TIME SERIES - ASSIGNMENT ON AUGMENTED DICKY FILLER TEST (ADF) - submitted by ABDHAHEER

In [3]:

```
# Augmented dickey filler test (ADF) is the test used to find out whether series has a unit root or not
# Thereby rejecting the null hypothesis if series doen't have a unit root and accpeting alternate hypotheis
# it is important for a time series data to be in stationarity in order to perform model creation using Time series algo
```

1.Loading the dataset ¶

In [1]:

```
# we downloaded this dataset in csv format from trading view for the Tatacoffee shares from 2013 to 2021
import pandas as pd
dataset=pd.read_csv("Tatacoffee13_21.csv", parse_dates=['Date'], index_col='Date')
```

In [2]:
```
dataset
```

Out[2]:
```
               Open     High      Low    Close
      Date
2013-01-01  1410.60  1427.90  1408.30  1415.10
2013-01-02  1421.00  1626.60  1416.15  1607.40
2013-01-03  1632.55  1673.90  1613.05  1626.20
2013-01-04  1627.75  1627.75  1574.60  1579.05
2013-01-07  1580.00  1639.50  1565.50  1595.65
       ...      ...      ...      ...      ...
2021-12-22   202.90   207.80   201.35   205.00
2021-12-23   206.00   206.85   202.05   202.95
2021-12-24   203.90   203.90   199.35   201.00
2021-12-27   200.00   222.00   196.00   218.35
2021-12-28   219.65   220.45   211.55   212.35

2225 rows × 4 columns
```

2.Data pre-processing for the purpose of plotting the graph

In [3]:

```
# the main reason for this pre-processing is that - in the share market data saturday and sunday datas are not available
# it means there is a break in between the dates of the dataset
# in order to make it a continuous series we are doing this pre-processing


#Start date and end_date

from datetime import date, timedelta
import pandas as pd
start_date = pd.to_datetime("2013-01-01")
end_date = pd.to_datetime("2019-02-04") - timedelta(days=1) #Excluding last

#List of all dates
all_date = pd.date_range(start_date, end_date, freq='d')
```

In [4]:

```
all_date
```

Out[4]:

```
DatetimeIndex(['2013-01-01', '2013-01-02', '2013-01-03', '2013-01-04',
               '2013-01-05', '2013-01-06', '2013-01-07', '2013-01-08',
               '2013-01-09', '2013-01-10',
               ...
               '2019-01-25', '2019-01-26', '2019-01-27', '2019-01-28',
               '2019-01-29', '2019-01-30', '2019-01-31', '2019-02-01',
               '2019-02-02', '2019-02-03'],
              dtype='datetime64[ns]', length=2225, freq='D')
```

In [5]:

```
dummyDate=dataset
```

In [6]:

```
dummyDate.index=all_date
```

In [7]:

```
dummyDate
```

Out[7]:

	Open	High	Low	Close
2013-01-01	1410.60	1427.90	1408.30	1415.10
2013-01-02	1421.00	1626.60	1416.15	1607.40
2013-01-03	1632.55	1673.90	1613.05	1626.20
2013-01-04	1627.75	1627.75	1574.60	1579.05
2013-01-05	1580.00	1639.50	1565.50	1595.65
...	...	...	...	...
2019-01-30	202.90	207.80	201.35	205.00
2019-01-31	206.00	206.85	202.05	202.95
2019-02-01	203.90	203.90	199.35	201.00
2019-02-02	200.00	222.00	196.00	218.35
2019-02-03	219.65	220.45	211.55	212.35

