```
# !pip install pandas-datareader
```

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
sns.set()
plt.style.use('fivethirtyeight')
import datetime

from pandas_datareader import data as pdr
import yfinance as yf
# yf.pdr_override()
```

```
import yfinance as yf

end_date = datetime.date.today().strftime('%Y-%m-%d')
apple = yf.Ticker("AAPL")
AAPL = apple.history(start = "2020-01-01", end= end_date)
AAPL.head()
```

	Open	High	Low	Close	Volume	Dividends	Stock Splits
Date							
2020-01-02 00:00:00-05:00	71.721019	72.776598	71.466812	72.716072	135480400	0.0	0.0
2020-01-03 00:00:00-05:00	71.941351	72.771768	71.783985	72.009140	146322800	0.0	0.0

Next steps: Generate code with AAPL View recommended plots New interactive sheet

Get the Balance Sheet and Income Statements

```
balance_sheet = apple.balance_sheet
```

```
print("Balance Sheet:")
print(balance_sheet.head())

income_statement = apple.financials
print("\nIncome Statement:")
print(income_statement.head())

# Information about Apple:
info = apple.info
print(f"\nCompany: {info['longName']}")
print(f"Sector: {info['sector']}")
print(f"Industry: {info['industry']}")
print(f"Market Cap: {info['marketCap']}")
print(f"P/E Ratio: {info['trailingPE']}")

# dividend data
dividends = apple.dividends
print("Dividends:")
print(dividends.tail())
```

```
Balance Sheet:
                           2024-09-30      2023-09-30      2022-09-30  \
Treasury Shares Number            NaN             0.0             NaN
Ordinary Shares Number  15116786000.0   15550061000.0   15943425000.0
Share Issued            15116786000.0   15550061000.0   15943425000.0
Net Debt                76686000000.0   81123000000.0   96423000000.0
Total Debt             106629000000.0  111088000000.0  132480000000.0

                           2021-09-30 2020-09-30
Treasury Shares Number            NaN        NaN
Ordinary Shares Number  16426786000.0        NaN
Share Issued            16426786000.0        NaN
Net Debt                89779000000.0        NaN
Total Debt             136522000000.0        NaN

Income Statement:
                                                    2024-09-30  \
Tax Effect Of Unusual Items                                0.0
Tax Rate For Calcs                                       0.241
Normalized EBITDA                                134661000000.0
Net Income From Continuing Operation Net Minori...   93736000000.0
Reconciled Depreciation                              11445000000.0

                                                    2023-09-30  \
Tax Effect Of Unusual Items                                0.0
Tax Rate For Calcs                                       0.147
Normalized EBITDA                                125820000000.0
Net Income From Continuing Operation Net Minori...   96995000000.0
```

```
Reconciled Depreciation                                 11519000000.0

                                                          2022-09-30  \
Tax Effect Of Unusual Items                                      0.0
Tax Rate For Calcs                                             0.162
Normalized EBITDA                                      130541000000.0
Net Income From Continuing Operation Net Minori...      99803000000.0
Reconciled Depreciation                                 11104000000.0

                                                          2021-09-30 2020-09-30
Tax Effect Of Unusual Items                                      0.0        NaN
Tax Rate For Calcs                                             0.133        NaN
Normalized EBITDA                                      123136000000.0        NaN
Net Income From Continuing Operation Net Minori...      94680000000.0        NaN
Reconciled Depreciation                                 11284000000.0        NaN

Company: Apple Inc.
Sector: Technology
Industry: Consumer Electronics
Market Cap: 3357525147648
P/E Ratio: 35.5335
Dividends:
Date
2024-02-09 00:00:00-05:00    0.24
2024-05-10 00:00:00-04:00    0.25
2024-08-12 00:00:00-04:00    0.25
2024-11-08 00:00:00-05:00    0.25
2025-02-10 00:00:00-05:00    0.25
Name: Dividends, dtype: float64
```

