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Naliniprava Tripathy and Ashish Garg

FORECASTING STOCK MARKET VOLATILITY: EVIDENCE FROM SIX EMERGING MARKETS

ABSTRACT

This paper forecasts the stock market volatility of six emerging countries by using daily observations of indices over the period of January 1999 to May 2010 by using ARCH, GARCH, GARCH-M, EGARCH and TGARCH models. The study reveals the positive relationship between stock return and risk only in Brazilian stock market. The analysis exhibits that the volatility shocks are quite persistent in all country's stock market. Further the asymmetric GARCH models find a significant evidence of asymmetry in stock returns in all six country's stock markets. This study confirms the presence of leverage effect in the returns series and indicates that bad news generate more impact on the volatility of the stock price in the market. The study concludes that volatility increases disproportionately with negative shocks in stock returns. Hence investors are advised to use investment strategies by analyzing recent and historical news and forecast the future market movement while selecting portfolio for efficient management of financial risks to reap benefits in the stock markets.

Key Words: GARCH, EGARCH, TGARCH, GARCH-M, stock market volatility

Naliniprava Tripathy
Indian Institute of Management Shillong
Ashish Garg
Lal Bahadur Shastri Institute of Management, Delhi

Correspondence: Naliniprava Tripathy
Associate Professor (Finance), Indian Institute of Management
Shillong, Meghalaya, India, PIN 793 014
Email: nalini_prava@yahoo.co.in/ nt@iimshillong.in

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INTRODUCTION

With the advancement of liberalization in the financial market, attention has been given in international transmission of stock market volatility in recent times. Various studies reports that stock market volatility is time varying and exhibits positive serial correlation (volatility clustering). This implies that changes in volatility are non-random. Therefore, practitioners and financial econometricians have developed a variety of time-varying volatility models that takes into account the fat tail, volatility clustering and leverage effects.

Poon and Granger (2003) provides a comprehensive review on volatility forecasting. They find that Arch and Garch classes of time series models are very useful in measuring and forecasting volatility. However, the volatility characteristics of the financial markets in the emerging markets are far from being thoroughly analysed despite their tremendous growth in recent years. The low interest rate and low stock return of USA and European countries encouraged the international investors to seek higher returns in emerging markets.

Further market opening allows international investors to avail greater opportunity for diversification. Emerging markets have received huge inflows of capital in the recent past and became a viable alternative for investors seeking international diversification. Presently emerging markets are attracting a lot of attention due to the unexplored opportunities unlike the developed markets.

Brazil, Russia, China and India (BRIC) are the best emerging markets over the world today and it is argued that their economic potential become the most dominant economies by the year 2050 (Goldman Sachs, 2003: 18-19). At this transitional stage, it is necessary to assess the level of efficiency of emerging stock market in order to establish its longer term role in world economy. Moreover, the increasingly complicated and competitive stock markets call for a deep understanding of return and volatility dynamics.

Since financial literature on the emerging markets as a whole is limited, this paper attempts to provide an insight into volatility, returns and asymmetry effect relationship of emerging stock markets by further examination of the return-volatility relationship. We raise three research questions. First, the present study reinvestigates the effects of volatility of the emerging stock market by using Arch/Garch model to see to what extent the changes could be attributed to the stock price changes to predict its future performance. Secondly, we use Garch-M model to determine whether investors in these markets are compensated for undertaking a higher level of risk or not.

Thirdly, we have used Egarch and Tgarch model to determine the asymmetric effect on emerging stock market volatility. The rest of the paper is organized as follows: Section 2 reports the literature review, and Section 3 describes data and methodology used. Section 4 discusses the empirical findings and interprets the results, and Section 5 deals with conclusion.

ECONOMIC AND COMPETITIVE MECHANISM OF CHINA, INDIA, BRAZIL, MEXICO, RUSSIA, AND SOUTH AFRICA

Out of all six emerging market, China is the second largest position in the world both in nominal Gross Domestic Product (GDP) and purchasing power. Annual average growth of the Chinese economy is excess of 10 percent over the last 30 years. International trade of China is also growing day by day. China has moved from a closed, centrally planned system to more market-oriented systems. Reforms brings a radical change in collectivized agriculture, gradual liberalization of prices, fiscal decentralization, increased autonomy for state enterprises, creation of a diversified banking system, development of stock markets, rapid growth of the private sector, and opening to foreign trade and investment.

Economic reforms have also brought rapid growth and China became one of the largest economies in the world. There are three sectors foremost in china. State sectors are under control of Government. Listed sectors are publicly traded through stock exchange. The size, growth, and importance of state sectors and listed sectors are slow due to poor legal protection and standard financing channels. Private sectors are mix of private and local Government ownership. The supportive attitude of local Government and effective corporate governance mechanisms augment the growth of private sectors in economy.

Though China is second to US in the value of services it produces, still per capita income is below the world average. The Chinese government faces numerous economic challenges and in 2010-2011, China faced high inflation resulting largely from its credit-fueled stimulus program.Though China's stock markets are still smaller in terms of market capitalization, but it is growing very rapidly since 1990. Medium- and small-cap stocks are traded frequently in China than large-cap stocks. China is one the most influential stock market because of natural and human resources as well as cheap product demanded by the whole world.

India is occupying eleventh position in the world in terms of nominal GDP and fourth position in purchasing power. India is ranking 51st in global competitiveness,

occupies 17th position in financial market sophistication, 24th in banking sector, 44th in business sophistication, and 39th in innovation, ahead of several advanced economies as of 2010. India is developing into an open-market economy and increasing integration into the global economy. The India's medium-term growth is positive due to healthy savings and investment rates.

