Share price forecast: using ARIMA model special study on Amman Stock Exchange (ASE)

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Abstract. The goal of this research is to explore the events and Stock price prediction of Amman Stock Exchange (ASE) so for their scientific importance in economics for predict financial time series, using the ARIMA model for the active Participation's of stock market as well as macro decision makers to be able to predict trend of the market. The data examined in the paper had been collected from Amman Stock Exchange (ASE) from 2012 to 2018. 15 well-known banks on the ASE have thus been selected for stock price forecasting. The data set examined information about: opening price, closing price Concerning the results of previous researches, which confirm the relative superiority of linear models in price index prediction, an appropriate model has been offered in this research ARIMA model, in order to predict price index of Amman Stock Exchange. The results show ability of a to predict stock price time series data using ARIMA model, but more variables should be studied to support results and non-impartiality.

Keywords: price, ARIMA model, time series, forecasting, Amman stock exchange (ASE).

1. Introduction

All investors, investment banks, hedge funds, etc., they financial decision makers. They will need to predict prices of financial assets such as stocks, bonds, etc. in order to make accurate financial decisions. It is the main reason that efforts for improving the efficiency for forecasting models has never been stopped in the finance. Banking time series data and financial time series in general is very hard in decomposition and forecasting because the data are non-stationary and non-linear with high heteroscedasticity (Pai and Lin, 2005; Wang et al, 2012; Wei, 2013). The next plan of the investors is to enhance their profits less risk. This idea force the researchers to develop many predicting models such as hybrid models and ARIMA models. The ARIMA procedure analyzes and forecasts equally spaced univariate time series data, transfer function data, and intervention data by using the autoregressive integrated moving average (ARIMA) or autoregressive moving average (ARMA) model.

An ARIMA model predict a value in a response time series as a linear combination of its own past values, past errors and current and past values of other time series. Pankratz (1991) refers to the ARIMA model as dynamic regression

Whereas, rarely to find any article that utilize Amman Stock Exchange using ARIMA model in forecasting such as (Alwadi, 2015).

This paper is organized as follows: The following section describes the literature review of the method used. Section 2 provides a description of the data set. Section 3 provides the methodology and research framework. Section 4 describes the ARIMA Box-Jenkins. In Section 5, we mention the conclusion and recommendations.

2. Literature review

Stock price prediction is regarded as an important topic in finance and economics which has spurred the interest of researchers over the years to develop better predictive models Ayo, Adewumi, Adebiyi [17]. And it's been autoregressive integrated moving average (ARIMA) models have been explored in literature for time series prediction. This research came to progress extensive process of building stock price predictive model using the ARIMA model. the Data were collected stock data obtained from New York Stock Exchange (NYSE) and Nigeria Stock Exchange (NSE) are used with stock price predictive model developed. The results showed obtained revealed in this research that the ARIMA model has a strong potential for short-term prediction and can compete favourably with existing techniques for stock price prediction.

The idea of research came to clarify demonstrate the usefulness for Stock price prediction over time is a problem of practical concern in economics and of scientific interest in financial time series forecasting. The matter in this research also expands toward detecting the variables that play an important role in its behaviour Stoean, Catalin Stoean, Sandita [13]. the Researchers' studied appoints an ARIMA model with regressors to predict the daily return of ten companies enlisted in the Romanian stock market on the base of nine exogenous predictors. The experimental results showed justify the benefits of the model with the evolutionary selector. The focus of research is to clarify the usefulness Banking time series forecasting gains a main rule in finance and economics which has encouraged the researchers to introduce a fit models in forecasting (Almasarweh and AL Wadi, [12]). The purpose of this study was the researchers present the advantages of the autoregressive integrated moving average (ARIMA) model forecasting accuracy. Data were collected from Banking data from Amman stock market (ASE) in Jordan was selected as a tool to show the ability of ARIMA in forecasting banking data. Therefore, Daily data from 1993 until 2017. the results shows that the ARIMA model has significant results for short-term prediction.