```python
apple = yf.Ticker("AAPL")

tickers = ["SPY", "AAL", "ZM", "NFLX", "META", 'AAPL']

end_date = datetime.date.today().strftime('%Y-%m-%d')
apple = yf.Ticker("AAPL")
AAPL = apple.history(start = "2020-01-01", end= "2024-12-31")

for ticker in tickers:
    globals()[ticker] = yf.Ticker(ticker)
    globals()[ticker] = globals()[ticker].history(start = "2020-01-01", end= "202
```

```
print(META.Close.mean())
META.describe()
```

```
299.97541435199213
```

	Open	High	Low	Close	Volume	Dividends
count	1257.000000	1257.000000	1257.000000	1257.000000	1.257000e+03	1257.000000
mean	299.811909	304.029698	295.797743	299.975414	2.315541e+07	0.001591
std	124.745251	125.702634	123.419958	124.602583	1.572882e+07	0.028172
min	89.657445	90.035660	87.676781	88.492935	4.726100e+06	0.000000
25%	207.860343	210.607429	205.541261	208.795944	1.453120e+07	0.000000
50%	277.850462	283.891993	274.984004	279.512634	1.938320e+07	0.000000
75%	345.004028	350.448357	341.570169	344.665588	2.711680e+07	0.000000
max	630.430133	637.318434	626.147422	631.608093	2.323166e+08	0.500000

Now, let us keep only the closing prices for our analysis.

```
## keep only column close for all tickers
for ticker in tickers:
    globals()[ticker] = globals()[ticker].Close
```

```
SPY
```

	Close
Date	
2020-01-02 00:00:00-05:00	300.291504
2020-01-03 00:00:00-05:00	298.017792
2020-01-06 00:00:00-05:00	299.154602
2020-01-07 00:00:00-05:00	298.313507
2020-01-08 00:00:00-05:00	299.903351
...	...
2024-12-23 00:00:00-05:00	592.906433
2024-12-24 00:00:00-05:00	599.496582
2024-12-26 00:00:00-05:00	599.536499
2024-12-27 00:00:00-05:00	593.225464
2024-12-30 00:00:00-05:00	586.455811

1257 rows × 1 columns

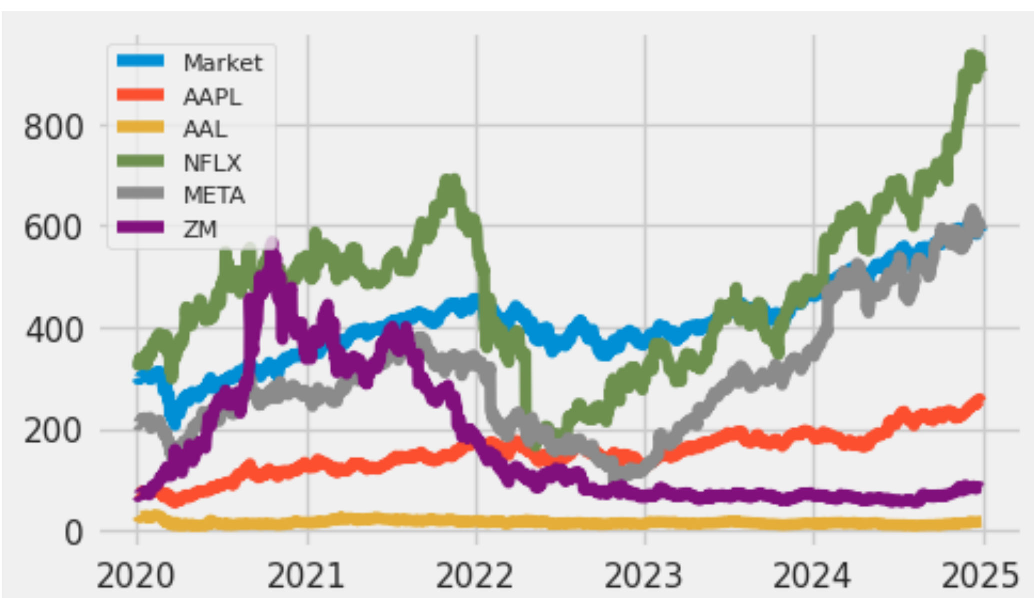
dtype: float64

