Use GARCH Models to Build a Econometric Model to Predict Average Daily Closing Prices of the Iraqi Stock Exchange for the Period 2013-2016

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Abstract

This research aims to build a standard model for the analysis and prediction of the average daily closing price fluctuations for companies registered in the Iraq Stock Exchange for the period 07/01/2013 to 30/06/2016, using the conditional generalized Heteroscedasticity Generalized Autoregressive (GARCH) models. As these models deal with the fluctuations that occur in the financial time series.

The results of the analysis showed that the best model for predicting the volatility of average closing prices in the Iraq Stock Exchange is the EGARCH model (3,1), depending on the statistical criteria used in the preference between the models (Akaike Information Criterion, Schwarz Criterion), and these models can provide information for investors in order to reduce the risk resulting from fluctuations in stock prices in the Iraqi financial market.

Keywords

Conditional Variance, Return, Akaike Information Criterion, Autoregressive Conditional Heteroskedastic (ARCH), Mean Absolute Error.

Introduction

Most of the financial markets in the world suffer from fluctuations in the behavior of the shares of the companies that make up the market, this may be due to internal factors related to the market and its component companies, or due to external factors as a result of financial globalization and the link and integration between financial markets around the globe, which creates a state of absence Certainty and poor forecasting of the future behavior of stock prices, which is reflected in one way or another in investor hedging in buying or selling operations.

Pursuant to the above, the importance of harnessing statistical and standard analysis tools to explain the frequent fluctuations in the behavior of stock prices, whether the fluctuations are upward or downward, and one of these models is a set of self-regression models conditional on the difference in autoregressive conditional heteroskedastic model (ARCH) in building models It explains the current and future behavior of stocks that suffer from frequent fluctuations.

The Importance of Studying

The Iraqi market for securities is considered one of the emerging financial markets and is characterized by its small size and the low participation rate of the Iraq Stock Exchange in the gross domestic product, as it reached the highest participation rate (4.8%) in 2015, and the lowest participation rate (1.4%) in 2008, and the average prices the closure of the companies that make up the Iraq Stock Exchange suffer from fluctuations, as the average closing prices for the year 2013 reached approximately 6.98 points and in 2015 became approximately 4.57 points, so the issue of fluctuations needs to be studied and analyzed by employing standard models that are able and correctly to model these fluctuations and It can be used in the future to understand the behavior of stock prices in the Iraq Stock Exchange and this helps investors to trade in the market and reduce the margin of risk associated with financial investment.

The Study Problem

The Iraqi market for securities suffers from fluctuations in the prices of companies ’shares, which is reflected in the aggravation of the problem of uncertainty and risk in this market, which leads to poor trading and investment in the market, and this matter may have negative effects on the real side of the Iraqi economy because of the link between the financial market And real.

Purpose of the Study

Attempting to build a standard model that explains the behavior of fluctuations in the average price of the shares of companies that make up the financial market during the period from 1-7-2013 to 06-30-2016 through employing a set of (ARCH) models, and then the possibility of harnessing the proposed model for future forecasting.

Study Hypothesis

The employment of ARCH group models contributes to reducing the risk and uncertainty in investing and trading in the shares of companies that make up the Iraq Stock Exchange.

It helps the investor in predicting the future behavior of the share prices of the companies that make up the Iraq Stock Exchange.

Reference Review

There are many studies that have used ARCH models to analyze and predict future behavior in financial markets or build models that explain the fluctuations that occur in stock prices or exchange rates, and among these studies the following:

- Study (Afsal and Haque, 2016) The study aimed to uncover the relationship between the gold market and the money market in the Kingdom of Saudi Arabia by employing a group of (ARCH) models, and the most important findings of the study is the absence of a dynamic relationship between the gold market and the Saudi money market.
- A study (Ciucu, 2016). The study aimed to build a standard model to explain the behavior of the Romanian Ron currency exchange rate against the euro for the period from 1-3-2005 to 2-5-2015, and multiple models were employed from the ARCH group, and a model was chosen (ARCH) as the best model for explaining fluctuations in the Ron exchange rate against the euro.
- Study (Bunnag, 2016) This study sought to apply the forward exchange group of the dollar and the S and P 500 index for the daily data from 2010 to 2015, and the results of the study showed that the fluctuations in the futures price of crude oil affect the fluctuations of the futures price of gold, as well as the fluctuations of gold prices Futures affect the futures exchange rates of the dollar and the prices of the S and P 500 index futures.
- A study (Belhaj and Abaoub, 2015). This study aimed to employ the (ARCH) group to explain the fluctuations in trading volume of 43 companies in the Tunis Stock Exchange through daily data for the period from 1-2-2008 to 06-29-2012, and the results showed the existence of A positive relationship between trading volume and market returns, which is subject to ARCH family model behavior.
- Study (Ahmad, 2013) This study sought to employ (ARCH) family models to explain and predict fluctuations in inflation rates in Oman and monthly data covering the period January 2001 through December 2011, and the results of the study showed that the seasonal ARCH family models are superior to ARIMA models in predicting inflation rates in Oman during the study period.

