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	0.005376	7.714844	10.4741	7.040206	12.3212	Fail to Reject	Fail to Reject
H1	0.000516	0.674638	2.9762	0.674638	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	-2.800209	0.058244	-3.435367	-2.863756	-2.56795	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	-2.792619	0.059336	-3.435367	-2.863756	-2.56795	Non-Stationary

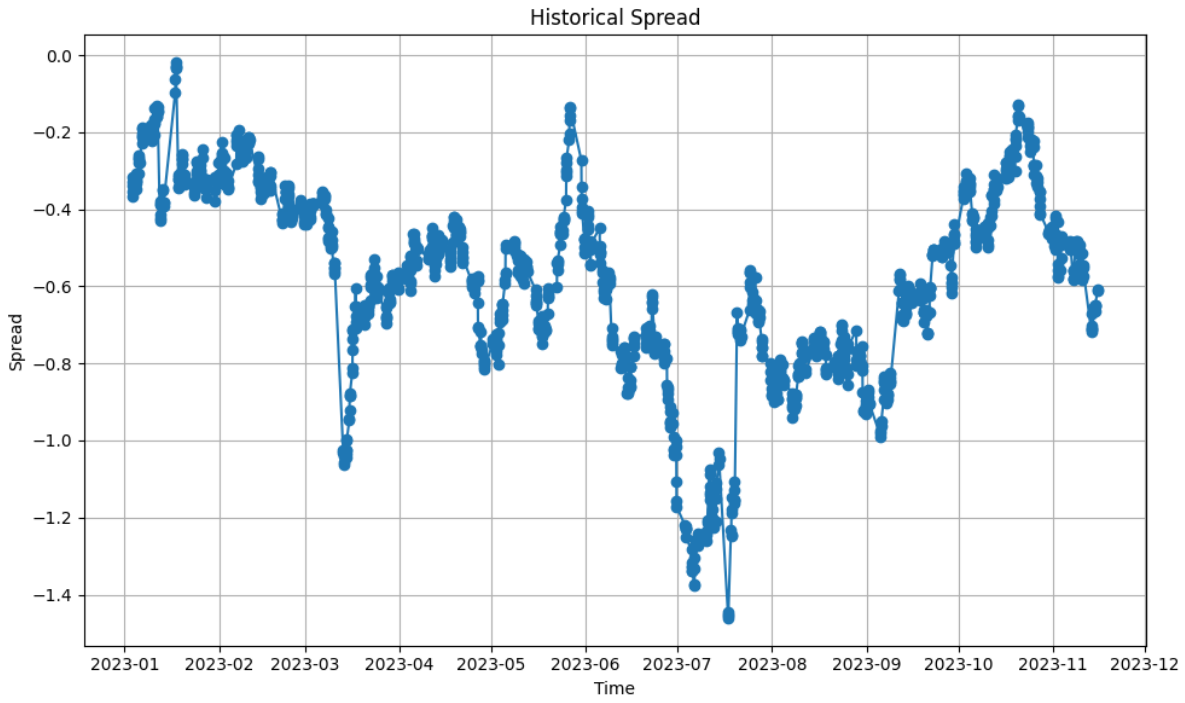
** IF p-value < 0.05, then REJECT the Null Hypothesis of a unit root (non-stationary time series).

