



FE 511-A Introduction to Bloomberg & Thomson-Reuters

“Correlation Between S&P 500 and Amazon (AMZN) Equity Price”

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➤ Introduction / Objective

The objective of this project is to examine the statistical relationship between the S&P 500 Index (SPX) and Amazon.com, Inc. (AMZN) equity prices. Specifically, we aim to determine how closely Amazon's stock movements align with those of the broader market. Understanding this correlation is valuable for portfolio managers, analysts, and individual investors seeking to assess risk, beta exposure, and diversification potential.

We hypothesize that Amazon, being a major constituent of the S&P 500, exhibits a strong positive correlation with the index. To test this hypothesis, we conduct a correlation analysis and linear regression using historical daily price data from Bloomberg.

➤ Data Collection

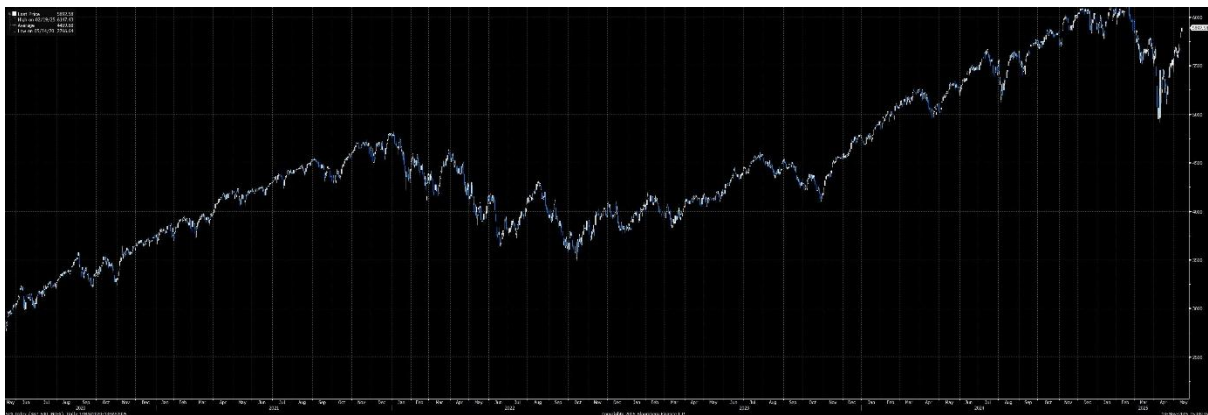
The data for this project was sourced from the Bloomberg Terminal. Historical daily adjusted closing prices for the S&P 500 Index (ticker: SPX Index) and Amazon.com, Inc. (ticker: AMZN US Equity) were extracted using the Graph Price (GP) function. The selected date range spans from May 1, 2020 to May 1, 2025.

[illegible]SPX Historical Data from 13th May 2020 to 13th May 2025

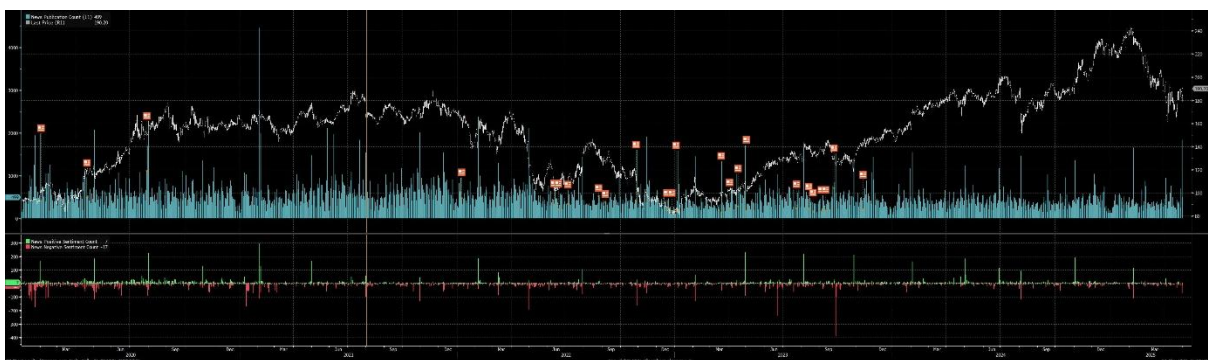
1	Date	News Publication Count (L1)	(R1) Open	(R1) High	(R1) Low	(R1) Close	News Positive Sentiment Count	News Negative Sentiment Count						
2	1/13/2020	328	94.565	94.9	94.04	94.565	1	-9						
3	1/14/2020	643	94.294	94.355	92.927	93.472	5	-88						
4	1/15/2020	1012	93.613	93.943	92.755	93.101	8	-110						
5	1/16/2020	742	94.149	94.28	93.301	93.897	8	-61						
6	1/17/2020	924	94.295	94.332	92.863	93.236	10	-128						
7	1/20/2020	385					3	-9						
8	1/21/2020	498	93.25	94.714	93	94.6	1	-8						
9	1/22/2020	1252	94.804	95.125	94.167	94.373	4	-51						
10	1/23/2020	1941	94.256	94.499	93.638	94.229	9	-178						
11	1/24/2020	745	94.568	94.749	92.372	93.082	5	-55						
12	1/27/2020	464	91	92.05	90.767	91.417	6	-25						
13	1/28/2020	619	92.025	92.906	91.501	92.662	10	-29						
14	1/29/2020	484	93.2	93.738	92.751	92.9	12	-10						
15	1/30/2020	536	92.9	93.644	92.531	93.534	14	-18						
16	1/31/2020	1981	102.574	102.786	100.114	100.436	169	-27						
17	2/3/2020	408	100.53	102.425	100.012	100.21	10	-27						
18	2/4/2020	736	101.494	102.99	100.769	102.483	20	-32						
19	2/5/2020	743	103.551	103.551	101.6	101.993	22	-22						
20	2/6/2020	510	102.051	102.815	101.24	102.511	16	-17						
21	2/7/2020	527	102.1	104.926	101.905	103.964	16	-17						
22	2/10/2020	399	104.251	106.78	104.248	106.696	5	-6						

