ARIMA Model To Forecast The ISX60 Indicator: An Applied Study An Iraqi Financial Market

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Abstract: This research aims to carry out the forecasting process in the Iraq Stock Exchange Index using the integrated regression model of moving averages "ARIMA", as the sample community is the Iraq Stock Exchange and the research sample is the 102 companies listed in the Iraq Stock Exchange and its number is (102) companies divided into seven sectors As follows (banks - communications - insurance - services - industry - hotels and tourism - agriculture, the study period was extended from (1/1/2019) to (1/31/2019), while statistical methods were used (arithmetic average - percentage change – T- test - the scatter plot – Q plot - and the autocorrelation coefficient), across applications (SPSS V25-Excle 2020- Py Charme2020) to compare results and test hypotheses, as it was found that the model was very good for predicting the full December sessions and was accurate at the reliability level (95%).

Introduction

The biggest challenges facing financial managers are the changes that occur in the financial markets, so by using forecasting models, financial managers will be able to rectify some of these challenges by drawing a prior picture of these changes by means of forecasting models, as well as converting those variables to their advantage in increasing profits and making decisions. In this research we will deal with the mechanism of action of the model (ARIMA) and the method of its application to predict the market index of the research sample, while we will deal with the technical analysis of the financial markets because it is the basis for the prediction process. Show results, as well as test hypotheses.

Methodology

The research methodology represents a series of organized steps that the researcher undertakes for the purpose of studying a specific topic and reaching valuable results that contribute to solving problems, as the methodology is the beacon that guides the researcher during his research and the roadmap that leads him towards satisfactory scientific results.

A. **Research problem**: We will embody the research problem through a specific question (Is it possible to predict the Iraq Market Index of Financial Markets using the (ARIMA) model?

B. **The importance of research**: The importance of research has crystallized in the extent of the possibility of predicting the Iraq Stock Exchange Index.

C. **Research hypotheses**: The Iraq Stock Exchange index can be predicted at a significant level (a<0.05).

Literature Review

Financial markets represent the markets in which money is transferred from people who have a surplus of available funds to people who need money, as financial markets represent the cornerstone of raising the economic efficiency and economic growth of countries, by directing money from people who do not use it productively, To those who will employ it better, and the weakness in the performance of financial markets is a major reason for the occurrence of financial and economic crises and the collapse of the financial system, and the stock market is the largest among the financial markets (Mishkin, 2016: 48).

Types of financial markets:

There are several types of financial markets that are based on financial exchanges according to the type of financial instrument that they want to trade in. There are several types of financial instruments that can be invested in by savers who want to increase their profits, and are classified as follows:

1. **Commodity market**: A financial market that is traded through the primary economic sector, instead of manufactured products, as solid basic materials are traded before refining such as crude oil and gold, and the oldest way to invest in commodities is futures contracts, so commodities are secured with physical assets. Financial commodity markets can include you, physical investments

And derivatives (Geisst, 1989: 90).

2. **The money market**: the money market represents one of the constituent parts of the economy, as it provides short-term funds, and the basis for its dealings is short-term loans, whose repayment periods are a year or less, and from this point of view money in the money market has become a commodity that is traded resulting in returns to its owners (Keown et al, 2017: 51).

3. **Derivatives market**: The derivative market is a financial market in which derivatives are traded, and financial derivatives represent futures contracts and options derived from several forms of assets. The derivative

market is divided into two parts, the derivatives traded in the organized market and the derivatives traded outside the organization, which are traded in particular (Bradfield, 2017: 433).

4. **Capital market or stock market**: a financial market in which long-term debt instruments that have a repayment period of more than a year or securities that are based on equity, as the capital market directs the wealth of savers to those who can employ them in a long productive use Forwards, the capital markets are divided on the basis of type Stock: (Matos, 2001: 11), (Arnold, 2012: 219-328).

