtosis	12.475	48.702	4.8191	87.371	249.00	16.689
	Hong Kong			*Thailand*		
Averages	-.00054	.00132	-.00346	-.00035	.00093	-.00232
Std. Devs.	.04397	.07937	.01773	.07113	.12470	.03133
Skewness	-.15305	3.8949	-7.5239	-.12299	4.8419	-5.3726
Kurtosis	45.640	308.73	5.6044	123.90	396.75	30.262
	India			*AMEX*		
Averages	.00006	.00322	-.00210	-.00036	.00233	-.00511
Std. Devs.	.06575	.11991	.03009	.04205	.11628	.00840
Skewness	.45981	5.8014	-6.1509	-.16706	6.6169	-11.380
Kurtosis	94.664	304.44	5.8495	43.977	359.29	4.0617
	Indonesia			*NASDAQ*		
Averages	-.00032	.00111	-.00224	-.00081	.00212	-.00760
Std. Devs.	.05662	.10632	.02397	.05782	.12756	.01855
Skewness	-.32917	1.6747	-5.1242	-.44388	5.8399	-9.2595
Kurtosis	40.251	276.11	6.3868	38.656	249.86	4.3757
	Japan			*NYSE*		
Averages	-.00006	.00130	-.00080	-.00011	.00158	-.00338
Std. Devs.	.02821	.04476	.01629	.02787	.06652	.00750
Skewness	.32002	1.6808	-1.1983	-2.2020	5.4295	-18.183
Kurtosis	12.782	45.871	4.9686	89.859	631.81	4.4043
	Korea					
Averages	-.00097	.00086	-.00381			
Std. Devs.	.04980	.07433	.03381			
Skewness	.08446	3.8045	-3.2422			
Kurtosis	24.332	272.23	3.2410			

Table 3: Market model regressions and excess return distributions

Statistics describing market model regressions with alternative market indexes from 50,000 security/event-date combinations randomly selected without replacement. ρ_{SM} and β_{SM} denote average correlations and slope coefficients, respectively, from regressions of individual share returns on market index returns. Value weight indexes are indicated by their ticker symbols and *EW* indicates an equal weight index.

				Excess return moments			
Market	Index	ρ_{SM}	β_{SM}	Mean	Std.Dev.	Skewness	Kurtosis
Australia	*EW*	.2558	.9707	-.00057	.0462	.7674	70.70
	AORD	.0653	.2642	-.00100	.0475	-.7775	67.99
Shanghai	*EW*	.6389	1.012	-.00019	.0199	-.0650	25.84
	SSEA	.6213	1.008	-.00022	.0204	-.1370	25.81
Shen Zhen	*EW*	.6506	1.008	-.00003	.0208	-1.276	127.7
	SZSA	.6443	1.041	-.00006	.0211	-1.278	123.0
Hong Kong	*EW*	.4527	1.435	-.00015	.0418	.1305	45.20
	HSI	.3778	.8659	-.00028	.0444	.1134	38.24
India	*EW*	.5217	1.149	-.00048	.0666	-1.515	165.8
	BSEN	.2336	.7688	.00023	.0717	1.028	125.2
Japan	*EW*	.4072	1.080	-.00009	.0274	.4503	14.33
	TOPIX	.3503	.7448	-.00013	.0281	.4662	14.27
Korea	*EW*	.4589	1.083	-.00031	.0457	.1066	22.98
	KOSPI	.0412	.0946	-.00023	.0517	.0103	16.37
Malaysia	*EW*	.5839	1.241	-.00059	.0349	-.9721	75.40
	KLSE	.4921	1.224	-.00063	.0384	-.5727	54.24
Taiwan	*EW*	.5938	1.032	.00020	.0373	3.202	158.4
	TWII	.1509	.3430	.00034	.0458	2.313	136.3
Thai., Sing., Indn.	*EW*	.5193	1.307	-.00099	.0537	1.162	246.0
	VW	.3559	.9479	-.00120	.0627	-1.623	226.1
AMEX	*EW*	.2234	1.101	-.00023	.0463	1.007	108.0
	XAX	.1851	.6236	-.00023	.0468	1.092	109.0
NASDAQ	*EW*	.2309	1.124	-.00100	.0589	-.0473	60.55
	IXIC	.1980	.5282	-.00099	.0596	-.1062	59.87
NYSE (*Log.*)	*EW*	.3245	1.091	-.00000	.0287	-4.581	172.3
	SPX	.2768	.5792	.00001	.0292	-4.341	161.4
NYSE (*Arith.*)	*EW*	.3123	1.077	.00002	.0278	-.3817	68.96
	SPX	.2785	.5791	.00002	.0282	-.3369	66.65