AMZN US Equity Historical Data from 13th May 2020 to 13th May 2025

Prices were exported as Excel files and included the “Adjusted Close” field to ensure accuracy in return calculations. The data was then imported into Python for preprocessing and analysis.



Graph / Chart of SPX Index (S&P 500 INDEX) on Bloomberg Terminal from 13th May 2020 to 13th May 2025



Graph / Chart of AMZN US Equity (Amazon.com Inc) on Bloomberg Terminal from 1st May 2020 to 1st May 2025

➤ Methodology

The analysis was performed in Python using libraries such as pandas, numpy, statsmodels, and matplotlib.

Steps:

- ❖ Merged SPX and AMZN data on the date field.
- ❖ Computed daily log returns for both assets to normalize for price scale.
- ❖ Calculated the Pearson correlation coefficient between the return series.
- ❖ Performed an Ordinary Least Squares (OLS) regression of AMZN returns on SPX returns to estimate beta, alpha, and R^2 .
- ❖ Generated a scatter plot with a regression line to visualize the relationship.
- ❖ Plotted a 60-day rolling correlation to observe how the relationship changed over time.
- ❖ Created a time series plot of both prices to understand broader trends.

➤ Results

```
Correlation between SPX and AMZN daily log returns: 0.7086
                                OLS Regression Results
=====
Dep. Variable:                AMZN_Return    R-squared:                0.502
Model:                        OLS           Adj. R-squared:        0.502
Method:                       Least Squares  F-statistic:             1257.
Date:                         Wed, 14 May 2025 Prob (F-statistic):      6.60e-191
Time:                         12:38:56      Log-Likelihood:          3403.5
No. Observations:             1248          AIC:                   -6803.
Df Residuals:                 1246          BIC:                   -6793.
Df Model:                      1
Covariance Type:              nonrobust
=====
              coef    std err          t      P>|t|      [0.025      0.975]
-----
const        -0.0004      0.000     -0.889      0.374     -0.001      0.000
SPX_Return     1.4156      0.040    35.448      0.000      1.337      1.494
=====
Omnibus:                213.739    Durbin-Watson:           1.972
Prob(Omnibus):           0.000    Jarque-Bera (JB):        3295.032
Skew:                    0.261    Prob(JB):                 0.00
Kurtosis:                10.943    Cond. No.                 89.1
=====
```

Correlation coefficient (Pearson) : 0.7086

```
Correlation between SPX and AMZN daily log returns: 0.7086
```

→ This indicates a strong positive correlation between AMZN and SPX returns.

