Cointegration Z-score

Preprocessing

Johansen Cointegration Test : (Ideal lag = 1)

Hypothesis	Eigenvalue	Trace Statistic	Critical Value (Trace)	Max Eigenvalue Statistic	Critical Value (Max Eigenvalue)	Decision (Trace)	Decision (Max Eigenvalue)
H0	0.005360	7.751673	10.4741	7.035262	12.3212	Fail to Reject	Fail to Reject
H1	0.000547	0.716411	2.9762	0.716411	4.1296	Fail to Reject	Fail to Reject

** IF Trace Statistic > Critical Value AND Max Eigenvalue > Critical Value then Reject Null of at most r cointegrating relationships.(r=0 in first test)

ADF Test Results

Ticker	ADF Statistic	p-value	Critical Value (1%)	Critical Value (5%)	Critical Value (10%)	Stationarity
spread	-2.804314	0.05766	-3.435355	-2.863751	-2.567947	Non-Stationary

** IF p-value < 0.05 and/or statistic < statistic @ confidence interval, then REJECT the Null that the time series posses a unit root (non-stationary).

Phillips Perron Results

Ticker	PP Statistic	p-value	Critical Value (1%)	Critical Value (5%)	Critical Value (10%)	Stationarity
spread	-2.797749	0.058596	-3.435355	-2.863751	-2.567947	Non-Stationary

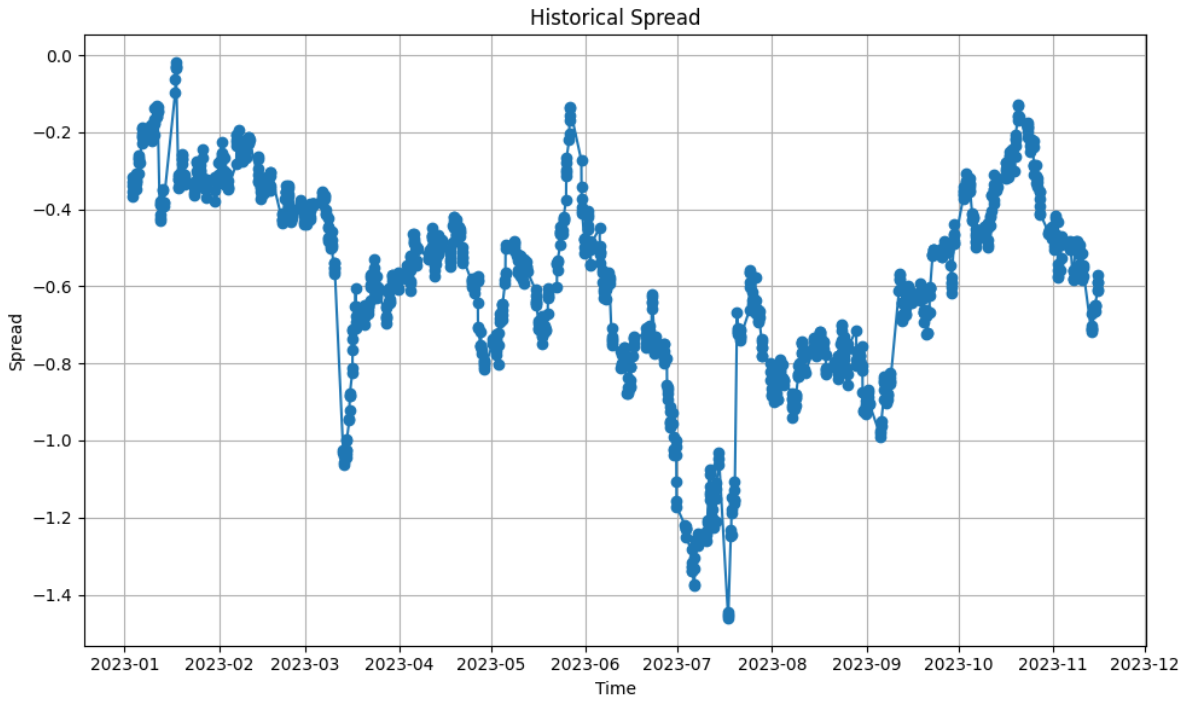
** IF p-value < 0.05, then REJECT the Null Hypothesis of a unit root (non-stationary time series).

