Untitled0.ipynb - Colab

colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK

Untitled0.ipynb

File Edit View Insert Runtime Tools Help

Share

Commands + Code + Text Run all

RAM Disk

[3]

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

from statsmodels.tsa.stattools import adfuller
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf
from statsmodels.tsa.arima.model import ARIMA
```

[9] 1m

```
df = pd.read_excel("/content/sample_data/cleaned_stock_details_5_years.xlsx")
df['Date'] = pd.to_datetime(df['Date'])
df = df.sort_values(by='Date')
df.head()
```

	Date	Open	High	Low	Close	Volume	Dividends	Stock Splits	Company
0	2018-11-29 05:00:00	68.673458	69.589358	68.673458	69.001251	2625800	0.0	0.0	A
477215	2018-11-29 05:00:00	132.538203	134.532268	132.069959	133.710434	1713000	0.0	0.0	NaN
475957	2018-11-29 05:00:00	15.000000	15.146000	14.625100	14.904000	11335000	0.0	0.0	NaN
68217	2018-11-29 05:00:00	31.753208	31.915178	31.450394	31.675745	2985223	0.0	0.0	NaN
474699	2018-11-29 05:00:00	48.835189	49.084842	48.702308	48.802975	3097540	0.0	0.0	NaN

[10]

```
apple_df = df[df['Company'] == 'AAPL']
```

Variables Terminal

11:48 AM Python 3

28°C Sunny

Search

ENG IN

11:54 AM 06-02-2026

Untitled0.ipynb - Colab

colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK

Untitled0.ipynb

File Edit View Insert Runtime Tools Help

Share

Commands + Code + Text Run all

RAM Disk

[10] 0s

```
apple_df = df[df['Company'] == 'AAPL']
apple_df.set_index('Date', inplace=True)
price_series = apple_df['Close']
price_series.head()
```

Date	Close
2018-11-29 05:00:00	43.083508
2018-11-30 05:00:00	42.850754
2018-12-03 05:00:00	44.348064
2018-12-04 05:00:00	42.397247
2018-12-06 05:00:00	41.924541

dtype: float64

[11] 0s

