market_overview

January 12, 2026

1 Market Overview & Risk Analysis — S&P 500

Objective:
To analyze historical equity index data using return-based statistics and standard risk metrics commonly used in quantitative finance.

Key Focus Areas:
- Returns & volatility
- Drawdowns
- Risk-adjusted performance

This notebook demonstrates applied Python, statistics, and financial reasoning.

[32]:
```
import yfinance as yf
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import warnings

warnings.filterwarnings("ignore")
plt.style.use("default")
```

[33]:
```
symbol = "^GSPC"
data = yf.download(symbol, start="2015-01-01", auto_adjust=True)

# Basic data checks
data = data.dropna()
data.head()
```

```
[*********************100%***********************]  1 of 1 completed
```

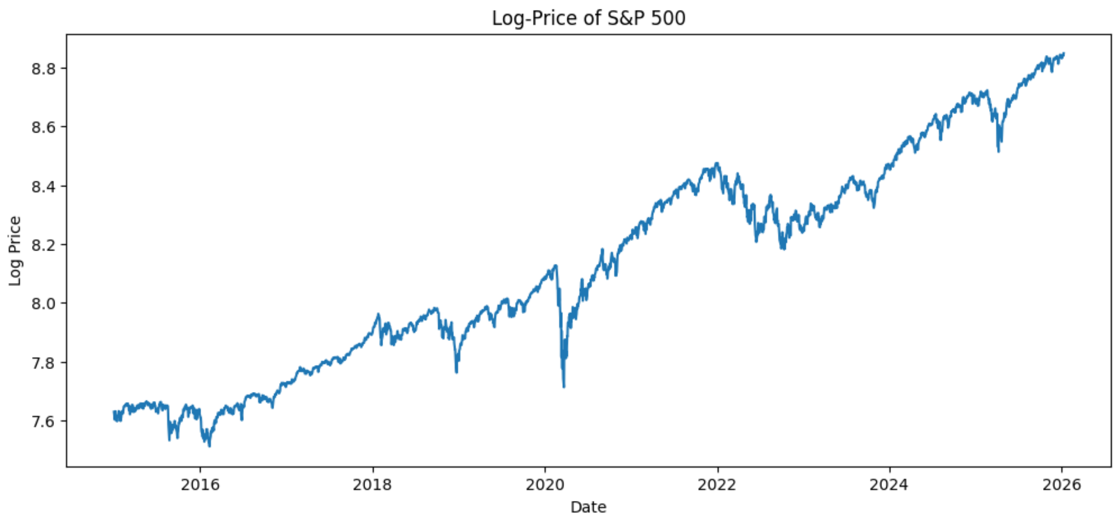
[33]:

Price	Close	High	Low	Open	Volume
Ticker	^GSPC	^GSPC	^GSPC	^GSPC	^GSPC
Date					
2015-01-02	2058.199951	2072.360107	2046.040039	2058.899902	2708700000
2015-01-05	2020.579956	2054.439941	2017.339966	2054.439941	3799120000
2015-01-06	2002.609985	2030.250000	1992.439941	2022.150024	4460110000
2015-01-07	2025.900024	2029.609985	2005.550049	2005.550049	3805480000
2015-01-08	2062.139893	2064.080078	2030.609985	2030.609985	3934010000

1.0.1 Dataset Summary

We use adjusted daily price data to ensure returns correctly reflect total market movement. The analysis period starts in 2015 to capture multiple market regimes: - Bull markets - COVID crash - High-inflation period

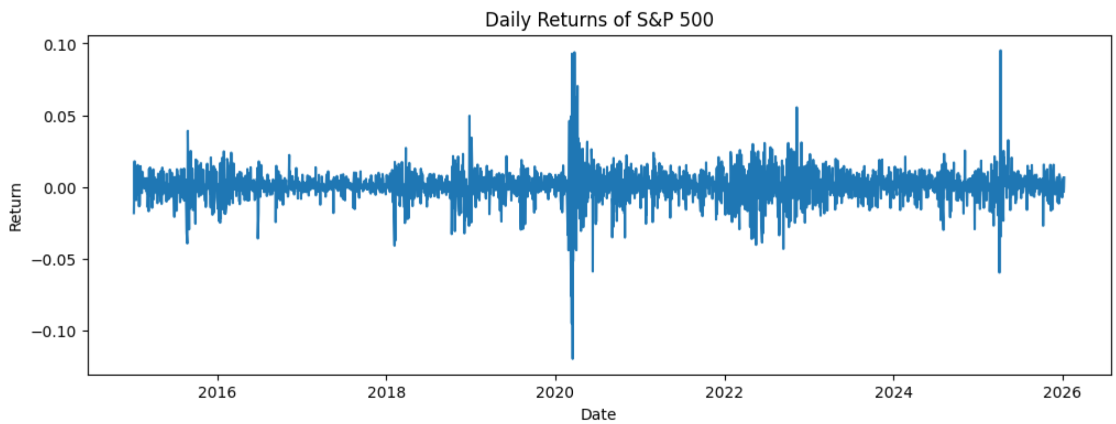
[34]:
```
plt.figure(figsize=(12,5))
plt.plot(np.log(data['Close']))
plt.title("Log-Price of S&P 500")
plt.xlabel("Date")
plt.ylabel("Log Price")
plt.show()
```