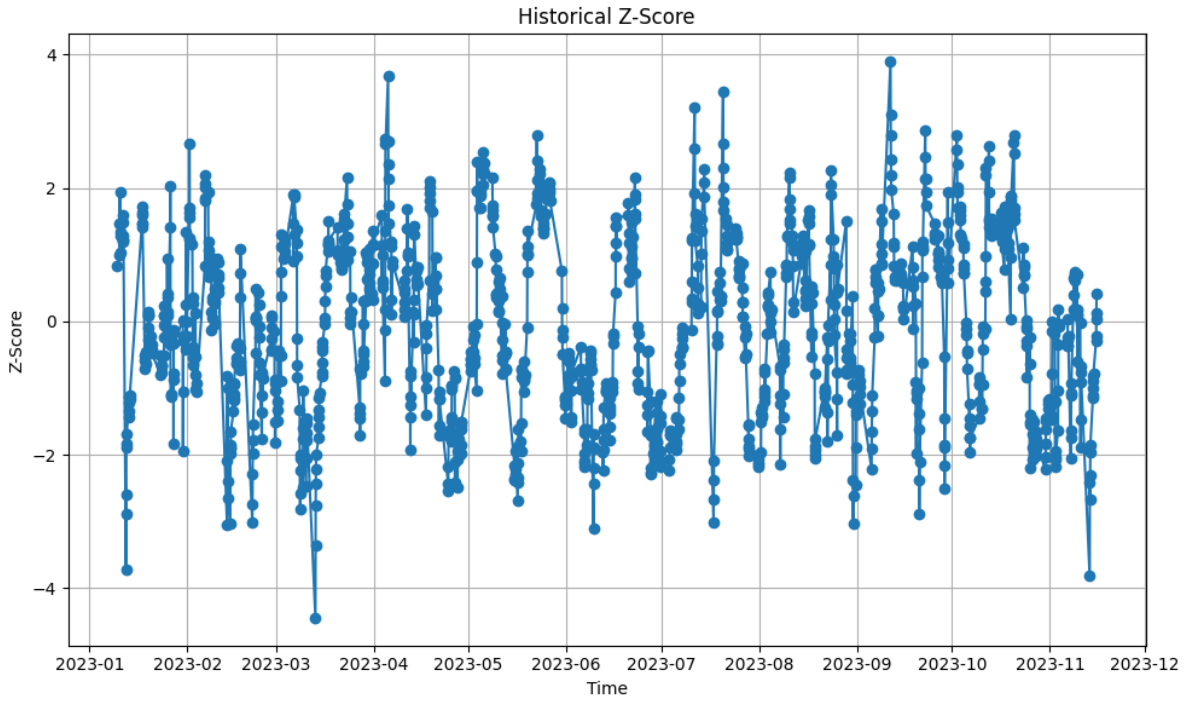
Cointegration Vector

	HE.n.0	ZC.n.0
cointegration vector	11.596794	-8.071631
standardized vector	-1.436735	1.000000
hedge ratios	-3.000000	2.000000

