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Efficient Markets Hypothesis and the Emerging Capital Market in Sri Lanka: Evidence from the Colombo Stock Exchange – A Note

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1. INTRODUCTION

Do the market prices of stocks listed in the Colombo Stock Exchange (CSE) consistently reflect all the relevant information available on them? The answer to this question is not only of paramount importance to investors but also to policy makers. The implications are enormous for foreign and local investors who make their decisions based on current market values and expected risk-return trade-offs that are associated with such investments. Stakes are equally high for policy makers who consider the stock market as a primary vehicle for transforming the Sri Lankan economy to economic prosperity.

Since its revival in 1985, the CSE has been one of the fastest growing emerging capital markets. For instance, daily volume totalled a mere US$10,000 in 1989 and about US$500,000 a year later. In 1992 the CSE computerised its clearing house and by January 1994, the daily turnover reached a record US$3.2 million. According to media reports, the CSE showed a

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significant overall improvement in 1997 so that the exchange emerged as one of the best in Asia despite the financial crisis that was engulfing the region.[1] The 1997 performance is manifested by appreciation of the All Share Price Index (ASI) by 16 per cent, and the Sensitive Share Price Index (SSI) by 19 per cent. The tremendous growth in the stock market has been helped by the continuing tide of foreign money flowing into Sri Lanka and the country's strong economic and political fundamentals. According to Du Bois (1994), although Sri Lanka's goal of becoming a Newly-Industrialised-Country (NIC) by the year 2000 is unlikely to be met, it is a possibility by 2008.

There are no published studies on the behaviour of stock prices on the CSE.[2] This study fills this deficiency by investigating the behaviour of CSE stock prices for the period of January 1991 through November 1996. It determines the extent to which daily, weekly and monthly returns of securities listed on the CSE conform to the weak-form of the Efficient Markets Hypothesis (EMH). The paper is organised as follows. The next section provides a brief description of the CSE followed by a discussion on the relationship of this study to the literature. Section 3 describes the data and methodology used in this study. Results are reported in Section 4, and Section 5 summarises the study and concludes the paper.

The CSE emerged in 1985 from a reorganisation of the Colombo Share Brokers Association that had been in operation for over a century. The CSE adopted the 'open-out-cry system,' replacing the traditional 'call-over system' for transactions. In 1987, the Sri Lankan government established the Securities Council to develop and regulate the activities of the share market. The Securities Exchange Commission (SEC), with seven board members, replaced the Securities Council in 1991. The SEC is presided over by a chairman and its activities are executed through its Secretariat, under the administration of a Director General. The SEC is the sole regulatory body that oversees the entire operation, including the control of listing and delisting of companies.[3]

The CSE is open for trading on every weekday from 9.30 a.m. to 11.30 a.m. except on public and mercantile holidays. In 1991 the CSE introduced a Central Depository System (CDS) automating the post-trade operations of the exchange, allowing

the settlement period to be five days, on a rolling basis. In 1996, electronic trading was introduced, enabling fully automated trading from brokers' offices. The brokers' commission for transactions in the primary market is three per cent of the value of the transaction, payable by the issuer. The secondary market transactions commission is also three per cent of the value of the transaction, but it is shared equally by the buyers and sellers. In November 1990, as an incentive to invest in shares, the Sri Lankan government, abolished stamp fees of one per cent of the value of the transaction, payable by the buyer.

Prerequisites for market efficiency include freely available information, competition among investors, and effective communication among market participants. The CSE has made substantial strides in addressing these and many related issues over the past few years. Peagam (1995) observes that Sri Lanka, being the first in the Indian subcontinent to pursue economic liberalisation, has continued its deregulation in the financial sector. Since 1990 the Sri Lankan authorities have lifted curbs on foreign banks and on foreigners' investment in equities, and dismantled most foreign exchange controls. In addition, they allowed the creation of mutual funds, merchant banks, venture capital companies and joint venture brokerage firms with foreign partners, and introduced a central depository system for paperless equity trading.

