The Journal of Commerce, Vol. 3, No. 2
ISSN: 2218-8118, 2220-6043
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WEAK FORM MARKET EFFICIENCY: EVIDENCE FROM EMERGING AND DEVELOPED WORLD

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Abstract

In recent years, especially in the aftermath of the global financial meltdown, the performance of emerging and developed capital markets has attracted the attention of the researchers and investors across the globe. The resilient shown by emerging markets provides the impetus to examine the efficient market hypothesis in these markets. It is with this backdrop, this paper is an attempt to test the weak form efficiency of select emerging and developed capital markets (India, China, Brazil, South Korea, Russia, Germany, US and UK) over the sample period spanning from January 2007 to December 2010. The application of unit root test and GARCH (1, 1) model estimation provides the evidence that these markets are not weak form efficient which has both positive and negative implications. On the one hand, such inefficiency disturbs the allocation of national resources for development projects, and on the other hand, provides incentives for creation of innovative financial products thereby making the markets move towards efficiency in the long run.

Keywords: South Asia Capital markets, Efficient Market Hypothesis, Unit Root Test.

INTRODUCTION

In both emerging and developed economies, capital market has been seen as the major vehicle of economic growth. Among many other functions, it performs the crucial function of channelizing savings into investment (Sudhahar and Raja, 2010). Thus, capital market plays a pivotal role in the allocation of economic resources into the productive activities of the economy. This allocation takes place through the appropriate pricing of securities traded in the market. The investors can be motivated to save and invest in the capital market of a country only if the securities in the market are appropriately priced. A capital market in which stock prices fully reflect all the available information is called efficient. In fact, the information and its dissemination determine the efficiency of a capital market. That is, how quickly and correctly the security prices reflect these information show the degree of efficiency of the capital market. Therefore, capital market being a vital institution that facilitates economic development, the efficiency of capital market is a matter of interest to many parties.

In recent years, especially in the aftermath of the global financial meltdown, the study of the weak form capital market efficiency has attracted the attention of researchers, economists, and financial analysts. It is considered that more efficient and better functioning capital markets could provide greater impetus to domestic economic growth. Market efficiency refers to a state in which current asset prices reflect all the publicly available information about the security. The accepted view is that when information arises, the news spreads very quickly and is incorporated into the prices of securities without delay. Under such a condition, the current market price in any financial market could be the best unbiased estimate of the value of the investment. Thus, efficient market hypothesis implies that old information can't be used to prefigure future price movements (Vaidyanathan and Gali, 1994).

So, neither technical analysis, which is the study of past stock prices in an attempt to predict future prices, nor even fundamental analysis, which is the analysis of financial information such as company earnings, asset values, etc., to help investors select "undervalued" stocks, would enable an investor to achieve returns greater than those that could be obtained by holding a randomly selected portfolio of individual stocks with comparable risk (Malkiel, 2003).

If market prices provide a valid benchmark of performance, then policies driven by market timing, earnings managements, and financial asset mispricing will not be value enhancing.

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In the finance literature, Fama (1970) classified the market efficiency into three levels, viz., weak form market efficiency, semi-strong form market efficiency, and strong form market efficiency depending on the information reflected in security prices. Weak form market efficiency stipulates that no one can beat the market using information that everybody else knows. Going one step ahead, semi-strong form market efficiency states that a company's financial statements, announcements, economic factors, and other similar information are of no help in forecasting future price movements and securing high investment returns. Similarly, strong form market efficiency holds that historical, publicly as well as privately held information or insider information too, is so quickly incorporated by market prices, these can't be used to make excess trading profits.

Capital market efficiency has important implications for investors and regulatory authorities. In efficient capital markets, the role of regulatory authorities is limited as securities are accurately priced. There will be no undervalued assets offering higher than expected return, or overvalued assets offering lower than the expected return. All assets will be correctly priced in the market offering optimal reward to risk. Thus, in an efficient market an optimal investment strategy will be to focus on risk and return characteristics of the asset and/or portfolio (Gupta and Basu, 2007).

