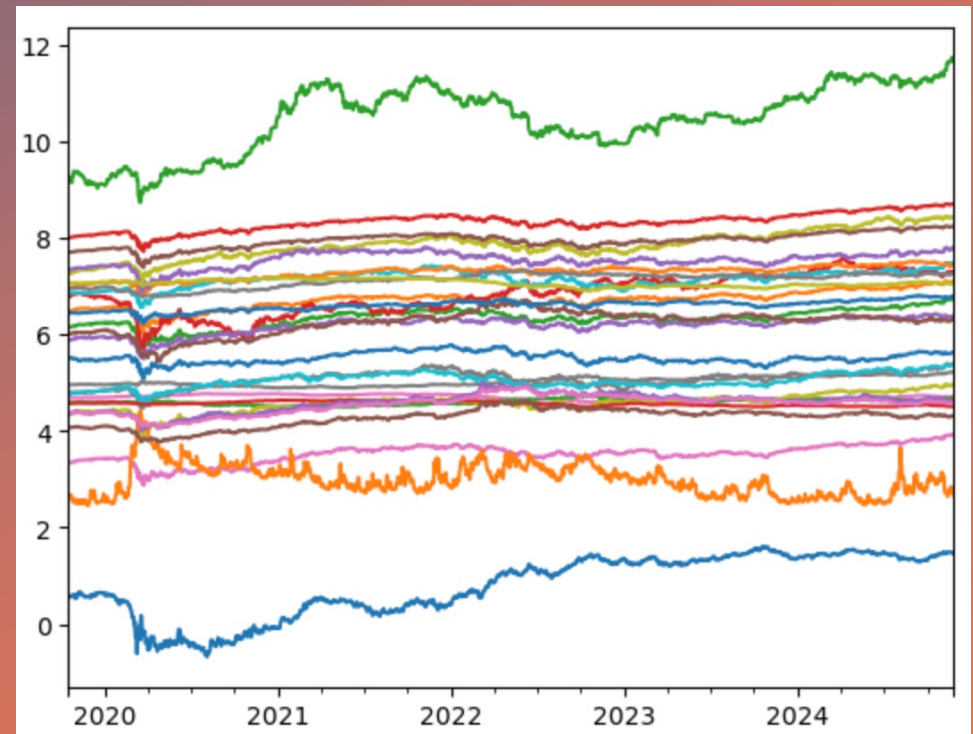


Studying the relationship between the VIX and SPX using financial analytics



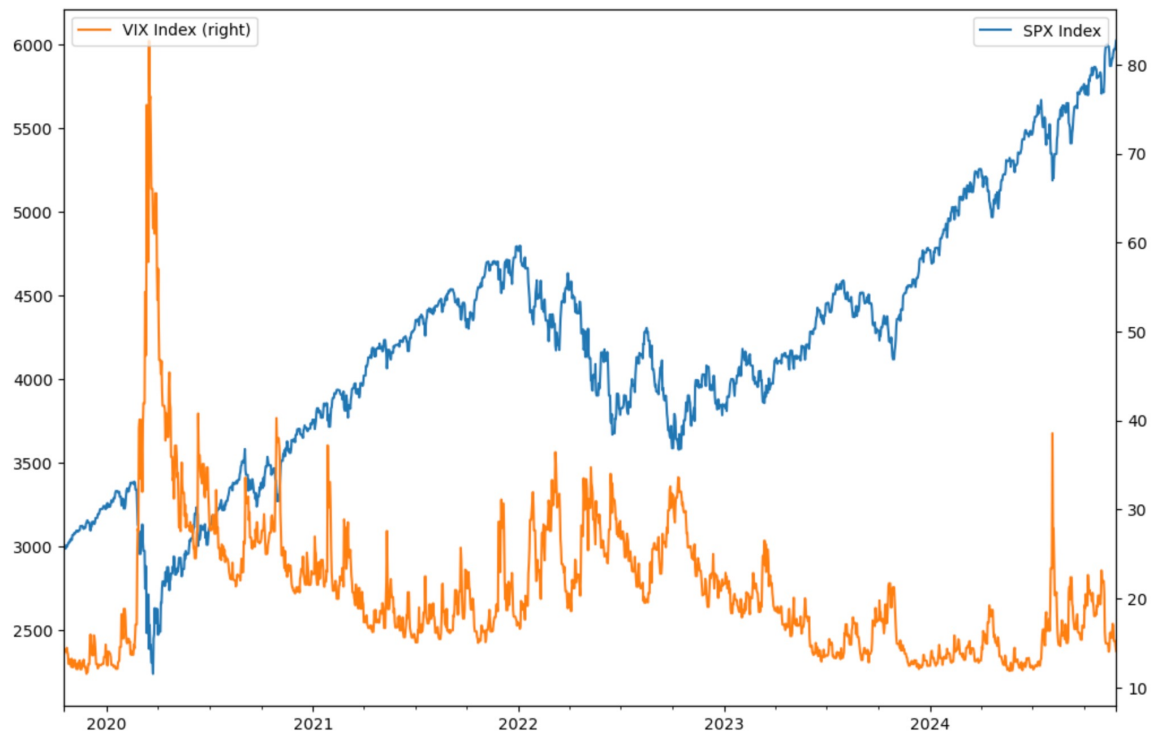
Descriptive statistics

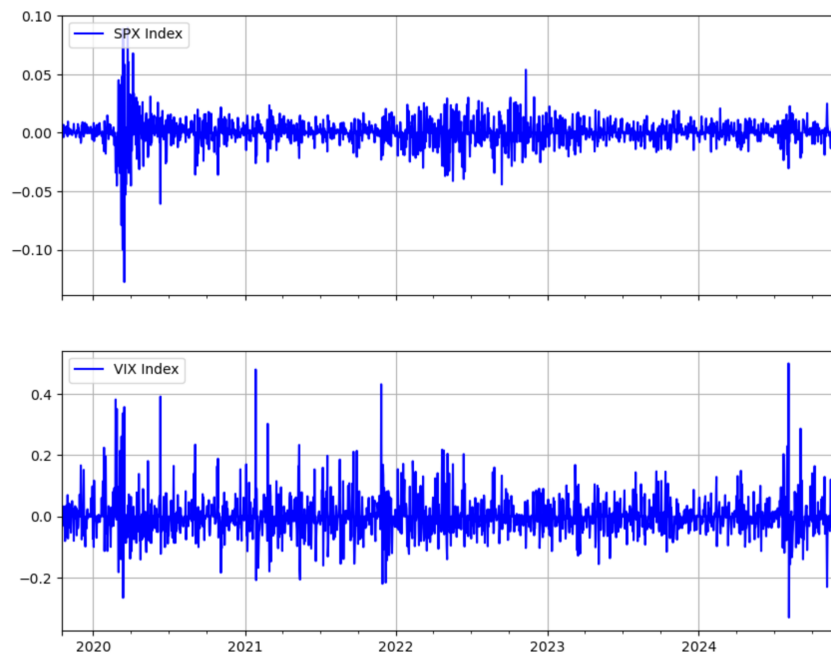
```
experiment.describe()
```

	SPX Index	VIX Index
count	1868.000000	1868.000000
mean	4180.975562	21.034545
std	751.603361	8.163890
min	2237.400000	11.540000
25%	3714.240000	15.390000
50%	4167.205000	19.275000
75%	4550.467500	24.640000
max	6021.630000	82.690000

Historical review

- Observe that when the SPX moves up, the VIX appears to move downwards
- Exhibits a negative correlation relationship