All Ordinaries (AORD), Shanghai A-Share (SSEA), Shen Zhen A-Share (SZEA), Hang Seng Index (HSI), Bombay Stock Exchange National (BSEN), Jakarta Stock Exchange Composite (JKSE), Tokyo Price Index (TOPIX), Korea Share Price Index (KOSPI), Kuala Lumpur Stock Exchange Composite (KLSE), Straits Times Index (STI), Taiwan Weighted Index (TWII), Stock Exchange of Thailand Index (SETI), American Stock Exchange Composite (XAX), NASDAQ Composite (IXIC), S&P 500 (SPX)

Table 4: Comparisons of excess return distributions

Comparison of daily excess return distributions from published studies of event study methodology. All statistics are taken from the first table of the referenced papers. Normal distribution skewness and kurtosis are zero and three, respectively.

	Sample size	Standard Deviation	Skewness	Kurtosis
NYSE/ASE stock market				
Brown and Warner (1985)	12,500	2.53%	1.01	6.80
Cowan (1992)	50,000	2.591%	.51092	3.22653
Dombrow, Rodriguez, Sirmans (2000)	12,500	3.04%	1.94	27.82
Jain (1986)	17,473	2.656%	.581	4.28
Nasdaq stock market				
Campbell and Wasley (1993)				
NMS securities	12,500	na	0.44	7.77
Non-NMS securities	12,500	na	1.14	19.4
Combined NMS/non-NMS	12,500	3.43%	.96	16.98
Cowan (1992)	50,000	3.381%	.64159	9.33155
Dombrow, Rodriguez, Sirmans (2000)	12,500	4.1685%	2.061	35.878

Table 5: Asia-Pacific and United States stock market index return distributions

Correlations and slope coefficients from regressions of equal weight index returns on value weight index returns for the major Asia-Pacific and United States stock markets over the period 1995-2004. $\rho_{EW/VW}$ and $\beta_{EW/VW}$ denote correlations and slope coefficients, respectively. Value weight indexes are indicated by standard ticker symbols.

Market	Index	$\rho_{EW/VW}$	$\beta_{EW/VW}$	Market	Index	$\rho_{EW/VW}$	$\beta_{EW/VW}$
Australia	*AORD*	.0756	.1135	*Malaysia*	*KLSE*	.8197	.8947
Shanghai	*SSEA*	.9800	.9999	*Singapore*	*STI*	.7776	.7721
Shen Zhen	*SZSA*	.9883	1.016	*Taiwan*	*TWII*	.2220	.3270
Hong Kong	*HSI*	.7192	.5510	*Thailand*	*SETI*	.3159	.5832
India	*BSEN*	.3153	.5749	*AMEX*	*XAX*	.7270	.5357
Indonesia	*JKSE*	.7537	.6596	*NASDAQ*	*IXIC*	.7994	.4276
Japan	*TOPIX*	.8179	.6623	*NYSE*	*SPX*	.8276	.5150
Korea	*KOSPI*	.0680	.0638				

All Ordinaries (AORD), Shanghai A-Share (SSEA), Shen Zhen A-Share (SZEA), Hang Seng Index (HSI), Bombay Stock Exchange National (BSEN), Jakarta Stock Exchange Composite (JKSE), Tokyo Price Index (TOPIX), Korea Share Price Index (KOSPI), Kuala Lumpur Stock Exchange Composite (KLSE), Straits Times Index (STI), Taiwan Weighted Index (TWII), Stock Exchange of Thailand Index (SETI), American Stock Exchange Composite (XAX), NASDAQ Composite (IXIC), S&P 500 (SPX)

Table 6: Test specification with no abnormal performance introduced

Percentage rejection rates from 1,000 simulated event studies in each market with no abnormal performance introduced. Each event study includes 50 security/event date combinations. The 50,000 security/event date combinations in each market are randomly selected without replacement. +0% and -0% indicate upper and lower tail tests, respectively, calibrated to a theoretical 5-percent test level in each tail. Rejection rates outside the interval (3.5%, 6.5%) indicated in bold represent instances of test misspecification.

