A Comparative Analysis of Stock Price Behaviors on the Colombo and Nigeria Stock Exchanges

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A Comparative Analysis of Stock Price Behaviors on the Colombo and Nigeria Stock Exchanges

R.M. Kapila Tharanga Rathnayaka, D.M. K. N. Seneviratna

Abstract—Time series models are widely used in economics today; especially the nonlinear models under the stationary and non-stationary frameworks for forecasting future patterns. This study sheds light on stock market performance between the Colombo stock exchange (CSE) and Nigeria stock exchange (NSE) from January 2007 to May 2013 under the comparative purposes. Miscellaneous types of statistical techniques were widely used. The study results clearly suggested that the price movement in CSE is more volatile than NSE.

Keywords—ARMA, CSE, NSE

I. INTRODUCTION

The trend analysis of economic time series is an important research derection; especially predictions and forecasting the future results under the stationary and non-stationary frameworks. Government rules and regulations with different type of macro and micro economic conditions directly affected [1, 2].

Stock market is a one and only platform for the buyers and sellers for trading their stocks and bonds. During the past three decades, many companies have been listed regularly in the stock markets and invested huge funds from their capital. When the companies obtain their capital need, the shareholders will benefit through dividends paid by companies.

Comparing with other stock exchanges, the Colombo Stock Exchange (CSE) and Nigerian Stock Exchange (NSE) are well organized markets in Asian and African continents today [3, 4, 5]. The main purpose of this study is to compare the directions and movements of market prices and trade volume rates during the past 7 year periods from January2006 to December 2013. Different types of statistical methods such as multivariate statistical methods, forecasting techniques with descriptive statistical methods have been widely used.

The rest of the paper is organized as follows. Section II explains about brief overview of existing solutions with pros and cons. Section III expatiates about proposed work under statistical frame work. Section IV expounds about experimental results and Section V ends up with conclusion and future work.

II. LITERATURE REVIEW

Economic data analysis is the process of handling economic data revise brief about economic problems. Different types of models and methodologies have been developed to overcome this problem. Some of the models and methodologies are only applicable at the level of theoretical assumptions.

In the past few decades many theories and hypotheses have developed by integrating both concepts of mathematics with modern financial to evaluate long term and short term market behaviors, market efficiency and stock's validations; especially, Hendry et al (1986) attempted to find out the short-run as well as long-runs relationships between stock market validity with respect to the macro and macro-economic variables [6, 7, 8]. The study results clearly show strong co-relation between macroeconomic variables on the stock market price as well as volume indices[9, 10].

Poshakwale et al. have done significant research works using the miscellaneous samples from stock markets around the world. By the end of 1999, Poshakwale et al has done a case study to evaluate the market efficiency in the Bombay Stock exchange within the period of 1987 to 1994 [11]. In their study they have tested the null hypothesis that the prices in Indian stock market follow random pattern or not. The non-parametric techniques results indicated that Bombay market (BSE) was not in a weak form efficient than other stock exchanges in Asia[12].

Rathnayaka et al have conducted a different type of study to evaluate the stock market volatility in CSE, Sri Lanka. Auto regressive model with ARCH and GRANCH models were used to find the results [1, 10, 13]. Their findings suggested that macro variables such as Narrow Money supply, Broad money supply, Inflation and interest rates directly affected market volatility. Moreover, their results suggested that inflation and interest rates are most significant macroeconomic factors which influence the stock market economy [13, 14, 15].

Chen et al. also did similar type of study to find the relationship between macro-economic variables and market validations in USA [16]. Various type of macro variables, such as industrial production, inflation and long and short terms interest rates on stock returns have used. Co-integration analysis techniques with vector auto regressive models and vector error correlation models were widely used to discuss the market performances. Their findings suggested that the lagged values of the macro economic variables directly influence on the stock market fluctuations [16].

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After 2000, gravity models have been successfully applied to solve economics and financial problems[17]. Thomas et al used gravity models to explain the trade patterns in 27 randomly selected stock markets around the world [18]. In the second part of their analysis, geographical data were gathered from various websites and CIA fact books. Their results suggest that more conventional variables highly influence the cross-country correlations. Their results were coincided with La Porta et al findings in 1998 [19].