	SPX Index	VIX Index
SPX Index	1.000000	-0.703415
VIX Index	-0.703415	1.000000

Correlation analysis

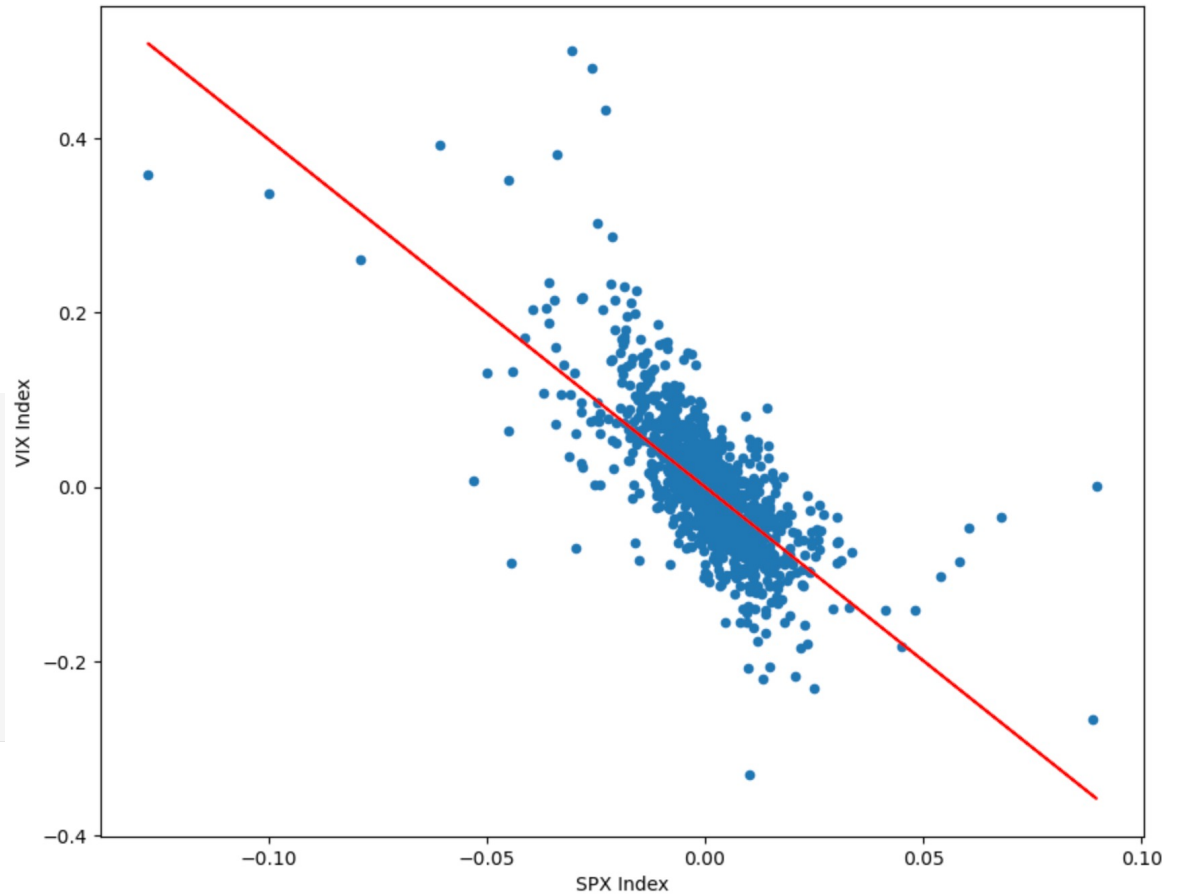
Correlation analysis

```
import statsmodels.api as sm

log_returns.plot(
    figsize=(10,8),
    x="SPX Index",
    y="VIX Index",
    kind='scatter')

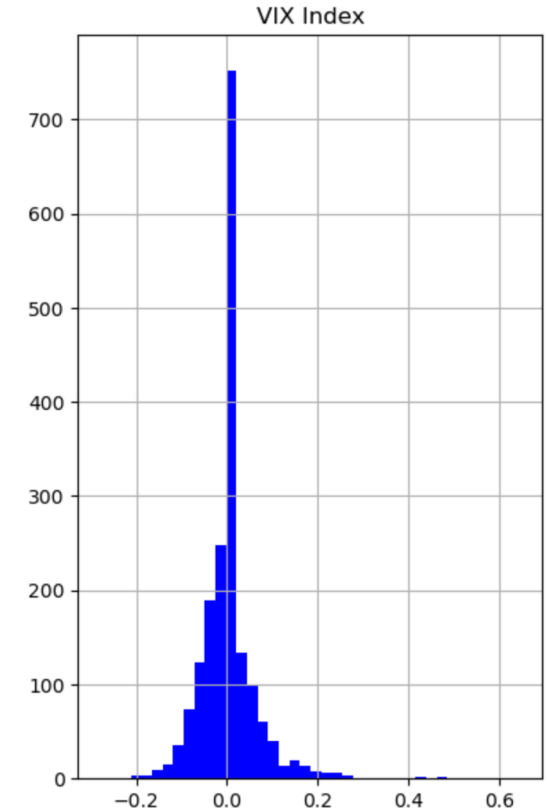
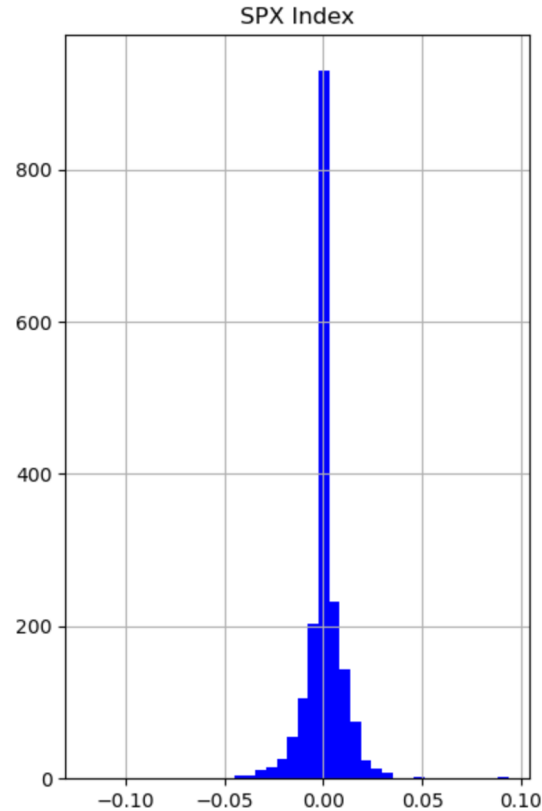
ols_fit = sm.OLS(log_returns['VIX Index'].values,
                  log_returns['SPX Index'].values).fit()

plt.plot(log_returns['SPX Index'], ols_fit.fittedvalues, 'r')
```