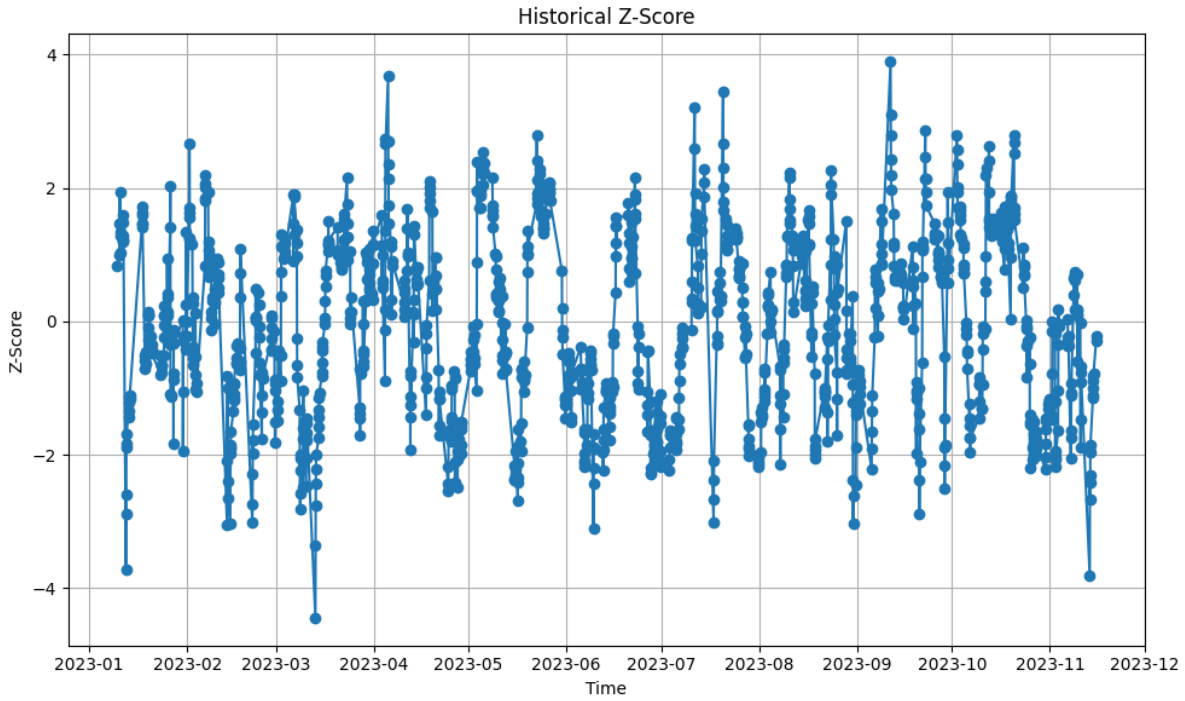
Cointegration Vector

	HE.n.0	ZC.n.0
cointegration vector	11.571898	-8.052704
standardized vector	-1.437020	1.000000
hedge ratios	-3.000000	2.000000

