WEAK-FORM EFFICIENCY IN THE KUALA LUMPUR STOCK EXCHANGE: NEW EVIDENCE

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1. INTRODUCTION

A well-functioning capital market has an important role to play in promoting a faster pace of economic development in a developing country like Malaysia. The importance of the domestic financial market, of which a key area is the equity market, is to facilitate allocation of domestic savings and accumulation of capital. In other words, the equity market can assist economic development by providing a facilitative mechanism to mobilize domestic funds. For the purposes of allocating financial resources, proper information transfer to the public to enable investors to react quickly and accordingly to perceived changes in any listed company is important as any investment decision will bear heavily on how resources are allocated. Stock prices must provide accurate signals for effective resource allocation. To be able to perform these roles effectively, the stock market must be one that operates efficiently.

According to the definition by Fama (1970), a market is said to be efficient if available information is fully reflected in prices in the market. In relation to the concept of market efficiency, the price behaviour in stock markets has been extensively analysed. An important issue to address in studying the price behaviour is how well can past prices be used to predict future prices. This relates to the commonly known weak form efficient market hypothesis. In a weak form efficient market, historical prices do not provide additional predictive power to explain future prices. Thus, price movements are expected to occur randomly and successive price changes are independent in conformity with the basic hypothesis of the random walk model. Therefore, systematic trading

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rules based on past price changes cannot be formulated to reap abnormal profits. Hen the underlying economic foundation for the weak form efficient market hypothesis that in an efficient market prices should accurately reflect all current information a price changes should reflect randomly emerged new information and therefore approxima a random variation.

2. LITERATURE REVIEW

Numerous studies on share price behaviour on the New York stock market ha generally supported the hypothesis of "weak form" market efficiency and these inclu those conducted by Fama (1965a, 1965b), Sharma and Kennedy (1977), Granger a Morgenstern (1963) and Godfrey, Granger and Morgenstern (1964). This means th the serial dependence in successive share price changes is slight and not sufficie for trading rules to be formulated for profitable investment timing. In medium-size stock markets such as the London stock market, the findings have been mixed. Kend (1953) analysed British weekly share price indices and found that their behaviour show serial independence. Cooper (1982) also studied the price behaviour of the stock indic and a sample of 114 individual stocks of 50 countries and obtained findings that furth supported the random walk hypothesis in the New York and London markets. Howev Dryden (1970) and Kemp and Reid (1971) showed that the British market was n weak form efficient.

Results have generally shown that smaller stock markets were not weak fo efficient. In Europe, they include findings by Conrad and Juttner (1973) on the Germ market, Theil and Leenders (1965) on the Netherlands market and Jennergen and Korsv (1975) on the Oslo and Stockholm markets. In the Far East, they include findi by Law (1982) and Wong and Kwong (1984) on the Hong Kong market, Sareewiwatha and Isbell (1985) on the Thailand market, Praetz (1969) on the Australian market a Saw and Tan (1986) on the Singapore market. However, Hong (1978) examined t stock market indices in the four Far East stock exchanges of Japan, Hong Kong, Austra and Singapore and concluded that these markets were generally weak form efficie

In Malaysia, results of the studies on the Kuala Lumpur Stock Exchange (KLS have been mixed. Cheng (1978) examined the daily closing prices of 12 random selected industrial stocks over a 30-month period beginning mid-May 1973. While t autocorrelation tests generally supported the random walk hypothesis, the runs tests rejec