		T-tests		Boot-strap	Rank tests		Sign tests	
Market	Δ%	(T_P)	(T_P^*)	(T_B)	(T_R)	(T_R^*)	$(\bar{T}_S)$	$(\hat{T}_S)$
Panel A: Logarithmic returns with equal weight indexes								
Australia	+0%	5.1	3.6	3.9	4.1	4.2	5.9	5.5
	-0%	**7.5**	6.2	**6.8**	**7.1**	**7.4**	5.3	**7.0**
Shanghai	+0%	6.2	3.9	4.1	5.1	4.7	4.7	5.5
	-0%	**7.3**	**8.0**	**8.3**	4.9	**7.0**	5.8	5.9
Shen Zhen	+0%	**7.3**	5.0	5.5	5.3	5.7	5.3	6.3
	-0%	6.5	**7.0**	**7.5**	5.8	**6.6**	5.7	5.5
Hong Kong	+0%	6.5	4.2	4.8	4.6	4.7	4.3	5.0
	-0%	**7.3**	**7.3**	**6.8**	**6.7**	**6.6**	4.5	**7.1**
India	+0%	**6.6**	4.0	5.1	4.3	4.4	3.9	5.0
	-0%	**7.6**	5.4	5.8	6.5	6.4	5.5	**6.8**
Japan	+0%	**6.6**	4.8	5.1	4.8	4.6	4.9	5.1
	-0%	6.4	6.4	6.3	5.7	5.3	5.4	5.9
Korea	+0%	**7.2**	5.2	5.7	5.3	5.2	5.9	5.5
	-0%	6.5	6.1	6.5	5.9	5.0	**3.4**	5.5
Malaysia	+0%	**8.3**	5.2	5.1	4.6	4.7	4.3	4.0
	-0%	**7.8**	**8.0**	**7.6**	**8.2**	**7.1**	**6.6**	**9.6**
Taiwan	+0%	**7.4**	4.6	5.4	5.1	4.9	5.8	6.1
	-0%	5.4	4.7	5.1	5.8	**6.6**	6.0	**7.0**
TH/SG/ID	+0%	**7.0**	**3.0**	3.9	3.6	3.9	3.7	3.7
	-0%	**9.2**	**8.7**	**8.9**	**7.3**	**6.7**	5.6	**7.1**
AMEX	+0%	5.7	**3.2**	3.5	3.7	3.8	3.8	3.6
	-0%	**7.5**	5.8	6.4	**6.6**	6.4	4.0	**6.7**
NASDAQ	+0%	6.0	4.7	5.2	4.6	4.2	4.6	5.2
	-0%	**9.0**	**6.9**	**6.7**	**6.8**	**7.0**	5.7	**6.7**
NYSE	+0%	5.7	5.2	5.8	5.5	5.2	4.8	5.7
	-0%	6.4	4.0	4.6	4.6	4.7	4.0	5.2
Rates outside (3.5%, 6.5%)		15	8	7	6	8	2	8
Standard deviation (%)		2.16	1.56	1.55	1.23	1.21	0.85	1.49

Table 6 continued

		T-tests		Boot-strap	Rank tests		Sign tests	
Market	Δ%	$\left(T_P\right)$	$\left(T_P^*\right)$	$\left(T_B\right)$	$\left(T_R\right)$	$\left(T_R^*\right)$	$\left(\bar{T}_S\right)$	$\left(\hat{T}_S\right)$
Panel B: Logarithmic returns with value weight indexes								
Australia	+0%	4.1	4.0	4.4	4.5	4.5	4.8	4.1
	-0%	**7.3**	6.1	**6.6**	**8.2**	**9.1**	5.3	**9.1**
Shanghai	+0%	5.5	3.7	4.2	4.5	4.7	5.0	4.5
	-0%	**7.0**	**7.7**	**8.0**	5.9	6.5	5.2	6.5
Shen Zhen	+0%	**7.2**	4.9	5.3	5.5	5.9	5.2	5.8
	-0%	**6.8**	**7.2**	**7.5**	6.0	6.5	5.0	6.0
Hong Kong	+0%	6.3	3.8	4.0	4.2	4.2	3.9	**3.1**
	-0%	**7.6**	6.3	6.3	**6.9**	**7.1**	5.3	**8.9**
India	+0%	**8.4**	3.9	6.0	4.5	4.5	4.6	4.6
	-0%	5.5	4.5	5.6	5.7	**8.3**	4.6	**7.1**
Japan	+0%	5.9	4.4	4.9	4.4	4.6	4.8	4.6
	-0%	6.5	6.3	6.4	5.4	5.6	5.5	**6.8**
Korea	+0%	6.0	5.2	5.2	4.8	4.6	3.4	4.1
	-0%	**6.7**	6.1	6.0	6.0	5.9	6.5	**8.3**
Malaysia	+0%	**7.2**	4.4	4.8	5.0	4.9	4.6	4.3
	-0%	**9.1**	**7.5**	**7.7**	**9.4**	**8.4**	**8.7**	**10.7**
Taiwan	+0%	**7.0**	6.3	6.5	4.9	4.9	**3.2**	3.6
	-0%	6.5	5.3	6.4	**6.8**	**8.6**	**7.4**	**9.0**
TH/SG/ID	+0%	5.3	**3.0**	4.1	3.9	3.7	**3.7**	**3.2**
	-0%	**10.7**	**8.7**	**9.6**	**9.9**	**9.3**	**6.8**	**9.2**
AMEX	+0%	5.1	**2.9**	3.5	**3.1**	**3.2**	4.1	3.8
	-0%	**7.3**	5.7	6.0	5.7	6.3	4.3	**6.6**
NASDAQ	+0%	5.5	4.1	5.2	4.5	4.6	3.6	4.1
	-0%	**9.2**	**6.7**	**6.7**	**6.9**	**6.9**	5.9	**6.9**
NYSE	+0%	**6.6**	5.6	6.0	6.1	5.9	4.7	5.6
	-0%	5.6	3.9	4.0	5.3	5.1	3.8	5.3
Rates outside (3.5%, 6.5%)		14	7	6	7	8	5	12
Standard deviation (%)		2.26	1.52	1.61	1.71	1.91	1.25	2.33

