Impact of COVID-19 on the Nigerian Stock Exchange Market

Safiyanu, Babangida Danladi and Isa, Musa and Lawan, Isah Isah

Deapartment of Economics, Federal University, Gashua- Nigeria, Department of Economics, Ahmadu Bello University, zaria-Nigeria, Department of Economics, Federal University, Wukari- Nigeria

September 2020

IMPACT OF COVID-19 ON THE NIGERIAN STOCK EXCHANGE MARKET

Babangida Danladi Safiyanu[1], *Musa Isa[2], Isah Lawan Isah[3]

1. Department of Economics and Development Studies, Federal University, Gashua.
2. Department of Economics, Ahmadu Bello University, Zaria.
3. Department of Economics and Development Studies, Federal University, Wukari

*Corresponding Author: imusar58@gmail.com

ABSTRACT

Volatility in financial markets particularly the stock exchange market is an important issue that concerns theorists and practitioners. This paper examined the impact of COVID-19 related cases and death on the Nigerian stock exchange market. Using the number of reported cases and death in Nigeria, China, and the US, and Nigerian stock exchange all share index daily data from 31st December 2019 to 16th April 2020, the study estimated GARCH 11, TGARCH 11, and EGARCH 11. The selection of best model was done based on Akaike Info, Schwarz and Hannan-quinn information Criteria; we found GARCH 11, TGARCH 11, and EGARCH 11 to be the best models. The study shows that only Nigerian confirmed cases have a significant impact on the Nigerian Stock Exchange's All Share Index (NSE's ASI), suggesting that the changes in the external cases and death from China and U.S do not have a significant impact on the NSE's ASI *during the period of analysis. Also, TGARCH 11 and E-GARCH 11 indicate the absence of leverage effect.*

Keywords: COVID-19; EGARCH 11; TGARCH 11; Nigerian Stock Exchange; All share Index

1.0 INTRODUCTION

The outburst of the new coronavirus has caused a pandemic of respiratory disease (COVID-19) for which vaccines and targeted therapeutics for treatment are not identified (Wang, Drabek, Okba, Haperen, Osterhaus, Kuppeveld, Baagmans, Grosveld & Bosch, 2020). This pandemic has caused major concerns about public health in the entire world. At the same time, another major concern is about the economic consequences as households are required to stay at home to reduce the spread of the virus. The impact of this on the supply chain and financial stability of the firms, the financial sector, and the individual is largely unknown. As a result, policymakers, businesses, and market participants are trying to estimate growth expectations for the coming years (Gormsen & Koijen, 2020).

Nigeria like most of the countries in the world is likely to be affected in some ways-directly as a result of cases within the country and indirectly due to the closeness of a country with China as a trading partner and also the reliance on global oil price ("The Impact of COVID-19", 2020).

The Nigerian stock market is affected negatively since the outbreak of the virus. The Nigerian stock exchange market lost N2.3 Trillion within three weeks after the Nigerian first case – an 18% decline ("The Impact of COVID-19", 2020). Uncertainty is a major factor for the shock in the stock market which has implications for the economy. As investors can easily lose money, and businesses lose capital, spending by firms and individuals savings decrease to the barest minimum. However, the Nigerian Stock Exchange (NSE)'s All Share index which shows general market performance, has so far taken a new direction, falling by 20.5 percent year-to-date, while market capitalization has lost over 12.12 percent, closing at N11.1 trillion as at Monday 30th March 2020 ("COVID-19 and Wealth Creation" 2020). To put it in context, these economic indicators mirror business activities and company performances in the country. According to Omordion, when the performance of the stock market declines, it means investors are losing value as the worth of quoted company contracts, given that the performance of any stock market is determined largely by the well-being of its quoted companies which are generally affected by cycles or disruptions in the economy. This paper is aimed at investigating the impact of COVID-19 related cases and death on stock exchange market volatility in Nigeria.

2.0 LITERATURE REVIEW

There is a little but gradually expanding literature on the impact of COVID-19 on the stock market in the world. Such works are; Onali (2020) which examined the impact of COVID-19 related cases and death on US stock market using GARCH (11), the study found that changes in the number of cases and death in the US and six other countries affected by the COVID-19 do not have an impact on US stock return apart from the number of reported cases from China. Furthermore, the result suggested that the number of reported death in Italy and France have a negative impact on stock market returns and positive impact on the VIX returns.