Stock price prediction has always attracted interest because of the direct financial benefit and the associated complexity (Mondal, et al [19]). Was check the effectiveness of Autoregressive Integrated Moving Average (ARIMA) model, on fifty six Indian stocks from different sectors. Was selected chosen ARIMA model, because of its simplicity and wide acceptability of the model. We studied

in research the effect on prediction accuracy based on various possible previous period data taken. The comparison and parameterization of the ARIMA model have been done using Akaike information criterion(AIC) (Mondal, Shit, Goswami, 2014). The result Accuracy of ARIMA model in predicting stock prices is above 85%, which indicates that ARIMA gives good accuracy of prediction.

In 2017 the autoregressive integrated moving average (ARIMA) models have been especially popular in time series prediction. The presents extensive process of building stock price predictive model using the ARIMA method, was selected from Stock data of Apple Inc obtained from Yahoo Finance are used (Dong, Li et al, 2017). Results revealed that the ARIMA model has a strong potential for short run forecast and is competitive with other prediction methods in guiding investment decision.

Stock price prediction is an important topic in finance and economics which has spurred the interest of researchers over the years to develop better predictive models (Adebiyi et al, [21]). The published stock data obtained from New York Stock Exchange (NYSE) and Nigeria Stock Exchange (NSE) are used with stock price predictive model developed. the Results show revealed that the ARIMA model has a strong potential for short-term prediction and can compete favourably with existing for stock price prediction (Adebiyi, Adewumi, K. Ayo, 2014).

3. Methodology

Previous studies have used statistics, technical analysis, fundamental analysis, and linear regression to forecast share price. Models in Time Series Analysis enable the user to generate: forecasts of a (dependent) time series that is based upon the information of its own past, explain events that occurred in the past, and provide insight into the dynamical interrelationships between variables. ARIMA model is a procedure of forecasting future values of time series that same as statistical models by using historical data generate forecasting value of variables. ARIMA is an Abbreviation that stands for Autoregressive Integrated Moving Average. This Abbreviation is described are:

AR: Auto regression. That uses the dependent relationship between an observation and some number from lagged observations. MA: Moving Average That uses relationship between an observation and a residual error from a moving average model applied to lagged observations. The data examined in the paper had been collected from the of Amman Stock Exchange (ASE) from 2012 to 2018. 15 well-known banks on the ASE have thus been selected for stock price forecasting. Two exogenous predictors are also taken into account in the process: opening price, closing price. Their values were recorded yearly (obviously excluding the weekends) for 7 years, about 105 observations were accumulated for each variable from related in period.

3.1 Variables

Table 1: list definition variables

variables	Define
x_1 x_2 Opening price	price of the first trade of any listed stock
x_1x_2 Closing price	final price a trades during regular market hours

3.2 ARIMA model

Application of nonlinear regression to price forecasting has not been reported so far. ARIMA is a suitable model for the stationary and non-stationary time series data , although most of the software uses least square estimation which requires stationary. The modeling procedure of ARIMA models based on the Box–Jenkins (Zhang, Patuwo, and Hu, 1998) methodology always contain three iterative steps, including model identification, parameter estimation and diagnostic checking. These three steps are described as follows:

1) Identification: In this step we look for the actual values of p (the number of auto regressive), d (the number of referencing) and q (the number of moving average). For this purpose Box and Jenkins (Zhang, Patuwo, and Hu 1998) proposed the autocorrelation function (ACF) and the partial autocorrelation function (PACF) of the sample data as the basic tools to identify the order of the autoregressive integrated moving average models.

2) Estimation: After choosing a specify ARIMA (p, d, q), the parameters which were identified in the previous phase, should be estimated by the ordinary least squared (OLS) method.

3) Diagnosis checking: The last step in model building is the diagnostic checking of model adequacy. If the model result is not adequate, a new structure of ARIMA model will be identified, and the three previous steps should be repeated until the best structure is found.