However, India has many long-term challenges not yet fully addressed. India's economic growth began slowing due to persistent inflation, high international crude prices, decline investment and global situation.In securities markets regulation, India scores 0.92 in the index of disclosure requirements third highest after the United States and Singapore. (La Porta, Lopez-de-Silance, and Shleifer, 2006) .India's strongest institutional factors are owners of installations use all means of control. Indian financial markets clearly defined the rules governing listing, trading and settlements.

Number of equity trades on Bombay Stock Exchange (BSE)/National Stock Exchange (NSE) is ten times greater than that of Euronext or London, and of the same order of magnitude as that of NASDAQ/NYSE. The number of trades is an important indicator of the extent of investor interest and investor participation in equities and equity trading, and emphasizes the crucial importance of corporate governance practices in India.

Brazil is one of the Latin American nations. Brazil is eighth largest economy by nominal GDP, ninth largest nation by purchasing power. Brazil has brought important reforms in 1990 including a reduction of state intervention in the economy, the liberalization of the flow of trade and capital and the privatization of state-owned companies (Gallagher and Chudnovsky, 2009). Brazilian government extend a special tax benefits for investments in underdeveloped regions of the country (USFCSUSDS, 2011).

The economy of Brazil experiences an average annual growth of 5 percent. It is one of the strongest trading nations in the world. The strongest institutional factors of Brazil are efficient local capital markets. Brazil is currently the largest recipient of FDI in Latin America (USFCSUSDS, 2011: 58).It is an attractive destination for foreign investment due to its growing domestic consumption and historically high interest rates (Newman, Rickert, and Schaap, 2011). Though Brazil experienced two quarters of recession but it is one of the first emerging markets to begin a recovery. The basic legal structure of Brazil is based on civil law with businesses having to comply with various civil codes.

Brazil is also facing lot of economic challenges due to shortcomings in productivity and cost competitiveness, pressing infrastructure bottlenecks, high tax burden, burdensome fragmented tax system and global crisis. Brazilian stock market has been a

pioneer in the introduction of trade innovations that allows the user to operate, consult, update statistics, work with electronic graphs directly connected to market information and receive news of the same.

Mexico occupies the 13th largest positions in the world in nominal terms and 11th by purchasing power parity. Mexico is currently ranked as the twelfth largest economy in the world by GDP (CIA, 2011b). Mexico is one of Latin American nations most affected in 2008 recession. However, after the implementation of NAFTA (North American Free Trade Agreement) Mexico monitors the policy of trade liberalization and ensures free trade agreements with over 50 countries (CIA, 2011a). More importantly, the opening of the Mexican economy to Foreign Direct Investment (FDI) is directly tied to Mexico's trade liberalization policies. About 95 percent of foreign investment transactions do not require government approval (USCS, 2011).

Mexico is now the second largest FDI recipient among developing countries and is also the seventh largest exporter in the world. Mexico has an active and wide ranging informal economy that led to destabilizes lawful business interaction since informal businesses are not complying with business regulation laws, such as taxes and labour laws. The greatest challenge of Mexico is uncompetitive domestic economy. Many markets are dominated by local oligopolies that blocking new entrants. Mexico has joined the ranks with countries such as China, India, Brazil, and Turkey as a Newly Industrialized Country (NIC). Recently, Mexico is now has a full contributor to the United Nations Development Program. In terms of domestic market capitalisations, Mexico is the second largest stock exchange in Latin America after Brazil by end of June 2011.

Russia is the twelfth largest economy in the world in terms of nominal value and sixth largest in purchasing power. Russia has undergone significant changes since the collapse of the Soviet Union, moving from a globally-isolated, centrally-planned economy to a more market-based and globally-integrated economy. Russia's restrictive and burdensome regulatory environment hampers the private-sector growth, dented investment climate and disappoints economic development. Russia is having long-term challenges of shrinking workforce and underinvestment in infrastructure. Russian economy is affected toughest by 2008-2009 global economic crises. Russian banks and firms relied on foreign credits was totally desiccated due to dropped in oil prices.

However, economy begins to grow in 2011 onwards at a modest level. Russia is the largest exporter of natural gas, as well as one of the largest oil and steel producers in the

world. In Russia, small and medium size firms have become a pillar in promoting industry diversification and innovation. Russia encourages foreign investment by removing administrative barriers and establishing special economic zones, high-technology parks, and investment promotion funds. However, rule of law, corporate governance, transparency still remain key concerns for foreign investors. Recent free market initiatives and country's huge/massive crude oil reserves have made popular destination for many investors.

South Africa is ranked as "upper middle-income country" by the World Bank. South Africa has prudent fiscal and monetary policies. The country is politically stable. It has a well-capitalized banking system. It has abundant natural resources, second-lowest effective business tax, well developed regulatory systems as well as research and development capabilities, and established manufacturing base. The GDP per Capita in South Africa is adjusted by purchasing power Parity equivalent to 50 percent of the world's average. In order to drive growth and improve international competitiveness, the Governments of South Africa liberalize trade competitiveness by lowering tariffs, abolishing most import controls, undertaking some privatization, and reforming the regulatory environment.

Virtually all business sectors are open to foreign investors. There are almost no restrictions on the form or extent of foreign investment. Nevertheless South Africa is facing economic challenges of high inflation, significant budget deficits and lack of economic empowerment among the disadvantaged groups. South Africa has well-developed financial markets and sound financial institutions. The country ranked 3rd out of 144 countries in financial market development and first in both legal rights in the financial sector and in securities exchanges regulation (WEF, 2012: 324-325). The JSE Securities Exchange SA (JSE) is the fourteenth largest exchange measured by market capitalization in the world. The country is ranked fourth for ease of accessing capital, fourth for cost of capital and sixth for its transport infrastructure better than China, India, Mexico, and Brazil.

Certain measures of trade connectedness suggest that China, India, and Russia are at same level of importance. Brazil and South Africa are close behind. However, the main emerging market powerhouses are China and India. Together their economic output ($15.9 trillion) is greater than U.S. ($15.3 trillion) (CIA World Fact Book, 2011).

