In [1]:

```
import pandas as pd
from random import gauss as gs
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.metrics import mean_squared_error
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import TimeSeriesSplit
import matplotlib.dates as mdates
import matplotlib as mpl
import seaborn as sns
from math import sqrt

import itertools
#from pmdarima import auto_arima

#statsmodels

from statsmodels.tsa.arima.model import ARIMA
from statsmodels.tsa.stattools import acf, pacf, adfuller
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf
from statsmodels.tsa.statespace.sarimax import SARIMAX
from statsmodels.graphics.tsaplots import plot_predict
import statsmodels.api as sm

%matplotlib inline
```

In [2]:

```python
crude_oil = pd.read_csv("data/crude_oil.csv")
gold = pd.read_csv("data/gold.csv")
dow_jones = pd.read_csv("data/dow_jones.csv")
fed_funds = pd.read_csv("data/fed_funds.csv")

crude_oil['Crude Oil'] = crude_oil['real']
crude_oil = crude_oil.drop(['real', 'nominal'], axis = 1)
crude_oil['date'] = pd.to_datetime(crude_oil['date'])
crude_oil.set_index('date', inplace = True)


gold['Gold'] = gold['real']
gold = gold.drop(['real', 'nominal'], axis = 1)
gold['date'] = pd.to_datetime(gold['date'])
gold.set_index('date', inplace = True)

dow_jones['Dow Jones'] = dow_jones['real']
dow_jones = dow_jones.drop(['real', 'nominal'], axis = 1)
dow_jones['date'] = pd.to_datetime(dow_jones['date'])
dow_jones.set_index('date', inplace = True)

fed_funds['date'] = fed_funds['DATE']
fed_funds['Fed Funds'] = fed_funds['FEDFUNDS']
fed_funds = fed_funds.drop(['DATE', 'FEDFUNDS'], axis = 1)
fed_funds['date'] = pd.to_datetime(fed_funds['date'])
fed_funds.set_index('date', inplace = True)

crude_oil
```

Out[2]:

	Crude Oil
date	
1946-01-01	18.79
1946-02-01	18.89
1946-03-01	18.69
1946-04-01	20.18
1946-05-01	20.07
...	...
2022-03-01	101.98
2022-04-01	105.84
2022-05-01	114.67
2022-06-01	159.57
2022-07-01	123.71

919 rows × 1 columns

In [3]:

```
occidental = pd.read_csv("data/OXY Historical Data.csv")
occidental['date'] = pd.to_datetime(occidental['Date'], format = "%b %y")
occidental['OXY Price'] = occidental['Price']
occidental = occidental.drop(['Date', 'Open', 'High', 'Low', 'Vol.', 'Change %', 'Price
occidental = occidental.set_index('date')
occidental
```

Out[3]:

	OXY Price
date	
2022-07-01	59.52
2022-06-01	58.88
2022-05-01	69.31
2022-04-01	55.09
2022-03-01	56.74
...	...
1980-08-01	13.19
1980-07-01	12.59
1980-06-01	12.83
1980-05-01	12.71
1980-04-01	11.33

508 rows × 1 columns

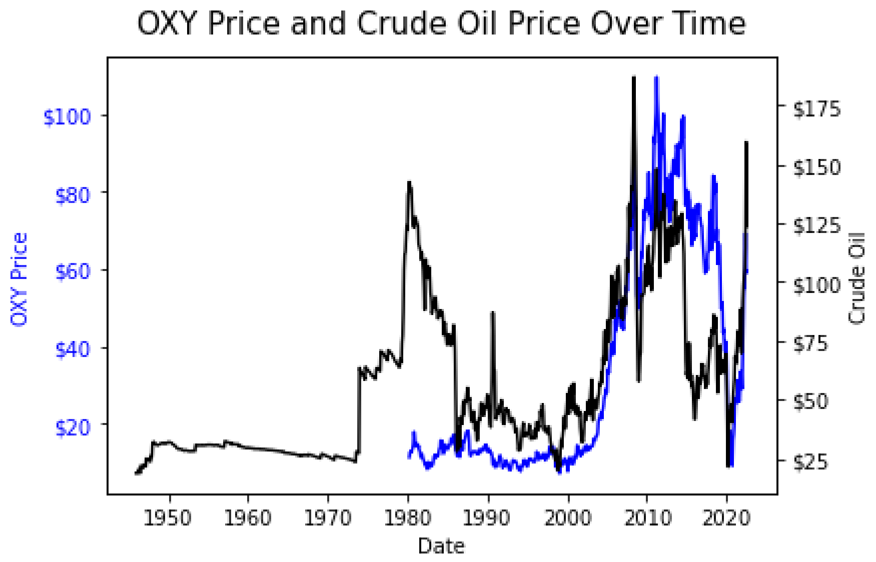
In [4]:

