

SGOL Forecasting using ARIMA Model

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SGOL(abrdn Physical Gold Shares ETF) Modeling

```
library(alphavantage)
```

```
options(readr.show_col_types = FALSE)
sgol_oct <- av_get(symbol = "SGOL",
                  av_fun = "TIME_SERIES_DAILY",
                  outputsize = "full")

options(readr.show_col_types = FALSE)
sgol_nov <- av_get(symbol = "SGOL",
                  av_fun = "TIME_SERIES_DAILY",
                  outputsize = "full")

sgol_oct <- subset(sgol_oct, timestamp >= as.Date("2025-10-01") &
                  timestamp <= as.Date("2025-10-31"))

sgol_nov <- subset(sgol_nov, timestamp >= as.Date("2025-11-01") &
                  timestamp <= as.Date("2025-11-07"))
```

```
library(ggplot2)

ggplot(sgol_oct, aes(x = timestamp, y = close)) +
  geom_line(color = "blue") +
  labs(title = "SGOL Closing Prices October 2025",
       x = "Date", y = "Price (USD)") +
  scale_x_date(date_labels = "%b %d") + # format x-axis dates nicely
  theme_minimal()
```



```
ggplot(sgol_nov, aes(x = timestamp, y = close)) +  
  geom_line(color = "darkgreen") +  
  labs(title = "SGOL Closing Prices November 2025",  
        x = "Date", y = "Price (USD)") +  
  scale_x_date(date_labels = "%b %d") + # format x-axis dates nicely  
  theme_minimal()
```



Augmented Dickey-Fuller Test for Stationarity

```
library(tseries)
```

Registered S3 method overwritten by 'quantmod':

```
method      from  
as.zoo.data.frame zoo
```

```
oct_ts <- ts(sgol_oct$close)  
adf.test(oct_ts)
```

Augmented Dickey-Fuller Test

```
data:  oct_ts  
Dickey-Fuller = -1.4936, Lag order = 2, p-value = 0.7653  
alternative hypothesis: stationary
```

Series Not Stationary

```
oct_diff_ts <- diff(oct_ts)
adf_test = adf.test(oct_diff_ts)
adf_test
```

Augmented Dickey-Fuller Test

```
data: oct_diff_ts
Dickey-Fuller = -2.357, Lag order = 2, p-value = 0.4364
alternative hypothesis: stationary
```

First Difference Not Stationary

```
oct_secdiff_ts <- diff(oct_diff_ts)
adf_test = adf.test(oct_secdiff_ts)
adf_test
```

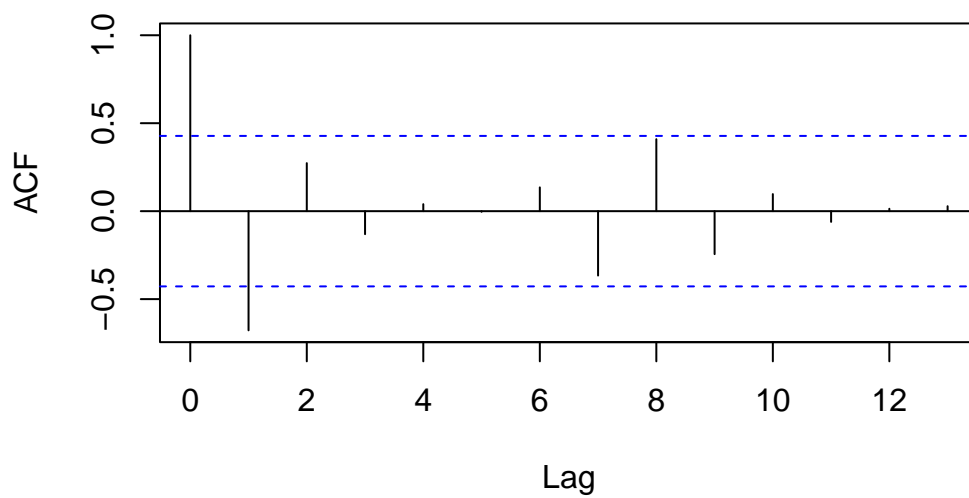
Augmented Dickey-Fuller Test

```
data: oct_secdiff_ts
Dickey-Fuller = -3.7904, Lag order = 2, p-value = 0.0364
alternative hypothesis: stationary
```

Second Difference is Stationary

```
acf(oct_secdiff_ts, main = "ACF of Oct Second Difference")
```