Market capitalization is a one of the significant indicator to evaluate market performances. Das et al carried out a comparative study based on the markets around the Asian such as Bangladesh, Pakistan, Philippine, Sri Lanka and Thailand. Their findings found a positive and notable correlation between market capitalization and GDP levels except Pakistan[20, 21, 22]. In 2009, Humpe et al conducted a study to compare the stock movements between US and Japan with the framework of a standard discount value model. They examined the stock price trend and various macroeconomic variables using the monthly data of over past 40 years [23, 24, 25]. It was a co-integration analytical method widely applied for finding the relationships between the macro economic variables with respect to the market performances. The results suggested that, there is a long run of significant relation between the macro economic variables with stock market performances in the developed stock market suck as London and Tokyo.

III. METHODOLOGY

This study mainly attempted to compare the directions and movements of market prices and trade volume rates between CSE and NSE during past 6 year periods from 2007 January to 2013December.The methodology is as follows: the first part of the research descriptive statistical techniques widely used to discuss the relationship between macro-economic variables and stock market validations. The different types of macro-economic variables, which high affect the market performances, were considered. In the second phase, time series forecasting techniques were widely used to forecast and predict the future results. As a first step, Augmented Dickey-Fuller Test (ADF) and Phillip and Perron Test (PP) models were used to identify the stationary/non-stationary conditions under the 0.05 level of significance [26, 27, 28].

H_0: Data series has a unit root

H_1: Data series has not a unit root

According to the definitions, if the null hypothesis is rejected under the 0.05 level of significance, then the series is said to be stationary. If the time series is non-stationary, data transformation techniques can be used to make series as stationary.

A. Linear and Nonlinear Time series modeling: ARMA Modeling Approach

Autoregressive moving average (ARMA) models often used to discuss the behaviors in stationary data patterns. It provides a parsimonious explanation of a stationary stochastic process in terms of two kinds of polynomials. One is auto regressive

process. ARMA model can be generally written as ARMA (p, q), where p and q represent the order of respectively [29, 30, 31].

$$X_t - \phi_1 X_{t-1} \cdots - \phi_p X_{t-p} = Z_t + \vartheta_1 Z_{t-1} \cdots + \theta_q Z_{t-q} \quad (1)$$

For every t, where $\{Z_t\} \sim WN(0, \sigma^2)$ and the polynomials. Moreover, $\phi_1, \phi_2, \ldots, \phi_p$, and $\theta_1, \theta_2, \ldots, \theta_q$ are constants.

$$\phi(z) = 1 - \phi_1 z - \ldots - \phi_p z^p \quad (2)$$

$$\theta(z) = 1 + \theta_1 z + \ldots + \theta_q z^q \quad (3)$$

Comparing the equations 1, 2 and 3, the system can be written as follows [32].

$$\phi(B)X_t = \theta(B)Z_t \quad (4)$$

IV. DATA ANALYSIS AND DISCUSSION

A. Requirement Analysis: Data source and sample

This comparison study carried out on the basis of secondary data, which were obtained from Colombo and Nigeria stock exchanges, annual reports of Central Banks of two counties, annual reports of listed companies and other relevant sources. The study broadly categorized into two main sections. In the first phrase market Capitalization, trade values, number of listed securities, listing agreements and market price indices were particularly considered. In the Second phrase, advanced statistical techniques were used to predict market indices for coming 10 months.

TABLE I.   MAJOR STOCK EXCHANGES

Rank	Stock Exchange	Economy	Market Capitalization (USD Billions)
1	NYSE Euronext	USA/ Europe	14,085
2	NASDAQ OMX Group	USA/Europe	4,582
3	Tokyo Stock Exchange	Japan	3,478
4	Colombo Stock Exchange	Sri Lanka	20
5	Nigeria Stock Exchange	Nigeria	57

a. Source: (Monthly Reports: December 2012 | World Federation of Exchanges)

Table 1 lists the CSE and NSE market capitalizations with other major stock exchanges around the world. The results suggested that, CSE and NSE have very less market capitalization comparing with top level stock exchangers such as NYSE Euronet and NASDAQ OMX Group exchanger in USA.

Variables	CSE	NSE
Index	The All Share Price Index (ASPI) The Milanka Price Index (MPI) The S&P Sri Lanka 20 (S&P SL20)	All- Share Index (NGSEI) NSE 30
Listed Companies	295	198

b. Source: CSE Annual Publication-2014/ NSE Annual Publication-2014

There are two main price indices are the most diligent indices in CSE today. These are All Share Price Index (ASPI) and the S&P Sri Lanka 20 Price Index (S&P SL20). The S&P SL 20 based on the best performing 20 companies' market capitalizations (Rathnayaka et al., 2013, Rathnayaka et al., 2014). However, concept of ASPI is totally different than S&P SL20. This weighted average index is a broadest and longest measure of the CSE and measured based on all the listed companies.

