AYU IMAS SUSANTI

UJIAN PRAKTIK DATA SCIENCE

FIBONACCI

LATAR BELAKANG

Harga saham selalu berfluktuatif akibat adanya faktor ekonomi yang bervariasi seperti inflasi dan indeks harga konsumen.

RUMUSAN MASALAH

Bagaimana prediksi saham dari PT Telkom Indonesia dengan menggunakan metode ARIMA

VARIABEL DATA

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
plt.rcParams['figure.figsize'] = 15, 6
import seaborn as sns
from statsmodels.tsa.stattools import adfuller
from statsmodels.tsa.seasonal import seasonal_decompose
from statsmodels.graphics.tsaplots import plot_acf
from statsmodels.graphics.tsaplots import plot_pacf
from statsmodels.tsa.arima.model import ARIMA
import warnings
from sklearn.metrics import mean_squared_error
```

```
from math import sqrt
```

Import Dataset

In [2]:

```
data = pd.read_csv("TLKM.JK.csv")
```

Reading Dataset

In [3]:

```
data
```

Out[3]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	2017-01-02	3980.0	3980.0	3980.0	3980.0	3310.131592	0.0
1	2017-01-03	3950.0	3990.0	3920.0	3950.0	3285.180664	71660600.0
2	2017-01-04	3880.0	3980.0	3880.0	3950.0	3285.180664	68494500.0
3	2017-01-05	3960.0	4030.0	3940.0	3950.0	3285.180664	74018400.0
4	2017-01-06	3970.0	4010.0	3960.0	4000.0	3326.765381	44136900.0
...	...	...	...	...	...	...	...
1417	2022-08-26	4510.0	4540.0	4480.0	4490.0	4490.000000	184317100.0
1418	2022-08-29	4370.0	4550.0	4360.0	4520.0	4520.000000	101529800.0
1419	2022-08-30	4580.0	4620.0	4480.0	4480.0	4480.000000	118884300.0
1420	2022-08-31	4420.0	4600.0	4420.0	4560.0	4560.000000	175300400.0
1421	2022-09-01	4560.0	4650.0	4530.0	4580.0	4580.000000	120871700.0

1422 rows × 7 columns

Eksplorasi Data

In [4]:

```
type(data)
```

Out[4]:

```
pandas.core.frame.DataFrame
```

In [5]:

```
data.isnull().sum()/len(data)
```

Out[5]:

```
Date         0.000000
Open         0.000703
High         0.000703
Low          0.000703
Close        0.000703
Adj Close    0.000703
Volume       0.000703
dtype: float64
```

In [6]:

```
data = data.drop(['Open','Low','Close','Adj Close','Volume'],axis='columns')
```

In [7]:

```
print(data.dtypes)
```

```
Date     object
High    float64
dtype: object
```

In [8]:

```
data
```

Out[8]:

	Date	High
0	2017-01-02	3980.0
1	2017-01-03	3990.0
2	2017-01-04	3980.0
3	2017-01-05	4030.0
4	2017-01-06	4010.0
...	...	...
1417	2022-08-26	4540.0
1418	2022-08-29	4550.0
1419	2022-08-30	4620.0
1420	2022-08-31	4600.0
1421	2022-09-01	4650.0

1422 rows × 2 columns

In [9]:

```
#Mengubah tanggal menjadi index
con = data['Date']
data['Date']=pd.to_datetime(data['Date'])
data.set_index('Date', inplace=True)
#check datatype of index
data.index
```

Out[9]:

```
DatetimeIndex(['2017-01-02', '2017-01-03', '2017-01-04', '2017-01-05',
               '2017-01-06', '2017-01-09', '2017-01-10', '2017-01-11',
               '2017-01-12', '2017-01-13',
               ...
               '2022-08-19', '2022-08-22', '2022-08-23', '2022-08-24',
               '2022-08-25', '2022-08-26', '2022-08-29', '2022-08-30',
               '2022-08-31', '2022-09-01'],
              dtype='datetime64[ns]', name='Date', length=1422, freq=None)
```

In [10]:

