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Weak-Form Efficiency of The Kuala Lumpur Stock Exchange: An Application of Unit Root Analysis

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ABSTRAK

Penemuan dari kajian-kajian lepas mengenai kecekapan telahan Bursa Saham Kuala Lumpur (BSKL) adalah tidak muktamad. Kebanyakan kajian-kajian ini tidak mengambilkira faktor-faktor ketipisan dagangan, hanyutan dan arahaliran masa, yang sememangnya menjadi ciri-ciri pasaran saham di negara-negara membangun. Tujuan kajian ini adalah untuk menilai kecekapan telahan BSKL dengan menggunakan analisis unit root yang mengambilkira faktor hanyutan dan arahaliran masa. Masalah ketipisan dagangan dikawal dengan mengelaskan indeks-indeks berdasarkan volum pusingganti saham bagi setiap unit saham diterbitkan. Penemuan kajian menunjukkan bahawa koefisien purata unit root adalah 0.9 yang bermakna peluang indeks-indeks tidak cekap dalam bentuk lemah adalah kurang dari 10 peratus bagi tempoh kajian ini. Penemuan kolerasi bersiri purata bertekalan dengan penemuan analisis unit root. Implikasi penemuan ini menunjukan bahawa BSKL adalah cekap dalam bentuk lemah secara keseluruhannya walaupun bukti ketidakcekapan wujud bagi sebahagian dari indeks-indeks.

ABSTRACT

Previous studies on the predictability efficiency of Kuala Lumpur Stock Exchange (KLSE) provide mixed evidence. Most of these studies did not attempt to control thinness of trading, drift and time-trend in the price series, which are peculiar characteristics of a developing securities market. This study investigates the predictability efficiency of KLSE using unit root analysis which incorporates the drift and time-trend factors. The thinness of trading was controlled by grouping the indices based on the volume of stock turnover per unit of outstanding shares. The findings suggest that the average unit root coefficient is 0.9 which implies that there is less than 10 percent chance that the indices are inefficiently priced over the period of study. The findings from the average serial correlation tests were consistent with unit root analysis. This implies that KLSE is weak-form efficient though there are pockets of inefficiencies for some indices.

INTRODUCTION

In a well functioning share market, prices of shares reflect all relevant and available information. Weak-form efficiency or currently known as predictability efficiency (Fama, 1992) implies that current prices fully reflect all past market information. This means that any trading rules using past prices or changes in past prices or any past market information to predict future prices or price changes should have little economic value.

Studies from developed countries, for example, by Fama (1970), Dryden (1970), Ball and Brown (1978), and Hawawini (1984) support market efficiency both in the weak and semi-strong sense. There have been some attempts to evaluate the weak form efficiency of KLSE: Lim (1980), Dawson (1981), Lawrence (1981), Nassir (1983), Barnes (1986), Yong (1989). The results are mixed; most studies did not control the possible effects of trend and drift in the price series.

A recent study (Annuar and Ariff (1990)) of 82 individual stocks continuously traded over the period 1975 to 1989, using unit-root analysis to account for cyclicality in price series and controlling thin trading effect, concluded that KLSE is generally weak-form efficient, though

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pockets of inefficiency are observed for shares that suffer liquidity problem.

Objective

This study investigates further the return predictability or weak-form efficiency of KLSE, using industrial, composite, property, finance, plantation, hotels and tin indices of the KLSE by applying unit root analysis. For comparative purposes, the Straits Times Index (STI) of the Stock Exchange of Singapore is also analysed.

Data and Methodology

(i) Data

Monthly and weekly closing prices of all KLSE indices over the period January 1977 to May 1989 were extracted from the security clearing automated network services files. The indices were ranked by taking the average volume (units) transacted per unit of outstanding shares over the period under study.

(ii) Test models

Traditional tests of weak-form efficiency using serial correlations and spectral analysis on price changes or rates of return are of limited use in thinly traded exchanges such as KLSE. These tests are suitable for developed securities market, which assume that the security prices in these markets are not subjected to substantial upward trend, and are more liquid. The unit-root analysis is an appropriate method of ascertaining the weak-form efficiency of developing securities markets.