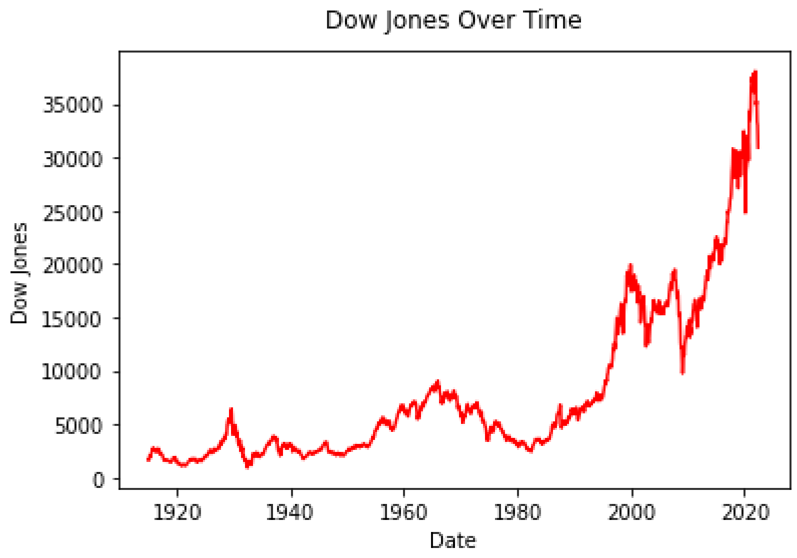
```
all_data = dow_jones.copy()
all_data['Gold'] = gold['Gold']
#all_data = all_data[400:]
#all_data['Crude Oil'] = crude_oil['Crude Oil']

all_data = pd.concat([all_data, crude_oil, fed_funds, occidental], axis=1)
#all_data = pd.concat([all_data, fed_funds], axis=1)
#all_data['Fed Funds'] = fed_funds['Fed Funds']


#all_data.set_index('date', inplace = True)


fig, ax1 = plt.subplots()
ax1.set_title('OXY Price and Crude Oil Price Over Time', pad = 12, fontsize = 15)
color = 'blue'
ax1.set_xlabel('Date')
ax1.set_ylabel('OXY Price', color = color)
ax1.plot(all_data.index, all_data['OXY Price'], color = color)
ax1.tick_params(axis ='y', labelcolor = color)
ax1.yaxis.set_major_formatter(mpl.ticker.StrMethodFormatter('${x:,.0f}'))

# Adding Twin Axes to plot using dataset_2
ax2 = ax1.twinx()

color = 'black'
ax2.set_ylabel('Crude Oil', color = color)
ax2.plot(all_data.index, all_data['Crude Oil'], color = color)
ax2.tick_params(axis ='y', labelcolor = color)
ax2.yaxis.set_major_formatter(mpl.ticker.StrMethodFormatter('${x:,.0f}'))


fig, ax3 = plt.subplots()
ax3.set_title('Dow Jones Over Time', pad = 12)
ax3.set_xlabel('Date')
color = 'red'
ax3.set_ylabel('Dow Jones')
ax3.plot(all_data.index, all_data['Dow Jones'], color = color)


fig, ax4 = plt.subplots()
ax4.set_title('Fed Funds Rate Over Time', pad = 12)
ax4.set_xlabel('Date')
ax4.set_ylabel('Fed')
ax4.plot(all_data.index, all_data['Fed Funds'])
ax4.yaxis.set_major_formatter(mpl.ticker.StrMethodFormatter('{x:,.0f}%'))

fig, ax5 = plt.subplots()
ax5.set_title('Crude Oil Price Over Time', pad = 12, fontsize = 15)
color = 'black'
ax5.set_ylabel('Crude Oil', color = color)
ax5.plot(all_data.index, all_data['Crude Oil'], color = color)
ax5.tick_params(axis ='y', labelcolor = color)
ax5.yaxis.set_major_formatter(mpl.ticker.StrMethodFormatter('${x:,.0f}'))
all_data
```

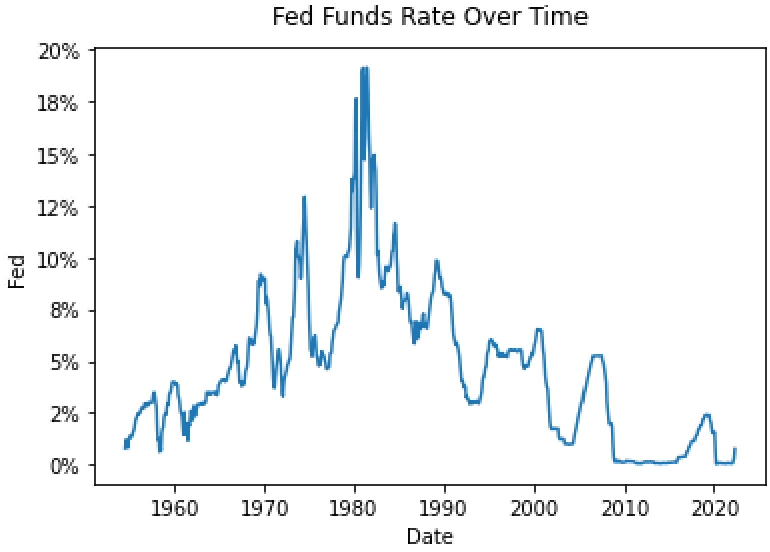
Out[4]:

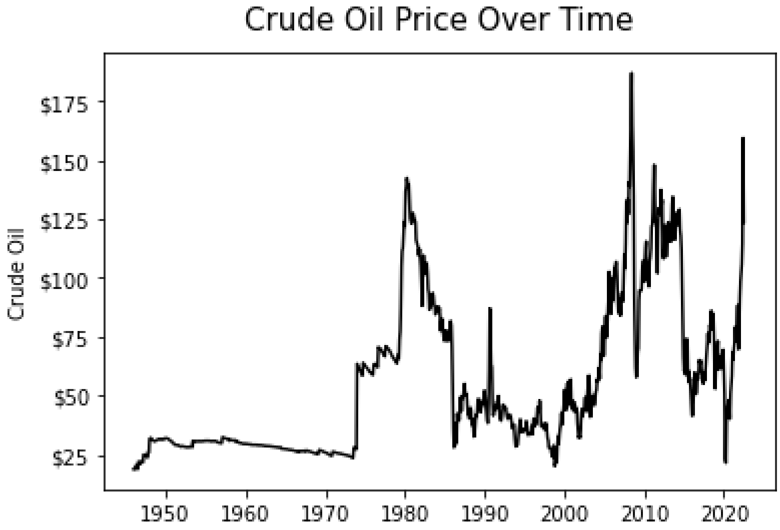
	Dow Jones	Gold	Crude Oil	Fed Funds	OXY Price
date					
1915-01-01	1636.27	557.10	NaN	NaN	NaN
1915-02-01	1608.23	562.68	NaN	NaN	NaN
1915-03-01	1796.01	568.36	NaN	NaN	NaN
1915-04-01	2098.13	562.68	NaN	NaN	NaN
1915-05-01	1881.39	557.10	NaN	NaN	NaN
...	...	...	...	...	...
2022-03-01	35267.88	1986.24	101.98	0.20	56.74
2022-04-01	33339.96	1932.73	105.84	0.33	55.09
2022-05-01	32990.12	1847.26	114.67	0.77	69.31
2022-06-01	30946.99	1824.80	159.57	NaN	58.88
2022-07-01	NaN	NaN	123.71	NaN	59.52