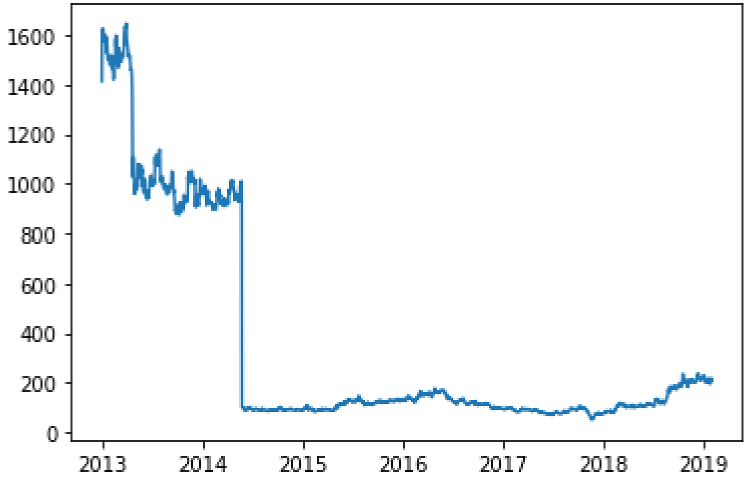
2225 rows × 4 columns

In [8]:

```
from pandas.plotting import register_matplotlib_converters
register_matplotlib_converters()
```

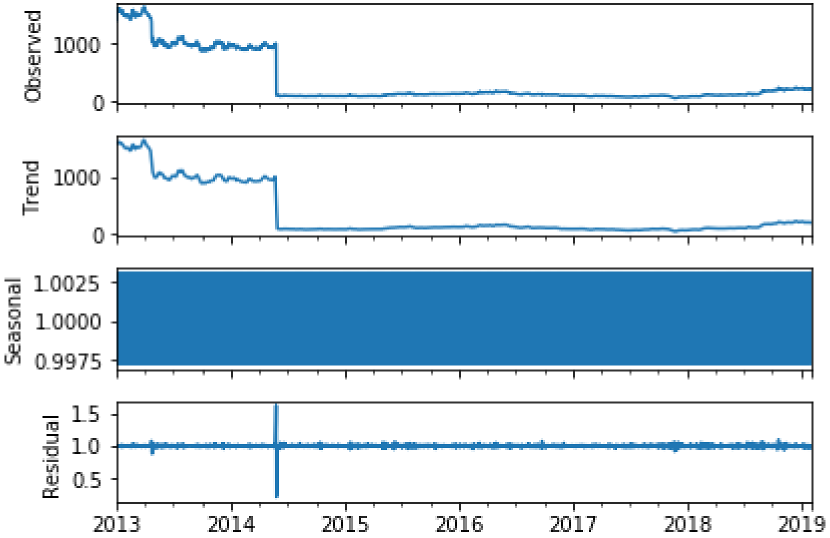
```
In [11]: import matplotlib.pyplot as plt
         plt.plot(dataset["Close"])
```

```
Out[11]: [<matplotlib.lines.Line2D at 0x1d9e7fddc48>]
```



In [12]:
```
from pandas import read_csv
from matplotlib import pyplot as plt
from statsmodels.tsa.seasonal import seasonal_decompose
result = seasonal_decompose(dummyDate["Close"], model='multiplicative')
plt.figure(figsize=(16,5))
result.plot()
plt.show()
```

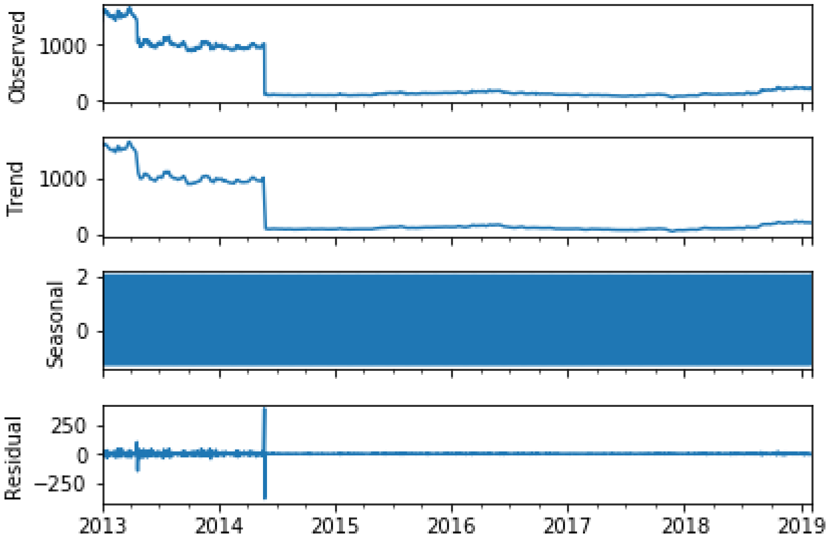
```
<Figure size 1152x360 with 0 Axes>
```