Table 6 continued

		T-tests		Boot-strap	Rank tests		Sign tests	
Market	Δ%	$\left(T_P\right)$	$\left(T_P^*\right)$	$\left(T_B\right)$	$\left(T_R\right)$	$\left(T_R^*\right)$	$\left(\bar{T}_S\right)$	$\left(\hat{T}_S\right)$
		Panel C: Arithmetic returns with equal weight indexes						
Australia	+0%	5.8	4.1	4.4	4.7	4.8	**6.7**	5.6
	-0%	**7.2**	**6.6**	**7.0**	**6.5**	**7.1**	3.5	**7.5**
Shanghai	+0%	6.2	4.0	4.1	5.2	4.9	4.6	5.8
	-0%	**7.1**	**8.2**	**8.5**	4.9	**7.2**	5.3	6.0
Shen Zhen	+0%	**7.6**	4.7	5.4	5.3	6.2	4.7	5.7
	-0%	6.3	**7.4**	**7.6**	5.7	6.5	5.2	5.5
Hong Kong	+0%	**7.3**	3.5	4.3	4.5	4.7	5.0	**4.8**
	-0%	**7.0**	**7.1**	**6.9**	**6.8**	**7.3**	4.6	**8.0**
India	+0%	**7.4**	3.5	4.7	4.5	4.5	4.4	4.3
	-0%	**7.9**	5.9	6.1	6.5	**7.3**	4.7	**7.1**
Japan	+0%	**6.8**	4.2	4.8	4.6	4.3	5.1	5.1
	-0%	6.4	6.4	6.5	5.9	5.4	4.8	5.7
Korea	+0%	**7.1**	4.9	5.1	5.3	5.2	5.6	5.6
	-0%	5.7	6.3	6.2	5.5	5.2	**3.1**	5.6
Malaysia	+0%	**8.4**	4.5	5.1	4.6	4.8	3.9	3.7
	-0%	**7.2**	**8.3**	**7.8**	**8.0**	**7.5**	**6.7**	**9.6**
Taiwan	+0%	**7.5**	5.2	5.6	5.6	5.6	5.3	6.0
	-0%	5.8	4.7	5.5	6.0	6.5	5.5	**7.3**
TH/SG/ID	+0%	**7.9**	**2.8**	3.8	3.7	3.6	4.1	3.5
	-0%	**9.6**	**8.6**	**9.2**	**7.0**	**7.2**	4.7	**7.7**
AMEX	+0%	**6.8**	**3.1**	**3.4**	3.6	3.9	4.8	4.3
	-0%	6.4	5.6	6.4	6.2	5.8	**2.9**	6.3
NASDAQ	+0%	**6.7**	4.5	4.9	5.0	4.6	5.7	5.4
	-0%	**8.4**	**7.4**	**7.1**	**6.8**	**7.1**	4.1	**6.7**
NYSE	+0%	5.6	4.7	5.7	5.2	5.0	5.5	5.5
	-0%	5.7	4.0	4.5	4.6	4.8	3.9	5.0
Rates outside (3.5%, 6.5%)		17	9	8	4	7	4	7
Standard deviation (%)		2.21	1.69	1.65	1.13	1.34	0.93	2.33

Table 7: Test specification with clustered event dates

Percentage rejection rates from 1,000 simulated event studies in each market with clustered event dates and no abnormal performance introduced. Each event study includes 50 security/event date combinations. The 50,000 security/event date combinations in each market are randomly selected without replacement. +0% and -0% indicate upper and lower tail tests, respectively, calibrated to a theoretical 5-percent test level in each tail. Rejection rates outside the interval (3.5%, 6.5%) indicated in bold represent instances of test misspecification.

