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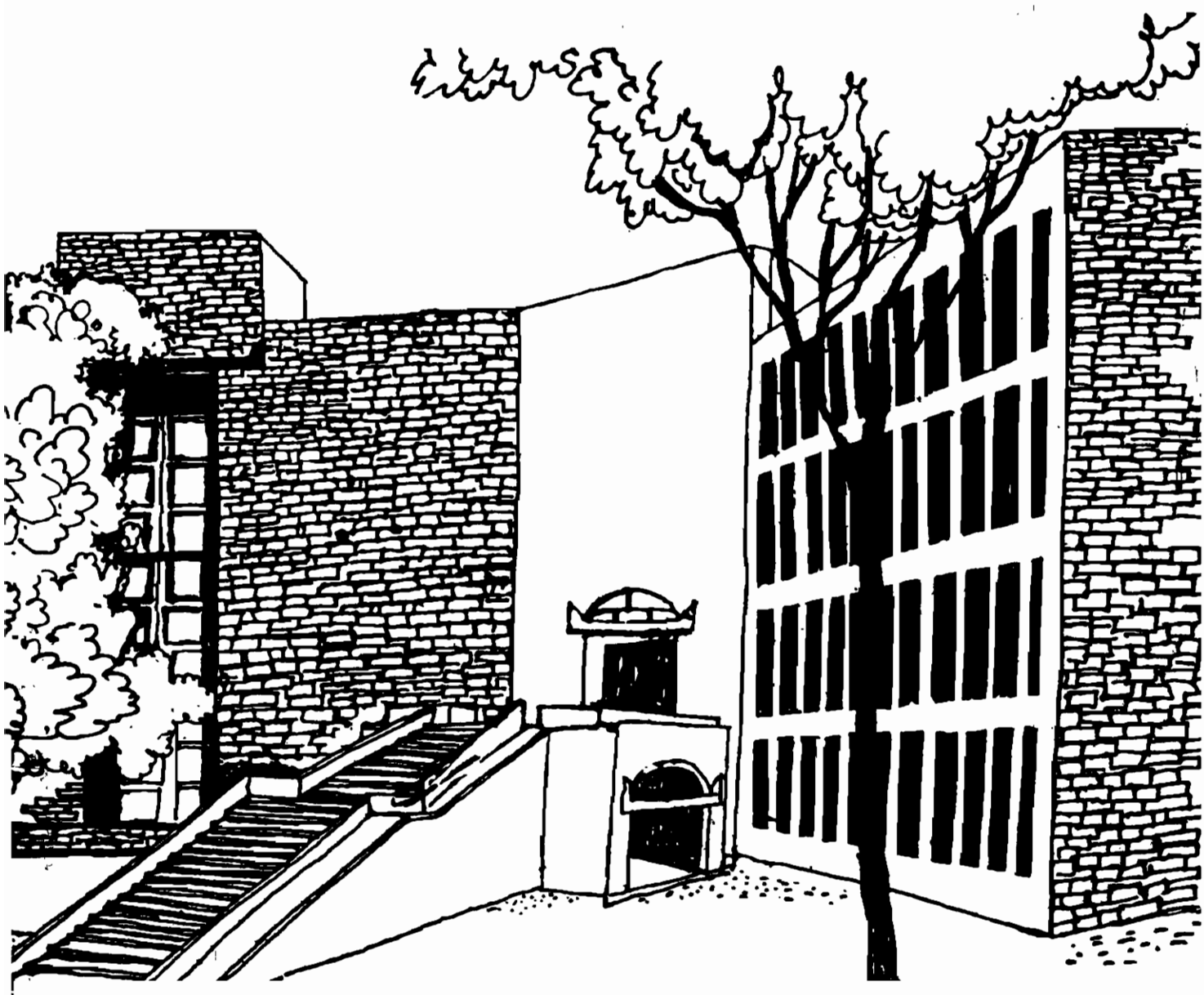

# IS THE TAIWAN STOCK MARKET EFFICIENT

By

Jyoti P. Gupta
I.M. Pandey
&
Chen Chao-Fu

W.P.No.98-12-06
December 1998 1489

WP1489
WP
98-12-06
(1489)

The main objective of the working paper series of the IIMA is to help faculty members to test our their research findings at the pre-publication stage.

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# IS THE TAIWAN STOCK MARKET EFFICIENT?

I. M. Pandey
Indian Institute of Management Ahmedabad, India
Jyoti P. Gupta
School of Management, AIT, Thailand
Chen Chao-Fu
Manager, Land Bank, Taipei, Taiwan

**ABSTRACT:** The main objective of the Taiwan Government in reforming the Taiwan Stock Exchange (TSE) has been to establish Taiwan as an Asia-Pacific financial centre. The liberalisation and internationalisation of TSE is expected to make it informationally efficient. Theoretically, the technical analysis should lose its effectiveness if a market is efficient. This study, using the serial correlation test, the run test and the normality test and simulation on mechanical rules that adopted stochastic and moving average convergence and divergence, examines the efficiency of the TSE in the period after financial deregulation and liberalisation.

**Key words:** Filter rule, market efficiency, run tests, serial correlation tests, Taiwan Stock Exchange, Technical analysis, Technical indicators tests.

## INTRODUCTION

A number of empirical studies have tested the efficient market hypothesis (EMH) in the case of developed countries. In recent years, one could also witness the interest of researchers in understanding the capital markets in emerging economies. Majority of these studies indicate that capital markets are efficient, at least, in the sense that the share price patterns can not be predicted on the basis of the past information. This is referred to as the weak-form efficiency. The empirical tests the weak-form efficiency can be divided into two types: (1) statistical tests of price series over time, and (2) the use of various mechanical trading rules or other factors that are considered "technical" in nature. The first type of tests provide support for the hypothesis that stock price changes are independently distributed random variables. In other words, the intrinsic value of a stock price series fluctuates in a random manner as new information enters the market. The second type of tests try to obtain abnormal profits in a simulation to test the EMH which implies that the future price can not be predicted by using past information.

While most of the research studies found evidences that support EMH, however, in many emerging markets like Taiwan, the technical and fundamental analysts still continue to flourish, commanding sizeable quantities of investors' capital in the process. If EMH do stand well in the emerging Taiwan stock market, then it means investors who believe in those technical analysts are wasting their money and those specialists have to start to worry about their future. Is the Taiwan stock market efficient? The objective of this paper is to attempt an answer to this question.

## THE TAIWAN STOCK EXCHANGE*

The development of Taiwan stock market may be divided into three phases: (1) before 1962, (2) between 1962 and 1987, and (3) after 1987. Before 1963, there was no centralised trading place for securities transactions, and the trading was done through the over-the-counter market (OTC). The establishment of the Taiwan Stock Exchange (TSE) in 1962 laid the foundation for the later activities in the Taiwan capital market. Taiwan's securities market thus has a relatively short history when compared with those of other countries. In January 1988, the government promulgated the Securities Exchange Law Amendment (SELA) to improve the functioning and scope of the domestic stock market. Since then, the market is much more liberalised and internationalised.

The TSE reform has been a dynamic and complex process as the regulatory authorities, in particular the Ministry of Finance (MoF) and the Securities Exchange Commission (SEC),* have attempted to liberalise and internationalise the TSE to improve its efficacy for both the users and suppliers of capital. Much substantial reforms have been implemented since the 1988 SELA. For instance,

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* For more details, please refer to publications of Taiwan Stock Exchange Corporation (1994 & 1997) and Taiwan Stock Exchange (1997).

the reforms include the permission for the new entry of securities firms, securities investment trust enterprises (SITEs), securities investment consulting enterprises (SICEs), and securities finance companies; the relaxation of investment by foreign individual and institutions; the raising of ceilings of foreign investment; deregulation of investment by financial institutions; and the deregulation of share issuing. All these reform are intended to make the TSE much deeper and broader. At present, the Taiwan Stock Exchange (TAIEX) has been added to the MSCI Emerging Markets Indices (EMI) and this is expected to draw significant buying interest from foreign investors.

