

# Gold Prices

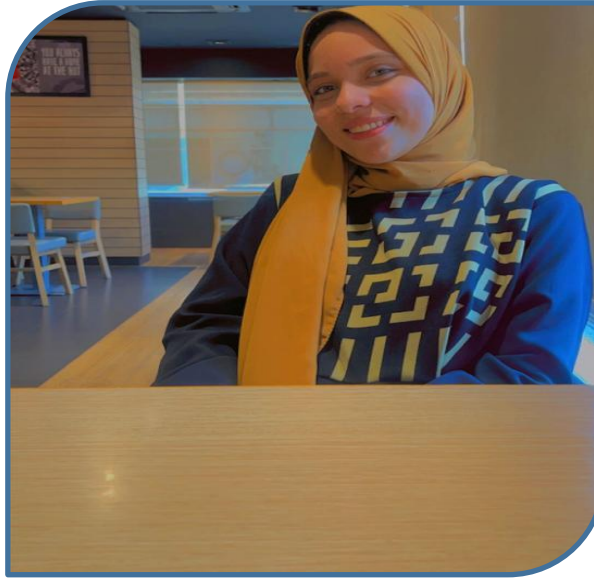
SIC 501



# Team



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**Supervised by : Dr Doaa Mahmoud  
Eng.Shaimaa Osman's team**

What is the relation between the US dollar and gold prices, and can we predict gold prices through the price of the dollar at the feature?



# Agenda

- | About
- | Preprocessing
- | Business Questions
- | Modeling
- | Conclusion
- | Update
- | Acknowledgement
- | References



# About

- Our data about Local gold prices at Egypt and Global gold prices with USD\_EGP.
- **Our goal** is to focus on the relationship between the US dollar and gold prices and we will forecast with gold prices prediction in the future.



# About

## USD data features :

**Date:** Observation record date.

**Price:** represents the closing price of a particular stock, commodity, or financial instrument on the given date.

**Open:** represents the opening price of a stock, commodity, or financial instrument at the start of the trading day.

**High:** represents the highest price a stock, commodity, or financial instrument reaches during the trading day.

**Low:** represents the lowest price a stock, commodity, or financial instrument reaches during the trading day.

**Change%:** represents the percentage change in the price of a stock, commodity, or financial instrument compared to its previous closing price. It indicates the percentage increase or decrease in value from the previous day's closing price.

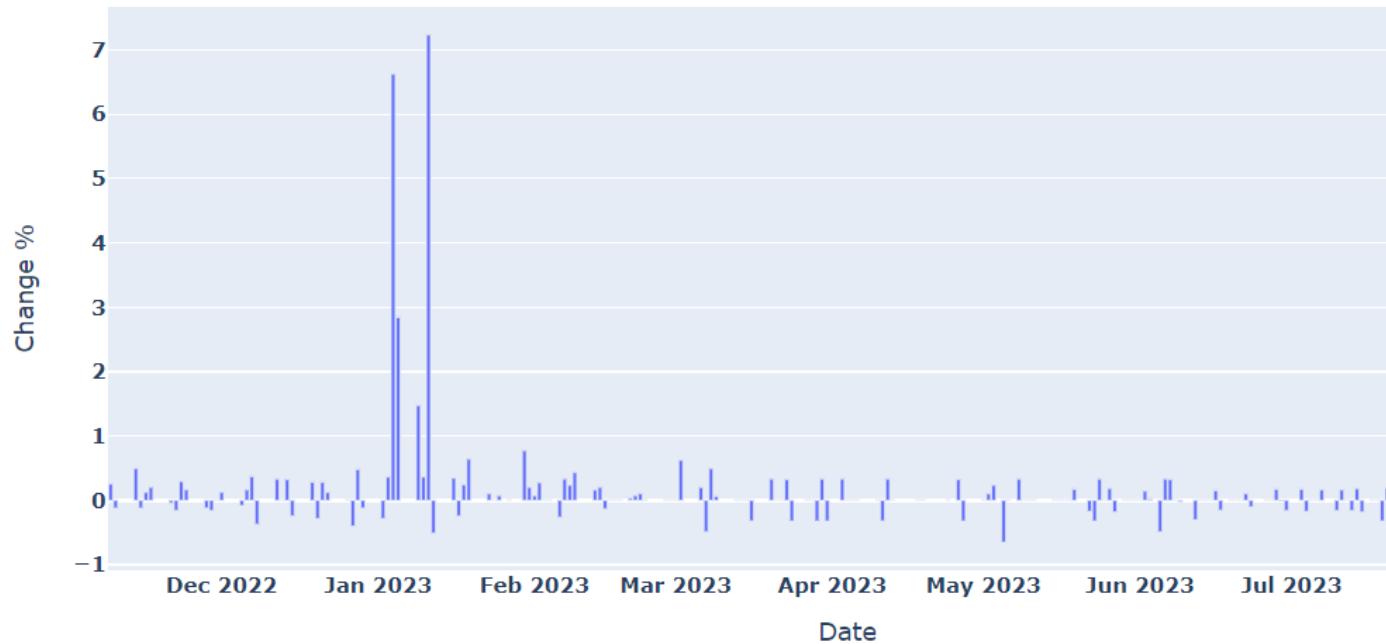
	Date	Price	Open	High	Low	Change %
6536	2004-03-12	6.1895	6.1895	6.1895	6.1895	0.00%
9714	1991-12-27	3.3425	3.3425	3.3425	3.3425	0.00%
2439	2015-06-06	7.6300	7.6300	7.6300	7.6300	0.00%



# About



- We notice that the USD/EGP daily rate exchange is unstable



# About



## Model Data Features :

	21K - Local Price/Buy	24K - Global Price	22K - Global Price	21K - Global Price	18K - Global Price	14K - Global Price	12K - Global Price	9K - Global Price	USD2EGP
Date									
2023-04-14	2290.0	2029.0	1860.0	1775.0	1522.0	1183.0	1014.00	760.78	30.891801
2023-09-04	2215.0	1931.0	1770.0	1689.0	1448.0	1126.0	965.29	723.97	30.949370
2023-06-25	2240.0	1909.0	1750.0	1670.0	1432.0	1113.0	954.41	715.81	30.774084

**Date:** Observation record date.

**21K - Local Price/Buy:** 21K gold gram buy price on Egyptian local markets

**24K - Global Price:** It represents the price of 24K gold on the global market.

**22K - Global Price:** It represents the price of 22K gold on the global market.

**21K - Global Price:** It represents the price of 21K gold on the global market.

**18K - Global Price:** It represents the price of 18K gold on the global market.

**14K - Global Price:** It represents the price of 14K gold on the global market.

**12K - Global Price:** It represents the price of 12K gold on the global market.

**9K - Global Price:** It represents the price of 9K gold on the global market.

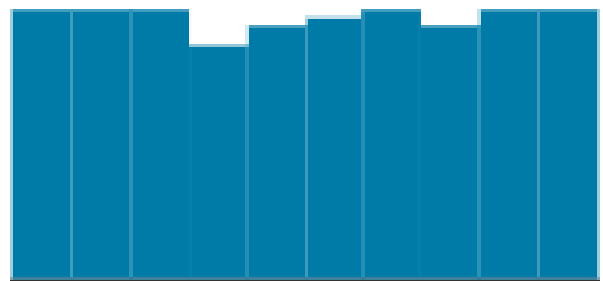
**USD2EGP:** represents the closing price of a particular stock, commodity, or financial instrument on the given date.