Distribution of daily returns

- The distribution of daily returns suggests low volatility around the mean
- Key takeaway
 - Suggests that returns will tend to converge to their long-run average



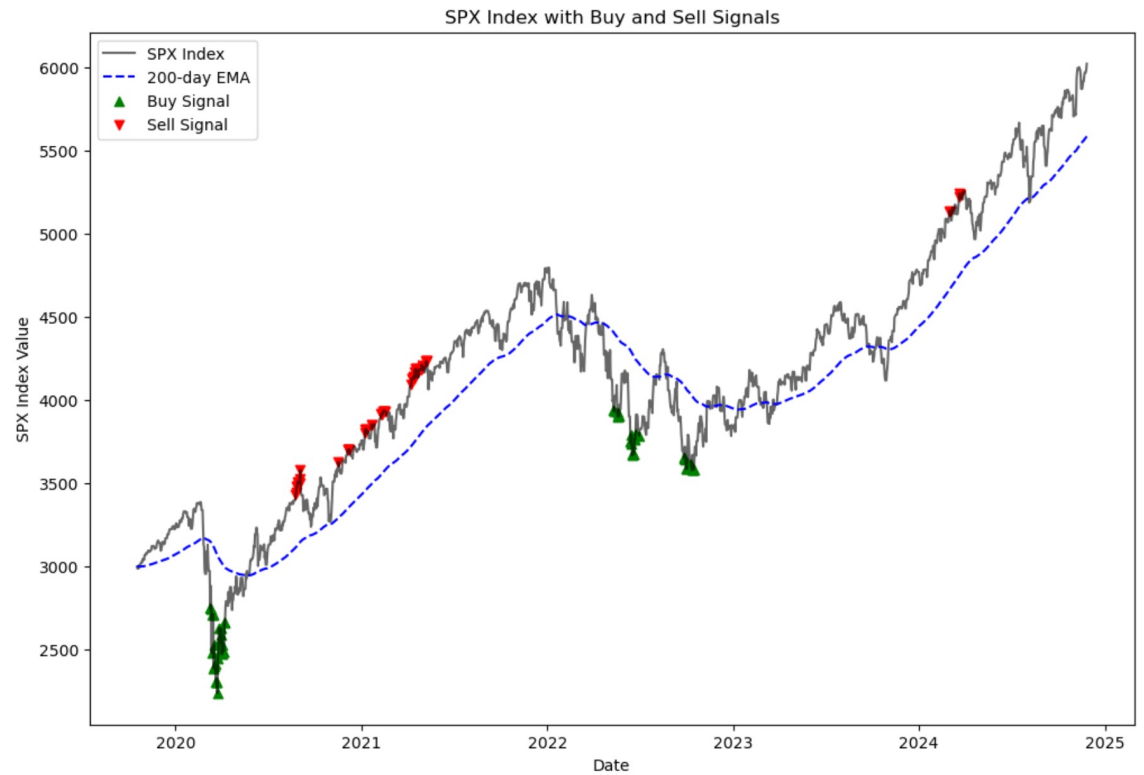
Trading SPX and VIX using mean reversion

- Identify when SPX significantly deviates from its long-run moving average
 - Above index then short, long if below index
- When VIX spikes near \$30, it tends to revert towards its long-run average
 - Short VIX futures after VIX spikes to significance level