The TAIEX index is compiled in accordance with *Paasche's formula*; that is, the figure derived from each day's total market value is divided by the base day's total market value. It takes the majority of issues listed on the exchange into account so as to accurately reflect market trends, and weighs the various issues according to the number of shares affecting the stock index. The formula is as follows:

$$\text{Index} = (\Sigma P_t Q_t / \Sigma P_0 Q_t) * 100$$

where $P_t$ = current close price of one stock A, $Q_t$ = Number of outstanding shares of company A, $P_0$ = stock price on the base day, $\Sigma P_t Q_t$ = total market capitalisation of all constituent stocks, $\Sigma P_0 Q_t$ = total market capitalisation of all constituent stocks at the base day, Base day = 1966. When there are changes in the total market value due to the listing of new issues, capital increases or de-listing, revisions and adjustments are made in the denominator, that is, the base day's total market value, in order to retain the index's relevance. The adjustment formula is:

New base value = Old base value * (Total capitalisation after change/ Total capitalisatio before change)

In 1967, there were two stock indices published by the Taiwan SEC; that is, the TAIEX and the Non-Financial. Since 1981, two more indices, stock category A and stock category B, are available. Moreover, eight industrial sector indices were also introduced by using the prices of December 29, 1986 as the base day. These eight indices include: cement and ceramics; foods, plastics and chemical; textiles, electrical, paper and pulp; construction; and banking and insurance. After 1994, fourteen more sector indices were published by the TSEC where some of them were split from the original indices.

## EMPIRICAL STUDIES OF WEAK-FORM EFFICIENCY

Fama (1970; 1976) defined the efficient market as a market in which firms can make production-investment decisions, and investors can choose among the securities that represent ownership of firms' activities under the assumption that security prices at any time "fully reflect" all available information; a market in which prices always fully reflect available information is called "efficient." He set the following conditions, that he considered sufficient but not necessary, for an efficient market: (a) there are no transactions costs in trading securities; (b) all

available information is costlessly available to all market participants; (c) all agree on the implications of current information for the current price and distributions of future prices of each security; and (d) all market participants are price takers.

Some empirical tests do show that it is possible to devise trading schemes based on very short term price swings that will on average out perform buy-and-hold (B&H) strategy. However, when one takes account of the minimum trading costs that would be generated by small filters, their advantage over B&H strategy disappears. (Alexander, 1964 ; Fama, 1976). Radcliffe (1994) draws a distinction between a perfectly efficient and an economically efficient market. According to him, a perfectly efficient market is one in which prices always reflect all known information, prices adjust instantaneously to new information, and speculative profits are simply a matter of luck. In an economically efficient market, prices might not adjust instantaneously to information, but, over the long run, speculative profits can not be earned after transaction costs such as brokerage commissions and taxes are paid.

Three versions of the efficient markets, depending on the specification of the information set, have been identified (Fama, 1970 & 1976). Firstly, in the weak form efficient market, the information set is just historical prices, and technical analysis can not be adopted to obtain excess return. Secondly, in the semi-strong efficient market, prices efficiently adjust to other information that is obviously publicly available. (e.g., announcements of annual earning, stock splits, etc.) Investors using fundamental analysis are not able to obtain excess return either. Finally, in the strong form efficient market, even investors with non-public information cannot earn superior investment results.

Owing to continuing evidence such as the size effect and January effect, challenging the EMH, Fama (1991) published an article titled "Efficient Capital Market: II" in which he replaced the three categories of efficient market - "weak form", "semi-strong" and "strong" - with "tests for return predictability", "event studies", and "tests for private information." In the tests for return predictability, in addition to only past price, variables like dividend yields and interest rates were also considered.

Researchers have used four methods to test the EMH in the weak form:

- Serial correlation test
- Run test
- Filter rule tests
- Technical indicators tests

**Serial Correlation Test**

A serial correlation or auto-correlation is a test of the correlation between the return on a stock in a given time period with its return in a subsequent time period. In an efficient market, the serial correlation coefficients should not be significantly different from zero. Trading decisions based on past returns are possible if the auto-correlation is significantly large.

By far the most comprehensive test has been conducted by Fama (1965) who examined daily returns for each of the 30 stocks in the Dow Jones Industrial Average between the years 1957 to 1962. He found that the auto-correlation was generally positive, but statistically very close to zero. He also calculated correlations for returns using lags of time intervals greater than a day, i.e. over four-, nine-, and sixteen-day intervals and then correlated with prior four-, nine-, and sixteen-day returns. Again, a few correlations were statistically different from zero and, the correlations were too small to be useful to traders.

The subsequent studies by Kendall (1953), Cootner (1962), and Moor (1964) are noteworthy. These studies and many others including tests that were carried out on the Taiwan Stock Exchange (Table 1)., generally arrived at the same conclusions as Fama (1965). Radcliffe (1994) has summarised the findings of these studies as follows: (1) Short-term security returns are generally unrelated to prior returns. This is true not only for the United States but also for many other countries. (2) In those cases where a significant correlation does exist between past and present returns, the size of the correlation is so slight that it is doubtful that profitable trading rules could be developed. (3) A minor tendency seems to exist towards positive correlation. But this can be explained by realising that stocks contain risk and will, on the average, yield positive returns. The slight positive correlation in returns simply reflects long-run positive returns on stocks. When returns are adjusted for such a risk impact, they show no correlation. (4) A "large return" day tends is followed by another "large return" day. But there is no relationship with the direction of the subsequent return. That is, given a large price drop on day 0, the price change on day 1 is also likely to be large – but the direction is unknown. (5) Tests on T-bills and futures prices suggest that they too follow a random walk.

**Insert Table 1**

**Run Test**

A run is a sequence of successive days/weeks/months in which the price moves in the same direction. Each day/week/month is classified as being a day/week/month of price rise or price fall, and the lengths of the runs are tallied. If this series of observations was random, the index of one sector traded on one day would be independent of that on any other. Then, a high index would be no more likely to be followed by another high index than by a low index.

Alexander (1961) conducted a set of simple tests of randomness of successive monthly or weekly changes of speculative prices (i.e. Wednesday closing prices of cash wheat over the period 1883-1934, excluding 1915-1920, a total of 2,379 weeks.) He found that the sequence of direction of changes in weekly wheat prices followed a random walk. Stevenson and Bear (1970) also obtained similar results of the price changes of July corn and July soybean during 1957 to 1968.

In Taiwan, Kue (1980) tested the weekly price of 20 stocks listed on the TSE and found that their changes of returns were randomly distributed. Further, Hong

(1985) tested the daily, weekly and monthly prices of 33 listed stocks from 1976 to 1984, and concluded that the TSE conformed to the weak form of the EMH.

**Tests of Technical Analysis**

The Dow theory, formulated by Charles H. Dow, is the foundation of much of the technical analysis. William P. Hamilton and Robert Rhea modified and polished the theory later on. The modern Dow theory is an integration of the ideas of Dow, Hamilton and Rhea.

Magee (1966) has provided a comprehensive definition of technical analysis. He states: "Technical analysis is the science of recording, usually in graphic form, the actual history of trading (price changes, volume of transactions, etc.) in a certain stock or in 'the averages' and then deducing from that pictured history the probable future trend". The basic premise of technical analysis is that the demand-supply forces determine the security prices. Thus, the technical analysts try to forecast short-run shifts in supply and demand which will affect the market price of one or more securities. Pure technicians tend to ignore factors such as the firms' risks and earnings growth. By concentrating upon this demand-supply factors, they claim to predict the direction of price movement and achieve gains by properly timing their buying and selling activities. According to the protagonists of Random Walk Hypothesis (RWH), this is not at all possible because price movements are seemingly display of a totally random process. Thus, there is no way to predict the future price movements. Although a great number of empirical studies on the effectiveness of technical analysis have been conducted during this century, the issue still remain disputable. Two important tests of technical analysis include filter tests and technical indicators tests.

***Filter tests.*** Some well known studies using the filter rule tests are those carried out by Alexander (1961), Fama & Blume (1966) and Sweeney (1988). In Taiwan, the similar tests were carried out by several researchers . The findings of some of the studies are given in Table 2.

**Table 2**

***Test on other technical indicators.*** Several technical indicators are also used in practice in predicting the share price changes. Researchers have carried out tests of the effectiveness of these indicators. Results of some of these studies, respectively in USA and Taiwan, are shown in Tables 3 and 4.

**Tables 3 and 4**

## METHODOLOGY AND DATA

Most studies of the EMH in Taiwan relate to pre-reform period when the Taiwan stock market was narrow and highly restricted. The present study uses the TSE data of the post-liberalisation period. The sector indices, tested in this study,

included the TAIEX and the eight industrial sector indices published after 1986. Since most policies to improve the market were promulgated after 1990, the study, therefore, tested the efficiency of the market over a 7-year period from 1990 to 1997 which was further broken into two period: October 1990 to October 1993 and October 1993 to October 1997.