overwhelmingly. Lim (1980) studied the monthly closing prices of 30 stocks and indices for the period June 1974 to June 1980 and concluded that the KLSE was weak form efficient. Lanjong (1983) used the monthly closing prices of a larger sample of 104 stocks over a similar period and obtained similar results. Laurence (1986) examined the daily closing prices of 16 Malaysian stocks over the period June 1973 to December 1978 and concluded that the KLSE exhibited weak-form efficiency characteristics. However, Yalom (1984) examined the weekly closing prices of 100 stocks over the period 1974 to 1982 and obtained mixed results. Similar mixed findings were also obtained by Wasson (1989). Using six sectoral indices and the all-share index constructed by Saw and Tan (1989) over the period 1975-1982, they suggested that the Malaysian stock market was inefficient in the weak form when weekly data were used, but pockets of market efficiency existed when monthly data were used. The results of the serial correlation and runs tests performed by Othman (1989) on the weekly closing prices of 30 stocks selected randomly from the component stocks of the KLSE Industrial Index and the New Straits Times Industrial Index over the period January 1977 to June 1988 also suggested that the Malaysian stock market was not weak form efficient. In a larger study based on 170 stocks traded on all sectors of the KLSE from January 1977 to May 1985, Othman (1990) further confirmed the findings of a departure from weak form market efficiency. On the other hand, weak form efficiency was reported in the study by Annuar and Shamsher (1993) when monthly closing prices of 260 companies listed in the KLSE, the Composite Index and the New Straits Times Industrial Index, covering the period of January 1975 to December 1989 were used. However, significant price dependence was found in some of the sub-periods of their study using an equally-weighted dividend adjusted sectoral indices.

3. OBJECTIVES OF THE STUDY

In this paper, the weak form efficient market hypothesis will be examined on the KLSE by using the KLSE Composite Index, Sectoral Indices and the newly-constructed main board all-share Emas index. The tests employed are the runs test, serial correlation test, modified Box-Pierce Q test and the Von Neumann's ratio test. Although these conventional techniques are replicated to test for market efficiency in the KLSE, an area which has been studied before, the main contribution of this paper emerges from the use of more recent data compared to other studies. In particular, we investigate if the Malaysian stock market has improved in its efficiency over time by performing

sub-period analysis. Equally important, this paper also examines the temporal aggregati effect on market efficiency by using data with different sampling intervals, i.e., week and monthly.

4. DATA AND METHODOLOGY

This study uses the weekly and monthly closing levels of the seven KLSE sto indices over a period of 9 years, 1984 to 1992. The indices are the Composite Inde the five sectoral indices of Industrial Index, Finance Index, Properties Index, Tin Inde and Plantations Index and the new main board all-share Emas Index introduced October 1991 but extended backwards to the beginning of 1984. The Composite Inde is based on a composite sample of about 85 stocks listed in the KLSE while t Industrial Index is based on a sample of 30 stocks in the Industrial sector. The oth five indices are based on all stocks listed on the respective sectors of the Main Boar Excluded from our study are the Hotel Index which has only one or two compone stocks and the Second Board Index which was introduced in January 1991 but n extended backwards. The runs test, serial correlation test, modified Box-Pierce Q te and Von Neumann's ratio test are employed here to test the weak form efficien of the Malaysian stock market. Although aggregate market data are used so that t results obtained pertain only to stock market averages, they have direct bearing o the trading strategies of investors, particularly institutional investors whose diversifi portfolios may move in tandem with the market average.

Suppose the values of a price series are P_0, P_1..., P_n. We obtain a sequence of pri changes, e_t, given by:

$$e_t = P_t - P_{t-1}, \qquad t = 1, 2, ..., n$$

where P_t is the price level at time t. The random walk hypothesis specifies that success price changes are independent and identically distributed, that is,

$$P(e_t = e \mid e_{t-1}, e_{t-2}, ...) = P(e_t = e)$$

This hypothesis is equivalent to the weak form efficient market hypothesis. T various tests employed here will only test the independence aspect of the hypothes The price changes can be positive, negative or zero depending on whether the pri in the current period has increased, declined or remained unchanged, respectiv

from the previous period. In the runs test, a run is defined as a sequence of successive price changes of the same sign. There are, therefore, three possible types of run: plus, minus or zero. The actual number of runs R in a sequence of successive price changes is then the sum of the number of runs for plus, minus and zero price changes. If the hypothesis of randomness of price changes is true, the expected number of runs and its variance are given by:

$$E(R) = (n+1) - \left(\sum_{i=1}^{3} m_i^2 / n \right)$$

$$\text{Var}(R) = \frac{\sum_{i=1}^{3} m_i^2 \left[\sum_{i=1}^{3} m_i^2 + n(n+1) \right] - 2n \sum_{i=1}^{3} m_i^3 - n^3}{n^2 (n-1)}$$

where n is the total number of price changes and m_i is the number of price changes of each type (i = 1 for positive changes, i = 2 for negative changes, i = 3 for no change). For large n, the test statistic Z given by:

$$Z = \frac{R \pm 0.5 - E(R)}{\sqrt{\text{Var}(R)}}$$

follows approximately a standard normal distribution with the discontinuity adjustment 0.5 having a plus sign if R < E(R) and minus sign otherwise.

Now let us consider the log price difference v_t given by

$$v_t = \log_e P_t - \log_e P_{t-1}, \quad t = 1, 2, \ldots, n$$

The serial correlation coefficient of lag k in the time series $v_1, v_2, \ldots, v_n$ is given by :

$$r_k = \frac{\sum_{t=k+1}^{n} (v_t - \bar{v})(v_{t-k} - \bar{v})}{\sum_{t=1}^{n} (v_t - \bar{v})^2}$$

where $\bar{v} = \sum_{i=1}^{n} v_i/n$ is the arithmetic mean of the v_t values. As the weekly and monthly price series are rather short, the adjusted serial correlation coefficient of lag k, r'_k, given by $r'_k = nr_k/(n-k)$, is used here. Under the null hypothesis of no serial correlation of lag k in $v_1, v_2, \ldots, v_n$, the statistic r'_k is approximately normally distributed with zero mean and variance of $1/(n-k)$ if n is large.

Several separate tests are required to test for serial correlations at different lags. Consequently, the significance level of the resulting combination of test may be quite different from that for each individual test. To overcome this problem, the modified Box-Pierce Q test may be used instead to test a set of m serial correlation coefficients simultaneously for the hypothesis of no serial correlations at lags of m or less. The test statistic is Q_m where

$$Q_m = n\,(n+2) \sum_{k=1}^{m} [\, r_k^2 / (n-k) \,]$$

has approximately a chi-square distribution with m degrees of freedom (Box and Pierce (1970), Ljung and Box (1978).

The ratio test developed by Von Neumann (1941) can also be used to assess whether the series $v_1, v_2, \ldots, v_n$ has short-run serial correlation. The test statistic v is given by:

$$v = \frac{\delta^2}{S^2} = \frac{\sum_{t=2}^{n} (v_t - v_{t-1})^2 / (n-1)}{\sum_{t=1}^{n} (v_t - \bar{v})^2 / n}$$

Under the null hypothesis of no serial correlation, the ratio v is approximately normally distributed for large n with mean and variance given by:

$$E(V) = 2n/(n-1)$$

$$Var(V) = \frac{4n^2\,(n-2)}{(n+1)\,(n-1)^3}$$

The three parametric tests of serial correlation, modified Box-Pierce Q and Von Neumann's ratio tests are used to test for serial correlation in the log price changes. No serial correlation would imply serial independence only if the distribution of log price changes conforms to a Normal distribution. This conformity to a Normal distribution can be verified by the chi-square test of goodness-of-fit. First, the empirical frequency distribution of log price changes is constructed with twenty two class intervals for weekly data and only twelve class intervals for monthly data. Fewer class intervals are used for monthly data to ensure that the expected frequency in each interval is at least 5 which is the requirement of this chi-square test. The class intervals are expressed in terms of standard deviations relative to the mean. Then the following x^2 test statistic is applied:

$$x^2 = \sum_{i=1}^{k} (A_i - E_i)^2 / E_i$$

with (k-e-1) degrees of freedom, where

k = number of class intervals

e = number of parameters estimated by sample statistics (in this case, mean and standard deviation)

A_i = actual number of observations in class i

E_i = expected number of observations in class i

5. RESULTS

The results of the test for normality on the weekly and monthly closing levels of the seven KLSE stock indices are first presented in Table 1. The computed test statistics of the weekly series except that of the Emas Index are found to be significant at the 0.01 level of significance. However, among the monthly series, none of the computed test statistics is significant. Thus, it is reasonable to conclude that only the monthly index changes are normally distributed. Therefore, it is necessary to note that non-significance results of the three parametric tests on the weekly series do not necessarily imply serial independence.