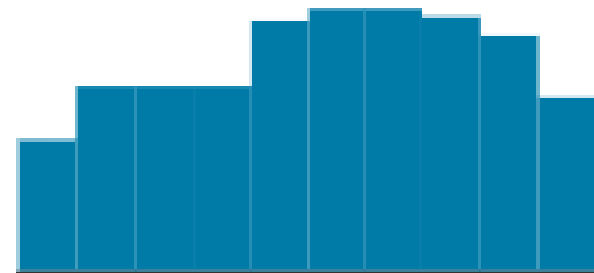
# About

We will use data from nov 22 2022 - today to fit with gold prices

```
specific_date = pd.to_datetime('2022-11-09')  
  
# Filter the DataFrame to keep rows on and after the specific date  
USD_EGP_filtered = USD_EGP[USD_EGP['Date'] >= specific_date]
```

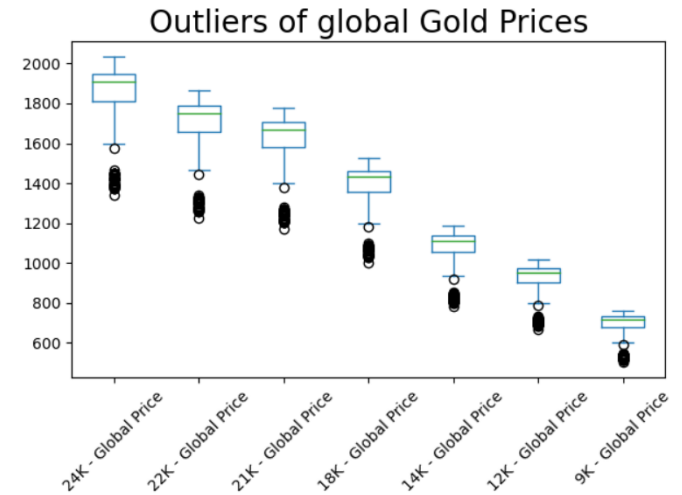
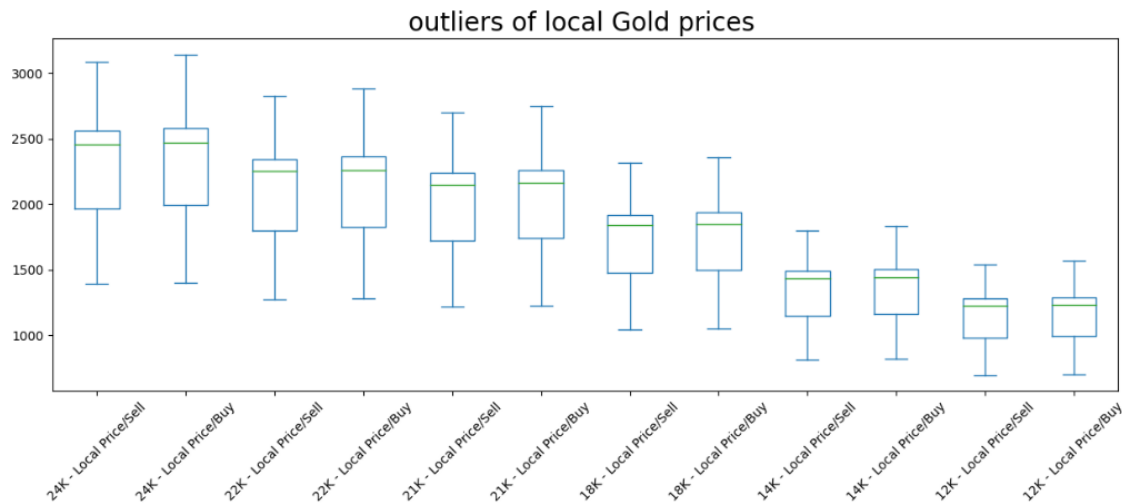


GOLD Dates



USD Dates

# Preprocessing



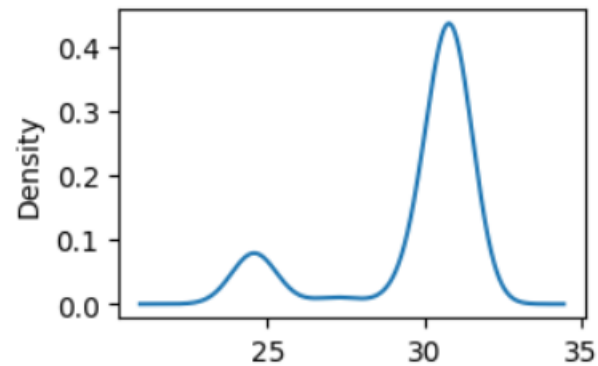
Note: we notice that there are no outliers in Local gold prices and there are in global prices

We need these outliers because we need to know all trends values

# Preprocessing

- **Missing Values:**

ratio of null 0.06774193548387097



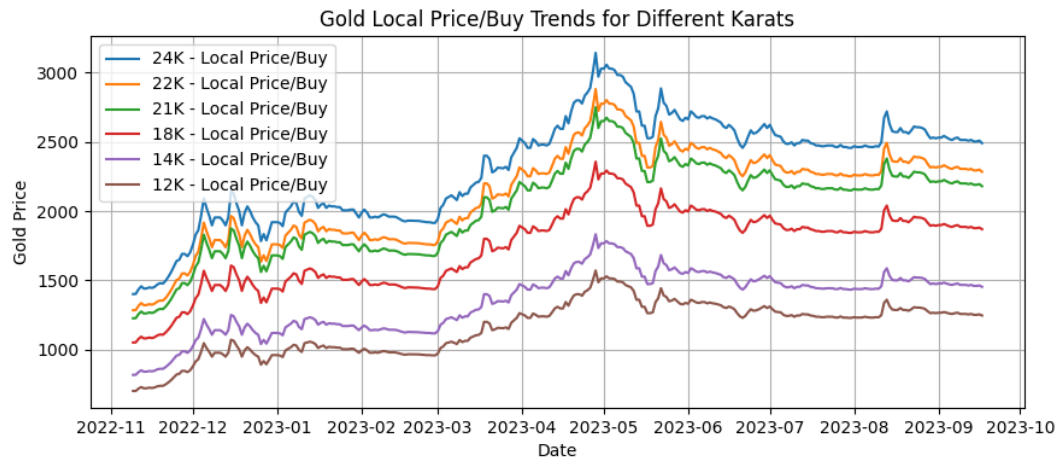
Note: We use bfill method to fill all missing values in the USD column because this method deals with prices .