Trading SPX using mean reversion

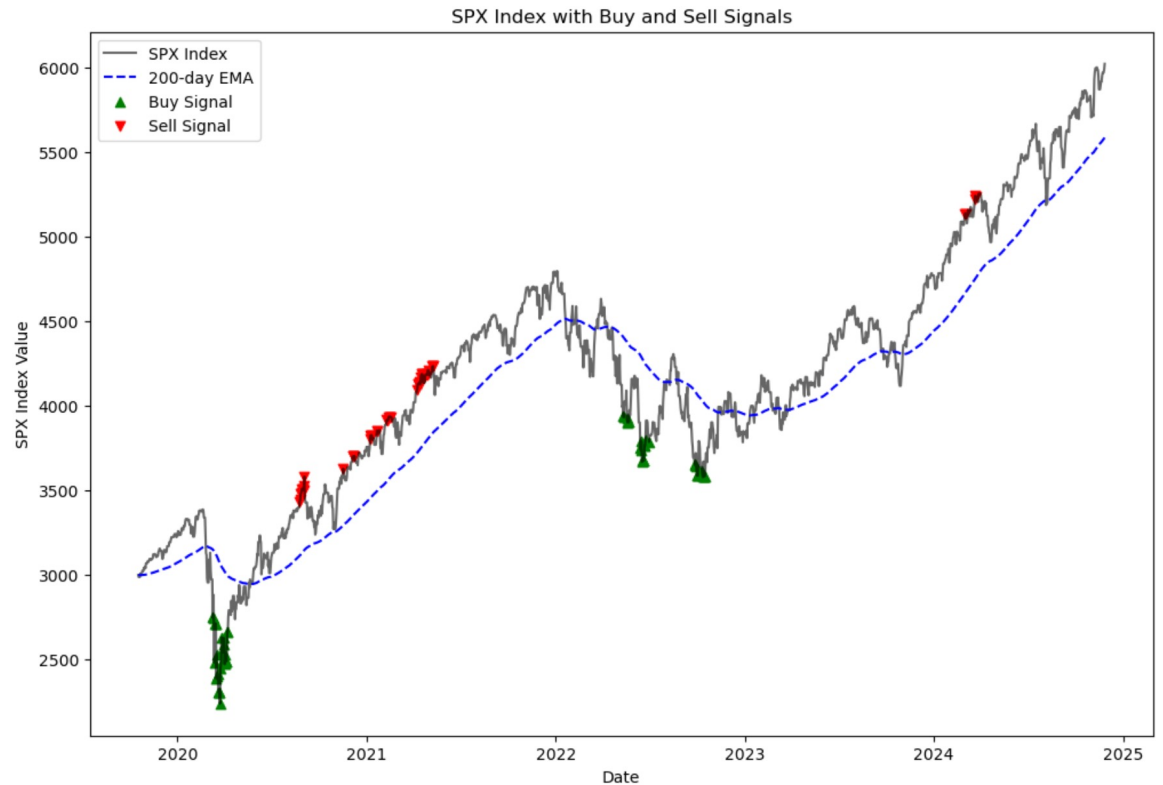


Trading SPX using mean reversion



Trading SPX using mean reversion

- Number of buy signals: 50
- Number of sell signals: 55
- Significance level: $\pm 10\%$ EMA