Spread Statistics

Half-life	Hurst Exponent
0.978197	59.067644

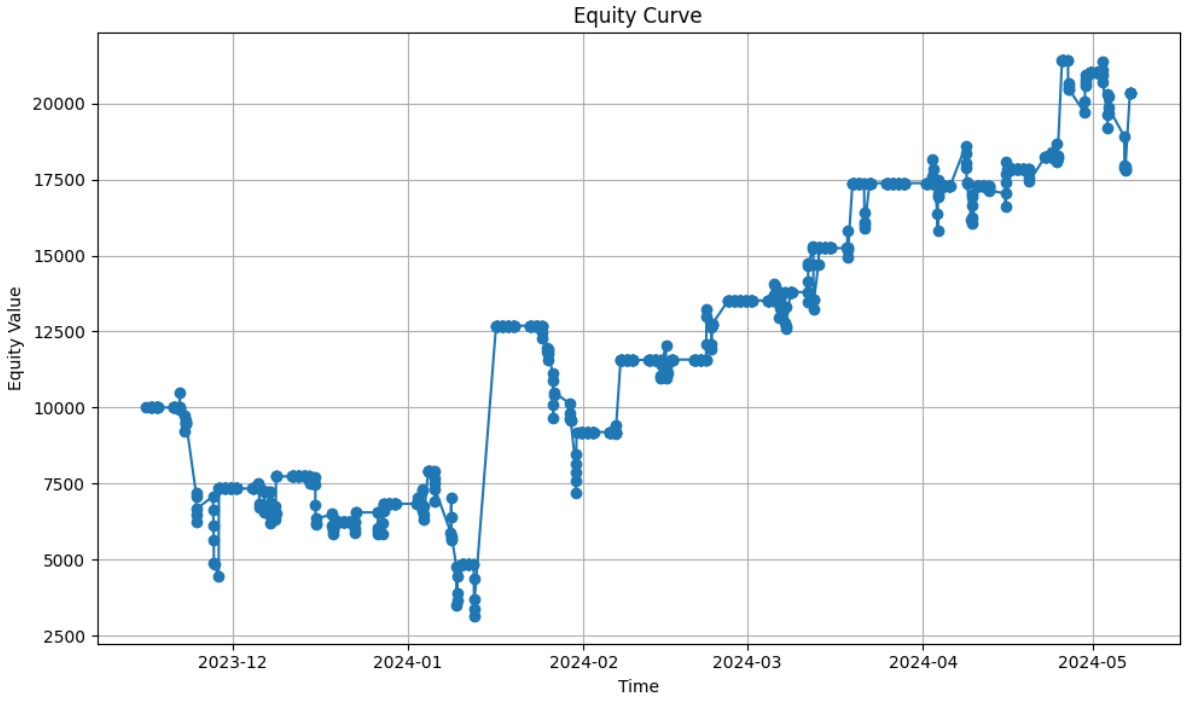


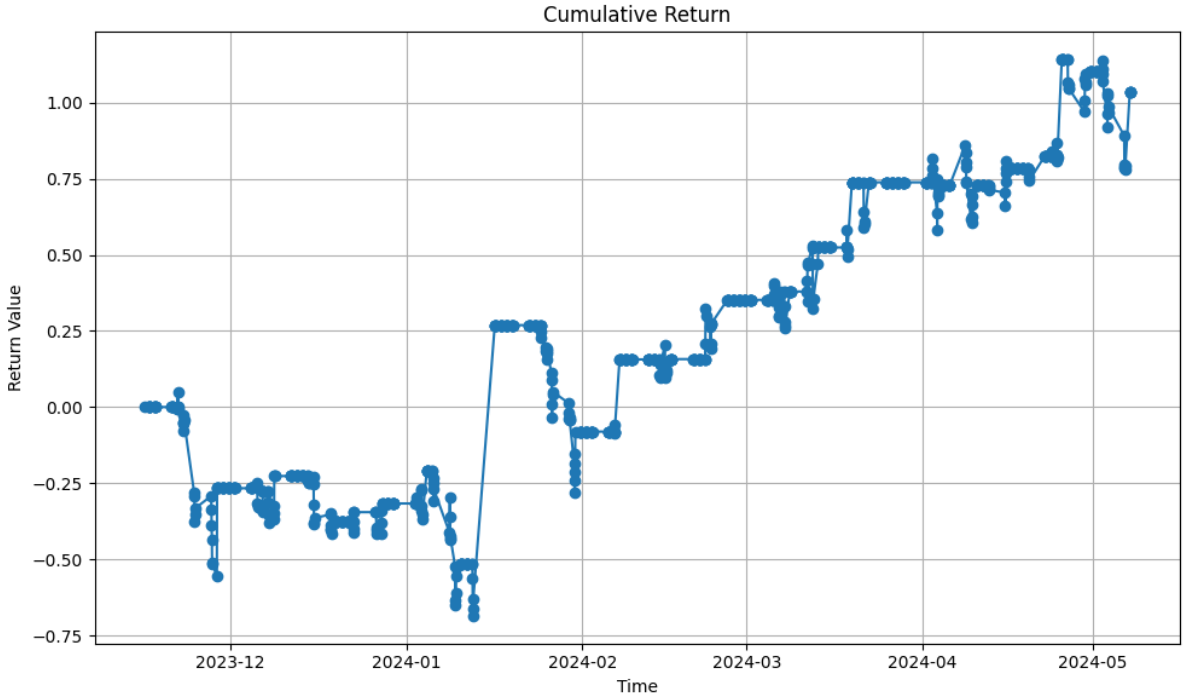


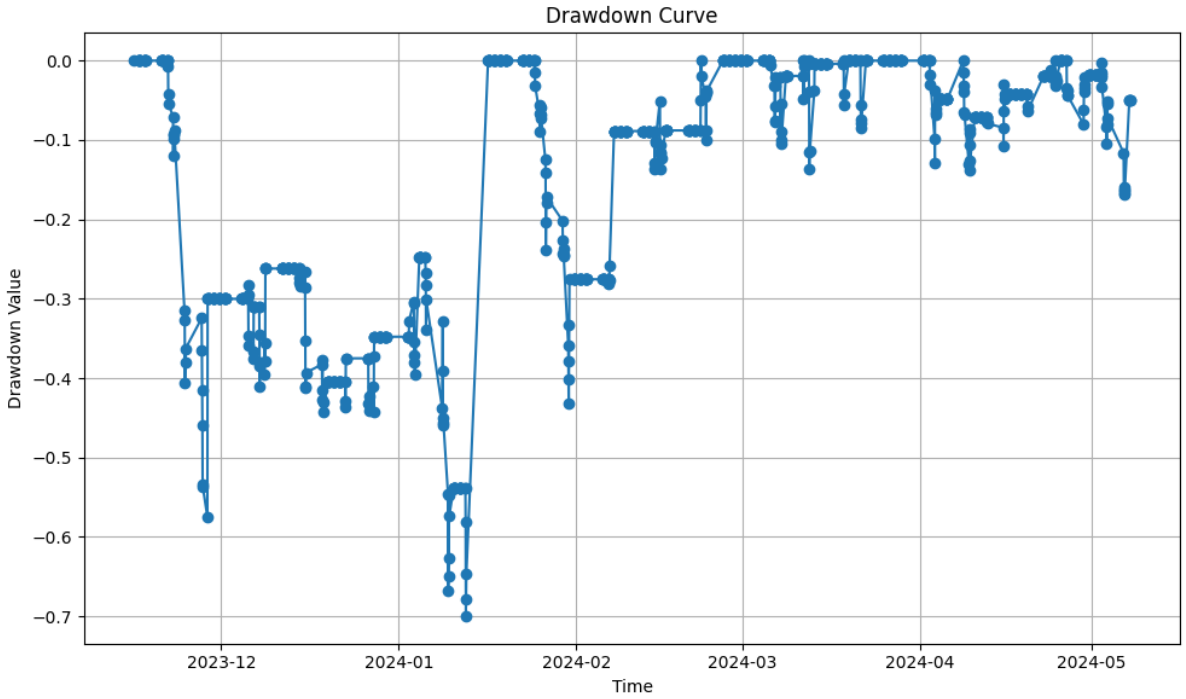
Performance Metrics

Summary Stats

	Value
annual_standard_deviation	3.8415
sharpe_ratio	1.3269
sortino_ratio	4.1735
max_drawdown	-0.6994
ending_equity	20355.0000