```
df = pd.DataFrame({'Market': SPY, 'AAPL':AAPL, 'AAL':AAL, 'NFLX':NFLX, 'META':META,
df.tail()
```

Date	Market	AAPL	AAL	NFLX	META	ZM
2024-12-23 00:00:00-05:00	592.906433	254.989655	17.250000	911.450012	599.316772	85.269997
2024-12-24 00:00:00-05:00	599.496582	257.916443	17.350000	932.119995	607.209778	85.669998
2024-12-26 00:00:00-	599.536499	258.735504	17.350000	924.140015	602.813660	85.440002

```
# print(AAPL)
# print(AAPL.shift(1))
```

```
plt.style.use('fivethirtyeight')
plt.figure(figsize=(5, 3))
plt.plot(df, label=df.columns)
plt.legend(loc='upper left',fontsize=8)
plt.show()
```



For financial analysis, we require the log returns (daily), rather than the raw stock prices. The formula for log returns is:

log(Today's Price/yesterday's price - 1)

```
# create new columns that are log returns of the columns
data = np.log(df/df.shift(1))
# data = (df-df.shift(1))/df.shift(1)
# replace first row with zeroes
data.iloc[0] = 0
data.head(5)
```

Market	AAPL	AAL	NFLX	META	ZM
Date						

Date	Market	AAPL	AAL	NFLX	META	ZM
2020-01-02 00:00:00-05:00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2020-01-03 00:00:00-05:00	-0.007600	-0.009770	-0.050769	-0.011926	-0.005305	-0.021177
2020-01-06 00:00:00-05:00	0.003807	0.007937	-0.012007	0.030014	0.018658	0.044193
2020-01-07						

Next steps: Generate code with data | View recommended plots | New interactive sheet

Find the betas of the stocks. The formula is shown below:

```
beta_aapl = (data[['Market','AAPL']].cov()/data['Market'].var()).iloc[0].iloc[1]
beta_aapl
```

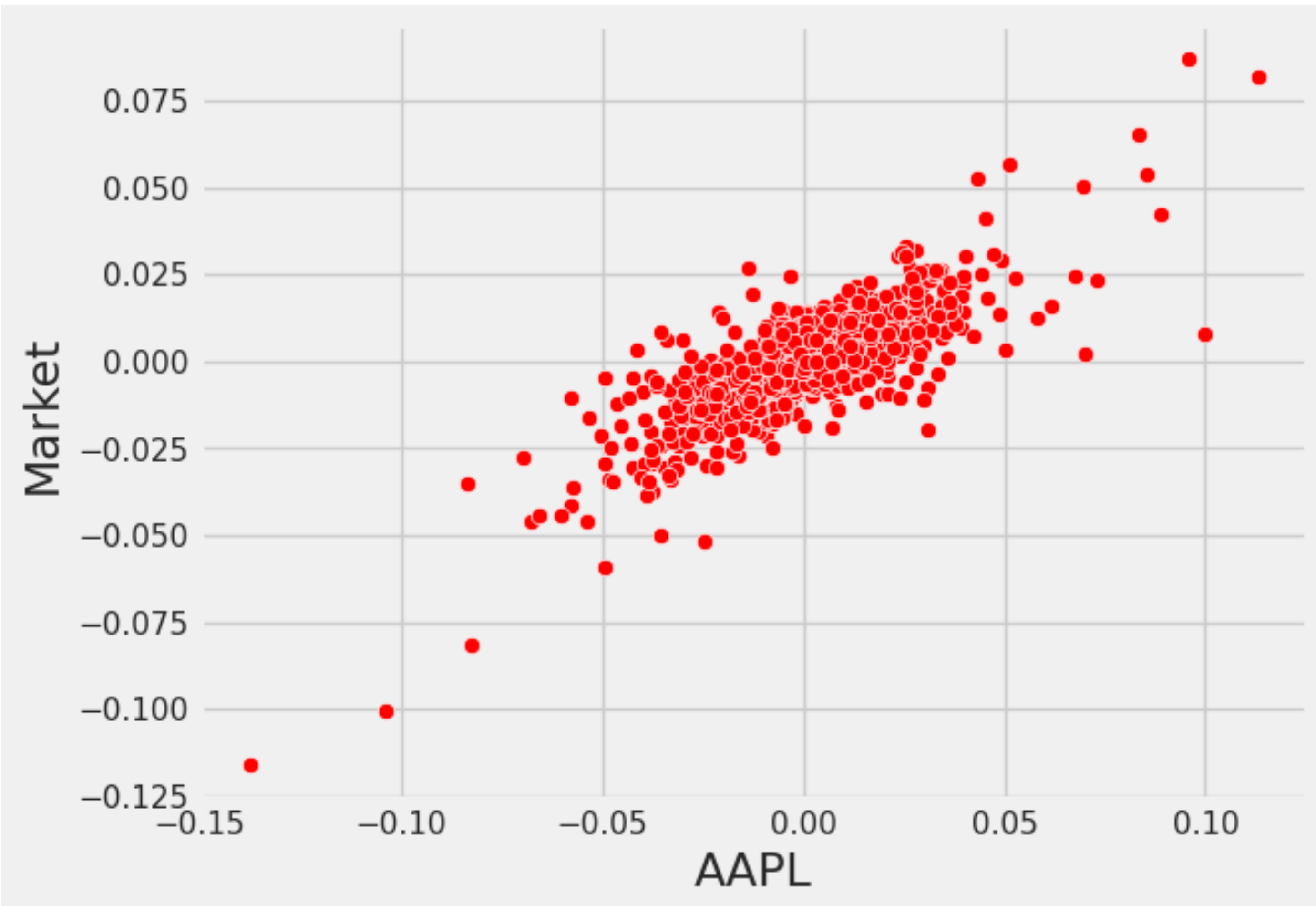
```
np.float64(1.189831202368612)
```

Calculate beta using regression line.