Market Indicator: expresses numbers that represent the stock's position during certain periods of time through some mathematical relationships that can be translated into a chart, and most stock markets have their own index (Temple, 2003: 174)

Forecasting and Technical Analysis

Technical analysis represents the process of determining the trends in the movement of stock prices according to the change in the orientation of investors and their positions in the financial market, as the movements of the financial markets result from what the investors expect, and the business cycle usually repeats itself, so investors behave the same behavior in most situations, so it can be inferred in the financial forecasting process. (Pring, 2002: 2,10)

Financial forecasting: The term forecast represents the process of developing future estimates related to a certain thing based on historical data for it, and it is defined in terms of financial management as the science and art of using advanced statistical tools in determining the trends of stocks in the future based on their previous behavior, and alternative relationships between prices must be identified. Stocks and their surroundings during the process of a prediction (Evans, 2003: 20).

The prediction is divided into:

1. **Qualitative prediction**: guessing is the basis for this type of prediction, as decisions are made based on intuition and experience, as it depends on the ability of the human mind to distinguish links between events and understand patterns.

 In ways that computers cannot display, but this makes processing a lot of data simultaneously and in a short period of time a great challenge for the human mind (Janse, 2020: 4).

2. **Quantitative prediction**: Quantitative forecasts are used in analyzing large amounts of past data to identify patterns and trends, and in general, quantitative forecasting is less deviating from qualitative (speculative) prediction, however, the lack of availability of historical data reduces the effectiveness of quantitative prediction, so this is usually used. The type of forecasting in speculation due to the ease of availability and accuracy of stock data, and from this way we take:

 AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS

The "ARIMA" model is an advanced model taken from the "Chaotic Dynamics" model of Box & Jankins1976), as it consists of simple solution mechanisms that follow complex paths and time series (Soofi & Cao, 2002: 214). ARIMA is looking for the ideal model with the lowest average error in dealing with the data, so the model uses the current level of volatility as an indicator of future fluctuations, and this prediction is best under the assumption that the volatility behaves randomly, as it precedes the events of volatility in light of the available information (Knight & Satchell, 2007:104)

Data and analysis

The use of the "ARIMA" model requires a relatively long time series, so we will need daily data for the stock index in the Iraq Stock Exchange for the year (2019), as the statistical methods represented by moving average and self-regression were used for the purpose of eliminating the discrepancy in the series because the model works with stable chains, so it must be Determine which model is best for ARIMA (p, d, q):(Kirchgassner & Wolters, 2007: 28)

$$X_t - \alpha_1 X_{t-1} - \cdots - \alpha_{p'} X_{t-p'} = \varepsilon_t + \theta_1 \varepsilon_{t-1} + \cdots + \theta_q \varepsilon_{t-q} \quad \cdots(1)$$

As:

X_t and at are data on variables in the period t, Ø the regression coefficient

P: Self-regression rank.

d: the number of variances for the chain to become stable.

q: the rank of moving average.

The best model is reached based on the criteria for accuracy of prediction and statistical tests, and the prediction process is carried out in several steps as follows:

1. Determining the stability of the time series: This is obtained by analyzing the indicator data during the time series as shown in Figure (1).

Figure 1

The ISX60 indicator in 2019

Since we find that the chain is unstable, that is, the chain has a non-constant direction and contrast, which may be decreasing or increasing, and this is the nature of all economic indicators.