What distinguishes our research is this from the few research that employs ARCH group models in analyzing and building a standard model to explain the fluctuations of the average prices of shares of companies traded in the Iraq Stock Exchange for the daily data for the

period from 1-7-2013 to 06-30-2016. If this period witnessed large fluctuations in the share prices of the Iraqi financial market companies as a result of the decline in crude oil prices and its reflection on all sectors of the Iraqi economy, including in particular the Iraqi financial market

The Theoretical aspect of ARCH Group Models

Suppose that $\{Y_t\}_{t=1}^{n}$ certain time series possess the following characteristics (Chris, 2014: 424):

$$1-E\left[Y_t \mid \sigma_{t-1}\right]=0 \qquad (1)$$

$$2-E\left[Y^2_t \mid \sigma^2_{t-1}\right]=\sigma_t^2 \qquad (2)$$

Where σ_t^2 represents the conditional variance of the time series $\{Y_t\}_{t=1}^{n}$

$$a_t=\sigma_t \varepsilon_t \qquad (3)$$

$$r_t=\mu+y_t \qquad (4)$$

Where ε_t represents random error, a_t represents error square, r_t represents return series μ It represents the average series

The conditional self-regression model of the invariance of variance (ARCH) (P) can be defined as that the instability of variance in the current period t is related to its instability in previous time periods and the mathematical formula for this model is (Johatha, kung, 2008: 287):-

$$\sigma_t^2=\alpha_0+\alpha_1 a_{t-1}+\alpha_2 a_{t-2}+\ldots+\alpha_p a_{t-p} \qquad (5)$$

Where

$$\alpha_i>0 \quad , \quad i=0,1,\ldots,p$$

When *p = 1*, and based on equation (5), we obtain the mathematical formula for the ARCH (1) model, which is: -

$$\sigma_t^{\ 2} = \alpha_0 + \alpha_1 a_{t-1} \tag{6}$$

As the unconditional variance can be defined by the following mathematical formula: -

$$\sigma_X^{\ 2} = \frac{\alpha_0}{1-\alpha_1} \tag{7}$$

In 1986, the researcher Bollersley expanded the ARCH (P) model with a more generalized model called the general self-regression model conditional on variance GARCH (p, q) as the conditional variance in this model in the t period does not depend only on the square of error in previous periods, but also on the conditional variance in the previous periods can be written in the following mathematical formula (Gebhard, jurgen, 2007: 252) are: -

$$\sigma_t^{\ 2} = \alpha_0 + \alpha_1 a_{t-1} + \alpha_2 a_{t-2} + ... + \alpha_p a_{t-p} + \beta_1 \sigma_{t-1}^2 + \beta_2 \sigma_{t-2}^2 + ... + \beta_q \sigma_{t-q}^2 \tag{8}$$

Equation (8) can be rewritten as follows:

$$\sigma_t^{\ 2} = \alpha_0 + \sum_{i=1}^{p} \alpha_i a_{t-i} + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 \tag{9}$$

Where $\sum_{i=1}^{p} \alpha_i + \sum_{j=1}^{q} \beta_j < 1$ (10)

When p = q = 1, from equation No. (9) we get the GARCH model (1,1) and its mathematical formula is: -

$$\sigma_t^{\ 2} = \alpha_0 + \alpha_1 a_{t-1} + \beta_1 \sigma_{t-1}^2 \tag{11}$$

The unconditional variance of this model can be defined by the following mathematical formula: -

$$\sigma_X{}^2 = \frac{\alpha_0}{1-(\alpha_1+\beta_1)} \tag{12}$$

There are other models that deal with sharp fluctuations that occur in the analysis of financial time series, including (the general self-regression model conditional on the instability of the integrated variance) as well as other models that address the sharp fluctuations that occur in the financial markets, including the general self-regression model conditional on the instability of the integrated variance (IGARCH), and the regression model General subjectivity conditional non-linear invariance of nonlinear variance (NGARCH) and general subjective regression model conditional non-invariance of exponential variance (EARCH).