If, on the other hand, a market is not efficient, the regulatory authorities can take necessary steps to ensure that stocks are correctly priced leading to capital market efficiency. In an inefficient market, an investor will be better off trying to spot winners and losers in the market, and correct identification of miss-priced assets will enhance the overall performance of the portfolio (Rutterford, 1993).

Thus, looking at the importance of capital market efficiency, this paper is an attempt to investigate the validity of weak form efficiency for select emerging and developed capital markets. Traditionally, more developed capital markets are considered to be more efficient. But the recent global financial crisis happens to undermine such efficiency and thus, we have attempted to revisit the issue in the context of select developed capital market. On the other hand, as it is believed that the understanding of efficiency of the emerging markets is important as a consequence of integration with developed markets and free movement of investments across national boundaries. Since early 1990s, most of the emerging nations have introduced the philosophy of liberalization and globalization in their economies that expected to lead to sustained reforms in the financial sector and increased efficiency of capital markets (Datar and Basu 2004). So it is imperative to re-investigate the efficient market hypothesis in the context of select emerging market economies.

Hence, Brazil, India, China, South Korea, and Russia amongst emerging economies and US, Germany, and UK amongst the developed economies have been considered for examining the market efficiency for a period January 2007 to December 2010.

It is with this objective the rest of the paper is organised as follows: Section II reviews the literature; Section III discusses the data and methodology of study; Section IV makes the analysis; and Section V concludes.

LITERATURE REVIEW

The extant of literature is voluminous with respect to the studies concerning investigation of capital market efficiency in individual as well as in group of countries. Fama (1965), Laurence (1986), Parkinson (1987), Lee (1992), Butler and Malaikah (1992), Srinivasan (1993), Choudhury (1994), Vaidyanathan and Gali (1994), Huang (1995), Urrutia (1995), Poshakwale (1996), Chan *et al* (1997), Ojah and Karemera (1999), Karemera *et al* (1999), Ramasastri (1999), Darrat and Zhang (2000), Pant and Bishnoi (2002), Appiah-Kusi and Menyah (2003), Buguka (2003), Worthington and Higgs (2003, 2004), Cooray and Wickremasinghe (2005), Worthington and Higgs (2006), Cheng and Lee (2006), Gupta and Basu (2007), Mishra (2009), Mishra and Pradhan (2009), Garg and Jain (2009), Samuel and Oka (2010), Hamid, Suleman, Shah and Akash (2010), Wen, Li, and Liang (2010), Srivastava and Thenmozhi (2011) have all studied the efficient market hypothesis in any of its degree, and the empirical evidence is mixed, and thus, the issue is still a moot point. These researchers have used different test procedures to examine the efficient market

hypothesis and reported contradictory results. Some studies accepted the weak form efficiency while others refuted it. Thus, the controversy on the efficiency of emerging and developed capital markets continues over a period of time. Therefore, it becomes important to re-examine the issue.

DATA AND METHODOLOGY

The objective of this study is to reinvestigate the efficient market hypothesis in its weak form in the context of the select emerging and developed capital markets. The sample period considered in the study spans from January 2007 to December 2010. Brazil, India, China, South Korea and Russia amongst emerging economies and US, Germany, and UK amongst the developed economies have been considered for the purpose. The BOVESPA of Brazil, Sensex of India, Shanghai Composite Index of China, KOSPI Composite Index of South Korea, RTS of Russia, NASDAQ Composite of US, DAX of Germany and FTSE 100 of UK have been considered as indices representing the respective countries' capital markets. The adjusted[2] daily closing stock price indices for select capital markets are plotted over the sample period (see Fig. 1).

The study uses the adjusted daily closing stock price indices to calculate daily stock returns by the formula: $R_t = \ln\left(\frac{I_t}{I_{t-1}}\right)$, Where R_t is the daily stock return at time 't' and I_t and I_{t-1} are the closing value of the Sensex at time '*t*' and '*t-1*' respectively. The daily stock return data have been plotted to observe the volatility of select capital markets (see Fig.2)

All required data have been obtained from Yahoo Finance. In this study, the basic Random Walk (RW) model and a GARCH (1, 1) model have been used.