The weekly data of each sector from October 13, 1990 to October 13, 1997 were collected from the TSE. The data included weekly open and close indices and return in percentage points. Nine indices studied are: TAIEX; Cement and Ceramics; Food, Plastics and Chemical; Textiles; Electrical; Paper and Pulp; Construction; and Banking. In order to compare the level of efficiency in two periods, the tests were conducted for the period of October 13, 1990 to October 12, 1993 and October 13, 1993 to October 13, 1997, respectively.

In the study, the simulation and statistical tests were used with the objective of testing the weak form efficiency of the TSE and thus, examining the effectiveness of technical analysis in the TSE. The following hypotheses were tested:

| | |
|---|---|
| H1 | the population correlation coefficient of successive price changes in different lags are zero. |
| H2 | the changes in stock prices are randomly distributed. |
| H3 | the changes in stock prices follow a normal distribution. |

The first hypothesis would test the efficiency of the market. In this case, the correlation coefficients of returns between different lags should be zero, or just slightly different from zero; the absolute t-value should not be larger than $t_{n-2, \alpha/2}$.

The second hypothesis would test the randomness of the series of prices changes. It would detect whether trends exist in price changes. If a series of price changes is random, the changes of prices of shares traded on one day will be independent of that on any other day, and there will be no abnormal profit that can be obtained from the trading rules.

The third hypothesis would test whether the random variables in this study follow a normal distribution. If it is a normal distribution, the skewness will be zero or close to zero. In addition, for the normal distribution, the population kurtosis should be 3. The Bowman-Shelton test for normality is, therefore, based on the closeness to 0 of the sample skewness and the closeness to 3 of the sample kurtosis. The significance at 5% and 10% significance level will be tested.

In the case of simulation on mechanical trading rule, the decision rules to judge whether the market is efficient in its weak form or not is that: (i) whether or not the performance of mechanical trading rule (technical analysis) is better than that of the buy-and-hold (B&H) strategy; and (ii) whether or not the first condition can be sustained in different time periods. The rates of return under technical analysis and B&H strategy in different periods are compared and tested by using t-test in order to detect if their performances are significantly different from each other. It is believed that if the market is efficient in its weak form, the expected value of

excess rate of return is zero. In other words, one technical indicator is effective only if there is positive excess rate of return obtained, and it is consistently positive in two consecutive periods as well as the whole study period under 5% and 10% significant level.

As for the simulation, the technical indicators, stochastic K%D and moving average convergence and divergence (MACD), are employed. The technical factor, K%D, is very susceptible to stock-price changes. Therefore, a short holding period and a high transaction frequency should underlie an investment decision when K%D is adopted. Due to its high sensitivity, it is able to indicate to investors the reverses of stock movement. Therefore, when one stock is moving up and down in a regular pattern of waves, generally one can obtain excess return by adopting K%D. Further, it is appropriate to adopt K%D when one stock is in its early stage of a bullish trend. However, the sensitivity of K%D also causes disguising signals when one stock is having a small range of sideways correction. Furthermore, when one stock price continues to move up or down for quite a long period without any correction, it is very easy for K%D to become inactive in the upper or lower extreme zone (80 or 20). This character of K%D generally will lead investors to make a wrong decision and cause loss in their investment activities.

The MACD is a trend-following momentum indicator and the interval of the formula is quite long. Therefore, when MACD is adopted in making investment decision, the holding period tends to be longer and the transaction frequency will be fewer than the K%D indicator. From the results of simulation, it is believed that the MACD can do better in a longer term trend. However, as it is a trend following indicator, it can only tell us that a trend has begun, but only after the fact. Therefore, it is very natural that there is always time lag in signals. The time lag in signals leads investors to react too late and therefore, the profit is decreased. The time lag is reduced with the shorter average, but can never be completely eliminated. However, shorter-term averages are more sensitive to the price action and it will be easier for MACD to generate disguising signals. As it has been mentioned in the above paragraphs, K%D usually creates disguising signal on the small range of sideways trend and so does MACD, but generally not as frequently as K%D does. The disguising signals on the sideways trend increase the frequency of transactions that cause the performance being deteriorated by increased transaction cost and losses from the failed transactions.

While studies in the past have generally used daily data to carry out simulation, we have used weekly and monthly data in order to test its effectiveness in longer time intervals. By comparing the performance of mechanical rules and that of B&H strategy, it is expected to test the effectiveness of individual technical indicator as well as the weak form of the EMH.

## RESULTS

### Serial Correlation Test

The sample serial correlation coefficients of return were computed for TAIEX and eight sectors for lag of one week to lag of ten weeks. Most of the sample serial

correlation coefficients (see Table 5 to Table 13) are quite small and some of them are negative. There is no significant difference between the correlation coefficients of periods I, II and III. Most of the serial correlation coefficients within lags 3, 5, 6, and 9 are larger than that in the other lags and lag 3 is the most significant.

**Tables 5 to 13**

**Run Test**

The results of the run test are given in Table 14. The results show that the null hypothesis is rejected only in the second period for food sector under 10% significance level as well as in the first period of plastics and chemical sector under 5% significance level. In case of other sectors, z-values are quite small and the null hypothesis can not be rejected. In period III, all the series of prices changes are found to be random.

**Table 14**

**Normality Test**

The results of the normality test are shown in Table 15. In the first period, all the prices have positive skewness while in the second period some of them have negative skewness. However, for the entire period of the study, the skewness coefficients for the TAIEX and all the eight sectors are all positive. Further, the range of the coefficients of kurtosis spreads from 0.30 to 6.66. Most of them are around 2.00-3.00. However, the results of the test show that only the TAIEX in the second period is inconsistent with the null hypothesis, the others, no matter in which period, all reject the null hypothesis. In all, the price changes of the TAIEX is close to the normal distribution, but not exactly. For the other sectors, the results show that they do not conform to the normal distribution. Furthermore, the results do not indicate that the price changes are closer to normal distribution in the second period.

**Table 15**

**Simulation on Mechanical Trading Rules**

Our results show that most of the time K%D has performed poorer than B&H strategy except in paper and pulp sector. Also, its performance in the second period is much worse than in the first period and that causes its performance in the whole study period to be worse than B&H strategy.

By adopting MACD in the simulation, the results show that the performance of MACD is much better than K%D. The performance of MACD in the first period is better than B&H strategy. However, in the second period, only the performance in

two sectors: cement and ceramics and food is better than B&H strategy. The performance in the other sectors, which is similar in the case of K%D, are much worse than in the first period. The detailed results are shown in Tables 16 and 17.

**Table 16 and 17**

Although K%D failed in some sectors in the first period and most of the sectors in the second period, it still performed very well in the paper and pulp sector. MACD failed in the second period in most of the sectors but still performed better than B&H in cement and ceramics sector and food sector. These evidences indicate that, for every individual technical indicator, it can obtain excess return in one stock but might not perform in the same in other stocks. The movement pattern of one stock price is directly influenced by different conditions and circumstances in that period of time. One should choose the technical indicator that can better predict the movement pattern of the stock. However, it is very difficult to foresee the movement pattern of one stock price and investors may lose money if they adopt a wrong technical indicator.

Our results indicate that the longer interval can stop creating disguising signals of a technical indicator. However, it makes the indicator slow in generating signals. Hence, the performance of adopting indicators of longer intervals might not be better than that of indicators of shorter intervals. It is also revealed that even though, in all the sectors except electrical, the weekly MACD obtained excess return in the first period, it could not consistently beat B&H strategy in the second period. Therefore, one technical indicator that was effective in one period of time might not be effective in the other period of time.

It is shown from our results that by adopting weekly K%D or MACD, investors are not able to obtain excess return in the second period. Meanwhile, the performance of both K%D and MACD in the second period is much poorer than in the first period. However, in some sectors such as electrical in the first period and construction and banking in the second period, the total amount of profit obtained from simulation is larger than under B&H strategy, but their excess rates of return are very close to zero and their t-values are not big enough to reject the null hypothesis. Thus, the null hypothesis can not be rejected and the market is efficient in its weak form in the second period. It is believed that the market has improved after the introduction of policies of internationalisation and liberalisation by the Taiwan government.