The Practical Aspect

In order to achieve the goal of the research, the data on the average daily closing prices of the companies that make up the Iraq Stock Exchange for the period 1/7/2013 until 30/06/2016 were taken, where the number of views reached (795 views and the following was addressed: -

Time Series Analysis

It is important to note the general behavior of the time series to determine its paths during the study period - and Figure (1) shows the average closing prices of the companies in the Iraq Stock Exchange from 7/1/2013 to 30/06/2016.

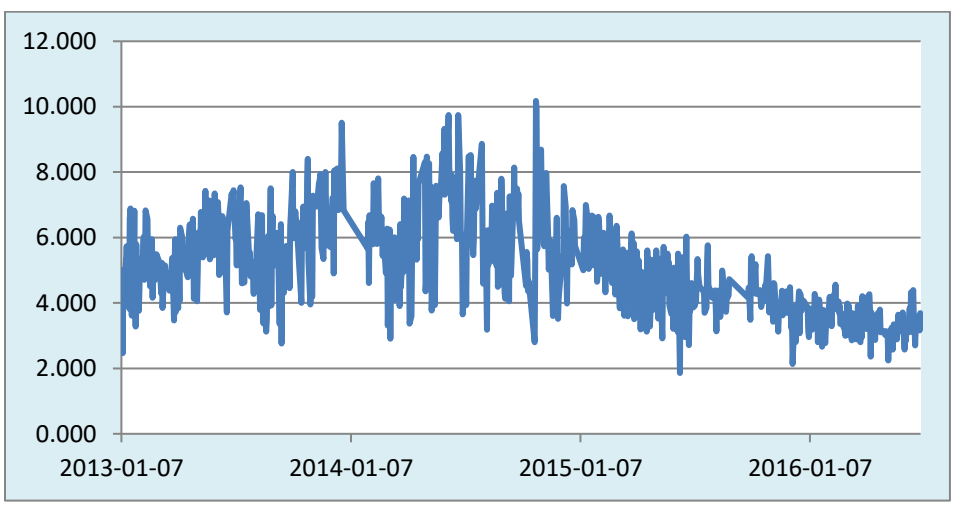

Figure 1 The temporal behavior of the average closing prices of the companies in the Iraq Stock Exchange

Source: From the researchers' work, using Excel program.

At first glance, the general behavior of the time series appears to be stable during the study period, and this can be confirmed by conducting stability tests for the time series.

Table 1 Stability tests for the time basket of average closing prices for the companies in the Iraq Stock Exchange at the original level of the data

	The equation		
	Fixed + direction	Fixed	
Type of test	-6.33189	-4.65182	ADF
	0.000	0.000	p -value
	-20.3415	-17.5786	P.P
	0.000	0.000	p -value

Source: From the researchers' work, using Eviews program.

The table shows the two most important tests for determining the stability of time series, which are the modified Dickey. And Fuller.1981 test and the Phillips-Peron PP test (Phillips, R., and P. Perron, 1986), and both tests show that the series is stable at the level. The original data is at a level of significance less than (0.01), meaning that the series has a constant average over time and a constant variance,

However, it is not possible to accept the stability of the time series definitively, as we notice the presence of fluctuations in the behavior of the chain, which requires relying on statistical and measurement tools to build a standard model to predict the behavior of average closing prices for companies that make up the Iraq Stock Exchange during the study period. It should be noted that the descriptive statistics of the time series are measured, as shown in Figure (2).