		T-tests		Boot-strap	Rank tests		Sign tests	
Market	Δ%	(T_P)	(T_P^*)	(T_B)	(T_R)	(T_R^*)	$(\bar{T}_S)$	$(\hat{T}_S)$
		Panel A: Logarithmic returns with equal weight indexes						
Australia	+0%	**10.5**	**9.7**	**10.0**	**10.6**	**11.2**	**11.5**	**10.4**
	-0%	**11.2**	**12.0**	**12.6**	**13.2**	**13.6**	**10.0**	**13.2**
Shanghai	+0%	5.8	4.9	5.3	5.3	5.7	**7.2**	**7.5**
	-0%	6.0	**7.2**	**7.2**	**8.0**	**9.2**	**8.1**	**9.3**
Shen Zhen	+0%	**7.0**	4.8	5.1	5.0	4.8	**7.0**	**8.7**
	-0%	4.9	6.1	6.2	6.5	**7.9**	5.9	**8.2**
Hong Kong	+0%	**11.0**	**8.8**	**9.3**	**10.3**	**10.2**	**12.4**	**11.0**
	-0%	**11.2**	**10.5**	**10.2**	**13.3**	**12.8**	**12.1**	**14.6**
India	+0%	6.3	**7.0**	**7.1**	**6.8**	**6.7**	**6.6**	**7.5**
	-0%	6.4	**9.2**	**9.6**	**9.3**	**12.4**	**8.8**	**10.6**
Japan	+0%	5.4	4.4	4.3	5.3	5.7	5.2	5.6
	-0%	**6.7**	6.4	**6.7**	**6.7**	6.4	6.5	**7.5**
Korea	+0%	**7.2**	5.6	6.0	**6.9**	**6.7**	**7.2**	**7.5**
	-0%	**8.1**	**7.5**	**7.6**	**8.0**	**7.7**	**7.1**	**7.8**
Malaysia	+0%	**8.2**	5.7	**6.4**	6.3	**6.9**	**7.4**	6.5
	-0%	**9.4**	**10.3**	**10.7**	**12.2**	**11.9**	**14.1**	**15.9**
Taiwan	+0%	**6.9**	**7.7**	**8.1**	**6.8**	**7.5**	**9.4**	**8.8**
	-0%	4.8	**6.7**	6.2	**7.9**	**9.1**	**6.7**	**8.7**
TH/SG/ID	+0%	**8.6**	**7.6**	**7.5**	**9.2**	**8.6**	**8.0**	**9.0**
	-0%	**10.3**	**13.1**	**13.0**	**12.9**	**14.9**	**11.4**	**14.2**
AMEX	+0%	**7.9**	5.6	6.3	**8.1**	**7.0**	**7.7**	**8.5**
	-0%	**8.8**	**8.5**	**8.8**	**9.0**	**8.7**	**7.2**	**10.0**
NASDAQ	+0%	6.0	4.5	4.8	5.9	5.4	4.8	5.9
	-0%	**9.2**	**7.5**	**8.6**	**9.3**	**9.0**	**6.7**	**7.7**
NYSE	+0%	6.3	5.9	6.1	6.3	6.4	5.9	**7.1**
	-0%	**7.5**	5.5	5.5	6.1	6.1	5.1	6.3
Rates outside (3.5%, 6.5%)		17	15	15	18	19	20	22
Standard deviation (%)		3.36	3.30	3.50	4.10	4.47	3.91	4.93

