Volatility Forecasting of MINT Stock Exchanges: An Evidence of Standardized GARCH

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Abstract

It is imperative to understand the trend of market for the investors to invest their money. Volatility is bound to happen in stock market globally as it has trend of upward and downward movement. Volatile security market decreases the investors' confidence and bothers the primary market ensuing into reduced collection of new funds by the issuers, implementing capital market inefficiency in generating and collecting funds. The prime objective of the present work is to forecast the volatility of selected stock market in Mexico, Indonesia, Nigeria and Turkey (MINT). For the same, adjusted closing price of stock market from April 1, 2011 to August 19, 2019 has been considered. Generalized Autoregressive Conditional Heteroscedasticity (GARCH) was used to examine the volatility. The result revealed that the GARCH (1,1) was best model to observe the volatility in stock market.

***Keywords*:** *Volatility, Investor's confidence, GARCH, MINT*

1. Introduction

Volatility is well defined as the qualified standard deviation of the asset returns. Thus, volatility modelling provides a modest method to calculating worth at risk of an economic position in risk management. The benefit of meaningful risks is that we can alter our conduct to avoid them. However, evading all risks is difficult. We selected to take some risks as the advantage of taking such risks surpasses the likely charges. It also plays a significant role in asset establishment under mean-variance framework. Demonstrating volatility of a time series can also recover the efficacy in parameter approximation and correctness of interval prediction. This volatility index of a market has turn out to be a very significant economic instrument for measuring the risk in the asset return/stock.

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In 2002, Bekaert and Harvey discover that, there are two forms of markets globally. "One is segmented market (a market effectively secure to outside investors) and another is united market (a market accessible by investors, and native investors able to spread their portfolios outside the country)". Native economy measures the risk of a segmented market whereas world economy measures the risk of united market. The amalgamation may be capital market integration and economic integration. Market capitalisations to GDP as well as the world market beta are related with capital market integration, and trade to GDP is often connected to economic integration. Also, numerous works note that among the BRIC countries the assemblies of financial markets are knowingly different. For example, "Kasman (2009) notes that, in this group of countries, Brazilian stock market is most volatile and Indian stock market is most stable". Volatility of stock market may weaken or distress the smooth working of the financial system and unfavorably affect the financial performance through its effect on customer spending. A surge in volatility energies the consumer spending. Though, a drop in stock market weakens consumer assurance and this drive down consumer expenditure. Volatility in stock market too disturbs business speculation such that an increase in risk of equity venture changes funds from risky assets in less risky ones (Yadav et al., 2020). This could prime to a rise in the charge of endowment to firms and new firms might be extremely affected, as investors would choose stocks in superior and well-known firms. There is a strong connection between volatility and market performance. Volatility inclines to drop as the stock market increases and rise as the stock market drops. When volatility increases, risk rises and returns drop. The spreading of yields around the mean signifies risk. The better the scattering of returns around the mean, the superior the drop in the complex return.

India is one of the fast-growing economies and has attracted global portfolio managers' attention for last two decades (Yadav & Pandey; 2020). But due to several risks prevailing in the market like political risk, interest and currency risk and the current slowdown, it has motivated researchers to carry on study. It would be interesting to know the diversification opportunities to investors spanning various economies. Few economies are Mexico, Indonesia, Nigeria and Turkey, which is popularly known as MINT economies. It is an acronym pioneered by Terrance James O'Neill, the same person who has developed the term BRIC. These economies have demographic similarities because of which

portfolio diversification can be done and one can study its risk and return profile.

In this study, the volatility of the MINT economies has been estimated. The best suitable model is GARCH (1,1). We observe that the overall persistency of shock is larger in Mexico stock return and lower in case of Indonesian stock exchange as their parameters sum is high and low respectively. The sum of α_1 & β_1 is less than one ($\alpha_1 + \beta_1 < 1$) implies the mean reverting GARCH model. Comparing the result of short run and long run shock persistency, it is found that long run shock is more persistent than short run as their β_1 is larger than α_1.

The remainder of the paper is categorized into four different sections. Section 2 provides detailed review of literature, section 3 discusses data and econometric model, section 4 provides result and discussion followed by conclusion in section 5.