```
plt.figure()
plt.plot(price_series)
plt.title("Apple Stock Close Price")
plt.xlabel("Date")
plt.ylabel("Price")
plt.show()
```

Variables Terminal

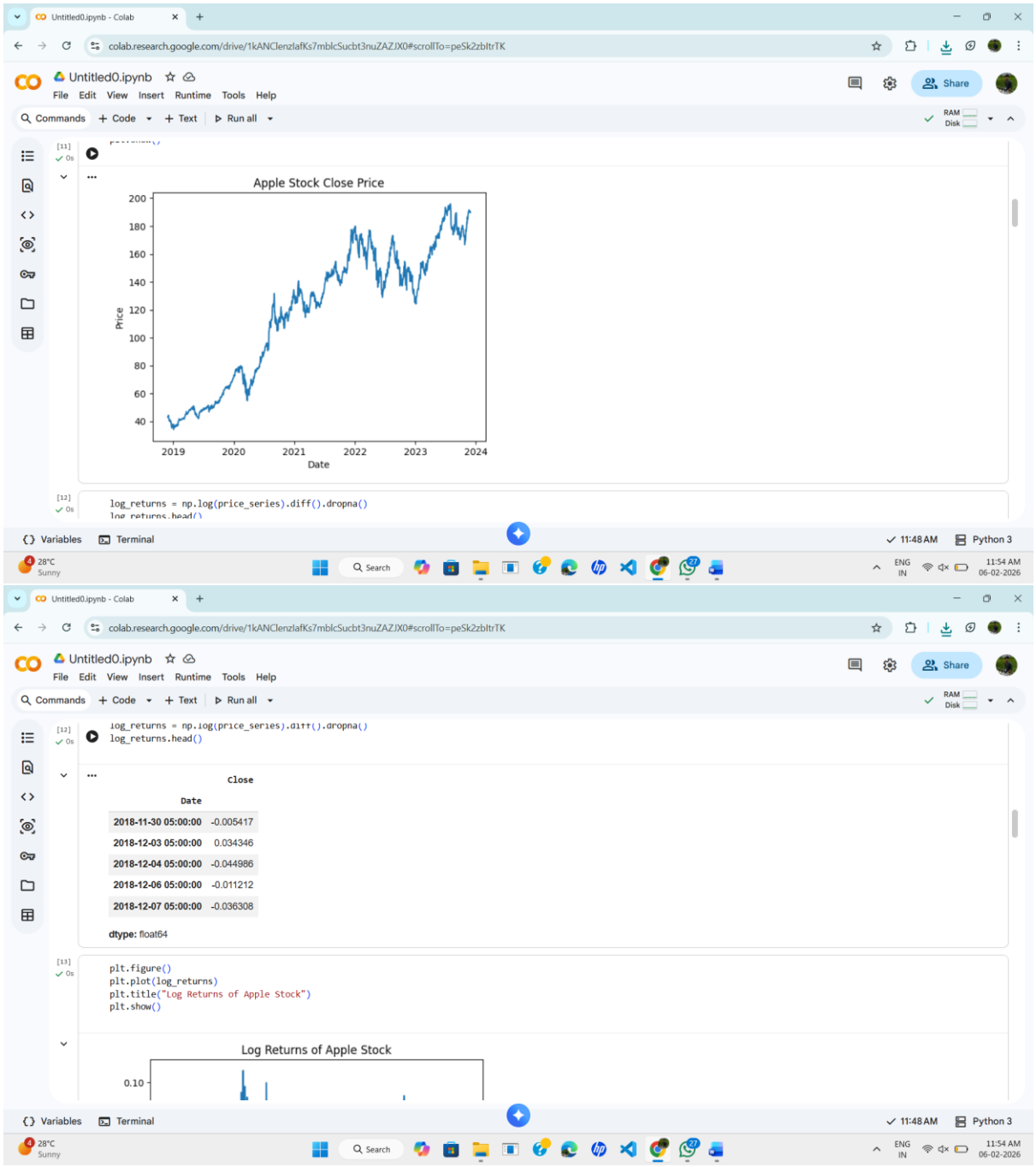
11:48 AM Python 3

28°C Sunny

Search

ENG IN

11:54 AM 06-02-2026


Untitled0.ipynb - Colab
colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK
Untitled0.ipynb
File Edit View Insert Runtime Tools Help
Share
Commands + Code + Text Run all
RAM Disk
Apple Stock Close Price
Price
Date
200
180
160
140
120
100
80
60
40
2019
2020
2021
2022
2023
2024
log_returns = np.log(price_series).diff().dropna()
Variables Terminal
11:48 AM Python 3
28°C Sunny
Search
ENG IN
11:54 AM 06-02-2026

Untitled0.ipynb - Colab
colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK
Untitled0.ipynb
File Edit View Insert Runtime Tools Help
Share
Commands + Code + Text Run all
RAM Disk
log_returns = np.log(price_series).diff().dropna()
log_returns.head()
Close
Date
2018-11-30 05:00:00 -0.005417
2018-12-03 05:00:00 0.034346
2018-12-04 05:00:00 -0.044986
2018-12-06 05:00:00 -0.011212
2018-12-07 05:00:00 -0.036308
dtype: float64
plt.figure()
plt.plot(log_returns)
plt.title("Log Returns of Apple Stock")
plt.show()
Log Returns of Apple Stock
0.10
Variables Terminal
11:48 AM Python 3
28°C Sunny
Search
ENG IN
11:54 AM 06-02-2026

Untitled0.ipynb - Colab

colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK

Untitled0.ipynb

File Edit View Insert Runtime Tools Help

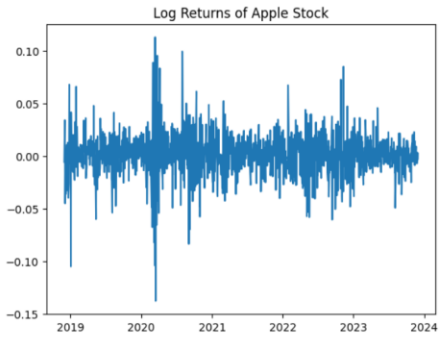
Share

Commands + Code + Text Run all

RAM Disk

[13] 0s