## CONCLUSIONS

The results of serial correlation test show that there is no significant correlation between stock price changes and lags. The successive price changes are independent with each other; this implies that it is very difficult to find variables which are useful in predicting future share prices and returns. Further, the results of run test indicate that the series of price changes are randomly distributed. No trend is observable in the series of price changes and consequently, no abnormal profit can be obtained from carrying out trading rules. The results of normality test show that the series of variables do not conform to normal distribution. The results

of the run test are quite consistent with the serial correlation test. Being a non-parametric test, the run test makes no assumption about the distribution from which the observation are drawn. Thus, the Taiwan stock market conforms to the weak form of efficiency.

The results of simulation on mechanical trading rules (K%D and MACD) show that the market do generally conform to the weak form efficiency. The weekly K%D can not obtain excess return in the first-period and it is even worse in the second period. The weekly MACD can obtain abnormal profit in the first period but it can not consistently do so in the next period. The performance of both weekly K%D and MACD in the second are much worse than that in the first period.

In view of the simulation results, we can not completely neglect the worth of technical analysis. Generally, one experienced technician or analyst would not simply adopt one technical indicator, but he is likely to consider several indicators and methods in the investment appraisal process and finally make a decision. Therefore, it is quite difficult to test whether technical indicator is effective or not.

The results of statistical tests and simulation are generally consistent with each other and basically conform to the weak form of EMH. However, the results of statistical tests do not completely match with the results of simulation, especially in the first period. The results of serial correlation test and run test show that the series of price changes and successive prices changes are independent and randomly distributed in the first period. However, the results of simulation show that K%D can obtain excess return in some sectors and so does MACD in most of the sectors in the same period. Similar inconsistencies also exist in the second period. The main reason for concluding that both methods conform to EMH is that, in most cases, they are not able to consistently obtain excess return in the second period. Besides, the results of statistical tests do not show any significant difference between two period.

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**Table 1. Summary of Serial Correlation Test in Taiwan**

| Researcher | Data | Results |
|---|---|---|
| Huang Shr Lu (1978) | Half-monthly price of 23 stocks from Feb. 1973 to Feb. 1978 | Not correlated |
| Chang Jin Kue (1980) | Weekly price of 20 stocks from 1973 to 1978 (1 – 4 lags) | Independent between lags. |
| Lee Hue Hong | Daily, weekly and monthly price of 33 stocks from 1976 to 1984 | Not correlated |

**Table 2. Summary of Studies of Filter Rule Tests**

| Researcher | Data | Results |
|---|---|---|
| Hsu Shr Hau (1979) | 27 stocks which have largest trading value in 1973 from 1974 to 1977 | Performance of Filter Rule is better than B & H. The market is not efficient. |
| Lee Huei Hung (1985) | Randomly select 33 stocks | Filter of 1% to 10% not valid. Filter of 11% valid. |
| Lin Chung Yong (1989) | 32 stocks which have the highest turnover during the period of 1986 to 1989 and studied during 1987 to 1988 | With transaction cost, filter of 6% to 30% can obtain excess return. |
| Alexander (1964) | Dow Jones Industrials from 1897 to 1927 and S&P Industrials from 1929 to 1959 | Invalid |
| Fama and Blume (1966) | 30 stocks listed in the New York Stock Exchange form 1957 to 1962 | Invalid |
| Sweeney (1988) | Same as above mentioned 30 stocks from 1970-1982 | Valid |

**Table 3. Studies of Technical Indicators in USA**

| Researcher | Data | MA | RSI | CRISMA |
|---|---|---|---|---|
| Van Horne & Parker (1967, 1968) | 30 stocks in the NYSE from 1960 to 1966 | X | | * |
| F. E. James (1968) | Common stocks in the NYSE from 1926 to 1960 using simple MA and exponential MA | X | | |
| Cootner (1962) | 45 stocks listed in the New York Stock Exchange from 1956 to 1960 | X | | |
| Robert A. Levy (1967) | Weekly closing prices of 200 stocks on the NYSE for the 260-week period | | O | |
| Michael C. Jensen & George A Beninton (1970) | University of Chicago Centre for Research in Security Prices Monthly Price Relative File | | X | |
| James Bohan (1981) | Rate of change for each of the S&P industry groups for each year from 1969 to 1980, | | O | |
| Pruitt, Tse & White (1992) | 148 stocks recommended by the CRISMA system from 1986 to 1990 | | | O |

*'O'' represents the way is valid,*
*''X'' represents the way is not valid*

**Table 4. Studies of Technical Indicators in Taiwan**

| Researcher | Data | MA | RSI | BIAS | KD | R% | MACD |
|---|---|---|---|---|---|---|---|
| Lee Huei Hung (1985) | Randomly select 33 stocks | X | | | | | |
| Yie Jr Wu (1986) | Weighted Index | O | | | | | |
| Lin Chung Yong (1989) | 32 stocks which have the highest turnover during the period of 1986-1988 and studied during 1987-1988 | X | X | | | | |
| Hsu Jue Long (1989) | 50 blue chips in Category A from 1975 to 1982 | X | X | X | | | |
| Yo Kuo Gee (1990) | 147 stocks randomly selected | | O | | | | |
| Chen Hsin Chiang (1990) | 22 stocks randomly selected which were listed before 1989 for 1 year (1989) | X | X | X | X | | |
| Lai Sheng Chang | 32 stocks which were selected from different sectors and listed before 1983 from 1984 to 1989 | O | X | | X | | |
| Chan Yi Ching (1990) | 166 stocks from 1980 to 1989 | O | | | | | |
| Tsai Yi Long (1990) | 110 stocks listed before Aug. 1986 from 1986 to 1989 | O | X | X | X | X | O |
| Fang Kuo Jung (1991) | Weighted Index and 7 Sector Index from 1987 to 1990 | O | X | O | O | O | X |
| Su Jr Long (1992) | Weighted Index from 1987 to 1991 | | | X | | X | |
| Kuang Yin Lin (1993) | Weighted Index from 1967 to 1991 | O | X | X | X | X | |

*O represents the way is valid*
*X represents the way is not valid*

**Table 5. The Results of Serial Correlation Test – TAIEX**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | 0.0568 | 0.7078 | 1.9754 | 1.6547 | 206 | 0.0228 | 0.3263 | 1.9717 | 1.6524 | 364 | 0.0443 | 0.8445 | 1.9665 | 1.6491 |
| 2 | 156 | 0.0775 | 0.9643 | 1.9755 | 1.6548 | 205 | 0.0761 | 1.0881 | 1.9717 | 1.6524 | 363 | 0.0770 | 1.4665 | 1.9666 | 1.6491 |
| 3 | 155 | 0.1052 | 1.3085 | 1.9756 | 1.6549 | 204 | 0.1853 | **2.6796 | 1.9718 | 1.6524 | 362 | 0.1370 | **2.6251 | 1.9666 | 1.6491 |
| 4 | 154 | 0.0320 | 0.3946 | 1.9757 | 1.6549 | 203 | 0.0179 | 0.2543 | 1.9718 | 1.6525 | 361 | 0.0276 | 0.5230 | 1.9666 | 1.6491 |
| 5 | 153 | 0.1128 | 1.3952 | 1.9758 | 1.6550 | 202 | -0.0400 | -0.5668 | 1.9719 | 1.6525 | 360 | 0.0524 | 0.9925 | 1.9666 | 1.6491 |
| 6 | 152 | -0.0153 | -0.1875 | 1.9759 | 1.6551 | 201 | -0.1009 | -1.4308 | 1.9720 | 1.6525 | 359 | -0.0528 | -0.9988 | 1.9666 | 1.6491 |
| 7 | 151 | -0.0570 | -0.6966 | 1.9760 | 1.6551 | 200 | -0.0375 | -0.5286 | 1.9720 | 1.6526 | 358 | -0.0429 | -0.8105 | 1.9667 | 1.6491 |
| 8 | 150 | -0.0750 | -0.9153 | 1.9761 | 1.6552 | 199 | 0.0844 | 1.1892 | 1.9721 | 1.6526 | 357 | -0.0047 | -0.0886 | 1.9667 | 1.6492 |
| 9 | 149 | -0.0187 | -0.2265 | 1.9762 | 1.6553 | 198 | -0.1483 | **-2.0993 | 1.9721 | 1.6527 | 356 | -0.0660 | -1.2437 | 1.9667 | 1.6492 |
| 10 | 148 | 0.0295 | 0.3565 | 1.9763 | 1.6554 | 197 | -0.0995 | -1.3968 | 1.9722 | 1.6527 | 355 | -0.0252 | -0.4728 | 1.9667 | 1.6492 |