The Random Walk Hypothesis states that stock market prices evolve according to a random walk and thus, the prices of the stock market can't be predicted. The theory of Random Walk in stock prices actually involves two separate hypotheses: First, successive price changes are independent; Second, the price changes confirm to some probability distribution. The Augmented Dickey-Fuller (ADF) unit root test is used directly to investigate the Random Walk Hypothesis (RWH) for select capital markets Ramasastri (1999). The ADF unit root test consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms and optionally, a constant and a time trend. The test requires estimating the following regression:

$$\Delta R_t = \beta_1 + \beta_2 t + \rho R_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta R_{t-i} + \varepsilon_t \text{.....(1)}$$

Where, R_t is the monthly general stock price index based stock market return, i.e., $R_t = \log(P_t / P_{t-1})$, ΔR_t is the first difference of the R_t, β_1 is the intercept, β_2, ρ are the coefficients, t is the time or trend variable, m is the number of lagged terms chosen to ensure that ε_t is white noise, i.e. ε_t contains no autocorrelation, ε_t is the pure white noise error term, and $\sum_{i=1}^{m} \alpha_i \Delta R_{t-i}$ is the sum of the lagged values of the dependent variable ΔR_t.

Using the equation (1), the null hypothesis (H_0) of a unit root i.e. $\rho = 0$ is tested against the alternative hypothesis (H_1) that $\rho < 0$. The acceptance of null hypothesis implies the existence of a unit root, which means the time series under consideration, is non- stationary thereby indicating that the market shows characteristics of random walk and as such is efficient in the weak form. The rejection of null hypothesis implies the non-existence of a unit root which means the time series P_t is stationary and do not show characteristics of random walk.

Further, the econometric estimate of the GARCH (1, 1) model is used to observe the volatility clustering and thus, the weak form market inefficiency. As per the GARCH (1, 1) model, the presence of persistence in volatility clustering implies inefficiency of a capital market. The GARCH (1, 1) model as put forward by Bollerslev (1986) can be specified as:

[2]Adjusted closing indices are the closing values adjusted for dividends and stock splits.

Mean Equation: $R_t = c + \varepsilon_t$.....(2)

Variance Equation: $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$.....(3)

Since σ_t^2 is the one-period ahead forecast variance based on past information, it is called the *conditional variance*. The above specified conditional variance equation is a function of three terms: a constant term (ω), news about volatility from the previous period, measured as the lag of the squared residual from the mean equation (ε_{t-1}^2), and the last period's forecast variance (σ_{t-1}^2). In the variance equation, $(\alpha + \beta)$ being very close to one shows high persistence in volatility clustering and thus, implies inefficiency of a capital market.

EMPIRICAL ANALYSIS

In the weak form of capital market efficiency, prices of securities at every instant fully reflect all available information of past prices. This means future price movements can't be predicted by using past prices. It is a direct repudiation of technical analysis. Thus, the study on weak form of capital market efficiency has implications for individual and institutional investors in their investment decisions. It is with this back drop, we have performed the ADF unit root test for all select capital markets, and the results are reported in Table-1.

It is cleared that, the null hypothesis of unit root (non-stationarity) is rejected, as the value of test statistic is more negative than the critical value in each country case. The results indicate that the stock prices in select emerging and developed capital markets do not follow random walk and hence, markets are not weak-form efficient.

Then to confirm the results of ADF unit root test and find the reasons for such findings, we have estimated GARCH (1, 1) model for each market and the results are reported in Table-2.

The reported results show that the value of $(\alpha + \beta)$ is very close to 1 for all capital markets, suggesting thereby a high persistence of volatility clusters over the sample period in the markets. This is an indication of weak form market inefficiency. Such high persistence of volatility clusters during the sample period in emerging as well as developed capital markets may be due to the most recent global financial recession, and underlying credit and confident crises.