We try to use knn imputer but it not fit at this data where it use mean and median at filling.

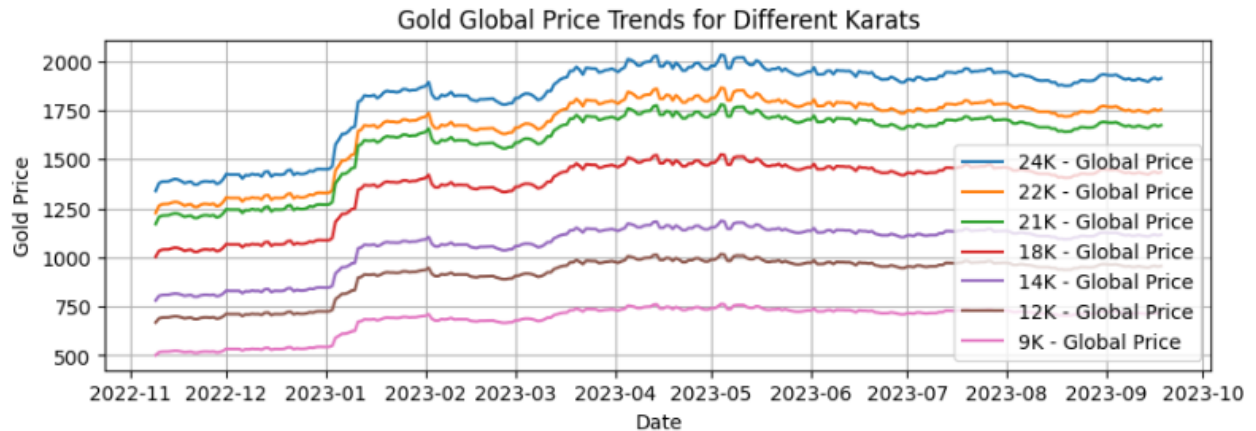
# Business Questions



- To show gold local price/buy and gold global price trends for different karats:



Note: Prices raised at 1/2023 after that, it becomes stable with some of the changes.



# Business Questions

- Is there evidence to suggest that gold prices react to global economic uncertainties or geopolitical events?



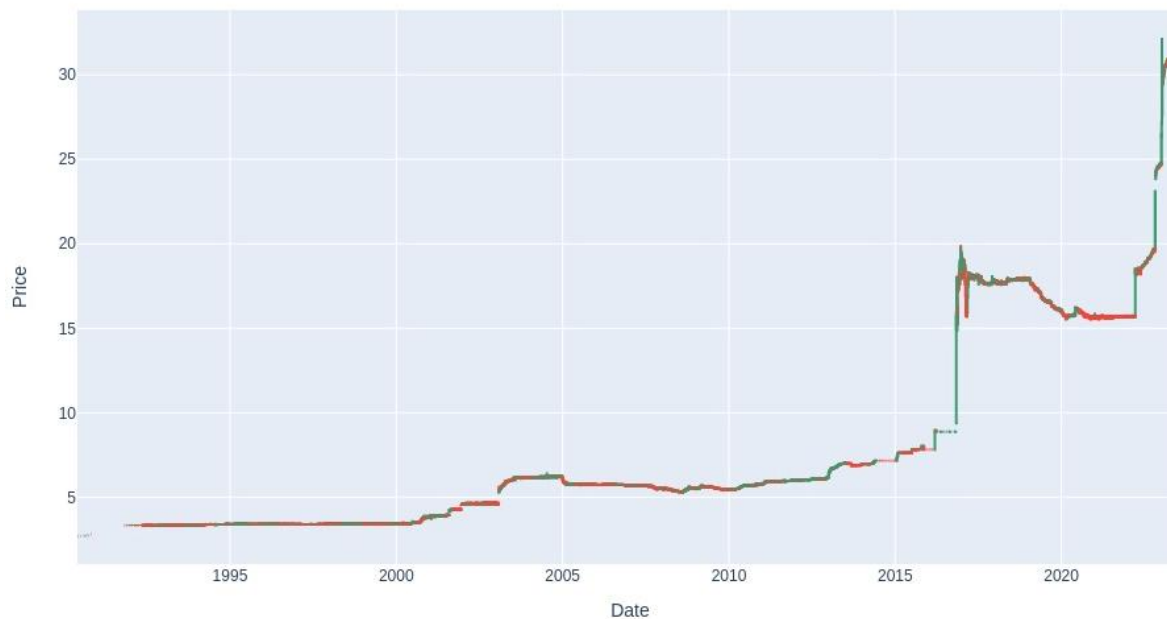
It's important to note that while there is evidence supporting the relationship between gold prices and global economic uncertainties or geopolitical events, the extent and duration of the impact can vary. Market dynamics, investor sentiment, and other factors can also influence gold prices alongside these factors.

there is a difference between Global gold price and Local gold price where local price has big effect with geopolitical events and economic.

# Business Questions

- What is the overall trend in the USD to EGP exchange rate over the available time period?

USD/EGP Exchange Rate Candlestick Chart

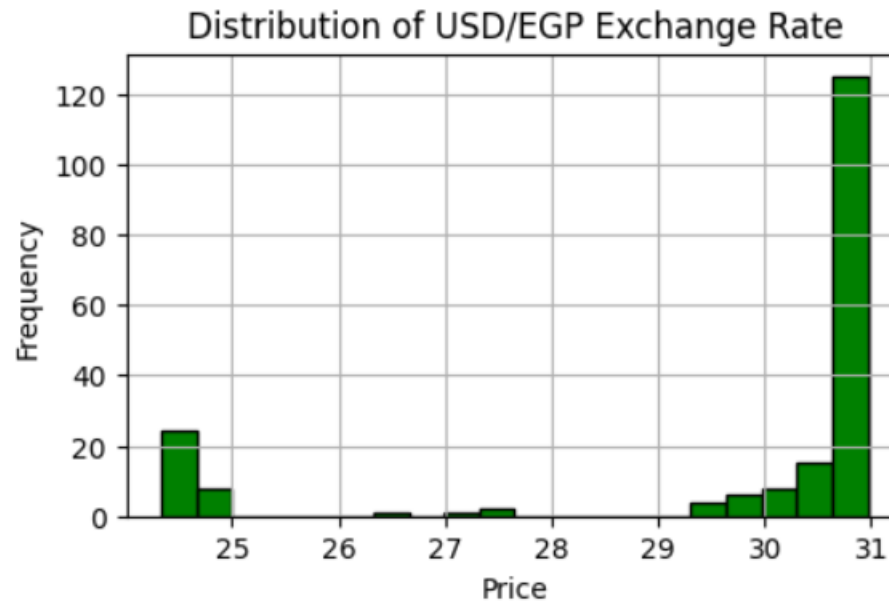


Note: At the history of USD to EGP in 2023 raised prices of USD, the prices of USD reached above 19, after that the price raised in 2022 then in 2023 reached above 30.