1.0.2 Daily Returns

Returns are analyzed instead of prices because: - Returns are stationary (prices are not) - Risk is defined in return space - Most quantitative strategies operate on returns - Adjusted prices account for dividends and splits and are required for accurate return calculations.

[35]:
```
data['Returns'] = data['Close'].pct_change()
data = data.dropna()

plt.figure(figsize=(12,4))
plt.plot(data['Returns'])
plt.title("Daily Returns of S&P 500")
plt.xlabel("Date")
plt.ylabel("Return")
plt.show()
```



1.0.3 Return Statistics

We compute key descriptive statistics to understand return distribution.

[36]:
```
stats = {
    "Mean Daily Return": data['Returns'].mean(),
    "Volatility (Std)": data['Returns'].std(),
    "Skewness": data['Returns'].skew(),
    "Kurtosis": data['Returns'].kurtosis()
}

pd.Series(stats)
```

[36]:
```
Mean Daily Return     0.000504
Volatility (Std)      0.011272
Skewness             -0.364731
Kurtosis             15.126114
dtype: float64
```

1.0.4 Annualized Risk Metrics

Annualized metrics assume 252 trading days.

Sharpe Ratio is computed assuming a zero risk-free rate for simplicity.

[37]:
```
annualized_return = data['Returns'].mean() * 252
annualized_vol = data['Returns'].std() * np.sqrt(252)
risk_free_rate = 0.0
sharpe_ratio = (annualized_return - risk_free_rate) / annualized_vol


pd.Series({
    "Annualized Return": annualized_return,
```

```
    "Annualized Volatility": annualized_vol,
    "Sharpe Ratio": sharpe_ratio
})
```

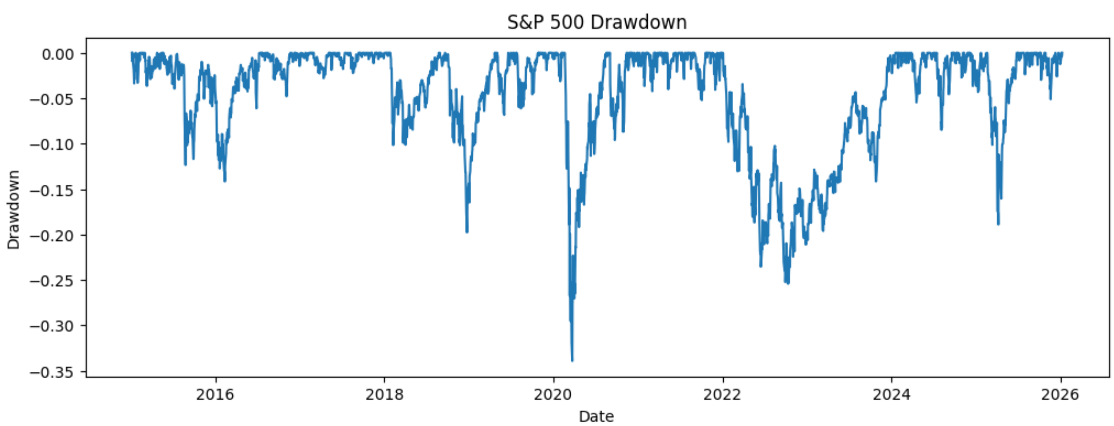
[37]:
```
Annualized Return        0.126963
Annualized Volatility    0.178936
Sharpe Ratio             0.709540
dtype: float64
```

1.0.5 Drawdown Analysis

Drawdowns capture downside risk ignored by volatility.

