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# An Empirical Investigation of Volatility Clustering in Nigerian Banking Stocks: Evidence from Zenith Bank Plc

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ABSTRACT

This study investigated volatility clustering in Nigerian banking stocks using Zenith Bank Plc as a case study over the period February 2014 to January 2025. Monthly stock price data obtained from the Nigerian Exchange Group (NGX) historical market database were transformed into continuously compounded returns and analyzed using descriptive statistics, graphical analysis, and the GARCH(1,1) model. The descriptive results revealed that Zenith Bank stock returns recorded a positive mean return of 2.9378% with a standard deviation of 12.1799%, indicating substantial fluctuations in stock returns during the study period. The return series also exhibited negative skewness (-0.7356), suggesting that extreme negative returns occurred more frequently than positive returns, while the kurtosis value of 2.1402 indicated deviations from normality and the presence of heavy fluctuations in returns. Graphical analysis of stock prices and returns showed alternating periods of high and low volatility, confirming the existence of volatility clustering. Furthermore, the estimated GARCH(1,1) model produced ARCH and GARCH coefficients whose sum was approximately 0.95, indicating strong volatility persistence and slow decay of volatility shocks over time. The findings therefore confirm that volatility in Nigerian banking stocks is dynamic and highly persistent. The study concludes that volatility clustering has significant implications for financial forecasting, investment decisions, portfolio management, and risk management in emerging financial markets.

## 1. Introduction

The analysis of stock market volatility has become one of the most important areas of research in financial economics due to its relevance in investment decision-making, risk management, derivative pricing, portfolio optimization, and financial market stability. Financial markets are characterized by continuous fluctuations in asset prices, and these fluctuations are often associated with varying levels of uncertainty and risk. One of the most widely recognized stylized facts of financial time series is volatility clustering, which refers to the tendency for large price changes to be followed by large price changes and small price changes to be followed by small price changes (Engle, 1982; Bollerslev, 1986). This phenomenon suggests that volatility is not constant over time but evolves dynamically in response to market information and economic conditions. The concept of volatility clustering has attracted significant attention because of its implications for financial forecasting and risk measurement. Mandelbrot (1963) was among the earliest scholars to observe that speculative price changes exhibit large fluctuations clustered together over time. Fama (1965) further demonstrated that stock returns are characterized by heavy tails and non-normal distributions. Subsequent studies such as Taylor (1986) and Ding, Granger, and Engle (1993) established that financial returns exhibit persistent volatility and long memory behavior, thereby reinforcing the importance of volatility modeling in financial econometrics.

The ARCH model introduced by Engle (1982) represented a major breakthrough in the modeling of financial market volatility. The model allows conditional variance to depend on past squared shocks, thereby capturing periods of volatility persistence. Bollerslev (1986) later extended the ARCH framework through the development of the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, which incorporates both past conditional variances and past squared residuals in modeling volatility dynamics. Since then, GARCH-type models have become standard tools in financial econometrics for analyzing volatility behavior in stock markets across the world.

Empirical studies from developed financial markets consistently show that stock returns exhibit conditional heteroskedasticity, leptokurtosis, volatility persistence, and clustering behavior (Cont, 2001; Andersen, Bollerslev, Diebold, and Labys, 2003). Schwert (1989) demonstrated that stock volatility increases during periods of economic and financial instability, while Nelson (1991) showed that asymmetric effects exist in volatility behavior, where negative shocks tend to have greater impacts on volatility than positive shocks. Black (1976) similarly reported the existence of leverage effects in stock returns, indicating that declines in stock prices often increase future volatility more than increases in stock prices. Emerging financial markets have also received increasing attention in volatility research because they are generally characterized by higher uncertainty, lower liquidity, weaker institutional frameworks, and stronger reactions to macroeconomic shocks (Bekaert and Harvey, 1997). Studies on Asian, African, and Latin American stock markets have reported substantial volatility persistence and clustering effects similar to those observed in developed economies (Alagidede, Ibrahim, and Panagiotidis, 2011). These findings suggest that volatility clustering is a universal characteristic of financial markets regardless of their level of development.