Baker, Bloom, Davis, Kost, Sammon, and Viratyosin (2020) using a text-based method, investigated the unprecedented stock market reaction to COVID-19 in the US, they argue that policy responses to the COVID-19 pandemic provide the most compelling explanation for its unprecedented stock market impact.

Albulescu (2020) examined Coronavirus and financial volatility in the US. The author searched for the effect of official announcement regarding new cases of infection and death ratio (China-Non outside China cases). On the financial markets volatility index (VIX), the result showed that the new cases reported in China and outside China have a mixed effect on financial volatility, the death ratio positively influences VIX, that outside China triggering a more important impact. Also, the higher the number of affected countries, the higher the financial volatility is.

Given the emerging nature of the area, few studies were conducted with none from Nigeria. Therefore, our paper contributed to the existing literature by examining the impact of COVID-19 related cases and death on the stock exchange market in Nigeria.

3.0 DATA AND METHOD

The daily data on the confirmed cases and death were collected from https://ourworldindata.org whilst those of the Nigerian Stock Exchange (NSE) all share index were obtained from https://www.investing.com/.

We collected data on confirmed cases and death for three countries namely; Nigeria, china and United States (U.S) we therefore have seven regressors (the lag of all share index included). Both data collected covered the period from 31st December, 2019 to 16th April, 2020.

One of the limitations of the data is excluding weekends and public holidays. This is in view of the fact that Nigerian Stock market does not operate on such days.

3.1 Garch Model:

The Generalized autoregressive conditional heteroscedasticity (GARCH) (*p*,*q*) model of Bollerslev (1986) includes *p* lags of the conditional variance in the linear ARCH(*q*) conditional variance equation, the mean equation which is the same for all GARCH family can be presented as follows;

$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 X_{2t} + \beta_3 X_{3t} + \varepsilon_t$ .... (i)

Where y_t is the daily ASI, β_0 is the intercept, y_{t-1} is one day lag of the ASI, X_{2t} stands for the cumulative confirmed cases and death from Nigeria at time t, while X_{3t} represents the total confirmed cases and death from the rest of the world (China and United state) at time t. Whereas the βo is the intercept of the model, while β1, β2and β3 are slope coefficients of the independent variables, that is Chinese confirmed cases and death and US confirmed cases and death, ε_t is the stochastic term which captures other variables affecting the volatility of ASI that are not included in the model. The subscript‘t’ indicates that we are dealing with time series data.

The conditional variance from the GARCH (1, 1) model may readily be calculated as:

$\sigma^2_t = \gamma o + \gamma 1 u^2_{t-1} + \theta u^2_{t-1}$ ……………………………………………………………… (ii)

Where σ^2_t conditional variance at time ‘t’γo is the intercept, γu^2_{t-1} is the ARCH term which captures the shocks from the previous period (day) measured as the lag of the squared residual, while θu^2_{t-1} is the GARCH term which measures the last periods forecast variance as a function of the past residuals. It measures the time taken for the volatility to die out.

3.2 Threshold garch (T-garch) model:

A major restriction of the ARCH and GARCH specifications above is the fact that they are symmetric. By this we mean that what matters is only the absolute value of the innovation and not its sign (because the residual term is squared). Therefore, in ARCH/GARCH models a big positive shock will have exactly the same effect in the volatility of the series as a big negative shock of the same magnitude. The main target of this model is to capture asymmetries in terms of negative and positive shocks. However, with regard to the news of COVID 19 related cases we assumed that this has impact on all share price index in Nigeria. The variance of TGARCH is specified as follows;

$\sigma^2_t = \gamma o + \gamma 1 u^2_{t-1} + \theta\, u^2_{t-1} dt_{-1} + ðht_{-1}$..iii

Where *dt takes* the value of 1 for $u_t < 0$, and 0 otherwise. So 'good news' and *'bad* news' have a different impact. Good news has an impact γ, while bad news has an impact of $\gamma + \theta$. If $\theta > 0$ we conclude that there is asymmetry, while if $\theta = 0$ the news impact is symmetric.

