

Forecasting Stock Price Volatility - An Empirical Study on Muscat Securities Market

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Abstract

Volatility is a real measure of the scattering of profits for a given security or market Index. The stock exchange is a standout amongst the most critical hotspots for organizations to raise cash. This facilitates organizations to be traded on an open market, or raise extra money related capital for development by offering offers of responsibility for organization in an open market. The liquidity that a trade manages the speculators gives them the capacity to rapidly and effortlessly offer securities. The main objective of the study is to measure the volatility of selected companies in Muscat securities market. The sample of this study is 6 companies taken MSM 30 Index. The Study period has taken from January 2012 to December 2016. Tools used for the Study is Descriptive Statistics, Unit Root Test (ADF & PP Test), GARCH (1,1) and EGARCH (1,1) Model. This finding has implications for less volatile during the study period for all the sample companies. The study also made a few observations which may help the investors to understand better about the stock market.

Keywords: *Muscat Security Market, Stock Price Volatility, EGARCH Model, GARCH Model, Unit Root Test.*

Introduction

The economic growth of country is linked with the financial market of the country and stock market is used as indicator of nation's economy. Capital market is a basic piece of money related framework and its assumes a vital part in a nation's monetary development by seeing an enormous development. It encourages the trading of assets between organization as demander and financial specialist as provider by trusting that the general development of economy relies on upon how effectively the stock exchange performs.

Volatility is a real measure of the scattering of profits for a given security or market Index. The stock exchange is a standout amongst the most critical hotspots for organizations to raise cash. This enables organizations to be traded on an open market, or raise extra money related capital for development by offering offers of responsibility for organization in an open market. The liquidity that a trade manages the speculators gives them the capacity to rapidly and effortlessly offer securities [10].

Volatility is the measure of risk and can be used to measure the market risk of an individual asset or an entire portfolio. Volatility of the financial markets remains a concern for investors, policy makers and regulators. The concern about volatility stems from the fact that price of an asset under volatile conditions no longer plays its role as a 'signal' about the true value of a firm, a concept that is core paradigm of the informational efficiency of markets [10].

Volatility is closely associated with the notion of risk. Risk and uncertainty play critical role in economics. Many economic models assume that the variance, as a measure of risk and uncertainty, is constant over time.

Thus, volatility can be predicted as it is determined by the immediate past. In order to model volatility, it is necessary to formulate an appropriate model not only for variance but also for mean of the data. Engle (1982), [1] developed autoregressive conditional heteroscedastic (ARCH) model to capture time varying variance that has proven to be very useful for modeling the variance of stock returns data. The seminal work on ARCH process by Engle (1982) to model volatility and its generalized form (GARCH) by Bollerslev (1986) [2], has paved a new way of Modeling of volatility. Much of the empirical work after this has used these models and their various extensions to incorporate other aspects such as negative

asymmetry that is commonly found in stock return data. This study concentrates on these basic GARCH and asymmetric GARCH models and evaluates their applicability in Muscat.

Measurement of Volatility

Volatility is measured by variance or the standard deviation of stock returns around their average value. When measuring the volatility, stock returns are taken rather than stock prices because mean must be stable at the different time period while measuring the dispersion around an average value. Another reason behind using return is that absolute price changes are dependent on the price level. In order to symmetrically treat the up moves and down moves, returns are calculated as the logarithmic difference of closing prices at the beginning and end of one measurement period. In order to compare the volatilities over different periods and over different countries, volatility is expressed as an annualized percentage. To annualize the volatility, the number of trading days in a year must be used. Also, volatility scales with the square root of time [3].

About Muscat Securities Market

The Muscat Securities Market (MSM) was built up by the Royal Decree (53/88) issued on 21 June 1988 to direct and control the Omani securities showcase and to partake, successfully, with different associations for setting up the framework of the Sultanate's monetary area.

Following ten years of consistent development there was a requirement for a superior working of the Market. The MSM has been rebuilt by two Royal Decrees (80/98) and (82/98). The Royal Decree (80/98) dated November ninth 1998 which proclaimed the new Capital Market Law accommodates the foundation of two separate substances, a trade, Muscat Securities Market (MSM) where all recorded securities should be exchanged and the Capital Market Authority (CMA) - the administrative. The Exchange is a legislative element, fiscally and authoritatively autonomous from the administrative yet subject to its supervision. Accordingly the securities business in Oman was settled to upgrade financial specialists' certainty by creating and enhancing every one of the procedures relating to the share trading system.