```
beta, alpha = np.polyfit(data['Market'], data['AAPL'], 1)
alpha
beta
```

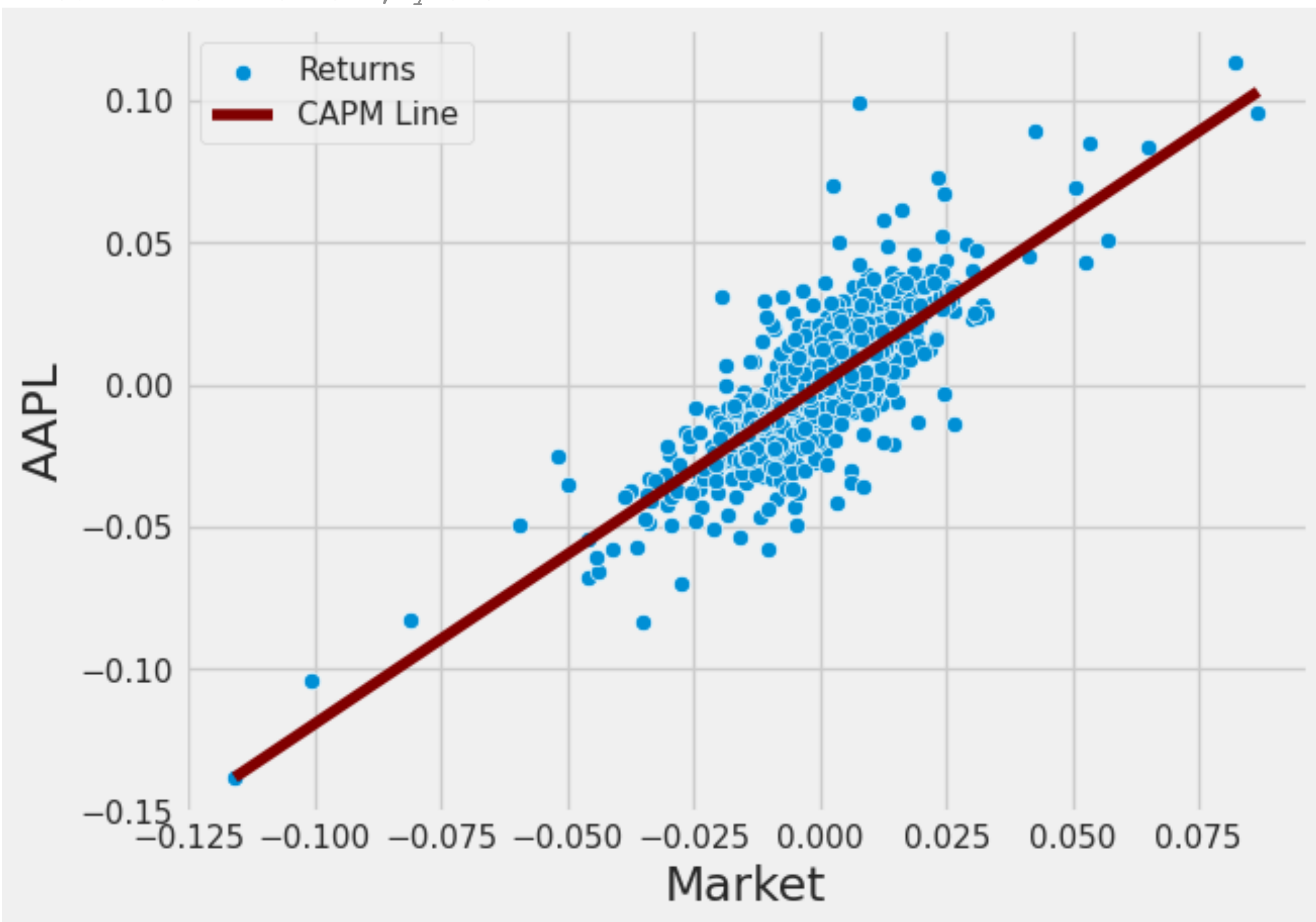
```
np.float64(1.1898312023686133)
```