3.3 Exponential garch (e-garch) model:

The exponential GARCH or EGARCH model was first developed by Nelson (1991), and the variance equation for this model is given by:

$$log(ht) = \gamma o + \sum_{j=1}^{q} \gamma 1 \left| \frac{Ut-j}{\sqrt{ht-j}} \right| + \sum_{j=1}^{q} €j \frac{Ut-j}{\sqrt{ht-j}} + \sum_{i=1}^{q} ðilog\,(ht-i) \text{.........................iv}$$

Where γo, the γ1, €, and ð are parameters to be estimated. Note that the left-hand side is the log of the variance series. This makes the leverage effect exponential instead of quadratic, and therefore the estimates of the conditional variance are guaranteed to be non-negative. The EGARCH model allows for the testing of asymmetries as well as the TARCH. To test for asymmetries the parameters of importance are the €s. If $€1 = €2 = \cdots = 0$, then the model is symmetric. When $€i < 0$, then positive shocks (good news) generate less volatility than negative shocks (bad news).

However, equation (i), (ii), (iii), (iv and (iiv) are estimated using maximum likelihood function

$$L(\theta) = -\frac{1}{2}\sum(\text{In}2\pi + \text{In}\sigma 2t + \frac{u2}{\sigma 2t}) \text{ ....} v$$

were σ^2_t is specified in each of the GARCH models.

4.0 RESULT DISCUSSION

4.1 Stationary Test:

Evidences from descriptive statistics show that the variables are not stationary. We perform a unit root test on each of the variable since the variables are time series in nature. This enables us to avoid the problems of spurious result that are associated with non-stationary time series models.

From table 1, all share index (ASI), Nigerian number of death (NGD), China number of death (CDT), and US confirmed cases (USC) are all stationary at first difference. While Nigerian confirmed cases (NGC), China confirmed cases (CCC), and US number of death (USD) are all stationary at levels.

4.2 Heteroskedasticity Test (ARCH):

From table 2 the ARCH LM test for heteroskedasticity shows that the hypothesis of no heteroskedasticity for all the variables can be rejected. Hence, it can be seen that these variables are heteroskedastic in their distribution which makes the application of an ARCH estimation technique plausible.

GARCH (1, 1)

Table 3 shows the mean equation, the lag of ASI from the table is positive meaning that the current value of ASI depends on the previous price. In other words, a one Naira increase in ASI during the previous day increases the price of the stock by 27%, meaning that the future price of ASI can be forecasted using the current price. However, is statistically insignificant.

The coefficients of Nigerian confirmed cases from table 5 is positive and statistically significant with p values 0.084, which means the Nigerian confirmed cases have a significant impact on the Nigerian stock exchange market. However, the sign is contrary to a priori expectation of negative sign. The reason for the wrong sign might not be unconnected with the perception of many residents that the virus is not in existence in Nigeria the government only plays politics to get sympathy from international donors for donations. In line with the a priori expectation, Nigerian death cases have a negative signs; however, it is not statistically significant as it shows a p-value of 0.44. The Chinese and U.S confirmed cases and death are all statistically insignificant. This is in line with the finding of Onali (2020), that changes in the number of cases and deaths in the US and six other countries majorly affected by the Covid-19 crisis do not have an impact on the US stock market returns, apart from the number of reported cases for China.

From table 4, ARCH and GARCH terms are both statistically significant with p values of 0.01 and 0.02 respectively, meaning that the internal shocks do significantly contribute to the changes in the volatility of NSE's ASI.

T-GARCH (1, 1)

Table 4 shows TGARCH result, equation (iii) is estimated, from the result we can see that the ARCH coefficient is positive and statistically significant with a p-value of 0.0577, this implies that previous shock influence the current stock volatility in Nigerian stock exchange. Also, the GARCH coefficient is positive as expected and is statistically significant with the probability value of 0.0215. This confirmed that the previous volatility influences the current stock volatility in NSE's all-share index. The summation of ARCH and GARCH components is less than one (0.946746) which shows that the volatility is persistent within the period of analysis.

The asymmetric component shows no presence of leverage effect; the coefficient is positive and statistically insignificant. This shows that there is symmetric in terms of volatility. This confirms the absence of leverage effect in NSE'ASI within the period of analysis.

E-GARCH (1, 1)

From table 4, the result indicates the absence of leverage effect meaning that good news causes less volatility than good news, and is significant as its p-value stands at 0.0005.