2. Literature Review:

Debasish (2009) using econometric models studied the effect of future trading on the volatility of NIFTY prices for both pre and post period. No structural change in the spot prices of NIFTY was observed with the onset of futures trading. Loudon et al. "Hung-Chun Liu and Jui-Cheng Hung (2010) practical substitute GARCH-type models to daily volatility forecasting and relate Value-at-Risk to the Taiwanese stock index futures markets that suffered most from the global financial tsunami that occurred during 2008. They conducted a forecast estimation using numerous substitute events constructed on both symmetric and asymmetric loss functions, though back-testing and two utility centred loss functions are engaged for further valuation with respect to risk management preparation. They validate that the EGARCH model delivers the most exact daily volatility forecasts, while the performances of the normal GARCH model and the GARCH models with highly persistent and long-memory characteristics are relatively poor.

Maria Assunta Baldini et al. (2011) examined the possible association between the stock market declaration of a brand's buy and sell arrangement and the stock price movement. Their statistical relevance of the analysis is partial by the observational data that it was conceivable to investigate. They examined investors' behaviour with regard to the achievement of a purchase/sale process for an asset that is usually observed as a major value driver. They inspected the market's reaction to a well-defined corporate event, stated separately and not

along with other occurrences." Seema (2014) analysed the India's trade with rest of BRICS Nations. Her article provides an assessment of India's trade with other BRICS nations. BRICs have been recognized as four major emerging economies with the ability to exceed the present G6 nations in terms of their combined gross domestic product (GDP) by 2050. The global economic crisis in last decade and slow growth of progressive economies had directed more courtesy on these emerging economies.

Sharma and Vipul (2015) studied and compared the advanced GARCH models with that of the standard GARCH models in terms of their forecasts with respect to the daily conditional variances and found that standard models outperform the advanced GARCH models. Mwita et.al. (2015) estimated the stock prices volatility in Kenyan Capital Markets using GARCH models. The model GARCH (1, 1) gave satisfactory results for volatility clustering and evidenced time varying volatility in the stock returns. Maqsood et al. (2017) attempted to model the stock market fluctuations in Kenyan Markets using GARCH model. Volatility clustering and leverage effect were captured using symmetric and asymmetric models and found that asymmetric models provide a better set of results than symmetric model. Fufa and Zeleke (2018) attempted to forecast volatility of weekly prices from 2000-15 of ETB exchange rate and found GJR – GARCH (2,2) was best estimator among various models. Awalludin, Ulfa and Soro (2018) modeled the stock price return volatility in Indonesian stock market. Garch(1,1) was employed to estimate the volatility and it showed the evidences of volatility clustering in few stocks. GARCH (1,1) a linear model captures volatility clustering successfully. Maximum Likelihood estimation method was used to estimate the parameters. Volatility series was fitted using natural cubic spline function. Sharma et al., (2020) compared linear and non-linear GARCH to predict the volatility of emerging economies using the data from January 2000 to December 2019. They found that standard GARCH (1,1) model is better and superior to model to predict than non-linear model as their leverage effect is not significant. Khera and Yadav (2020) forecasted the volatility of 11 emerging economies considering adjusted daily return of the data of 5 years extending from January 1, 2014 to December 31, 2108. They found various estimation model of different economies. As per the detailed review of literature mentioned above, it is found that majority of the studies on forecasting of a series are based on other

stock exchanges rather than MINT stock exchanges which provides motivation to carry on present study.

3. Objective

The prime objective of the present work is to forecast the volatility of selected stock market in Mexico, Indonesia, Nigeria and Turkey (MINT).

4. Data and Econometric Model

The purpose of the present study is to estimate the volatility of MINT group countries. For the same, daily adjusted closing price of individual stock has been collected from April 1, 2011 to August 29, 2019. The data was collected using Bloomberg. While collecting the data, the stock having nil values was removed. As per the detailed review of literature, the conditional variance or volatility can be examined by symmetric model and asymmetric model of volatility estimation. As per symmetric model, conditional variance depends on the magnitude. Therefore, the GARCH model has been used to forecast and find out the volatility.
The GARCH is developed by Robert F. Engel in 1982 which is an extension of the autoregressive conditional heteroskedasticity. It is considered as an efficient technique to estimate, analyse & model the time-varying variance or volatility. GARCH model is based on past of variance of a series and ARCH is based on past squared error. In order to apply GARCH, volatility clustering has to be present. Apart this, ARCH effect should also occur in the series. In order to apply GARCH, optimum lag length of squared error and variance of series are needed. In present study, GARCH (1,1) is applied as it is best model as per AIC criteria.