As a proceeding with process in the improvement of the securities advertise, the MSM has built up its controls to give data and monetary information identifying with the execution of the Market and all recorded organizations specifically to financial specialists through an

exceedingly progressed electronic exchanging framework. This won't just guarantee straightforwardness of exercises which is thought to be one of the primary standards of a very much sorted out market, yet will bolster the market by urging financial specialists to settle on the right venture choice at the correct time.

The Market has built up its current system of freedom and settlement by presenting another component for empowering stable managing in securities and also giving a superior situation that may help the stream of outside venture to the Sultanate.

The previous settlement instrument was including just three gatherings in the leeway and settlement, MSM, Muscat Clearing and Depository Company (S.A.O.C) and the handle .The recently presented settlement recipe is through a Settlement Bank with a Settlement Guarantee Fund (SGF) [11].

Literature Review

Denice Bodeutsch and Philip Hans Franses (2014) inspected that the experimental properties of stock returns for 10 organizations recorded in the Suriname Stock Exchange (SSE) by using Correlation, GARCH. Individual stock returns are observed to be unsurprising from the claim past to some degree, however the equivalent weighted list returns are most certainly not. Dynamic connections with extensive Latin-American securities exchanges seem, by all accounts, to be zero. They reasoned that there is considerably more proficiency to be picked up for the SSE [4].

Vijayalakshmi and Sania Gaur (2013) probed the volatility of Indian Stock & Foreign exchange markets from 2004 to 2006 by using several models like (EWMA), ARCH and GARCH family models (TARCH, EGARCH, PARCH, and so forth.) and their exactness in displaying and determining the unpredictability of Indian Rupee against USD and record return developments. The outcome found that TARCH and PARCH will prompt better unpredictability figure for BSE and NSE return arrangement for the share trading system assessment and ARCH and EGARCH for the remote trade showcase [5].

Prashant Joshi (2010) investigated the stock market volatility in the emerging stock markets of India and China using daily closing price from 1st January, 2005 to 12th May, 2009. The

test connected for the study is ARCH-LM, GARCH. The outcomes recognize the nearness of non-linearity through BDSL test while restrictive Heteroscedasticity is distinguished through ARCH-LM test. The study found that the GARCH (1, 1) demonstrate effectively catches nonlinearity and instability bunching. The investigation recommends that the constancy of unpredictability in Chinese securities exchange is more than Indian stock exchange [6].

Kumar S. S. S (2006) investigated the Comparative Performance of Volatility Forecasting Models in Indian Markets. In this review aggregate of ten distinct models are assessed on the premise of two classes of assessment measures – symmetric and hilter kilter blunder insights. In view of the out of test figures and the quantity of assessment measures are rank a specific strategy as unrivaled. The EWMA will prompt changes in instability estimates in the share trading system and the GARCH (5. 1) will accomplish the same in the Forex market [7].

Kogan (2004) and Zhang (2005) join the restrictive instability of stock return and the genuine economy through the speculation procedure. Kegan (2004) contends that the irreversibility of speculation choices makes the contingent instability of significant worth firms more countercyclical than that of development firms. Zhang (2005) presents prove that the esteem premium is countercyclical. In terrible conditions of the economy, esteem firms are loaded by more capital than they need and face substantial expenses on the off chance that they wish to diminish limit. While, development firms hold choices to grow however won't have such abundance limit when request falls. This time-changing nature of the hazard premium outcomes in the esteem premium being countercyclical [8,9].

Objectives of the study

1. To measure the extent of stock price volatility of selected companies in Muscat Securities Market.
2. To identify the suitable model for forecasting the volatility of stock prices.

Data Specification adopted for the Study

The Data are based on the financial information provided by the Muscat Securities Market. Database of the companies listed in Muscat Securities Market and selected MSM 30 Index during the year January 2012 to December 2016 (Five Years) of monthly closing price is taken into consideration.

