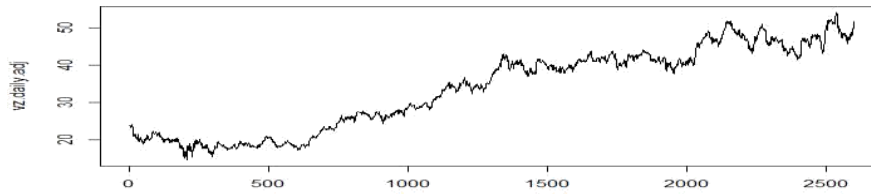# Forecasting Verizon stock Data using GARCH Model

Exploratory Data Analysis

The above time series plot represents a non-stationary time series, it displays trend component. The mean and variance is not constant, they change over time.

Check for Stationarity – adf test – p-value < alpha(0.05), we reject null hypothesis, hence the data is stationary

```
Title:
 Augmented Dickey-Fuller Test

Test Results:
  PARAMETER:
    Lag Order: 1
  STATISTIC:
    Dickey-Fuller: -39.4413
  P VALUE:
    0.01
```

Null Hypothesis – Time series is non-stationary; Alternate Hypothesis – time series is stationary

Fitting the model

ARIMA models of orders (1,0,2),(2,0,0), (2,0,1), (3,0,3) and (4,0,2) have lower AIC values. Since the squared returns of ACF and PACF plots display volatility, ARMA in combination with GARCH (1,1) model was used. All the computed ARMA and GARCH models represented non-significant MA and AR terms. Hence ARMA was removed from the GARCH model. Data was partitioned into training (75%) and test data sets (25%).

GARCH models with Gaussian distribution of orders (1,1) and (2,0) were implemented on training dataset and ARCH & GARCH coefficients turned out significant. Out of all these GARCH models, GARCH(1,1) using student t-distribution for innovation (tgf1) has the least AIC value (-6.115894) and most significant ARCH & GARCH coefficients.

Final Predictions using the GARCH model

```
> predict(tgf1,newdata=test1,10,plot=TRUE)
   meanForecast  meanError standardDeviation lowerInterval upperInterval
1  0.0002351171 0.01282743      0.01282743    -0.02540074    0.02587098
2  0.0002351171 0.01282294      0.01282294    -0.02539177    0.02586200
3  0.0002351171 0.01281854      0.01281854    -0.02538298    0.02585321
4  0.0002351171 0.01281423      0.01281423    -0.02537437    0.02584460
5  0.0002351171 0.01281001      0.01281001    -0.02536593    0.02583616
6  0.0002351171 0.01280587      0.01280587    -0.02535766    0.02582790
7  0.0002351171 0.01280182      0.01280182    -0.02534956    0.02581980
8  0.0002351171 0.01279785      0.01279785    -0.02534162    0.02581186
9  0.0002351171 0.01279396      0.01279396    -0.02533385    0.02580408
10 0.0002351171 0.01279014      0.01279014    -0.02532623    0.02579646
```


Prediction with confidence intervals