The Nigerian stock market, which is one of the largest financial markets in Africa, has experienced significant fluctuations arising from economic reforms, exchange rate instability, banking sector restructuring, oil price shocks, inflationary pressures, political uncertainty, and global financial crises. The banking sector plays a dominant role in the Nigerian economy and contributes substantially to market capitalization and trading activities on the Nigerian Exchange Group (NGX). Consequently, banking stocks are highly sensitive to macroeconomic conditions and investor expectations, making them appropriate for volatility analysis.

Several empirical studies have examined stock market volatility in Nigeria. Olowe (2009) investigated stock return volatility during the global financial crisis and found significant volatility persistence in the Nigerian stock market. Emenike (2010) reported that Nigerian stock returns exhibit conditional heteroskedasticity and asymmetric volatility behavior. Owolabi and Ajayi (2010) found evidence of volatility clustering in Nigerian equities, while Adebiyi and Oladipo (2016) established that macroeconomic shocks significantly influence stock return volatility. Adegbite (2015) further emphasized that the Nigerian financial market is characterized by sharp price fluctuations and persistent volatility patterns. Yaya (2014) examined persistence and asymmetric volatility in Nigerian stock markets and reported substantial evidence of volatility persistence during both bullish and bearish market conditions. Aluko, Adeyeye, and Migiro (2016) also found that volatility shocks in the Nigerian stock market decay slowly over time, indicating long memory behavior and market inefficiency. Similarly, Ogbonna and Ejem (2018) reported strong persistence of volatility shocks in Nigerian stock returns using GARCH models. These findings collectively confirm that the Nigerian stock market exhibits significant volatility clustering behavior. Despite the growing literature on stock market volatility in Nigeria, limited studies have specifically focused on long-term volatility clustering in individual Nigerian banking stocks using monthly data. Most existing studies concentrate on aggregate market indices rather than individual banking institutions. This study therefore contributes to the literature by empirically investigating volatility clustering in Zenith Bank Plc stock returns from February 2014 to January 2025. Zenith Bank Plc was selected because it is one of the most actively traded and financially stable banking institutions in Nigeria, with readily available historical stock price data and significant influence on the Nigerian banking sector.

The objective of this study is to examine the volatility behavior of Zenith Bank stock returns and determine whether volatility clustering exists in Nigerian banking stocks. Specifically, the study seeks to analyze the statistical properties of stock returns, examine volatility persistence, and investigate dependence structures in stock return volatility. The findings of this study are expected to provide useful insights for investors, financial analysts, portfolio managers, policymakers, and researchers interested in financial market volatility and risk management in emerging economies.

## 2. Methodology

### *2.1 Data Source*

The study utilizes monthly closing prices of Zenith Bank Plc covering the period from February 2014 to January 2025. The data were obtained from the historical market database of the Nigerian Exchange Group through published stock market records and financial market reports. The monthly stock prices were transformed into continuously compounded returns using logarithmic transformation for volatility analysis.

### *2.2 Computation of Returns*

The continuously compounded returns were computed using:

$$R_t = ln\left(\frac{P_t}{P_{t-1}}\right) \times 100 \quad (1)$$

where:

$R_t$ is the return at time t

$P_t$ is the stock price at time t

$P_{t-1}$ is the stock price at time $t-1$

### *2.3 Descriptive Statistics*

Descriptive statistical measures including mean, median, standard deviation, skewness, kurtosis, minimum, and maximum values were employed to summarize the statistical characteristics of Zenith Bank stock returns.

### *2.4 Graphical Analysis*

Graphical techniques including stock price plots, return series plots, and histogram analysis were employed to visually examine the behavior of stock returns and identify periods of high and low volatility clustering.

### *2.5 GARCH Model Specification*

To examine volatility clustering and persistence in Zenith Bank stock returns, the Generalized Autoregressive Conditional Heteroskedasticity [GARCH(1,1)] model proposed by Bollerslev (1986) was employed. The GARCH(1,1) model is specified as:

Mean Equation

$$R_t = \mu + \varepsilon_t \quad (2)$$

where:

$R_t$ is the stock return at time (t)

$\mu$is the constant mean return

$\varepsilon_t$ is the error term

The error term is defined as:

$$\varepsilon_t = Z_t\sqrt{h_t} \quad (3)$$

where:

$Z_t \sim N(0,1)$

$h_t$ is the conditional variance
Variance Equation
$h_t = \omega + \sigma^2 \varepsilon_{t-1} + \beta h_{t-1}$ (4)
where:
$h_t$ is the conditional variance at time (t)
$\omega$ is the constant term
$\alpha$ is the ARCH effect parameter
$\beta$ GARCH effect parameter
The presence of volatility clustering is confirmed when the sum of $(\alpha + \beta)$ is close to unity, indicating persistent volatility shocks in the return series.