```
data
```

Out[10]:

	High
Date	
2017-01-02	3980.0
2017-01-03	3990.0
2017-01-04	3980.0
2017-01-05	4030.0
2017-01-06	4010.0

Date	High
2017-01-06	4010.0
...	...
2022-08-26	4540.0
2022-08-29	4550.0
2022-08-30	4620.0
2022-08-31	4600.0
2022-09-01	4650.0

1422 rows × 1 columns

Menghapus Nilai Null

In [11]:

```
data.isnull().sum()
```

Out[11]:

```
High    1
dtype: int64
```

In [12]:

```
data = data.dropna()
print(data)
```

```
              High
Date
2017-01-02  3980.0
2017-01-03  3990.0
2017-01-04  3980.0
2017-01-05  4030.0
2017-01-06  4010.0
...            ...
2022-08-26  4540.0
2022-08-29  4550.0
2022-08-30  4620.0
2022-08-31  4600.0
2022-09-01  4650.0

[1421 rows x 1 columns]
```

In [13]:

```
data.isnull().sum()
```

Out[13]:

```
High    0
dtype: int64
```

In [14]:

```
data = data.dropna(axis = 0, how = 'any')
```

PREPROCESSING DATA

In [15]:

```
#Menginisialkan variabel High sebagai data time series
```

```
ts = data['High']
ts.head(10)
```

Out[15]:

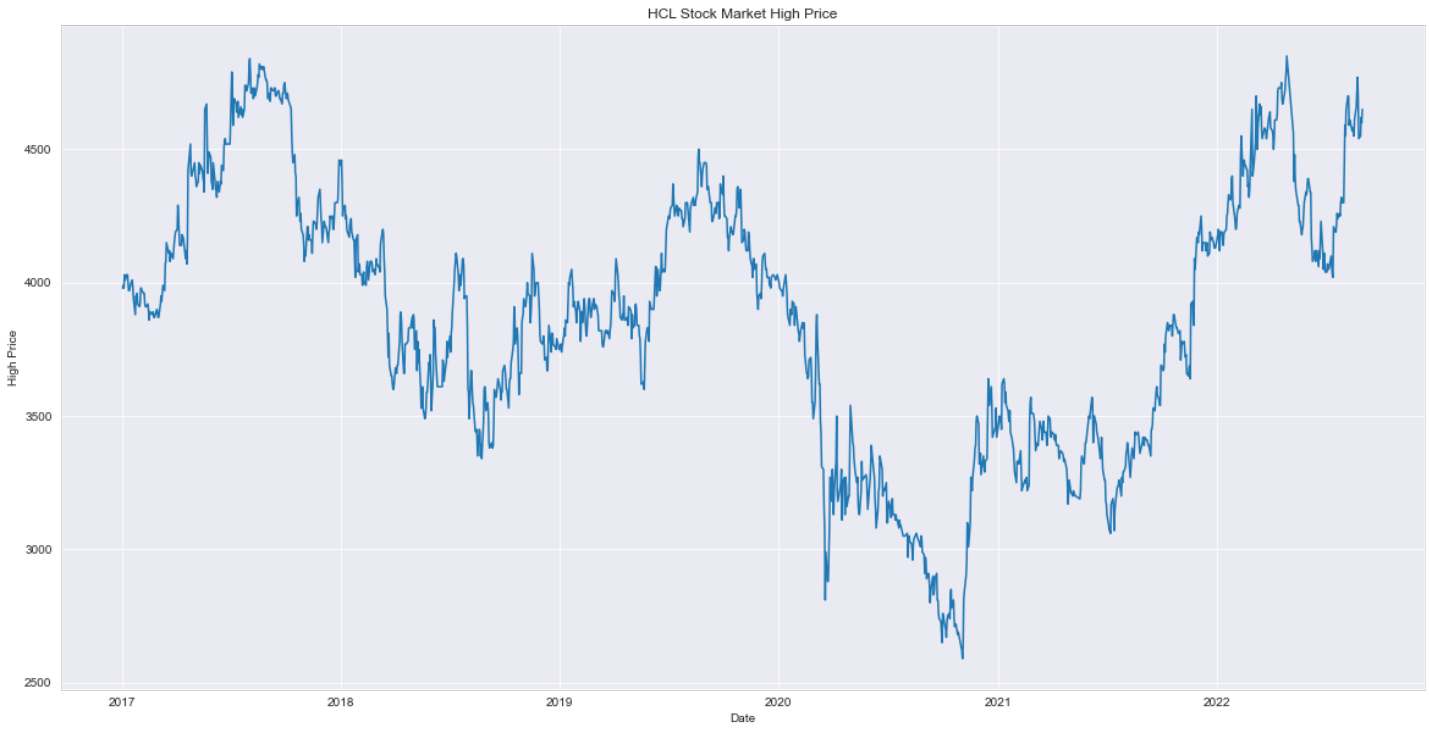
```
Date
2017-01-02    3980.0
2017-01-03    3990.0
2017-01-04    3980.0
2017-01-05    4030.0
2017-01-06    4010.0
2017-01-09    4030.0
2017-01-10    4030.0
2017-01-11    4000.0
2017-01-12    3970.0
2017-01-13    3970.0
Name: High, dtype: float64
```

In [16]:

```
#Visualisasi dataset
plt.figure(figsize=(20,10))
sns.set_style('darkgrid')
plt.xlabel('Date')
plt.ylabel('High Price')
plt.title('HCL Stock Market High Price')
plt.plot(data['High'])
```

Out[16]:

```
[<matplotlib.lines.Line2D at 0x262bdd0d430>]
```



Uji Stasioneritas Data

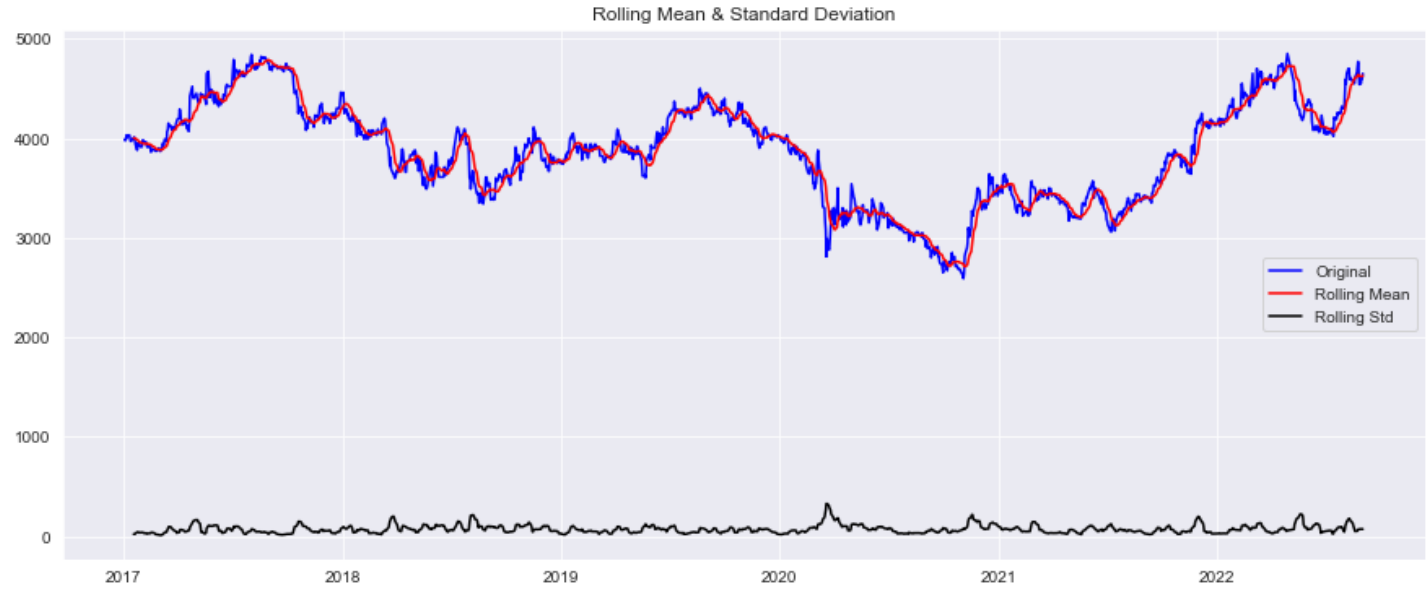
In [17]:

```
#Deklarasi fungsi untuk mengecek stasioneritas data
def test_stationarity(timeseries):

    #Determing rolling statistics
    rolmean = timeseries.rolling(window=12).mean()
    rolstd = timeseries.rolling(window=12).std()

    #Plot rolling statistics:
    orig = plt.plot(timeseries, color='blue',label='Original')
    mean = plt.plot(rolmean, color='red', label='Rolling Mean')
```

```
    std = plt.plot(rolstd, color='black', label = 'Rolling Std')
    plt.legend(loc='best')
    plt.title('Rolling Mean & Standard Deviation')
    plt.show()


    #Perform Dickey-Fuller test:
    print('Results of Dickey-Fuller Test:')
    datatest = adfuller(timeseries, autolag='AIC')
    dataoutput = pd.Series(datatest[0:4], index=['Test Statistic','p-value','#Lags Used'
,'Number of Observations Used'])
    for key,value in datatest[4].items():
        dataoutput['Critical Value (%s)'%key] = value
    print(dataoutput)
```

In [18]:

```
#Melakukan uji stasioneritas untuk dataset
test_stationarity(ts)
```




```
Results of Dickey-Fuller Test:
Test Statistic                  -1.775556
p-value                          0.392663
#Lags Used                       2.000000
Number of Observations Used    1418.000000
Critical Value (1%)             -3.434970
Critical Value (5%)             -2.863580
Critical Value (10%)            -2.567856
dtype: float64
```

Diperoleh nilai p-value < 0,05, maka H0 tidak ditolak.

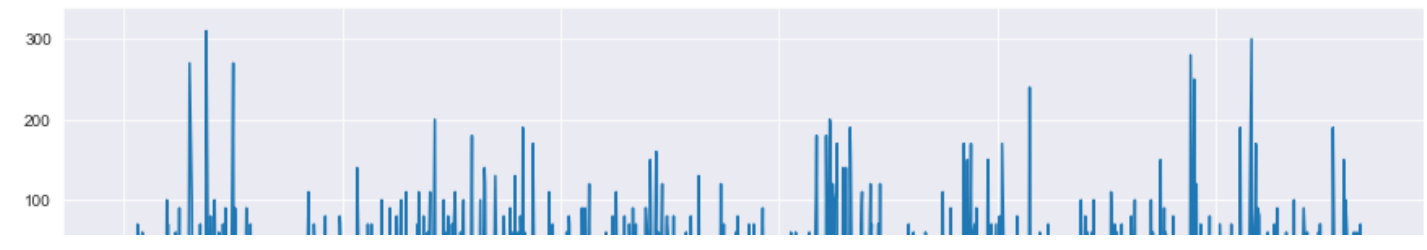
Jadi, data memiliki keadaan yang tidak stasioner.

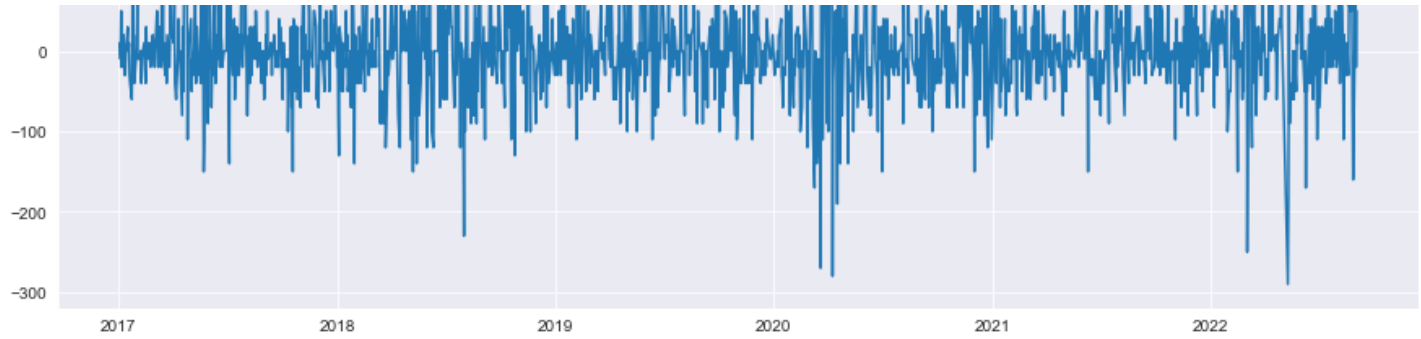
In [19]:

```
ts_diff_1 = ts - ts.shift()
ts_diff_1 = ts_diff_1.dropna()
plt.plot(ts_diff_1)
```

Out[19]:

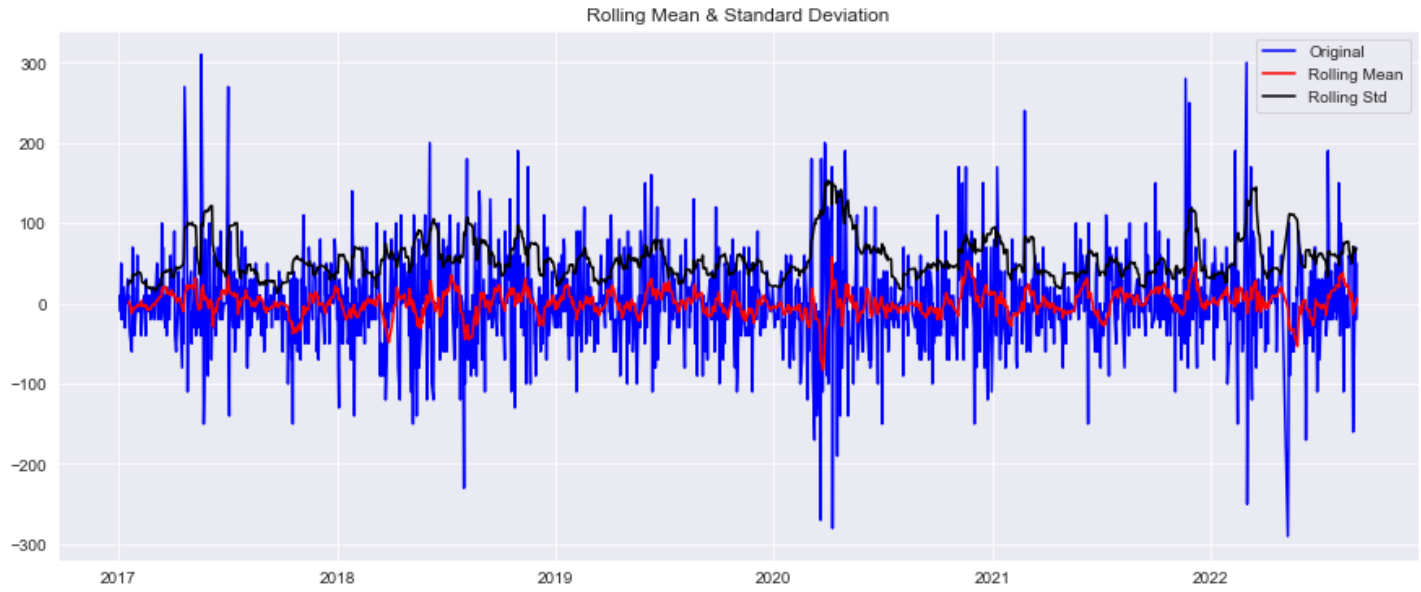
```
[<matplotlib.lines.Line2D at 0x262bdf63e20>]
```





In [20]:

```
test_stationarity(ts_diff_1)
```

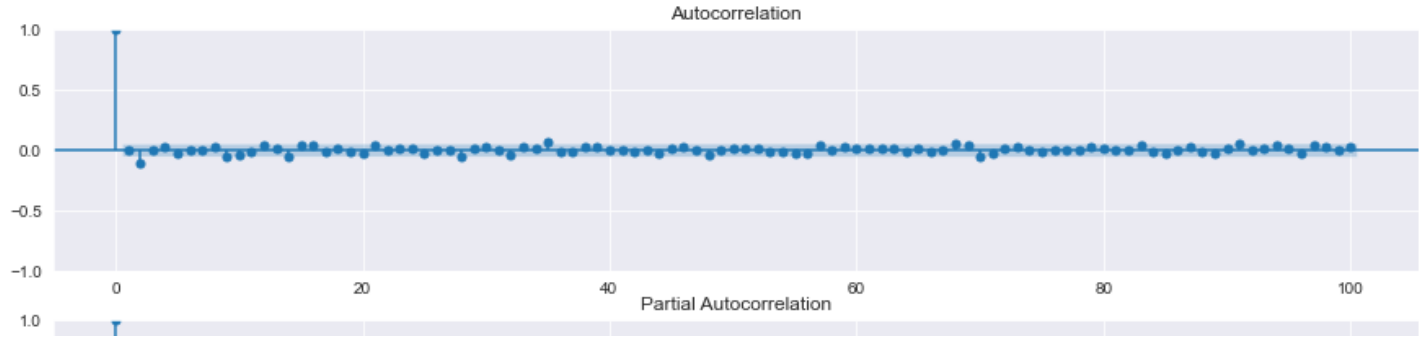


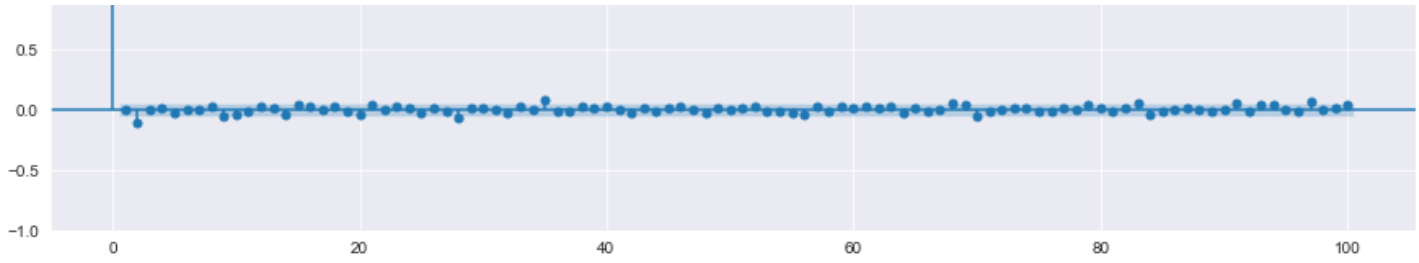

```
Results of Dickey-Fuller Test:
Test Statistic                  -29.891562
p-value                           0.000000
#Lags Used                        1.000000
Number of Observations Used    1418.000000
Critical Value (1%)              -3.434970
Critical Value (5%)              -2.863580
Critical Value (10%)             -2.567856
dtype: float64
```

In [21]:

```
plt.figure()
plt.subplot(211)
plot_acf(ts_diff_1, ax=plt.gca(), lags=100)
plt.subplot(212)
plot_pacf(ts_diff_1, ax=plt.gca(), lags=100)
plt.show()
```

```
C:\Users\ayuim\anaconda3\lib\site-packages\statsmodels\graphics\tsaplots.py:348: FutureWa
rning: The default method 'yw' can produce PACF values outside of the [-1,1] interval. Af
ter 0.13, the default will change tounadjusted Yule-Walker ('ywm'). You can use this meth
od now by setting method='ywm'.
  warnings.warn(
```





MODEL DAN PARAMETER

In [22]:

```
def evaluate_arima_model(X, arima_order):
 # prepare training dataset
 X = X.astype('float32')
 train_size = int(len(X) * 0.7)                #data trainingnya 70%
 train, test = X[0:train_size], X[train_size:]
 history = [x for x in train]
 # make predictions
 predictions = list()
 for t in range(len(test)):
  model = ARIMA(history, order=arima_order)
  model_fit = model.fit()
  yhat = model_fit.forecast()[0]
  predictions.append(yhat)
  history.append(test[t])
 # calculate out of sample error
 rmse = sqrt(mean_squared_error(test, predictions))
 return rmse

# evaluate combinations of p, d and q values for an ARIMA model
# evaluate combinations of p, d and q values for an ARIMA model
def evaluate_models(dataset, p_values, d_values, q_values):
 dataset = dataset.astype('float32')
 best_score, best_cfg = float("inf"), None
 for p in p_values:
  for d in d_values:
   for q in q_values:
    order = (p,d,q)
    try:
     rmse = evaluate_arima_model(dataset, order)
     if rmse < best_score:
      best_score, best_cfg = rmse, order
     print('ARIMA%s RMSE=%.3f' % (order,rmse))
    except:
     continue
 print('Best ARIMA%s RMSE=%.3f' % (best_cfg, best_score))
```

In [23]:

```
p_values = range(0, 2)
d_values = range(0, 2)
q_values = range(0, 2)
warnings.filterwarnings("ignore")
evaluate_models(ts.values, p_values, d_values, q_values)
```

```
ARIMA(0, 0, 0) RMSE=497.556
ARIMA(0, 0, 1) RMSE=269.975
ARIMA(0, 1, 0) RMSE=61.292
ARIMA(0, 1, 1) RMSE=61.394
ARIMA(1, 0, 0) RMSE=61.299
ARIMA(1, 0, 1) RMSE=61.405
ARIMA(1, 1, 0) RMSE=61.373
```

```
ARIMA(1, 1, 1) RMSE=61.599
Best ARIMA(0, 1, 0) RMSE=61.292
```

Setelah dilakukan percobaan dengan model ARIMA(p,d,q) dengan:

- **orde p = 0 dan 1**
- **orde d = 0 dan 1**
- **orde q = 0 dan 1**

Diperoleh model yang menghasilkan RMSE terkecil adalah model ARIMA (0,1,0).

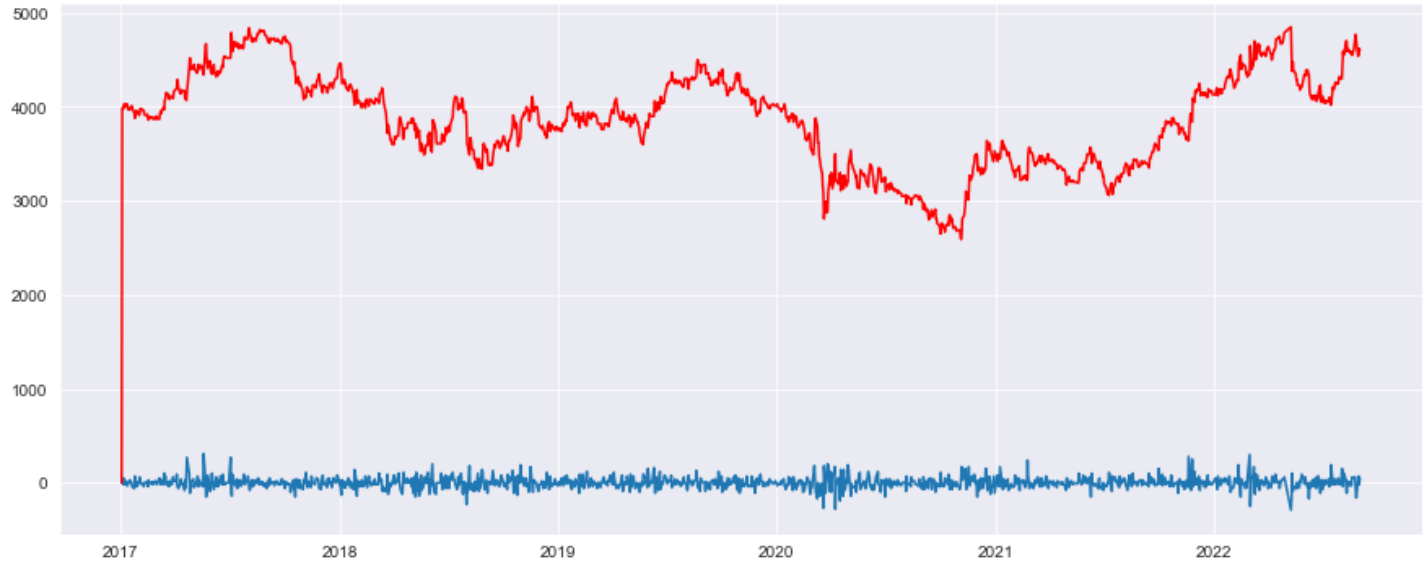
Hal ini sesuai dengan plot ACF dan PACF yang dies down setelah lag ke-1 dan dataset telah mengalami 1x proses differencing.

In [24]:

```
#Visualisasi perbandingan antara dataset setelah differencing dengan data hasil prediksi ARIMA(1,1,1)
model_ARIMA = ARIMA(ts, order=(0,1,0))
results_ARIMA = model_ARIMA.fit()
predictions_ARIMA = pd.Series(results_ARIMA.fittedvalues,copy=True)
plt.plot(ts_diff_1)
plt.plot(predictions_ARIMA, color='red')
```

Out[24]:

```
[<matplotlib.lines.Line2D at 0x262be25cfa0>]
```



In [25]:

```
#Informasi yang diperoleh dari pemodelan ARIMA(0,1,0) pada dataset
results_ARIMA.summary()
```

Out[25]:

SARIMAX Results

Dep. Variable:	**High**	**No. Observations:**	**1421**
Model:	**ARIMA(0, 1, 0)**	**Log Likelihood**	**-7831.233**
Date:	**Sat, 17 Sep 2022**	**AIC**	**15664.466**
Time:	**20:08:31**	**BIC**	**15669.724**
Sample:	**0**	**HQIC**	**15666.430**
	- 1421		
Covariance Type:	**opg**		

	coef	std err	z	P>|z|	[0.025	0.975]
sigma2	**3612.0431**	**80.925**	**44.634**	**0.000**	**3453.433**	**3770.653**

Ljung-Box (L1) (Q):	0.00	Jarque-Bera (JB):	799.15
Prob(Q):	0.94	Prob(JB):	0.00
Heteroskedasticity (H):	1.09	Skew:	0.37
Prob(H) (two-sided):	0.37	Kurtosis:	6.60

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

PREDIKSI DATA

In [26]:

```
#Prediksi data dengan model ARIMA(0,1,0) untuk 4 hari ke depan
predict_dif = results_ARIMA.predict(start=1328,end=1331)
predictions_dif_cum_sum = predict_dif.cumsum()                    #prediksi differencingn
ya
pred_ts = [ts[-1]]
for i, j in enumerate(predictions_dif_cum_sum):                   #prediksi data aslinya
  a = pred_ts[i] + j
  pred_ts.append(a)
predict = pd.Series(pred_ts[1:], index=predict_dif.index)
print(predict)
```

```
Date
2022-04-11     9260.0
2022-04-12    18480.0
2022-04-13    32330.0
2022-04-14    50900.0
dtype: float64
```

KESIMPULAN

Berdasarkan Prediksi Saham PT Telkom Indonesia dengan menggunakan metode ARIMA Diperoleh hasil prediksi untuk nilai harga tertinggi saham TELKOM pada periode tanggal :

- **11 April 2022 = 9260.0**
- **12 April 2022 = 18480.0**
- **13 April 2022 = 32330.0**
- **14 April 2022 = 50900.0**