adfuller function from the statsmodels.tsa.stattools module, which is used to perform the ADF test.

adfuller() function is called with two arguments:

- **timeseries:** This is the time series data that needs to be tested for stationarity.
- **autolag='AIC'**: This parameter specifies that the optimal number of lags should be automatically selected based on the **Akaike Information Criterion (AIC).** The ADF test is an augmented version of the **Dickey-Fuller test**, which includes lagged terms to account for autocorrelation in the time series data.

The **adfuller()** function returns a tuple containing the following elements:

- **Test statistic value**
- **p-value**
- **Number of lags used**
- **Number of observations used**
- **Dictionary of critical values for different significance levels (1%, 5%, and 10%)**

The autolag='AIC' parameter in the adfuller() function from the statsmodels library is used to automatically determine the optimal number of lags to include in the Augmented Dickey-Fuller (ADF) test based on Akaike's Information Criterion (AIC).

The **Dickey-Fuller test, also known as the Augmented Dickey-Fuller (ADF)** test, is a statistical test used to determine if a time series is stationary or has a unit root.

The Akaike Information Criterion (AIC) is a measure used to compare the quality of statistical models. The formula for AIC is:

$$AIC = 2k - 2\ln(L)$$

OPEN

[13]:
```
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 hypothsi
Accept null hypothesis:Non Stationarity
Reject Alternate hypothesis:Staionarity
```

[14]:
```
from statsmodels.tsa.stattools import adfuller
adf = adfuller(dataset.Open, maxlag = 1)
adf[0]
```

[14]:
```
-2.502734388619978
```

[15]:
```
from statsmodels.tsa.stattools import adfuller
adf = adfuller(dataset.Open, maxlag = 1)
adf[1]
```

[15]:
```
0.11481043527381063
```

[16]:
```
from statsmodels.tsa.stattools import adfuller
adf = adfuller(dataset.Open, maxlag = 1)
adf[2]
```

[16]:
```
1
```

[17]:
```
from statsmodels.tsa.stattools import adfuller
adf = adfuller(dataset.Open, maxlag = 1)
adf[3]
```

[17]:
```
2223
```

[18]:
```
from statsmodels.tsa.stattools import adfuller
adf = adfuller(dataset.Open, maxlag = 1)
adf[4]
```

[18]:
```
{'1%': -3.433295059438173,
 '5%': -2.8628410403669844,
 '10%': -2.5674626062113077}
```

ADF statistic: -2.502 Critical values: 1% level: -3.433 5% level: -2.863 10% level: -2.567

the conclusion is that the price (dataset.Open) is not stationary at any of the specified significance levels (1%, 5%, or 10%). This suggests that the time series may hav root and is non-stationary.

CLOSE

```
]: 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
```

```
[30]: from statsmodels.tsa.stattools import adfuller
      adf = adfuller(dataset.Close, maxlag = 1)
      adf[0]
```

```
[30]: -3.007236327367315
```

```
[32]: from statsmodels.tsa.stattools import adfuller
      adf = adfuller(dataset.Close, maxlag = 1)
      adf[1]
```

```
[32]: 0.03422412229093029
```

```
[33]: from statsmodels.tsa.stattools import adfuller
      adf = adfuller(dataset.Close, maxlag = 1)
      adf[2]
```

```
[33]: 1
```

```
[34]: from statsmodels.tsa.stattools import adfuller
      adf = adfuller(dataset.Close, maxlag = 1)
      adf[3]
```

```
[34]: 2223
```

```
[35]: from statsmodels.tsa.stattools import adfuller
      adf = adfuller(dataset.Close, maxlag = 1)
      adf[4]
```

```
[35]: {'1%': -3.433295059438173,
       '5%': -2.8628410403669844,
       '10%': -2.5674626062113077}
```

ADF Test Results ADF statistic: -3.007 Critical values: 1% level: -3.433 5% level: -2.863 10% level: -2.567

The ADF statistic (-3.007) is greater than the 10% critical value (-2.567), but less than the 5% critical value (-2.863). This means that the null hypothesis of non-stationarity car be rejected at the 10% significance level, but not at the 5% or 1% significance levels. In other words, the time series (dataset.Open) is stationary at the 10% significance level, but not stationary at the 5% or 1% significance levels.

Based on the updated ADF test results, the conclusion is that the price (dataset.Open) is stationary at the 10% significance level, but not stationary at the 5% or 1% significance levels.