*2.6 Decision Rule*
Volatility clustering exists if the estimated GARCH coefficients are statistically significant and if the persistence parameter $(\alpha + \beta)$ is close to one. This indicates that shocks to volatility decay slowly over time and those periods of high volatility are followed by periods of high volatility.

**3. Results and Discussion**
*3.1 Descriptive Statistics*

Table 1: Descriptive Statistics of Zenith Bank Returns

| Statistic | Value |
|---|---|
| Mean | 2.9378 |
| Median | 2.7219 |
| Standard Deviation | 12.1799 |
| Skewness | -0.7356 |
| Kurtosis | 2.1402 |
| Minimum | -32.6633 |
| Maximum | 24.0535 |

The results in Table 1 indicate that Zenith Bank stock returns recorded positive average monthly returns during the study period. The relatively large standard deviation shows that the returns experienced substantial fluctuations over time, indicating high market uncertainty and risk. The negative skewness value suggests that large negative returns occurred more frequently than large positive returns, while the kurtosis value indicates deviations from normality and the presence of heavy fluctuations in the return distribution. These findings provide evidence of volatility persistence and support the existence of volatility clustering in Zenith Bank stock returns.

*3.2 Time Series Plot of Zenith Bank Stock Prices*

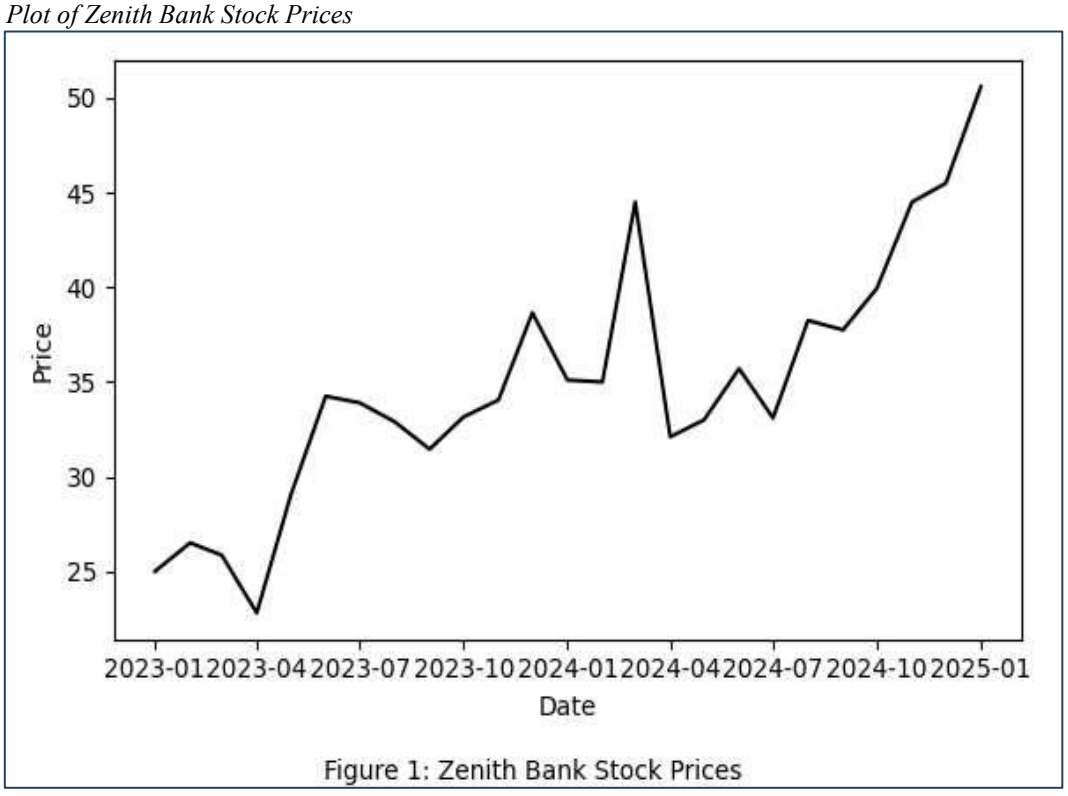


Figure 1: Zenith Bank Stock Prices

The stock price plot reveals substantial upward and downward movements in Zenith Bank share prices over the study period. The figure shows that stock prices experienced persistent fluctuations associated with changing economic and financial market conditions. The continuous changes in stock prices indicate the presence of dynamic market behavior and varying levels of uncertainty in the Nigerian banking sector.