The ARCH and GARCH terms suggest that internal shocks that cause volatility in ASI are statistically significant. The coefficient of GARCH 0.373285 indicates the previous volatility influences the current volatility of ASI in the Nigerian stock exchange market; the result is statistically significant at 10% level of significant.

The other cases and death from China and the U.S are all statistically insignificant, meaning that they do not contribute significantly to changes in the volatility of NSE's ASI.

4.5 DIAGNOSTIC TEST

The diagnostic test presented in appendix ii shows that the three models (GARCH 11, TGARCH, and EGARCH) passed two of the three residual diagnostic tests, vis;, Normality test (Jarque-Bera) and heteroskedasticity test (ARCH), however, they did not pass serial correlation (correlogram of standard residuals)

With regard to serial correlation, a correlogram of standard residuals was employed to see whether an error transfers from one day to another. The p-value for the test stands at 0.012, 0.012, and 0.018 for GARCH11, TGARCH 11 and EGARCH 11 respectively, we, therefore reject the null hypotheses of no serial correlation in the three models.

For the Normality test, Jarque-Bera was used to check whether the residuals are normally distributed. The P values for the test are 0.18, 0.28, and 0.38 for GARCH11, TGARCH11, and EGARCH11 respectively, hence we fail to reject the null hypothesis and conclude that the errors are normally distributed with 0 mean and constant variance for all the models which are desirable. With respect to the heteroskedasticity test, we use ARCH test and obtained 0.43, 0.55, and 0.99 as the p values for the three models for the observed R-square. Therefore we fail to reject the null hypothesis and conclude that the variances of the residuals are homoskedastic (constant) for all the models.

5.0 CONCLUSION

This paper is the pioneer effort to investigate the impact COVID-19 on the Nigerian stock exchange market (ASI). We generated data on Nigerian confirmed cases and death and two other countries (China and U.S) and Nigerian All-share index from 31st December 2019 to 16th April 2020. Volatility models were employed (GARCH 11, TGARCH 11 & E-GARCH 11). The findings of the results suggest that only Nigerian confirmed cases have a significant impact on the NSE's ASI, suggesting that the changes in the external cases and death from China and U.S do not have any impact on the NSE's ASI during the period of the analysis. The models, TGARCH 11 & E-GARCH 11 indicate the absence of leverage effect in the models.

REFERENCES

Baker, S.R., Bloom, N., Davis, S.J., Kost, K.J., Sammon, M.C & T. Viratyosin (2020). The Unprecedented Stock Market Reaction to COVID-19. *NBER working paper* 26945.

Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics,* 31:307-327.

COVID-19 and Wealth Creation Opportunities. (2020, April 1). *Thisday.* Retrieved from http://www.google.com/amp/s/www.thisdaylive.com/index,php/2020/04/01/covid-19-and-wealth-creation-oppotunities/amp.

Engle, R. F. (1982): Autogressive Conditional Heteroscedasticity with Estimates of the Variance of the United Kingdom Inflation. *Econometrica, 50*(4), 987-1008.

Gormsen, N. J., & R. S. J., Koijen (2020). Coronavirus: Impact on Stock Prices and Growth Expectations. Working Paper, University of Chicago Booth School of Business.

Onali, E. (2020). Covid-19 and stock market volatility, 360709711.

Ramelli, S., & A. F.,Wagner (2020). Feverish Stock Price Reactions to COVID-19. Retrieved from http://ssrn.com/abstract=3550274.

The Impact of COVID-19 on Nigeria's economy**.** (2020, March 26). *Stears Business Economy.* Retrieved from https://www.stersng.com/article/the-impact-of-covid-19-on-nigerias-economy.

Tiberiu, C.A. (2020). Coronavirus and financial volatility: 40 days of fasting and fear. https://www.researchgate.net/publication/339813612.

Wang, C., Li, W., Drabek, D., Okba, N.M.A., Haperen, R,N., Albert, D.M.E …J., Bosch (2020). A human monoclonal 1 antibody blocking SARS-CoV-2 infection, bioRxiv.

APPENDIX 1

TABLE I. UNIT ROOT TEST.