Equity Curve
Equity Value
20000
17500
15000
12500
10000
7500
5000
2500
2023-12
2024-01
2024-02
2024-03
2024-04
2024-05
Time


Cumulative Return
Return Value
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
2023-12
2024-01
2024-02
2024-03
2024-04
2024-05
Time



Regression Analysis

OLS Regression Results

Dep. Variable:	strategy_return	**R-squared:**	0.080
Model:	OLS	**Adj. R-squared:**	0.056
Method:	Least Squares	**F-statistic:**	3.412
Date:	Thu, 13 Jun 2024	**Prob (F-statistic):**	0.0379
Time:	10:44:51	**Log-Likelihood:**	-10.833
No. Observations:	82	**AIC:**	27.67
Df Residuals:	79	**BIC:**	34.89
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	0.0321	0.032	1.015	0.313	-0.031	0.095
HE_futures	-2.3286	0.951	-2.448	0.017	-4.222	-0.436
ZC_futures	-2.5610	3.237	-0.791	0.431	-9.005	3.883

Omnibus:	136.253	**Durbin-Watson:**	1.975
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	6305.282
Skew:	5.734	**Prob(JB):**	0.00
Kurtosis:	44.400	**Cond. No.**	104.

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

	Value	Significant
R-squared	0.079518	False
Adjusted R-squared	0.056214	False
RMSE	0.065035	True

	Value	Significant
MAE	0.053699	True
F-statistic	3.412278	True
F-statistic p-value	0.037898	True
Durbin-Watson	2.150807	True
Jarque-Bera	0.53242	True
Jarque-Bera p-value	0.766278	True
Condition Number	93.482034	False
VIF (const)	1.028759	True
VIF (HE_futures)	1.053077	True
VIF (ZC_futures)	1.053077	True
Alpha	0.032115	False
Alpha p-value	0.313314	False
Beta (HE_futures)	-2.328639	True
Beta (HE_futures) p-value	0.016563	True
Beta (ZC_futures)	-2.560985	False
Beta (ZC_futures) p-value	0.431289	False
Model Validity	False	False