Table 7 continued

		T-tests		Boot-strap	Rank tests		Sign tests	
Market	Δ%	(T_P)	(T_P^*)	(T_B)	(T_R)	(T_R^*)	$(\bar{T}_S)$	$(\hat{T}_S)$
		Panel B: Logarithmic returns with value weight indexes						
Australia	+0%	**11.9**	**14.1**	**14.1**	**12.7**	**13.4**	**11.6**	**10.9**
	-0%	**13.6**	**14.9**	**15.9**	**18.0**	**18.8**	**14.1**	**16.7**
Shanghai	+0%	**10.8**	**10.7**	**11.3**	**11.2**	**11.2**	**10.5**	**11.2**
	-0%	**11.4**	**12.4**	**13.1**	**13.9**	**15.9**	**12.2**	**14.2**
Shen Zhen	+0%	**9.2**	**7.7**	**8.3**	**8.3**	**8.2**	**8.0**	**10.2**
	-0%	**8.0**	**9.0**	**9.5**	**10.9**	**11.8**	**8.2**	**11.5**
Hong Kong	+0%	**18.7**	**18.7**	**19.2**	**19.4**	**19.8**	**16.6**	**15.7**
	-0%	**18.1**	**19.6**	**19.7**	**21.0**	**21.8**	**17.7**	**21.8**
India	+0%	**12.7**	**19.0**	**19.2**	**20.2**	**20.7**	**17.7**	**17.1**
	-0%	**11.9**	**20.0**	**20.6**	**20.0**	**25.7**	**16.6**	**19.6**
Japan	+0%	**12.0**	**11.3**	**11.6**	**12.4**	**11.9**	**8.9**	**9.9**
	-0%	**12.5**	**13.6**	**13.5**	**12.8**	**14.0**	**11.3**	**12.3**
Korea	+0%	**21.7**	**24.3**	**24.5**	**23.3**	**24.5**	**19.7**	**20.2**
	-0%	**20.4**	**21.4**	**21.4**	**22.2**	**24.0**	**23.4**	**25.3**
Malaysia	+0%	**19.8**	**17.9**	**18.5**	**19.3**	**19.4**	**16.2**	**16.7**
	-0%	**21.9**	**23.7**	**24.1**	**25.4**	**26.5**	**24.4**	**25.8**
Taiwan	+0%	**20.0**	**29.1**	**29.0**	**25.5**	**27.7**	**22.8**	**23.4**
	-0%	**19.0**	**24.0**	**24.1**	**25.6**	**30.1**	**25.7**	**26.7**
TH/SG/ID	+0%	**8.0**	**10.2**	**10.5**	**11.7**	**11.1**	**10.0**	**9.6**
	-0%	**12.9**	**16.9**	**16.8**	**18.2**	**21.8**	**15.4**	**18.4**
AMEX	+0%	**10.9**	**9.1**	**9.7**	**10.4**	**9.8**	**9.8**	**10.5**
	-0%	**14.1**	**11.9**	**12.3**	**13.3**	**12.9**	**10.4**	**13.6**
NASDAQ	+0%	**8.3**	**7.8**	**8.6**	**8.1**	**8.8**	**7.1**	**7.1**
	-0%	**12.4**	**10.9**	**11.7**	**12.0**	**11.9**	**9.5**	**12.4**
NYSE	+0%	**11.1**	**11.2**	**11.0**	**12.2**	**12.5**	**10.8**	**11.9**
	-0%	**12.9**	**10.8**	**11.4**	**12.2**	**12.7**	**10.6**	**11.6**
Rates outside (3.5%, 6.5%)		26	26	26	26	26	26	26
Standard deviation (%)		9.98	11.89	12.14	12.41	13.75	10.65	11.89