# Business Questions



- It can show you how prices are distributed and whether they follow a particular pattern.

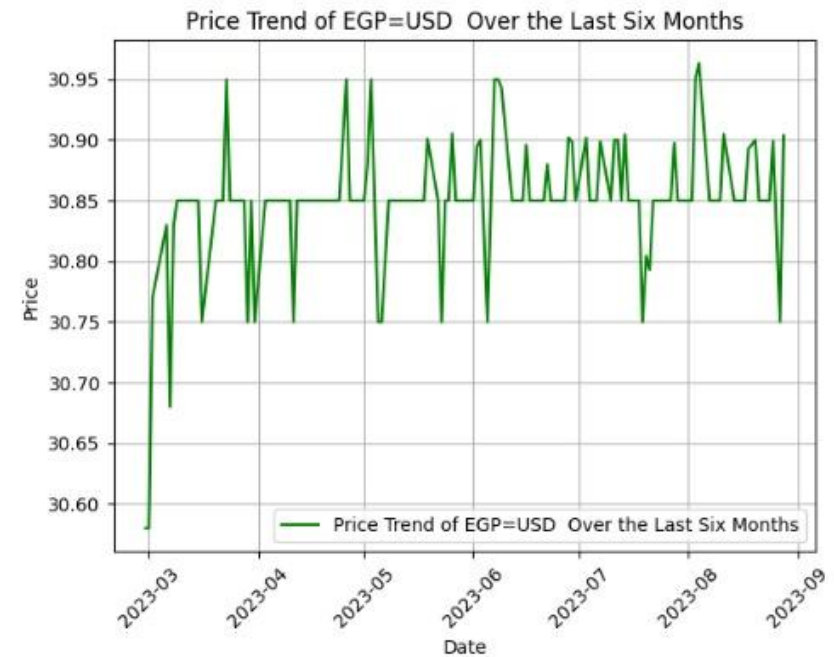


Note: A price under 25 has a high frequency but a price above 30 has a higher frequency above 120

Note: A price from 25 to 29.5 hasn't frequency where the price raised from 25 to 29.5 very quickly.

# Business Questions

- Is The price of 21K local, 21K global and Prices of Dollar have been stable over the last six months?

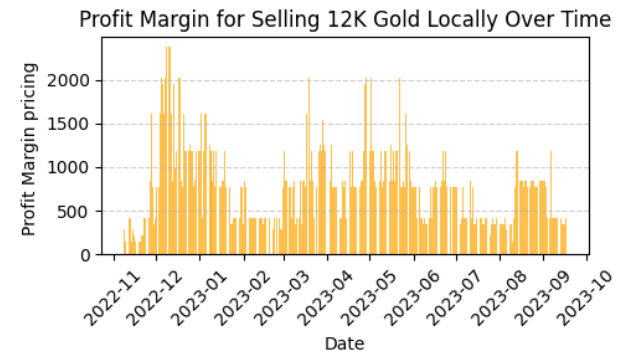
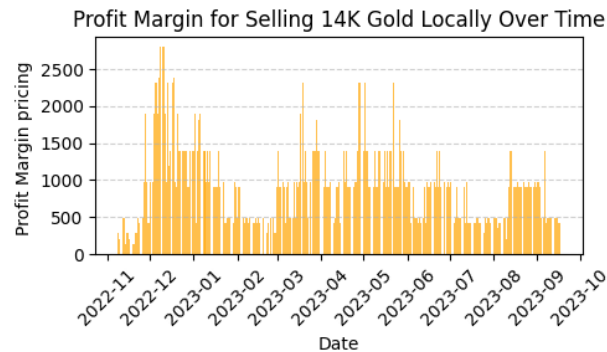
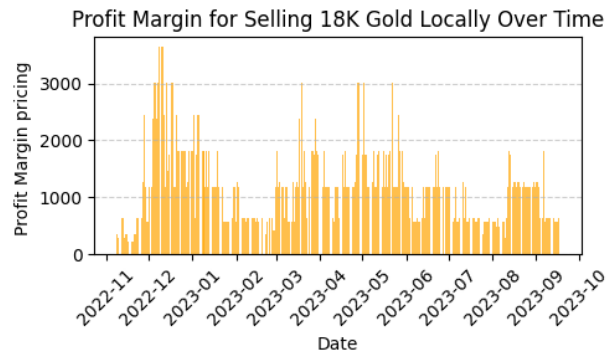
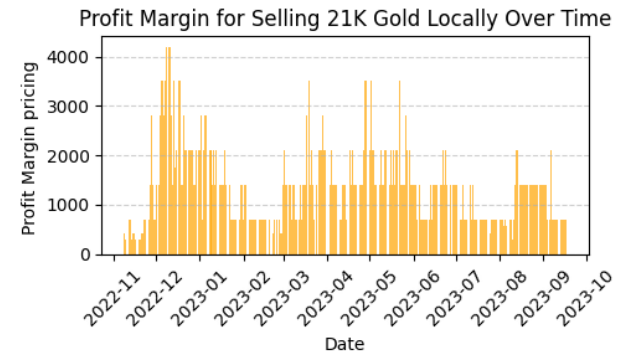
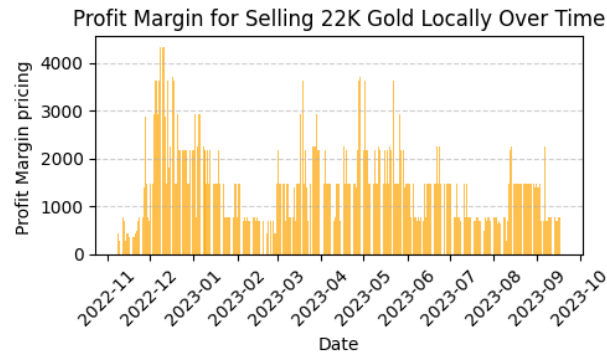
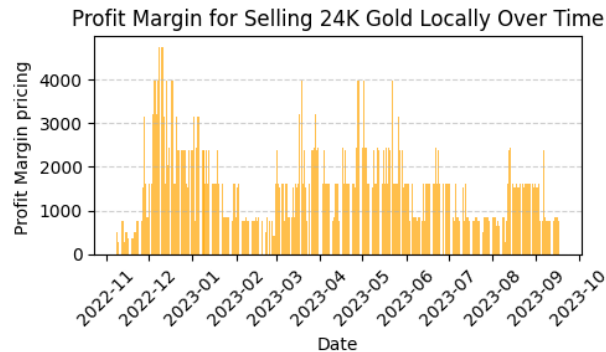


The price of 21K gold and USD price has not been relatively stable over the last six months.