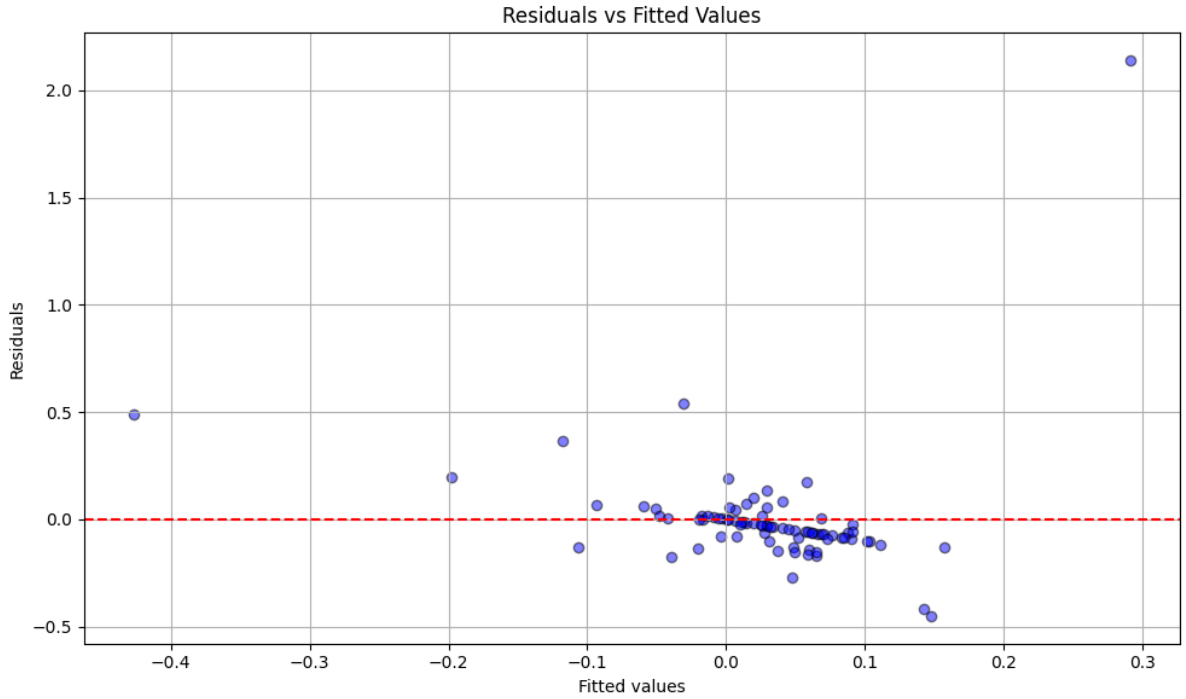
Summary Stats

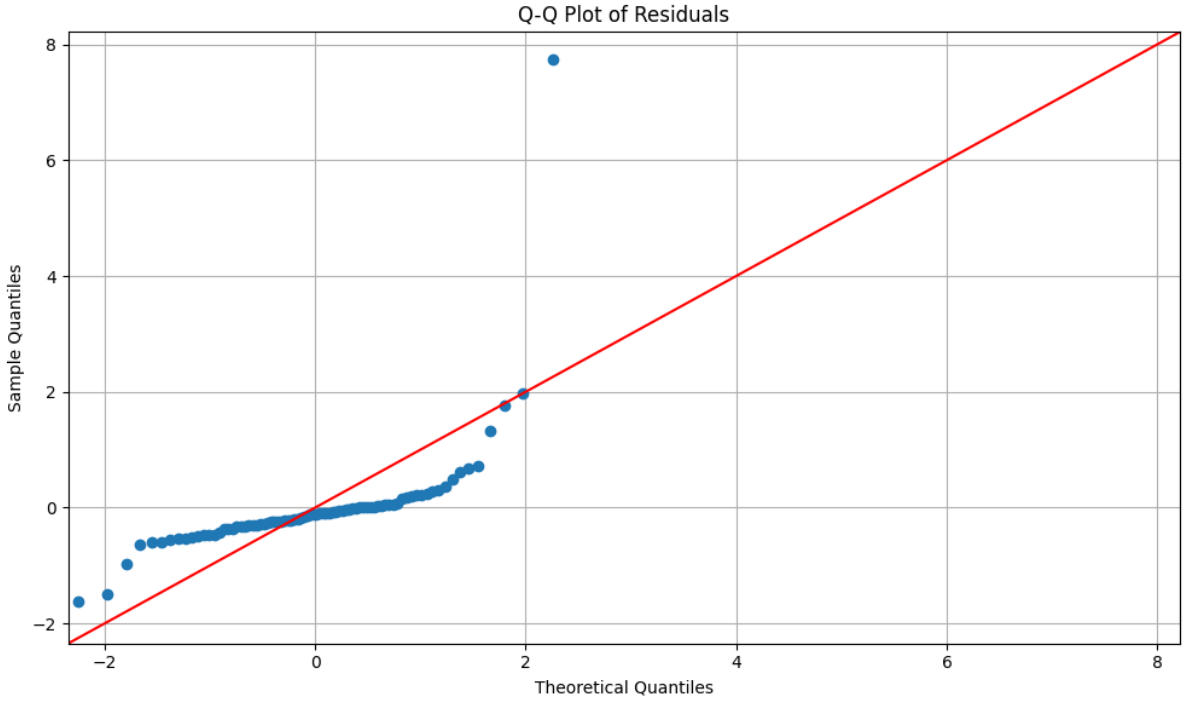
	Metric	Value
0	Total Contribution	0.020558
1	Systematic Contribution	-0.005428
2	Idiosyncratic Contribution	0.025986
3	Alpha Contribution	0.032115
4	Randomness	-0.006129
5	Total Volatility	0.243014
6	Systematic Volatility	0.068527
7	Idiosyncratic Volatility	0.233152