The following unit root regression models are estimated:

(1) $Yt = b_1 (Y_{t-1}) + e_t$

(2) $Yt = a_2 + b_2 (Y_{t-1}) + u_t$

(3) $Yt = a_3 + b_3 (Y_{t-1}) + c [(t-1) - T/2] + v_t$

where,

Y_t : monthly index prices at time $t = 1 \ldots\ldots T$

a, b, c : regression coefficient respectively of the drift, unit root, and time trend.

$t-1$: lagged specification operator, and

e_t, u_t, v_t : i.i.d. residual term.

Equation (1) represents the random walk with one lag but specified as prices without drift and trend. Equation (2) incorporates the drift but not the trend. Equation (3) incorporates the drift and the time-trend in the price series of indices on the Kuala Lumpur Stock Exchange.

Unit root tests use the augmented t-statistics test of Dickey-Fuller critical values, which are robust tests of the coefficients from a data set containing drift and time trend. After isolating the drift and time-trend effects in the coefficient b, the following weak-form efficient test is conducted:

Ho : $b = 1$ if unit root is present
Ha : $b \neq 1$ if unit root is not present

If the KLSE is weak-form efficient, then the null hypothesis of unit root is accepted. For comparative purposes, the serial correlation test is conducted on all the indices.

RESULTS

Only results from model (3) are presented in Tables 1 and 2 for the monthly and weekly data respectively*.

Table 1 shows that the average coefficient of the unit roots, b, is 0.95 for the most active index and 0.94 for the least active index. If price series possess unit roots, then b should be close to one. A statistical test of significance using Dickey-fuller critical values indicate that none of the coefficients are significantly different from one at 5 percent level. The average coefficient of determination, R^2, varies from 0.89 to 0.96. This reflects a good-fit for the unit root model and implies that current prices are the best estimates of future prices after adjustments for trend and cycle.

Table 2 shows that the average coefficients of unit root, b, taking into consideration the drift and time-trend of weekly data. The value of

* Similar but not identical results are observed for models (1) and (2).

TABLE 1
Summary of unit root regressions on 8 indices using model 3: 1977 to 1989
(monthly data)

Indices					
Most Active	b	R^2	t-calculated	t-Dickey-Fuller	Durbin-Watson Statistic
Composite	0.95	0.93	−1.98	3.14	1.95
Straits Time Index	0.89	0.94	−2.92	3.14	1.67
Finance	0.93	0.95	−2.24	3.14	1.89
Properties	0.97	0.95	−1.50	3.14	2.02
Industrial	0.94	0.92	−2.05	3.14	1.69
Hotels	0.97	0.96	−1.51	3.14	2.94
Plantations	0.93	0.94	−2.40	3.14	2.38
Tin	0.94	0.89	−2.28	3.14	1.89
Least Active					

The DF Critical Value for two-tailed test is ±3.14

the coefficients range from 0.75 to 0.99. Statistical tests of significance using Dickey-Fuller critical values indicate that the coefficient for the Hotel index is significantly different from one at 5 percent level, and other coefficients are not significant.

Traditional tests of serial corelation and Box-Pierce Q-Statistic are also applied on all the price series in the indices. The serial correlation should be absent in each lagged period (12 lags for monthly data and 33 lags for weekly data) and the average serial correlation should not be significant in the Q-Statistics test for an efficient pricing of the indices. These tests are conducted on rates of return data of each index.

The null hypothesis of no correlation for (a) serial correlation coefficients and (b) Q-Statistics should be accepted if weak-form efficiency is a valid description of the price series in the various indices on KLSE. The summary of serial correlation coefficients in rates of return for the monthly data for each index, from most active to

TABLE 2
Summary of unit root regressions on 8 indices using model 3: 1977 to 1989
(weekly data)

Indices					
Most Active	b	R^2	t-calculated	t-Dickey-Fuller	Durbin-Watson
Composite	0.98	0.98	−1.904	3.14	1.94
Straits Time Index	0.98	0.99	−2.486	3.14	1.65
Finance	0.98	0.99	−1.938	3.14	1.87
Properties	0.98	0.97	−1.869	3.14	2.01
Industrial	0.99	0.98	−1.660	3.14	1.68
Hotels	0.75	0.69	−9.584*	3.14	2.62
Plantations	0.97	0.98	−2.914	3.14	2.36
Tin	0.99	0.98	−1.739	3.14	1.88
Least Active					

* Significant at 5 percent level

least active, is shown in Table 3. Table 4 summarises the findings for weekly data.