In [13]:

```
from pandas import read_csv
from matplotlib import pyplot as plt
from statsmodels.tsa.seasonal import seasonal_decompose
result = seasonal_decompose(dummyDate["Close"], model='additive')
plt.figure(figsize=(16,5))
result.plot()
plt.show()
```

```
<Figure size 1152x360 with 0 Axes>
```



3. ADF TEST

In [16]:

```
# Importing library statsmodel.tsa.stattools for time series
# Statsmodels is a Python module that provides functions and classes for the estimation of many statistical models
# The function to perform ADF is called adfuller.

def adf_test(timeseries,df,Close):
    plt.figure(figsize=(16,5))
    # Plot the data

# ADF Test
    from statsmodels.tsa.stattools import adfuller
    print ('Results of Dickey-Fuller Test:')
    dftest = adfuller(timeseries, autolag='AIC')
    dfoutput = pd.Series(dftest[0:4], index=['Test Statistic','p-value','#Lags Used','Number of Observations Used'])

# Add  critical values
    for key,value in dftest[4].items():
        dfoutput['Critical Value (%s)'%key] = value
    print (dfoutput)
    ans=dfoutput


# General condition of hypothesis testing
    print("Condition:")
    print("p-value<=0.05-->Accept Alternate Hypothesis")
    print("p-value>0.05-->Accept Null Hypothesis")


# Checking conditions and deciding the datapoint are in stationarity or non- stationarity
    if(ans['Test Statistic']<ans["Critical Value (1%)"] or ans['Test Statistic']<ans["Critical Value (5%)"] or ans['Test
        print("Condition: statictic < any critical value and p-value <0.05 to reject null hypothsis")
        print("Reject null hypothesis:Non Stationarity")
        print("Accept Alternate hypothesis:Staionarity ")
        message="Stationarity based on ADF"
    else:
        print("Condition: statictic < any critical value and p-value <0.05 to reject null hypothsis")
        print("Accept null hypothesis:Non Stationarity" )
        print("Reject Alternate hypothesis:Staionarity ")
        message="Non-stationarity based on ADF"


# Plotting the time series
```