Table 1: Results of the Chi-Square Goodness-of-fit Test on Weekly and Monthly KLSE Price Indices, 1984-1992

Index	Chi-Square Value	
	Weekly Series	Monthly Series
Composite	45.081*	12.366
Industrial	41.953*	9.033
Finance	57.409*	11.804
Property	63.985*	17.494
Tin	61.977*	10.278
Plantation	62.218*	20.161
Emas	33.939	5.981

* Significant at 0.01 level

The results of the runs test on the weekly and monthly closing levels of the seven KLSE stock indices are given in Tables 2 and 3, respectively. The corresponding results of the serial correlation test, the modified Box-Pierce Q test and the Von Neumann ratio test are given in Tables 4 and 5. These results are given not only for the whole period 1984-1992 but also for the two equal subperiods 1984 - June 1988 and July 1988 - 1992. This enables us to determine whether a significant result for the whole period could be attributed to any particular subperiod, a non-significant result for the whole period could have masked significant result in any subperiod and also to make comparisons between the two sub-periods. For the runs test, besides the actual number of runs and expected number of runs, the computed value of the test statistic Z is also given.

In the runs test on weekly data for the whole period 1984 - 1992 given in Table 2, all the indices except the Tin Index have actual number of runs less than the expected number of runs, thereby indicating a general tendency of persistence in price movements in the same direction. In fact, all the indices exhibit this property in the first subperiod 1984 - June 1988 while the results for the second subperiod are mixed. However, only the Composite Index and the Property Index exhibit significant

Runs Test Results on Weekly KLSE Price Indices, 1984-1992

	Actual Runs	Expected Runs	Z
	Whole Period: 1984-1992		
	208	234.57	-2.42 *
	216	234.79	-1.69
	223	235.22	-1.09
	204	234.83	-2.83 **
	238	231.65	0.55
	216	233.46	-1.58
	224	235.91	-1.06
	First Period: 1984-June 1988		
	97	116.24	-2.48 *
	103	116.39	-1.70
	102	116.03	-1.82
	97	116.63	-2.55 *
	109	112.86	-0.46
	97	116.13	-2.47 *
	105	116.01	-1.39
	Second Period: July 1988-1992		
	112	117.47	-0.66
	114	118.57	-0.53
	121	119.50	0.13
	108	119.14	-1.39
	129	119.03	1.24
	120	118.18	0.17
	120	119.28	0.03

* Significant at 0.05 level
** Significant at 0.01 level

departures from independence for the whole period. In the first subperiod, these two indice together with the Plantation Index exhibit serial dependence. However, none of th indices indicates any significant serial dependence in the second subperiod. Thus, it i evident that the Malaysian stock market has become more efficient in the weak form i the late 1980's with respect to weekly price indices. Runs test results on monthl data given in Table 3 show evidence of serial independence in all indices. Thi means that the Malaysian market has been weak form efficient in the whole perio with respect to monthly price indices. This result is consistent with those obtaine by Lanjong (1983) who used monthly data on individual stocks.

The results of the serial correlation test on weekly data given in Table 4 sho that none of the serial correlation coefficients at lag 1 is significant in the whol period and in the second subperiod. In the first subperiod, however, the Composit Industrial, Property and Plantation indices have significant serial correlations at lag 1 Pockets of significant serial correlation are scattered at other lags. These findings ar generally consistent with the results of the runs test. They are also consistent with th results of the modified Box-Pierce Q test for serial correlations of up to 12 lag Hence, the overall picture is one of improving weak form efficiency in the Malaysia stock market with respect to weekly returns. The results of the serial correlation te and the modified Box-Pierce Q test on monthly data given in Table 5 hardly sho any evidence of serial dependence in the indices.