Spread Statistics

Half-life	Hurst Exponent
0.978197	59.097051

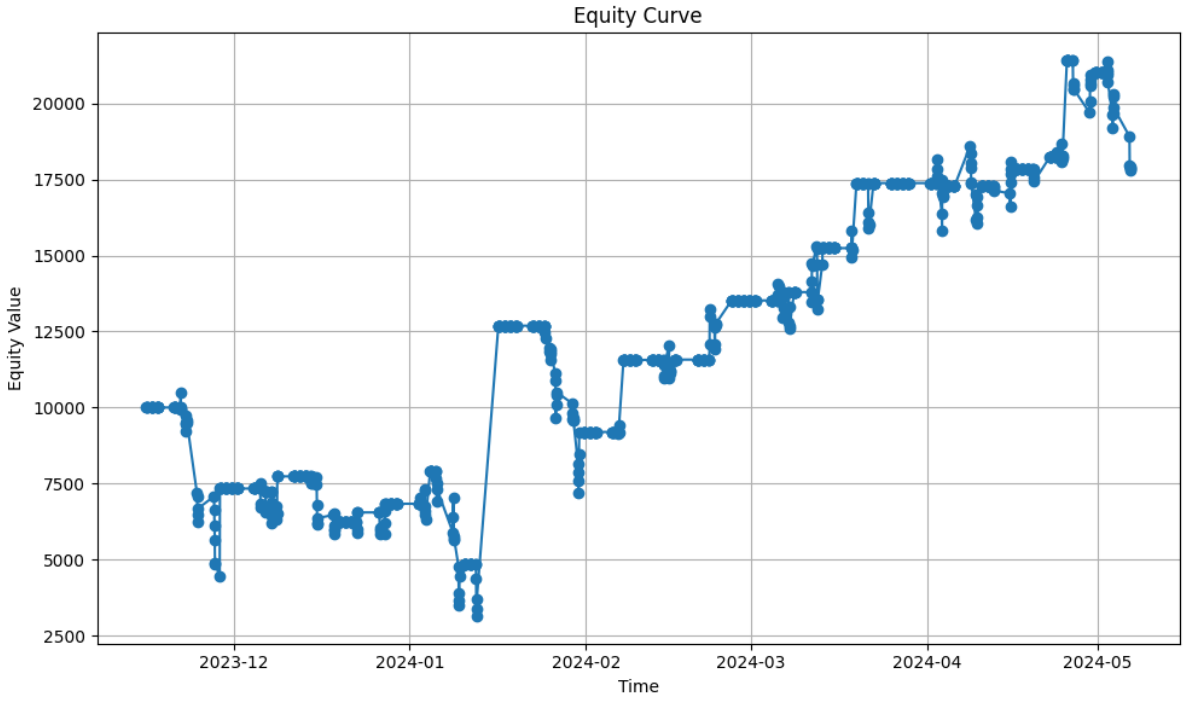


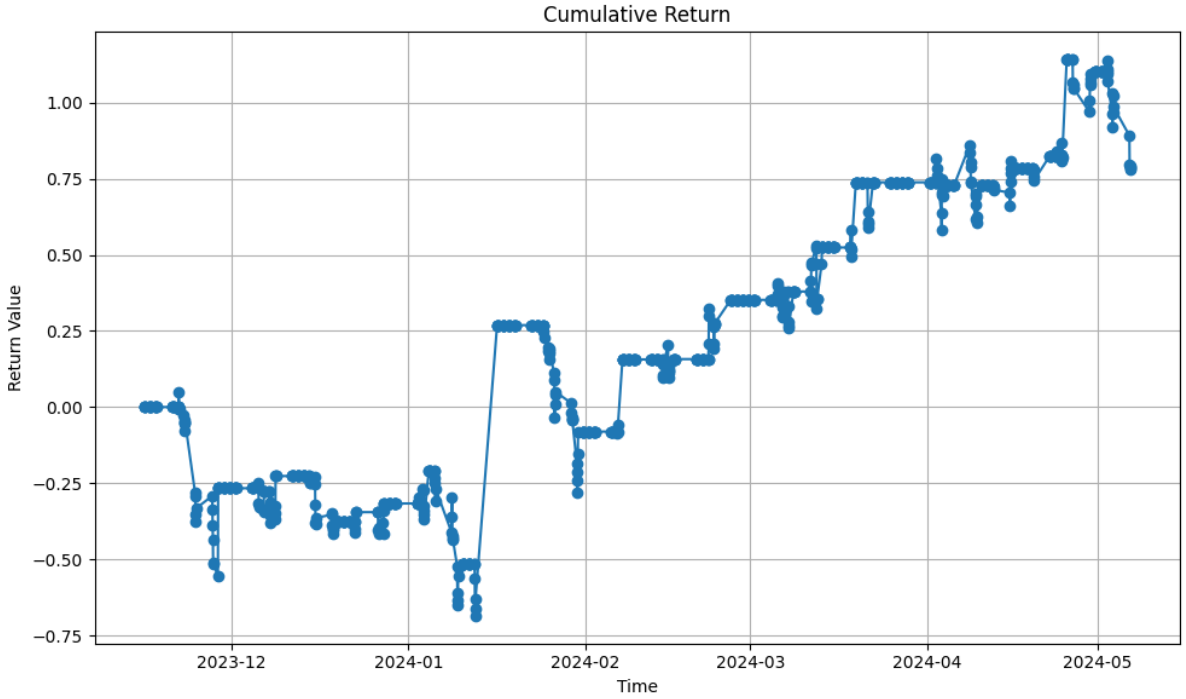


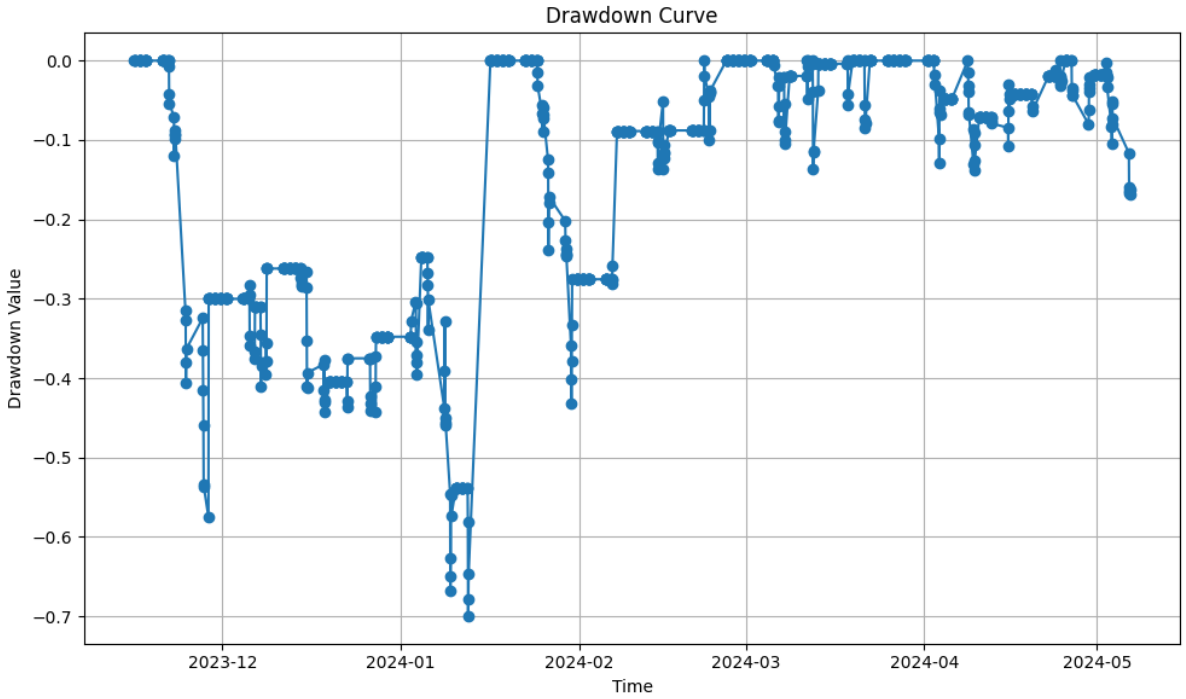
Performance Metrics

Summary Stats

	Value
annual_standard_deviation	3.8542
sharpe_ratio	1.2592
sortino_ratio	3.9753
max_drawdown	-0.6994
ending_equity	17940.0000


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:**	0.079
Model:	OLS	**Adj. R-squared:**	0.056
Method:	Least Squares	**F-statistic:**	3.366
Date:	Thu, 30 May 2024	**Prob (F-statistic):**	0.0396
Time:	10:34:31	**Log-Likelihood:**	-11.197
No. Observations:	81	**AIC:**	28.39
Df Residuals:	78	**BIC:**	35.58
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	0.0319	0.032	0.995	0.323	-0.032	0.096
HE_futures	-2.3294	0.957	-2.433	0.017	-4.235	-0.424
ZC_futures	-2.5784	3.277	-0.787	0.434	-9.102	3.946

Omnibus:	134.553	**Durbin-Watson:**	1.973
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	6071.582
Skew:	5.699	**Prob(JB):**	0.00
Kurtosis:	43.854	**Cond. No.**	104.

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

	Value	Significant
R-squared	0.079458	False
Adjusted R-squared	0.055854	False
RMSE	0.062927	True

	Value	Significant
MAE	0.051337	True
F-statistic	3.366338	True
F-statistic p-value	0.039601	True
Durbin-Watson	2.042989	True
Jarque-Bera	0.259741	True
Jarque-Bera p-value	0.878209	True
Condition Number	92.465904	False
VIF (const)	1.036879	True
VIF (HE_futures)	1.045211	True
VIF (ZC_futures)	1.045211	True
Alpha	0.031923	False
Alpha p-value	0.322834	False
Beta (HE_futures)	-2.329449	True
Beta (HE_futures) p-value	0.017244	True
Beta (ZC_futures)	-2.578356	False
Beta (ZC_futures) p-value	0.433787	False
Model Validity	False	False