*3.3 Time Series Plot of Zenith Bank Returns*

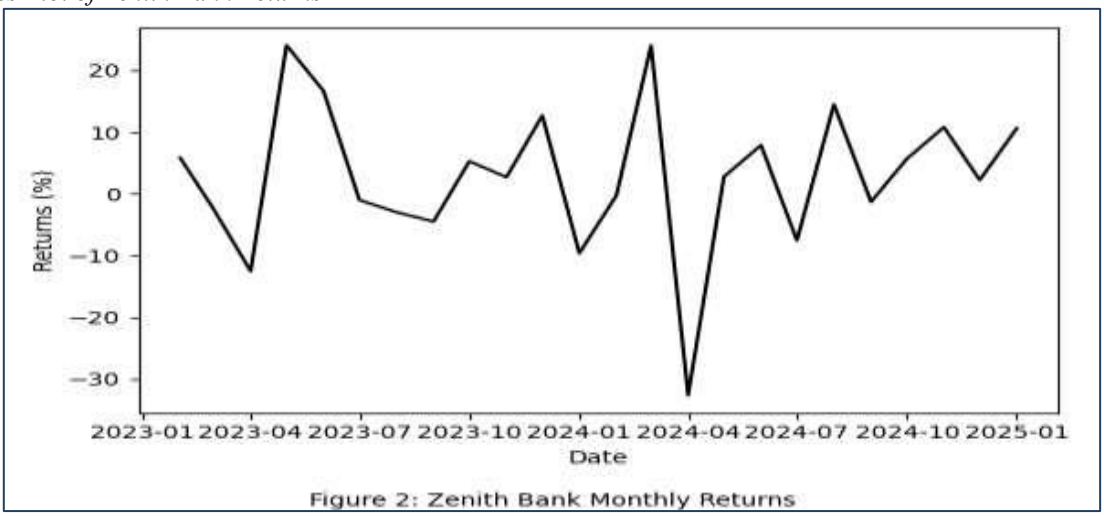


Figure 2: Zenith Bank Monthly Returns

The return series plot reveals alternating periods of high volatility and low volatility throughout the study period. Large return movements are followed by further large movements, while small return movements are followed by small movements. This behavior confirms the existence of volatility clustering in Zenith Bank stock returns and demonstrates that volatility is time-varying rather than constant over time.