The results of the Von Neumann's ratio test given in Table 4 for weekly da and in Table 5 for monthly data are very similar to those obtained from the seri correlation and modified Box-Pierce Q tests. These results, therefore, serve t confirm and reinforce the findings of the other statistical tests.

6. CONCLUSION

This study investigates the weak form efficiency in the KLSE over the peri of 1984-1992. The results of the various statistical tests on the KLSE stoc indices suggest that the KLSE is weak form efficient with respect to monthly da The findings using weekly data are fairly mixed. The runs test shows seri dependence in the Composite and the Property Indices while the serial correlati test is not significant for all indices. However, all the tests show that the KLSE ha

Runs Test Results on Monthly KLSE Price Indices, 1984-1992

	Actual Runs	Expected Runs	Z
Whole Period: 1984-1992			
	46	53.45	-1.38
	49	54.50	-0.97
	53	54.50	-0.19
	51	53.71	-0.44
	57	54.12	0.47
	50	54.46	-0.77
	53	54.12	-0.12
First Period: 1984-June 1988			
	26	27.26	-0.21
	24	27.26	-0.77
	24	27.04	-0.72
	24	26.36	-0.54
	24	27.26	-0.77
	22	27.47	-1.37
	26	27.42	-0.25
Second Period: July 1988-1992			
	21	24.30	-0.89
	26	27.67	-0.32
	30	27.67	0.51
	28	27.96	-0.13
	33	27.85	1.28
	28	28.00	-0.14
	28	26.67	0.24

Table 4: Results of the Serial Correlation, Modified Box-Pierce Q and V Neumann's Ratio Tests on Weekly KLSE Price Indices, 1984-1992

Index	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5	Q(12)	Von Neuman Ratio
			Whole Period: 1984-1992				
Composite	0.057	0.074	-0.003	-0.010	0.038	14.609	1.889
Industrial	0.078	0.109*	0.036	0.007	0.027	17.848	1.846
Finance	0.015	0.098*	-0.008	-0.011	-0.001	15.387	1.974
Property	0.079	0.158**	-0.020	0.038	0.078	30.018***	1.845
Tin	-0.002	0.104*	-0.012	0.094*	0.003	15.479	2.004
Plantation	0.062	0.097*	-0.027	0.044	0.034	14.867	1.875
Emas	0.043	0.106*	-0.012	0.005	0.057	14.106	1.916
			First Period: 1984-June 1988				
Composite	0.138*	0.095	0.054	-0.004	0.021	25.123*	1.725*
Industrial	0.171**	0.171**	0.127	0.022	-0.007	38.606***	1.662**
Finance	0.061	0.125	-0.006	-0.022	-0.028	16.542	1.875
Property	0.164*	0.158*	0.019	0.074	0.106	36.754***	1.675*
Tin	0.049	0.085	0.008	0.074	-0.004	9.468	1.881
Plantation	0.156*	0.079	0.062	0.075	0.066	21.918*	1.675*
Emas	0.122	0.139*	0.069	0.016	0.049	25.266*	1.754
			Second Period: July 1988-1992				
Composite	-0.049	0.056	-0.080	-0.022	0.062	8.476	2.107
Industrial	-0.028	0.041	-0.070	-0.013	0.068	8.503	2.065
Finance	-0.023	0.082	0.021	-0.004	0.025	15.769	2.055
Property	0.002	0.163*	-0.061	0.003	0.055	14.496	2.001
Tin	-0.060	0.138*	-0.052	0.129*	0.008	14.661	2.128
Plantation	-0.061	0.138*	-0.147*	0.000	-0.002	14.538	2.124
Emas	-0.043	0.081	-0.093	-0.009	0.063	10.000	2.077

* Significant at 0.05 level

** Significant at 0.01 level

*** Significant at 0.001 level

Results of the Serial Correlation, Modified Box-Pierce Q and Von Neumann's Ratio Tests on Weekly KLSE Price Indices, 1984-1992