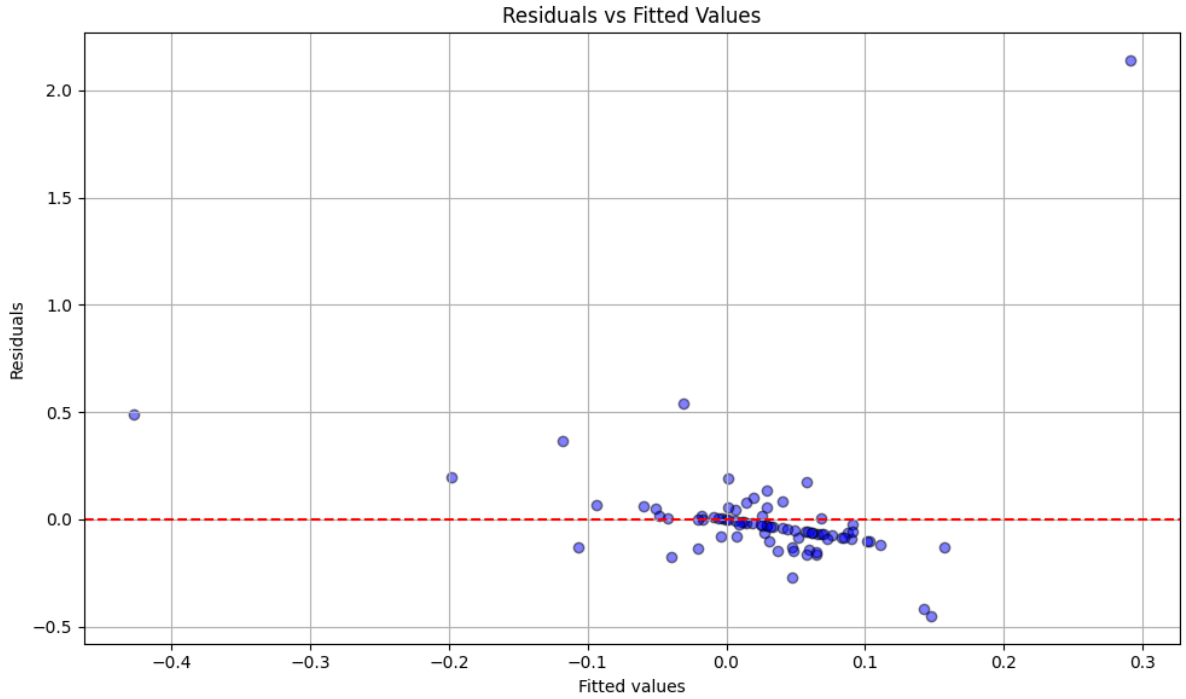
Summary Stats

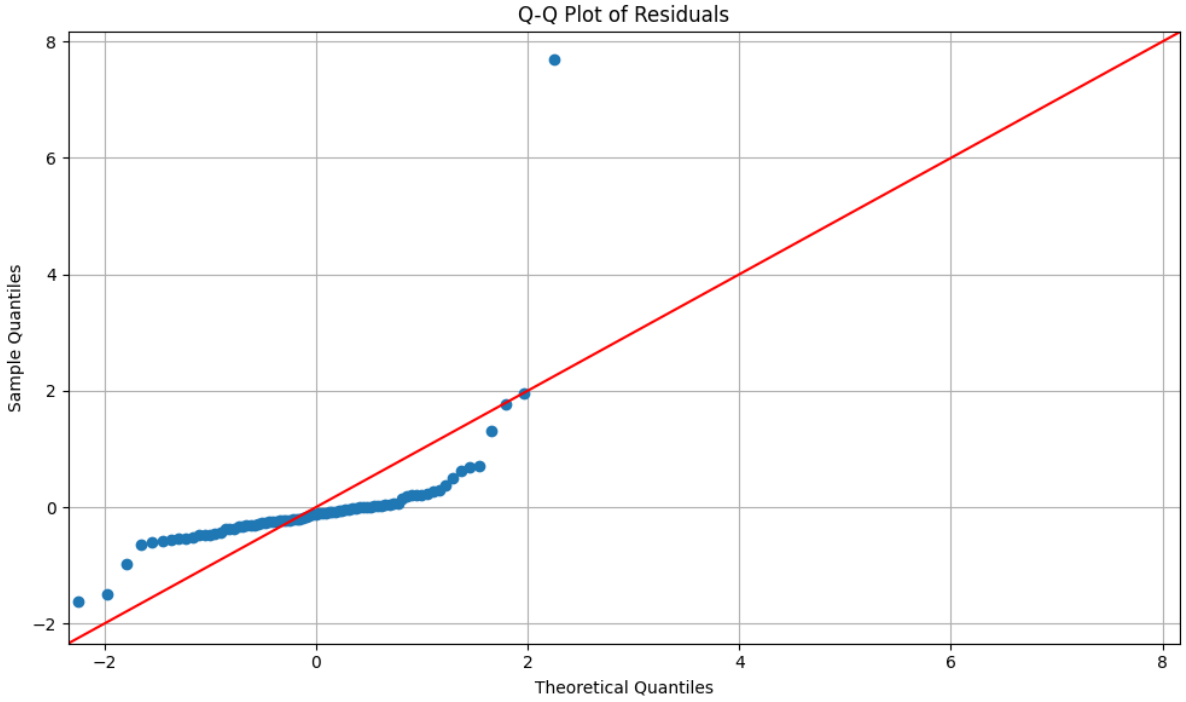
	Metric	Value
0	Total Contribution	0.019583
1	Systematic Contribution	-0.005500
2	Idiosyncratic Contribution	0.025083
3	Alpha Contribution	0.031923
4	Randomness	-0.006841
5	Total Volatility	0.243827
6	Systematic Volatility	0.068731
7	Idiosyncratic Volatility	0.233940