1291 rows × 5 columns


OXY Price and Crude Oil Price Over Time


Dow Jones Over Time

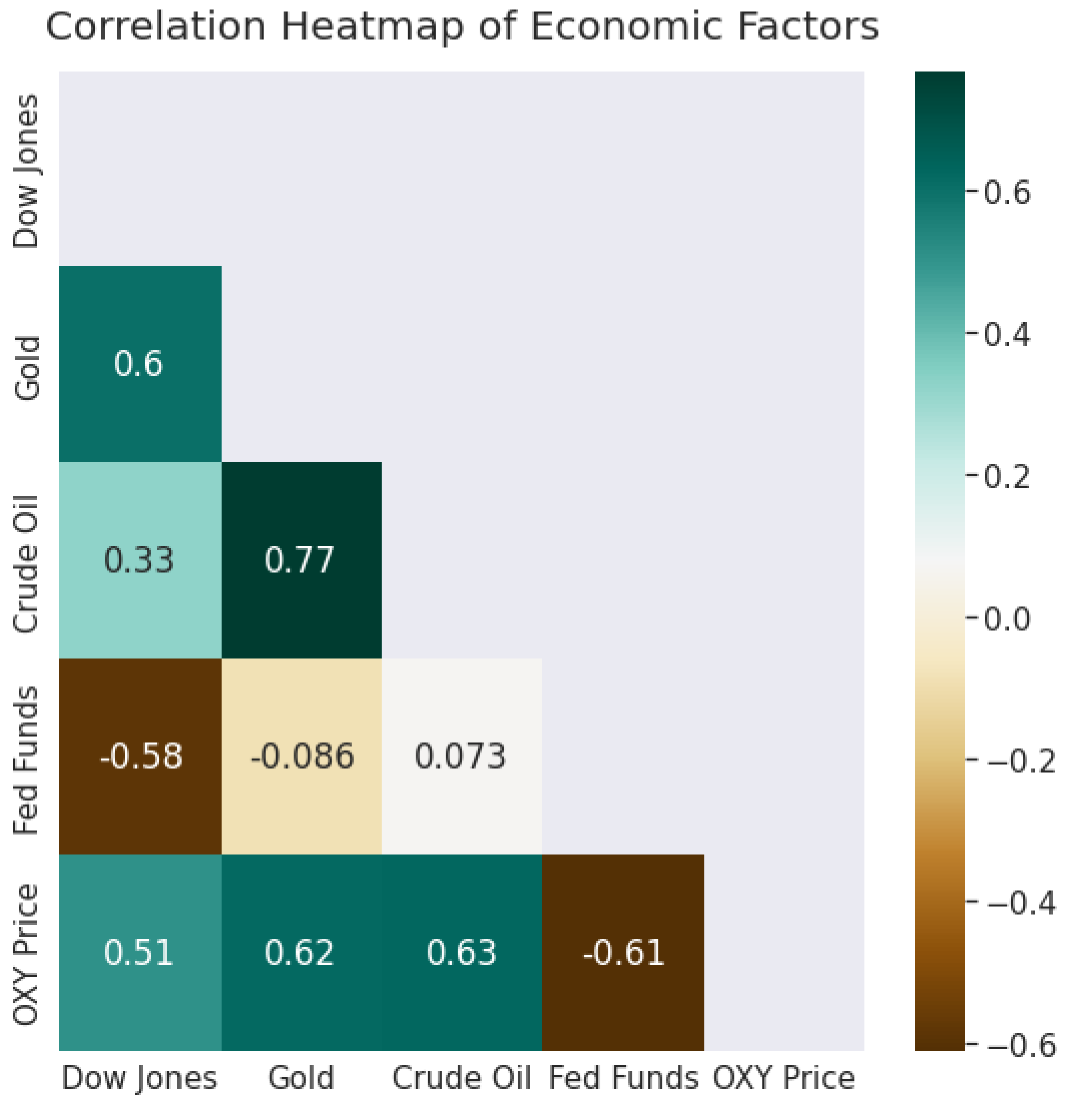

Fed Funds Rate Over Time
Fed
20%
18%
15%
12%
10%
8%
5%
2%
0%
1960
1970
1980
1990
2000
2010
2020
Date


Crude Oil Price Over Time
Crude Oil
$175
$150
$125
$100
$75
$50
$25
1950
1960
1970
1980
1990
2000
2010
2020

In [5]:

```
with sns.axes_style('darkgrid'):

    f, ax = plt.subplots(figsize=(9,9))

    mask = np.triu(np.ones_like(all_data.corr(), dtype=np.bool))

    plt.xticks(fontsize = 15)

    plt.yticks(fontsize = 15)

    sns.set(font_scale=1.4)

    heatmap = sns.heatmap(all_data.corr(), annot = True, mask = mask, cmap = "BrBG")

    heatmap.set_title("Correlation Heatmap of Economic Factors", fontdict={'fontsize':
```

```
C:\Users\wjsdn\AppData\Local\Temp\ipykernel_31800\504848525.py:5: Deprecatio
nWarning: `np.bool` is a deprecated alias for the builtin `bool`. To silence
this warning, use `bool` by itself. Doing this will not modify any behavior
and is safe. If you specifically wanted the numpy scalar type, use `np.bool_
` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/d
evdocs/release/1.20.0-notes.html#deprecations (https://numpy.org/devdocs/rel
ease/1.20.0-notes.html#deprecations)
  mask = np.triu(np.ones_like(all_data.corr(), dtype=np.bool))
```



In [6]:

```
all_data['Crude Oil']
```

Out[6]:

```
date
1915-01-01       NaN
1915-02-01       NaN
1915-03-01       NaN
1915-04-01       NaN
1915-05-01       NaN
               ...  
2022-03-01    101.98
2022-04-01    105.84
2022-05-01    114.67
2022-06-01    159.57
2022-07-01    123.71
Freq: MS, Name: Crude Oil, Length: 1291, dtype: float64
```

In [7]:

```
train_df = all_data['1990-07-01':'2021-05-01']
test_df = all_data['2021-05-01':'2022-07-01']

test_df
```

Out[7]:

	Dow Jones	Gold	Crude Oil	Fed Funds	OXY Price
date					
2021-05-01	37498.98	2068.55	72.02	0.06	25.96
2021-06-01	37124.70	1906.24	79.05	0.08	31.27
2021-07-01	37415.89	1942.92	79.20	0.10	26.10
2021-08-01	37765.26	1939.27	73.16	0.09	25.69
2021-09-01	36077.62	1872.60	79.98	0.08	29.58
2021-10-01	37861.27	1885.58	88.33	0.08	33.53
2021-11-01	36276.87	1868.27	69.62	0.08	29.65
2021-12-01	38082.54	1916.37	78.82	0.08	28.99
2022-01-01	36537.13	1867.96	91.68	0.08	37.67
2022-02-01	34909.38	1957.72	98.59	0.08	43.73
2022-03-01	35267.88	1986.24	101.98	0.20	56.74
2022-04-01	33339.96	1932.73	105.84	0.33	55.09
2022-05-01	32990.12	1847.26	114.67	0.77	69.31
2022-06-01	30946.99	1824.80	159.57	NaN	58.88
2022-07-01	NaN	NaN	123.71	NaN	59.52

In [8]:

```
test_df_oil = test_df['Crude Oil']
test_df_oil = pd.DataFrame(test_df_oil)
test_df_oil
```

Out[8]:

```
            Crude Oil
      date
2021-05-01      72.02
2021-06-01      79.05
2021-07-01      79.20
2021-08-01      73.16
2021-09-01      79.98
2021-10-01      88.33
2021-11-01      69.62
2021-12-01      78.82
2022-01-01      91.68
2022-02-01      98.59
2022-03-01     101.98
2022-04-01     105.84
2022-05-01     114.67
2022-06-01     159.57
2022-07-01     123.71
```

In [9]:

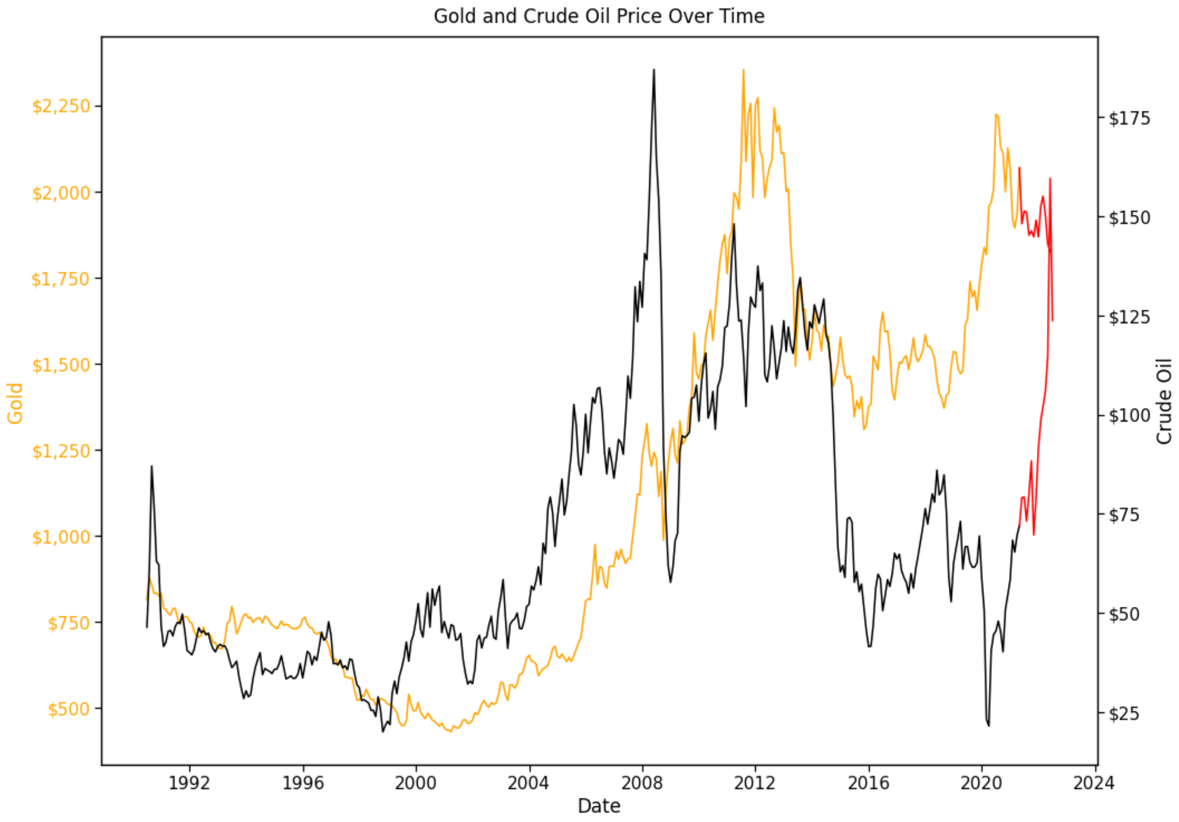
```
train_df_oil = train_df['Crude Oil']
train_df_oil = pd.DataFrame(train_df_oil)
train_df_oil
```

Out[9]:

```
            Crude Oil
      date
1990-07-01      46.39
1990-08-01      60.68
1990-09-01      87.04
1990-10-01      77.12
1990-11-01      63.04
       ...        ...
2021-01-01      58.31
2021-02-01      68.33
2021-03-01      65.31
2021-04-01      69.62
2021-05-01      72.02

371 rows × 1 columns
```

In [10]:

```
gold = pd.DataFrame()

fig, ax1 = plt.subplots(figsize=(16,12))
ax1.set_title('Gold and Crude Oil Price Over Time', pad = 12)
color = 'orange'
ax1.set_xlabel('Date')
ax1.set_ylabel('Gold', color = color)
ax1.plot(train_df.index, train_df['Gold'], color = color)
ax1.plot(test_df.index, test_df['Gold'], color = 'red')
ax1.tick_params(axis ='y', labelcolor = color)
ax1.yaxis.set_major_formatter(mpl.ticker.StrMethodFormatter('${x:,.0f}'))

# Adding Twin Axes to plot using dataset_2
ax2 = ax1.twinx()

color = 'black'
ax2.set_ylabel('Crude Oil', color = color)
ax2.plot(train_df.index, train_df['Crude Oil'], color = color)
ax2.plot(test_df.index, test_df['Crude Oil'], color = 'red')
ax2.tick_params(axis ='y', labelcolor = color)
ax2.yaxis.set_major_formatter(mpl.ticker.StrMethodFormatter('${x:,.0f}'))
```