[38]:
```
cum_returns = (1 + data['Returns']).cumprod()
rolling_max = cum_returns.cummax()
drawdown = (cum_returns - rolling_max) / rolling_max
max_dd = drawdown.min()
print(f"Maximum Drawdown: {max_dd:.2%}")


plt.figure(figsize=(12,4))
plt.plot(drawdown)
plt.title("S&P 500 Drawdown")
plt.xlabel("Date")
plt.ylabel("Drawdown")
plt.show()

drawdown.min()
```

```
Maximum Drawdown: -33.92%
```

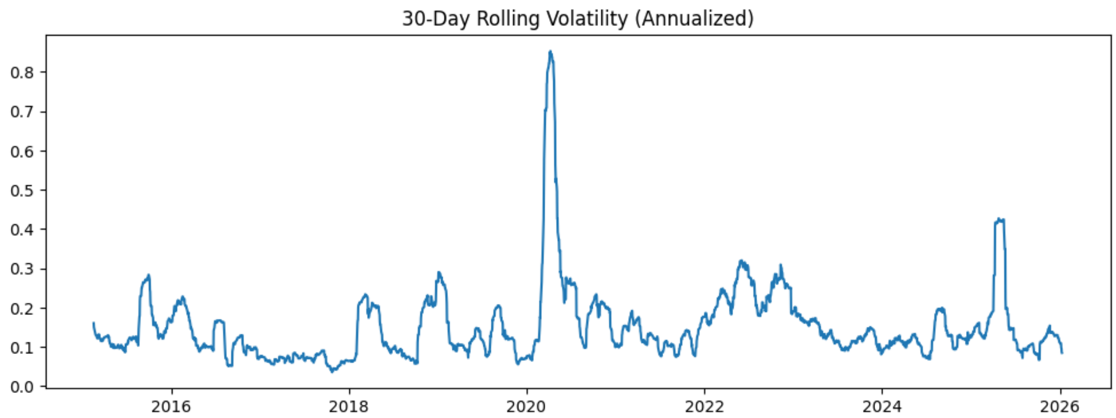


[38]:
```
np.float64(-0.3392496000265331)
```

1.0.6 Rolling volatility

Rolling volatility is annualized using $\sqrt{252}$ and expressed in percentage terms.

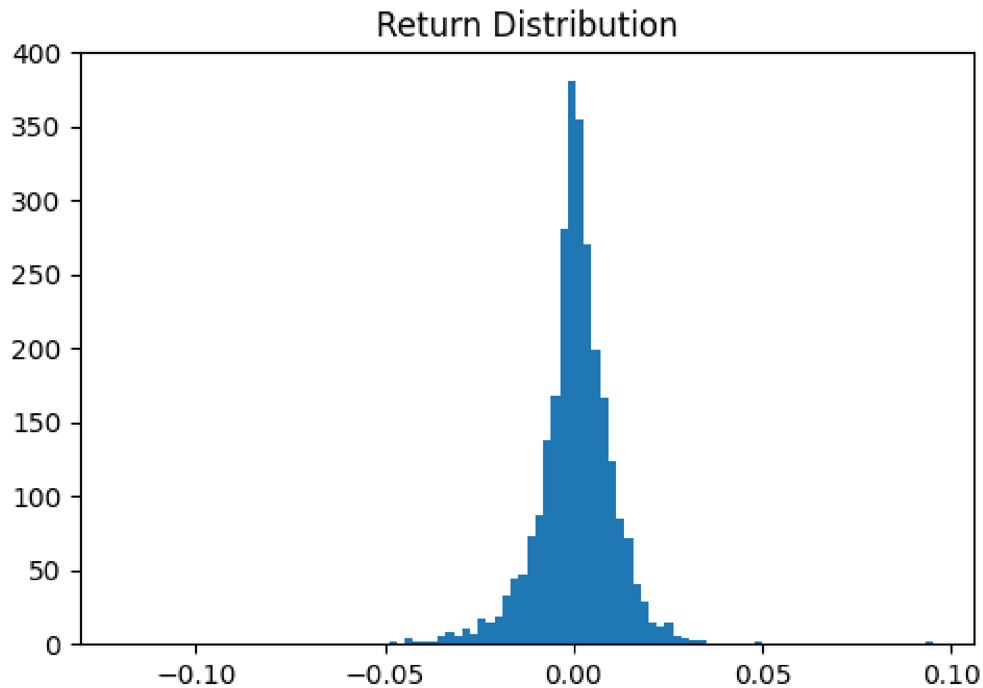
[39]:
```
data['RollingVol_30'] = data['Returns'].rolling(30).std() * np.sqrt(252)

plt.figure(figsize=(12,4))
plt.plot(data['RollingVol_30'])
plt.title("30-Day Rolling Volatility (Annualized)")
plt.show()
```



1.0.7 Histogram of returns

The distribution exhibits fat tails and negative skewness, highlighting the presence of extreme downside events not captured by normal assumptions.

[40]:
```
plt.figure(figsize=(6,4))
plt.hist(data['Returns'], bins=100)
plt.title("Return Distribution")
plt.show()
```



1.0.8 Interpretation

- Volatility clustering confirms non-constant variance in equity returns
- Drawdowns highlight asymmetric downside risk
- Risk-adjusted performance varies significantly across regimes
- Simple descriptive statistics already reveal meaningful market structure