VARIABLE	LEVEL	FIRST DIFFERENCE	ORDER OF INTEGRATION
ASI*	-3.069721 (0.1213)	-5.160197 (0.0003)	I(1)
NGC*	-4.518064 (0.0030)		I(0)
NGD*	1.452687 (1.0000)	-4.581594 (0.0024)	I(1)
CCC*	-5.071258 (0.0005)		I(0)
CDT*	-1.955007 (0.6155)	-17.25050 (0.0001)	I(1)
USC**	1.548715 (1.0000)	-3.208121 (0.0923)	I(1)
USD**	-4.136764 (0.0092)		I(0)

Note: * and ** indicate 5% and 10% level of significant respectively

Source: Researchers' computation using E-VIEWS 9.0

Table II ARCH TEST

	Heteroskedasticity Test: ARCH		
F-statistic	13.34966	Prob.(F1,71)	0.0005
Obs R-squared	11.55340	Prob. Chi-Square(1)	0.0007

TABLE III GARCH (1,1)

MEAN EQUATION

Variables	Coefficient	Std. Error	Z-Statistic	Probability
ASI(-1)	0.026881	0.019452	1.381958	0.1670
NGC**	16.05616	9.313279	1.724007	0.0847
NGD	-152.8386	200.1772	-0.763516	0.4452
CCC	0.002706	0.027638	0.097912	0.9220
CDT	-0.156287	1.731236	-0.090275	0.9281

USC	0.006344	0.027164	0.233532	0.8153
USD	-0.084372	0.379575	0.222279	0.8241

Note: * and ** indicate 5% and 10% level of significant respectively

Source: Researchers' computation using E-VIEWS 9.0

Table IV, VARIANCE EQUATION, GARCH (1,1) TGARCH(1,1) & EGARCH (1,1)

Model	Parameter	Estimate	P-value
GARCH (1,1)	Γo γ1 θ	11987.15 0.508698 0.462231	0.1478 0.0101 0.0177
T-GARCH(1,1)	Γo γ1 ð θ	11493.68 0.479369 0.069205 0.467377	0.1933 0.0577 0.8228 0.0215
E-GARCH(1,1)	Γ0 γ1 € Ð	1236.655 6.375269 0.964580 0.373285	0.1356 0.0086 0.0005 0.0804

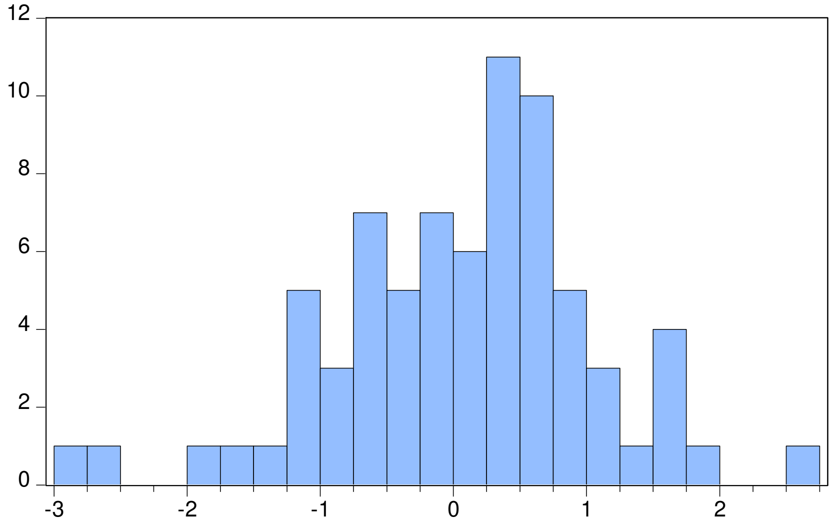
GARCH (1,1)

Serial correlation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |** |	. |** |	1	0.287	0.287	6.3399	0.012

*Probabilities may not be valid for this equation specification.