# Business Questions

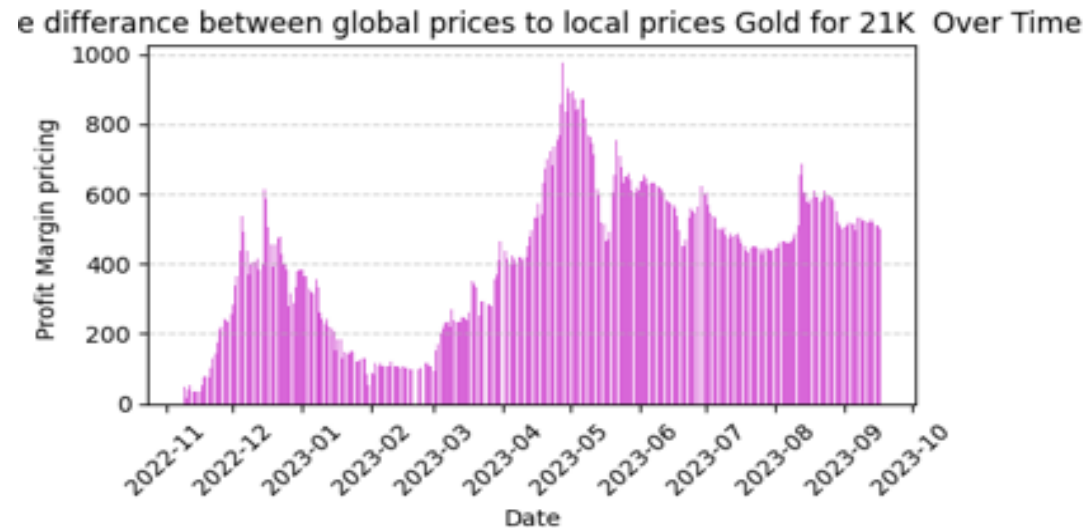
- What is the profit margin for selling prices gold locally?



Note: The distribution for all karats is the same but different at values where 24k, 22, and 21 are above 4000 sometimes, 18k sometimes above 3000, and 14k and 12k areas range from 2000 to 2750.

# Business Questions

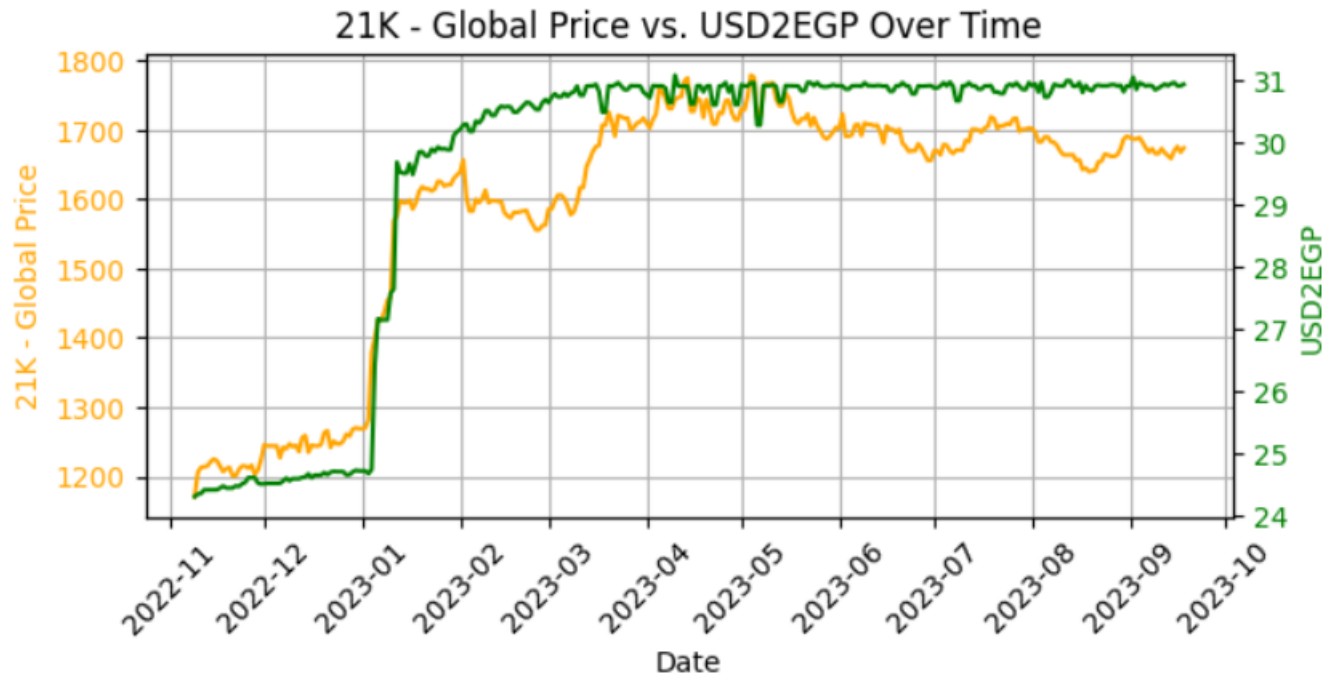
- What is the difference value between global prices to local prices gold for 21K ?



Note: 2/2023 has a lower difference but at last week of 4/2023 has a higher difference.

# Business Questions

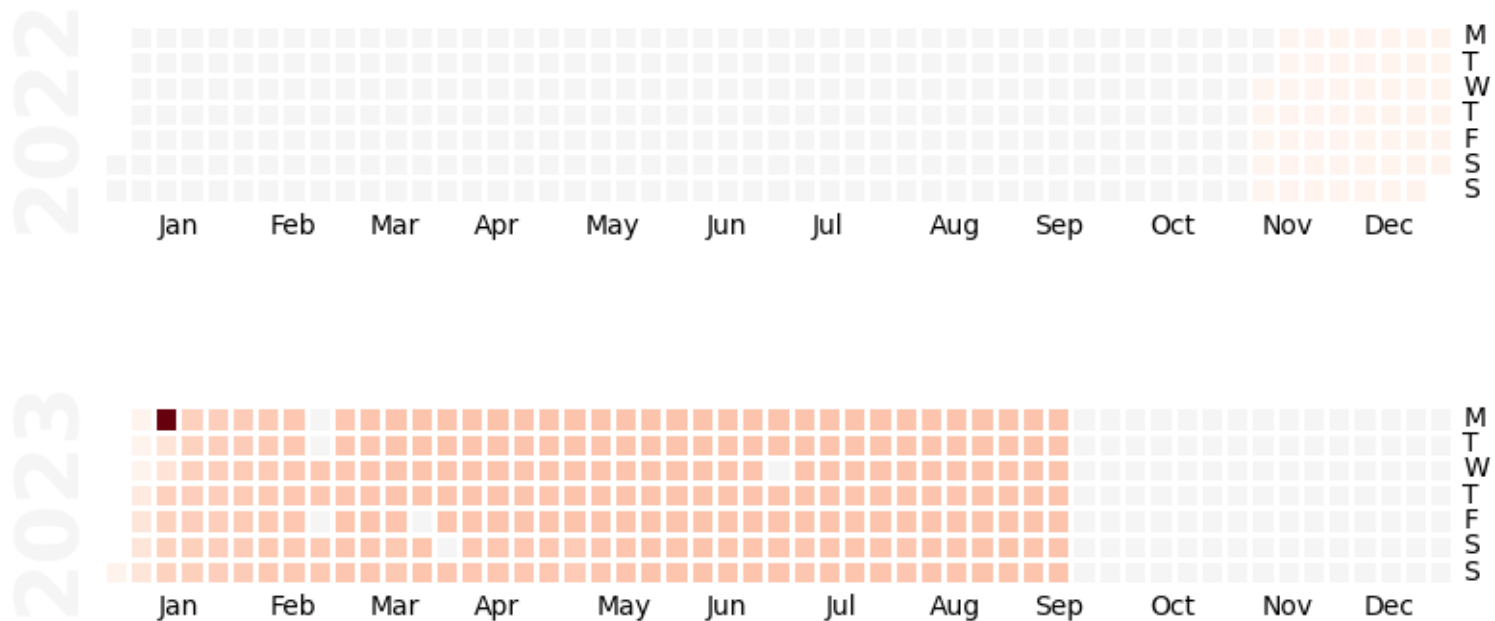
- How does fluctuations in the USD to EGP exchange rate impact the price of gold in the international market?



