

## **Performance Measurement of Some Selected Companies of Dhaka Stock Exchange by GARCH family**

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**Abstract.** Economic markets are absolute judgment of stock souks which indicates stock souk is one of the most key resources for companies to raise capital. Here, we take four selected company to initially measure forecasting performance and discover Aftab Automobiles Ltd and Beximco Pharmaceutical Ltd gives minimum AIC, BIC in EGARCH and Bata Shoes Company Ltd and Southeast Bank Ltd provides lowly AIC, BIC in TGARCH model. Finally, General Index of DSE deliver lowest amount of AIC, BIC and SIC in GARCH (1, 3). Overall, GARCH (1, 3) model is the standard among other.

**Keywords:** GARCH (1, 3), EGARCH, TGARCH, economic market.

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### **1. Introduction**

Financial souk measurement is very complex in real circumstances because economic data give an idea about different pattern in nature. Alteration in market volatility would merely reflect change in local or global economic environment, changes in trading quantity, swing investor's tolerances of risk and increase insecurity. So, guesstimate the suitable volatility model is key approach to know the market condition, which helps the investors to make decision if he invests his capital or not. Therefore, GARCH models can be attributed largely to their ability to restrain numerous stylized facts such as time-varying volatility, persistence and clustering of volatility, and asymmetric feedbacks to upbeat and depressing shocks of equal magnitude. Most recent works related to GARCH family are as follows: Jánský and Rippel (2011) evaluate ARCH models on six world stock indices, in modeling 1-day-ahead VaR [10]. Bialkowski, Gottschalk and Wisniewski (2008) and Boutchkova et al.(2012) touches on the financial sector in an examination of elections and their financial impact via GARCH family [2,3].Islam et al.(2012) use twelve linear and nonlinear model to forecast the future forecasting volatility of DSE[8] and so on Bangladesh stock market is so much volatile to invest. So, manufacturing market efficient and dropping market hazard that investor's comfort to

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invest. The particular focus of the study is to ascertain the best forecasting method for daily returns of selected company. After that, locate the best measurement volatility model for each company. Finally, make comparison on the overall stocks and discover the standard one. The paper is prearranged by the subsequent ways, section 2 carry out some forecasting techniques. Diagnostic clarification is specified in section 3. Section 4 contains conclusions.

## 2. Some forecasting techniques

### 2.1. GARCH

Bollerslev (1986) launched standard GARCH models which is specified as [1],

$$y_t = \sigma_t \varepsilon_t, \sigma_t = \alpha_0 + \alpha_1 y_{t-1}^2 + b_1 \sigma_{t-1}^2, \alpha_0 > 0, \alpha_1, b_1 \geq 0.$$

GARCH (1, 1) model contains a constant term, news about volatility from the earlier stage, exact the lag of earlier term squared residual  $\varepsilon_{t-1}^2$  (the ARCH term), and preceding period's forecast variance  $\sigma_{t-1}^2$  (the GARCH term). Enders (1995) commenced the more general GARCH (p, q) model is [5, 9],

$$y_t = \sigma_t \varepsilon_t, \sigma_t^2 = a_0 + \sum_{i=1}^q a_i y_{t-i}^2 + \sum_{j=1}^p b_j \sigma_{t-j}^2$$

### 2.2. GARCH in Mean (GARCH-M)

Engle, Lilien and Robins (1987) put forward GARCH in mean process. Here, the mean of the sequence depends on its own conditional variance [6],

$y_t = c + \alpha^2 u_t + u_t$ , with  $u_t = \sigma_t \varepsilon_t$  and  $\sigma_t^2 = a_0 + a_1 y_{t-1}^2 + b_1 \sigma_{t-1}^2$ ,  $a_0 > 0, a_1, b_1 \geq 0$   
ML estimation method is used to estimate GARCH-M models [5].