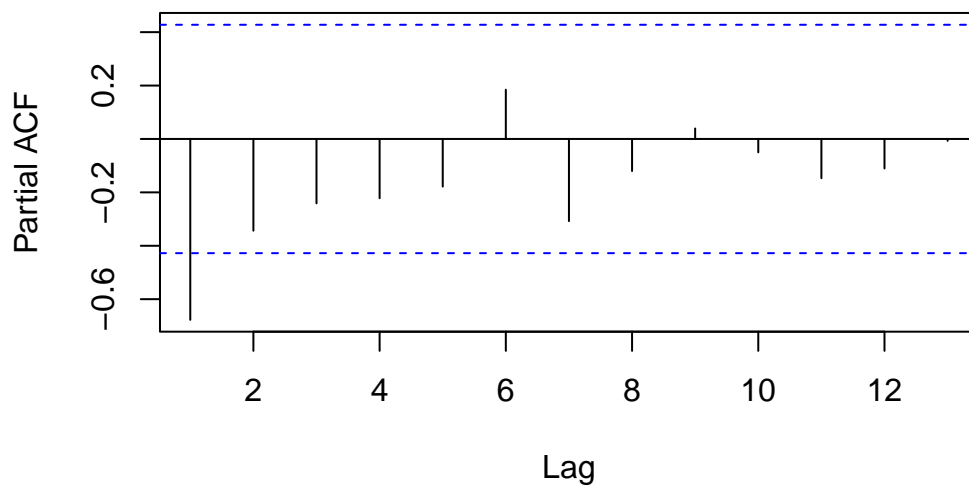
ACF of Oct Second Difference



MA Order is 1

```
pacf(oct_secdiff_ts, main = "PACF of Oct Second Difference")
```

PACF of Oct Second Difference



AR order is 0

Fit ARIMA(0, 2, 1) on October Data and Test on November Data

```
library(forecast)
train_series <- c(sgol_oct$close)
model <- Arima(train_series, order = c(0, 2, 1))
predicted <- forecast(model, h=5)$mean
actual <- sgol_nov$close
```

```
cat("Predicted: ", predicted, "\n")
```

Predicted: 38.15092 38.17184 38.19277 38.21369 38.23461

```
cat("Actual: ", actual)
```

Actual: 38.22 37.54 37.97 37.94 38.17

Plot Predicted and Actual

```
library(ggplot2)
library(tibble)
library(dplyr)
```

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

filter, lag

The following objects are masked from 'package:base':

intersect, setdiff, setequal, union

```

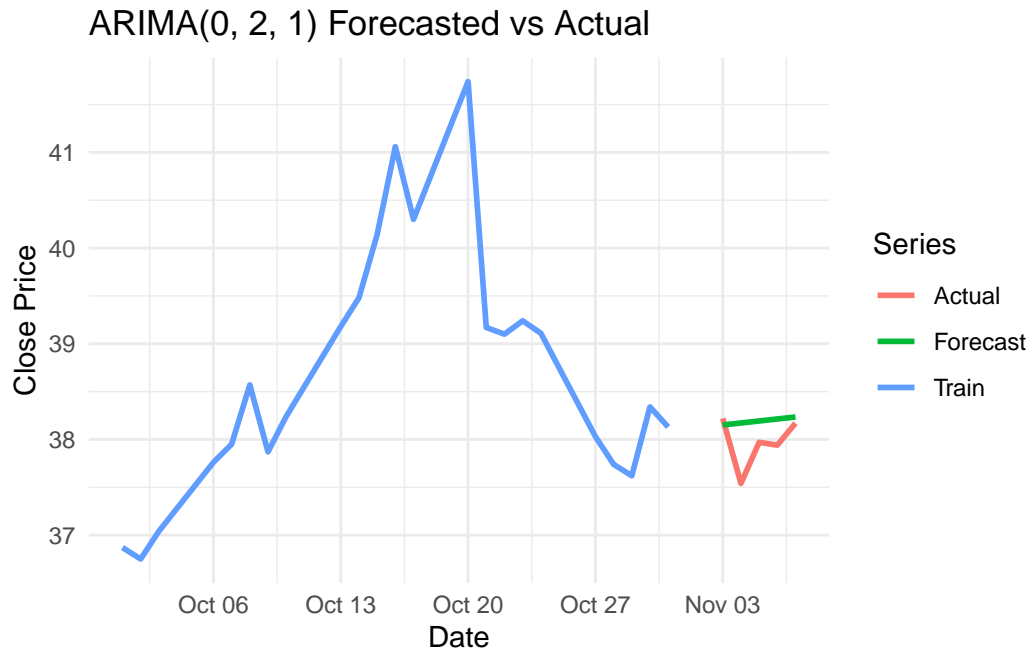
train_dates <- sgol_oct$timestamp
test_dates <- sgol_nov$timestamp

plot_data <- tibble(
  date = c(train_dates, test_dates, test_dates),
  value = c(train_series, predicted, actual),
  type = c(
    rep("Train", length(train_series)),
    rep("Forecast", length(predicted)),
    rep("Actual", length(actual))
  )
)

ggplot(plot_data, aes(x = date, y = value, color = type)) +
  geom_line(size = 1) +
  labs(title = "ARIMA(0, 2, 1) Forecasted vs Actual",
       x = "Date",
       y = "Close Price",
       color = "Series") +
  theme_minimal()

```

Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
 i Please use `linewidth` instead.



Evaluation of Fit

```
mse <- mean(predicted - actual)^2  
cat("MSE: ", mse)
```

MSE: 0.05051951

```
rss <- sum((predicted - actual)^2)  
tss <- sum((actual - mean(actual))^2)  
r_squared <- 1 - rss/tss  
cat("R Squared: ", r_squared)
```

R Squared: -0.8478622

Conclusion

ARIMA is a good tool for extrapolation. However in this case, we would have been better off simply predicting the mean as the R Squared was negative.