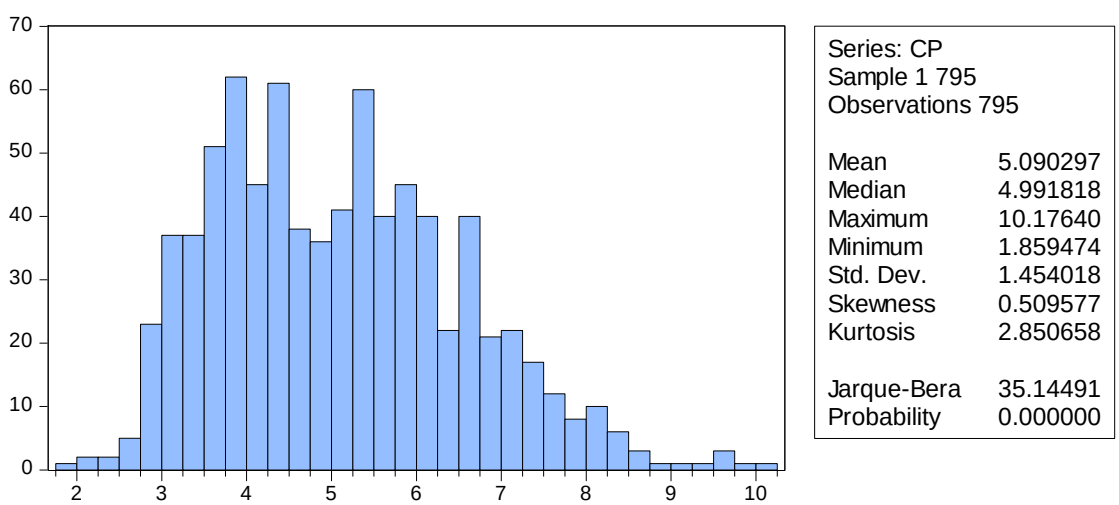

Figure 2 Descriptive statistical measures and the normal distribution of average daily closing prices of the companies in the Iraq Stock Exchange

Source: From the researchers' work, using Eviews program.

From the observation of Figure (2) and the descriptive statistics of scales, we find that the series does not follow the normal distribution (according to the JB test), and there is a clear fluctuation in the series if the highest mean is 10.17 while the lowest average is 1.85 (see Figure 1). For the time series at the beginning of 2015, the torsion modulus shows a slope to the right of the series mean because the skew coefficient is equal to 0.509.

Estimating ARCH Models

Since the time series suffers from obvious fluctuations, it will be necessary to apply ARCH models, and we will try to implement the different ARCH models, which are:

- **ARCH** - autoregressive conditional heteroskedastic model.
- **GARCH** - generalized autoregressive conditional heteroskedastic model.
- **EGARCH** - exponential generalized autoregressive conditional heteroskedastic model.
- **TARCH** - threshold generalized autoregressive conditional heteroskedastic model.

The comparison between these models will be done through the Akaike information criterion and SIC - Schwarz information criterion, and the smaller the values of these tests, the better (Helmut Lutkepohl, 2004):

$$\text{AIC(m)} = \text{Log det}\ (\textstyle\sum(e)) + \left(\frac{2}{T}\right) mK^2 \qquad (13)$$

$$\text{HQ(m)} = \text{Log det}\ (\textstyle\sum(e)) + \left(\frac{2loglogT}{T}\right) mK^2 \qquad (14)$$

To diagnose (ARCH) models, the series was estimated using the usual least squares method, depending on the original level of the series, according to the results of the stability of the time series, which showed that the series is stable at grade (0), and table (2) shows the results of the equation of the average regression of the closing prices of the Iraq Stock Exchange.

Table 2 Results of the formula regression average closing prices for the Iraq Stock Exchange

Dependent Variable: CP				
Method: Least Squares				
Date: 04/16/17 Time: 00:41				
Sample: 1 795				
Included observations: 795				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.090297	0.051569	98.70904	0.000
R-squared	0.000	Mean dependent var		5.090297
Adjusted R-squared	0.000	S.D. dependent var		1.454018
S.E. of regression	1.454018	Akaike info criterion		3.587795
Sum squared resid	1678.649	Schwarz criterion		3.59368
Log likelihood	-1425.149	Hannan-Quinn criter.		3.590057
Durbin-Watson stat	0.678585			

Source: From the researchers' work, using Eviews program.

Then the rest of the model was examined in Table (2), and Figure (3) shows the remainder of the above model.