All-share index and NSE 30 price indices mainly used in Nigeria Stock exchange today. NSE 30 price index is calculated based on top level thirty listed companies' highest market capitalizations. It is very similar to the S&P SL20 index in CSE. Furthermore, All-Share index also theoretically coincide with the ASPI index which is being used in Colombo stock exchange, Sri Lanka. As a result, these indices can be directly use for our further discussions.

B. Similarities and Dis-similarities between SSE and CSE
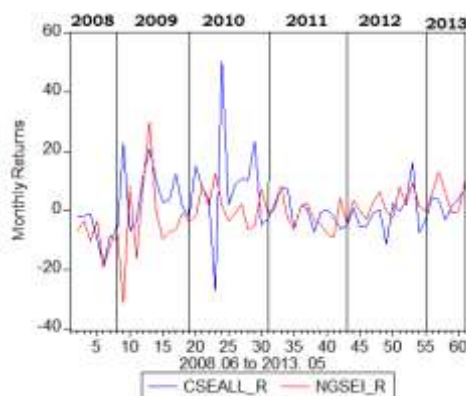

Figure 1. Comparison Results of SSE and ASPI Price Returns

Figure 1 clearly shows that, in the beginning months of 2008, both the stock exchanges were at the same level and there appeared to be low connectivity between them. However, after the January 2009, ASPI was rising very sharply and reached the highest point in the CSE history. Political stability of the Sri Lanka after the end of the civil war in the northern part and the 2010 presidential election results directly caused market fluctuations. As a result, between 2009 and the end of 2010, ASPI market indices fluctuated with high volatility and reached over Rs. 5000 level.

Incidentally, in this same period the NGSEI flows almost constant and deviates around the mean value. However, at the end of 2011, the ASPI index has started falling down again in a negative trend. According to the financial reports in CSE, by the end of 2012 ASPI fell down 63.74% comparing to its performance by January. Furthermore, data patterns clearly show that, the volatility in the ASPI is much higher than the NGSEI.

C. Stationary /Non stationary Model Checking

TABLE III. SUMMARY ADF AND PP TEST RESULTS

Index	Test statistics		t- Statistic	Probability
ASPI	ADF	1% level	-3.4452	0.0000
		5% Level	-2.8216	
	PP	1% level	-3.4563	0.0000
		5% Level	-2.9013	
NGSEI	ADF	1% level	-3.6226	0.0123
		5% Level	-2.9145	0.0000
	PP	1% level	-3.2464	0.0110
		5% Level	-2.8116	0.0000

c. Source: CSE Daily Reports-2013/ NSE Daily Reports -2013

The reported results in Table 3 clearly show that ASPI and NGSEI returns have significantly precluded the unit root hypothesis under the 0.01 and 0.05 levels of significances and have no unit root. These results coincide with ACF and PACF figure results in Figure 2.
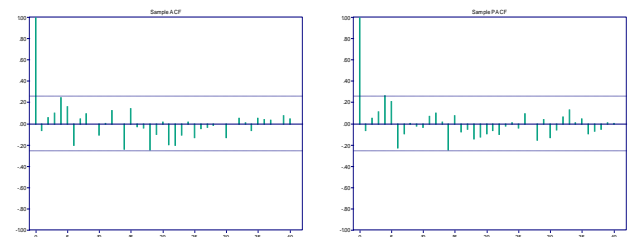

Figure 2. ACF and PACF of ASPI

D. Mean equation Model Fitting: Sector vice Analysis

ADF and PP test results suggest that our data series is stationary and independent with each other. Due to these conditions, ARMA model is a most suitable time series model for predicting future patterns.

TABLE IV. ARMA MODEL FITTINGS ANALYSIS FOR SSE

Index	Fitted Model	AR coefficient	MA Coefficient
ASPI	ARMA(1,2)	0.1287	-.216440 .162669
NGSEI	ARMA(1,3)	.149387	.908269 .209619 .301331

The reported results in Table 4 shows that based on 2008 to 2013 price indices, ARMA (1,2) and ARMA (1, 3) are most

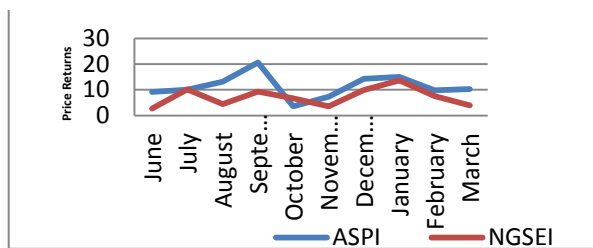suitable models for predicting the ASPI and NGSEI indices respectively.

