



Arima Model for Gold Price Prediction

Bottu Rama¹, B. Chandrakala², K. Srujana³, B. Sravanthi⁴

^{1,2}Assistant Professor in Statistics, Bankatlal Badruka College for Information Technology, Hyderabad, Telangana, India.

^{3,4}Assistant Professor in Mathematics, Bankatlal Badruka College for Information Technology, Hyderabad, Telangana, India.

Email ID: ramabottu9@gmail.com¹, chandrakala215@gmail.com², srujanakundaram@gmail.com³, bandarISRavanthi1989@gmail.com⁴

Abstract

Despite increases in 2017 and 2018, the price of gold has been stagnant globally since 2013. The price volatility of gold will significantly influence how people, businesses, and nations choose to invest. This study focuses on the World Gold Council's data for gold prices from Jan 2018 to Feb 2023, and it uses the ARIMA model to forecast and analyze the daily Indian rupee (per ounce) gold price for the month of Feb 2023. The accuracy of models is also estimated in this study using AC, PAC, and BIC. Results from experiments show that ARIMA (4,1,4) is the best model for predicting the Indian price of gold (National Currency Unit per troy ounce). For consumers to comprehend the effectiveness of gold prices and make wise investment decisions, the estimate outcomes of the ARIMA Model are essential.

Keywords: ARIMA Model; Forecast; Gold Price

1. Introduction

Gold may be viewed as a precious metal as well as a stock contract instrument on the commodities market. Many financial products have had poor results during the 2008 global economic crisis. Only the gold market, nevertheless, saw exceptional performance. The dollar exchange rate, inflation, and monetary policy are only a few examples of the many variables affecting variations in gold prices. Regression models are typically built using these criteria by academics both at home and abroad. The historical financial time series data is modelled and analyzed using the time series analysis approach in this research. This article focuses on the World Gold Council's estimate of gold prices from Jan 2018 to Feb 2023. It also aims to forecast and analyze daily gold price in the month of March 2023 through the establishment of ARIMA model. The format of this five-part article is as follows: Segment 2 specifies the sample, and sector, discusses the ARIMA model approach. In addition, section 3 sets the outcomes, and places the conclusion

1.1. Sub Section 1

This study forecasts the global gold price that is set in Indian rupees (National Currency Unit per troy ounce). The World Gold Council provided the information, which was compiled from 1347 daily

observations between Jan 1 2018 to Feb 28 2023 [2].

1.2. Sub Section 2

Researchers from all around the world have historically predicted the price of gold using regression analysis (Deepika, Nambiar, & Rajkumar, 2012; Ismail, Yahaya, & Shabri, 2009; Khashei, Hejazi, & Bijari, 2008; Zhang, Ma, & Wang, 2011). The Autoregressive Moving Average Model was initially introduced by Box and Jenkins in 1970. The ARIMA models offer two benefits. First of all, ARIMA models are a specific class of linear models that are limited to linear characteristics in time series and designed for linear time series. Second, the optimal hypothetical basis for ARIMA models. Because of this, ARIMA models are widely employed in a variety of real-world scenarios. However, the ARIMA has the drawback of being unable to capture nonlinear patterns of complex time series if nonlinearity is present (Shouyang, Lean, & Lai, 2005). T. A number of time series were examine and used to forecast the seasonally adjusted French monetary aggregates. According to Machak, Spivey, and Wroblewski (1987), the performance of multivariate models' forecasting is contrasted with that of single-variable random walk ARIMA



models. A number of authors have employed ARIMA in the future to anticipate time series, including Abdullah (2012), Banerjee (2014), Deepika et al. (2012), Nielsen (2005), and L. Xu & Luo [3]. The study was based on the test of the asymmetric power GARCH model (APGARCH) of Ding, Granger, and Engle (1993), which is one of its extensions. Tully & Lucey (2007) later explored the ARCH and GARCH methodology in forecasting the gold market to examine both cash and futures prices and significant economic variables. By using the Box Jenkins Autoregressive Integrated Moving Average approach, Sharma (2016) claimed that ARIMA (3,1,3) is the most suitable model to predict the price of gold in India. Determining an accurate and suitable model to anticipate the price of gold is therefore crucial [4].

2. Method

This study uses an ARIMA model to forecast Indian gold prices. For instance, after differencing at the first level, we get the stationary series. The model we

are looking at right now is ARIMA (p, 1, q). To accomplish our goal of predicting future gold prices, we must first define the model, estimate adequate parameters, do examinations for residuals, and then eventually be successful [5]. IBM SPSS Software was employed for calculation & graphic visualization of data. First of all the gathered data was evaluated for Stationarity which is an early stage of suitability for time series analysis. Durbin Watson Test was used to determine the kind of data. Durbin and Watson (1951) created this technique to find serial correlation if the data is appropriate for regression analysis. For modelling, a suitable time lag and serial correlation between the results are also crucial. If DW value lies between 0 to 1.5 or between 2.5 to 4 then the data is long-term i.e. relying on time, so time-series analysis can be done, but if DW value is within 1.5 to 2.5 then it is cross-sectional data i.e. distinct of time hence regression analysis should be carried out on the collected data [6].