In [11]:

```
oil_train = train_df['Crude Oil']


oil_train_model = ARIMA(oil_train, order = (0,3,1))
oil_train_model_fit = oil_train_model.fit()
print(oil_train_model_fit.summary())
```

```
                               SARIMAX Results                              
============================================================================
==
Dep. Variable:              Crude Oil   No. Observations:                  3
71
Model:                 ARIMA(0, 3, 1)   Log Likelihood               -1332.6
17
Date:                Wed, 13 Jul 2022   AIC                           2669.2
34
Time:                        09:15:22   BIC                           2677.0
50
Sample:                    07-01-1990   HQIC                          2672.3
40
                         - 05-01-2021                                       
Covariance Type:                  opg                                       
============================================================================
==
                 coef    std err          z      P>|z|      [0.025      0.97
5]
----------------------------------------------------------------------------
--
ma.L1         -0.9998      1.615     -0.619      0.536      -4.165       2.1
66
sigma2        80.5360    130.201      0.619      0.536    -174.653     335.7
25
============================================================================
=======
Ljung-Box (L1) (Q):                  59.96   Jarque-Bera (JB):              
49.96
Prob(Q):                              0.00   Prob(JB):                      
0.00
Heteroskedasticity (H):               2.62   Skew:                          
-0.21
Prob(H) (two-sided):                  0.00   Kurtosis:                      
4.75
============================================================================
=======

Warnings:
[1] Covariance matrix calculated using the outer product of gradients (compl
ex-step).
```

```
C:\Users\wjsdn\AppData\Roaming\Python\Python39\site-packages\statsmodels\tsa
\statespace\sarimax.py:978: UserWarning: Non-invertible starting MA paramete
rs found. Using zeros as starting parameters.
  warn('Non-invertible starting MA parameters found.'
```

In [12]:

```
oil_train_model_fit
```

Out[12]:

```
<statsmodels.tsa.arima.model.ARIMAResultsWrapper at 0x269afe2a880>
```

In [13]:

```
predict = oil_train_model_fit.predict()
oil_train_predict = pd.DataFrame(predict)
oil_train_predict
```

Out[13]:

	predicted_mean
date	
1990-07-01	0.000000
1990-08-01	92.781245
1990-09-01	74.383557
1990-10-01	125.463889
1990-11-01	55.097781
...	...
2021-01-01	57.930450
2021-02-01	62.151491
2021-03-01	78.338395
2021-04-01	62.242848
2021-05-01	73.902921

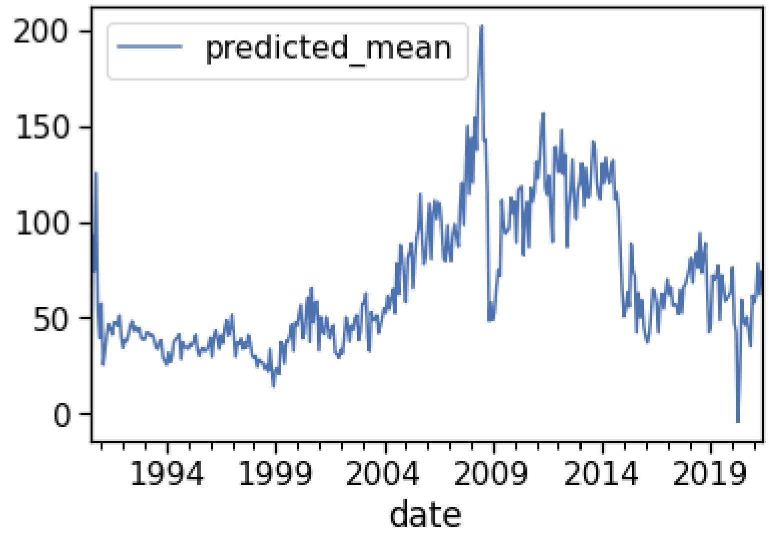
371 rows × 1 columns

In [14]:

```
oil_train_predict.plot()
```

Out[14]:

```
<AxesSubplot:xlabel='date'>
```



In [15]:

```
oil_fore = oil_train_model_fit.forecast(steps=100)
oil_fore = pd.DataFrame(oil_fore)
oil_fore
```

Out[15]:

	predicted_mean
2021-06-01	74.387812
2021-07-01	76.723436
2021-08-01	79.026871
2021-09-01	81.298119
2021-10-01	83.537178
...	...
2029-05-01	152.552034
2029-06-01	151.829785
2029-07-01	151.075347
2029-08-01	150.288722
2029-09-01	149.469908

100 rows × 1 columns

In [16]:

```
oil_fore.idxmax()
```

Out[16]:

```
predicted_mean   2027-07-01
dtype: datetime64[ns]
```

In [17]:

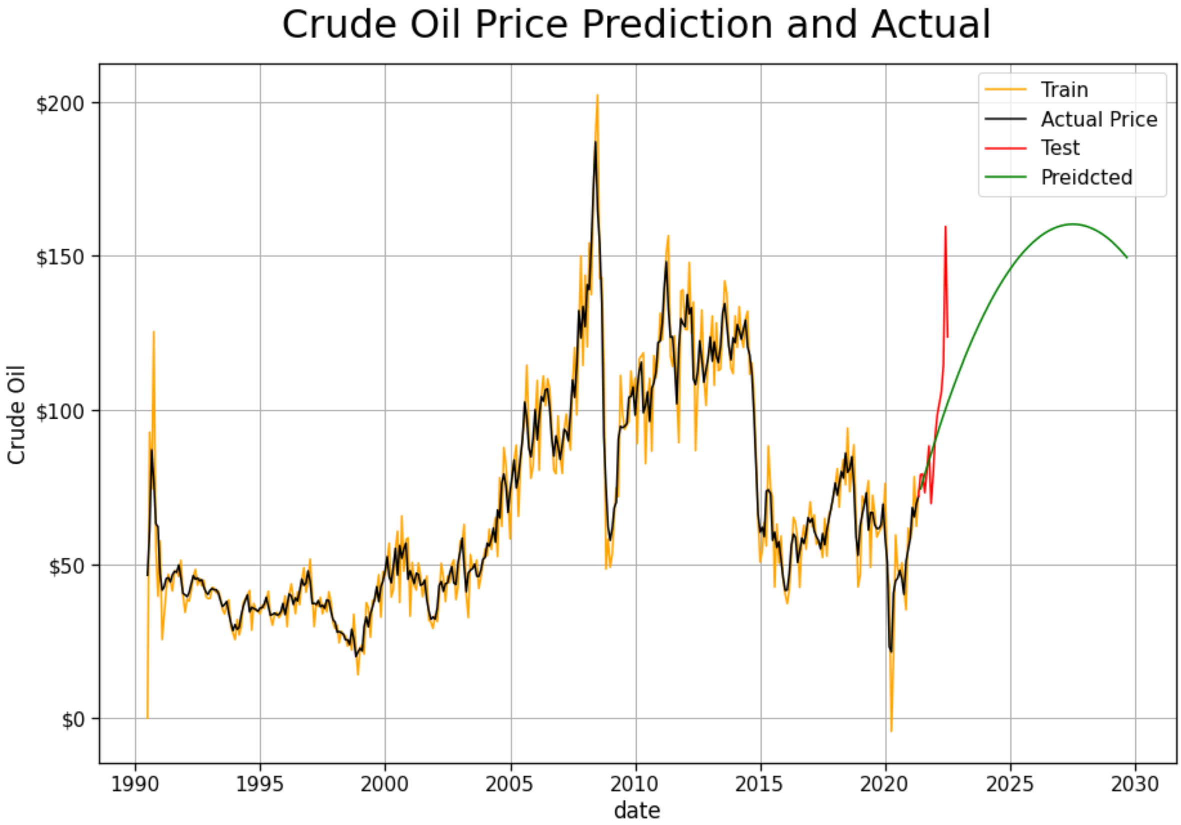
```
oil_fore_error = oil_fore[:14]
oil_fore_error
```

Out[17]:

	predicted_mean
2021-06-01	74.387812
2021-07-01	76.723436
2021-08-01	79.026871
2021-09-01	81.298119
2021-10-01	83.537178
2021-11-01	85.744049
2021-12-01	87.918732
2022-01-01	90.061227
2022-02-01	92.171534
2022-03-01	94.249652
2022-04-01	96.295583
2022-05-01	98.309325
2022-06-01	100.290880
2022-07-01	102.240246

In [18]:

```
fig, ax2 = plt.subplots(figsize=(15, 10))

ax2.set_title('Crude Oil Price Prediction and Actual', pad = 20, fontsize = 30)
color = 'black'
ax2.set_ylabel('Crude Oil', color = color)
ax2.plot(oil_train_predict.index, oil_train_predict['predicted_mean'], color = 'orange'
ax2.plot(train_df.index, train_df['Crude Oil'], color = color)
ax2.plot(test_df.index, test_df['Crude Oil'], color = 'red')
ax2.plot(oil_fore.index, oil_fore['predicted_mean'], color = 'green')

ax2.tick_params(axis ='y', labelcolor = color)
ax2.yaxis.set_major_formatter(mpl.ticker.StrMethodFormatter('${x:,.0f}'))
plt.legend(['Train', 'Actual Price', 'Test', 'Preidcted']);
ax2.set_xlabel('date')
plt.grid()
```



In [19]:

```
test_df_oil_error = test_df_oil[1:]
test_df_oil_error.mean()
```

Out[19]:

```
Crude Oil    96.014286
dtype: float64
```

In [20]:

```
rms_test = sqrt(mean_squared_error(test_df_oil_error, oil_fore_error))
rms_test
```

Out[20]:

```
18.645331606904584
```

In [21]:

```
rms_train = sqrt(mean_squared_error(train_df_oil, oil_train_predict))
rms_train
```

Out[21]:

```
9.645492079222704
```

In [22]:

```
train_df_oil.mean()
```

Out[22]:

```
Crude Oil    67.93442
dtype: float64
```

In [23]:

```
from prophet import Prophet
```

In [24]:

```
oil_df =all_data['2005-05-01':'2022-07-01']
oil_df['ds'] = oil_df.index
oil_df.rename(columns = {'Crude Oil' : 'y'}, inplace = True)
oil_df = oil_df.reindex(columns=['ds', 'y'])
oil_df
```

```
C:\Users\wjsdn\AppData\Local\Temp\ipykernel_31800\993763398.py:2: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/
stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pand
as.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-v
ersus-a-copy)
  oil_df['ds'] = oil_df.index
C:\Users\wjsdn\AppData\Local\Temp\ipykernel_31800\993763398.py:3: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/
stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pand
as.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-v
ersus-a-copy)
  oil_df.rename(columns = {'Crude Oil' : 'y'}, inplace = True)
```

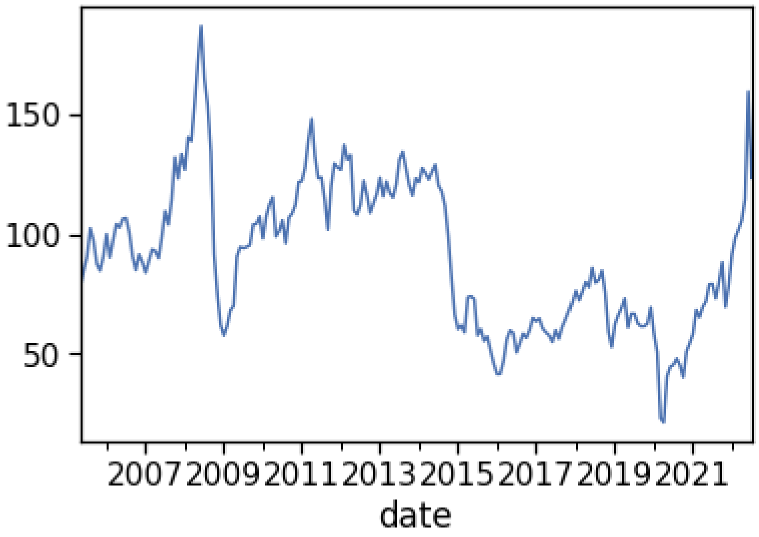
Out[24]:

	ds	y
date		
2005-05-01	2005-05-01	78.16
2005-06-01	2005-06-01	84.92
2005-07-01	2005-07-01	90.61
2005-08-01	2005-08-01	102.58
2005-09-01	2005-09-01	97.37
...	...	...
2022-03-01	2022-03-01	101.98
2022-04-01	2022-04-01	105.84
2022-05-01	2022-05-01	114.67
2022-06-01	2022-06-01	159.57
2022-07-01	2022-07-01	123.71