The formula of ARIMA model for time series forecasting is shown in equation (1).

The forecast (with forecast lead l) of a time series Yt at a forecast origin t is denoted by Ft+l or Ft(l) which is, in our case, always a combination of previous observations. The forecast can obviously also be written in terms of previous error-shocks.

$$Ft(1) = \sum_{1=0}^{\varphi} \psi^{*}1 + 1^{e}t - 1. \tag{1}$$

The general ARMA(p,q) can be defined as in equation 2:

$$(1 - \phi_1 B - \phi_2 B^2 - ...\phi_p B^p)W_t = e_t W_t - \phi_2 W_t 1 - \phi_2 W_t 2 - .....\phi_p W_t p = e_t$$

(2)

$$W_t - e_t = \phi 1 W_t - 1 + \phi 2 W t_t - 2 + ...\phi 2 W_t - p F_t = \sum_{t-1}^{p} \phi_1 W_t - 1,$$

where W_t is a stationary time series, et is a white noise error element, and Ft is the forecasting. the AR(p) process can be written as in equations 3 and 4.

$$\phi(B)W_t = \alpha, \quad W_t = \psi(B)_e t(\phi(B)^{-1} = \psi(B)) \tag{3}$$

the MA(q) process is defined by

$$\begin{aligned} W_t &= (1 - \theta_1 B - \theta_2 B^2 - \theta_2 B^3 - .....\theta_q B^q \alpha \\ W_t - e_t &= -\theta_1 e_t - \theta_2 e_t - \theta_1 e_t - .....\theta_q e_t q \\ F_t &= -\sum_{t-1}^{q} \theta_1 e_t, \end{aligned} \tag{4}$$

where W_t is a stationary time series, is a white noise error element, and Ft is the forecasting Remark that this description of the $MA(q)$ process is not simple to use for forecasting purposes due to its recursive character. The theoretical ACF and PACF are equations in 5 and 66 on replacing $\psi_1 = -\theta_1, \psi_2 = -\theta_2, \psi_3 = -\theta_3, ...\psi_q = -\theta_q$ and $\psi_j = 0$, for all

$$j > q, \tag{5}$$

$$\rho_k - \sum_{j=1}^{p} \phi_i \rho_{k-i} = 0 \text{ for } k > q. \tag{6}$$

4. Results

The statistical analysis of ARIMA variables is presented in table 2.

Table 2: The sample distribution for field of specialization

	N	**MEAN**	**MEDIAN**	**STD.DEV**	**STD.ERR**
X_1 X_1	105	2.611	1.52	0.654	0.063
X_2 X_2	102	2.577	1.52	0.669	0.065

ARIMA Parameter Estimation and Backward Selection are presented in Figure 1.

The AR(1) coefficient is fairly significant and the “Mean” (which is the estimated trend per period when a single order of differences has been used).

	AR1	MA1	SAR1	SMA1
Estimates (1)	0.4567	-0.93	0.4567	-0.93
(p-val.)	(0.0507)	(0)	(0.0507)	(0)
Estimates (2)	0	-1.064	0.7686	-1.064
(p-val.)	(NA)	(0)	(0)	(0)
Estimates (3)	0.4667	-0.9257	0.4667	-0.9257
(p-val.)	(0.1298)	(0)	(0.1298)	(0)
Estimates (4)	0	-1.0001	0.8804	-1.0001
(p-val.)	(NA)	(0)	(0)	(0)

Figure 1: ARIMA Parameter Estimation and Backward Selection

The AR1 for $x_1 = 0.45$ and the AR1 for $x_2 = 0.46$ is a tiny numbers reflecting the smoothness of the series. the MA(1) there is a negatives for x1 and x2 in the ACF plot and a decay pattern (from below) in the PACF plot.

The residual and partial autocorrelation function is presented in Figure 2.