The EMH has been one of the most actively researched areas in finance over the last three decades. The general conclusion from numerous studies in developed countries, beginning with Fama (1965) is that the weak-form of market efficiency holds and that no exploitable patterns in past trading records exist.[4] More recently, however, a number of studies have raised questions about the degree of prevailing market efficiency and have pointed to some market inefficiencies based on observations such as autocorrelation, the small-firm effect, the January-effect and the weekend-effect. Lo and MacKinlay (1988) and Fama and French (1988) observed some autocorrelation of share prices, indicating that the prices do not follow a random walk.

Evidence from stock markets in developing countries, however, is mixed. For instance, Dickson and Moragu (1994) found evidence consistent with the EMH in their study of the Nairobi Stock Exchange, while Barnes' (1986) study of the Kuala Lumpur

stock exchange provided only limited support of the weak form of the EMH. Zychowicz et al. (1995) concluded that on the Istanbul stock exchange, daily and weekly returns diverge from a random walk, while monthly returns are consistent with weak form market efficiency.

With the substantial growth in emerging markets, many studies have recognised the important institutional, developmental and cultural differences that exist between stock markets in industrialised and developing countries. Although Asian stock markets have made impressive strides in recent years, very little is known about the behaviour of these emerging markets compared with the vast quantity of research information available on developed countries' stock markets. Only a few studies on Asia related to this topic are available. These include Bailey et al. (1990), Annuar (1994), Mun and Kee (1994), Chan et al. (1992), Chan et al. (1996), Laurence (1996) and Berry et al. (1997). None of these studies, however, include the Colombo Stock Exchange.

DATA AND METHODOLOGY

This study employs daily, weekly and monthly returns of two value-weighted portfolios of stocks listed on the CSE during the period between January 1991 and November 1996.[5] The all Share Price Index (ASI) reported by the CSE is based on market prices of all stocks listed on the CSE. A total of 235 companies were listed in 1996. The Sensitive Share Price Index (SSI) is based on market prices of 24 blue-chip companies listed on the CSE.[6] We chose the SSI over the ASI to minimize potential problems arising from close correlation between the two indices and thin trading experienced by most stocks in the ASI.[7] Construction of the SSI does not take dividends into account.

Exclusion of dividends in the SSI could result in serious errors in our conclusions. In order to incorporate dividends, while recognizing the reality of thin-trading on the CSE, we constructed our own time-series, a total returns index. The balance between a representative sample of stocks in our portfolio, i.e., the size, and the liquidity of shares included in this sample is an important consideration. We arbitrarily chose

the stocks that missed less than 100 days of trading over the 1,418 days of our study period with the hope that such a compromise does little damage from adding a small amount of thin trading to our sample. As forty stocks met our requirements, we called this portfolio the Forty Share Index (FSI). Thus a major preliminary phase of this study involved the construction of the total return series, after identifying the forty most frequently traded stocks using daily trading data. The total returns of the forty individual stocks were used to compute the value weighted 40-security portfolio returns. Eleven stocks are common to the SSI and FSI. About 88 per cent of the companies in the FSI paid dividends on a regular basis at an annual average rate of Rs.20.40 during the six-year study period.

The weak-form of the EMH asserts that successive returns of securities are independent, resembling a random walk. In general, weak-form efficiency has been tested in two ways: (1) by showing that successive changes in stock prices are independent of each other and therefore cannot contain information for predicting future prices; (2) by showing that technical trading rules based on historical prices do not outperform a buy-and-hold strategy. The focus of this study is to employ several commonly used statistical techniques to determine the level of independence of the successive returns; viz., runs tests, serial correlations, tests for stationarity, and security and portfolio return patterns.[8]

RESULTS[9]

Table 1 reports the results of runs tests. Columns titled SSI and FSI represent the Sensitive Share Index and the Forty-Share Index respectively. For both series, the K-statistic indicates that the null hypothesis of independence is rejected at a 5 per cent level. Thus we conclude that the two series are non-random, implying that the tests fail to support weak-form efficiency.