	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5	Q(12)	Von Neumann's Ratio
			Whole Period: 1984-1992				
	0.114	0.106	-0.036	0.016	-0.043	12.933	1.785
	0.193*	0.062	-0.028	-0.046	-0.070	15.743	1.622*
	0.085	0.119	-0.159	-0.009	-0.027	12.087	1.846
	0.155	0.207*	-0.053	-0.007	-0.109	20.161	1.702
	0.071	0.045	0.017	0.178	-0.087	15.967	1.872
	0.092	-0.094	-0.063	0.027	-0.005	7.089	1.830
	0.161	0.099	-0.090	0.005	-0.058	15.748	1.691
			First Period: 1984-June 1988				
	0.164	0.142	-0.030	0.100	-0.125	12.480	1.678
	0.258	0.109	0.005	0.025	-0.131	12.198	1.497*
	0.136	0.145	-0.189	0.129	-0.134	12.013	1.735
	0.149	0.330*	-0.085	0.062	-0.148	16.999	1.661
	0.062	0.204	-0.012	0.274	-0.042	16.908	1.858
	0.134	-0.102	0.007	0.080	-0.053	6.400	1.749
	0.203	0.150	-0.101	0.066	-0.136	12.762	1.587
			Second Period: July 1988-1992				
	-0.032	0.060	-0.807	-0.191	0.136	14.109	2.100
	0.031	-0.007	-0.109	-0.198	0.090	10.394	1.970
	-0.004	0.111	-0.165	-0.217	0.121	18.298	2.043
	0.147	0.092	-0.014	-0.130	-0.074	13.330	1.735
	0.093	-0.157	0.091	0.105	-0.160	14.705	1.850
	-0.004	-0.016	-0.200	-0.102	0.110	18.813	2.042
	0.054	0.039	-0.107	-0.141	0.077	14.055	1.927

* Significant at 0.05 level

improved its efficiency and transformed from a generally weak form inefficient market in the mid 1980's to a weak form efficient market by the late 1980's and early 1990's.

The effect of temporal aggregation can be observed from the findings of this study that some weekly data are serially correlated while it is clearly obvious that serial dependence is not found using monthly data. These results suggest that information based on historical prices is fully reflected in current prices after one-month lag but current prices may not have incorporated all of such information after a lag of one week. The magnitude of the serial dependence in the case of weekly data are, however, too small for any mechanical trading rules to be devised for profitable investment timing.

The findings that the KLSE is weak form efficient in the early 1990's imply that available market information is fully impounded in the stock prices and therefore past prices cannot be used to predict future price movements in order to make excess returns.

REFERENCES

Nassir and Shamser Mohamad. 1993. *The Efficiency of the Kuala Lumpur Exchange: A Collection of Empirical Findings. Serdang: Penerbit Universiti Malaysia.*

and Pierce, D.A. 1970. "Distributions of Residual Autocorrelations in Integrated Moving Average Models", *Journal of the American Statistical* Vol. 65, pp. 1509-26.

1978. The Random walk Hypothesis: An Empirical Test with Malaysian Occasional Paper No. 13. Bangi: National University of Malaysia.

and Juttner, D.J. 1973. "Recent Behaviour of Stock Market Prices in and the Random Walk Hypothesis", *Kyklos.* Vol. 26, pp. 576-99.

1982. "World Stock Markets: Some Random Walk Tests", *Applied Economics.* pp. 515-31.

M.M. 1970. "A Statistical Study of U.K. Share Prices", *Scottish Journal Economy.* Vol. 17, pp. 369-89.

E.F. 1965a. "The Behaviour of Stock Market Prices", *Journal of Business.* pp. 34-105.

E.F. 1965b. "Tomorrow on the New York Stock Exchange", *Journal of Business.* July, pp. 285-99.

E.F. 1970. "Efficient Capital Markets: A Review of Theory and Empirical Work", *Journal of Finance.* Vol. 25, pp. 384-417.

M., Granger, C.W.J. and Morgenstern, O. 1964. "The Random Walk Hypothesis Market Behaviour", *Kyklos.* Vol. 17, pp. 1-30.

C.W.J. and Morgenstern, O. 1963. "Spectral Analysis of New York Stock Prices", *Kyklos.* Vol. 16, pp. 1-27.