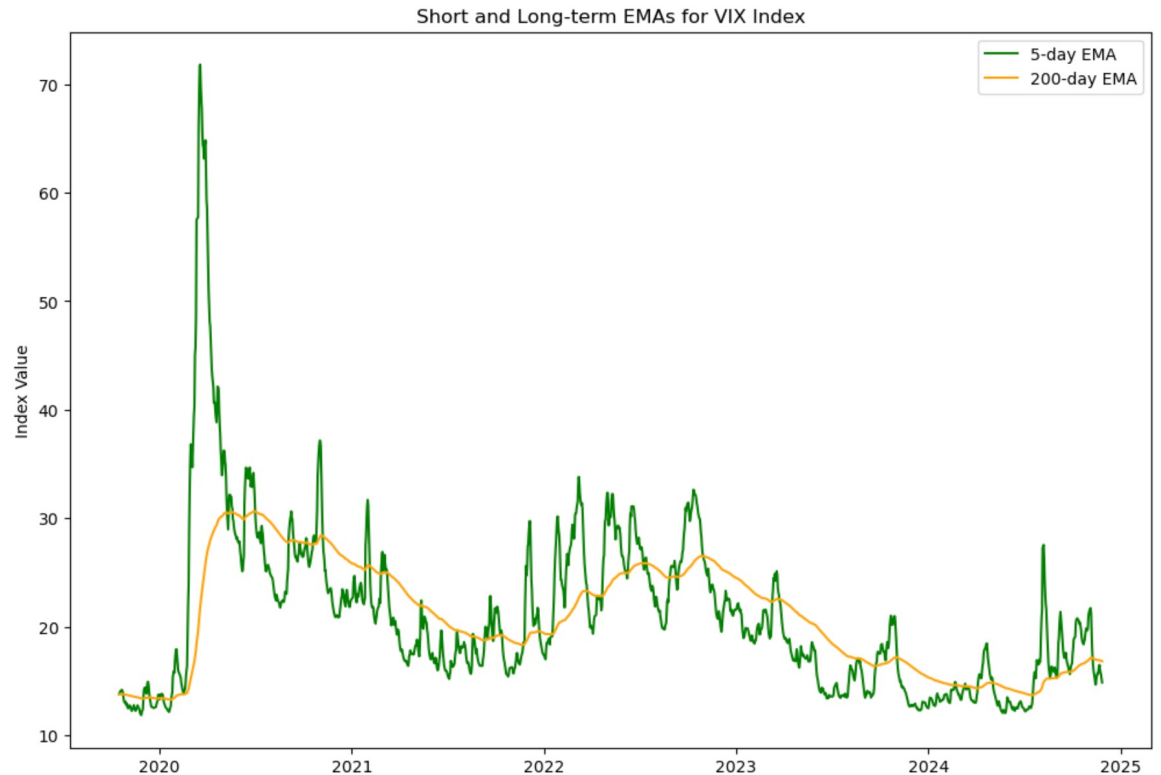


Trading VIX using mean reversion

```
df_sma = pd.DataFrame(index=experiment.index)

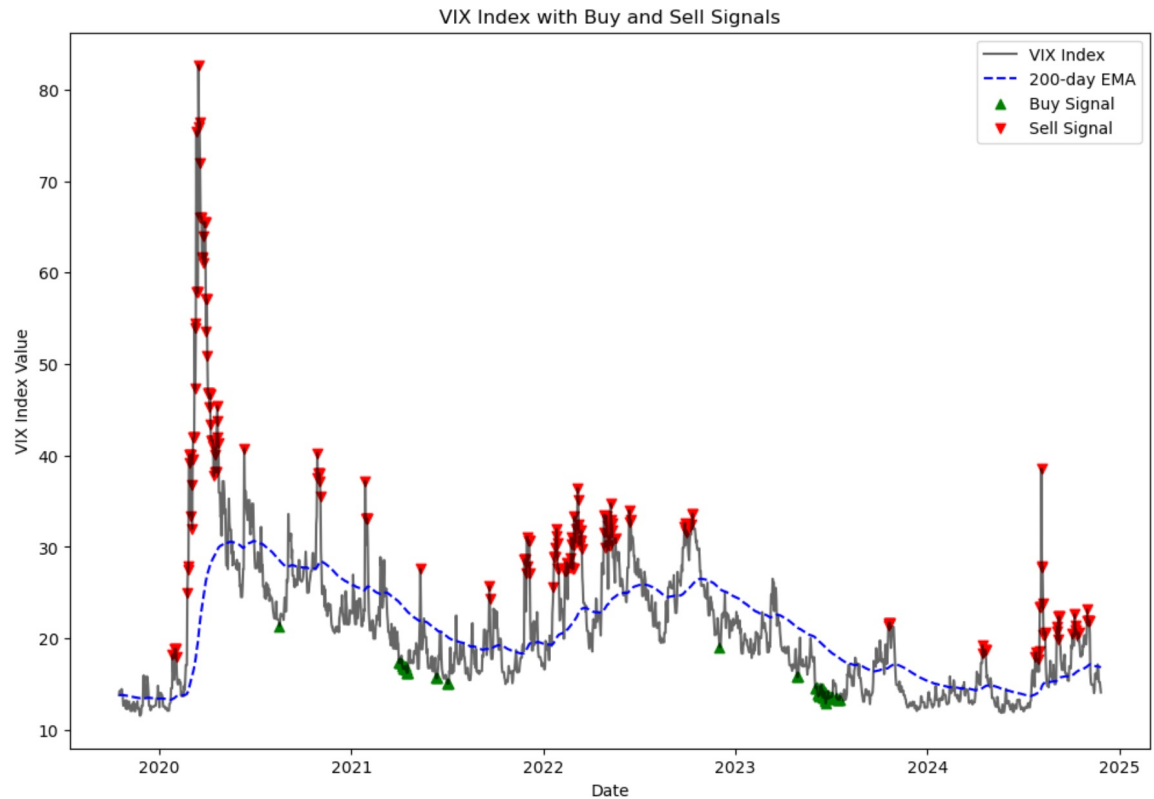
df_sma['short'] = experiment['VIX Index'].rolling(window=5, min_periods=5).mean()
df_sma['long'] = experiment['VIX Index'].rolling(window=200, min_periods=30).mean()

plt.figure(figsize=(12, 8))
plt.plot(df_sma.index, df_sma['short'], label='5-day SMA', color='green')
plt.plot(df_sma.index, df_sma['long'], label='200-day SMA', color='orange')
plt.title("Short and Long-term SMAs for VIX Index")
plt.xlabel("Date")
plt.ylabel("Index Value")
plt.legend()
plt.show()
```



Trading VIX using mean reversion

- Number of buy signals:
63
- Number of sell signals:
200
- Significance level: $\pm 25\%$
EMA



Summary

- Trading SPX and VIX using mean reversion
 - Short/long SPX when it significantly deviates ($\pm 10\%$) from its long-run average
 - Short VIX futures after VIX spikes 25% from its long-run average
 - Pair trading knowing SPX and VIX have a strong negative correlation