Figure 3. Forecasting Results for next 11 months: ASPI and NGSEI

A Figure3 result also clearly shows that ASPI has highest forecasting returns comparing with NGSEI. Furthermore, after July stocks will be increasing with positive trend up to next September. However, after the September, the market indices will negatively fluctuate with high volatile fluctuations.

V. CONCLUSION

The Economical Time series models are widely used to develop the economic relationships, especially for the nonlinear models for the stationary and non-stationary frameworks for prediction and forecasting future patterns. This study directly sheds light on economic relationships between the Colombo and Nigeria stock markets. The analysis gave a broader knowledge to reader with the financial circumstance of the stock markets in Sri Lankan and Nigeria between 2008 and 2013. Different types of statistical methods were mainly used to discuss our results. They are; multivariate statistical methods, Econometric statistical techniques, forecasting methods and descriptive statistical Techniques.

Many economic and political changers have happened during our sample period. So, study results clearly suggested that, political stability of the country directly affect the market fluctuations; especially in CSE. These findings are coincided with the findings of Pries et al, (Pries et al, 2011) and Abeysekara et al, (Abeysekara et al, 2001) research findings that were based on stock market volatility on CSE.

REFERENCES

[1] Rathnayaka, R.M. K. T. and Seneviratne, D.M.K.N. and Wang, Z.J., "An Investigation of Statistical Behaviors of the Stock Market Fluctuations in the Colombo Stock Market: ARMA & PCA Approach", Journal of Scientific Research & Reports 3(1): 130-138, 2014.

[2] Samarathunga, D. (2008). "Stock market efficiency and integration: A study of eight economies in the Asia-Pacific region". Central Bank of Sri Lanka, Staff studies, 83 (1&2), 95-117.

[3] Jayathileke, P. M. B., and Rathnayaka, R.M. K. T. "Testing the Link between Inflation and Economic Growth: Evidence from Asia", Modern Economy,4, 87.

[4] Abeysekera, S.P. (2001). "Efficient market hypothesis and the emerging capital market in Sri Lanka: Evidence from the Colombo stock exchange-A note". Journal of Business Finance and Accounting, (28), 249-261.

[5] Bandara, W.M.G. (1999). "Behaviour of share index returns of the Colombo stock exchange: An empirical study". Proceedings of the annual research sessions of the faculty of graduate studies, University of Sri Jayewardenepura, 183-196.

[6] Kumar, A. (2011), "An empirical analysis of causal relationship between stock market and macroeconomic variables in India" IJCSMS International Journal of Computer Science &Management Studies, 11 (01) 253-260.

[7] Rathnayaka, R.M. K. T. and Wang, Z.J., "Influence of Family Status on the Dietary Patterns and Nutritional Levels of Children", Food and Nutrition Sciences, 2012.

[8] Rathnayaka, R.M. K. T. and Wang, Z.J., "Enhanced Greedy Optimization Algorithm with Data Warehousing for Automated Nurse Scheduling System", E-Health Telecommunication Systems and Networks 1.04 (2012): 43.

[9] Peiris, T.U.I, Peiris, T.S.G.(2011). "Measuring stock market volatility in an emerging economy", ICBI, 2011/A&F 152.pdf.

[10] Rathnayaka, R.M. K. T. and Seneviratne, D.M.K.N "G M (1, 1) Analysis and Forecasting for Efficient Energy Production and Consumption", International Journal of Business, Economics and Managment Works, Kambohwell Publisher Enterprises, 1 (1), 6-11, 2014.

[11] Poshakwale, S, Alexakis, C, Patra, T. (2010). "Predictability of Stock Returns using Financial Statement Information: Evidence on Semi-strong Efficiency of Emerging Greek Stock Market", Applied Financial Economics, 20, 16, 1321-1326.

[12] ZhuKong , Li J.J. (2010). "Studies of discriminant analysis and logistic regression model application in credit risk for China's listed companies". Management Studies and Engeneering, (4), 24-32.