```
plt.figure()
plt.plot(log_returns)
plt.title("Log Returns of Apple Stock")
plt.show()
```



Variables Terminal

11:48 AM Python 3

28°C Sunny

Search

ENG IN 11:54 AM 06-02-2026

Untitled0.ipynb - Colab

colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK

Untitled0.ipynb

File Edit View Insert Runtime Tools Help

Share

Commands + Code + Text Run all

RAM Disk

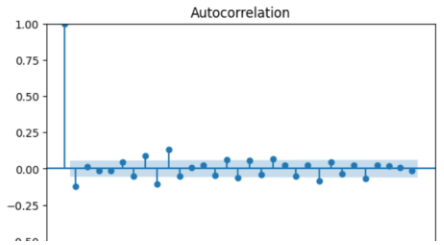
[14] 0s

```
adf_result = adfuller(log_returns)
print("ADF Statistic:", adf_result[0])
print("p-value:", adf_result[1])
```

```
ADF Statistic: -10.952988871319397
p-value: 8.702564601637606e-20
```

[15] 0s

```
plot_acf(log_returns, lags=30)
plt.show()
```



Variables Terminal

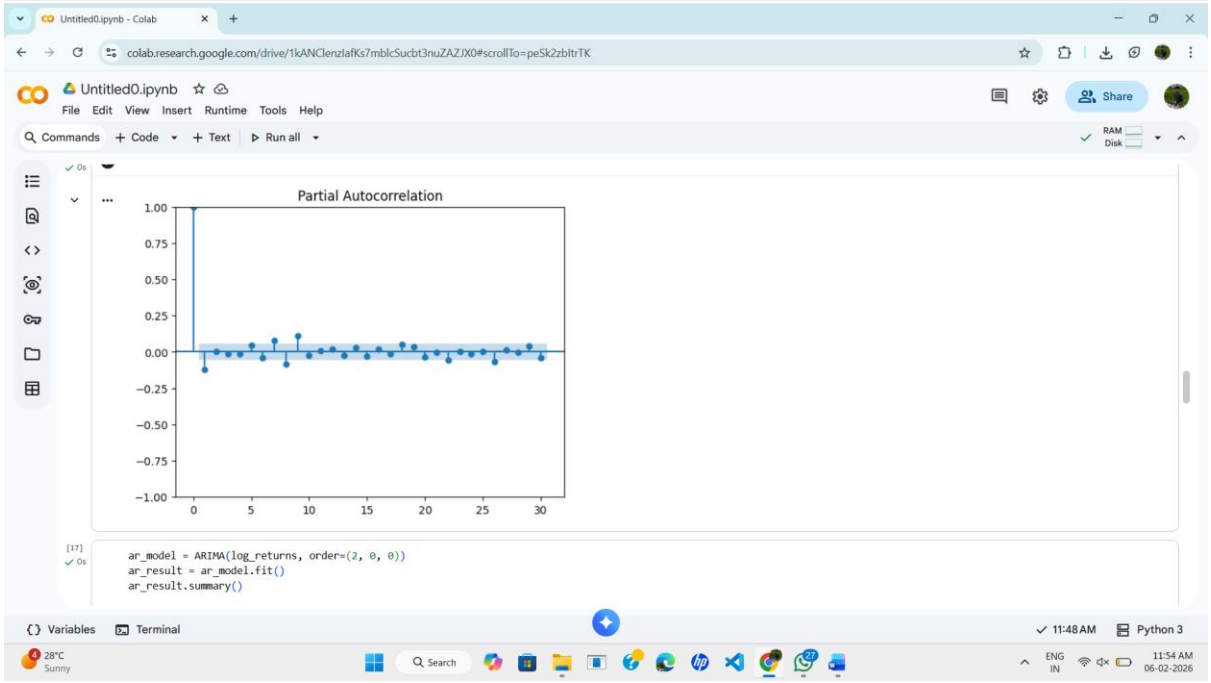
11:48 AM Python 3

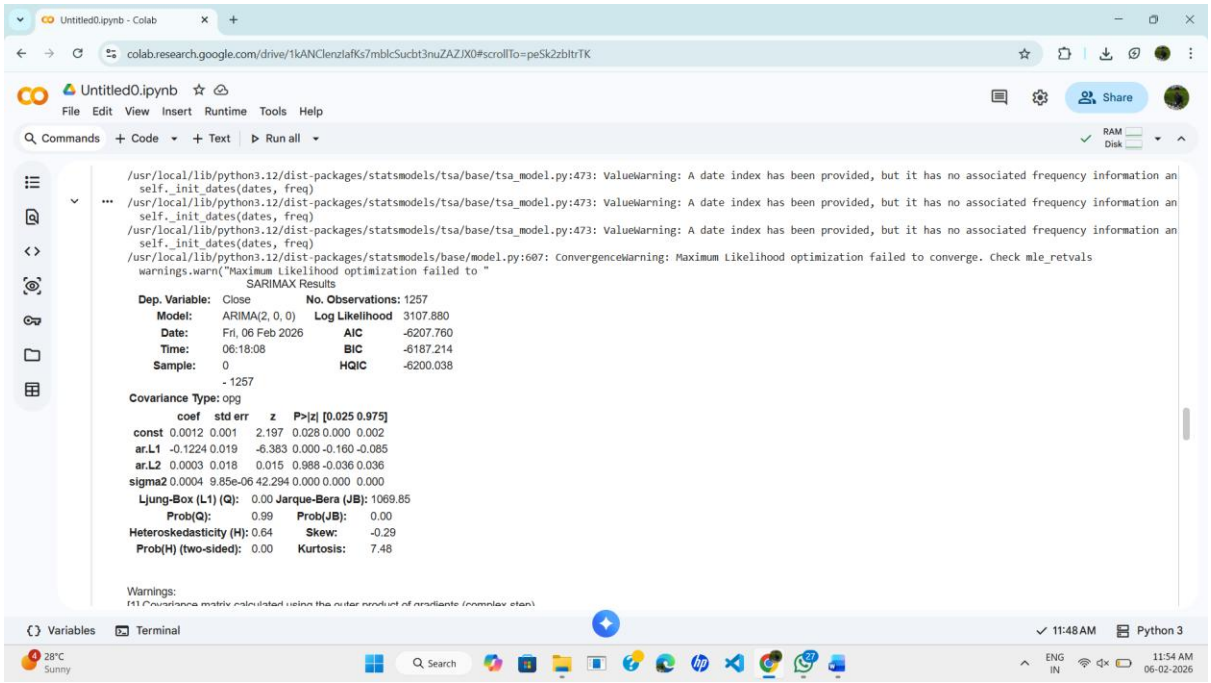
28°C Sunny

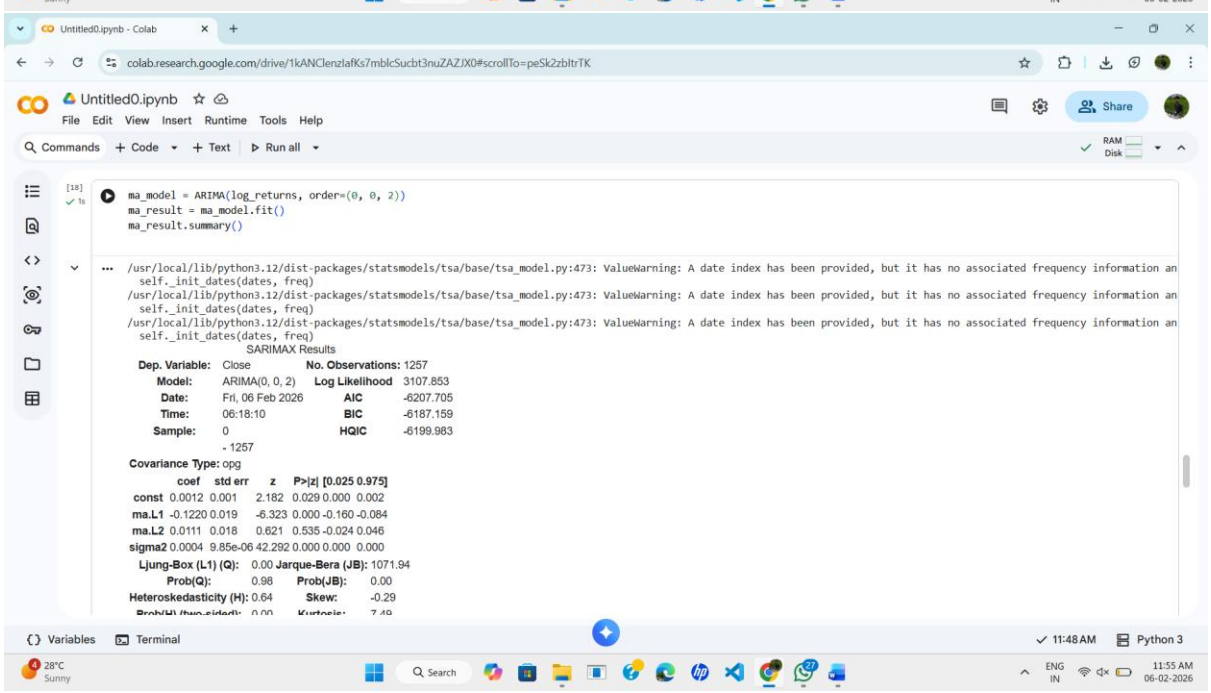
Search

ENG IN 11:54 AM 06-02-2026


Untitled0.ipynb - Colab
colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK
Untitled0.ipynb
File Edit View Insert Runtime Tools Help
Share
Commands + Code + Text Run all
RAM Disk
Autocorrelation
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0 5 10 15 20 25 30
[16]
0s
plot_pacf(log_returns, lags=30)
plt.show()
Variables Terminal
11:48 AM Python 3
28°C Sunny
Search
ENG IN
11:54 AM 06-02-2026