Normality test

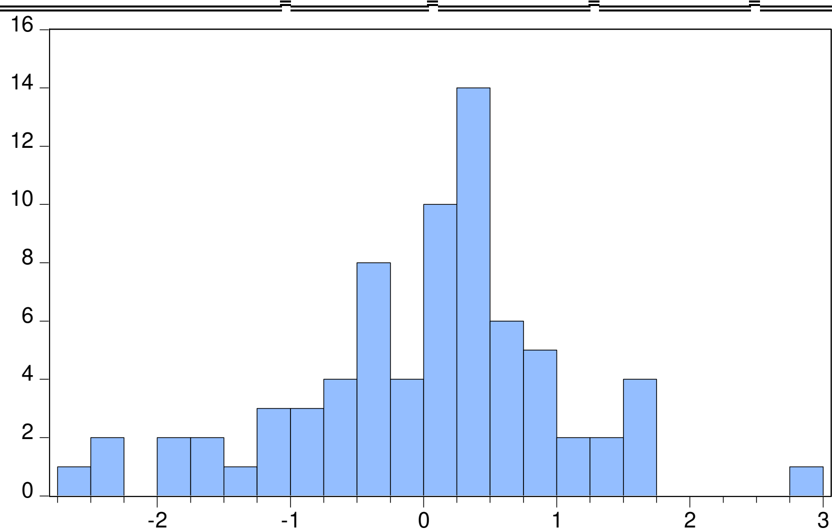


Series: Standardized Residuals	
Sample 1/02/2020 4/16/2020	
Observations 74	
Mean	0.085881
Median	0.232456
Maximum	2.644520
Minimum	-2.792644
Std. Dev.	1.002342
Skewness	-0.407312
Kurtosis	3.659201
Jarque-Bera	3.385991
Probability	0.183968

Heteroskedasticity Test: ARCH

F-statistic	0.588685	Prob. F(1,71)	0.4455
Obs*R-squared	0.600291	Prob. Chi-Square(1)	0.4385

T-GARCH(1,1)



Series: Standardized Residuals	
Sample 1/02/2020 4/16/2020	
Observations 74	
Mean	0.013157
Median	0.152073
Maximum	2.760358
Minimum	-2.603536
Std. Dev.	1.006637
Skewness	-0.356555
Kurtosis	3.554816
Jarque-Bera	2.517072
Probability	0.284070

Heteroskedasticity Test: ARCH

F-statistic	0.346364	Prob. F(1,71)	0.5580
Obs*R-squared	0.354392	Prob. Chi-Square(1)	0.5516

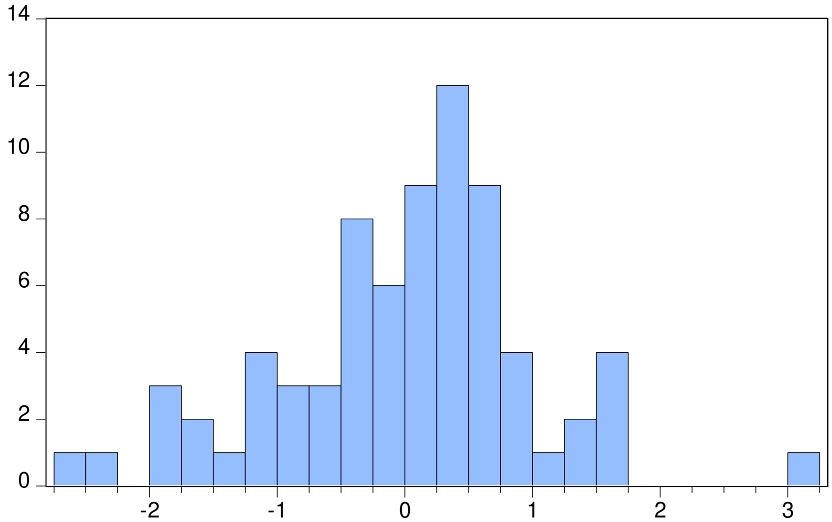
Serial correlation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |** |	. |** |	1	0.288	0.288	6.3839	0.012

*Probabilities may not be valid for this equation specification.

E-GARCH (1,1)

Normality **Test**



Series: Standardized Residuals	
Sample 1/02/2020 4/16/2020	
Observations 74	
Mean	0.003561
Median	0.170548
Maximum	3.068171
Minimum	-2.561440
Std. Dev.	1.006739
Skewness	-0.185133
Kurtosis	3.695234
Jarque-Bera	1.913044
Probability	0.384227

Heteroskedasticity Test: ARCH

F-statistic	2.40E-05	Prob. F(1,71)	0.9961
Obs*R-squared	2.47E-05	Prob. Chi-Square(1)	0.9960

Serial correlation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |** |	. |** |	1	0.269	0.269	5.5881	0.018

*Probabilities may not be valid for this equation specification.