* *The null hypothesis is rejected under 10% significance level.*

** *The null hypothesis is rejected under 5 % significance level*

**Table 6. The Results of Serial Correlation Test – Cement & Ceramics Sector**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | 0.0084 | 0.1048 | 1.9754 | 1.6547 | 206 | -0.0540 | -0.7730 | 1.9717 | 1.6524 | 364 | -0.0163 | -0.3095 | 1.9665 | 1.6491 |
| 2 | 156 | 0.0143 | 0.1775 | 1.9755 | 1.6548 | 205 | 0.0347 | 0.4949 | 1.9717 | 1.6524 | 363 | 0.0233 | 0.4430 | 1.9666 | 1.6491 |
| 3 | 155 | 0.0284 | 0.3518 | 1.9756 | 1.6549 | 204 | 0.0996 | 1.4229 | 1.9718 | 1.6524 | 362 | 0.0583 | 1.1087 | 1.9666 | 1.6491 |
| 4 | 154 | -0.0403 | -0.4969 | 1.9757 | 1.6549 | 203 | -0.0653 | -0.9276 | 1.9718 | 1.6525 | 361 | -0.0486 | -0.9212 | 1.9666 | 1.6491 |
| 5 | 153 | 0.0760 | 0.9369 | 1.9758 | 1.6550 | 202 | 0.0462 | 0.6534 | 1.9719 | 1.6525 | 360 | 0.0642 | 1.2172 | 1.9666 | 1.6491 |
| 6 | 152 | -0.0806 | -0.9905 | 1.9759 | 1.6551 | 201 | -0.0408 | -0.5756 | 1.9720 | 1.6525 | 359 | -0.0648 | -1.2271 | 1.9666 | 1.6491 |
| 7 | 151 | -0.0043 | -0.0527 | 1.9760 | 1.6551 | 200 | 0.0095 | 0.1334 | 1.9720 | 1.6526 | 358 | -0.0010 | -0.0183 | 1.9667 | 1.6491 |
| 8 | 150 | 0.0268 | 0.3260 | 1.9761 | 1.6552 | 199 | 0.0192 | 0.2690 | 1.9721 | 1.6526 | 357 | 0.0259 | 0.4875 | 1.9667 | 1.6492 |
| 9 | 149 | -0.0790 | -0.9611 | 1.9762 | 1.6553 | 198 | -0.1019 | -1.4341 | 1.9721 | 1.6527 | 356 | -0.0879 | *-1.6595 | 1.9667 | 1.6492 |
| 10 | 148 | -0.0104 | -0.1257 | 1.9763 | 1.6554 | 197 | -0.0197 | -0.2756 | 1.9722 | 1.6527 | 355 | -0.0134 | -0.2527 | 1.9667 | 1.6492 |

* The null hypothesis is rejected under 10% significance level.
** The null hypothesis is rejected under 5 % significance level.

**Table 7. The Results of Serial Correlation Tests – Food Sector**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | -0.0142 | -0.1774 | 1.9754 | 1.6547 | 206 | -0.0301 | -0.4301 | 1.9717 | 1.6524 | 364 | -0.0177 | -0.3377 | 1.9665 | 1.6491 |
| 2 | 156 | 0.0825 | 1.0270 | 1.9755 | 1.6548 | 205 | 0.0167 | 0.2373 | 1.9717 | 1.6524 | 363 | 0.0599 | 1.1392 | 1.9666 | 1.6491 |
| 3 | 155 | 0.0643 | 0.7968 | 1.9756 | 1.6549 | 204 | 0.1809 | **2.6141 | 1.9718 | 1.6524 | 362 | 0.1037 | **1.9789 | 1.9666 | 1.6491 |
| 4 | 154 | -0.0179 | -0.2207 | 1.9757 | 1.6549 | 203 | -0.0599 | -0.8513 | 1.9718 | 1.6525 | 361 | -0.0291 | -0.5524 | 1.9666 | 1.6491 |
| 5 | 153 | 0.0485 | 0.5968 | 1.9758 | 1.6550 | 202 | -0.0902 | -1.2810 | 1.9719 | 1.6525 | 360 | -0.0002 | -0.0040 | 1.9666 | 1.6491 |
| 6 | 152 | 0.0164 | 0.2010 | 1.9759 | 1.6551 | 201 | 0.0076 | 0.1070 | 1.9720 | 1.6525 | 359 | 0.0110 | 0.2079 | 1.9666 | 1.6491 |
| 7 | 151 | 0.0090 | 0.1098 | 1.9760 | 1.6551 | 200 | 0.0027 | 0.0374 | 1.9720 | 1.6526 | 358 | 0.0029 | 0.0550 | 1.9667 | 1.6491 |
| 8 | 150 | -0.0556 | -0.6775 | 1.9761 | 1.6552 | 199 | 0.0556 | 0.7815 | 1.9721 | 1.6526 | 357 | -0.0167 | -0.3152 | 1.9667 | 1.6492 |
| 9 | 149 | 0.0073 | 0.0885 | 1.9762 | 1.6553 | 198 | -0.0793 | -1.1140 | 1.9721 | 1.6527 | 356 | -0.0313 | -0.5898 | 1.9667 | 1.6492 |
| 10 | 148 | 0.0093 | 0.1126 | 1.9763 | 1.6554 | 197 | -0.0070 | -0.0982 | 1.9722 | 1.6527 | 355 | 0.0054 | 0.1014 | 1.9667 | 1.6492 |

* The null hypothesis is rejected under 10% significance level.

** The null hypothesis is rejected under 5 % significance level.

**Table 8. The Results of Serial Correlation Test – Plastics & Chemical Sector**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | -0.0151 | -0.1884 | 1.9754 | 1.6547 | 206 | -0.0510 | -0.7290 | 1.9717 | 1.6524 | 364 | -0.0301 | -0.5738 | 1.9665 | 1.6491 |
| 2 | 156 | 0.0429 | 0.5333 | 1.9755 | 1.6548 | 205 | 0.0166 | 0.2369 | 1.9717 | 1.6524 | 363 | 0.0313 | 0.5955 | 1.9666 | 1.6491 |
| 3 | 155 | 0.0315 | 0.3897 | 1.9756 | 1.6549 | 204 | 0.1988 | **2.8832 | 1.9718 | 1.6524 | 362 | 0.1038 | **1.9803 | 1.9666 | 1.6491 |
| 4 | 154 | -0.0324 | -0.3999 | 1.9757 | 1.6549 | 203 | -0.0336 | -0.4765 | 1.9718 | 1.6525 | 361 | -0.0310 | -0.5882 | 1.9666 | 1.6491 |
| 5 | 153 | 0.0292 | 0.3595 | 1.9758 | 1.6550 | 202 | -0.0388 | -0.5489 | 1.9719 | 1.6525 | 360 | -0.0004 | -0.0084 | 1.9666 | 1.6491 |
| 6 | 152 | 0.0348 | 0.4269 | 1.9759 | 1.6551 | 201 | -0.0519 | -0.7334 | 1.9720 | 1.6525 | 359 | -0.0070 | -0.1320 | 1.9666 | 1.6491 |
| 7 | 151 | -0.0859 | -1.0528 | 1.9760 | 1.6551 | 200 | -0.0625 | -0.8816 | 1.9720 | 1.6526 | 358 | -0.0758 | -1.4343 | 1.9667 | 1.6491 |
| 8 | 150 | -0.0349 | -0.4252 | 1.9761 | 1.6552 | 199 | 0.0898 | 1.2660 | 1.9721 | 1.6526 | 357 | 0.0274 | 0.5169 | 1.9667 | 1.6492 |
| 9 | 149 | -0.0063 | -0.0769 | 1.9762 | 1.6553 | 198 | -0.0529 | -0.7417 | 1.9721 | 1.6527 | 356 | -0.0328 | -0.6183 | 1.9667 | 1.6492 |
| 10 | 148 | -0.0138 | -0.1665 | 1.9763 | 1.6554 | 197 | -0.0613 | -0.8581 | 1.9722 | 1.6527 | 355 | -0.0384 | -0.7220 | 1.9667 | 1.6492 |

* The null hypothesis is rejected under 10% significance level.

