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Assessing volatility and returns of NIFTY50 index using symmetric GARCH modeling

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ABSTRACT This article aims to predict volatility for national stock exchange using symmetric GARCH model. This paper protested to estimate the unpredictability and transmitting patterns for NSE. Generalized autoregressive conditional heteroskedesticity with AR-1-GR-1 used considering NIFTY50 index as specimen series from National Stock Exchange (NSE). Result indicates investment risks and the return prospects from NIFTY50 index. GARCH (1, 1) model explored for series returns with empirical discussion along with detail graphical explanations for volatility sketches and series returns.

KEYWORDS :

Introduction

NIFTY50 is one of the stock index representatives of National Stock Exchange (India) and as benchmark stock market index for Indian equity market. NIFTY50 consist diversified 50 stock indexes indicating various sectors of Indian economy such as Metal, Bank, FMCG etc. The index also recognizes as idle for derivatives as well equity market. This study protested to estimate and forecast the index movement and measure the volatility for the covered time range. Stock market volatility offers immense opportunity for trades and gains the margin for intra-day traders.

The ups and downs in stock prices takes more and more attention of investors. Higher volatility carries high degree of risk along with also creates opportunity for possible profits. One of the well-known models for volatility estimation introduced by Engle (1982) ARCH, autoregressive conditional heteroskedesticity which further extended with generalizing term added by Bollerslev in 1986. Such advancements in the area captured mass attention of the world researcher and investor community. If volatility prediction is possible with promised degree of accuracy that can add uncounted value addition to one and all. It is assumed that past volatility may impact on future volatility and volatility forecasting models (several models) can predict past volatility with better accuracy. There are various arguments and comments delivered by scholars in the area to support, favor or compare the various model to claim to perform better than the competitive.

This study employs generalized autoregressive conditional heteroskedesticity model to capture and measure the volatility in one of the benchmark index of national stock exchange. There are several supporting studies for volatility forecasting using GARCH (1, 1) model. Such as Hakim, A., & McAleer, M. (2009) contributed research work on forecasts conditional correlations between stock, bond and foreign exchange considering Australia and New Zealand. The results provide evidence of volatility spillovers and asymmetric effect of negative and positive shock on the conditional variance in covered financial markets. While Wuertz, D., Chalabi, Y., & Luksan, L. (2006) contributed and implemented family of ARMA model along with GARCH. The GARCH (1, 1) test directed with Bollerslev (1986) employed to DEMGBP foreign exchange rate.

Tse, Y. K. (1991) worked on paper using ARCH and GARCH models using financial series returns of Tokyo stock exchange. In his research work inspected the stock returns volatility in the Tokyo Stock Exchange in the period 1986 to 1989. The research work tested the significance of ARCH and GARCH effects. Alike, Ardia, D., & Hoogerheide, L. (2009) contributed estimation for Bayesian estimation using GARCH (1,1) following student-t distributions.

The model also used to compare the dynamic relationship between the exchange rate and the stock price returns using GARCH (1, 1). For instance, Zhao, H. (2010) contributed research paper to analyze the relationship between the RMB and stock price considering monthly data. He concluded the result that there is not a stable long-term symmetry connection between RMB real actual exchange rate and stock price. Added that not mean spillovers between the foreign exchange and stock markets. The research scrutinizes the cross-volatility effects among foreign exchange and stock markets by likelihood ratio statistic. He found the evidence of presence of volatility spillovers properties between the covered study markets suggesting historical innovations in stock market have the inordinate effect on future volatility in foreign exchange market and stock market.

The continuous improvements in original model allowed scholar to introduce various extensions and innovation in original model to capture the various details and justify the accuracy of model. Ryan, S., & Worthington, A. (2004) contributed research work with using an extended form of the GARCH in Mean (GARCH-M) model to reflect the time-series compassion of Australian bank stock returns to market, interest rate and foreign exchange rate risks. They considered daily bank portfolio returns as sample. They found that market risk is significant cause of bank stock returns, sideways with short and medium term interest rate levels and their volatility.

Data and methodology

Various volatility estimation models being used by scholars to forecast the financial market volatility of which ARCH and Generalized ARCH are at the top most famous models. This research work followed by Bollerslev (1986) GARCH with AR-(1) and GARCH-(1) lag terms considering daily observation data range from 01:2009 to 12:2016 that counts 1981 observations.

Generalized autoregressive conditional heteroskedesticity (GARCH) by Bollerslev (1986) which consists ARCH (1) and GARCH (1) lag terms. Model property is given below;

$$h_t = \omega + \alpha 1 ut\text{-}1^2 + \beta 1\, h_t\text{-}1$$

Where;

Ht signifies the volatility for financial series returns of NIFTY50 index

Ω specifies the constant which originates as superior than 0 and to sustenance this α1ut-12 and β1 ht-1 must be >0 and specifies weighted average of a long term average.