2 . Accuracy standards and statistical tests: It helps in determining whether the series data are homogeneous or not, and determining the best model for work, as in Figure (2).
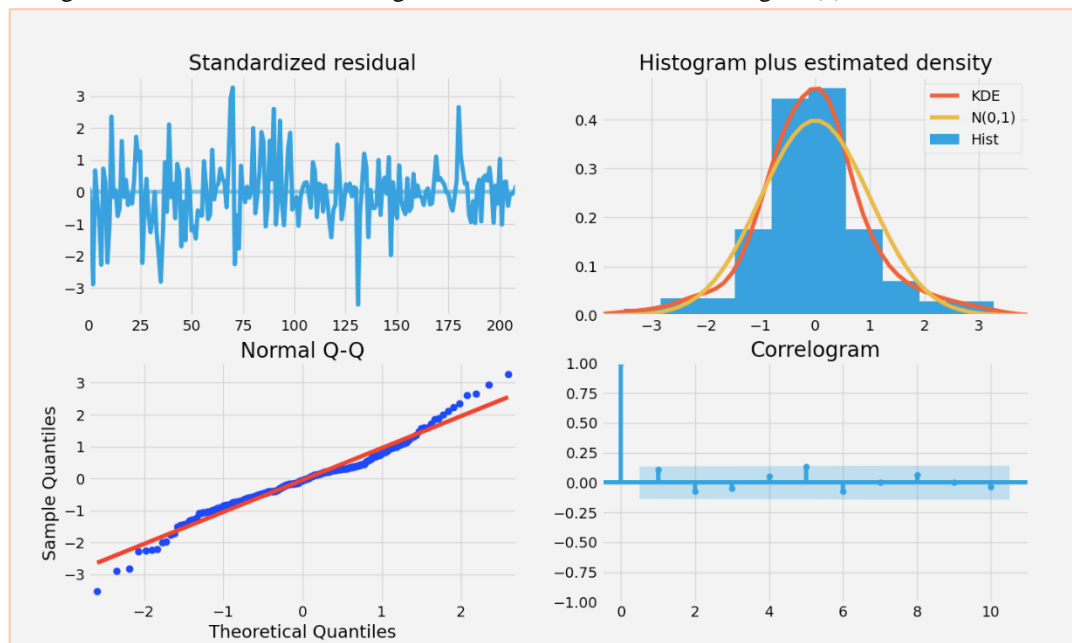

Figure 2

ARIMA model building

As the benefit of the histogram is in determining the compatibility of the real data distribution with the normal distribution and finding the differences in order for the series to become stable. Density, according to which a large number of data is distributed, through which it can determine whether the data is sufficient to perform the prediction of the model or not, and the standard remainder shows the ratio between the real number and the expected number and the standard deviation of the expected number in the (k) square, which represents a statistical approach to testing hypotheses Distribution, as the normal distribution of the data has a certain value based on the change of data in the chain.

The figure also shows the "Q-Q" chart, which is one of the statistics techniques to test the suitability of the probability distribution with the theoretical distribution of the data. This technique is used in

determining the outliers that must be modified to arrive at the theoretical structural assumptions of a large set of data.

In addition to the autocorrelation scheme, the autoregressive order of the data correlation is determined, which does not exceed the zero value, so its value will be zero. We conclude from this that the best model (0,1,0) for the application of the "ARIMA" model

3. Prediction: The implementation of the model is predicted by the statistical program and choosing the best model that has been determined in advance, as the table shows the prediction of the December sessions index (2019). An indicator of (19) sessions was predicted during the month.

Table 1

Forecasting the market indicator for December 2019

	trading session	Forecast	Real	The highest forecast range	The lowest forecast range
1	01/12/2019	485.71	484.26	491.7	479.71
2	02/12/2019	485.61	484.3	494.09	477.14
3	03/12/2019	485.52	484.31	495.9	475.14
4	04/12/2019	485.42	484.72	497.41	473.44
5	05/12/2019	485.33	484.26	498.73	471.93
6	08/12/2019	485.23	484.8	499.91	470.55
7	09/12/2019	485.14	483.26	500.99	469.28
8	11/12/2019	485.04	484.89	501.99	468.09
9	12/12/2019	484.95	483.91	502.93	502.93
10	15/12/2019	484.85	486.8	503.81	465.9
11	16/12/2019	484.76	487.22	504.64	464.88
12	17/12/2019	484.67	488.93	505.43	463.9
13	18/12/2019	484.57	490.89	506.18	462.96
14	19/12/2019	484.48	492.31	506.9	462.05
15	22/12/2019	484.38	493.93	507.59	461.17
16	23/12/2019	484.29	491.5	508.26	460.32
17	24/12/2019	484.19	493.25	508.9	459.48
18	25/12/2019	484.1	493.2	509.52	458.67
19	26/12/2019	484	493.76	510.13	457.88
	Average	484.85	487.92	502.89	468.7