The evidence of weak form inefficiency implies the existence of a sizable amount of stock prices in select capital markets to be either undervalued or overvalued. There is a chance for hardworking analysts to consistently outperform the market averages. People such as corporate officers who have inside information can do better than the market averages, and individuals and organizations that are especially good at digging out information on small and new companies are likely to consistently do so well.

In a less efficient capital market, the share prices may not necessarily reflect the true value of stocks. So, companies with low true values may be able to mobilize a lot of capital, while companies with high true values may find it difficult to raise capital. This disrupts the investment scenario of the country as well as the total productivity. In other words, investment funds are not channeled to avenues where they are most useful. This resource mal-allocation in the long run is destructive as it would hinder the sustainable development of the economy.

CONCLUSION

The issue of capital market efficiency is significant for its implications both for investors and regulatory authorities. In an informationally efficient capital market, the role of the regulatory authorities is delimited by correct pricing of stocks. The efficient dissemination of information ensures that capital is optimally allocated to projects that yield the highest expected return with necessary adjustment for risk and uncertainty. With an efficient pricing mechanism, an economy's savings and investment are allocated efficiently. Hence, an efficient capital market provides no opportunities to involve in gainful trading activities on a continuous basis. But on the contrary, if a capital market is not efficient, the regulatory bodies can take necessary steps to ensure that stocks are correctly priced leading to stock market efficiency.

In view of such important implications of the efficient market hypothesis and the impacts of recent global financial crisis, this

paper is an earnest attempt to examine the Efficient Market Hypothesis in its weak form in the context of select emerging and developed capital markets. The sample basket consists of the time series data on BOVESPA of Brazil, Sensex of India, Shanghai Composite Index of China, KOSPI Composite Index of South Korea, RTS of Russia, NASDAQ Composite of US, DAX of Germany and FTSE 100 of UK for the period 2007 to 2010. The application of most popular econometric techniques of ADF unit root test and GARCH model estimation provides the evidence that the capital markets in select economies are not weak for efficient giving scope for profitable trading. Such weak form market inefficiency has a deteriorating effect on the gross savings and investment status of any country thereby disturbing the resource mobilization process for the larger interest of a nation. However, such informational inefficiency of capital markets has an interesting implication. The opportunity of making excess profit in an inefficient market often provides the impetus for successful financial innovation by financial firms thereby making the market move towards efficiency in the long run. Thus, the policy makers and other regulators should make necessary arrangements to improve timely corporate disclosures so that security prices appropriately and quickly reflect all available information.

REFERENCES

Appiah-Kusi, J., & Menyah, K. (2003). Return Predictability in African Stock Markets. *Review of Financial Economics* , Vol.12, 247 -270.

Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroscedasticity. J*ournal of Econometrics, pp.*307-327.

Buguka, Cumhur and Brorsen, B. Wade (2003). Testing Weak-Form Market Efficiency: Evidence from the Istanbul Stock Exchange. *International Review of Financial Analysis*, Vol. 12, pp. 579–590.

Butler, C. K., & Malaikah, S. J. (1992). Efficiency and Inefficiency in Thinly Traded Stock Markets: Kuwait and Saudi Arabia. *Journal of Banking and Finance* , Vol.16, 197-210.

Chan, K. C., Gup, B. E., & Pan, M. S. (1997). International Stock Market Efficiency and Integration: A Study of Eighteen Nations. *Journal of Business Finance and Accounting* , Vol.26, No.6.

Cheng, Sheng. S., and Lee, Hwey. C., (2006). Weak Form Market Efficiency Hypothesis Testing – A Price Asymmetry Viewpoint, *The Journal of Global Business Management*, Vol.2, No.2.

Choudhry, T. (1994). Stochastic Trends and Stock Prices: An International Inquiry. *Applied Financial Economics* , Vol.4, 383-390.

Cooray, A., & Wickremasinghe, G. (2005). The Efficiency of Emerging Stock Market: Empirical Evidence from the South Asian Region. *Discussion Paper Series*, No.2, School of Economics, UTAS , 1-15.

Darrat, A. F., and Zhang, M. (2000). On Testing the Random Walk Hypothesis: A Model Comparison Approach, *The Financial Review*, Vo.35, pp.105-124.