### 2.3. Exponential GARCH (EGARCH)

Nelson (1991) introduced EGARCH process, have same effect on the conditionals variance [6]. The simple EGARCH (p, q) is as follows [12]

$$y_t = \sigma_t \varepsilon_t, \sigma_t^2 = \exp\left[\alpha_0 + \sum_{i=1}^q \beta_i \ln(\sigma_{t-i}^2) + \sum_{j=1}^p \left(\theta_j \frac{y_{t-1}}{\sqrt{h_{t-1}}} + \gamma_j \left| \frac{y_{t-j}}{\sqrt{h_{t-j}}} \right| \right)\right]$$

### 2.4. Threshold GARCH (TGARCH)

Glosten, Jagannathan, and Runkle (1993) and Zakoian (1994) commonly used TGARCH to handle leverage effects [7]. A TGARCH (m, s) model assumes the form

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^s (\alpha_i + \gamma_i N_{t-i}) a_{t-i}^2 + \sum_{j=1}^m \beta_j \sigma_{t-j}^2$$

where  $N_{t-i}$  is an indicator for negative  $a_{t-i}$ , that is,

$$\text{i) } N_{t-i} = 1 \text{ if } a_{t-i} < 0, \text{ ii) } N_{t-i} = 0 \text{ if } a_{t-i} \geq 0$$

and  $\alpha_i, \gamma_i$  and  $\beta_j$  are non-negative parameters satisfying conditions similar to those of GARCH models [13].

### 2.5. Asymmetric Power GARCH (APGARCH)

Ding et al. (1993) proposed an APGARCH model which is generalization standard deviation GARCH models of Taylor (1986). Writing  $\sigma_t = \sqrt{h_t}$  the APGARCH model

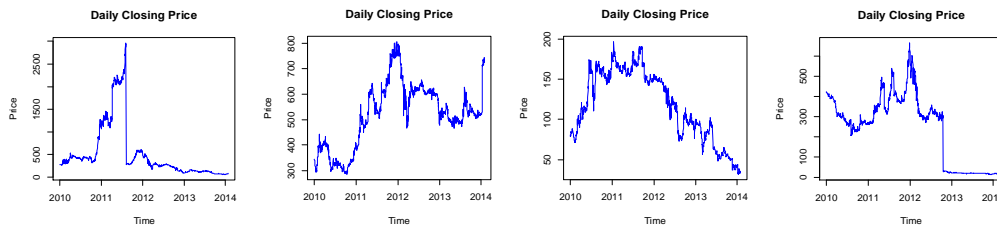
Performance Measurement of Some Selected Company of DSE by GARCH family is given by [4]:

$$\sigma_t^\delta = \omega + \sum_{i=1}^p \alpha_i (|\varepsilon_{t-i}| - \gamma_i \varepsilon_{t-i})^\delta + \sum_{j=1}^q \beta_j \sigma_{t-j}^\delta,$$

where,  $\delta$  can be estimated rather than imposed and  $\gamma$  is included to capture the effects of asymmetric shocks[11].

### 3. Diagnostic clarification

Closing price of four companies such as Aftab Automobiles Ltd, Bata Shoe Company Ltd, Beximco Pharmaceutical Ltd and Southeast Bank Ltd and General Index of DSE are used here from May, 2000 to April, 2014 for time series analysis, measuring and forecasting the volatility models.



**Figure 1:** Time series plot of Aftab Auto, Bata Shoe, Beximco Pharma. & Southeast Bank

The graphs give an idea of closing price of selected companies that over the period of study the time series data seems to be trending, signifying mean and variance has been changing. Now, by unit root check the daily data of closing price is non-stationary and after taking first difference it becomes stationarity. Also, the cointegration instigates a long term relationship between DSE General Index and our selected companies. Now, examining basic statistics such as mean, variance, skewness, kurtosis and Shapiro-Wilk normality test we find the non-normality of data. So, we consider higher order GARCH models as well as EGARCH, IGARCH, TGARCH to capture the actual volatility performance to the selected companies and GIN of Bangladesh.

Company	Assessments	GARCH	EGARCH	IGARCH	TGARCH
Aftab Auto.	log -Likelihood	2135.99	2126.48	2133.64	2102.15
	LM-Arch test (p-value)	0.059 (1.00)	0.002 (0.998)	0.003 (0.999)	0.004 (0.997)
	AIC	-4.913895	-4.8945	-4.9047	-4.8946
	BIC	-4.899024	-4.8797	-4.8936	-4.8848
Bata Shoes.	log -Likelihood	8126.98	8086.066	8122.416	8015.217
	LM-Arch test (p-value)	0.003822752 (1.000)	0.0005926 (0.9997)	0.0006302 (0.9997)	0.0006466 (0.9997)
	AIC	-5.616046	-5.5831	-5.6107	-5.5015
	BIC	-5.602920	-5.5681	-5.5995	-5.4846
B. Pharm.	log -Likelihood	2542.029	2543.56	2541.948	2544.119
	LM-Arch test (p-value)	3.521469 (0.9906087)	0.3707 (0.8308)	0.3684 (0.5439)	0.8341 (0.6590)
	AIC	-4.807667	-4.8114	-4.8115	-4.8168