Table 1 Arima Model Summary

Model Statistics									
Model	Model Fit statistics					Ljung-Box Q(18)			Number of Outliers
	R-squared	RMSE	MAE	MaxAPE	Normalized BIC	Statistics	DF	Sig.	
ARIMA (4,1,4)	.010	1158.701	795.045	5.400	14.158	24.361	10	.007	0

Table 2 Estimate Table of Arima (4,1,4)

ARIMA Model Parameters						
			Estimate	SE	t	Sig.
AR	Lag 4		-.758	.108	-7.034	.000
Difference			1			
MA	Lag 4		-.688	.121	-5.685	.000

Table 3 Comparison of the Actual Figure of The Data with The Predicted Values

Time Period	Observed Values	Predicted Values	Relative Error
3/1/2023	151,914.6	151033.9	-0.57973
3/2/2023	151,654.1	152051.45	0.262011
3/3/2023	150,946.7	151647.62	0.464349
3/6/2023	151,499.6	151159.61	-0.22442
3/7/2023	149,656.1	151339.06	1.124552
3/8/2023	149,026.3	149039.8	0.009059
3/9/2023	150,140.5	150001.97	-0.09227
3/10/2023	152,710.9	152350.88	-0.23575
3/13/2023	156,970.3	156995.99	0.016366
3/14/2023	157,349.0	157890.49	0.344133
3/15/2023	158,870.4	158873.51	0.001958
3/16/2023	159,090.7	158610.67	-0.30173