207 rows × 2 columns

In [25]:

```
ax = oil_df['y'].plot()
plt.show()
```



In [26]:

```
oil_prophet = Prophet(changepoint_prior_scale = 1)
oil_prophet.fit(oil_df)
```

```
09:15:25 - cmdstanpy - INFO - Chain [1] start processing
09:15:25 - cmdstanpy - INFO - Chain [1] done processing
```

Out[26]:

```
<prophet.forecaster.Prophet at 0x269b02ca100>
```

In [27]:

```
forecast_time = 19
df_forecast = oil_prophet.make_future_dataframe(periods = forecast_time, freq = 'M')
df_forecast
```

Out[27]:

	ds
0	2005-05-01
1	2005-06-01
2	2005-07-01
3	2005-08-01
4	2005-09-01
...	...
221	2023-09-30
222	2023-10-31
223	2023-11-30
224	2023-12-31
225	2024-01-31

226 rows × 1 columns

In [28]:

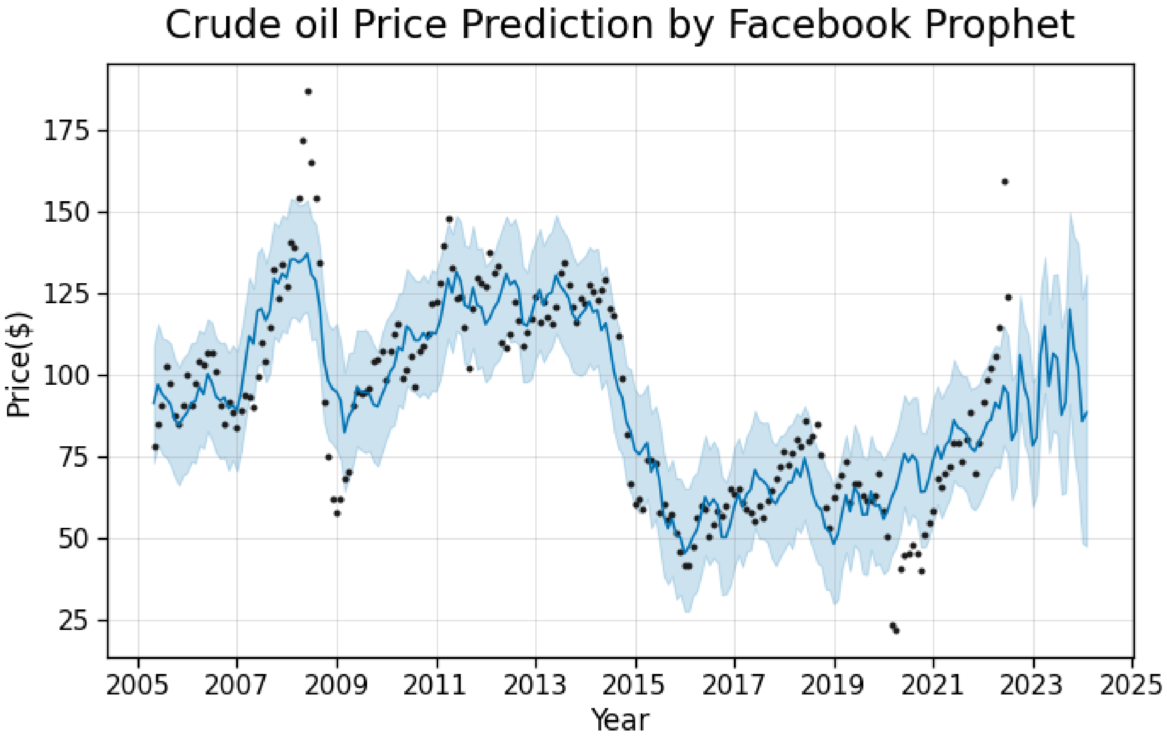
```
df_forecast = oil_prophet.predict(df_forecast)
df_forecast
```

Out[28]:

```
             ds       trend  yhat_lower  yhat_upper  trend_lower  trend_upper  additive_terms  addit
  0       2005-   86.586988   72.868965  108.747989    86.586988    86.586988        4.668387
          05-01
  1       2005-   86.866336   78.650136  115.549001    86.866336    86.866336        9.987831
          06-01
  2       2005-   87.136672   75.634254  111.273987    87.136672    87.136672        6.853261
          07-01
  3       2005-   87.416020   74.611630  110.748112    87.416020    87.416020        5.215402
          08-01
  4       2005-   87.695367   72.139217  109.608403    87.695367    87.695367        3.110068
          09-01
...         ...         ...         ...         ...          ...          ...             ...
221       2023-  100.096265   91.004391  149.758995    75.648719   124.544801       19.976464
          09-30
222       2023-  100.972340   75.390245  142.297150    73.659790   127.795888        7.105148
          10-31
223       2023-  101.820155   66.292015  140.175814    71.800028   132.089511        0.785069
          11-30
224       2023-  102.696229   48.309463  123.255013    69.370914   136.154813      -17.041895
          12-31
225       2024-  103.572304   47.317726  130.845662    67.072985   140.791943      -15.232677
          01-31

226 rows × 16 columns
```