In 2008, all these emerging markets are exposed to tenuous economy due to crash of US stock market. Although each economy differs in specific situation, certain challenges are shared across among them. An investment in these economies is looking quite

lucrative. Opening of emerging financial markets over the last few years have led some practitioners and policymakers to question whether opening is in fact substantially raise/reduce the volatility of asset prices. It is commonly believe that market openings decrease the variability of asset prices. Keeping in view, the present study has been undertaken to examine the relationship between time varying return and volatility of these six country's stock market to provide new insights to the investors as well as to regulators.

LITERATURE REVIEW

Extensive work both theoretically and empirically has been done in developed and developing markets of Europe, Asia and United states in modeling of financial time series. Shin (2005) uses Garch-M estimations and finds a positive insignificant relationship between expected stock returns and volatility in emerging stock markets. Hui and Christopher (2006) analyzes the risk-return relation of daily MSCI stock market by using component Garch model concludes that the relation is positive and often statistically significant in almost all markets.

Bhar and Nikolova (2007) analyses the degree of integration of the BRIC countries on a regional and global basis and finds that high degree of integration exists between the BRIC countries and their respective regions and lesser with rest of the world. The study also finds that China is the only country where there exists a negative relationship between volatility spill over effects on a regional and global basis. The study concludes that the increased levels of integration of these economies regionally and across the rest of the world highlights the need for employment of portfolio stock selection strategies and investment in specific growth areas within these economies, rather than taking a position in the country index.

Ozun (2007) analyzes the impacts of volatility in the Brazilian and Turkish equity markets by using Egarch model and concludes that the impact level varies among the emerging markets. Floros (2008) examines the volatility and explain the financial market risk by using daily data of Egypt (CMA General Index) and Israel (TASE-100 index) concludes that increased risk does necessarily lead to raise the returns. Sabur and Mobarek (2009) investigates the time-varying risk return relationship and the persistence of shocks to volatility by using Garch framework both in developed and emerging markets and concludes that there is a long-term persistence shock in emerging markets compared to developed markets.

Goudarzi and Ramanarayanan (2010) studies the volatility of Indian stock market over a period of ten years by using Arch and Garch models and concludes that Garch (1,1) model explained the volatility of the Indian stock markets. Al Janabi Mazin, Abdulnasser, and Manuchehr (2010) investigates the underlying nexus of stock market returns and volatility in the Gulf Cooperation Council (GCC) countries, Middle East and North Africa (MENA) region by using the Garch-M model and exhibits that volatility is time-varying in all countries and indicates substantial variation in the degree of risk across time. Mishra and Rahman (2010) studies the dynamics of stock market return volatility of India and Japan by using Tgarch model and finds that these markets are impacted asymmetrically by bad news and good news. The return volatility is persisted in both the countries.

RESEARCH METHODOLOGY

The required time series daily closing prices of all indices have been collected from January 1999 to May 2010 from www.moneycontrol.com. We have chosen six emerging countries, i.e., Brazil, Russia, Mexico India, China and South Africa. For our study, most prominent stock indices of Brazil (IBOVESPA), Russia (RTSI), Shanghai Stock Exchange (SSE) for China, India (BSE Sensex), South Africa (FTSE/JSE All Share Index) and Mexican Stock Exchange(IPC) have been taken. Data consists of daily stock prices of selected indices. The return is calculated as the continuously compounded return using the closing price index:

$$R_t = \ln(P_t / P_{t-1}) * 100 \text{ ---------- (1)}$$

Where R_t is the return in the period t, P_t is the daily closing share price index at a particular time t; P_{t-1} is the closing share price index for the preceding period and In is natural logarithm. Time series data are often assumed to be non-stationary. It is thus necessary to perform a pre-test to ensure that a stationary relationship is existed among the variables. This would avoid problems of spurious regressions. To test the presence of unit roots, the standard Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests are employed in the study.

Augmented Dickey Fuller Test

It is a test for unit root in a time series sample developed by Dickey and Fuller (1981). The Augmented Dickey-Fuller (ADF) statistics, used in the test, is a negative number. The

more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of 5 percent confidence. ADF test follows the below stated model:

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \beta_t \Delta Y_{t-1} + \ldots + \delta_p \Delta Y_{t-p} + \varepsilon_t \text{ ---------- (2)}$$

Where α is a constant, β the coefficient on a time trend and *p* the lag order of the autoregressive process. Imposing the constraints α = 0 and β = 0 corresponds to modeling a random walk and using the constraint β = 0 corresponds to modeling a random walk with a drift. By including lags of the order *p* the ADF formulation allows for higher-order autoregressive processes. This means that the lag length *p* has to be determined when applying the test. For the purpose of our analysis, the study has considered a lag of 1 variable.

Phillips-Perron (PP) Test

Phillips and Perron (1988) suggest an alternative (nonparametric) method of controlling of serial correlation when testing for a unit root. The PP method estimates the non-augmented DF test equation and modifies the t-ratio of the coefficient so that serial correlation does not affect the asymptotic distribution of test statistic. The advantage of Phillips and Perron test is that it is free from parametric errors. PP test allows the disturbances to be weakly dependent and heterogeneously distributed. The PP test is based on the following statistic:

$$\pi_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0}\right)^{1/2} - \frac{T(f_0 - \gamma_0)\varepsilon_t(\hat{\alpha})}{2 f_0^{1/2} \varepsilon} \text{ ---------- (3)}$$

Where $\hat{\alpha}$ is the estimate, and t_α is the ratio of α and $\varepsilon_t(\hat{\alpha})$ is coefficient standard error, and ε is the standard error of the test regression. In addition γ_0, is a consistent estimate of the error variance. The remaining term f_0, is an estimator of the residual spectrum at frequency zero. The asymptotic distribution of the PP modified t-ratio is the same as that of the ADF statistic.