The GARCH equation is shown in equation 1:
$\sigma 2= \omega+ \Sigma\alpha\varepsilon pi=12t-i + \Sigma\beta pi=1j\ \sigma 2t-j$ ………………………………………..(1)

In above mentioned equation, $\sigma 2$ refers to conditional variance, ω is constant term and $\varepsilon 2t-1$ is denoted for ARCH term which is news about previous period volatility or lag of the squared residual calculated with the help of mean equation.

5. Result and Discussion

The descriptive statistics of stock markets of Mexico, Indonesia, Nigeria and Turkey (MINT) is presented in Table 1 denoted by RMEX, RJKS, RNSE and RTUR respectively. The total realization or observations of the series is 1989. Each series is witnessed with negative return in form of minimum value. Nigerian Stock Exchange (RNSE) has the maximum return along with minimum return which indicates unpredictable stock market compared to rests of the stock exchanges. The Indonesian Stock Exchange (RJKS) offers highest average return. The first quartile of all the series is negative and third quartile is positive. There is difference in the value of mean and median which indicates the condition of outlier in the series. The Turkey Stock exchange (RTUR) is more volatile market as its standard deviation is high. LCL and UCL stand for lower control limit and upper control limit. Further, to know the distribution pattern different series, skewnees and kurtosis have been computed. Only RNSE is positively skewed, rests are negatively skewed. Hence, asymmetry in upside and downside of return series is observed. The kurtosis value of all the stock exchanges' return is larger than the normal distribution which signifies the rejection of normality. It implies that possibility of extreme gains or loss is greater than predicted by the average. Finally, Jarque-Bera test indicates significant value in case of all the series that rejects the normality of the series. However, it must be remembered this fact that it is relevant in case of unconditional distribution only.

Table 1: Descriptive Statistics of stock return of MINT group countries

	RMEX	RJKS	RNSE	RTUR
nobs	1989	1989	1989	1989
Minimum	-0.059884	-0.092997	-0.139551	-0.109020
Maximum	0.061149	0.046488	0.112030	0.069095
Mean	0.000071	0.000279	0.000052	0.000194
Variance	0.000089	0.000106	0.000115	0.000234
Stdev	0.009426	0.010301	0.010722	0.015283
Skewness	-0.291763	-0.766444	0.024690	-0.563031
Kurtosis	4.765823	6.458956	26.079226	3.707685
Jarque-Bera	1916.8***	3662.6***	56492***	1248.7***

Source: Authors own presentation

Table 2: Testing of Stationarity and Arch Effect

Stationarity	**Dickey-Fuller**	**Lag order**	**p-value**
RMEX	-13.041	12	0.0001
RJKS	-12.503	12	0.0001
RNSE	-12.417	12	0.0001
RTUR	-12.122	12	0.0001
ARCH Effect	**Chi-squared**	**Df**	**p-value**
RMEX	208.12	12	0.0000
RJKS	271.03	12	0.0001
RNSE	292.14	12	0.0001
RTUR	96.216	12	0.0001

Source: Authors own presentation

Table 2 presents the results of testing of stationarity and Arch Effect. The stationarity confirms the stability of the parameters in which mean, variance and auto covariance remain constant. In present study, the stationarity has been tested applying Augmented Dickey-Fuller test in RMEX, RJKS, RNSE and RTUR. Dickey-Fuller value is negative and significant in the series which confirms the rejection of unit root and acceptance of stationarity. On the whole, return of series are I(0). Testing of ARCH effect has been also presented in Table 2. Autoregressive Conditional Heteroscedasticity (ARCH) refers to autocorrelation in squared value of residuals. While testing the arch effect, "there is no arch effect" is assumed as null hypothesis. The p-value is less than 5% level of significance. Therefore, every series is witnessed with arch effect. In order to estimate the volatility, arch effect and volatility clustering have to occur in the series. Volatility clustering refers to high changes followed by high changes and low changes followed by low changes. The figure 1 to figure 4 presents the plot of a series. In each series, there exists volatility clustering.