Table 2 reports correlation coefficients at lag 1, and *Q*-statistics for 24 lags. Correlation coefficients, reported in column 3, indicate substantial autocorrelation in all three series. The daily SSI series shows the highest correlation at 0.45 whereas the weekly SSI series shows the least correlation at 0.26. All

Table 1

Results of Runs Tests

	Daily Returns		*Weekly Returns*		*Monthly Returns*	
	SSI	*FSI*	*SSI*	*FSI*	*SSI*	*FSI*
Number of observations	1418	1418	308	308	70	70
Actual number of runs	437	561	105	108	25	26
Expected number of runs	708.17	707.14	152.89	151.86	35.28	34.17
Standard error of runs	18.77	18.75	8.64	8.58	4.07	3.93
K-statistic	−14.45	−7.79	−5.54	−5.11	−2.53	−2.08

Table 2

Correlation Coefficient Test for Serial Dependence

Series	*Share Index*	*Correlation Coefficient at Lag 1*	*Q-Statistics at 24 Lags*
Daily	SSI	0.45*	471.35**
	FSI	0.33*	272.89**
Weekly	SSI	0.26*	45.17**
	FSI	0.28*	67.99**
Monthly	SSI	0.34*	50.62**
	FSI	0.35*	50.84**

Notes:
* Based on *t*-test, reject the null hypothesis of no correlation at the 5% level.
** Significant at the 5% level.

correlation coefficients at lag 1 are statistically different from zero at a 5 per cent level. Consequently, the hypothesis of serial independence is rejected.

The computed *Q*-statistics for each series are reported in the last column of Table 2. All *Q*-statistics at lag 24 are greater than the critical value of 36.415. Consequently, the hypothesis of independence is rejected at a 5 per cent level of significance. These results are similar to empirical findings of Mun and Kee (1994) on other Asian markets.

Table 3 reports the results of Augmented Dickey-Fuller tests of stationarity of the series. All *t*-statistics are smaller than the critical value except for the monthly SSI. As the vast majority of the *t*-statistics are smaller than the critical values, we reject the null

Table 3

Tests for Stationarity: Unit Root Tests[1]

Series		*Constant no Trend*		*Constant and Trend*	
		t-Statistic	*F-Statistic*	*t-Statistic*	*F-Statistic*
Daily	SSI	−4.81	11.57	−4.91	8.06
	FSI	−5.12	13.09	−5.29	9.34
Weekly	SSI	−4.02	8.10	−4.15	5.74
	FSI	−3.89	7.57	−4.17	5.81
Monthly	SSI	−2.3	2.69	−2.26	1.80
	FSI	−3.33	5.54	−3.50	4.13

Notes:
[1] The null hypothesis is rejected if the *t*-statistic is smaller than the critical value. For Constant no trend, the critical *t*-value 10% is −2.57 and the critical *F*-value at 10% is 3.78. For constant and trend, the critical *t*-value at 10% is −3.13 and the critical *F*-value at 10% is 4.03.

hypothesis and conclude that the return series are not random. The calculated *F*-statistics are all greater than the critical *F*-value, except, for the monthly SSI. As the vast majority of the *F*-statistics are greater than the critical values, we reject the null hypothesis of a unit root. Therefore we conclude that the three series do not conform to the independence hypothesis.

Test results for security and Portfolio daily return patterns are as reported in Table 4. The null hypothesis is that there is no difference in mean returns across the days of the week. All the computed *F*-test statistics are less than their corresponding critical values, and as a result we fail to reject the null hypothesis. We therefore, conclude that there is no difference in mean returns across the days of the week.

The day-of-the-week-effect is still controversial because of mixed empirical results as documented by Athanassakos and Robinson (1994) and many others. So far there is no globally accepted scientific explanation of the day-of-the-week-anomaly, there are only the so called 'possible explanations.' However, our analysis in this study indicates that there is no significant day-of-the-week-effect on the Colombo Stock Exchange.