Since the basic objective of the study is to examine the relationship between the time varying volatility and return, it is studied in two different dimensions. The effect of change in expected variance on expected returns and second, the effect of unexpected shocks in

return on conditional variance. For the first dimension, the study used Garch-M model with and without making adjustment for asymmetric responses of conditional volatility. For second, Egarch and Tgarch have been used.

Garch Model

In order to determine the nature of conditional volatility Garch model developed by Bollerslev (1986) has been used. The model can be specified as follows:

$$R_t = c + \rho R_{t-1} + \varepsilon_t \text{ ---------- (4a)}$$
$$\varepsilon_t/\varepsilon_{t-1} \sim N(0, h_t) \text{ ---------- (4b)}$$
$$h_t = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j} \text{ -- (4c)}$$

Where,R_t in return equation is the stock market return in time period t and $\boldsymbol{\varepsilon_t}$ pure white noise error term. In variance equation h_t is the conditional variance and ω, α_1, α_2 …..α_q ,β_1...β_p are parameters to be estimated. q is the number of squared error term lags in the model and p is the number of past volatility lags included in the model. The study has used the Garch (1,1) Model that assume ω > 0, α and β≥ 0. The stationary condition for Garch (1,1) is α +β< 1. If this condition is fulfilled, it means the conditional variance is finite. A straightforward interpretation of the estimated coefficient in above equation is that the constant ω is long – term average volatility where α_i and β_j represent how the volatility is affected by current news and past information regarding volatility, respectively.

Garch-M Model

To determine the impact of conditional volatility on the return, Garch-M model has been used. The model has been developed by Engle, Lilien, and Robins (1987). The Garch-M specifies conditional mean return as a linear function of conditional variance. This study used the following Garch-M (1, 1) model which can be specified as follows:

$$R_t = c + \rho R_{t-1} + \gamma h_t + \varepsilon_t \text{ ---------- (5a)}$$
$$\varepsilon_t/\varepsilon_{t-1} \sim N(0, h_t) \text{ ---------- (5b)}$$
$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1} \text{ ---------- (5c)}$$

R_t is the stock market return, h_t is the conditional variance and ε_t stand error for a

Gaussian innovation with zero mean. Where, in return equation c, ϱ and γ are the parameters to be estimated. Among all the parameters γ is the most significant one as it describes the nature of relationship between stock market return and volatility. More precisely a positive and significant γ implies that increased risk given by an increase in conditional variance represented by h_t leads a hike in the mean return or vice versa.

Egarch Model

To ascertain the effect of unexpected shock on the mean return Exponential Garch or Egarch model has been used by the study as it is most popular among the asymmetric Garch models. The model is based on the log transformation of conditional variance, the conditional variance always remains positive. The model has been developed by Nelson (1991). The study used the following model specifications:

$$R_t = c + \rho R_{t-1} + \varepsilon_t \text{ ---------- (6a)}$$

$$\varepsilon_t/\varepsilon_{t-1} \sim N(0, h_t) \text{ ---------- (6b)}$$

$$h_t = \alpha_0 + \alpha_1(|Z_{t-1}| - E|Z_{t-1}| + \delta Z_{t-1}) + \beta_1 ln(h_{t-1}) \text{ ----- (6c)}$$

Here, $Z_{t-1}$is the standard residual. The term$(|Z_{t-1}| - E|Z_{t-1}|)$ measures the size effect of innovations in returns on volatility, while δZ_{t-1}measures the sign effect. A negative value of δ is consistent with leverage effect, which explains that when the total value of a leveraged firm falls due to fall in price, the value of its equity becomes a smaller share of the total value. The total effect of a positive shock in return is equal to one standardized unit is (1+ δ), that of a negative shock of one standardizes unit is (1- δ). β_1 is the coefficient of autoregressive term in variance equation. The value of β_1 must be less than 1 for stationarity of the variance.

Tgarch Model

To confirm the results produced by the Egarch model, Threshold Garch or Tgarch model has also been used in the study. This model is also named as GJR (Glosten, Jagannathan and Runkle ,1993). The specification of the Tgarch model used in the study is as follows:

$$R_t = c + \rho R_{t-1} + \varepsilon_t \text{ ---------- (7a)}$$

$$\varepsilon_t/\varepsilon_{t-1} \sim N(0, h_t) \text{ ---------- (7b)}$$

$$h_t = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \delta\varepsilon_{t-1}^2 D_{t-1} + \beta_1 h_{t-1} \text{ ---------- (7c)}$$

Where, the dummy variable D_{t-1} represents the bad news, a positive value of δ signify an asymmetric volatility response. When the innovation in return $\varepsilon_{t-1}$is positive, the total effect in the variance is $\delta\varepsilon_{t-1}^2$; while the return shock is negative the total effect in the variance is $(\alpha + \delta)\varepsilon_{t-1}^2$.

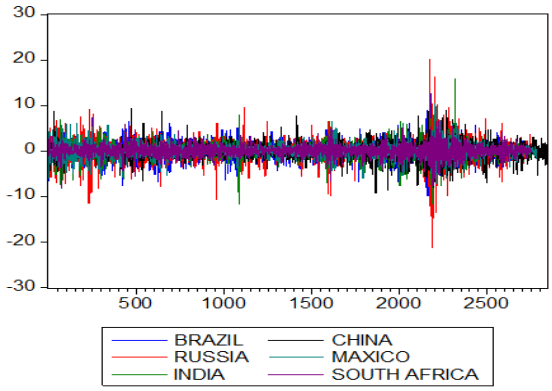
EMPIRICAL ANALYSIS

Descriptive statistics of the daily stock market mean returns, standard deviations, skew ness, kurtosis, Arch-LM and Jarque-Bera test are reported in Table 1. The daily mean return of all six countries' are exhibited in Figure 1. The highest mean daily returns are given by Russian stock market with highest standard deviation at 0.08 percent and 2.38 percent. The lowest return is given by china is at 0.02 percent.