Table 7 continued

		T-tests		Boot-strap	Rank tests		Sign tests	
Market	Δ%	$\left(T_P\right)$	$\left(T_P^*\right)$	$\left(T_B\right)$	$\left(T_R\right)$	$\left(T_R^*\right)$	$\left(\bar{T}_S\right)$	$\left(\hat{T}_S\right)$
Panel C: Arithmetic returns with equal weight indexes								
Australia	+0%	**10.4**	**10.6**	**10.8**	**11.9**	**12.4**	**12.8**	**11.3**
	-0%	**11.0**	**11.5**	**11.7**	**12.4**	**12.9**	**9.0**	**12.2**
Shanghai	+0%	6.0	5.0	5.3	5.2	5.7	**7.3**	**7.9**
	-0%	5.8	**7.2**	**7.3**	**8.5**	**9.2**	**8.0**	**9.7**
Shen Zhen	+0%	**7.2**	4.7	4.8	5.2	4.9	**6.8**	**8.8**
	-0%	4.8	6.3	6.2	**6.8**	**7.9**	6.3	**7.7**
Hong Kong	+0%	**11.9**	**9.0**	**9.5**	**10.7**	**10.7**	**12.5**	**10.9**
	-0%	**11.9**	**11.2**	**11.1**	**14.3**	**13.2**	**11.3**	**14.4**
India	+0%	**6.9**	**7.2**	**7.4**	**7.8**	**7.9**	**7.6**	**7.3**
	-0%	6.2	**8.9**	**8.9**	**10.1**	**13.7**	**8.5**	**11.6**
Japan	+0%	5.7	4.5	4.5	5.9	5.7	4.8	5.5
	-0%	6.4	6.4	**6.6**	6.5	6.3	5.7	**7.7**
Korea	+0%	**7.8**	6.0	**6.6**	**7.4**	**7.4**	**7.7**	**7.8**
	-0%	**7.8**	**8.3**	**8.4**	**8.5**	**8.4**	6.5	**7.9**
Malaysia	+0%	**8.6**	5.4	6.4	**6.7**	**6.8**	**7.2**	**6.7**
	-0%	**9.4**	**10.2**	**10.8**	**11.7**	**12.6**	**13.6**	**15.9**
Taiwan	+0%	**7.7**	**8.3**	**9.1**	**7.6**	**7.9**	**8.2**	**8.5**
	-0%	5.1	**6.6**	6.5	**8.4**	**10.3**	**6.9**	**9.3**
TH/SG/ID	+0%	**8.8**	**7.9**	**8.1**	**9.5**	**9.0**	**10.0**	**9.2**
	-0%	**10.5**	**13.6**	**13.4**	**13.7**	**16.5**	**11.7**	**15.2**
AMEX	+0%	**8.2**	6.0	**6.9**	**8.0**	**8.0**	**8.5**	**8.8**
	-0%	**8.7**	**9.0**	**9.3**	**9.2**	**9.3**	6.7	**9.0**
NASDAQ	+0%	**6.7**	4.7	4.8	5.3	5.2	**6.7**	**6.7**
	-0%	**8.8**	**7.4**	**8.2**	**9.2**	**9.1**	4.8	**7.2**
NYSE	+0%	**7.4**	**7.0**	**7.1**	**7.4**	**7.8**	**7.7**	**8.4**
	-0%	**7.5**	6.4	**7.0**	**7.2**	**6.8**	6.1	**8.0**
Rates outside (3.5%, 6.5%)		19	16	19	21	21	20	25
Standard deviation (%)		3.55	3.51	3.70	4.42	4.99	3.97	5.09

Table 8: Test specification with an event date variance increase

Percentage rejection rates from 1,000 simulated event studies in each market with a doubled event date returns variance and no abnormal performance introduced. Each event study includes 50 security/event date combinations. The 50,000 security/event date combinations in each market are randomly selected without replacement. +0% and -0% indicate upper and lower tail tests, respectively, calibrated to a theoretical 5-percent test level. Rejection rates outside the interval (3.5%, 6.5%) in bold represent instances of test misspecification.

		T-tests		Boot-strap	Rank tests		Sign tests	
Market	Δ%	(T_P)	(T_P^*)	(T_B)	(T_R)	(T_R^*)	$(\bar{T}_S)$	$(\hat{T}_S)$
		Panel A: Logarithmic returns with equal weight indexes						
Australia	+0%	**15.0**	4.8	5.0	**8.9**	5.7	**8.5**	**7.4**
	-0%	**15.0**	5.6	5.9	**9.4**	5.2	4.2	6.0
Shanghai	+0%	**15.4**	3.6	3.6	**7.1**	**6.8**	**7.7**	5.5
	-0%	**19.2**	**7.2**	**7.8**	**13.8**	5.2	4.0	**7.4**
Shen Zhen	+0%	**15.6**	4.2	4.6	**7.1**	**7.2**	**10.7**	**7.3**
	-0%	**20.0**	**6.7**	**6.9**	**12.9**	**3.4**	**2.5**	5.5
Hong Kong	+0%	**15.6**	3.9	4.9	6.1	5.6	5.1	4.9
	-0%	**16.4**	6.5	**6.6**	**11.1**	5.0	4.2	**6.8**
India	+0%	**16.7**	4.0	4.8	5.9	4.2	5.5	4.7
	-0%	**18.3**	5.7	6.2	**10.9**	4.8	5.1	**7.2**
Japan	+0%	**15.2**	5.3	5.4	**7.8**	5.8	6.1	4.8
	-0%	**14.6**	5.2	5.8	**11.2**	5.2	5.7	**7.3**
Korea	+0%	**13.2**	4.7	4.8	6.1	6.2	**6.8**	4.5
	-0%	**16.8**	**6.8**	**6.6**	**10.7**	5.6	4.2	5.7
Malaysia	+0%	**13.6**	**3.1**	3.6	4.3	3.9	3.7	**2.1**
	-0%	**21.2**	**8.6**	**8.5**	**14.7**	6.2	**7.0**	**9.9**
Taiwan	+0%	**17.0**	4.6	5.4	**7.7**	6.5	**6.7**	6.5
	-0%	**16.7**	5.2	6.5	**10.1**	4.7	**3.2**	6.5
TH/SG/ID	+0%	**14.0**	**3.0**	3.8	**7.0**	4.9	5.2	4.7
	-0%	**23.0**	**7.3**	**7.9**	**15.0**	**7.1**	5.2	**10.2**
AMEX	+0%	**15.7**	5.7	5.6	**7.4**	6.1	6.0	5.0
	-0%	**14.2**	5.3	5.8	**8.6**	5.3	4.0	5.8
NASDAQ	+0%	**11.0**	4.4	4.3	6.0	4.2	3.8	4.7
	-0%	**17.9**	**7.1**	**7.7**	**11.0**	6.1	5.4	**7.3**
NYSE	+0%	**15.4**	**6.6**	**6.9**	**11.3**	**7.2**	**7.2**	**7.5**
	-0%	**14.0**	4.0	4.5	**7.0**	4.8	**3.0**	5.4
Rates outside (3.5%, 6.5%)		26	9	8	21	5	10	11
Standard deviation (%)		11.47	1.44	1.53	5.07	1.11	1.87	2.05