From this graph, we note that the rise of the price of USD lead to a rise in Gold prices where gold price has a strong correlation with it.

# Business Questions

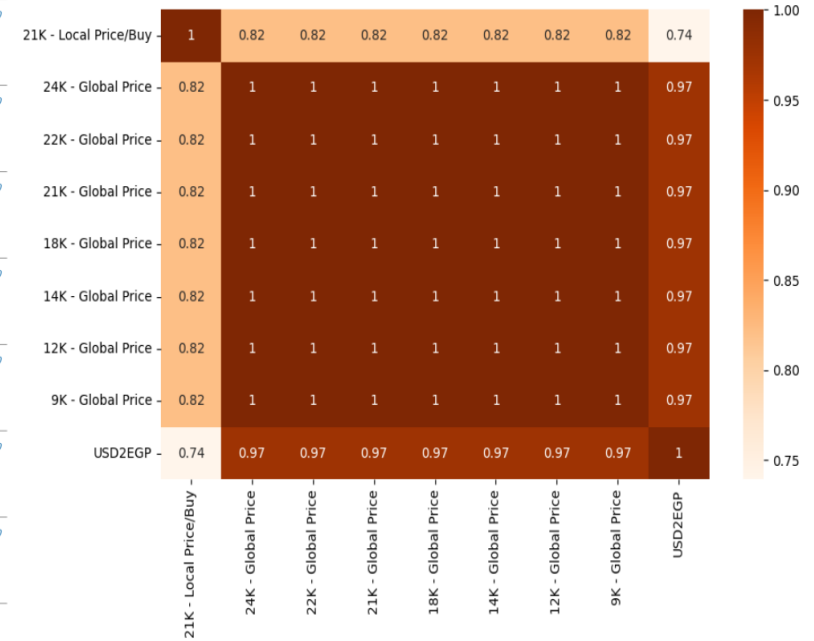
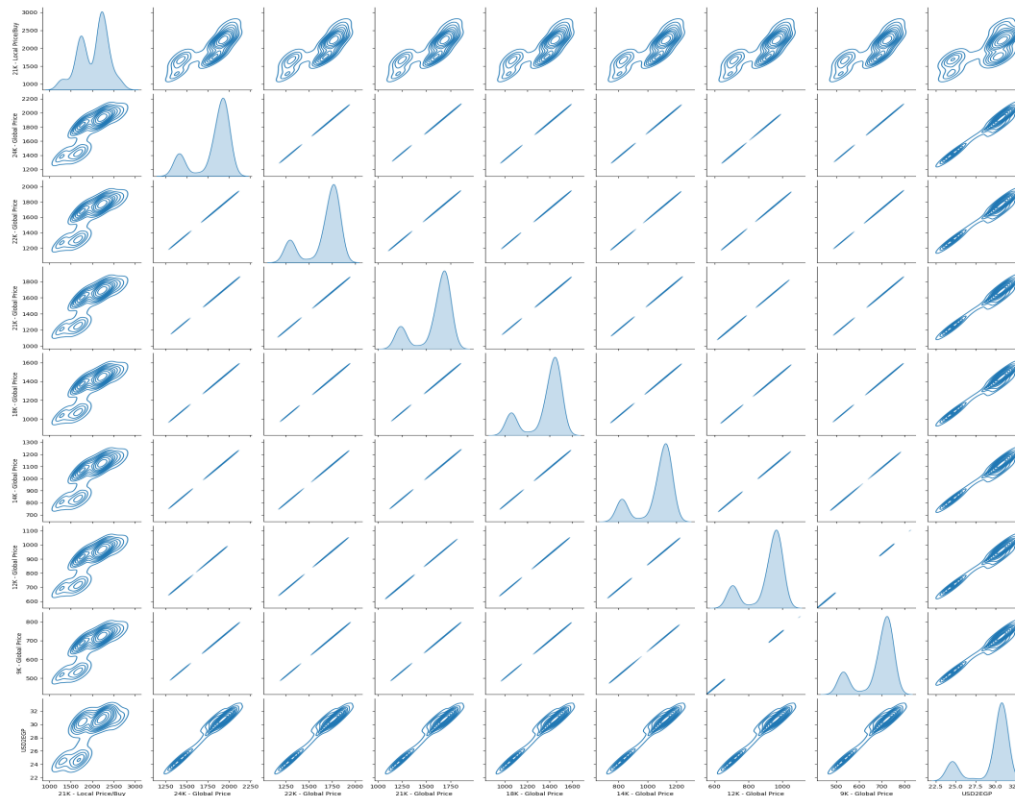
- Are there any trends or correlations between changes in the exchange rate and gold prices, that may require special attention or analysis?



Note: Monday for the second week of Jan/2023 has a higher price for 21k gold prices and USD.