Datar, M. K. and Basu, P. K., (2004). Financial sector reforms in India: Some Institutional Imbalances, *Conference Volume, Academy of World Business, Marketing and Management Development Conference*, Gold Coast, Australia, July.

Dickey, D. A. and Fuller, W. A. (1979). Autoregressive Time Series with a Unit Root, *Journal of the American Statistical Association, Vol.*74, pp.427–431.

Fama, E. F. (1965). The Behaviour of Stock Market Prices. *Journal of Business* , Vol.38, 34-105.

Fama, E. F. (1970). Efficient Cpaital Markets: A Review of Theory and Empirical Work. *The Journal of Finance* , Vol.25, 383-417.

Garg, V. and Jain, Priya (2009). Efficient Market Hypothesis: A Critical Review of Theory and its Implications for Investment Decision. *Manglmay Journal of Management and Technology*, Vol.3, Issue 2.

Gupta, R., & Basu, P. K. (2007). Weak Form Efficiency in Indian Stock Markets. *IBER Journal* , Vol.6, No.3, 57-64.

Hamid, K., Suleman, M. T., Shah, S. Z. A., and Akash, R. S. I. (2010). Testing the Weak form of Efficient Market Hypothesis: Empirical Evidence from Asia-Pacific Markets. *International Research Journal of Finance and Economics*, Issue 58, pp.121-133

Huang, B. N. (1995). Do Asian Stock Markets Follow Random Walks: Evidence from the Variance Ratio Test. *Applied Financial Economics* , Vol.5, No.4, 251-256.

Karemera, D., Ojah, K., & Cole, J. A. (1999). Random Walks and Market Efficiency Tests: Evidence from Emerging Equity Markets. *Review of Quantitative Finance and Accounting* , Vol.13, No.2, 171-188.

Laurence, M. M. (1986). weak-form Efficiency in the Kuala Lumpur and Singapore Stock Markets. *Journal of Banking and Finance* , Vol.10, 431-445.

Lee, U. (1992). Do Stock prices Follow Random Walk? Some International Evidence. *International Review of Economics and Finance* , Vol.1, No.4, 315-327.

Malkiel, B. G., (2003). The Efficient Market Hypothesis and its Critics, CEPS Working Paper No.91, pp. 1-47.

Mishra, P. K. (2009). Indian Capital Market - Revisiting Market Efficiency. *Indian Journal of Capital Market*, Vol. II, No. 5, pp. 30-34.

Mishra, P. K., and B. B. Pradhan (2009). Capital Market Efficiency and Financial Innovation – A Perspective Analysis. *The Research network*, Vol.4, No. 1, pp. 1-5

Ojah, K., & Karemera, d. (1999). Random Walk and Market Efficiency Test of Latin American Emerging Equity Markets: a Revisit. *The Financial Review*, Vol.34, No.2, 57-72.

Pant, B., & Bishnoi, T. R. (2002). Testing Random Walk Hypothesis for indian Stock Market Indices. *Working Paper series*, Indian Institute of Management, Ahmadabad .

Parkinson, J. M. (1987). The EMH and CAPM on Nairobi Stock Exchange. *East Africa Economic Review* , Vol.3, No.2, 105-110.

Phillip, P.C.B. and Perron, P. (1988). Testing for a Unit Root in Time Series Regression, *Biometrika, Vol.*75, pp.335-346.

Poshakwale, S. (1996). Evidence on weak Form Efficiency and Day of the Week effect in the Indian Stock Market. *Finance India* , Vol.10, No.3, 605-616.

Ramasastri, A. S., (1999). Market efficiency in the Nineties: Testing through Unit Roots *Prajanan*, Vol.XXVIII, No.2, pp.155-161

Rutterford, J. (1993). *Introduction to Stock Exchange Investment, Second Edition*, pp.281-308, The Macmillan Press Ltd., London.