Tools Used for Analysis

- ❖ Descriptive Statistics
- ❖ Unit Root Test (ADF & PP Test)
- ❖ GARCH Model
- ❖ EGARCH Model

Data Analysis of the Study

Table 1 Descriptive Statistics for Selected Companies

S.No.	Company Name	Mean	S.D.	Skewness	Kurtosis
1	Al Anwar	0.0005	0.0598	0.7219	9.002
2	Bank Muscat	0.0002	0.0368	-0.6634	10.5680
3	Bank Sohar	0.0007	0.0355	1.0110	9.8727
4	Dhofar Investments	0.0017	0.0365	0.1406	4.5406
5	Gulf Investment	0.0027	0.0604	0.4489	8.5499
6	Taageer Finance	0.0001	0.0459	-1.0841	17.0634

Sources: Computed from Eviews

From the above tables the mean and standard deviation values for 6 selected companies are positive during the sample period from January 2012 to December 2016; standard deviation values are strategized from the mean. The Standard Deviation of Returns is the highest (0.0604) for Gulf Investment and the lowest (0.0355) for Bank Sohar. This indicates that the select companies are more volatile; the highest volatile company is Gulf Investment and the least volatile is Bank Sohar during the study period. The companies like Al Anwar, Bank Sohar, Dhofar Investments and Gulf investment are positively skewed (Right Skewed Distribution) which indicates that probability of getting positive returns. The remaining companies has negatively skewed (Left Skewed Distribution), which shows these companies has the probability of producing negative returns; companies are positively / negatively deviated from Normal Distribution. The kurtosis value of the selected companies is greater than 3 which show the distribution is not normal and the nature of distribution is Leptokurtic.

Table 2 Unit Root Test for Selected Companies

S. No.	Company Name	Augmented Dickey Fuller Test			Phillips – Perron Test		
		Intercept	Trend	Both	Intercept	Trend	Both
1	Al Anwar	-12.657	-12.659	-12.668	-12.307	-12.309	-12.314
2	Bank Muscat	-13.948	-13.951	-13.954	-13.943	-13.946	-13.952
3	Bank Sohar	-14.289	-14.292	-14.294	-14.365	-14.368	-14.371
4	Dhofar Investments	-14.452	-14.456	-14.462	-14.455	-14.458	-14.463
5	Gulf Investment	-12.328	-12.328	-12.336	-12.140	-12.142	-12.149
6	Taageer Finance	-14.880	-14.884	-14.891	-14.882	-14.884	-14.889

Sources: Computed from Eviews; **Note:** The P value at 1% for ADF Test for intercept, trend and with both are - 3.4585, -2.8738 and -2.5734 respectively.

Above table shows the critical values of t-statistics like Intercept, Trend and Both for finding Unit Root of the data series; Test statistics are combined the result of Phillip Peron (PP) and the Augmented Dickey Fuller (ADF) test for the volatility series. The Critical Values are - 3.4585 (Intercept), -2.8738 (Trend) and -2.5734 (Both). It is identified that data for the selected companies are stationarity at level itself because the Test Statistic Values are less than the critical values at 1% significant level.

In the P-P test also test statistic values are more negative than the Test Critical Values. The Unit Root Test results detects that the stock price return for the selected companies are stationary in Level and Intercept at the order of I (0).

Table 3 GARCH (1,1) Model for Selected Companies

S. No.	Company Name	Estimated Model with Values				AIC	Log Likelihood
		α_0	α_1	β_1	$\alpha_j + \beta_i$		
1	Al Anwar	0.0004 (2.6745)	0.2283 (2.7367)	0.6787 (6.6660)	0.907	-2.9425	344.333
2	Bank Muscat	0.0001 (3.1777)	0.0809 (3.9339)	0.8401 (22.0125)	0.921	-3.7810	446.777
3	Bank Sohar	0.0001 (0.8568)	0.0817 (1.6134)	0.8056 (4.3007)	0.887	-3.8719	452.146
4	Dhofar	0.0003	0.1053	0.6268	0.732	-3.7823	369.362

	Investments	(1.4700)	(1.2604)	(2.6726)			
	Gulf Investment	0.0012 (4.0174)	0.1876 (3.3774)	0.4780 (4.0927)	0.665	-2.8772	336.764
5	TAAGEER Finance	0.0012 (0.7971)	-0.03049 (-1.0192)	0.5690 (1.0285)	0.873	-3.2571	361.473

Sources: Computed from Eviews; α_0 is constant which represents a long-run average; α_1 is The ARCH term which denote the lag of the squared residuals from the mean equation, signifies news about volatility from the previous period; β_1 is The GARCH term ; the last period's forecast variance; $\alpha_j + \beta_j$ is the indicator of volatility persistence .