Table 1: Descriptive statistics of the daily stock market return of Brazil, Russia, India, China, South Africa and Mexico

Statistics	Brazil	Russia	India	China	Mexico	South Africa
Mean	0.0500	0.0852	0.0447	0.0241	0.0595	0.0488
Median	0.1177	0.2208	0.1246	0.0000	0.1195	0.0838
Std. Dev.	1.9690	2.3837	1.7301	1.6570	1.4936	1.3465
Skewness	-0.0839	-0.4528	-0.1996	-0.1127	0.0483	-0.1754
Kurtosis	6.5779	11.1959	9.0447	7.2835	7.1605	6.2758
ARCH-LM test	202.6312	134.8356	81.9341	31.9223	76.0624	125.2140
Probability	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Jarque-Bera	1463.6789	7804.9482	4195.7436	2178.7365	2004.7230	1243.626
Probability	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	0.000000
Maximum	13.6766	20.2039	15.9900	9.4008	10.4407	6.8339
Minimum	-12.0961	-21.1994	-11.8092	-9.2562	-8.2673	-7.9483

Figure 1: Daily mean return of Brazil, Russia, India, China, Mexico and South Africa from January 1999-May 2010



In terms of risk is concerned, South Africa accomplished lowest position with standard deviation of 1.35 percent and Indian stock market attained third position with a standard deviation of 1.73 percent followed by the China and Mexico. The Jarque-Bera test is used to test whether stock indices of all six countries individually follow the normal probability distribution.

The return series are examined for heteroscedasticity. The Jarque-Bera test indicates that the null hypothesis of normality is rejected and shows that all the series exhibit non-normality. Hence the study shows volatility clustering tendency. To determine the conditional volatility and volatility clustering, Arch-LM test is applied. Arch-LM test provides evidence for rejecting the null hypothesis indicating the presence of Arch effects in the residuals series of the mean equation. It is found from the table that variance of return series shows presence of volatility tendency.

The present study employs the Augmented Dickey Fuller test and PP test to examine whether the time series properties are stationary or not. The results are presented in Table 2. Table 2 presents that all series are stationary at 1 percent, 5 percent and 10 percent level of significance. The series have a unit root. Null hypothesizes of both of the tests are rejected as the test statistics in all case are higher than the critical values.

Table 2: ADF and PP test for unit root

Country	ADF test	PP test
Brazil	-51.47875*	-51.55571*
Russia	-48.05911*	-47.98871*
India	-48.69653*	-48.65771*
China	-52.90673*	-52.91849*
Mexico	-37.80372*	-47.56314*
South Africa	-47.78057*	-47.70116*
Asymptotic critical values*		
1% level	-3.432547	-3.432547
5% level	-2.862397	-2.862397
10% level	-2.567271	-2.567271

Note: Null hypothesis is rejected at a level of 1 per cent significance

In order to verify the relationship between return and volatility in various emerging market Garch family models have been applied. The results of the Garch (1,1) model exhibits in Table 3. Table 3 presents that value of α_1 and β_1 is highly significant and sum of the both is less than 1. So it is interpreted that model is valid. α_1 value shows that the recent news has a positive impact on the current market volatility. Historical volatility impact is represented by β_1 which is also positive and higher than recent news impact.

This implies that the recent news and past news have an impact on the volatility of spot market in Brazilian stock market. Russian stock markets also have positive and highly significant Garch (1,1) coefficients. Result of Garch (1,1) model of Indian stock market shows that lagged squared residual (α_1) and lagged conditional variance (β_1) are highly statistical significant. Similarly results of standard Garch model shows that value of α_1 and β_1 is highly significant in Chinese's stock market, Mexican stock market and South African stock market. It is evident from the analysis that the recent news α_1 have an impact on the volatility of spot market.

Similarly, $\beta 1$ coefficient is past news which is also significant impact in all emerging stock market suggests that old news too is influencing the stock market volatility. The $\alpha_1 + \beta_1$ measures the degree of persistence of volatility shocks. It is also found from the analysis that the sum of Arch and Garch coefficients ($\alpha + \beta$) is very close to one, indicating that volatility shocks are quite persistent and long memory in the conditional variance in all country's stock market.

In Garch (1,1) model ($\alpha + \beta$) of Brazil, Russia India, China, Mexico and South Africa are 0.9789, 0.9774, 0.9815, 0.9912, 0.9885, and 0.9866 are estimation of rate at which the response functions declines on daily basis. Since the rate is very high, the response function to shock is likely to die slowly. It indicates that new shock will have implications

on returns for a longer period. In such market, old information is more important than recent information and the information decays slowly.

Table 4 shows that γ is positive and statistical significant which indicates the positive relationship between stock return and risk in Brazilian stock market. Brazilian stock market confirms the International Capital Asset Pricing Model (ICAPM). It shows the linear relationship of expected return and risk. In other words, volatility is significant and positively associated with return in Brazil.

This indicates the positive relationship between stock return and risk.γ is positive but statistical insignificant in Russia, China, Mexico and South Africa. However, insignificant relationship between stock return and risk indicating that these markets are not rewarding return to their investors those who are taking risk in the market. In India, γ is negative and indicates negative relation between risk and return. However, in view of the insignificance relationship, the result is inconclusive as there might be need for further research to find other risk measures.