Figure 1: Plot of RMEX

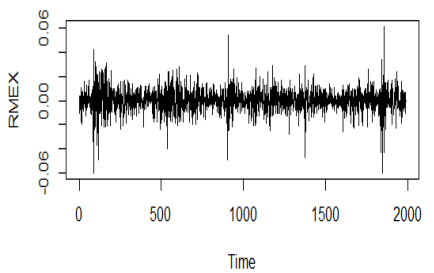

Figure 2: Plot of RJKS

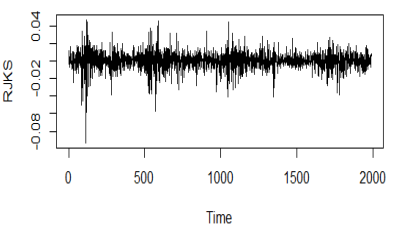

Figure 3: Plot of RNSE

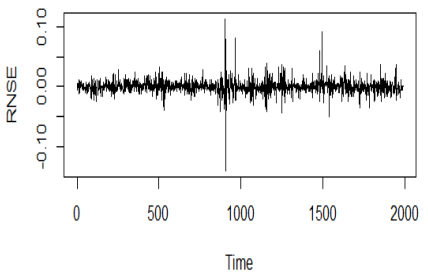

Figure 4: Plot of RTUR

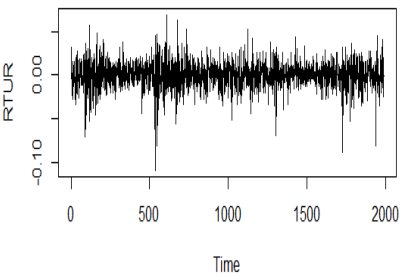

Table 3 presents the estimation result of GARCH (1, 1) model of the series considered in present study. The mu value is positive of all the series except Nigerian stock market (RNSE). It is observed that the parameters of standard GARCH model of the series i.e. alpha (α_1) and beta (β_1) are positive and significant which indicates the presence of short term and long term persistency of shock (Lim & Sek, 2013). The statistical significance of α_1 and β_1 signifies that the information on volatility of past period affects the current volatility. It is evident from the result that the sum of coefficients (α_1 & β_1) are 0.95 in case of Mexico stock return, 0.98 in case of Indonesian stock return, 0.87 in case of Nigerian stock return and 0.96 in case of Turkey stock return. The overall persistency of shock is larger in Mexico stock return and lower in case of Indonesian stock exchange as their parameters sum is greater and lower respectively. The sum of α_1 & β_1 is less than one ($\alpha_1 + \beta_1 < 1$) implies the mean reverting GARCH model. Similarly, the α_1 is least for the Turkey stock exchange and larger in Nigerian stock exchange which indicates that short term persistency of shock is less in Turkey stock exchange and more in Nigerian stock exchange. Comparing the result of short run and long run shock persistency, it is found that long run shock is more persistent than short run as their $\beta 1$is larger than α_1.

Table 3: Estimation Result of GARCH (1, 1)

RMEX	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.000216	0.000183	1.180540	0.237785
omega	0.000004	0.000002	2.435315	0.014879
alpha1	0.118631	0.013799	8.596926	0.000000
beta1	0.839408	0.008691	96.585710	0.000000

RJKS	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.000509	0.000144	3.5367	0.000405
omega	0.000002	0.000002	1.4015	0.161058
alpha1	0.089268	0.018836	4.7392	0.000002
beta1	0.892527	0.021040	42.4213	0.000000

RNSE	Estimate	Std. Error	t value	Pr(>|t|)
mu	-0.000259	0.000233	-1.11008	0.266966
omega	0.000015	0.000004	3.41959	0.000627
alpha1	0.285796	0.030218	9.45780	0.000000
beta1	0.593859	0.091090	6.51950	0.000000

RTUR	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.000696	0.000317	2.19679	0.028035
omega	0.000009	0.000000	18.18991	0.000000
alpha1	0.072498	0.005595	12.95806	0.000000
beta1	0.890525	0.008799	101.20238	0.000000

Source: Author's Calculation

6. Conclusion

The basic objective of the paper is to examine the volatility of MINT group co untries. We examined the patterns of the data applying descriptive statistics an d testing of unit root. Further, standard GARCH has been applied to examine t he volatility persistence. It is observed that volatile security market decreases t he investors' confidence and bothers the primary market ensuing into reduced collection of new funds by the issuers, implementing capital market ineffici ency in generating and collecting funds. The overall persistency of shock is lar ger in Mexico stock return and lower in case of Indonesian stock exchange as t heir parameters sum is high and low respectively. The sum of α_1 & β_1 is less th an one ($\alpha_1 + \beta_1 < 1$) implies the mean reverting GARCH model. Comparin g the result of short run and long run shock persistency, it is found that long r un shock is more persistent than short run as their β_1 is larger than α_1. It giv es implication to the global investors and portfolio managers. If investors want to invest in risky avenue, they can invest in Mexico stock return. Similarly, if they want to invest in least risky avenue, they can opt Indonesia for the inve stment purpose.

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