The return series of the selected companies has significant constant coefficient over the period. From the GARCH (1, 1) table coefficient of β_1 is large which indicates that long term volatility; β_1 value is near to one for all the companies is indicates new stocks does not have an impact on prices for a longer duration.

The average value of an ARCH and GARCH coefficient of selected companies is found to be less than one. Which is obviously indicates greater persistence of external shocks towards return. From the above said the lesser value of ARCH coefficient compare to GARCH coefficient indicates less reaction of stocks towards other shocks in the market. The selected companies have not displayed greater than one while adding the value of ARCH and GARCH effect. This evidently demonstrates that the less volatility i.e. the change in return has less impact over the companies which has value less than one.

Table 4 EGARCH (1,1) Model for Selected Companies

S. No.	Company Name	Estimated Model with Values				AIC	Log Likelihood
		α_0	α_1	β_1	γ_1		
1	Al Anwar	-1.4548 (-2.6886)	0.3700 (3.1820)	-0.1413 (-2.5028)	0.7913 (9.6273)	-2.9590	347.252
2	Bank Muscat	-10.5251 (-11.0736)	0.4850 (3.4000)	0.02950 (0.4695)	-0.5323 (-3.4893)	-3.7576	446.778
3	Bank Sohar	-10.7997 (-6.9655)	-0.2910 (-3.9461)	-0.0096 (-0.1985)	-0.6356 (-2.8068)	-3.8483	450.409
4	Dhofar Investments	-2.4062 (-1.7361)	0.2819 (1.9194)	0.0179 (0.3055)	0.6680 (3.3622)	-3.7867	397.819
5	Gulf Investment	-2.21963 (-2.7855)	0.2913 (3.8472)	-0.1314 (-2.6090)	0.6448 (4.8245)	-2.8534	334.996
6	TAAGEER Finance	-2.7298 (-6.2254)	-0.6294 (-6.5805)	-0.1106 (-1.9964)	0.5120 (6.7557)	-3.4267	375.803

Sources: Computed from Eviews; α_0 is constant which represents a long-run average; α_1 is The ARCH term which denote the lag of the squared residuals from the mean equation, signifies news about volatility from the previous period; β_1 is The GARCH term; the last period's forecast variance; γ_1 is used to identify the leverage effect; which is Correlation between the realized volatility and the historic return.

As of the EGARCH table it is observed that constant coefficient for the companies are significant. The value of larger coefficient in EGARCH(1,1) equation indicated long term volatility persistence of the return series. β_1 value is near to one for all the companies is indicates new stocks does not have an impact on prices for a longer duration. The value of EGARCH coefficients are less than one for return of selected companies proves that the new shocks will not have an huge effect on prices for a longer duration.

The co-efficient results of the ARCH effect are shows the highest for Bank Muscat and the lowest for Taageer Finance. The value of an ARCH and GARCH coefficient of all selected companies are found to be less than one. This clearly shows that larger persistence of external shocks concerning return. Form the above said ARCH term, the larger coefficient specifies less reaction of stocks concerning new shocks in the market. As of the EGARCH table it is observed that, there is a leverage effect for all the selected companies. All the companies have significant impact. It evidences that a positive shock has higher impact on conditional variance related to the negative shock.

Modeling and Forecasting Stock Price Volatility

Modeling and forecasting stock price volatility in financial markets is one of the most important and baffling tasks in financial research. Recently, a great deal of attention has been directed to this area by academicians, policy makers and practitioners over the globe, because it can be used as a measure of risk and also can exhibit some typical characteristics. Basically the volatility estimates are complex to the design of the volatility model. Hence, it is important to get the right balance between catching the salient features of the data and over fitting the data. As the estimated restrictions are the true parameters of the volatilities models, which often change the volatility forecasts it is difficult to observe the volatility estimate correctly. Further, volatility forecasts are attached at noisy proxies or estimations of the present level of volatility. More over correctly specified and projected volatility model, estimates the future volatility inherit and even intensify the uncertainty about the present level of volatility.