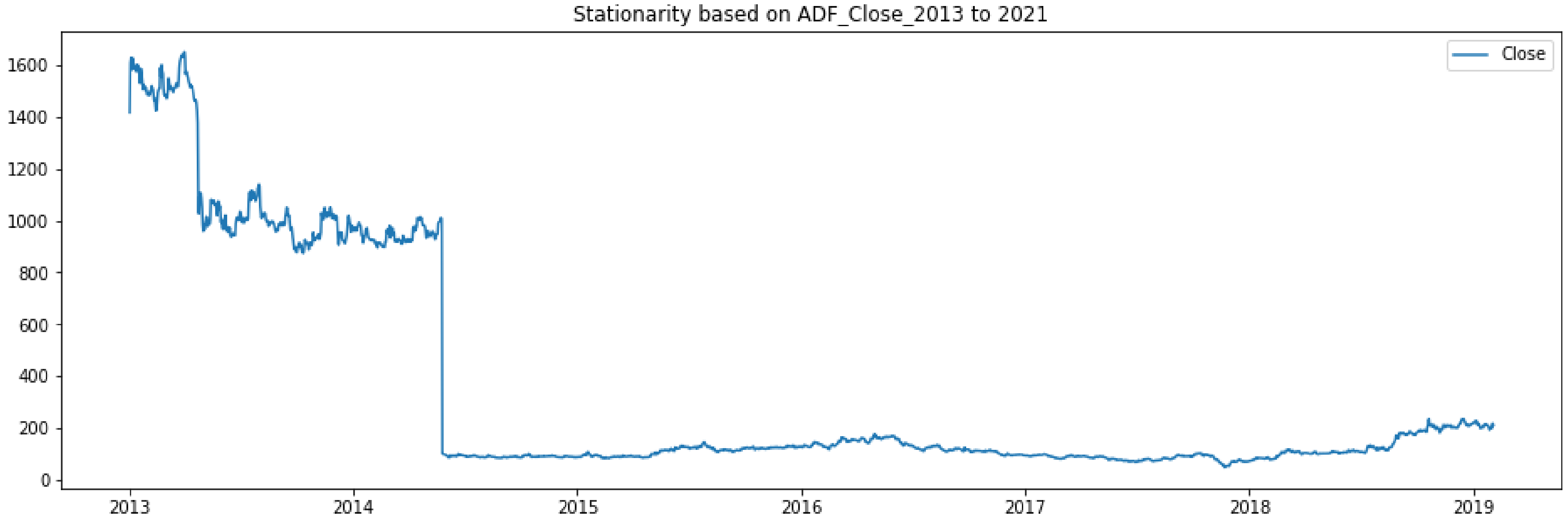
```
    plt.plot(df.index, df[Close], label = Close)
    plt.legend(loc='best')
    plt.title("{}_{}_2013 to 2021".format(message,Close))
    plt.savefig("{}_ADH.png".format(Close))
    plt.show()

    return message

# Call the function and run the test
```

```
In [17]: adf_test(dataset["Close"],dataset,"Close")
```

```
Results of Dickey-Fuller Test:
Test Statistic                  -3.007236
p-value                          0.034224
#Lags Used                       1.000000
Number of Observations Used   2223.000000
Critical Value (1%)             -3.433295
Critical Value (5%)             -2.862841
Critical Value (10%)            -2.567463
dtype: float64
Condition:
p-value<=0.05-->Accept Alternate Hypothesis
p-value>0.05-->Accept Null Hypothesis
Condition: statictic < any critical value and p-value <0.05 to reject null hypothsis
Reject null hypothesis:Non Stationarity
Accept Alternate hypothesis:Staionarity
```

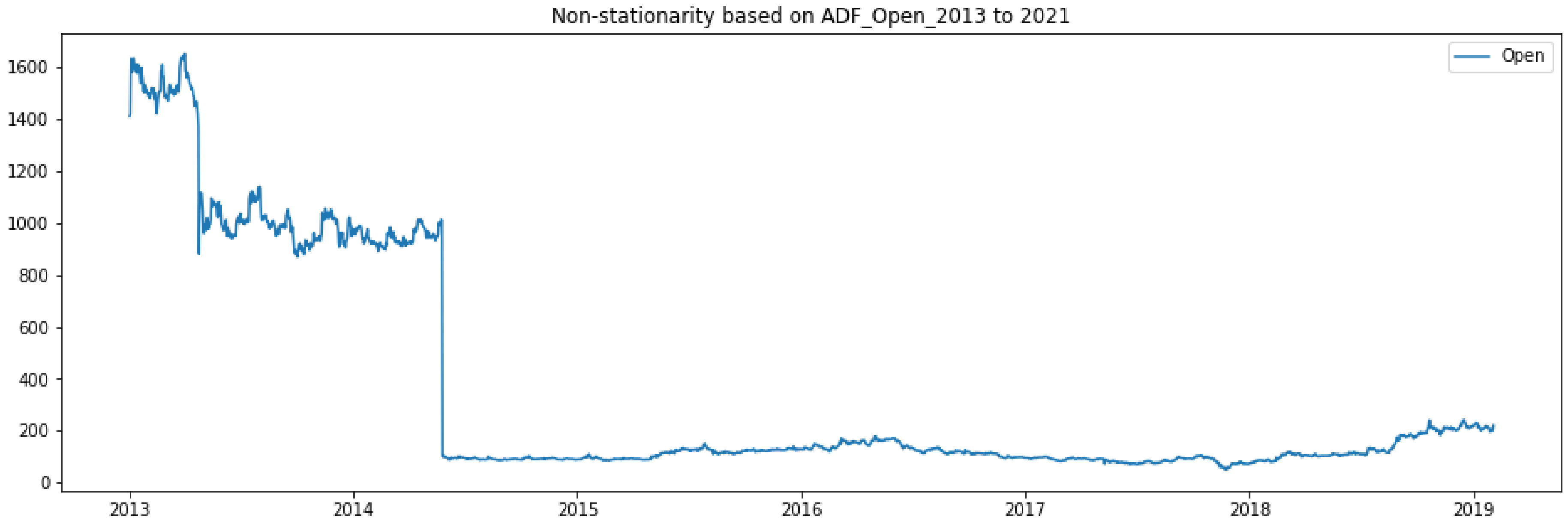


```
Out[17]: 'Stationarity based on ADF'
```