As we find from Table (1) that the prediction process according to the "ARIMA" model produced three values for each prediction process for each session. There was an upper limit to the prediction values and a lower limit, and the average was taken and counted as the approximate prediction for that session. All sessions did not exceed the prediction of a session, but was inherent in the movement of the index over the course of the trading sessions.

As the first (10) sessions were predicted very close to the real index of trading sessions, each of the sessions recorded (1,2,3,4,5,6,7,8,9,10) from the date of (1/12) / 2019) to (12/15/2019) forecasting the market index reached (485.71), ((485.61), (485.52), (485.42), (485.33), (485.23), (485.14), (485.04) - (484.95) - 484.85) points respectively.

While the rest of the sessions for the month of December represented by the session (11,12,13,14,15,16,17,18,19) from the date (12/16/2019) to (12/26/2019), predicting the market index with a slight difference It did not go beyond the prediction range of (484.76), (484.67), (484.57), (484.48), (484.38), (484.29), (484.19), (484.1), (484.0) points, respectively. The prediction was closest to the last ten sessions, as the model achieved the highest prediction limit which reached (503.81), (504.64), (505.43), (506.18), (506.9), (507.59), (508.26), (508.9) and (509.52)) And (510.13) points, respectively.

Figure (3) shows the graph of the forecasting process for the Iraq Stock Exchange Index for the December (2019) trading sessions with the "ARIMA" model.
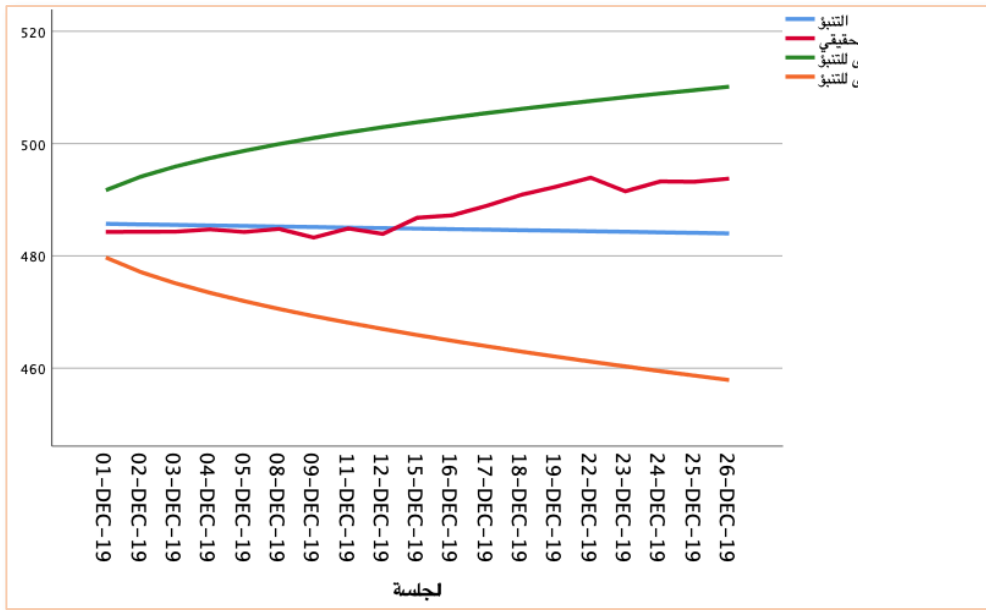
Figure (3)

Predicting the Iraq Stock Exchange Index for the month of December (2019) according to the "ARIMA" model
It is noticed that the prediction process w   acterized by accuracy within the lowest range of (468.70) points, and the average of the highest range (302.89) points at the level of reliability (95%).