The results in Table 3 show that for the active indices, KLSE Composite has significant serial coefficients in lags 1 and 11, Properties in lag 2 and STI in lag 11, at 5 percent level. For the moderately active index, KLSE Industrial, the serial coefficient in lag 2 is significant at 5 percent level. For the less active index, Plantations has a significant coefficient in lag 10

TABLE 3
Serial correlation coefficients of 7 indices on KLSE and Straits Times Index on SES, by relative activeness: 1977 to 1989

	Coefficients of Lags = 12												
Indices	1	2	3	4	5	6	7	8	9	10	11	12	Q-Statistic
Most Active Composite	0.19*	0.06	–0.03	0.01	0.06	–0.05	–0.05	0.08	–0.03	0.08	0.17*	0.00	13.72
Straits Time Index	0.06	0.02	–0.14	0.03	0.02	–0.07	–0.04	–0.05	0.00	–0.04	0.17*	0.06	9.81
Finance	0.10	–0.08	–0.07	0.07	0.03	–0.01	–0.03	–0.11	–0.02	0.10	0.08	0.05	8.98
Properties	0.08	0.19*	0.05	–0.06	0.02	–0.09	0.01	–0.03	0.06	0.12	0.04	0.02	17.78
Industrial	0.18*	0.03	–0.01	0.02	–0.02	–0.01	–0.05	–0.13	–0.14	0.04	0.10	0.03	12.91
Hotels	–0.13	0.04	0.08	0.09	–0.07	0.03	0.05	0.02	0.07	0.06	–0.01	0.02	7.87
Plantations	0.07	0.04	–0.02	–0.07	0.08	–0.08	0.07	–0.11	–0.05	0.17*	0.06	0.01	11.19
Tin Least Active	–0,18*	0.17*	0.03	0.08	–0.03	–0.02	–0.08	–0.03	–0.04	0.15	–0.15	–0.01	18.56

* Significant at 5 percent level
The Q-Statistic Critical Value is 21.03 at 5 percent level and 12 degrees of freedom.

TABLE 4
Serial correlation coefficients of 7 indices on KLSE and Straits Time Industrial Index on SES, by relative activeness: 1977 to 1989

	Coefficients of Lags = 33											
Indices	1	2	3	4	5	6	7	8	9	10	11	12
Most Active Composite	–0.01	0.04	0.05	0.02	0.05	0.01	0.05	0.01	–0.05	0.06	–0.02	–0.01
Straits Time Index	0.18*	–0.02	0.03	0.01	0.10*	0.04	0.01	–0.02	0.03	0.04	–0.09	–0.06
Finance	0.05	0.01	–0.03	0.07	0.02	0.03	0.07	0.03	–0.00	–0.00	–0.05	0.06
Properties	0.03	0.09*	0.03	0.03	0.01	0.01	0.03	0.00	0.05	0.03	–0.01	0.04
Industrial	0.13*	0.13*	0.07	0.04	0.01	0.03	0.03	0.03	–0.01	0.02	–0.03	–0.01
Hotel	–0.09*	–0.00	–0.00	–0.00	–0.00	–0.00	–0.00	–0.00	–0.00	–0.00	–0.00	–0.00
Plantation	–0.07*	0.02	0.04	–0.00	0.01	–0.00	0.00	0.04	–0.01	0.01	0.04	–0.02
Tin Least Active	0.09*	0.04	0.03	0.05	0.02	0.04	0.05	0.04	0.09	0.03	–0.02	–0.01
Accept Null	5 of 8	2 of 8	Nil	Nil	1 of 8	Nil	Nil	Nil	1 of 8	Nil	1 of 8	Nil

TABLE 4 (Continued)