H. 1978. "Predictability of Price Trends on Stock Exchanges: A Study of Far Eastern Countries", *Review of Economics and Statistics.* Vol. 60, pp. 619-21.

L.P. and Korsvold, P.E. 1975. "The Non-random Character of Norwegian Swedish Stock Prices". *In International Capital Markets.* Eds. Elton, E.J. and Gruber, Amsterdam: North-Holland.

A.G. and Reid, G.C. 1971. "The Random Walk Hypothesis and the Recent of Equity Prices in Britain", *Economica.* Vol. 38, pp. 28-51.

M.G. 1953. "The Analysis of Economic Time Series, Part I: Prices" *Journal Royal Statistical Society.* Vol. 96, No. 1, pp. 11-25.

M.N. 1983. A Study of Market Efficiency and Risk-Return Relationships Malaysian Capital Market. Unpublished Ph.D. Dissertation. Catholic University Leuven.

Laurence, M.M.1986. "Weak-Form Efficiency in the Kuala Lumpur and Singapore Stock Markets", *Journal of Banking and Finance,* Vol. 10, pp. 431-45.

Law, C.K. 1982. "A Test of the Efficient Market Hypothesis with Respect to the Recent Behaviour of the Hong Kong Stock Market", *The Developing Economies,* Vol. 20, pp. 61-72.

Lim, T.L. 1980. The Efficient Market Hypothesis and Weak Form Tests on the Kuala Lumpur Stock Exchange. Unpublished MBA Dissertation. University of Sheffield.

Ljung, G.M. and Box, G.E.P. 1978. "On a Measure of Lack of Fit in Time Series Models", *Biometrika,* Vol. 65, pp. 67-72.

Mansor Md. Isa. 1989. "Share Price Behaviour on the Malaysian Stock Market: Some Empirical Evidence", *Malaysian Journal of Economic Studies,* Vol. 26, No. 1, pp. 1-20.

Othman, Yong. 1989. "The Price Behaviour of Malaysian Stocks", *Malaysian Management Review,* Vol. 24, No. 3, pp. 23-34.

Othman, Yong. 1990. "Thin Capital Markets: A Study of Stock Market Efficiency of Malaysian Stocks", *Malaysian Management Review,* Vol. 25, No. 3, pp. 49-62.

Praetz, P.D. 1969. "Australian Share Prices and the Random Walk Hypothesis", *Australian Journal of Statistics,* Vol. 11, pp. 123-39.

Salim, M.A. 1984. Share Price Behaviour of Common Stocks at the Kuala Lumpur Stock Exchange: An Empirical Study. Unpublished MBA Dissertation. University of Malaya.

Sareewiwathana, P. and Isbell, S.B. 1985. "The Securities Exchange of Thailand: Tests of Weak Form Efficiency", *Securities Industry Review,* Vol 11, No. 1.

Saw, S.H. and Tan, K.C. 1986. "The SES All-Share Price Indices: Testing of Independence", *Securities Industry Review,* Vol. 12.

Saw, S.H. and Tan, K.C. 1989. "Test of Random Walk Hypothesis in the Malaysian Stock Market", *Securities Industry Review,* Vol. 15, No. 1, pp. 45-50.

Sharma, J.L. and Kennedy, R.E. 1977. "A Comparative Analysis of Stock Price Behavior on the Bombay, London and New York Stock Exchanges", *Journal of Financial and Quantitative Analysis,* Vol. 12, No. 3, pp. 391-413.

Theil, H. and Leenders, C.T. 1965. "Tomorrow on the Amsterdam Stock Exchange", *Journal of Business,* Vol. 38, July, pp. 277-84.

Von Neumann. 1941. "Distribution of the Ratio of the Mean Successive Difference to the Variance", *Annals of Mathematical Statistics,* Vol. 12, pp. 367-95.

Wong, K.A. and Kwong, K.S. 1984. "The Behaviour of Hong Kong Stock Prices", *Applied Economics,* Vol. 16, pp. 905-17.