	BIC	-4.798417	-4.7966	-4.8004	-4.8002
S. Bank	log -Likelihood	2559.276	2574.867	2559.104	2529.869
	LM-Arch test (p-value)	0.00954675 (1.000)	0.0003092 (0.9860)	0.001212 (0.9994)	0.001772 (0.9991)
	AIC	-4.936663	-4.9118	-4.9349	-4.8681
	BIC	-4.921893	-4.8970	-4.9239	-4.8515
GIN	log -Likelihood	2192.564	2197.924	2194.505	2197.162
	LM-Arch test (p-value)	9.34172 (0.673499)	2.228 (0.32816)	1.198 (0.5495)	1.564 (0.4574)
	AIC	-4.995575	-5.0055	-5.0023	-5.0038
	BIC	-4.957381	-4.9619	-4.9696	-4.9601

**Table 1:** Performance test for daily return by GARCH, EGARCH, IGARCH, TGARCH

Proposed estimated model for forecasting future observations	
A.A.	EGARCH (1,1) $y_t = \sigma_t \varepsilon_t,$ $\sigma_t^2 = \exp[-0.211336 + 0.173905 \ln(\sigma_{t-1}^2) - 0.325125 (y_{t-1} / \sigma_{t-1}) + 0.970661   y_{t-1} / \sigma_{t-1}  ].$
B.S.	TGARCH (1,1) $r_t = -0.000683 + y_t, \quad y_t = \sigma_t \varepsilon_t$ $\sigma_t^2 = 0.000140 + (0.580201 + 0.060666 N_{t-1}) y_{t-1}^2 + 0.389731 \sigma_{t-1}^2$
B.P.	TGARCH (1,1) $y_t = \sigma_t \varepsilon_t,$ $\sigma_t^2 = \exp[-0.332033 - 0.022100 \ln(\sigma_{t-1}^2) + 0.413059 (y_{t-1} / \sigma_{t-1})]$
S. B.	TGARCH (1,1) $r_t = -0.001774 + y_t, \quad y_t = \sigma_t \varepsilon_t$ $\sigma_t^2 = 0.000317 + (0.554207 + 0.408764 N_{t-1}) y_{t-1}^2 + 0.246261 \sigma_{t-1}^2$
GIN	GARCH (1,3) $r_t = -0.0005768 + y_t, \quad y_t = \sigma_t \varepsilon_t$ $\sigma_t^2 = 0.00001432 + 0.17061 y_{t-1}^2 + 0.8247 \sigma_{t-1}^2 + (1 \times 10^{-8}) \sigma_{t-2}^2 + 0.0013112 \sigma_{t-3}^2$

**Table 2:** Estimated volatility models of selected companies

Table 1 and Table 2 In the above estimation of volatility modeling for DSE we observed that different sectors company give different model for return series volatility and DGEN daily return gives GARCH(1,3) for estimating volatility by using AIC, BIC and SIC. Comparatively DGEN modeling gives good estimation for all over the estimation.

Company name	Likelihood ratio statistics	1% level of significance	5% level of significance	10% level of significance
Aftab Auto.	-0.053	Accepted	Accepted	Accepted
Bata Shoes.	2.60	Accepted	Accepted	Accepted
Beximco Phar.	0.30	Accepted	Accepted	Accepted
Southeast B.	0.29	Accepted	Accepted	Accepted

**Table 3:** Comparing volatility model for General index of DSE with four companies

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Table 3 shows that likelihood ratio statistics is accepted different significance level. Finally we conclude that our General index of DSE gives better model than our selected companies through Likelihood ratio test comparing chi-square distribution with one degree of freedom.

#### 4. Conclusion

Assessment of financial stock is intricate in actual world as well-documented volatility modeling is tricky to forecast. This study compares four kinds of volatility models and obtains the best fitted model for our selected companies. Aftab Automobiles Ltd and Beximco Pharmaceutical Ltd gives minimum AIC, BIC in EGARCH and Bata Shoes Company Ltd and Southeast Bank Ltd gives lowest AIC, BIC in TGARCH model. Finally, General index of DSE deliver lowest amount of AIC, BIC and SIC in GARCH (1, 3) which is standard one.

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