Conventional Garch models are unable to capture the asymmetric effect of negative or positive returns on volatility. Hence, to investigate the leverage effect, the study has used Egarch and Tgarch Model. Egarch and Tgarch model helps to explain the volatility of spot market when some degree of asymmetric is present in the price series. If the bad news has a greater impact on volatility than good news, a leverage effect exists. Table 5 presents the results of Egarch models. The coefficient asymmetry (γ) is -0.0882, -0.0661, -0.1061, -0.0243, -0.1130. The coefficient is negative and highly significant which indicates a strong presence of asymmetry effect in volatility, i.e., volatility increases disproportionately with negative shocks in stock returns.

This negative shock may be attributing to domestic currencies depreciated, international stock price return fell and unfavorable economic factors. The coefficient asymmetry (γ) of South Africa is 0.979959. The asymmetric effect is positive and highly significant suggesting no leverage effect found in South Africa. So it is evident that South Africa's stock market return is not affected with negative shocks/positive shocks.

Table 3: GARCH model

	Brazil			Russia			India			China			Mexico			South Africa		
	Coeffi-cient	**Z - Value**	**p - value**	**Coeffi-cient**	**Z - Value**	**p - value**	**Coeffi-cient**	**Z - Value**	**p - value**	**Coeffi-cient**	**Z - Value**	**p – value**	**Coeffi-cient**	**Z - Value**	**p – value**	**Coeffi-cient**	**Z - Value**	**p – value**
Return equation																		
Intercept (c)	0.0979	2.8986	0.0037*	0.1945	5.5053	0.0000*	0.1249	4.9344	0.0000*	0.0308	1.3386	0.1807	0.114	4.5883	0.0000*	0.003729	0.248309	0.8039
AR(1) (ϱ)	0.0128	0.6108	0.5413	0.083	4.0608	0.0000*	0.0868	4.2388	0.0000*	0.0144	0.785	0.4325	0.0796	3.8776	0.0001*	-0.485406	-26.57391	0.0000*
Variance equation																		
Intercept (αo)	0.0744	4.5184	0.0000*	0.1201	8.0575	0.0000*	0.0657	7.706	0.0000*	0.0276	7.3209	0.0000*	0.0254	5.4404	0.0000*	5.4404	3.763218	0.0002*
α1	0.0692	8.4355	0.0000*	0.124	12.2318	0.0000*	0.1421	14.7104	0.0000*	0.0659	18.3593	0.0000*	0.0778	10.3066	0.0000*	10.3066	10.72317	0.0000*
β1	0.9097	84.3572	0.0000*	0.8534	74.5558	0.0000*	0.8394	90.366	0.0000*	0.9253	288.2145	0.0000*	0.9107	120.574	0.0000*	120.574	66.61068	0.0000*
α1+ β1	0.9789			0.9774			0.9815			0.9912			0.9885			0.9866		
Diagnostic statistics																		
log likelihood		-5477			-5752			-4929			-5156			-4659			-4820.191	
Durbin waston statistic		1.9842			1.9883			2.0149			2.1027			1.9411			2.24966	
Schwarz criterion		4.0166			4.1914			3.608			3.6434			3.3696			3.562723	
Akaike Information criterion		4.0058			4.1807			3.5973			3.6329			3.3589			3.551852	

Note: H_0: The independent variable is not explaining the dependent variable.

*Null hypothesis is rejected at a significance level of 5 percent.

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Table 4: GARCH-M model

Parameters	Brazil			Russia			India			China			Mexico			South Africa		
	Coeffi-cient	Z - Value	p - value	Coeffi-cient	Z - Value	p - value	Coeffi-cient	Z - Value	p - value	Coeffi-cient	Z - Value	p – value	Coeffi-cient	Z - Value	p – value	Coeffi-cient	Z - Value	p – value
Return equation																		
Intercept (c)	-0.0003	-0.0439	0.9651	0.0019	3.6683	0.0002*	0.0014	3.9674	0.0001*	-0.0007	-0.1862	0.8523	0.0008	1.9262	0.0541	0.017962	0.254054	0.7995
AR(1) ϱ)	0.0123	0.5767	0.5641	0.0978	4.8094	0.0000*	0.0791	3.8967	0.0001*	0.0134	0.7029	0.4821	0.0909	4.4588	0.0000*	0.061251	3.040901	0.0024
Volatility (γ)	3.9371	2.6466	0.0081*	0.1763	0.1643	0.8695	-0.0581	-0.0353	0.9719	2.1834	1.2829	10.1995	2.8992	1.4985	0.1340	0.069157	1.046088	0.2955
Variance equation																		
Intercept (αo)	0.0001	5.9587	0.0000*	0.0001	7.9942	0.0000*	0.0001	7.5875	0.0000*	0.0000	6.7599	0.0000*	0.0000	5.6164	0.0000*	0.031155	4.016405	0.0001
α1	0.0953	12.1912	0.0000*	0.1253	12.5073	0.0000*	0.1323	14.3370	0.0000*	0.0672	17.4172	0.0000*	0.0770	10.4422	0.0000*	0.105169	10.26263	0
β1	0.8672	74.4304	0.0000*	0.8596	80.8548	0.0000*	0.8501	93.0647	0.0000*	0.9252	264.5065	0.0000*	0.9115	123.1356	0.0000*	0.878008	72.39031	0
Diagnostic statistics																		
log likelihood		-5476.453			-5752.933			-4929.181			-5160.18			-4660.03			-4765.502	
Durbin waston statistic		1.9792			1.9909			2.0137			2.0085			1.9395			2.0129	
Schwarz criterion		4.0191			4.0191			3.6113			3.6494			3.6494			3.1729	
Akaike informati on criterion		4.0062			4.1822			3.5984			3.6368			3.6368			3.1609	

Note: H_0: The independent variable is not explaining the dependent variable.

*Null hypothesis is rejected at a significance level of 5 percent.