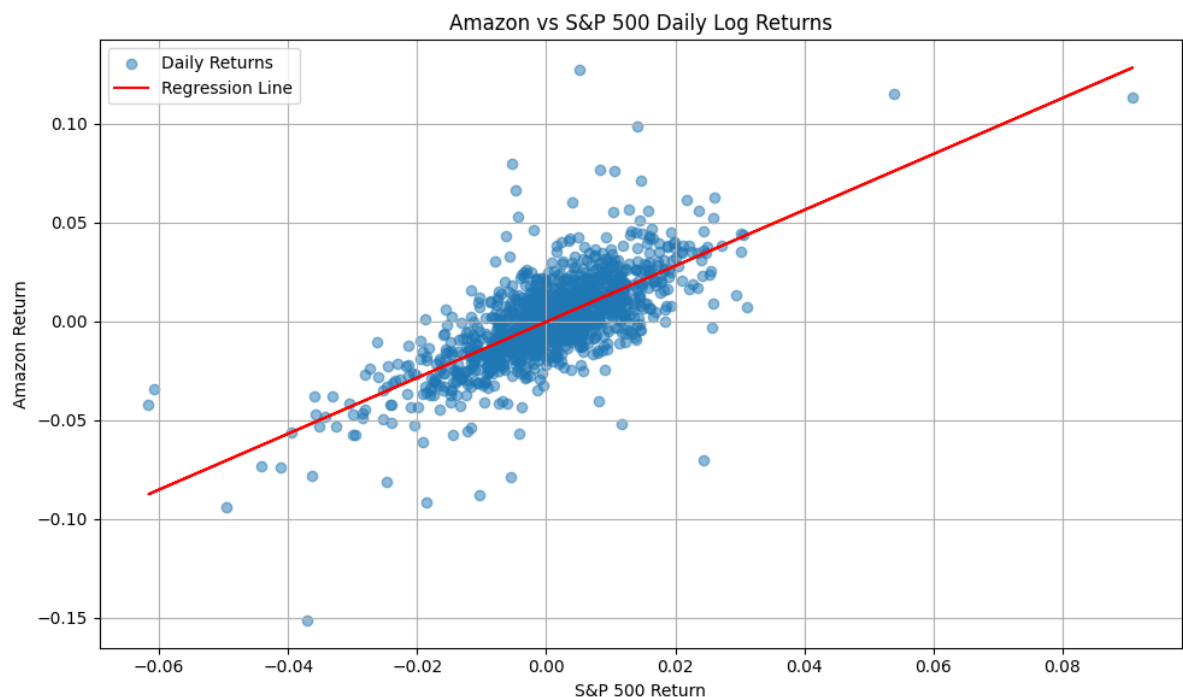
OLS Regression Output:

OLS Regression Results			
=====			
Dep. Variable:	AMZN_Return	R-squared:	0.502
Model:	OLS	Adj. R-squared:	0.502
Method:	Least Squares	F-statistic:	1257.
Date:	Wed, 14 May 2025	Prob (F-statistic):	6.60e-191
Time:	12:52:59	Log-Likelihood:	3403.5
No. Observations:	1248	AIC:	-6803.
Df Residuals:	1246	BIC:	-6793.
Df Model:	1		
Covariance Type:	nonrobust		
=====			

- Beta: 1.4156 → Amazon reacts more strongly to SPX movements.
- Alpha: -0.0004 → Statistically insignificant ($p = 0.374$)
- R-squared: 0.502 → 50.2% of AMZN's return variation is explained by SPX.

➤ Visuals:

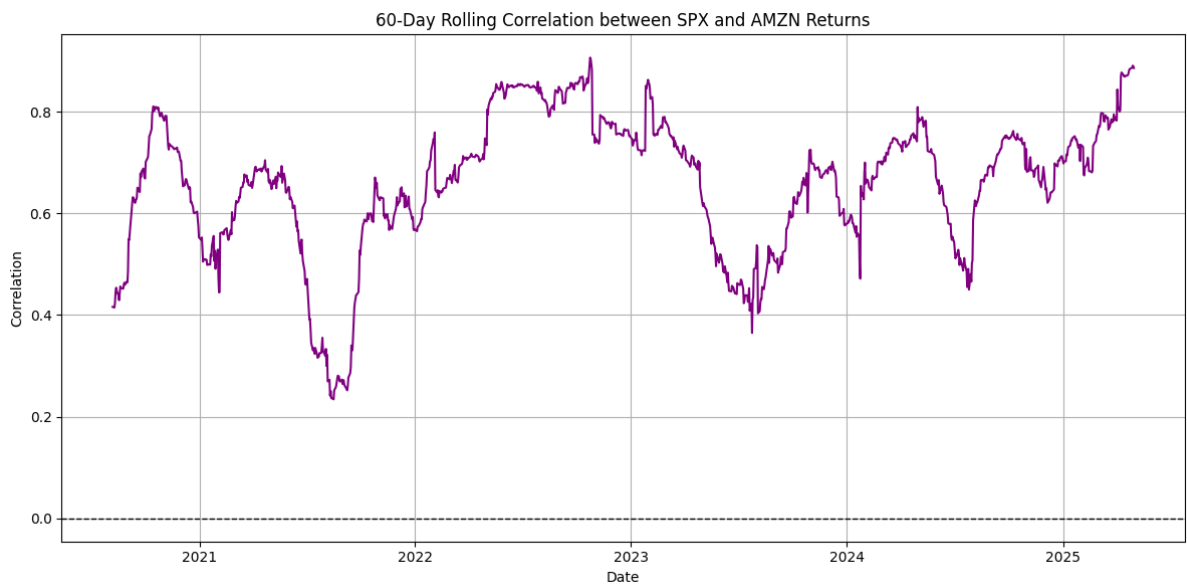
1. Scatter plot of SPX vs AMZN daily returns, with regression line