```
# plt.axvline(0, color='grey', alpha = 0.5)
# plt.axhline(0, color='grey', alpha = 0.5)
sns.scatterplot(y = 'Market', x = 'AAPL', data = data, color = 'red')
plt.show()
```



```
sns.scatterplot(y = 'AAPL', x = 'Market', data = data, label = 'Returns')
sns.lineplot(x = data['Market'], y = alpha + (data['Market']-alpha)*beta_aapl, colc
```

```
<Axes: xlabel='Market', ylabel='AAPL'>
```



Convert Daily Stock Market Returns to Annualized Returns (assuming 252 trading days in a year).

```
rm = data['Market'].mean()*252
rm
cov = data[['Market','AAPL']].cov() *252
cov_aapl_market = cov.iloc[0,1]
cov_aapl_market
market_var = data['Market'].var()*252
market_var

AAPL_beta_annual = cov_aapl_market / market_var
print('The annualized beta will equal the one calculated at daily returns:',AAPL_

rf = 0.025
riskpremium = rm - rf

## CAPM
AAPL_capm_return = rf + AAPL_beta_annual*riskpremium

print(f"The annualized CAPM return of AAPL is {AAPL_capm_return*100:.2f}%")
```

```
The annualized beta will equal the one calculated at daily returns: 1.1898312(
The annualized CAPM return of AAPL is 15.49%
```

```
sharperatio = (rm-rf)/(data['AAPL'].std()*np.sqrt(252))
sharperatio
print(f"Sharpe Ratio: {round(sharperatio,4)}")
```

```
Sharpe Ratio: 0.345
```

Start coding or generate with AI.