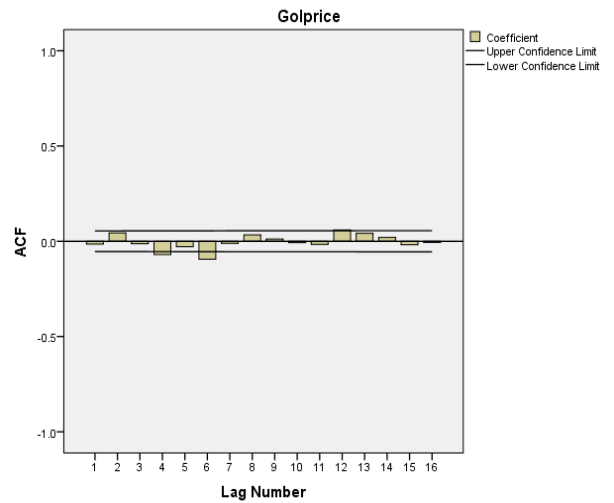


Figure 3 ACF Graph-Gold Price Correlogram

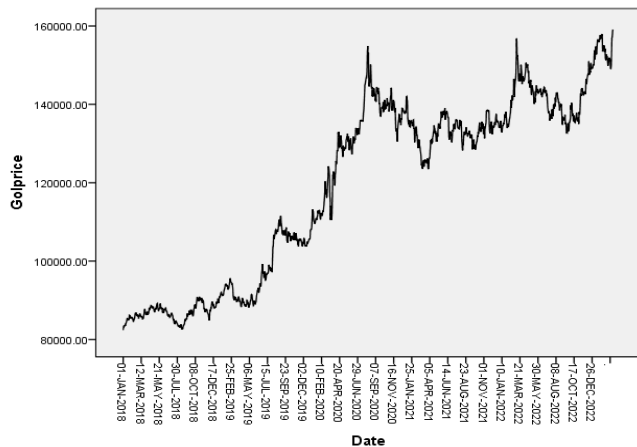


Figure 1 Graph of Gold Price

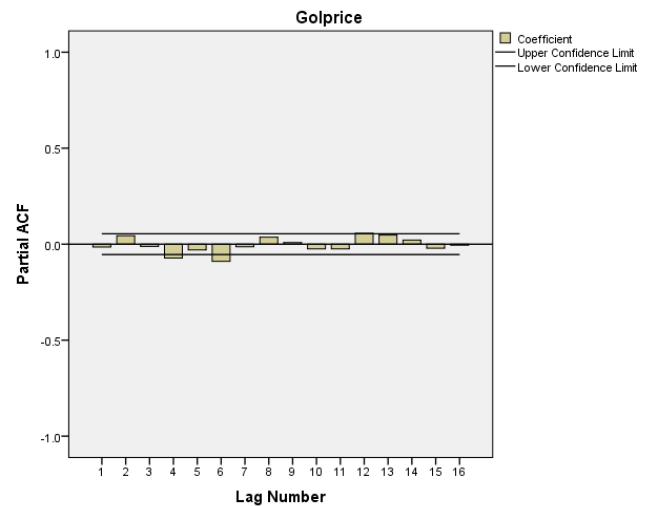


Figure 4 PACF Graph-Gold Price Correlogram

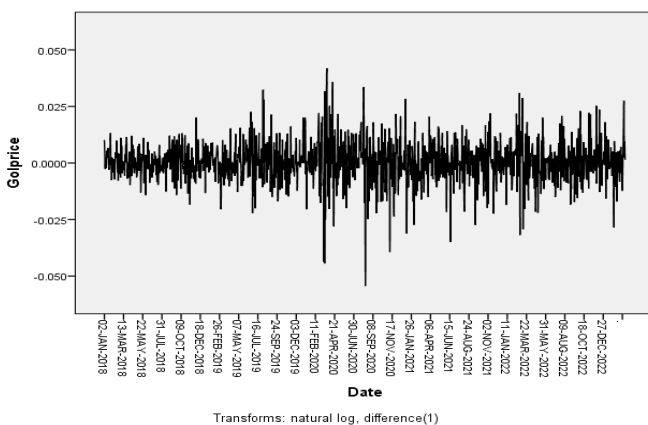


Figure 2 Graph of Gold Price at I Difference

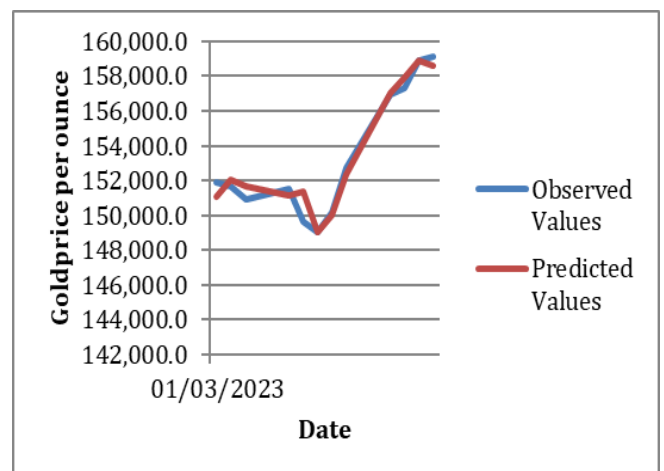


Figure 5 Gold Price Forecasting Results



3. Results and Discussion

3.1. Results

The value of Durbin-Watson (DW) was 0.017 for the sample data of the Gold price from Jan 2018 to Feb 2023 which shows that the data is appropriate for time-series analysis. The graph of gold price data from Jan 2018 to Feb 2023 shows a rising trend in figure1 whereas Figure 2 shows a variable trend. The ARIMA framework was developed using the ACF and PACF correlogram as shown in figure 3 and 4. By using SPSS Expert modeler, the appropriate Time series model is ARIMA (4,1,4) which is used for gold price prediction. The Fit Statistic is given in Table1 The Table 2 shows the Parameter estimates of ARIMA (4,1,4) with respective significant level Since none of the significant values in this case exceed 0.05, ARIMA (4,1,4) was considered. The price of gold is predicted using the ARIMA (4,1,4) model. Results of the gold price projection from March 1 to March 16, 2023 are shown in Table 3. As can be seen in Figure. 5, the percentage error between the projected values and the actual values is all fairly tiny, less than 1.2%. It implies that the model generates precise predictions.

3.2. Discussion

The price of gold is predicted using the ARIMA (4,1,4) model [7]. Results of the gold price projection from March 1 to March 16, 2023 are shown in Table 3. As can be seen in Fig. 5, the percentage error between the projected values and the actual values is all fairly tiny, less than 1.2%. It implies that the model generates precise predictions.

Conclusion

In order to identify the most precise and suitable model for forecasting, the major objective of this research study is to explore and carry out the prediction of the future price of gold. This research makes a quick forecast of the future price of gold using an ARIMA model and daily time series data. According to the study's findings, ARIMA (4,1,4) seems to be the most accurate model for forecasting gold prices. According to this study, the ARIMA model may be used to forecast the price of gold. In addition, this post analyzed the gold prices from Mar 1 to Mar 16, 2023. The ARIMA (4,1,4) model was selected after many screens to evaluate and forecast

the price of gold. The findings demonstrate that the model may, to a certain extent, capture the underlying trend in gold prices and offer investors some direction. When using ARIMA modelling to forecast data, there are several restrictions. This method is only used in the short term to identify minute variations in the data. This method of forecasting assumes that historical data is linear, but there is no proof that the price of gold is linear. As a result, this method is insufficient in situations where there is sudden change in the data set (when the variation is large), a change in government policies, economic instability (structural break), etc. It becomes difficult to identify the specific change under these conditions. Since the ARIMA model's predicting of the price of gold was based on the fundamental supposition that the price follows a completely linear pattern, using non-linear forecasting methods employing soft computing techniques might be thought of as having less white noise term [8].

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