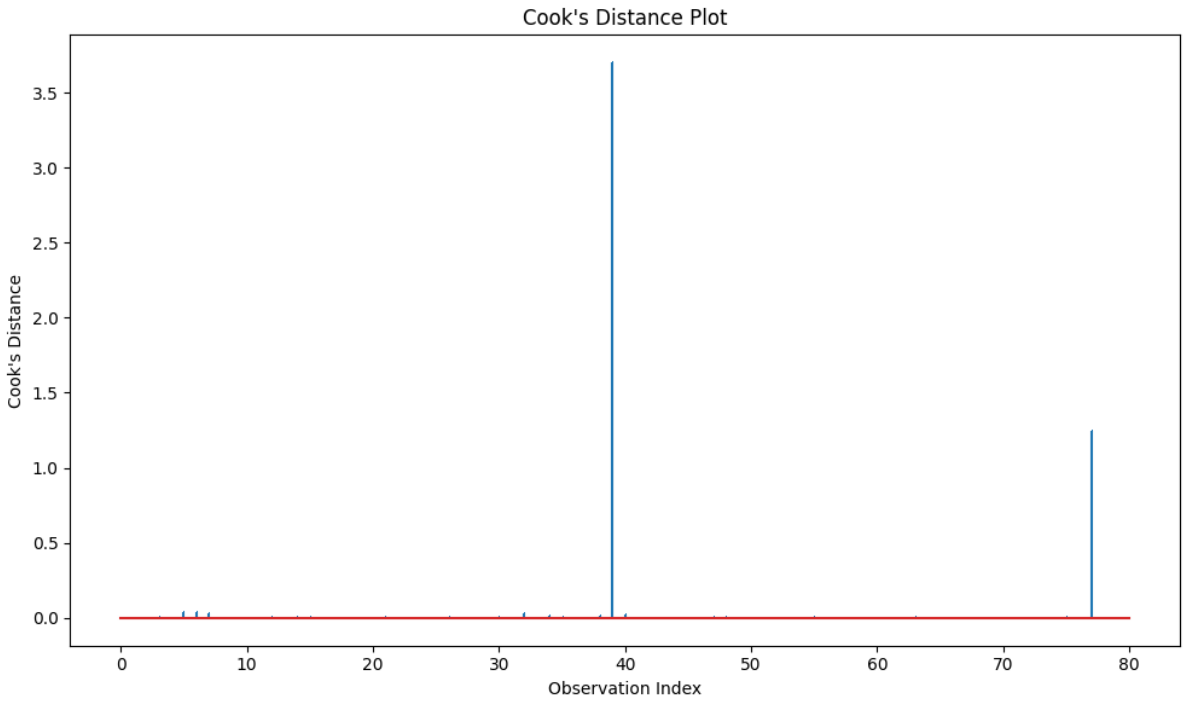
zscore volatility Results

Annualized Volatility	Annualized Mean Return	Z-score for 1 SD (annualized)	Z-score for 2 SD (annualized)	Z-score for 3 SD (annualized)
3.837798	4.893102	0.274976	-0.725024	-1.725024

** 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