$\alpha 1 ut\text{-}1^2$ indicates ARCH term which represents volatility from the previous period

And, $\beta_1 h_{t-1}$ designates GARCH term this is also last period forecast variances.

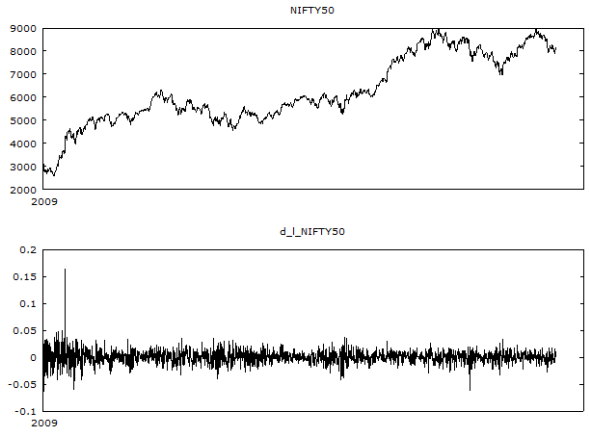
Result and discussion

In general financial series returns represents speculative asset prices and contains unit root problems i.e. non stationary data series. The unpredictable market data needs to convert stationary to employ the estimation models such as GARCH. NIFTY50 data series

converted to log and considered first log differences. The stationary test is being conducted by Augmented Dickey fuller test to identify the significance of data. The result property rejects null hypothesis of unit root. The test conducted using AIC criterion considering maximum 4 lag and 1979 daily observation of NIFTY50. The significant series returns of NIFTY50 found significant at 1% of significance level.

Actual series returns of NIFTY50 and volatility sketches indicates series movements where the low point marked below 2900 points and journey up to 9000 points with several medium and high volatility sketches.

Fig1 – NIFTY50 asset return property (actual) and (stationary) series returns

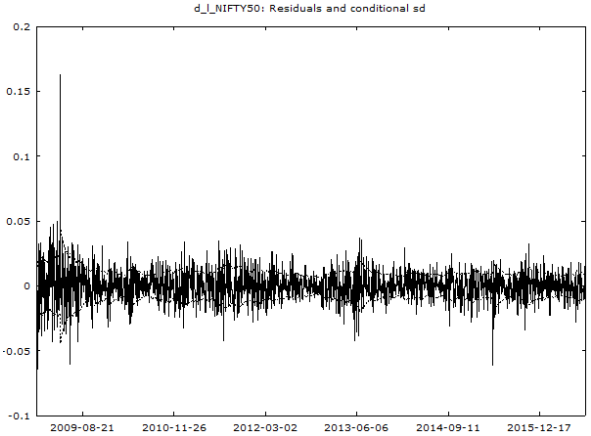


Source: Author's computation using series returns of NIFTY50 from 01:2009 to 12:2016.

The GARCH (1,1) model exploration for NIFTY50 mentioned below;

The above computation considered at significance level of 10% and computes the volatility for NIFTY50 for the covered study time range. The volatility for NIFTY50 is recorded 0.9883 and found persistent. The unpredictable price moments indicates only 0.05 degree of magnitude of positive news or good news. Investors may suffer longer wait to gain objected returns. The largest magnitude positive shock recorded up to the scale of 0.15 (see fig2) during 2009. NIFTY50 residuals and degree of conditional standard deviations presented in graphical manner.

Fig2 – NIFTY50 residuals and conditional standard deviations-



Source: Author's computation using series returns of NIFTY50 from 01:2009 to 12:2016.

The details of descriptive statistics computed to assess the series return property. The result of descriptive statistics identifies mean return merely valued to zero i.e. (0.0005013), the NIFTY50 index moved more than 2.5 times from low to high. This can be recorded for important consideration because it counts unidentified investment opportunity where the lowest investment point with least risk ratio to earn highest returns during the study period range. The return found with normal skewness but extremely high kurtosis recorded (16.10), the highest. This creates leptokurtosis impact and makes longer wait or holding time for investors. The risk factor, degree of standard deviation found (0.01232) which indicates high risk factor for the time range. Likewise it is also an opportunity to gain high returns.

Conclusion

Generalized autoregressive conditional heteroskedesticity model by Bollerslev (1986) fitted to financial series returns of NIFTY50. The market returns found volatility at high degree with persistence in volatility returns. Asset returns confirms volatility at significance level of 10%. Asset returns computed considering first log differences. Property of descriptive statistics provides significance information where the returns are found non negative skewed, and almost normal degree of skewness. However, the degree of ex kurtosis found record high i.e. 3 as normal where the reported is 16.10. Returns from financial market investment depend on time and trend of the market condition. Long-term investment in financial market may provide better returns. Recently Asian financial markets reacted high volatile particularly during day transactions.

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