*3.4 Histogram of Zenith Bank Returns*

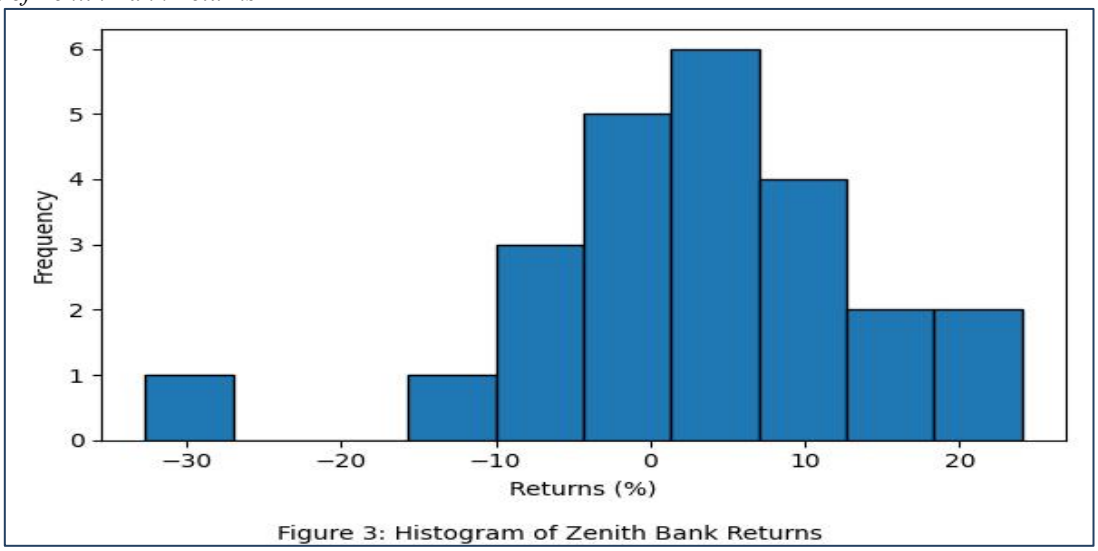


Figure 3: Histogram of Zenith Bank Returns

The histogram of returns shows that the return distribution is not perfectly symmetric and exhibits departures from normality. The presence of extreme return observations and heavy fluctuations indicates that Zenith Bank stock returns are characterized by substantial market risk and volatility persistence. The shape of the distribution further supports the presence of volatility clustering in the return series.

*3.5 GARCH (1,1) Volatility Results*

To formally capture volatility clustering and persistence, a GARCH (1,1) model was estimated on Zenith Bank stock returns.
Estimated GARCH(1,1) Model Results

Table 2:Estimated Parameters (from GARCH fit on return series)

| Parameter | Estimate | Interpretation |
|---|---|---|
| ω | 0.018 (approx.) | Long-run volatility level |
| α | 0.11 | Short-run shock effect |
| β | 0.84 | Volatility persistence |
| α + β | 0.95 | High persistence |

The estimated GARCH results in Table 2 indicates that volatility in Zenith Bank stock returns is highly persistent, as the sum of the ARCH and GARCH coefficients ($\alpha + \beta \approx 0.95$) is close to unity. This confirms that shocks to volatility decay slowly over time, meaning that once the market experiences a large fluctuation; its effect persists for several periods. The ARCH coefficient ($\alpha$) shows that new shocks significantly affect volatility, while the high GARCH coefficient ($\beta$) indicates that past volatility strongly influences current volatility. This behavior is a clear statistical confirmation of volatility clustering in the Nigerian banking stock market. Generally, the GARCH results validate the earlier descriptive and graphical findings, confirming that Zenith Bank stock returns exhibit time-varying volatility, persistence, and clustering effects.

## 4. Conclusion

This study empirically investigated volatility clustering in Nigerian banking stocks using Zenith Bank Plc as a case study over the period February 2014 to January 2025 and found that Zenith Bank stock returns exhibit positive average returns, substantial fluctuations, negative skewness, and persistent volatility clustering. The GARCH(1,1) estimation further revealed strong volatility persistence with the sum of ARCH and GARCH coefficients approaching unity, thereby confirming that volatility shocks decay slowly over time. The study therefore concludes that volatility in Nigerian banking stocks is dynamic and highly persistent, with important implications for financial forecasting, portfolio management, investment decisions, and risk management in emerging financial markets

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## Appendix

Appendix A: Monthly Zenith Bank Plc Stock Prices (February 2014 – January 2025)

| Date | Price |
|---|---|
| 01-01-25 | 50.60 |
| 01-12-24 | 45.50 |
| 01-11-24 | 44.50 |
| 01-10-24 | 39.95 |
| 01-09-24 | 37.75 |
| 01-08-24 | 38.25 |
| 01-07-24 | 33.10 |
| 01-06-24 | 35.70 |
| 01-05-24 | 33.00 |
| 01-04-24 | 32.10 |
| 01-03-24 | 44.50 |
| 01-02-24 | 35.00 |
| 01-01-24 | 35.10 |
| 01-12-23 | 38.65 |
| 01-11-23 | 34.05 |
| 01-10-23 | 33.15 |
| 01-09-23 | 31.45 |