Table 9: Test performance with ±3/4% abnormal performance introduced

Percentage rejection rates from 1,000 simulated event studies in each market with abnormal performance introduced. Each event study includes 50 security/event date combinations. The 50,000 security/event date combinations in each market are randomly selected without replacement. +Δ% and -Δ% indicate upper and lower tail tests with positive and negative abnormal performance, respectively.

		T-tests		Boot-strap	Rank tests		Sign tests	
Market	Δ%	$\left(T_P\right)$	$\left(T_P^*\right)$	$\left(T_B\right)$	$\left(T_R\right)$	$\left(T_R^*\right)$	$\left(\bar{T}_S\right)$	$\left(\hat{T}_S\right)$
Panel A: Logarithmic returns with equal weight indexes								
Australia	+0%	69.8	66.9	68.0	76.7	73.1	58.6	57.7
	-0%	74.7	71.3	71.3	81.9	76.9	55.9	63.6
Shanghai	+0%	90.7	89.9	89.6	97.8	97.6	95.7	95.3
	-0%	92.2	88.5	87.9	97.5	95.0	88.5	93.2
Shen Zhen	+0%	90.8	90.7	90.4	97.2	97.3	93.6	95.4
	-0%	90.5	85.4	85.0	96.2	93.5	88.6	92.2
Hong Kong	+0%	56.5	51.6	53.7	61.1	60.9	46.6	48.9
	-0%	56.9	54.3	54.7	66.5	60.8	46.3	53.8
India	+0%	39.7	39.9	42.4	51.5	49.1	42.7	44.7
	-0%	42.0	42.0	43.9	61.1	53.1	46.4	54.7
Japan	+0%	77.2	75.9	75.7	83.5	82.6	72.5	73.9
	-0%	76.6	74.0	72.8	83.9	79.7	70.3	74.6
Korea	+0%	42.5	40.2	41.2	51.2	50.4	44.6	47.2
	-0%	45.1	42.8	42.1	54.2	50.7	40.3	47.2
Malaysia	+0%	59.6	55.0	55.4	68.9	67.5	56.2	55.3
	-0%	69.4	64.1	63.0	80.2	72.9	68.8	72.1
Taiwan	+0%	65.4	66.1	66.5	78.4	76.5	64.7	66.6
	-0%	60.8	60.6	60.8	77.1	70.1	56.0	65.5
TH/SG/ID	+0%	51.1	47.9	49.0	64.3	61.0	48.3	48.6
	-0%	62.3	59.3	59.0	71.9	64.1	53.1	59.3
AMEX	+0%	84.0	80.1	80.9	89.2	87.0	73.9	75.1
	-0%	86.4	80.2	80.0	91.3	87.2	75.9	80.6
NASDAQ	+0%	38.0	38.3	39.2	46.8	45.6	35.5	37.4
	-0%	47.2	45.0	45.4	57.5	54.0	40.4	45.9
NYSE	+0%	89.7	87.7	87.5	95.7	93.7	86.8	88.9
	-0%	89.5	86.5	86.7	94.2	92.4	82.0	85.4
Column averages (%)		67.3	64.8	65.1	76.0	72.8	62.8	66.3