Untitled0.ipynb - Colab
colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK
Untitled0.ipynb
File Edit View Insert Runtime Tools Help
Share
Commands + Code + Text Run all
RAM Disk
0s
Partial Autocorrelation
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0 5 10 15 20 25 30
[17]
0s
ar_model = ARIMA(log_returns, order=(2, 0, 0))
ar_result = ar_model.fit()
ar_result.summary()
Variables Terminal
11:48 AM Python 3
28°C Sunny
Search
ENG IN
11:54 AM 06-02-2026


Untitled0.ipynb - Colab
colab.research.google.com/drive/1kANClenzIafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK
Untitled0.ipynb
File Edit View Insert Runtime Tools Help
Share
Commands + Code + Text Run all
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473: ValueWarning: A date index has been provided, but it has no associated frequency information an
self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473: ValueWarning: A date index has been provided, but it has no associated frequency information an
self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473: ValueWarning: A date index has been provided, but it has no associated frequency information an
self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/base/model.py:607: ConvergenceWarning: Maximum Likelihood optimization failed to converge. Check mle_retvals
warnings.warn("Maximum Likelihood optimization failed to "
SARIMAX Results
Dep. Variable: Close No. Observations: 1257
Model: ARIMA(2, 0, 0) Log Likelihood 3107.880
Date: Fri, 06 Feb 2026 AIC -6207.760
Time: 06:18:08 BIC -6187.214
Sample: 0 HQIC -6200.038
- 1257
Covariance Type: opg
coef std err z P>|z| [0.025 0.975]
const 0.0012 0.001 2.197 0.028 0.000 0.002
ar.L1 -0.1224 0.019 -6.383 0.000 -0.160 -0.085
ar.L2 0.0003 0.018 0.015 0.988 -0.036 0.036
sigma2 0.0004 9.85e-06 42.294 0.000 0.000 0.000
Ljung-Box (L1) (Q): 0.00 Jarque-Bera (JB): 1069.85
Prob(Q): 0.99 Prob(JB): 0.00
Heteroskedasticity (H): 0.64 Skew: -0.29
Prob(H) (two-sided): 0.00 Kurtosis: 7.48
Warnings:
Variables Terminal
11:48 AM Python 3
28°C Sunny
Search
ENG IN
11:54 AM 06-02-2026


Untitled0.ipynb - Colab
colab.research.google.com/drive/1kANClenzIafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK
Untitled0.ipynb
File Edit View Insert Runtime Tools Help
Share
Commands + Code + Text Run all
[18]
ma_model = ARIMA(log_returns, order=(0, 0, 2))
ma_result = ma_model.fit()
ma_result.summary()
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473: ValueWarning: A date index has been provided, but it has no associated frequency information an