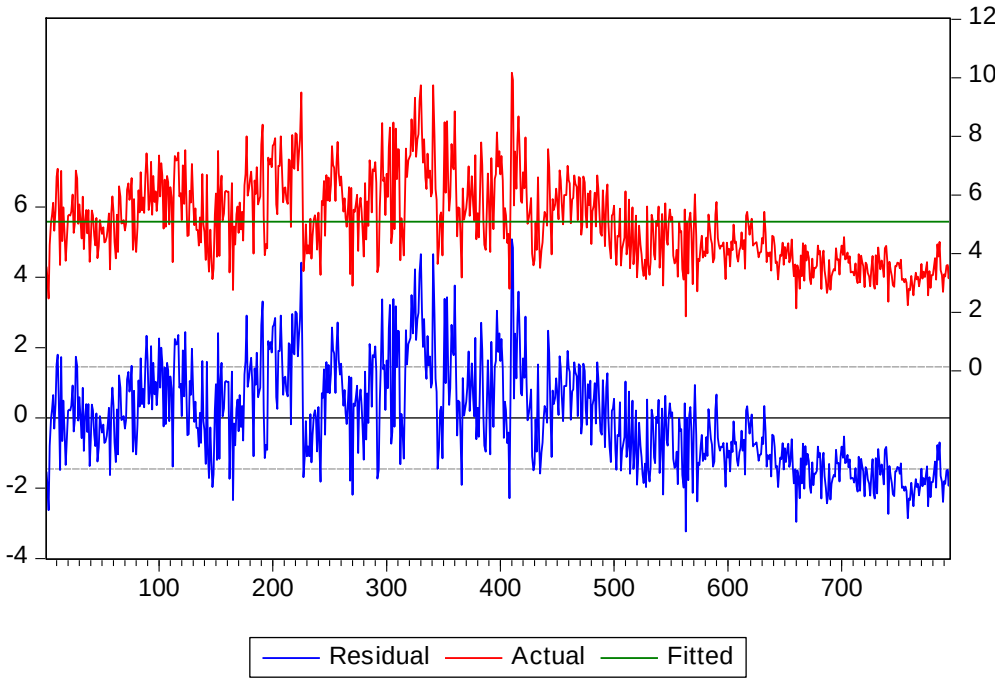

Figure 3 The remainder of the average closing price regression model for the Iraq Stock Exchange

We notice from Figure (3) the existence of long periods of upward fluctuations (positive) followed by downward (negative) fluctuations for the remainder, which gives an indication

of the need to use the ARCH family of models. It can be confirmed by conducting the (ARCH) residue test.

Table 3 ARCH test results for the rest

Heteroskedasticity Test: ARCH			
F-statistic	133.1444	Prob. F(1,792)	**0.000**
Obs*R-squared	114.2704	Prob. Chi-Square(1)	**0.000**

Source: From the researchers' work, using Eviews program.

We find that the probability value of the ARCH test confirms the existence of a variation effect in the average closing prices of the Iraq Stock Exchange during the study period.

Then, the ARCH group models were evaluated and as in Appendix (1), and criteria for selecting the best model were found, as in Table (4).

Table 4 Results of tests for AIC and SC values

	ARCH(0,9)	**GARCH(3,1)**	**EGARCH(3,1)**	**TARCH(7,0)**
Akaike info criterion	**3.01545**	**2.916415**	**2.689941**	**2.914437**
Schwarz criterion	**3.086067**	**2.957608**	**2.737018**	**2.95563**

Source: From the researchers' work, using Eviews program.

Table (4) shows that the best model is EGARCH, as it achieved the lowest values according to the AIC and SC test.

Analyzing the EGARCH Model

Ensure that the EGARCH model is free from ARCH by performing the ARCH test on the residues, as shown in Table (5).

Table 5 ARCH test of the EGARCH model

Heteroskedasticity Test: ARCH			
F-statistic	**2.541789**	**Prob. F(1,792)**	**0.1113**
Obs*R-squared	**2.540056**	**Prob. Chi-Square(1)**	**0.111**

Source: From the researchers' work, using Eviews program.

Table (5) shows the absence of the remainder of the ARCH EGARCH pattern at a level less than (0.05). Also, it is necessary to ensure the normal distribution of the residuals, and Figure (4) shows the normal distribution curve of the EGARCH model.