** The null hypothesis is rejected under 5 % significance level.

**Table 9. The Results of Serial Correlation Test – Textile Sector**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | 0.0356 | 0.4434 | 1.9754 | 1.6547 | 206 | 0.0225 | 0.3214 | 1.9717 | 1.6524 | 364 | 0.0306 | 0.5831 | 1.9665 | 1.6491 |
| 2 | 156 | 0.1438 | *1.8036 | 1.9755 | 1.6548 | 205 | 0.0129 | 0.1840 | 1.9717 | 1.6524 | 363 | 0.0835 | 1.5921 | 1.9666 | 1.6491 |
| 3 | 155 | 0.0838 | 1.0407 | 1.9756 | 1.6549 | 204 | 0.1081 | 1.5461 | 1.9718 | 1.6524 | 362 | 0.0954 | *1.8178 | 1.9666 | 1.6491 |
| 4 | 154 | 0.0435 | 0.5367 | 1.9757 | 1.6549 | 203 | 0.0282 | 0.4003 | 1.9718 | 1.6525 | 361 | 0.0365 | 0.6928 | 1.9666 | 1.6491 |
| 5 | 153 | 0.1317 | 1.6328 | 1.9758 | 1.6550 | 202 | -0.0280 | -0.3968 | 1.9719 | 1.6525 | 360 | 0.0561 | 1.0639 | 1.9666 | 1.6491 |
| 6 | 152 | 0.0713 | 0.8752 | 1.9759 | 1.6551 | 201 | -0.0451 | -0.6370 | 1.9720 | 1.6525 | 359 | 0.0140 | 0.2646 | 1.9666 | 1.6491 |
| 7 | 151 | -0.0148 | -0.1811 | 1.9760 | 1.6551 | 200 | -0.0008 | -0.0117 | 1.9720 | 1.6526 | 358 | -0.0042 | -0.0793 | 1.9667 | 1.6491 |
| 8 | 150 | 0.0143 | 0.1746 | 1.9761 | 1.6552 | 199 | 0.0498 | 0.6992 | 1.9721 | 1.6526 | 357 | 0.0351 | 0.6613 | 1.9667 | 1.6492 |
| 9 | 149 | 0.0237 | 0.2880 | 1.9762 | 1.6553 | 198 | -0.0463 | -0.6482 | 1.9721 | 1.6527 | 356 | -0.0155 | -0.2916 | 1.9667 | 1.6492 |
| 10 | 148 | -0.0148 | -0.1790 | 1.9763 | 1.6554 | 197 | -0.0736 | -1.0303 | 1.9722 | 1.6527 | 355 | -0.0488 | -0.9186 | 1.9667 | 1.6492 |

* The null hypothesis is rejected under 10% significance level.

** The null hypothesis is rejected under 5 % significance level.

**Table 10.The Results of Serial Correlation Test – Electrical Sector**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | 0.0284 | 0.3542 | 1.9754 | 1.6547 | 206 | -0.0224 | -0.3194 | 1.9717 | 1.6524 | 364 | 0.0047 | 0.0898 | 1.9665 | 1.6491 |
| 2 | 156 | 0.0264 | 0.3280 | 1.9755 | 1.6548 | 205 | 0.1494 | **2.1533 | 1.9717 | 1.6524 | 363 | 0.0915 | *1.7449 | 1.9666 | 1.6491 |
| 3 | 155 | 0.1276 | 1.5910 | 1.9756 | 1.6549 | 204 | 0.0994 | 1.4201 | 1.9718 | 1.6524 | 362 | 0.1145 | **2.1869 | 1.9666 | 1.6491 |
| 4 | 154 | -0.0018 | -0.0218 | 1.9757 | 1.6549 | 203 | 0.1346 | 1.9257 | 1.9718 | 1.6525 | 361 | 0.0723 | 1.3741 | 1.9666 | 1.6491 |
| 5 | 153 | 0.0673 | 0.8286 | 1.9758 | 1.6550 | 202 | -0.0919 | -1.3046 | 1.9719 | 1.6525 | 360 | -0.0127 | -0.2401 | 1.9666 | 1.6491 |
| 6 | 152 | -0.0062 | -0.0763 | 1.9759 | 1.6551 | 201 | 0.0883 | 1.2499 | 1.9720 | 1.6525 | 359 | 0.0464 | 0.8785 | 1.9666 | 1.6491 |
| 7 | 151 | 0.0303 | 0.3695 | 1.9760 | 1.6551 | 200 | -0.0357 | -0.5021 | 1.9720 | 1.6526 | 358 | -0.0048 | -0.0908 | 1.9667 | 1.6491 |
| 8 | 150 | -0.0603 | -0.7346 | 1.9761 | 1.6552 | 199 | 0.0499 | 0.7014 | 1.9721 | 1.6526 | 357 | 0.0053 | 0.1000 | 1.9667 | 1.6492 |
| 9 | 149 | -0.0136 | -0.1649 | 1.9762 | 1.6553 | 198 | -0.0721 | -1.0114 | 1.9721 | 1.6527 | 356 | -0.0416 | -0.7831 | 1.9667 | 1.6492 |
| 10 | 148 | 0.0486 | 0.5884 | 1.9763 | 1.6554 | 197 | -0.0635 | -0.8892 | 1.9722 | 1.6527 | 355 | -0.0106 | -0.1985 | 1.9667 | 1.6492 |

* The null hypothesis is rejected under 10% significance level.

** The null hypothesis is rejected under 5 % significance level.

**Table 11. The Results of Serial Correlation Test – Paper & Pulp Sector**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | 0.0255 | 0.3175 | 1.9754 | 1.6547 | 206 | -0.0333 | -0.4765 | 1.9717 | 1.6524 | 364 | -0.0029 | -0.0545 | 1.9665 | 1.6491 |
| 2 | 156 | 0.1198 | 1.4970 | 1.9755 | 1.6548 | 205 | 0.0244 | 0.3478 | 1.9717 | 1.6524 | 363 | 0.0718 | 1.3671 | 1.9666 | 1.6491 |
| 3 | 155 | 0.0085 | 0.1048 | 1.9756 | 1.6549 | 204 | 0.1095 | 1.5658 | 1.9718 | 1.6524 | 362 | 0.0568 | 1.0800 | 1.9666 | 1.6491 |
| 4 | 154 | -0.0264 | -0.3257 | 1.9757 | 1.6549 | 203 | 0.0391 | 0.5549 | 1.9718 | 1.6525 | 361 | 0.0093 | 0.1768 | 1.9666 | 1.6491 |
| 5 | 153 | 0.0973 | 1.2019 | 1.9758 | 1.6550 | 202 | -0.0290 | -0.4106 | 1.9719 | 1.6525 | 360 | 0.0359 | 0.6804 | 1.9666 | 1.6491 |
| 6 | 152 | 0.0174 | 0.2127 | 1.9759 | 1.6551 | 201 | -0.0701 | -0.9910 | 1.9720 | 1.6525 | 359 | -0.0291 | -0.5509 | 1.9666 | 1.6491 |
| 7 | 151 | -0.0186 | -0.2265 | 1.9760 | 1.6551 | 200 | 0.1031 | 1.4589 | 1.9720 | 1.6526 | 358 | 0.0391 | 0.7386 | 1.9667 | 1.6491 |
| 8 | 150 | -0.0646 | -0.7879 | 1.9761 | 1.6552 | 199 | 0.0950 | 1.3388 | 1.9721 | 1.6526 | 357 | 0.0216 | 0.4065 | 1.9667 | 1.6492 |
| 9 | 149 | -0.0485 | -0.5883 | 1.9762 | 1.6553 | 198 | -0.0972 | -1.3672 | 1.9721 | 1.6527 | 356 | -0.0712 | -1.3430 | 1.9667 | 1.6492 |
| 10 | 148 | -0.0422 | -0.5104 | 1.9763 | 1.6554 | 197 | -0.0271 | -0.3784 | 1.9722 | 1.6527 | 355 | -0.0418 | -0.7851 | 1.9667 | 1.6492 |

* The null hypothesis is rejected under 10% significance level.
** The null hypothesis is rejected under 5 % significance level.