self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473: ValueWarning: A date index has been provided, but it has no associated frequency information an
self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473: ValueWarning: A date index has been provided, but it has no associated frequency information an
self._init_dates(dates, freq)
SARIMAX Results
Dep. Variable: Close No. Observations: 1257
Model: ARIMA(0, 0, 2) Log Likelihood 3107.853
Date: Fri, 06 Feb 2026 AIC -6207.705
Time: 06:18:10 BIC -6187.159
Sample: 0 HQIC -6199.983
- 1257
Covariance Type: opg
coef std err z P>|z| [0.025 0.975]
const 0.0012 0.001 2.182 0.029 0.000 0.002
ma.L1 -0.1220 0.019 -6.323 0.000 -0.160 -0.084
ma.L2 0.0111 0.018 0.621 0.535 -0.024 0.046
sigma2 0.0004 9.85e-06 42.292 0.000 0.000 0.000
Ljung-Box (L1) (Q): 0.00 Jarque-Bera (JB): 1071.94
Prob(Q): 0.98 Prob(JB): 0.00
Heteroskedasticity (H): 0.64 Skew: -0.29
Variables Terminal
11:48 AM Python 3
28°C Sunny
Search
ENG IN
11:55 AM 06-02-2026

Untitled0.ipynb - Colab

colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK

Untitled0.ipynb

File Edit View Insert Runtime Tools Help

Share

Commands + Code + Text Run all

RAM Disk

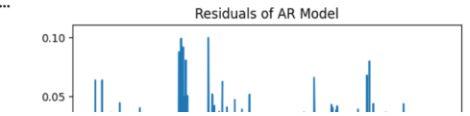
```
[19] print("AR Model AIC:", ar_result.aic)
     print("AR Model BIC:", ar_result.bic)