Table 5: EGARCH model

Parammeters	Brazil			Russia			India			China			Mexico			South Africa		
	Coeffi-cient	Z - Value	p - value	Coeffi-cient	Z - Value	p - value	Coeffi-cient	Z - Value	p - value	Coeffi-cient	Z - Value	p – value	Coeffi-cient	Z - Value	p – value	Coeffi-cient	Z - Value	p – value
Return equation																		
Intercept (c)	0.0447	1.3585	0.1743	0.1517	4.3907	0.0000*	0.0680	2.7146	0.0066*	0.0383	1.6579	0.0973	0.0628	2.6748	0.0075*	-0.0449	-2.5946	0.0095
AR(1) (ϱ)	0.0240	1.1441	0.2526	0.0825	4.2460	0.0000*	0.1034	5.0743	0.0000*	0.0103	0.5947	0.5520	0.0893	4.5477	0.0000*	-0.4829	-27.9467	0.0000
Variance equation																		
Intercept (αo)	-0.0627	-5.6843	0.0000*	-0.1179	-11.1191	0.0000*	-0.1708	-14.8098	0.0000*	-0.0801	-18.7125	0.0000*	-0.0918	-8.0349	0.0000*	-0.1575	-10.7178	0.0000
α1	0.1210	7.8135	0.0000*	0.2244	13.3318	0.0000*	0.2622	16.4856	0.0000*	0.1243	22.8460	0.0000*	0.1325	8.6675	0.0000*	0.2222	11.8545	0.0000
β1	0.9719	222.9502	0.0000*	0.9604	238.9015	0.0000*	0.9572	229.1390	0.0000*	0.9877	631.7059	0.0000*	0.9777	368.4767	0.0000*	-0.1123	-5.9828	0.0000
Asymmetry (γ)	-0.0882	-8.5835	0.0000*	-0.0661	-6.7712	0.0000*	-0.1061	-9.8788	0.0000*	-0.0243	-5.4649	0.0000*	-0.1130	-11.5370	0.0000*	0.9799	193.2906	0.0000
Diagnostic statistics																		
log likelihood		-5448.96			-5755.64			-4909.069			-5148.162			-4603.341			-4812.904	
Durbin waston statistic		2.0067			1.9896			2.0499			2.0045			1.9614			2.249424	
Schwarz criterion		3.9991			4.1971			3.5967			3.6409			3.3325			3.547225	
Akaike informati on criterion		3.9861			4.1842			3.5837			3.6284			3.3197			3.560270	

Note: H_0: The independent variable is not explaining the dependent variable.
*Null hypothesis is rejected at a significance level of 5 percent.

Table 6: TGARCH model

Parameters	Brazil			Russia			India			China			Mexico			South Africa		
	Coefficient	Z - Value	p - value	Coefficient	Z - Value	p - value	Coefficient	Z - Value	p - value	Coefficient	Z - Value	p – value	Coefficient	Z - Value	p – value	Coefficient	Z - Value	p – value
Return equation																		
Intercept (c)	0.0518	1.5514	0.1208	0.1492	4.0620	0.0000*	0.0777	2.9486	0.0032*	0.0125	0.5131	0.6079	0.0722	3.0382	0.0024*	-0.0303	-1.7685	0.0770
AR(1) (ϱ)	0.0240	1.1351	0.2563	0.0897	4.4003	0.0000*	0.1014	4.8254	0.0000*	0.0182	0.9901	0.3221	0.0843	4.1474	0.0000*	-0.4842	-27.0399	0.0000
Variance equation																		
Intercept (αo)	0.0963	5.7806	0.0000*	0.1406	8.8504	0.0000*	0.0780	9.1436	0.0000*	0.0292	7.5788	0.0000*	0.0330	7.0702	0.0000*	0.0421	3.6487	0.0003
α1	0.0055	0.6052	0.5450	0.0694	5.2113	0.0000*	0.0600	7.2883	0.0000*	0.0440	9.1486	0.0000*	0.0069	0.9004	0.3679	0.0563	4.0221	0.0001
β1	0.9094	79.0850	0.0000*	0.8515	70.1252	0.0000*	0.8382	85.2795	0.0000*	0.9266	289.5946	0.0000*	0.9090	108.9731	0.0000*	0.1258	4.8303	0.0000
Asymmetry (γ)	0.1113	7.2196	0.0000*	0.0935	5.9427	0.0000*	0.1489	8.4205	0.0000*	0.0382	5.3613	0.0000*	0.1334	10.1607	0.0000*	0.8717	68.5447	0.0000
Diagnostic statistics																		
log likelihood		-5448.937			-5738.937			-4905.174			-5148.069			-4612.716			-4810.461	
Durbin waston statistic	2.0066			2.0042			2.0459			2.0201			1.9519			2.249822		
Schwarz criterion		3.9985			4.1849			3.5938			3.6409			3.3392			3.558471	
Akaike informati on criterion		3.9855			4.1721			3.5808			3.6283			3.3264			3.545426	

Note: H_0: The independent variable is not explaining the dependent variable.

*Null hypothesis is rejected at a significance level of 5 percent.

In the conditional variance equation; α, the coefficient for latest news which is statistically significant at 1 percent level in Brazil, Russia, India, China, South Africa and Mexico indicating that the recent news have an impact on the volatility of stock market. Similarly β coefficient is significant in all emerging country's stock market and suggests that old news is influencing the stock market volatility as well. A persistent volatility shock raises the asset price volatility.

Table 6 presents the results of Tgarch models. Results of the Tgarch model is also confirming the same as the value of the coefficient of Tgarch model (γ) is 0.1113, 0.0935, 0.1489, 0.0382, 0.1334, 0.8717 and significant at 1 percent level. γ is highly significant which indicate the presence of asymmetrical relationship between return shocks and volatility adjustment. Coefficient γ is positive and greater than 0 indicating the impact is asymmetric. The analysis shows that stock return of all emerging market is associated with stock market volatility.