2. Time series chart of SPX and AMZN adjusted closing prices



3. 60-day rolling correlation between the two-return series



➤ Interpretation

The analysis shows that Amazon shares are closely tied to the broader market, as expected. The beta value above 1 suggests that Amazon is more volatile than the index—typically amplifying SPX movements. The rolling correlation chart indicates that while the relationship is generally strong, it can fluctuate during market stress or company-specific events (e.g., earnings, regulatory news).

The alpha is near zero and statistically insignificant, indicating no persistent outperformance after controlling for market exposure.

➤ **Conclusion:**

Amazon's equity returns demonstrate a strong positive correlation with the S&P 500, with a beta of 1.42 and an R-squared of 0.50. This supports the hypothesis that AMZN's price behavior is significantly influenced by the broader market. These findings are relevant for investors considering Amazon as part of a diversified portfolio and suggest that the stock carries above-market volatility.

➤ **Python Code :**

```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import statsmodels.api as sm

import seaborn as sns


# Loading Excel Files

spx = pd.read_excel("SPX_Historical.xlsx")

amzn = pd.read_excel("AMZN_Historical.xlsx")


# Renaming columns to simplify

spx = spx[['Date', 'Close']].rename(columns={'Close': 'SPX'})

amzn = amzn[['Date', '(R1) Close']].rename(columns={'(R1) Close': 'AMZN'})


# Converting 'Date' to datetime format

spx['Date'] = pd.to_datetime(spx['Date'])

amzn['Date'] = pd.to_datetime(amzn['Date'])


# Merging the two datasets on Date

data = pd.merge(spx, amzn, on='Date').sort_values('Date')
```



```

# Calculating log returns

data['SPX_Return'] = np.log(data['SPX'] / data['SPX'].shift(1))
data['AMZN_Return'] = np.log(data['AMZN'] / data['AMZN'].shift(1))

# === Drop rows with NaN values (first row will have NaN return) ===
data.dropna(inplace=True)

# Correlation
correlation = data['SPX_Return'].corr(data['AMZN_Return'])
print(f"Correlation between SPX and AMZN daily log returns: {correlation:.4f}")

# Regression Analysis
X = sm.add_constant(data['SPX_Return']) # Adds intercept
model = sm.OLS(data['AMZN_Return'], X).fit()
print(model.summary())

# Plotting the Scatter and Regression Line
plt.figure(figsize=(10, 6))

plt.scatter(data['SPX_Return'], data['AMZN_Return'], alpha=0.5, label='Daily
Returns')

plt.plot(data['SPX_Return'], model.predict(X), color='red', label='Regression Line')

plt.title('Amazon vs S&P 500 Daily Log Returns')
plt.xlabel('S&P 500 Return')
plt.ylabel('Amazon Return')
plt.grid(True)
plt.legend()
plt.tight_layout()
plt.show()

```

```
# Time Series Plot of Adjusted Prices
```

```
plt.figure(figsize=(12, 6))
```

```
plt.plot(data['Date'], data['SPX'], label='S&P 500 (SPX)', alpha=0.8)
```

```
plt.plot(data['Date'], data['AMZN'], label='Amazon (AMZN)', alpha=0.8)
```

```
plt.title('Price Time Series: SPX vs AMZN')
```

```
plt.xlabel('Date')
```

```
plt.ylabel('Price')
```

```
plt.legend()
```

```
plt.grid(True)
```

```
plt.tight_layout()
```

```
plt.show()
```

```
# Rolling Correlation Plot ===
```

```
rolling_corr = data['SPX_Return'].rolling(window=60).corr(data['AMZN_Return']) #  
60-day rolling
```

```
plt.figure(figsize=(12, 6))
```

```
plt.plot(data['Date'], rolling_corr, color='purple')
```

```
plt.title('60-Day Rolling Correlation between SPX and AMZN Returns')
```

```
plt.xlabel('Date')
```

```
plt.ylabel('Correlation')
```

```
plt.grid(True)
```

```
plt.tight_layout()
```

```
plt.axhline(y=0, color='black', linestyle='--', linewidth=1)
```

```
plt.show()
```