[13] Rathnayaka, R.M. K. T. and Seneviratne, D.M.K.N, and Nagahawatta, S.C. "Statistical Techniques Approach For Evaluating The Market Fluctuations; The Case Study In Colombo Stock Exchange ", International Conference on Business & Information 2013 , ISBN 978-955-4563-17-9 .

[14] Rathnayaka, R. M. Kapila Tharanga and Wang, Zhong Jun and Seneviratna, D.M Kumudu Nadeeshani and Nagahawatta, Sachini Chandima, An Econometric Evaluation of Colombo Stock Exchange: Evidence from ARMA & PCA Approach (2013). Proceedings of the 2nd International Conference on Management and Economics, 2013.

[15] R.M Kapila Tharanga Rathnayaka, D.M K. N. Seneviratna and S.C. Nagahawatta, "Empirical Investigation of Stock Market Behaviour in the Colombo Stock Exchange", 3rd International Conference on Management and Economics, (ICME) University of Ruhuna, Sri lanka, 209-216,2014, ISBN 978-955-1507-30-5.

[16] Chan, K.C., Gup, B.E., & Pan Ming-shium.(1992). An Empirical Analysis of Stock Prices in Major Asian Markets and United States. The financial Review, 27,2, 289-307

[17] Rathnayaka, R.M. K. T. and Wang, Z.J., "Prevalence and effect of personal hygiene on transmission of helminthes infection among primary school children living in slums", International Journal of Multidisciplinary Research Journal; ZENITH, ISSN: 2231-5780, Vol 02, April 2012.

[18] Lin, W.L. (1992), "Alternative estimators for factor GARCH models – a Monte Carlo comparison" Journal of Applied Econometrics 7, 259–279.

[19] Antoniou, A., Ergul, N., Holmes, P. (1997). "Market efficiency, thin trading and non-linear behaviour: Evidence from an emerging market". European Financial Management, 3 (2), 175-190.

[20] R.M. Kapila Tharanga Rathnayaka, Wei Jianguo and D.M.K.N Seneviratne, "Geometric Brownian Motion with Ito lemma Approach to evaluate market fluctuations: A case study on Colombo Stock Exchange", 2014 International Conference on Behavioral, Economic, and Socio-Cultural Computing (BESC'2014- IEEE), Shanghai, China, 2014.

[21] Durbin, J. and S. J. Koopman (2001). Time Series Analysis by State Space Methods. Oxford: Oxford University Press.

[22] Goonatilake, R., and Herath, S. (2007), "The volatility of the stock market and news" , International Research Journal of Finance and Economics", (11) ,45-60.

[23] Gujarati, D. N. (2004). "Basic econometrics", New Delhi: Tata McGraw-Hill.

[24] Pallegedara, A. (2012), "Dynamic relationships between stock market performance and short term interest rate empirical evidence form Sri Lanka", MPRA, 40773

[25] Kerby, A., Lawrence, J. (2010), "A multivariate statistical analysis of stock trends", MI. Oxford, 3, 55-80.

[26] Rathnayaka, R.M. K. T., and Wang, Z.J., "Enhanced Greedy Optimization Algorithm with Data Warehousing for Automated Nurse Scheduling System", E-Health Telecommunication Systems and Networks 1.04 (2012): 43.

[27] Conrad, K. & Juttner, D.J. (1973). "Recent behaviour of stock market prices in Germany and the random walk hypothesis", Kyklos, 26 (3), 576-599.

[28] R.M Kapila Tharanga Rathnayaka, Wei Jianguo and S.C. Nagahawatta "A Review on Geometric Brownian motion for forecasting the Daily Share Prices in CSE", KDU International Research Conference, General Sir John Kotelawala Defence University, Sri Lanka, (2104).

[29] Rathnayaka, R.M. K. T., and Wang, Z.J., "Influence of Family Status on the Dietary Patterns and Nutritional Levels of Children", *Food and Nutrition Sciences* 2012 (2012).

[30] Fama, E.F. (1965), "The behavior of stock-market prices", The Journal of Business, 38 (1), 34-105.

[31] Rathnayaka, R.M. K. T., "Cross-Cultural Dimensions of Business Communication: Evidence from Sri Lanka", International Review of Management and Business Research, 3(3), 1579-1587, 2014; ISSN: 2306-9007, 2014.

[32] Seneviratne, D. M. K. N. & Jianguo, W.,2013. Analyzing the causal relationship between stock prices and selected macroeconomic variables:evidence from Sri Lanka , ZIJBEMR, Vol.3 (9),1-10.