```
import numpy as np
import pandas as pd
import yfinance as yf

# Define the tickers, including 5 additional stocks
tickers = ["SPY", "AAL", "ZM", "NFLX", "META", "AAPL", "MSFT", "AMZN", "GOOG", "TSL

# Define the risk-free rate
rf = 0.025

# Create an empty dictionary to store the results
results = {}
```

```
# Loop through the tickers
for ticker in tickers:
    # Get the stock data
    stock_data = yf.download(ticker, start="2020-01-01", end="2024-12-31")["Close"]

    # Calculate the daily returns
    daily_returns = np.log(stock_data / stock_data.shift(1))
    daily_returns.iloc[0] = 0  # Replace the first row with zeroes

    # Calculate the market returns (using SPY as a proxy)
    market_data = yf.download("SPY", start="2020-01-01", end="2024-12-31")["Close"]
    market_returns = np.log(market_data / market_data.shift(1))
    market_returns.iloc[0] = 0  # Replace the first row with zeroes

    # Calculate the beta
    beta = np.cov(daily_returns, market_returns)[0, 1] / np.var(market_returns)

    # Calculate the annualized market return
    rm = market_returns.mean() * 252

    # Calculate the cost of equity (CAPM)
    cost_of_equity = rf + beta * (rm - rf)

    # Calculate the Sharpe ratio
    sharpe_ratio = (daily_returns.mean() * 252 - rf) / (daily_returns.std() * np.sq

    # Store the results in the dictionary
    results[ticker] = {"Cost of Equity": cost_of_equity, "Sharpe Ratio": sharpe_rat

# Convert the results to a pandas DataFrame
results_df = pd.DataFrame.from_dict(results, orient="index")

# Print the results
print(results_df)
```

```
[*********************100%***********************]  1 of 1 completed
[*********************100%***********************]  1 of 1 completed
<ipython-input-20-24ac1fec6f7c>:29: RuntimeWarning: Degrees of freedom <= 0 fo
  beta = np.cov(daily_returns, market_returns)[0, 1] / np.var(market_returns)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/_core/fromnumeric.py:4006: Futur
  return var(axis=axis, dtype=dtype, out=out, ddof=ddof, **kwargs)
[*********************100%***********************]  1 of 1 completedYF.downloa
```

```
[*********************100%***********************]  1 of 1 completed
<ipython-input-20-24ac1fec6f7c>:29: RuntimeWarning: Degrees of freedom <= 0 fo
  beta = np.cov(daily_returns, market_returns)[0, 1] / np.var(market_returns)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/_core/fromnumeric.py:4006: Futu
  return var(axis=axis, dtype=dtype, out=out, ddof=ddof, **kwargs)
[*********************100%***********************]  1 of 1 completed
[*********************100%***********************]  1 of 1 completed
<ipython-input-20-24ac1fec6f7c>:29: RuntimeWarning: Degrees of freedom <= 0 fo
  beta = np.cov(daily_returns, market_returns)[0, 1] / np.var(market_returns)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/_core/fromnumeric.py:4006: Futu
  return var(axis=axis, dtype=dtype, out=out, ddof=ddof, **kwargs)
[*********************100%***********************]  1 of 1 completed
[*********************100%***********************]  1 of 1 completed
<ipython-input-20-24ac1fec6f7c>:29: RuntimeWarning: Degrees of freedom <= 0 fo
  beta = np.cov(daily_returns, market_returns)[0, 1] / np.var(market_returns)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/_core/fromnumeric.py:4006: Futu
  return var(axis=axis, dtype=dtype, out=out, ddof=ddof, **kwargs)
[*********************100%***********************]  1 of 1 completed
[*********************100%***********************]  1 of 1 completed
<ipython-input-20-24ac1fec6f7c>:29: RuntimeWarning: Degrees of freedom <= 0 fo
  beta = np.cov(daily_returns, market_returns)[0, 1] / np.var(market_returns)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/_core/fromnumeric.py:4006: Futu
  return var(axis=axis, dtype=dtype, out=out, ddof=ddof, **kwargs)
[*********************100%***********************]  1 of 1 completed
[*********************100%***********************]  1 of 1 completed
<ipython-input-20-24ac1fec6f7c>:29: RuntimeWarning: Degrees of freedom <= 0 fo
  beta = np.cov(daily_returns, market_returns)[0, 1] / np.var(market_returns)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
/usr/local/lib/python3.11/dist-packages/numpy/lib/_function_base_impl.py:2773:
  c *= np.true_divide(1, fact)
```

```
Start coding or generate with AI.
```

```
Start coding or generate with AI.
```