Samuel, S. E., and Oka, R. U. (2010). Efficiency of the Nigerian Capital Market: Implications for Investment Analysis and Performance. *Transnational Corporations Review*, Vol. 2, No. 1, pp.42-51

Srinivasan, R. (1993). Securities Prices Behaviour Associated with Rights Issue-Related Events. Doctoral Dissertation, Indian Institute of Management, Ahmedabad .

Srivastava, S. P., and Thenmozhi, M., (2011). A Study of Market efficiency of stock Markets in Emerging and Developed Economies, *Paper presented in 8th AIMS International Conference on Management*, January 1-4, Conference Volume, pp.674-682..

Sudhahar, J. C., and Raja, M., (2010). An Empirical Assessment of Indian Stock Market Efficiency, Karunya Journal of Research, Vol.2, No.1, pp.100-112.

Urrutia, J. L. (1995). Test of Random Walk and Market Efficiency. *Journal of Financial Research* , Vol.18, 299-309.

Vaidyanathan, R., & Gali, K. K. (1994). Efficiency of the Indian Capital Market. Indian *Journal of Finance and Research* , Vol.5, No.2.

Wen, Xianming, Li, Kexi, and Liang, Lin, (2010). A Weak-Form Efficiency Testing of China's Stock Markets. *Third International Joint Conference on Computational Science and Optimization,* May, pp.514-517.

Worthington, A. C. and Higgs, H., (2003). Tests of Random Walks and Market Efficiency in Latin American Stock Markets: An Empirical Note. School of Economics and Finance, Queensland University of Technology in its Series *School of Economics and Finance Discussion Papers and Working Papers Series No. 157*.Worthington,

Worthington, A. C. and Higgs, H., (2004). Random Walks and Market Efficiency in European Equity Markets, *Global Journal of Finance and Economics,* Vol. 1, No. 1, pp. 59-78.

Worthington, A. C., & Higgs, H. (2006). Evaluating Financial Development in emerging Capital Markets with efficiency Benchmarks. *Journal of Economic Development* , Vol.31, No.1, pp.1-27.