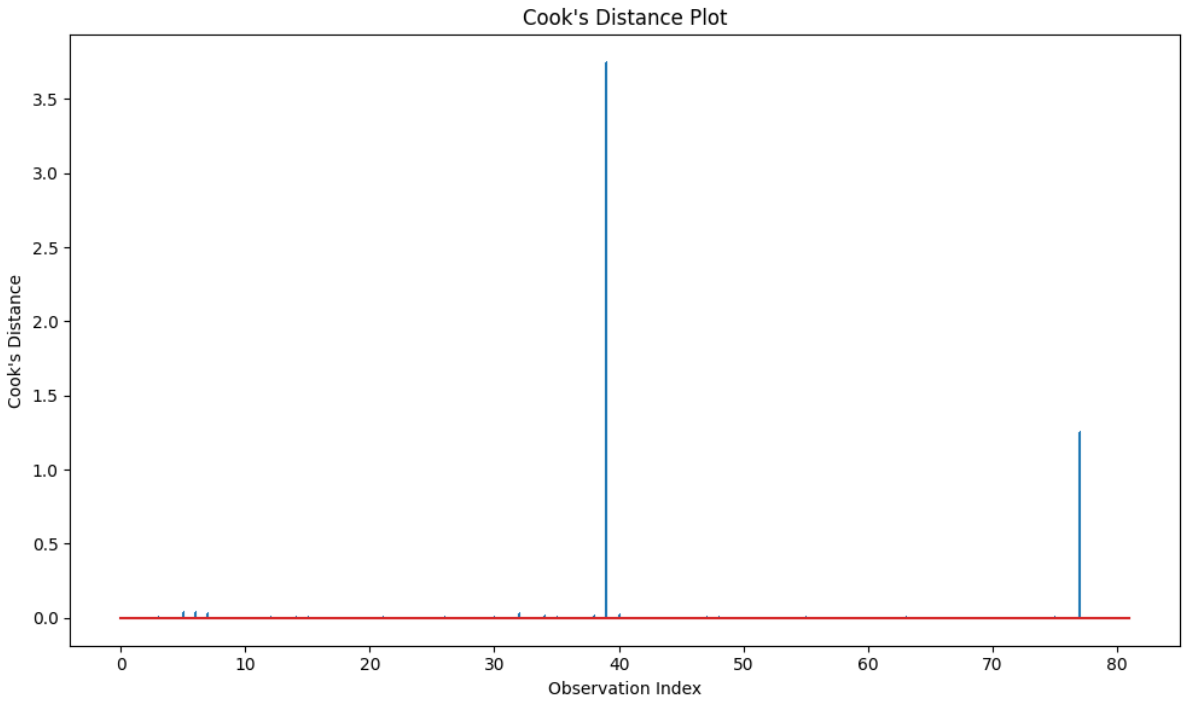
zscore volatility Results

Annualized Volatility	Annualized Mean Return	Z-score for 1 SD (annualized)	Z-score for 2 SD (annualized)	Z-score for 3 SD (annualized)
3.825283	5.137051	0.34292	-0.65708	-1.65708

** Note: Z-scores provide a statistical measure of the volatility's deviation from its mean, with larger absolute values indicating more significant deviations.


Residuals vs Fitted Values
Residuals
Fitted values
2.0
1.5
1.0
0.5
0.0
−0.5
−0.4
−0.3
−0.2
−0.1
0.0
0.1
0.2
0.3


Q-Q Plot of Residuals
Sample Quantiles
Theoretical Quantiles
8
6
4
2
0
−2
−2
0
2
4
6
8


Cook's Distance Plot
Cook's Distance
Observation Index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
0
10
20
30
40
50
60
70
80