Good news, therefore, induces increase stock return than bad news. It is evident from analysis that opening of stock market has increased volatility for some countries and decreased for others depending on individual country's circumstances. AIC and SIC criteria used in the above all models indicating low for the regression which is quite reasonable and fit for models. Further, Durbin-Watson statistic is near to 2 in all cases, so it is concluded that the error terms are not auto correlated indicating the models are statistically fit and appropriate.

It has been observed from the theoretical analysis that economic environment is varying from country to country. The nature and level of development of the economy, economic resources, size of the economy, economic systems and economic policies, economic conditions, trends in various economic indicators like national income, per capita income, foreign trade, inflation rate, industry production are different in China, India, Mexico, Brazil, Russia and South Africa.

The study reveals that all emerging country is experiencing of different reforms procedures depending on their own country's intuitional arrangements and financial conditions. Normally Short-term changes in the monetary police of the any local Government lead to cause a sharp movement in the market. The market generally moves up when the local Government affluences monetary policy and down when the local Government tightens monetary policy. Each domestic country's economic factors, such as tax, changes in inflation and interest policy contribute to the directional change of the market. Stock market volatile is positively and negatively caused by economic releases,

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company news, popular Initial public offerings, unexpected earnings and foreign exchange volatility.

Volatility transpires with disorderly market conditions. Since Stock market reacts to messy market conditions very faster, Stock markets of each country are responded to these changes asymmetrically in our study that leads to decrease the stock price return and volatility ascends in the market. Asymmetric relationship between return shocks and volatility is found in Brazil, Russia India, China and Mexico's stock market. This may be also ascribing to shrinkage of economy that leads to lower the revenues for businesses and intensify the reduction in corporate earnings. Secondly asymmetric effects found in the study may be attributing to day traders, short sellers and institutional investors. However, companies/Firms cannot escape from consequences of systemic externalities caused by their risk-taking. But policymaking can protect them from external systemic shocks that sharply raise volatility and, in turn, hedging costs.

CONCLUDING OBSERVATION

Since interrelations and opening of trading linkages among countries have a serious implication for international portfolio diversification and macro-economic policy of concerned countries, it is a topic of interest for practitioners', researchers and policy makers today. This paper examines time-varying risk and return of six most emerging markets of the world i.e., Brazil, Russia, India, China, South Africa and Mexico by using four alternative models Garch (1,1), Garch-M, Egarch and Tgarch. It is perceived from the analysis that both recent news (α_1) and past news (β_1) are influencing the stock market volatility in all six emerging stock markets.Sum of the both coefficients (α_{1+} $\beta_{1)}$ are near to "1" , which indicate that shocks to the conditional variance is highly persistent in all six emerging stock markets.

A large sum of these coefficients implies that a large positive and negative return lead future forecasts of the variance to be high for an extended period. It is also evident from Garch analysis that volatility in emerging stock markets changes over time. Hence Garch(1,1) process can be used in all emerging stock market to predict the future behavior of market volatility. Garch-M model specifies the relationship between stock market return and conditional variance of all six emerging market. It is found from the analysis that Brazilian, Russian, Chinese, South African and Mexican stock markets' returns are positively related with volatility. But investors are not rewarded return on their investment

in spite of taking market-wide risk. Surprisingly evidence is found from the analysis that no country's stock is able to reward risk premium. But only in Brazil, risk and return relationship is statistically significant.

The results of (French, Schwert, and Stambaugh, 1987; Choudhry, 1996; De Santis and Imrohoroglu, 1997; Lee, Chen, and Rui, 2001; Shin, 2005) are consistent with results of the present study. Our study finds that Indian stock market return is negatively related with stock market volatility. Our results are not supported with the results of (Hui and Christopher, 2006). Somehow out of all six countries; Indian stock market is only one which is negatively discounting risk in return. This may be attributed to market imperfection and anomalies behavior of traders in the market. It implies that Indian stock market penalize the investors for bearing irrelevant local market risk.

All asymmetric Garch models results suggests the existence of leverage effect is present in all county's stock markets and news impact is asymmetric. It suggests that stock market volatility increases due to bad news and it induces low stock return in the market. This indicates that the negative innovations in returns lead to positive innovations in volatility. In other words in all six emerging stock markets, conditional volatility increase in a higher proportion after a negative return innovation rather than an increase after a positive innovation which is consistent with volatility feedback hypothesis. This may be attributed to the factors of domestic trading mechanisms and regulatory environments. Hence it is suggested that each country can reduce their market volatility by controlling their domestic financial sector regulations and macro-economic measures.

Every country's stock market is differing in terms of their objective, tolerance for risk and desire to avoid taxes and their general interest in the financial market. An investor must understand the cultural differences and differences of legal framework of different country before making any overseas investment to leverage portfolio return in the market. It is also suggested that able investors are required to apply the strategy of adjusting the quantity of their portfolio in response to shocks so that there will be less impact on the share price and volatility of returns can be reduced. Further, an investor can reduce their risk while taking investment strategy by looking companies that have sound fundamentals, good balance sheets and solid business models. So accordingly, investors can use investment strategies by analyzing each countries business environment and economic factors, recent and historical news and forecast the future market movement to reap benefits in the stock markets. Investors are also advised to be more sensible towards

adequate product and market knowledge as well as proper investment advice while selecting portfolio for efficient management of financial risks.

Now it is high time for all these emerging countries to have some degree of convergence of stock market rules and regulations and institutional arrangement so that investors can be able to get diversified portfolio return. Policy makers should make an effort to focus not only on a trade level discussion, but to move one step forward to an international finance level so that it will provide a legal basis for enforcing the rights of the investors in the countries involved. One of the most important implications of our paper is that it is tantamount importance to pay more attention to the cross effects of policies among these emerging countries in order to encourage capital inflows and provide safe business environment for all investments.

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