**Table 12. The Results of Serial Correlation Test – Construction Sector**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | 0.0027 | 0.0332 | 1.9754 | 1.6547 | 206 | 0.0488 | 0.6979 | 1.9717 | 1.6524 | 364 | 0.0219 | 0.4168 | 1.9665 | 1.6491 |
| 2 | 156 | 0.1250 | 1.5636 | 1.9755 | 1.6548 | 205 | -0.0134 | -0.1903 | 1.9717 | 1.6524 | 363 | 0.0678 | 1.2903 | 1.9666 | 1.6491 |
| 3 | 155 | 0.1107 | 1.3773 | 1.9756 | 1.6549 | 204 | 0.0478 | 0.6804 | 1.9718 | 1.6524 | 362 | 0.0842 | 1.6032 | 1.9666 | 1.6491 |
| 4 | 154 | -0.0045 | -0.0555 | 1.9757 | 1.6549 | 203 | -0.0199 | -0.2819 | 1.9718 | 1.6525 | 361 | -0.0095 | -0.1791 | 1.9666 | 1.6491 |
| 5 | 153 | 0.1230 | 1.5235 | 1.9758 | 1.6550 | 202 | 0.0178 | 0.2520 | 1.9719 | 1.6525 | 360 | 0.0793 | 1.5049 | 1.9666 | 1.6491 |
| 6 | 152 | -0.0457 | -0.5607 | 1.9759 | 1.6551 | 201 | 0.0106 | 0.1489 | 1.9720 | 1.6525 | 359 | -0.0244 | -0.4605 | 1.9666 | 1.6491 |
| 7 | 151 | 0.0273 | 0.3333 | 1.9760 | 1.6551 | 200 | 0.0049 | 0.0694 | 1.9720 | 1.6526 | 358 | 0.0153 | 0.2881 | 1.9667 | 1.6491 |
| 8 | 150 | -0.0144 | -0.1751 | 1.9761 | 1.6552 | 199 | -0.0276 | -0.3870 | 1.9721 | 1.6526 | 357 | -0.0164 | -0.3091 | 1.9667 | 1.6492 |
| 9 | 149 | -0.1174 | -1.4327 | 1.9762 | 1.6553 | 198 | -0.1779 | **-2.5317 | 1.9721 | 1.6527 | 356 | -0.1432 | **-2.7222 | 1.9667 | 1.6492 |
| 10 | 148 | -0.0320 | -0.3873 | 1.9763 | 1.6554 | 197 | -0.0413 | -0.5765 | 1.9722 | 1.6527 | 355 | -0.0361 | -0.6779 | 1.9667 | 1.6492 |

* The null hypothesis is rejected under 10% significance level.

** The null hypothesis is rejected under 5 % significance level.

**Table 13. The Results of Serial Correlation Test – Banking Sector**

| | Period I | | | t-statistic | | Period II | | | t-statistic | | Period III | | | t-statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% | n | r | t-value | 5% | 10% |
| 1 | 157 | 0.1493 | *1.8798 | 1.9754 | 1.6547 | 206 | 0.0377 | 0.5392 | 1.9717 | 1.6524 | 364 | 0.1020 | *1.9501 | 1.9665 | 1.6491 |
| 2 | 156 | 0.0914 | 1.1388 | 1.9755 | 1.6548 | 205 | 0.0795 | 1.1364 | 1.9717 | 1.6524 | 363 | 0.0848 | 1.6166 | 1.9666 | 1.6491 |
| 3 | 155 | 0.1332 | *1.6618 | 1.9756 | 1.6549 | 204 | 0.1265 | *1.8128 | 1.9718 | 1.6524 | 362 | 0.1268 | **2.4259 | 1.9666 | 1.6491 |
| 4 | 154 | 0.0379 | 0.4673 | 1.9757 | 1.6549 | 203 | 0.0074 | 0.1049 | 1.9718 | 1.6525 | 361 | 0.0257 | 0.4869 | 1.9666 | 1.6491 |
| 5 | 153 | 0.0765 | 0.9434 | 1.9758 | 1.6550 | 202 | 0.0187 | 0.2651 | 1.9719 | 1.6525 | 360 | 0.0501 | 0.9493 | 1.9666 | 1.6491 |
| 6 | 152 | 0.0223 | 0.2729 | 1.9759 | 1.6551 | 201 | -0.1543 | **-2.2027 | 1.9720 | 1.6525 | 359 | -0.0592 | -1.1214 | 1.9666 | 1.6491 |
| 7 | 151 | -0.0714 | -0.8743 | 1.9760 | 1.6551 | 200 | 0.0051 | 0.0714 | 1.9720 | 1.6526 | 358 | -0.0376 | -0.7107 | 1.9667 | 1.6491 |
| 8 | 150 | -0.0930 | -1.1361 | 1.9761 | 1.6552 | 199 | 0.0475 | 0.6679 | 1.9721 | 1.6526 | 357 | -0.0300 | -0.5660 | 1.9667 | 1.6492 |
| 9 | 149 | -0.1171 | -1.4291 | 1.9762 | 1.6553 | 198 | -0.0537 | -0.7525 | 1.9721 | 1.6527 | 356 | -0.0857 | -1.6183 | 1.9667 | 1.6492 |
| 10 | 148 | 0.0671 | 0.8129 | 1.9763 | 1.6554 | 197 | -0.0666 | -0.9320 | 1.9722 | 1.6527 | 355 | 0.0058 | 0.1080 | 1.9667 | 1.6492 |

* The null hypothesis is rejected under 10% significance level.

** The null hypothesis is rejected under 5 % significance level.

**Table 14. The Results of Run Test**

| | Period I (Oct. 13, 90—Oct. 9, 93) | | | | Period II (Oct. 16, 93—Oct. 11, 97) | | | | Period III (Oct. 13, 90—Oct. 11, 97) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Size | No. of Runs | Median | Z-value | Sample Size | No. of Runs | Median | Z-value | Sample Size | No. of Runs | Median | Z-value |
| 1 TAIEX | 156 | 81 | 0.0019 | 0.3212 | 208 | 103 | 0.0061 | -0.2780 | 364 | 183 | 0.0048 | 0.000( |
| 2 Cement & Ceramics | | 85 | -0.0001 | 0.9639 | | 109 | 0.0016 | 0.5560 | | 193 | 0.0011 | 1.049 |
| 3 Food | | 87 | 0.0034 | 1.2010 | | 93 | 0.0030 | *-1.6681 | | 176 | 0.0031 | -0.734 |
| 4 Plastics & Chemical | | 91 | 0.0022 | **1.9278 | | 105 | 0.0035 | 0.0000 | | 191 | 0.0034 | 0.839 |
| 5 Textile | | 85 | -0.0014 | 0.9639 | | 95 | 0.0030 | -1.3901 | | 182 | 0.0040 | -0.105 |
| 6 Electrical | | 79 | 0.0056 | 0.0000 | | 100 | 0.0084 | -0.6951 | | 178 | 0.0081 | -0.524 |
| 7 Paper & Pulp | | 84 | -0.0024 | 0.8032 | | 94 | 0.0009 | -1.5291 | | 173 | -0.0001 | -1.049 |
| 8 Construct -ion | | 77 | 0.0000 | -0.3213 | | 103 | 0.0018 | -0.2780 | | 169 | 0.0011 | -1.469 |
| 9 Banking | | 81 | -0.0050 | 0.3213 | | 115 | 0.0028 | 1.3901 | | 184 | 0.0012 | 0.105 |