As in this, the forecasting process is acceptable, as the figure shows the clarification between the real index and the predicted indicator during the month of January (2019), as the market index statement in the first (10) sessions was less than the discrepancy in the remaining sessions of the month, but as previously stated. His mention did not go beyond predictions.

In addition to the index prediction rate during the month's sessions, it reached (484.85) points, while the real index rate was (487.92), i.e. a change rate of (0.6%), and this is a very small percentage of change.

The accuracy of forecasting can also be increased by increasing the length of the time series, as the model improves the accuracy of forecasting as the time series increases, so if the Iraq Stock Exchange Index data were used from the year (2009), that is, since the market shifted to the electronic system and the index started to work to this day , Will be different from what we harvested during this period despite the modeling work well during this period, as the figure (4) shows the prediction of the Iraq Market Index of financial stocks by (10%) of the total market sessions during (2019-2018).

Figure (34) also shows the prediction of the Iraq Market Index of financial markets by (10%) of all market sessions during (2018-2019).
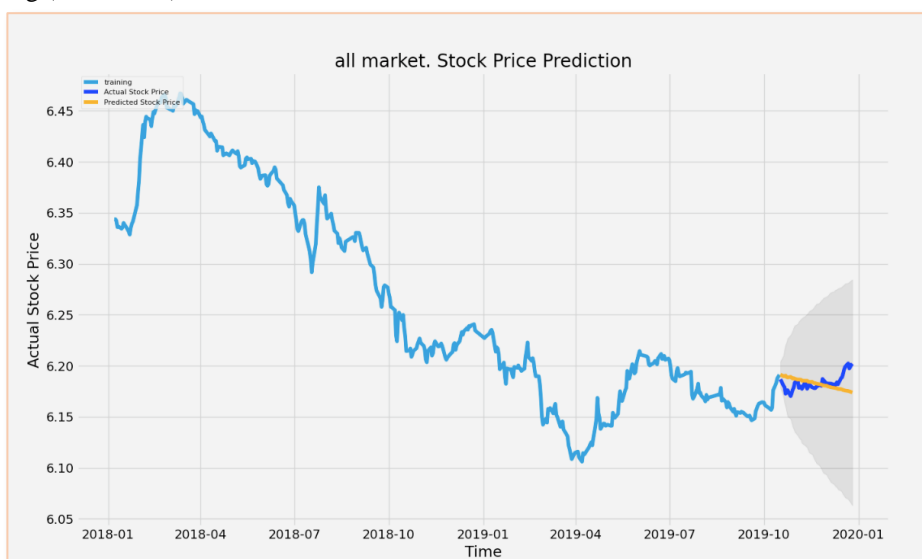

Fig (34)

Prediction (10%) of sessions (2019-2018)

Since we notice from the previous table the high accuracy of prediction, the forecast line may show the average between the highest range of prediction and the highest range of prediction and the fluctuation of values between them in a congruent manner, evidence of the accuracy of the prediction.

Hypothesis Testing

We notice from Table (2) the coefficients and values of the effect between the real index values and the predicted index values.

Table (2)

		Mean	Std. Deviation	t	Sig. (2-tailed)
Pair	Real - forecast	16.924	2.359	1.588	0.00

As the table shows that the prediction at the level of significance is (0.00) and it is less than the value of (0.05), so the test's significance was fulfilled. As for the effect of () calculated, it is (1.588), which is less than its value (1.96), i.e. The differences in the influences are not large, so we turn to accepting a loan that the market index can be predicted.

Results

We have reached a prediction of a good and highly accurate Arima model for forecasting the index of the Iraq Stock Exchange (ISX60), as during the trading sessions that were predicted for the index, which reached (19) sessions, the prediction did not go out, not once from the forecast range represented by the highest and lowest point. For prediction, which indicates that the model succeeded in performing the prediction function during this period under those conditions**.**

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