Test results for the month-of-the-year effect are reported in Table 5. Based on the corresponding *t*-values, all coefficients are statistically insignificant. The *F*-statistic corresponding to SSI and

Table 4

Test for Security and Portfolio Return Patterns: Day-of-the-Week Effect[1]

Series	α_1	α_2	α_3	α_4	α_5	*F-Statistic*
SSI	0.000492	−0.000809	−0.001552	0.000929	0.000273	2.227
	(0.747)	(−0.878)	(−1.678)	(1.010)	(0.293)	
FSI	0.002322*	−0.002271*	−0.001997	−0.000693	−0.000279	1.675
	(2.895)	(−2.025)	(−1.773)	(−0.618)	(−0.246)	

Notes:
[1] The following regression model is estimated to test for differences in mean returns across the days of the week:

$$r_{it} = \alpha_1 + \alpha_2 D_2 + \alpha_3 D_3 + \alpha_4 D_4 + \alpha_5 D_5 + u_t$$

where, r_{it} is the daily return on security i and $d_{t,k}$ is a dummy variable for the k^{th} day of the week. The null hypothesis H_o: $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ is rejected if the estimated F-value is greater than the critical F-value. $F_{(4,1413)}$ at the 5% significance level is 2.37. See French (1980), Gibbons and Hess (1981) and Keim and Stambaugh (1984) for further details.

* Significant at the 5% level; t-statistics in parentheses.

FSI are 0.4916 and 0.5397 respectively. As a result we fail to reject the null hypothesis that the expected return is the same for each month and conclude that CSE share prices do not display a month-of-the-year effect or January effect. This finding is consistent with the current view, based on Western capital markets, that the January effect has been on a decline since it was revealed three decades ago.

Lack of evidence on seasonal patterns as reported in Tables 4 and 5 does not necessarily imply market efficiency of the CSE. Ball (1998) argues that it is difficult to tell whether the findings such as above should be attributed to defects in markets themselves, to 'flaws in market efficiency' as a way of thinking about competitive markets, or to problems with the research itself. As microstructure or trading-mechanism effects could determine the behaviour of stock market prices, the stock prices are likely to be affected in systematic ways by institutional arrangements. Even though the taxation year in Sri Lanka ends in December, there may be other factors that counter the familiar patterns in stock returns. Only further research, beyond the scope of this study, can shed light on this and other related issues.

Table 5

Test for Month-of-the-Year Effect[1]

	SSI		*FSI*	
Month	*Coefficient*	*t-Statistic*	*Coefficient*	*t-Statistic*
January	0.01689	0.4893	0.01723	0.4064
February	−0.01948	−0.3993	−0.01457	−0.2431
March	−0.06520	−1.3360	−0.04881	−0.8143
April	−0.02925	−0.5994	−0.02974	−0.4962
May	0.02628	0.5385	0.00743	0.1239
June	−0.00245	−0.0502	0.04752	0.7927
July	−0.00576	−0.1181	0.02349	0.3920
August	−0.02077	−0.4257	−0.03550	−0.5923
September	0.01952	0.4000	0.00487	0.0812
October	0.01145	0.2347	0.04712	0.7860
November	−0.01142	−0.2230	0.00425	0.0676
December	−0.00571	−0.1115	−0.03179	−0.5056
R^2	0.0853		0.0929	
F-Statistic	0.4916		0.5397	

Notes:

[1] The following model is estimated: $R_t = \alpha + \beta_2 D_{2,t} + \ldots + \beta_{12} D_{12,t} + \varepsilon_t$,
where, R_t is the monthly return based on one of the two return series; SSI and FSI. D_i is the dummy variable indicating the month on which the return is observed; D_{2t} = February, D_{3t} = March, …, $D_{12,t}$ = December.

The expected return for January is measured by α, while β_2 through β_{12} represent the difference between the expected return for January and the expected return for each of the respective calendar months of the year. If the expected return is the same for each month, then the estimated coefficients β_2 through β_{12} will be insignificantly different from zero. Therefore, the *F*-statistic measuring the joint significance of the dummy variables should be statistically insignificant. Null hypothesis, H_0: $\eta_2 = \beta_3 = \ldots = \beta_{12} = 0$ is tested against the alternative hypothesis, H_1: $\beta_2 \neq \beta_3 \neq \ldots \neq \beta_{12} \neq 0$.