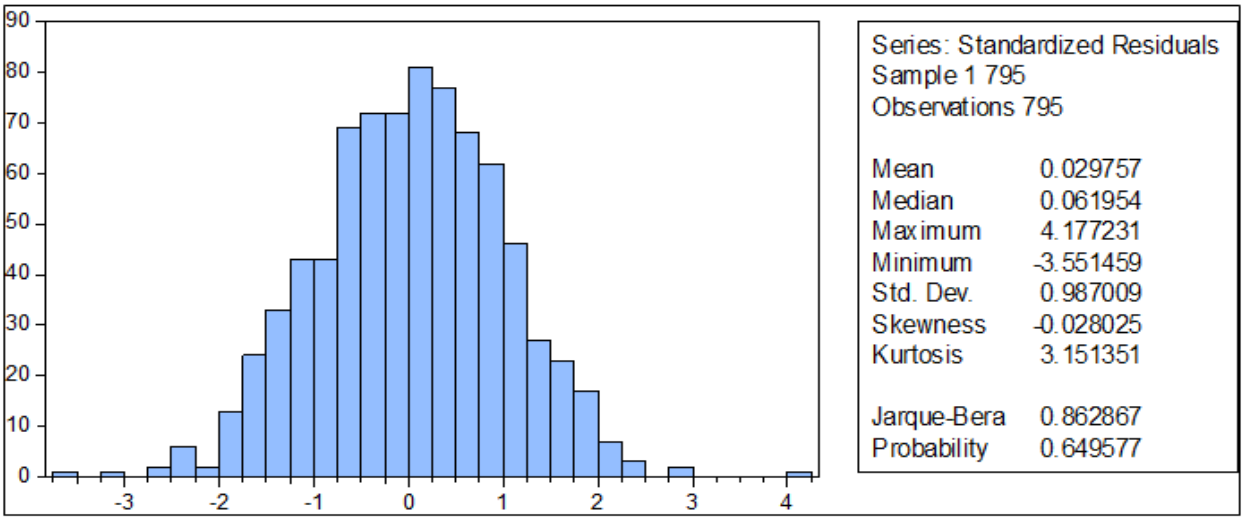

Figure 4 Normal distribution curve of the EGARCH model

Close to zero, and the coefficient of flocculation is close to number (3), and this confirms the normal distribution of the remainder and that these tests support the diagnosis of the chosen model to predict the average closing prices of the companies in the Iraq Stock Exchange during the study period.

Forecasting using the EGARCH Model

In order to ensure the predictive power of the diagnosed model, it can be used with criteria of predictive power, which are as follows (Brooks, 2014: 239):

- Root Mean Squared Error.
- Mean Absolute Error.
- Mean Absolute Percent Error.
- Theil Inequality Coefficient.

Table (6) shows the values of the predictive power parameters for the selected model.

Table 6. Criteria for the predictive power of the EGARCH model

	ARCH(0,9)	GARCH(3,1)	EGARCH(3,1)	TGARCH(7.0)
Root Mean Squared Error	**1.393935**	**1.185274**	**1.035517**	**1.081347**
Mean Absolute Error	**1.094085**	**0.885708**	**0.786971**	**0.81729**
Mean Abs. Percent Error	**21.75193**	**17.27126**	**16.18177**	**16.87851**
Theil Inequality Coefficient	**0.139899**	**0.116397**	**0.099384**	**0.103624**

Source: From the researchers' work, using Eviews program.

The table shows that all the predictive power standards achieved the lowest values when the EGARCH model, which means the possibility of this model in prediction due to its high predictive power compared to the ARCH model group, see Figure (6).

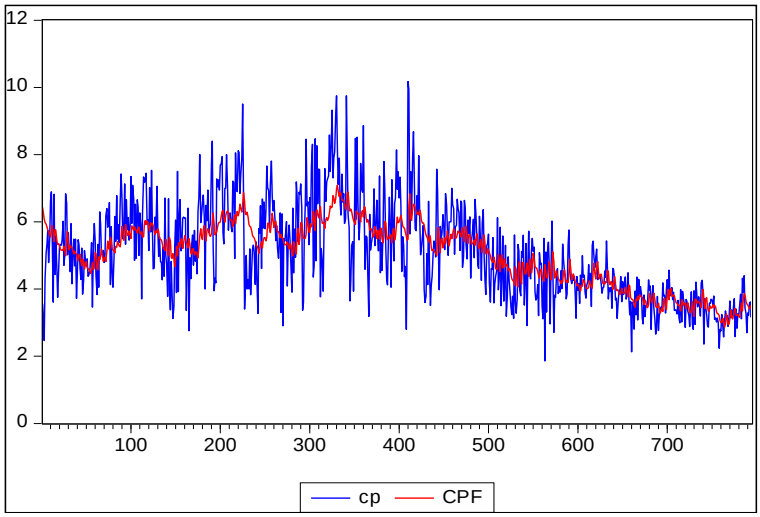

Figure 5 Predicted (CPF) and actual values (CP) of average closing prices for the companies in the Iraq Stock Exchange