# Modeling

## Feature Selection



All features has strong correlation with USD ,so at model we will deal with 21K and USD

# Modeling



## Applied Models:

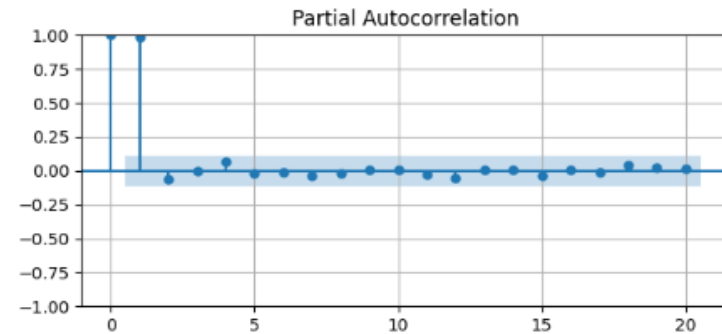
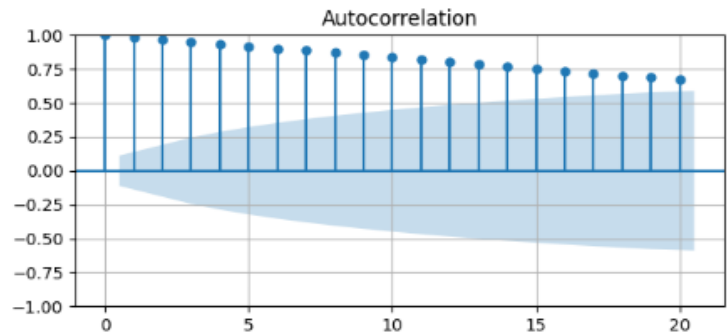
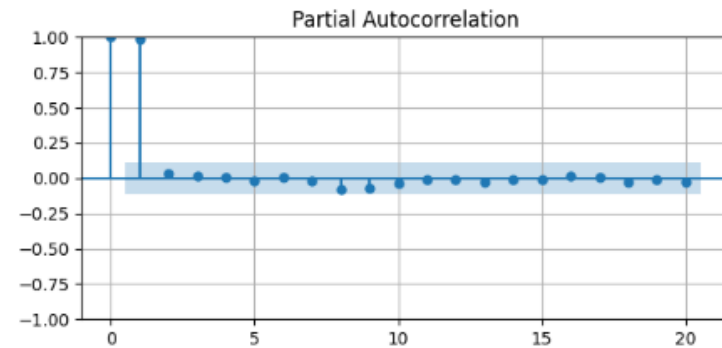
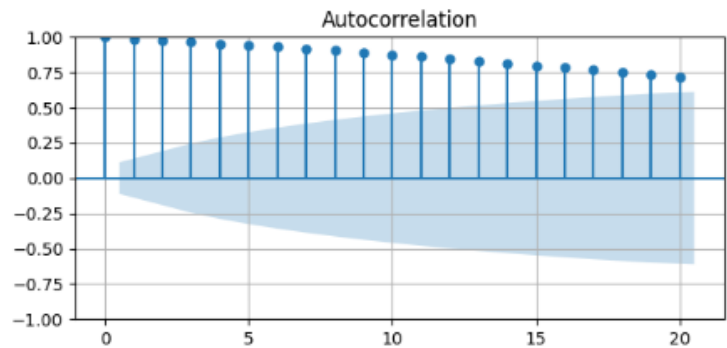
1. Arima.
2. SVR
3. XGBOOST as a Regressor
4. Naïve Bayes
5. Gradient Boosting Regressor
6. Decision Tree
7. Random Forest

# Modeling



## 1. ARIMA

- Show AutoCorrelation and PAutoCorrelation for global price and local price for 21K



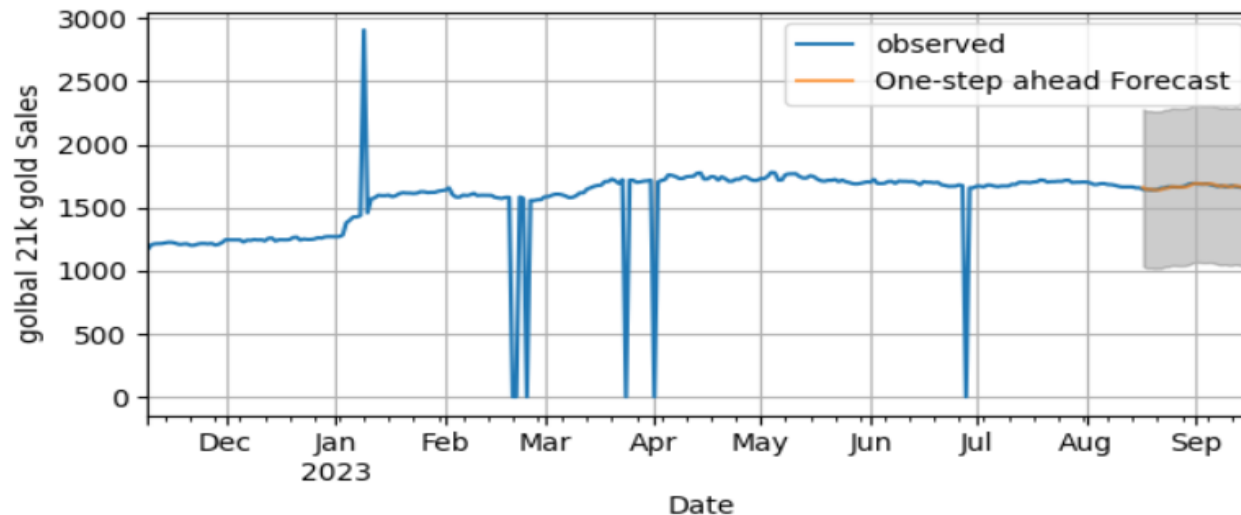
Note: AC is slow and PAC is slow so we may need ARIMA model

# Modeling



## 1. ARIMA

- ARIMA Forecasting



### Actual Prices

➤ 9-17 predicting	Global 21k Gold price Tomorrow : 2023-09-18	1668.0	2180	0
	Local 21k Gold price Tomorrow : 2023-09-18	2180.0		
➤ 9-18 predicting	Global 21k Gold price Tomorrow : 2023-09-19	1674.0	1682	-8
	Local 21k Gold price Tomorrow : 2023-09-19	2175.0	2210	-35
➤ 9-19 predicting	Global 21k Gold price Tomorrow : 2023-09-20	1683.0		
	Local 21k Gold price Tomorrow : 2023-09-20	2215.0	2210	



# Modeling



## 1. ARIMA

- Evaluation of ARIMA

```
evaluation of ARIMA for global 21k gold price
MAPE = 0.003138113186550831
MAE = 5.235294117647059
MSE = 43.05882352941177
RMSE = 6.561922243474984
R2 = 0.7927243653807716
```

```
evaluation of ARIMA for local 21k gold price
MAPE = 0.004550681994962352
MAE = 10.147058823529411
MSE = 200.73529411764707
RMSE = 14.168108346481795
R2 = 0.7945733002832861
```

# Modeling



## 2. SVR (Support Vector Regression)

- SVR Prediction and Score

	y_test	y_predicted
Date		
2023-07-23	1706.0	1682.059770
2023-01-08	1437.0	1425.177309
2022-11-16	1223.0	1232.513482

Train Score : 0.9486705726525813  
Test Score : 0.9495877916388924

- SVR Evaluation

evaluation of SVR

MAPE = 0.017632975901678626

MAE = 28.359575461959434

MSE = 1587.6086488222206

RMSE = 39.8448070496297

R<sup>2</sup> train: 0.9495877916388924

# Modeling



## 3. XGBOOST model as a regressor

- XGBOOST Prediction and Score

	y_test	y_predicted
46	<b>1425.0</b>	<b>1433.807495</b>
108	<b>1785.0</b>	<b>1815.792603</b>
206	<b>1952.0</b>	<b>1976.468506</b>