In [18]:

```
adf_test(dataset["Open"],dataset,"Open")
```

```
Results of Dickey-Fuller Test:
Test Statistic                   -2.502734
p-value                           0.114810
#Lags Used                        1.000000
Number of Observations Used    2223.000000
Critical Value (1%)              -3.433295
Critical Value (5%)              -2.862841
Critical Value (10%)             -2.567463
dtype: float64
Condition:
p-value<=0.05-->Accept Alternate Hypothesis
p-value>0.05-->Accept Null Hypothesis
Condition: statictic < any critical value and p-value <0.05 to reject null hypothsis
Accept null hypothesis:Non Stationarity
Reject Alternate hypothesis:Staionarity
```

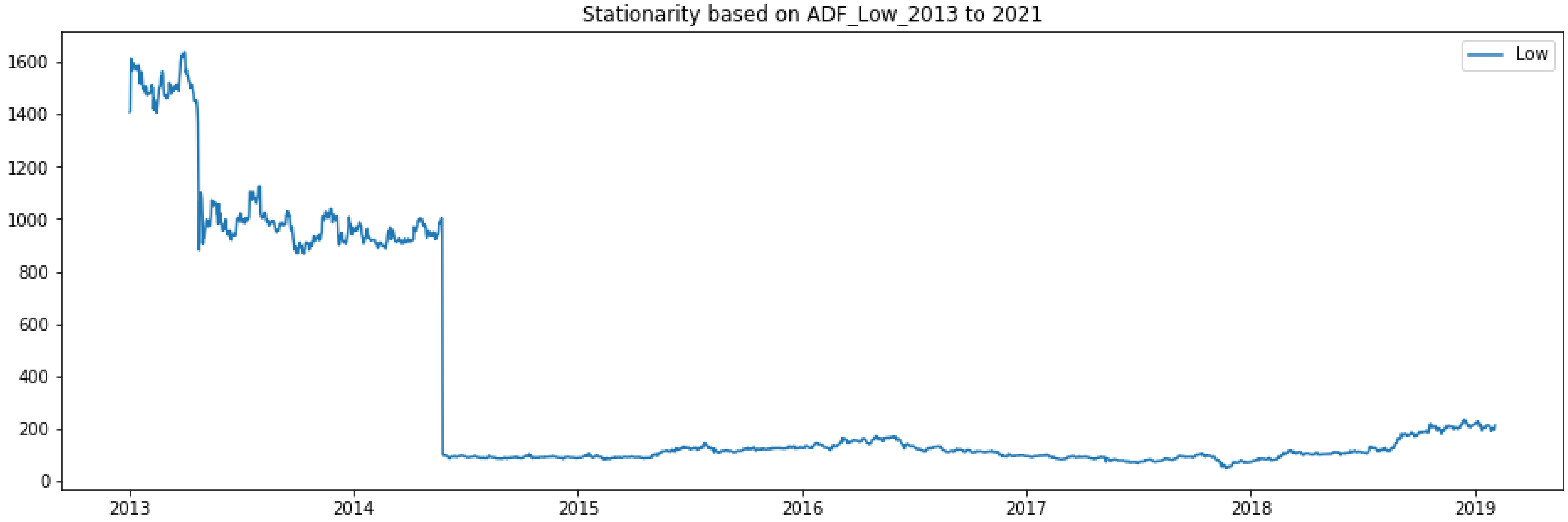


Out[18]:

```
'Non-stationarity based on ADF'
```

In [20]:
```
adf_test(dataset["Low"],dataset,"Low")
```

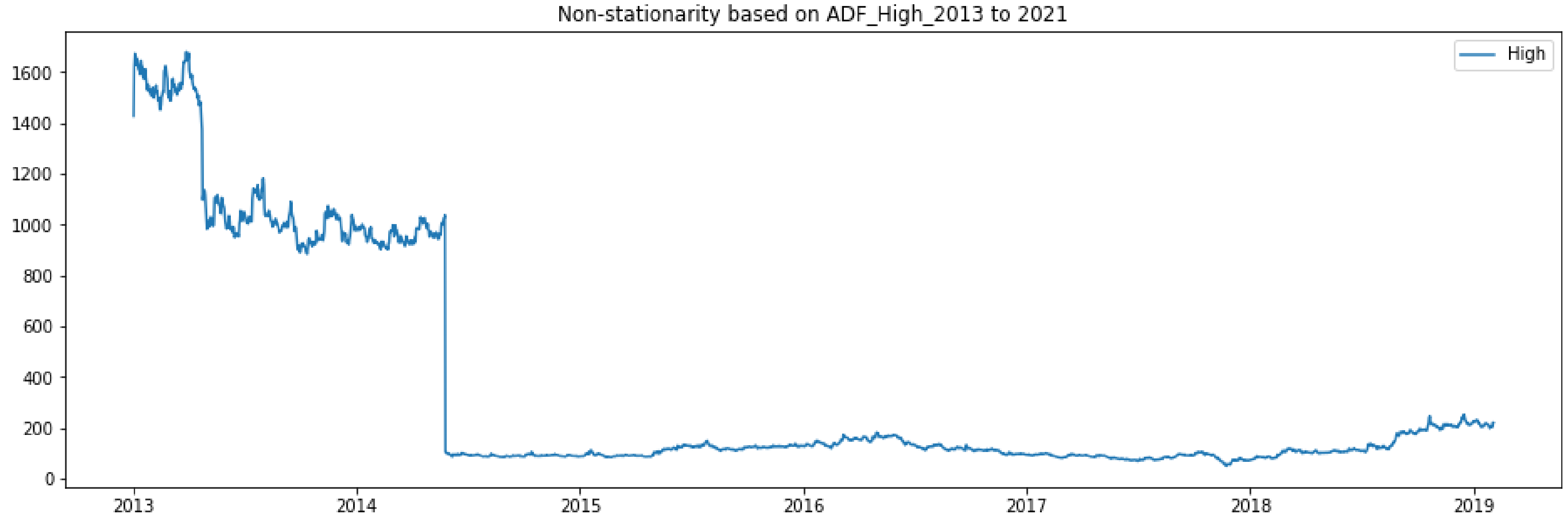
```
Results of Dickey-Fuller Test:
Test Statistic                   -3.055296
p-value                           0.030043
#Lags Used                        2.000000
Number of Observations Used    2222.000000
Critical Value (1%)              -3.433296
Critical Value (5%)              -2.862842
Critical Value (10%)             -2.567463
dtype: float64
Condition:
p-value<=0.05-->Accept Alternate Hypothesis
p-value>0.05-->Accept Null Hypothesis
Condition: statictic < any critical value and p-value <0.05 to reject null hypothsis
Reject null hypothesis:Non Stationarity
Accept Alternate hypothesis:Staionarity
```



Out[20]:
```
'Stationarity based on ADF'
```

```
In [21]: adf_test(dataset["High"],dataset,"High")
```

```
Results of Dickey-Fuller Test:
Test Statistic                   -2.462481
p-value                           0.124872
#Lags Used                        0.000000
Number of Observations Used    2224.000000
Critical Value (1%)              -3.433294
Critical Value (5%)              -2.862840
Critical Value (10%)             -2.567462
dtype: float64
Condition:
p-value<=0.05-->Accept Alternate Hypothesis
p-value>0.05-->Accept Null Hypothesis
Condition: statictic < any critical value and p-value <0.05 to reject null hypothsis
Accept null hypothesis:Non Stationarity
Reject Alternate hypothesis:Staionarity
```



```
Out[21]: 'Non-stationarity based on ADF'
```

4.Result infered from ADF TEST

In [4]:

```
# Conclusion
## --> From the above time series data - Close and Low are Stationarity based wheareas Open and High are non stationarit
## contd...
```