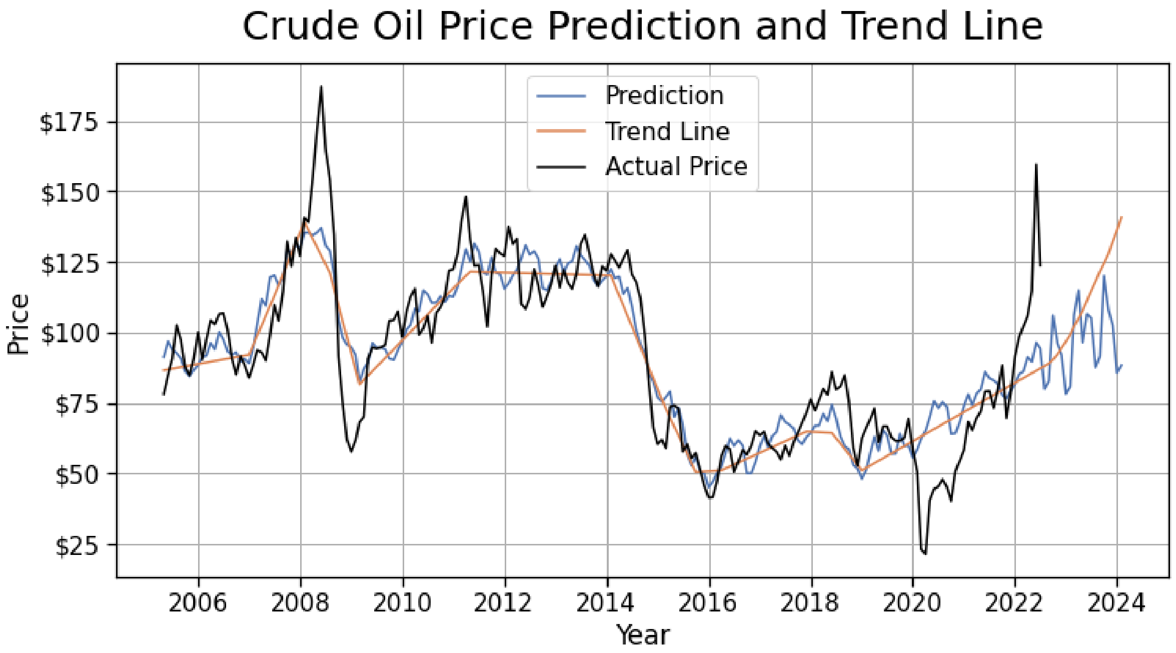
In [29]:

```
oil_prophet.plot(df_forecast, xlabel = 'Year', ylabel = 'Price($)')
#plt.set_major_formatter(mpl.ticker.StrMethodFormatter('${x:,.0f}'))
plt.title('Crude oil Price Prediction by Facebook Prophet', fontsize = 23, pad = 15);
```



In [30]:

```
fig, ax = plt.subplots(figsize=(12, 6))

ax.yaxis.set_major_formatter(mpl.ticker.StrMethodFormatter('${x:,.0f}'))

plt.plot(df_forecast['ds'], df_forecast['yhat'], label = 'Prediction')
plt.plot(df_forecast['ds'], df_forecast['trend_upper'], label = 'Trend Line' )
plt.plot(oil_df['ds'], oil_df['y'], label = 'Actual Price', color = 'black')
plt.legend()
plt.grid()
plt.ylabel('Price')
plt.xlabel('Year')
plt.title('Crude Oil Price Prediction and Trend Line', fontsize = 25, pad = 15);
```



In [31]:

```
df_forecast
```

Out[31]:

	ds	trend	yhat_lower	yhat_upper	trend_lower	trend_upper	additive_terms	addit
0	2005-05-01	86.586988	72.868965	108.747989	86.586988	86.586988	4.668387	
1	2005-06-01	86.866336	78.650136	115.549001	86.866336	86.866336	9.987831	
2	2005-07-01	87.136672	75.634254	111.273987	87.136672	87.136672	6.853261	
3	2005-08-01	87.416020	74.611630	110.748112	87.416020	87.416020	5.215402	
4	2005-09-01	87.695367	72.139217	109.608403	87.695367	87.695367	3.110068	
...	...	...	...	...	...	...	...	
221	2023-09-30	100.096265	91.004391	149.758995	75.648719	124.544801	19.976464	
222	2023-10-31	100.972340	75.390245	142.297150	73.659790	127.795888	7.105148	
223	2023-11-30	101.820155	66.292015	140.175814	71.800028	132.089511	0.785069	
224	2023-12-31	102.696229	48.309463	123.255013	69.370914	136.154813	-17.041895	
225	2024-01-31	103.572304	47.317726	130.845662	67.072985	140.791943	-15.232677	

226 rows × 16 columns

In [32]:

```
df_forecast_error = df_forecast[:207]
df_forecast_error
```

Out[32]:

	ds	trend	yhat_lower	yhat_upper	trend_lower	trend_upper	additive_terms	additi
0	2005-05-01	86.586988	72.868965	108.747989	86.586988	86.586988	4.668387	
1	2005-06-01	86.866336	78.650136	115.549001	86.866336	86.866336	9.987831	
2	2005-07-01	87.136672	75.634254	111.273987	87.136672	87.136672	6.853261	
3	2005-08-01	87.416020	74.611630	110.748112	87.416020	87.416020	5.215402	
4	2005-09-01	87.695367	72.139217	109.608403	87.695367	87.695367	3.110068	
...	...	...	...	...	...	...	...	
202	2022-03-01	83.761709	69.182633	106.381322	83.761709	83.761709	2.407280	
203	2022-04-01	84.637784	71.777500	108.942321	84.637784	84.637784	6.663959	
204	2022-05-01	85.485598	71.326503	108.076995	85.485598	85.485598	4.116755	
205	2022-06-01	86.361673	78.401552	115.016823	86.361673	86.361673	10.024304	
206	2022-07-01	87.209488	75.653664	112.018439	87.209488	87.209488	7.085945	

207 rows × 16 columns

In [33]:

```
facebook_rmse = sqrt(mean_squared_error(oil_df['y'], df_forecast_error['yhat']))
facebook_rmse
```

Out[33]:

```
14.08660156768478
```

In [ ]:

```

```