Figure 5 Shows the predicted values compared to the actual values of the average closing prices of the Iraq Stock Exchange companies during the period from 01/7/2013 to 06/30/2016

Conclusions

1. The results of the standard analysis showed an effect of variation on the average daily closing prices of the Iraqi market for daily securities during the studied period, as well as the results of the ARCH test for the remainder, which means there are fluctuations in the Iraqi stock market, and this requires the use of ARCH group models to predict the average closing prices of the component companies for the market.
2. The best standard model for estimating the studied time series data is the EGARCH model (3,1) among the other ARCH models because the model has the lowest value for the statistical criteria used (Akaike Information Criterion, Schwarz Criterion), in the preference between the studied models, which confirms the importance The use of ARCH models in analyzing the fluctuations occurring in the Iraqi financial market, thus reaching correct and accurate conclusions that serve the dealers in the market.
3. The results of the standard analysis showed that the residues of the selected model (3.1) EGARCH were naturally distributed, and this was confirmed by the (J-B) test and the torsion coefficient whose value was close to zero, as well as the value of the flocculation coefficient was greater than 3. Which gives an impression and emphasis on the

importance of using ARCH family models in forecasting financial time series if they contribute to obtaining estimates that meet the statistical conditions for accurate forecasting. This gives more power to rely on these models in forecasting.

4. The selected model (3.1) EGARCH showed a good predictive ability compared to the other ARCH models, which leads to the possibility of using it in predicting the average values of the daily closing prices of the Iraqi market for securities outside the studied period.

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Appendix 1 ARCH Models

ARCH model				
Dependent Variable: CP				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 04/16/17 Time: 17:38				
Sample: 1 795				
Included observations: 795				
Convergence achieved after 65 iterations				
Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-2)^2 + C(6)*RESID(-3)^2				
+ C(7)*RESID(-4)^2 + C(8)*RESID(-5)^2 + C(9)*RESID(-6)^2 + C(10)				
*RESID(-7)^2 + C(11)*RESID(-8)^2 + C(12)*RESID(-9)^2				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(GARCH)	0.979842	0.035655	27.48143	0.000
C	4.64783	0.043406	107.0769	0.000
	Variance Equation			
C	0.085709	0.01741	4.923059	0.000
RESID(-1)^2	0.17093	0.023715	7.207758	0.000
RESID(-2)^2	0.198202	0.01411	14.04679	0.000
RESID(-3)^2	0.112626	0.019343	5.822443	0.000
RESID(-4)^2	0.106424	0.015936	6.678155	0.000
RESID(-5)^2	0.113805	0.017991	6.325509	0.000
RESID(-6)^2	0.113331	0.015962	7.09995	0.000
RESID(-7)^2	0.074846	0.011773	6.35735	0.000
RESID(-8)^2	0.145209	0.01472	9.864436	0.000
RESID(-9)^2	0.071673	0.012379	5.790005	0.000
R-squared	0.345472	Mean dependent var		5.090297
Adjusted R-squared	0.344647	S.D. dependent var		1.454018
S.E. of regression	1.177084	Akaike info criterion		3.01545
Sum squared resid	1098.722	Schwarz criterion		3.086067
Log likelihood	-1186.64	Hannan-Quinn criter.		3.042586
Durbin-Watson stat	1.153936			
GARCH model				
Dependent Variable: CP				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 04/16/17 Time: 17:41				
Sample: 1 795				
Included observations: 795				
Failure to improve likelihood (singular hessian) after 96 iterations				
Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(3) + C(4)*RESID(-1)^2*(RESID(-1)<0) + C(5)*GARCH(-1) +				
C(6)*GARCH(-2) + C(7)*GARCH(-3)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(GARCH)	0.860491	0.054376	15.82497	0.000
C	4.878201	0.060765	80.28033	0.000