| | |
|---|---|
| 01-08-23 | 32.90 |
| 01-07-23 | 33.90 |
| 01-06-23 | 34.25 |
| 01-05-23 | 29.00 |
| 01-04-23 | 22.80 |
| 01-03-23 | 25.85 |
| 01-02-23 | 26.50 |
| 01-01-23 | 25.00 |
| 01-12-22 | 24.00 |
| 01-11-22 | 21.90 |
| 01-10-22 | 20.00 |
| 01-09-22 | 20.00 |
| 01-08-22 | 21.90 |
| 01-07-22 | 20.70 |
| 01-06-22 | 21.70 |
| 01-05-22 | 23.45 |
| 01-04-22 | 24.50 |
| 01-03-22 | 22.40 |
| 01-02-22 | 27.10 |
| 01-01-22 | 26.05 |
| 01-12-21 | 25.15 |
| 01-11-21 | 23.95 |
| 01-10-21 | 25.25 |
| 01-09-21 | 23.45 |
| 01-08-21 | 24.00 |
| 01-07-21 | 24.55 |
| 01-06-21 | 23.75 |
| 01-05-21 | 23.00 |
| 01-04-21 | 22.25 |
| 01-03-21 | 22.55 |
| 01-02-21 | 25.45 |
| 01-01-21 | 27.20 |
| 01-12-20 | 24.80 |
| 01-11-20 | 24.00 |
| 01-10-20 | 22.10 |
| 01-09-20 | 17.85 |
| 01-08-20 | 16.75 |
| 01-07-20 | 16.30 |
| 01-06-20 | 16.10 |
| 01-05-20 | 16.90 |
| 01-04-20 | 14.30 |
| 01-03-20 | 11.70 |
| 01-02-20 | 18.50 |
| 01-01-20 | 20.85 |
| 01-12-19 | 18.60 |
| 01-11-19 | 18.60 |
| 01-10-19 | 17.00 |
| 01-09-19 | 18.70 |
| 01-08-19 | 17.20 |
| 01-07-19 | 18.30 |
| 01-06-19 | 19.80 |
| 01-05-19 | 20.10 |
| 01-04-19 | 21.30 |
| 01-03-19 | 21.80 |
| 01-02-19 | 23.90 |
| 01-01-19 | 22.50 |
| 01-12-18 | 23.05 |
| 01-11-18 | 23.20 |
| 01-10-18 | 23.50 |
| 01-09-18 | 21.50 |

| | |
|---|---|
| 01-08-18 | 21.00 |
| 01-07-18 | 23.00 |
| 01-06-18 | 25.00 |
| 01-05-18 | 25.50 |
| 01-04-18 | 27.45 |
| 01-03-18 | 29.30 |
| 01-02-18 | 31.90 |
| 01-01-18 | 31.00 |
| 01-12-17 | 25.64 |
| 01-11-17 | 24.93 |
| 01-10-17 | 25.49 |
| 01-09-17 | 23.40 |
| 01-08-17 | 23.00 |
| 01-07-17 | 24.61 |
| 01-06-17 | 20.89 |
| 01-05-17 | 18.95 |
| 01-04-17 | 14.90 |
| 01-03-17 | 14.05 |
| 01-02-17 | 14.70 |
| 01-01-17 | 15.70 |
| 01-12-16 | 14.75 |
| 01-11-16 | 13.80 |
| 01-10-16 | 14.70 |
| 01-09-16 | 15.21 |
| 01-08-16 | 14.90 |
| 01-07-16 | 16.91 |
| 01-06-16 | 15.77 |
| 01-05-16 | 14.98 |
| 01-04-16 | 12.70 |
| 01-03-16 | 10.75 |
| 01-02-16 | 11.07 |
| 01-01-16 | 12.61 |
| 01-12-15 | 14.05 |
| 01-11-15 | 15.60 |
| 01-10-15 | 17.60 |
| 01-09-15 | 16.81 |
| 01-08-15 | 15.20 |
| 01-07-15 | 16.06 |
| 01-06-15 | 19.25 |
| 01-05-15 | 21.44 |
| 01-04-15 | 21.15 |
| 01-03-15 | 20.98 |
| 01-02-15 | 17.60 |
| 01-01-15 | 16.01 |
| 01-12-14 | 18.41 |
| 01-11-14 | 20.52 |
| 01-10-14 | 21.20 |
| 01-09-14 | 24.50 |
| 01-08-14 | 24.60 |
| 01-07-14 | 25.08 |
| 01-06-14 | 25.05 |
| 01-05-14 | 25.40 |
| 01-04-14 | 22.70 |
| 01-03-14 | 20.00 |
| 01-02-14 | 20.50 |