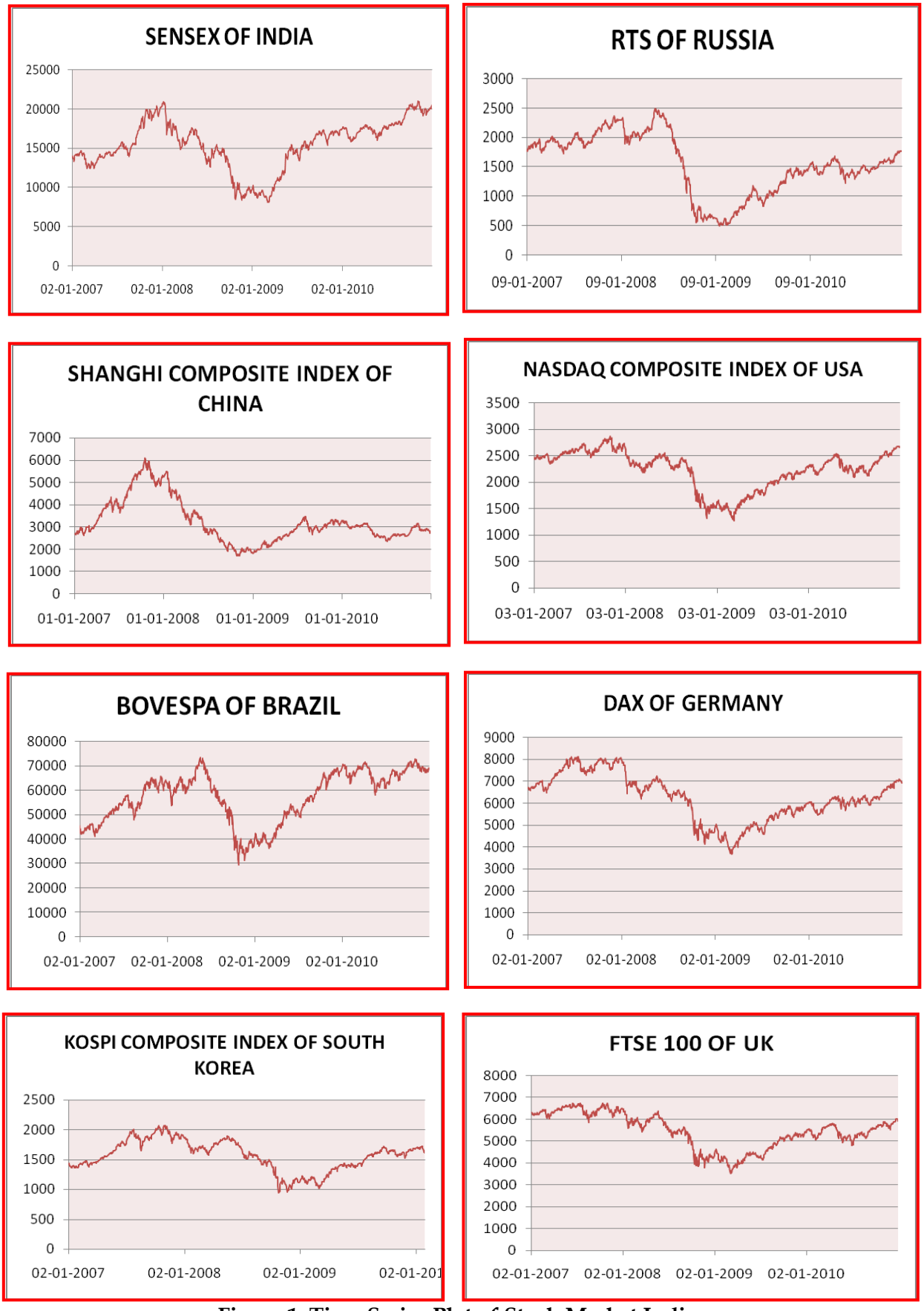

Figure 1: Time Series Plot of Stock Market Indices

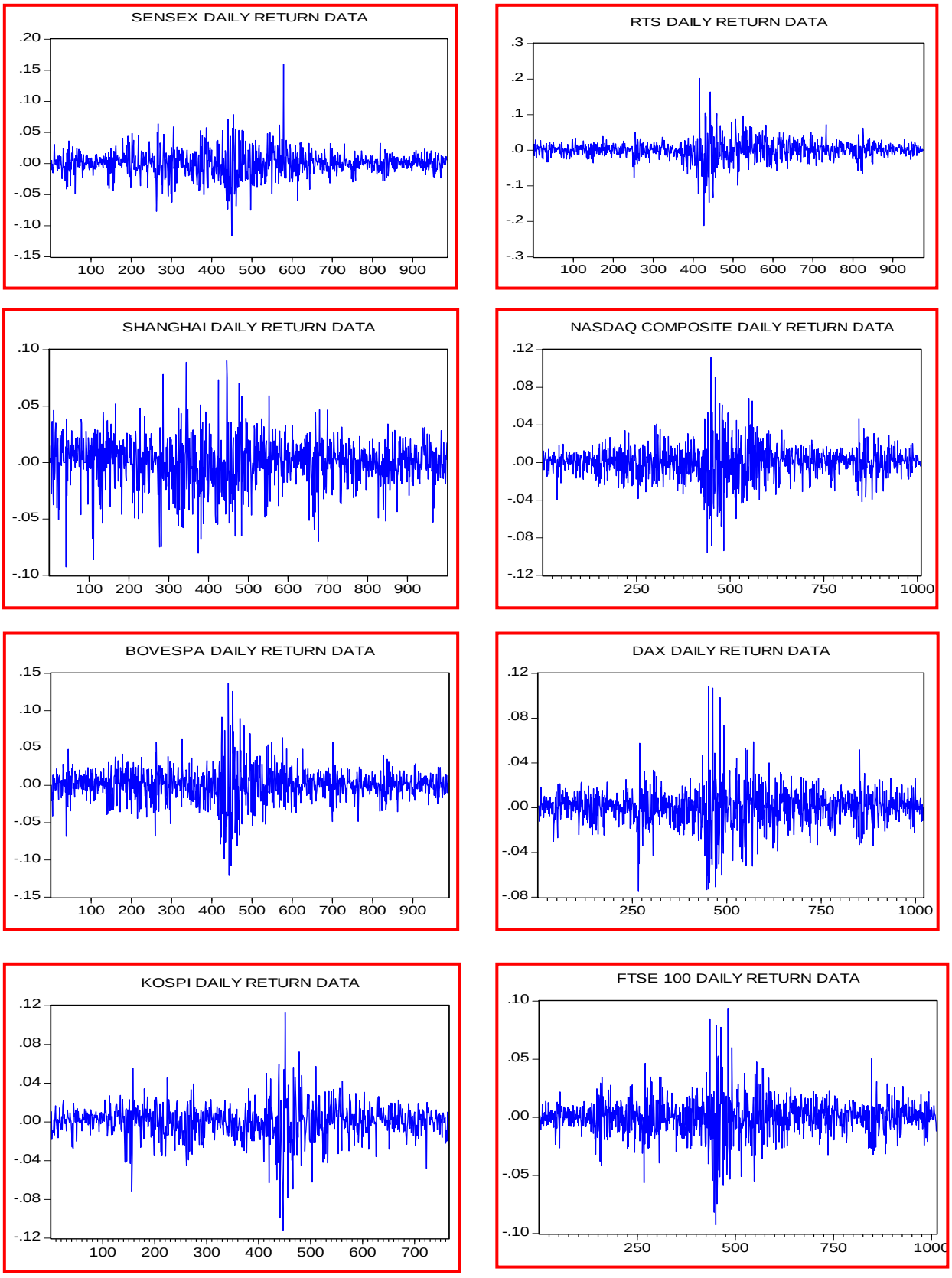

Figure 2: Time Series Plot of Daily Stock Return Data

Table 1: Results of Augmented Dickey-Fuller Unit Root Test

Countries	ADF(Level Form) Test statistic with No Trend & Intercept	ADF(Level Form) Test statistic with Trend & intercept
India	-10.69(7)	-10.70(7)
China	-13.44(4)	-13.45(4)
Brazil	-20.35(2)	-20.34(2)
South Korea	-27.25(0)	-27.23(0)
Russia	-10.86(8)	-10.89(8)
USA	-18.64(2)	-18.66(2)
Germany	-14.72(4)	-14.73(4)
UK	-14.45(5)	-14.49(5)

Source: Author's calculation

i. ADF (Level Form) critical values with an intercept and no trend are -3.43, -2.86, and -2.56 at 1%, 5%, and 10% levels of significance.
ii. ADF (Level Form) critical values with an intercept and trend are -3.96, -3.41 and -3.12 at 1%, 5%, and 10% levels of significance.