Table 5 Forecast for Selected Companies

S. No.	Company Name	GARCH		EGARCH	
		RMSE	MAE	RMSE	MAE
1	Al Anwar	0.059743	0.038068	0.059740	0.038065
2	Bank Muscat	0.036751	0.023328	0.036745	0.023322
3	Bank Sohar	0.035482	0.023638	0.035478	0.023630
4	Dhofar Investments	0.036463	0.025937	0.036460	0.025929
5	Gulf Investment	0.060362	0.039782	0.060359	0.039774
6	TAAGEER Finance	0.045816	0.022721	0.045812	0.022716

Sources: Computed from Eviews

From the GARCH and EGARCH models' evaluation terms i.e Roots Mean Error term and Mean Absolute Error term is used to compare forecasting efficiency of two different models. The RMSE and MAE are found to be the lowest under EGARCH model for all the selected companies. Hence we may conclude that, the EGARCH model outperform the other model and provides the most accurate forecast in terms of RMSE and MAE. Despite its mathematical and statistical simplicity, the EGARCH model provides the most accurate forecast compared to other model in the study. Among the nonlinear models, EGARCH model performs the best fit in terms of forecasting ability.

Major Findings of the Study

❖ Descriptive Statistics

The Standard deviation values for 6 selected companies are positive during the sample period from January 2012 to December 2016; standard deviation values are strategized from the

mean. The Standard Deviation of Returns is the highest (0.0604) for Gulf Investment and the lowest (0.0355) for Bank Sohar. This indicates that the select companies are more volatile; the highest volatile company is Gulf Investment and the least volatile is Bank Sohar during the study period. The companies are Al Anwar, Bank Sohar, Dhofar Investments and Gulf investment has positive (Right Skewed Distribution) skewness value which shows that there is more chance for getting positive returns. The remaining companies have Left Skewed Distribution, which indicates that the companies have more probability of getting negative returns and the positive and negative return of the companies followed the Distribution. The selected companies has the kurtosis values more than 3 (Leptokurtic distribution), which shows unanticipated return distributions are not normal.

❖ Unit Root Test

Test found that the Test Statistic Values are satisfied at Level Difference itself and the select companies are stationary at 1% significant level in the First Difference. It is to be noted that the P-P tests' calculated statistic values are more negative than the tabled Critical Values. The Test Statistic Values of First Difference are higher than the Test Critical Values of Level Difference. The returns are stationary in Level Difference itself (or) the Unit Root Test results finds that the data series for the select companies are stationary in Level and Intercept at the order of I (0).

❖ GARCH Model

The researcher attempted various combinations of ARCH and GARCH lags and the most appropriate models are selected for the consideration of results. The selected company's values have not posted greater than one which proved ARCH and GARCH effect. This clearly proves less volatility.

❖ EGARCH Model

The researcher attempted various combinations of ARCH and GARCH lags and the most appropriate models are selected for the consideration of results. It is found from the EGARCH table that the leverage effect for all the selected companies is significant. It is proved that positive shock makes high impact for all companies.

❖ Forecasting the Volatility of Selected Companies

The GARCH and EGARCH models' evaluation terms i.e Roots Mean Error term and Mean Absolute Error term is used to compare forecasting efficiency of two different models. The RMSE and MAE are found to be the lowest under EGARCH model for the selected companies. Hence we may conclude that, the EGARCH model outperforms the other model and provides the most accurate forecast in terms of RMSE and MAE. Despite its mathematical and statistical simplicity, the EGARCH model provides the most accurate forecast compared to other competing models in the study.

Conclusion

The study measured the extent of stock price volatility in selected companies and identified suitable model for forecasting the volatility of the share prices. It assessed the comparative ability of various statistical and econometric forecasting models in the framework of selected companies. Two different competing models were considered for the study and the forecasting performance of two different models is tested by forecasting error terms viz., Root Mean Square Error and the Mean Absolute Error. Based on the RMSE and MAE terms the best model was suggested. The EGARCH model provides the most accurate forecast compared to other model in the study. The study also made a few observations which may help the investors to understand better about the stock market.

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