     print("MA Model AIC:", ma_result.aic)
     print("MA Model BIC:", ma_result.bic)
```

```
AR Model AIC: -6207.759786160888
AR Model BIC: -6187.213853326527
MA Model AIC: -6207.70520093818
MA Model BIC: -6187.159268103818
```

```
[20] residuals = ar_result.resid

     plt.figure()
     plt.plot(residuals)
     plt.title("Residuals of AR Model")
     plt.show()
```



Variables Terminal

11:48 AM Python 3

28°C Sunny

Search

ENG IN

11:55 AM 06-02-2026

Untitled0.ipynb - Colab

colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=peSk2zbItrTK

Untitled0.ipynb

File Edit View Insert Runtime Tools Help

Share

Commands + Code + Text Run all

RAM Disk

[20] plt.figure()
plt.plot(residuals)
plt.title("Residuals of AR Model")
plt.show()

Variables Terminal

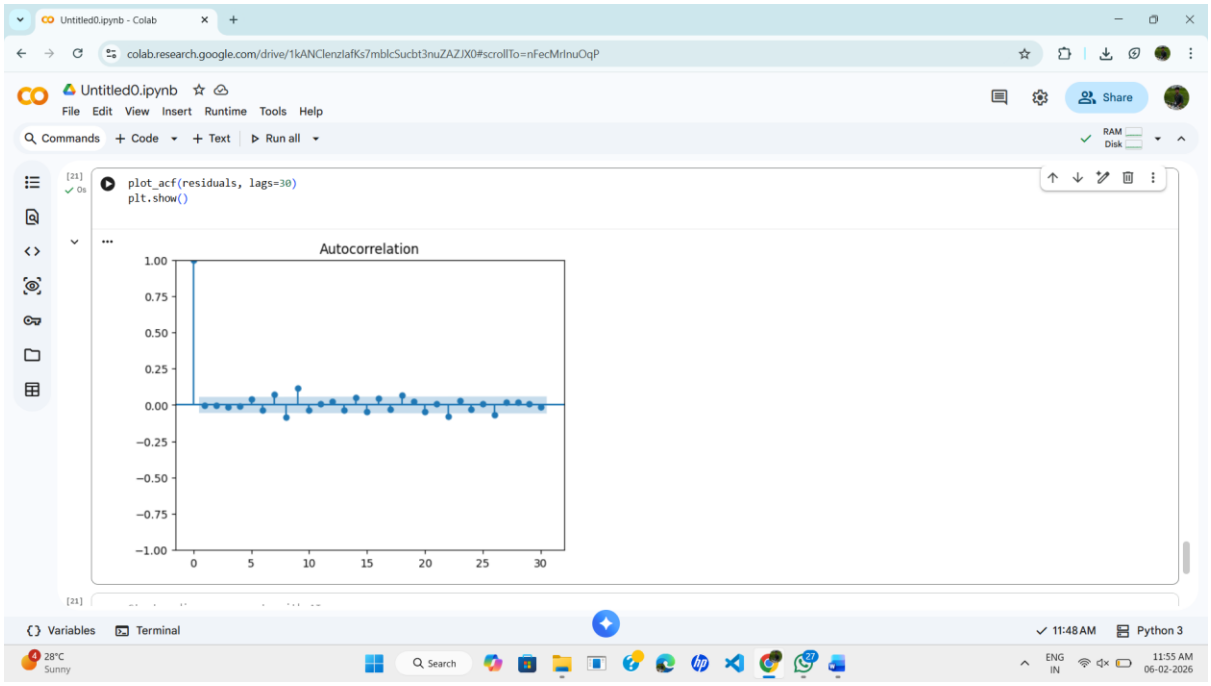
11:48 AM Python 3

28°C Sunny

Search

ENG IN

11:55 AM 06-02-2026


Untitled0.ipynb - Colab
colab.research.google.com/drive/1kANClenzlafKs7mblcSucbt3nuZAZJX0#scrollTo=nFecMrlnuOqP
Untitled0.ipynb
File Edit View Insert Runtime Tools Help
Share
Commands + Code + Text Run all
RAM
Disk
plot_acf(residuals, lags=30)
plt.show()
Autocorrelation
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
5
10
15
20
25
30
Variables
Terminal
11:48 AM
Python 3
28°C
Sunny
Search
ENG
IN
11:55 AM
06-02-2026