SUMMARY AND CONCLUSION

In general, the Efficient Market Hypothesis (EMH) is concerned with whether stock prices fully reflect all the information available at that point in time. Weak form tests of the EMH model focus on the information subset of historical price or return consequences. This study examines the behaviour of stock returns on the Colombo Stock Exchange (CSE), with a view to determine its consistency with the weak form of the Efficient Markets Hypothesis. Data employed include daily, weekly and monthly returns of stock indices for the period January 1991 through November 1996. We use the Sensitive Share Index

reported by the Colombo Stock Exchange and a 40-security value-weighted index, adjusted for dividends, splits, rights and bonuses.

Results of this study indicate that the stocks traded in CSE do not behave in a manner consistent with the weak-form of the Efficient Market Hypothesis. A recent study of the Kuala Lumpur stock exchange by Berry (1997), based on 17 years of data, reached a similar conclusion. Essentially, the results of this study are consistent with the conventional wisdom that the emerging stock markets are not as informationally efficient as their developed country counterparts. Given the fact that the CSE has experienced tremendous changes in its culture and operations as a result of organizational and technological changes, it is not unreasonable to expect the CSE to have a lower level of informational efficiency than a well-developed market. For instance, a 'noise trader' approach to finance suggests that noise or liquidity traders transact based on beliefs or sentiments that are not fully justified by fundamental information.[10] It is possible for the noise traders to cause prices to diverge from fundamental valuations. Shleifer and Summers (1990) suggest two main risks that would explain why rational investors are unwilling to attempt to arbitrage prices. First, the fundamental risk of market movements, and second, the unpredictability of the future sale price; even if an asset is overpriced today, it could become even more overpriced in the next period.

The day-of-the-week-effect test results indicates that there is no such effect on the Colombo Stock Exchange. This finding is contrary to the conclusions of studies such as Aggarwal and Rivoli[11] (1989), Martikainen and Puttonen (1996) and Wang et al. (1997), which found evidence of day-of-the-week effect in other Asian markets. We also found no evidence of a month-of-the-year effect on the CSE.

Further research is necessary to explain the observed differences in behaviour of stock returns between developed stock markets and certain emerging stock markets. Market structures, thin trading, relatively short series of data, short selling restrictions, and distributional properties of returns in some of these markets could potentially explain some of these differences. Consequently, future studies will have to explicitly incorporate these market qualities to reach strong conclusions.

Potential avenues of research, for example, would be to investigate differential days-of-the-week effect within a given month, as proposed by Wang et al. (1997), and a closer examination of patterns of security returns associated with local holidays.

NOTES

1 *Daily News*, January 13, 1998.
2 To the best of my knowledge, there are no other published empirical studies on the CSE.
3 For a detailed description and the operations of the CSE, see 'A Guide to Share Investment in Sri Lanka' published by the Government of Sri Lanka (1992).
4 See Malkiel (1990) for a summary of findings of various studies.
5 Tests carried out on percentage or one-period returns covering a period of less than a month are essentially identical to tests based on changes in the natural log price. See fn. 13, Fama (1970).
6 The selection of companies that constitute SSI is based on several factors such as (1) size of the company, (2) difference between the nominal price and the market price, (3) dividend record of the company, (4) frequency of transactions, and (5) earnings per share in the past three years.
7 The correlation coefficient between ASI and SSI returns is 0.0832; ASI and FSI is 0.5696; and, SSI and FSI is 0.4544.
8 To the extent that the distributional properties of each series have overlapping influences on determining the outcome of these tests, it is important to recognize the inter-dependence of these apparently different tests. For example, autocorrelation and non-stationarity are related. In order to maintain brevity, we do not present the methodologies associated with each of these tests.
9 We do not report descriptive statistics or the series as our findings suggest non-normal distribution of returns are consistent with other emerging markets studies such as Fang and Lai (1997) and Bekaert et al. (1998).
10 Asset mispricing model developed by Shleifer and Summers (1990) identify two types of investors; (1) rational arbitrageurs, and (2) uninformed noise (or liquidity) traders who trade based on beliefs and sentiments that are not fully justified by fundamental news.
11 Aggarwal and Rivoli (1989) examine seasonal and daily patterns in the equity returns of four emerging markets: Hong Kong, Singapore, Malaysia and the Philippines.

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