* The null hypothesis is rejected under 10% significance level

** The null hypothesis is rejected under 5% significance level

\# Z-statistics: 5% significant = 1.96, 10% significant = 1.645

**Table 15. The Result of Normality Test**

| | Period I (Oct. 13, 90—Oct. 9, 93) | | | | Period II (Oct. 16, 93—Oct. 11, 97) | | | | Period III (Oct. 13, 90—Oct. 11, 97) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Size | Skewness | Kurtosis | B-Value | Sample Size | Skewness | Kurtosis | B-Value | Sample Size | | Kurtosis | B-Value |
| TAIEX | 157 | 0.3981 | 3.02 | *4.1237 | 208 | 0.1029 | 2.41 | 3.3894 | 365 | 0.3161 | 3.65 | **12. |
| Cement & Ceramics | | 0.2701 | 2.53 | 3.3727 | | 0.0376 | 1.20 | **28.0893 | | 0.2258 | 2.60 | **5. |
| Food | | 0.4376 | 2.67 | **5.7756 | | -0.0596 | 2.13 | **6.5899 | | 0.3614 | 3.74 | **16. |
| Plastics & Chemical | | 0.6564 | 2.87 | **11.4553 | | 0.4716 | 2.78 | **8.1346 | | 0.5953 | 3.17 | **22. |
| Textile | | 0.6473 | 2.92 | **11.4064 | | -0.2719 | 1.90 | **13.0557 | | 0.2977 | 2.79 | **6. |
| Electrical | | 0.4712 | 2.90 | **5.8803 | | 0.1967 | 0.30 | **64.3539 | | 0.3255 | 1.71 | **31. |
| Paper & Pulp | | 0.6075 | 1.00 | **35.7917 | | -0.0129 | 1.51 | **19.3175 | | 0.3252 | 1.28 | **51. |
| Construc. | | 0.2587 | 1.49 | **16.6560 | | 0.0615 | 1.ÿ3 | **2ÿ.4842 | | 0.2182 | 1.97 | **18. |
| Banking | | 0.4177 | 2.43 | **6.7085 | | 1.2652 | 6.66 | **171.8275 | | 0.7367 | 4.16 | **53. |

I Bowman-Shelton Statistic

| Sample Size n | 10% Significant | 5% Significant |
|---|---|---|
| 150 | 3.43 | 4.39 |
| 200 | 3.48 | 4.43 |
| 300 | 3.68 | 4.60 |
| 400 | 3.76 | 4.74 |

**Table 16. Comparison on the Performance of K%D and B&H**

| Sector | | B & H Profit | K%D Profit | Excess Return | Standard Deviation | t-Value | t-Statistics 5% | t-Statistics 10% |
|---|---|---|---|---|---|---|---|---|
| TAIEX | Period I | 478.91 | 915.75 | 0.0004 | 0.0029 | **4.2464 | 1.6462 | 1.2823 |
| | Period II | 1141.44 | 29.87 | -0.0006 | 0.0025 | -9.5845 | 1.6459 | 1.2821 |
| | Period III | 2183.21 | 984.57 | -0.0004 | 0.0027 | -7.7634 | 1.6454 | 1.2819 |
| Cement & | Period I | 399.93 | 158.11 | -0.0001 | 0.0020 | -2.1984 | | |
| Ceramics | Period II | 63.06 | -289.80 | -0.0002 | 0.0018 | -5.2493 | | |
| | Period III | 496.95 | -172.68 | -0.0002 | 0.0018 | -5.7547 | | |
| Food | Period I | 620.38 | 1101.48 | 0.0030 | 0.0025 | **4.0343 | | |
| | Period II | 812.53 | 296.35 | -0.0007 | 0.0027 | -10.3686 | | |
| | Period III | 1954.26 | 487.40 | -0.0005 | 0.0027 | -9.3208 | | |
| Plastics & | Period I | 441.43 | 71.15 | -0.0012 | 0.0034 | -11.7897 | | |
| Chemical | Period II | 846.40 | 470.26 | -0.0002 | 0.0025 | -2.4577 | | |
| | Period III | 1677.08 | 639.50 | -0.0003 | 0.0026 | -6.1981 | | |
| Textile | Period I | 446.42 | 1131.01 | 0.0006 | 0.0038 | **5.4604 | | |
| | Period II | 503.10 | 72.76 | -0.0002 | 0.0029 | -2.3075 | | |
| | Period III | 1186.89 | 1252.53 | 0.0000 | 0.0031 | 0.7734 | | |
| Electrical | Period I | 837.96 | 624.51 | 0.0000 | 0.0027 | -0.5917 | | |
| | Period II | 3506.89 | 543.06 | -0.0019 | 0.0036 | -20.5185 | | |
| | Period III | 7332.15 | 1506.72 | -0.0023 | 0.0032 | -35.7906 | | |
| Paper & | Period I | 288.44 | 1669.90 | 0.0010 | 0.0040 | **8.6671 | | |
| Pulp | Period II | 270.81 | 1689.22 | 0.0005 | 0.0027 | **7.2624 | | |
| | Period III | 646.99 | 4797.65 | 0.0007 | 0.0033 | **10.7341 | | |
| Construction | Period I | 640.37 | 1013.97 | 0.0003 | 0.0030 | **3.7883 | | |
| | Period II | 613.65 | 579.87 | -0.0001 | 0.0018 | -1.0850 | | |
| | Period III | 1662.52 | 2094.05 | 0.0000 | 0.0024 | -0.8549 | | |
| Banking | Period I | 438.37 | 363.65 | 0.0002 | 0.0043 | 1.3729 | | |
| | Period II | 959.05 | -402.04 | -0.0007 | 0.0033 | -7.7937 | | |
| | Period III | 1834.40 | -184.59 | -0.0005 | 0.0037 | -6.7139 | | |

Period I : 13 Oct. 1990 to 13 Oct. 1993
Period II : 13 Oct. 1993 to 13 Oct. 1997
Period III : 13 Oct. 1990 to 13 Oct 1997
** The null hypothesis is not accepted under 5% significance level

**Table 17. Comparison on the Performance of MACD and B&H**

| Sector | | B & H Profit | MACD Profit | Excess Return | Standard Deviation | t-Value | t-Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 5% | 10% |
| TAIEX | Period I | 478.91 | 2015.02 | 0.0008 | 0.0013 | **19.15 | 1.6462 | 1.2823 |
| | Period II | 1141.44 | 12.73 | -0.0007 | 0.0015 | -16.7984 | 1.6459 | 1.2821 |
| | Period III | 2183.21 | 1933.72 | -0.0003 | 0.0015 | -8.8783 | 1.6454 | 1.2819 |
| Cement & | Period I | 399.93 | 797.80 | 0.0003 | 0.0010 | **8.8683 | | |
| Ceramics | Period II | 63.06 | 387.42 | 0.0002 | 0.0012 | **6.6679 | | |
| | Period III | 496.95 | 1364.17 | 0.0002 | 0.0011 | **9.5836 | | |
| Food | Period I | 620.38 | 2809.93 | 0.0011 | 0.0018 | **19.8302 | | |
| | Period II | 812.53 | 2022.30 | 0.0003 | 0.0008 | **15.8718 | | |
| | Period III | 1954.26 | 10582.42 | 0.0004 | 0.0013 | **16.3284 | | |
| Plastics & | Period I | 441.43 | 1001.23 | 0.0004 | 0.0016 | **8.8906 | | |
| Chemical | Period II | 846.40 | 650.15 | -0.0001 | 0.0016 | -3.0529 | | |
| | Period III | 1677.08 | 2180.22 | 0.0000 | 0.0016 | -1.4239 | | |
| Textile | Period I | 446.42 | 2034.85 | 0.0010 | 0.0018 | **17.7724 | | |
| | Period II | 503.10 | -59.70 | -0.0003 | 0.0020 | -5.2632 | | |
| | Period III | 1186.89 | 1821.84 | 0.0002 | 0.0020 | **4.0178 | | |
| Electrical | Period I | 837.96 | 2417.65 | 0.0000 | 0.0002 | -3.8396 | | |
| | Period II | 3506.89 | 1206.33 | -0.0014 | 0.0025 | -20.9982 | | |
| | Period III | 7332.15 | 6642.58 | -0.0020 | 0.0019 | -52.8007 | | |
| Paper & | Period I | 288.44 | 1147.88 | 0.0007 | 0.0013 | **16.384 | | |
| Pulp | Period II | 270.81 | 37.13 | 0.0000 | 0.0018 | -0.5358 | | |
| | Period III | 646.99 | 1979.43 | 0.0003 | 0.0017 | **10.3349 | | |
| Construction | Period I | 640.37 | 2303.26 | 0.0009 | 0.0021 | **15.183 | | |
| | Period II | 613.65 | -58.07 | -0.0004 | 0.0013 | -11.2482 | | |
| | Period III | 1662.52 | 3021.99 | 0.0000 | 0.0018 | 0.7748 | | |
| Banking | Period I | 438.37 | 2351.06 | 0.0016 | 0.0016 | **33.1812 | | |
| | Period II | 959.05 | -2.55 | -0.0018 | 0.0017 | -40.4048 | | |
| | Period III | 1834.40 | 2126.89 | 0.0000 | 0.0018 | -0.9413 | | |

** The null hypothesis is rejected under 5% significance level.

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