iii. The numbers within parenthesis represents the lag length of the dependent variable used to obtain white noise residuals.

TABLE 2: GARCH (1, 1) Estimates of Daily Stock Return Data

Variables	India			China			Brazil			South Korea			Russia			USA			Germany			UK		
	Coef.	Z-stat	Prob.	Coef.	Z-stat	Prob.	Coef.	Z-stat	Prob.	Coef.	Z-stat	Prob.	Coef.	Z-stat	Prob.	Coef.	Z-stat	Prob.	Coef.	Z-stat	Prob.	Coef.	Z-stat	Prob.
ω	0.000003	3.43	0.00	0.000008	3.51	0.00	0.000008	3.40	0.00	0.00004	2.53	0.01	0.00006	3.42	0.00	0.00003	3.46	0.00	0.00004	4.43	0.00	0.00003	3.28	0.00
α	0.12	8.46	0.00	0.06	6.41	0.00	0.093	6.02	0.00	0.08	6.14	0.00	0.10	8.25	0.00	0.08	5.91	0.00	0.10	6.82	0.00	0.11	6.69	0.00
β	0.87	66.28	0.00	0.92	81.09	0.00	0.88	50.42	0.00	0.91	57.4	0.00	0.88	63.2	0.00	0.90	54.14	0.00	0.88	54.7	0.00	0.87	52.5	0.00

Source: Author's Calculation