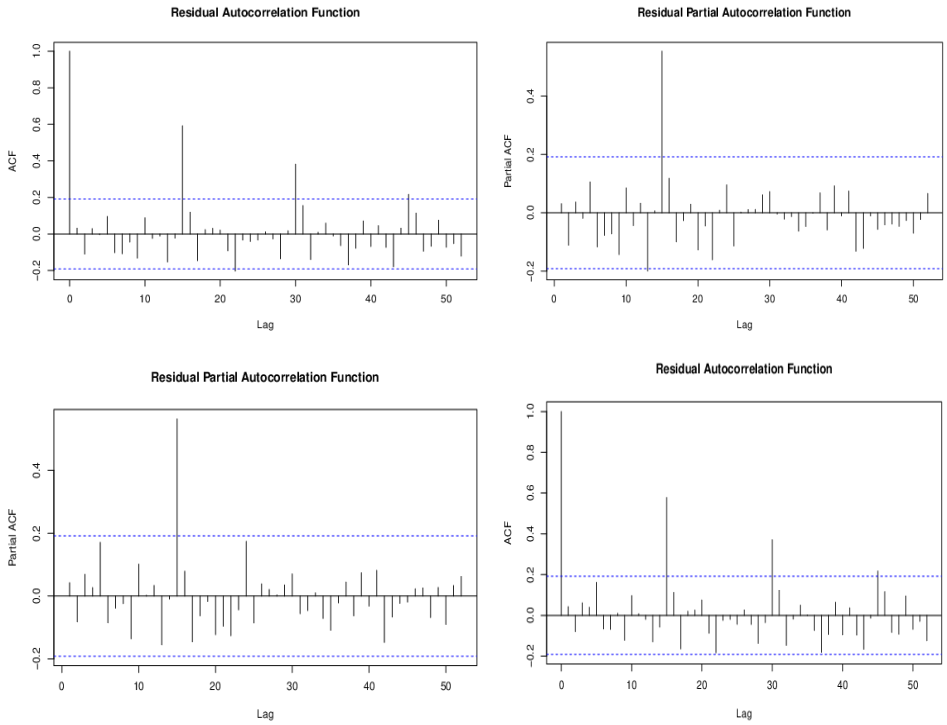

Figure 2: residual and partial autocorrelation function

Results refer to the ACF and PACF plots of the different series, we see our first significant value in lag 16 for ACF and in the lag 16 for PACF which suggest to use p = 1 and q = 1. We also have a big value at lag 16 in the ACF and PACF plot for all variables which suggests our season is S =6 and since this lag is a positive it suggests $P = 1$ and $Q = 0$. Since this is a differentiated series for ARIMA, we have identified d = 1, and since the seasonal pattern is unstable over time we set $D = 0$ All this gives us together the ARIMA model $(1, 1, 0)$, with the autoregressive coefficient alpha = 0.5.

4.1 Conclusion and recommendation

All investors, investment banks, hedge funds, etc., they financial decision makers. They will need to predict prices of financial assets such as stocks, bonds, etc. in order to make accurate financial decisions. It is the main reason that efforts for improving the efficiency for forecasting models has never been stopped in the finance. This study came to was conducted to obtain a suitable forecasting model for stock prices of ASE banks sector. The data examined in the paper had been collected from the of Amman Stock Exchange (ASE) from 2012 to 2018. 15 well-known banks on the ASE have thus been selected for stock price forecasting. The data set examined information about: opening price, closing price. Concerning the results of previous researches, which confirm the relative superiority of linear models in price index prediction, an appropriate model has been offered in this research ARIMA model, in order to predict price index of Amman Stock Exchange.

ARIMA model has been selected for forecasting stock prices. From the Structural Time Series, it could be seen that the highest value of stock price occurred in 2017 and the lowest total value of stock price occurred in the year 2018. It is suggested that in future for forecasting the time series a Hybrid method and study more variables such as: average closing price, exchange rate ,highest price , lowest price. However, for the scope of the present study ARIMA $(1, 1, 0)$ is the most appropriate model for forecasting purposes.

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