	Coefficient of Lags = 33											
Indices	13	14	15	16	17	18	19	20	21	22	23	24
Most Active Composite	0.02	−0.03	−0.01	−0.01	−0.01	−0.03	0.02	−0.02	0.00	0.01	−0.01	−0.01
Straits Time Index	−0.04	−0.03	0.02	−0.04	−0.02	−0.03	0.02	0.01	−0.04	0.06	0.01	0.02
Finance	−0.00	−0.04	0.01	−0.03	−0.01	−0.03	0.04	0.03	0.00	0.02	0.00	−0.02
Properties	0.01	0.02	0.01	0.00	−0.00	−0.01	−0.00	−0.01	−0.03	−0.03	0.04	−0.02
Industrial	0.00	−0.01	0.01	−0.04	−0.05	−0.02	0.00	−0.03	0.00	0.06	0.00	−0.04
Hotel	−0.00	−0.00	0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00
Plantation	−0.01	0.07	−0.01	−0.02	−0.00	−0.02	−0.04	0.00	0.03	−0.00	−0.00	−0.00
Tin	0.08*	0.04	−0.07	−0.01	0.02	−0.03	0.09*	−0.00	0.05	0.04	−0.02	−0.05
Least Active												
Accept Null	1 of 8	Nil	Nil	Nil	Nil	Nil	1 of 8	Nil	Nil	Nil	Nil	Nil

	Coefficient of Lags = 33									
Indices	25	26	27	28	29	30	31	32	33	Q-statistics
Most Active Composite	−0.01	−0.02	−0.00	−0.01	−0.01	0.01	−0.02	−0.02	0.02	13.99
Straits Time Index	0.03	−0.03	−0.09*	−0.02	0.01	−0.01	−0.07	−0.00	0.01	58.83*
Finance	0.02	−0.04	0.04	0.04	−0.01	0.01	0.02	0.00	−0.04	23.73
Properties	0.00	−0.03	−0.04	0.00	−0.00	0.03	−0.02	0.02	0.02	22.12
Industrial	−0.01	−0.05	−0.02	−0.05	0.01	−0.06	−0.02	0.03	0.04	43.60
Hotel	0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	5.97
Plantation	−0.03	−0.00	−0.02	0.01	−0.01	−0.04	0.00	0.02	−0.00	18.07
Tin	0.02	−0.03	0.01	0.02	−0.00	−0.01	−0.04	−0.04	−0.00	42.21
Least Active										
Accept Null	Nil	Nil	Nil	1 of 8	Nil	Nil	Nil	Nil	Nil	Nil

* Significant at 5 percent level.
The Q-Statistic Critical Value is 47.40 at 5 percent level and 33 degrees of

and Tin in lags 1 and 2. These results imply that though in general the findings for individual serial correlations are consistent with weak-form efficiency, there are pockets of inefficiencies, even for active indices.

The results of Q-statistics indicate that none of the eight indices have significant average serial correlations at 5 percent level. Thus the indices are, on average, efficiently priced. These results are generally consistent with the unit root results. In general, the prices series of firms listed on the KLSE do possess unit root, which means that current prices are the best estimates of future prices. Even, the least active index conforms with weak-form efficiency. On average, 92 percent of the current price behaviour may be explained by the immediate price lag variable. These findings are consistent with the findings of Annuar and Ariff (1990) on 82 individual stocks over a 15 year period.

The summary of serial correlation coefficients on rates of return over 33 lags of weekly data for each index from most active to least active, is shown in Table 4. The results show that none of the active indices on KLSE have significant serial correlations, implying they are efficiently priced. For the intermediate active group, Industrial Index has significant serial correlations in lags one and two and the Q-statistic is not significant at 5 percent level.

Even the least active index such as Tin Index, shows a non-significant Q-statistic at 5 percent level, implying that on average over 33 lags, the index is also efficiently priced.

CONCLUSION

For the monthly data, the findings on eight indices on the KLSE using both unit root analysis and traditional test of serial correlation and Q-Statistics, strongly suggest that KLSE is weak-form efficient, though there are pockets of inefficiences for some indices. The findings indicate that the average unit root coefficient is 0.92 which implies that there is only an 8 percent chance that the indices are inefficiently priced over the period January 1977 to May 1989.

Results for the weekly data with drift and time-trend adjustments in the price series of indices on the KLSE, indicate that the indices are efficiently priced. Except for the Hotel index, none of the coefficients of the indices is significantly different from one using the Dickey-Fuller critical values at 5 percent level. The average unit root coefficient is 0.95 which implies that there is only a 5 percent chance that the indices are inefficiently priced over the period January 1977 to May 1989.

Results of Q-statistics over 33 lags indicate that except for STI index, all other indices are generally efficiently priced. In developing securities markets such as KLSE, where cyclicality and time trend effects on the price series are pronounced, the unit-root analysis with Dickey-Fuller significance tests is robust in addressing the weak-form efficiency of the market.

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