	Variance Equation			
C	0.00247	0.001064	2.322759	0.020
RESID(-1)^2*(RESID(-1)<0)	-0.0574	0.006232	-9.20977	0.000
GARCH(-1)	1.034908	0.078538	13.17719	0.000
GARCH(-2)	-0.80081	0.10961	-7.30594	0.000
GARCH(-3)	0.778064	0.062597	12.42973	0.000
R-squared	0.366707	Mean dependent var		5.090297
Adjusted R-squared	0.365908	S.D. dependent var		1.454018
S.E. of regression	1.157832	Akaike info criterion		2.916415
Sum squared resid	1063.077	Schwarz criterion		2.957608
Log likelihood	-1152.28	Hannan-Quinn criter.		2.932244
Durbin-Watson stat	1.100646			
EGARCH modl				
Dependent Variable: CP				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 04/16/17 Time: 18:08				
Sample: 1 795				
Included observations: 795				
Convergence achieved after 64 iterations				
Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.7)				
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)				
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1)) + C(7)				
*LOG(GARCH(-2)) + C(8)*LOG(GARCH(-3))				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(GARCH)	1.13278	0.081553	13.89017	0.000
C	5.210283	0.070066	74.36222	0.000
	Variance Equation			
C(3)	-0.08579	0.018634	-4.6041	0.000
C(4)	0.094012	0.022733	4.135419	0.000
C(5)	0.127461	0.016817	7.579377	0.000
C(6)	0.972306	0.084101	11.56115	0.000
C(7)	-0.55984	0.126556	-4.42368	0.000
C(8)	0.572301	0.085685	6.679148	0.000
R-squared	0.471722	Mean dependent var		5.090297
Adjusted R-squared	0.471055	S.D. dependent var		1.454018
S.E. of regression	1.057486	Akaike info criterion		2.689941
Sum squared resid	886.794	Schwarz criterion		2.737018
Log likelihood	-1061.25	Hannan-Quinn criter.		2.708031
Durbin-Watson stat	1.467494			
TGARCH model				
Dependent Variable: CP				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 04/16/17 Time: 18:48				
Sample: 1 795				
Included observations: 795				
Convergence achieved after 72 iterations				

Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) +				
C(6)*RESID(-2)^2 + C(7)*RESID(-2)^2*(RESID(-2)<0) + C(8)*RESID(				
-3)^2 + C(9)*RESID(-3)^2*(RESID(-3)<0) + C(10)*RESID(-4)^2 + C(11)				
RESID(-4)^2(RESID(-4)<0) + C(12)*RESID(-5)^2 + C(13)*RESID(				
-5)^2*(RESID(-5)<0) + C(14)*RESID(-6)^2 + C(15)*RESID(-6)^2				
*(RESID(-6)<0) + C(16)*RESID(-7)^2 + C(17)*RESID(-7)^2*(RESID(				
-7)<0) + C(18)*RESID(-8)^2 + C(19)*RESID(-9)^2				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(GARCH)	1.309542	0.096455	13.57668	0.000
C	5.078828	0.074353	68.30658	0.000
	Variance Equation			
C	0.225837	0.034509	6.544369	0.000
RESID(-1)^2	0.301482	0.04072	7.40371	0.000
RESID(-1)^2*(RESID(-1)<0)	-0.3297	0.040285	-8.18431	0.000
RESID(-2)^2	0.300055	0.046558	6.444702	0.000
RESID(-2)^2*(RESID(-2)<0)	-0.28302	0.048896	-5.78809	0.000
RESID(-3)^2	0.183914	0.02967	6.198593	0.000
RESID(-3)^2*(RESID(-3)<0)	-0.21322	0.030675	-6.95108	0.000
RESID(-4)^2	0.171216	0.027743	6.171566	0.000
RESID(-4)^2*(RESID(-4)<0)	-0.19055	0.029552	-6.44798	0.000
RESID(-5)^2	0.18605	0.026203	7.100385	0.000
RESID(-5)^2*(RESID(-5)<0)	-0.14579	0.028576	-5.1019	0.000
RESID(-6)^2	0.161069	0.02755	5.846471	0.000
RESID(-6)^2*(RESID(-6)<0)	-0.08947	0.029612	-3.02133	0.003
RESID(-7)^2	0.106515	0.017342	6.142113	0.000
RESID(-7)^2*(RESID(-7)<0)	-0.06703	0.021615	-3.10125	0.002
RESID(-8)^2	0.042475	0.012259	3.464686	0.001
RESID(-9)^2	0.063922	0.008696	7.351057	0.000
R-squared	0.423216	Mean dependent var		5.090297
Adjusted R-squared	0.422489	S.D. dependent var		1.454018
S.E. of regression	1.104968	Akaike info criterion		2.869948
Sum squared resid	968.2175	Schwarz criterion		2.981757
Log likelihood	-1121.8	Hannan-Quinn criter.		2.912913
Durbin-Watson stat	1.562468			