Train Score : 0.9988830205136398

Test Score : 0.955881974903611

- XGBOOST Evaluation

```
XGBOOST model evaluation
MAPE = 0.01414965562118113
MAE = 26.685147193170362
MSE = 1815.5556310052352
RMSE = 42.60933736876502
R^2 = 0.955881974903611
```

# Modeling



## 4. Naive Bayes

- Naive Bayes Prediction and Score

	y_test	y_predicted
Date		
2023-08-29	1673.0	1689.984572
2022-11-18	1207.0	1232.900278
2023-01-05	1400.0	1370.815462

Train Score : 0.9488038815874373

Test Score : 0.9499894643855321

- Naive Bayes Evaluation

```
BayesianRidge model evaluation  
MAPE = 0.017489920931927718  
MAE = 28.234674652528703  
MSE = 1574.9589525027588  
RMSE = 39.6857525127439  
R^2 = 0.9499894643855321
```

# Modeling



## 5. GradientBoostingRegressor

- GradientBoostingRegressor Prediction and Score

	y_test	y_predicted
Date		
2023-04-20	1744.0	1725.357470
2023-04-25	1724.0	1682.360906
2023-05-30	1697.0	1690.029019

Train Score : 0.9866379751776844  
Test Score : 0.9599239696553128

- GradientBoostingRegressor Evaluation

```
GradientBoosting model evaluation
MAPE = 0.014642989776256889
MAE = 23.70591583218592
MSE = 1262.096116280695
RMSE = 35.525992122398144
R^2 = 0.9599239696553128
```

# Modeling



## 6. Decision Tree

- Decision Tree Prediction and Score

	y_test	y_predicted
Date		
2023-07-16	<b>1697.0</b>	<b>1701.741935</b>
2022-12-21	<b>1266.0</b>	<b>1252.571429</b>
2023-04-07	<b>1746.0</b>	<b>1701.741935</b>

Train Score : 0.9767120050206706

Test Score : 0.9578321557031714

- Decision Tree Evaluation

```
Decision Tree model evaluation
MAPE = 0.015552127783688939
MAE = 25.22340401160967
MSE = 1327.9726575017876
RMSE = 36.44135916101082
R^2 = 0.9578321557031714
```

# Modeling



## 7. Random Forest model

- Random Forest Prediction and Score

	y_test	y_predicted
Date		
2023-07-11	1685.0	1676.603405
2023-01-31	1635.0	1598.351607
2023-05-05	1776.0	1690.648600

Train Score : 0.9878752178254215

Test Score : 0.9626697490209842

- Random Forest Evaluation

Random Forest model evaluation

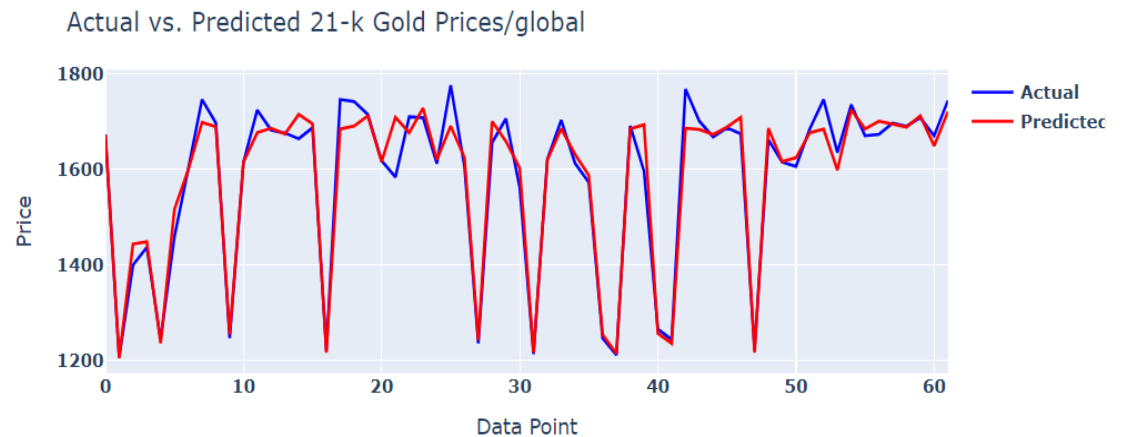
MAPE = 0.014036727586097732

MAE = 22.88249887665396

MSE = 1175.6245410330482

RMSE = 34.28738165904548

R^2 = 0.9626697490209842



# Conclusion

	MAPE	MAE	MSE	RMSE	Score
model					
ARIMA_Global_21k	0.003071	5.121212	41.909091	6.473723	0.000000
ARIMA_Local_21k	0.004141	9.242424	158.333333	12.583057	0.000000
SVR	0.017615	28.331247	1580.320431	39.753244	0.949804
XGB	0.015738	29.323965	2165.275026	46.532516	0.947369
NB	0.017449	28.167981	1567.572350	39.592579	0.950209
GB	0.014662	23.741299	1318.912613	36.316836	0.958107
DT	0.016022	26.015543	1390.575969	37.290427	0.955831
RF	0.014227	23.208332	1242.493197	35.249017	0.960534

- After this analysis, we confirmed that gold prices are greatly affected by dollar prices, the global economy, and inflation.
- Through this project, we can predict what the price of gold will be tomorrow, and we help people to have knowledge of the price of gold tomorrow, and we help them determine the time of day they will buy in order to preserve their money, so they buy gold when its price is low compared to the previous days.
- We Find that Random Forest has heigher accuracy for Forecasting Gold Price as ML with accuracy = 96% and RMSE = 35.24 , ARIMA has lower error = 6.48 and XGBboosting has heigher error = 40.53.



# Updates

- We will use LSTM and RNN deep learning models to get strong performance the ratio of error is very small.
- We will forecast for all karats of gold.



# Acknowledgement

We express our gratitude to Dr. Alhussien for his contributions in the field of Python. Additionally, we extend our appreciation to Dr. Doaa for her exceptional dedication in teaching us everything we needed to know. We are also thankful to Dr. Shady for providing us with comprehensive insights and assisting us in gaining a deep understanding of the models. Furthermore, we acknowledge Dr. Mohamed for his guidance in enhancing our thought process when it comes to selecting models. Lastly, We would like to express our thanks to the facilitators for their valuable mentoring and unwavering support throughout our journey.



# References

Our kaggle notebook :

- <https://www.kaggle.com/code/fatmayousufmohamed/gold-prices/input>
- <https://www.kaggle.com/datasets/mohamedmagdy11/egypt-gold-prices-daily-updated>
- <https://www.kaggle.com/datasets/mh0386/usd-to-egp>
- SIC Slides
- <https://scikit-learn.org/stable/index.html>
- <https://matplotlib.org/stable/tutorials/introductory/pyplot.html>
- <https://plotly.com/python/>



# Thank You



# Any Questions



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**Enabling People**

Education for Future Generations

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