

Refining Stock Report

Tickers: CL=F, GC=F, MPC, PSX, VLO, ^GSPC, ^VIX

Contents:

- Price series & ACF(Price); Moving Averages (5/10/20)
- Daily log-returns TS; Histogram+KDE (with Std Dev); Q-Q plot
- ACF>Returns), Rolling Autocorr>Returns)
- Volatility clustering: ACF(|r|) & ACF(r²)
- Seasonality: Monthly/DOW/Quarterly; Month×Year heatmap; Month-End/Start bars
- Engineered feature distributions (Spreads/MAs/Lags) & correlation heatmaps
- Cross-ticker Adjusted/Close overlay & Return correlation

CL=F • Price

Adj/Close

Price (USD)

120
100
80
60
40
20
0
-20
-40

2012

2014

2016

2018

2020

2022

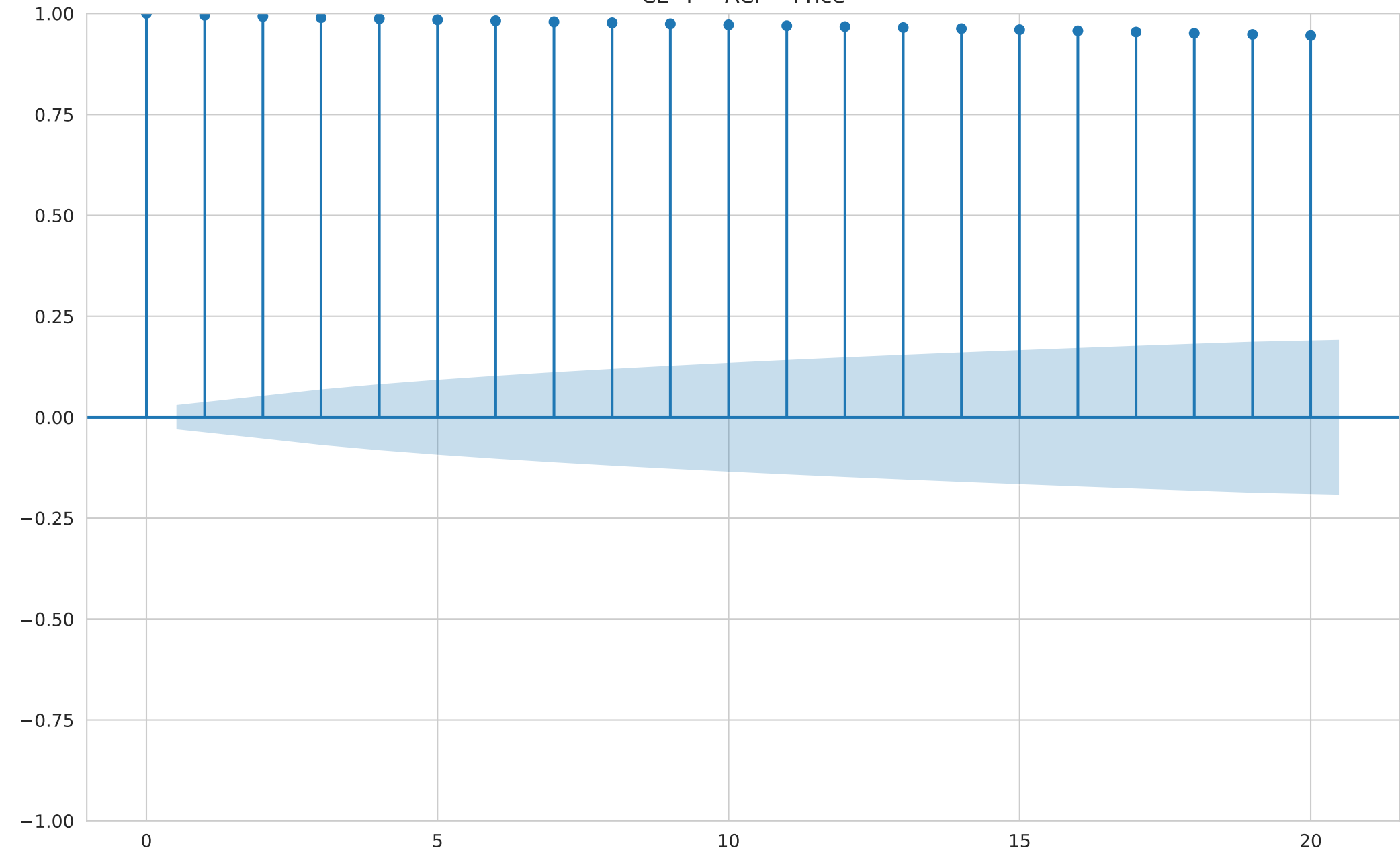
2024

2026

Date



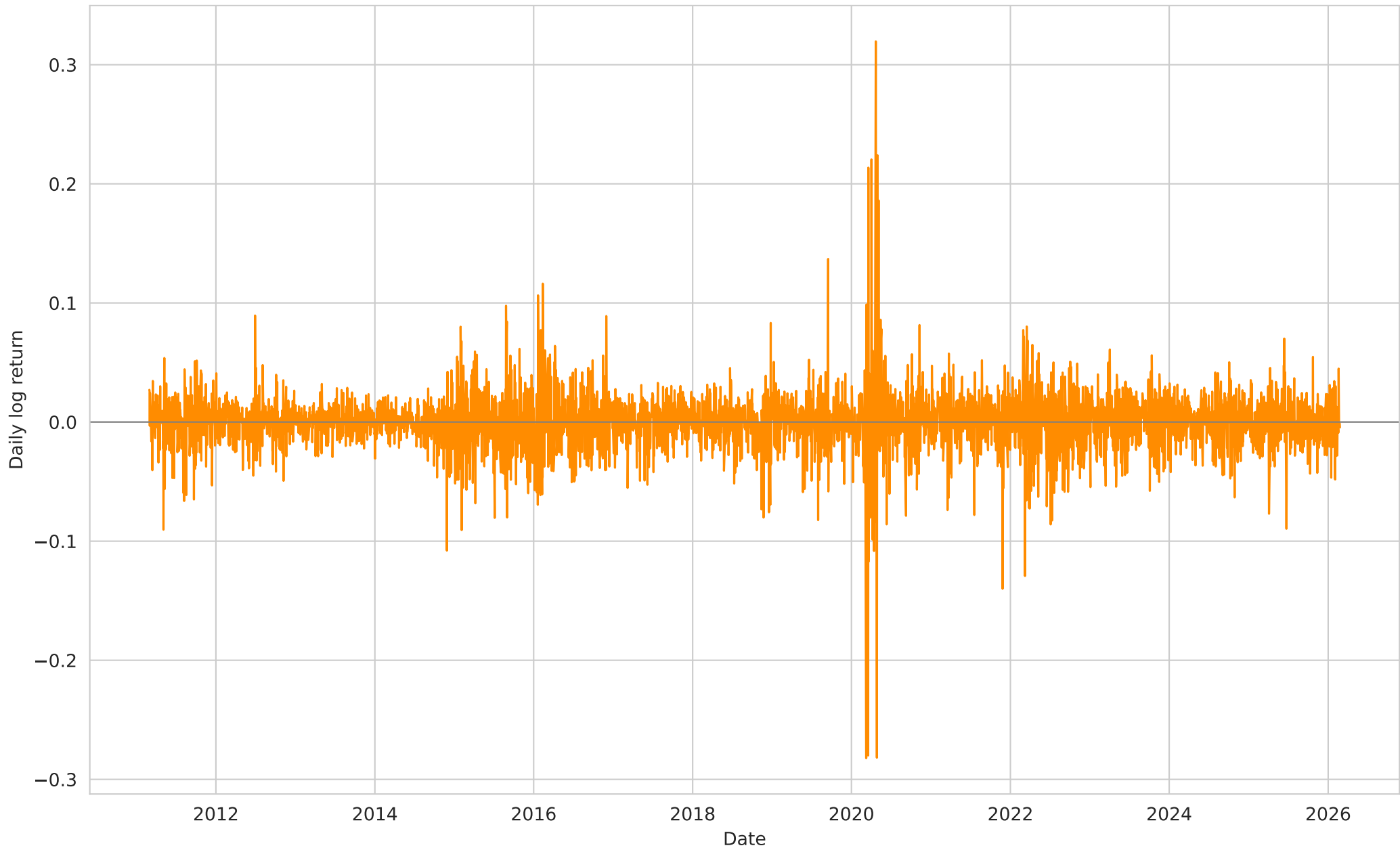
CL=F • ACF • Price



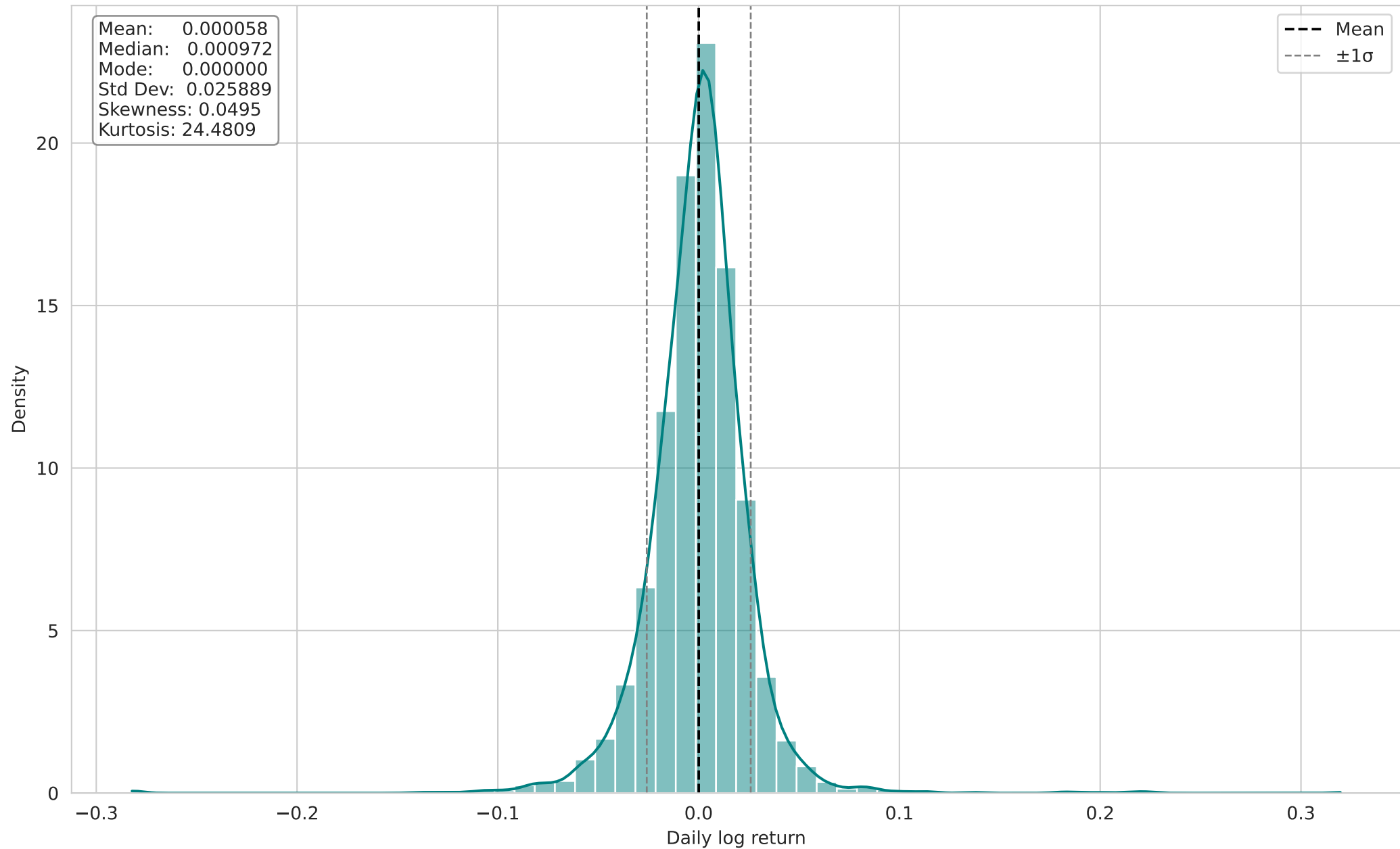
CL=F • Moving Averages (5/10/20)



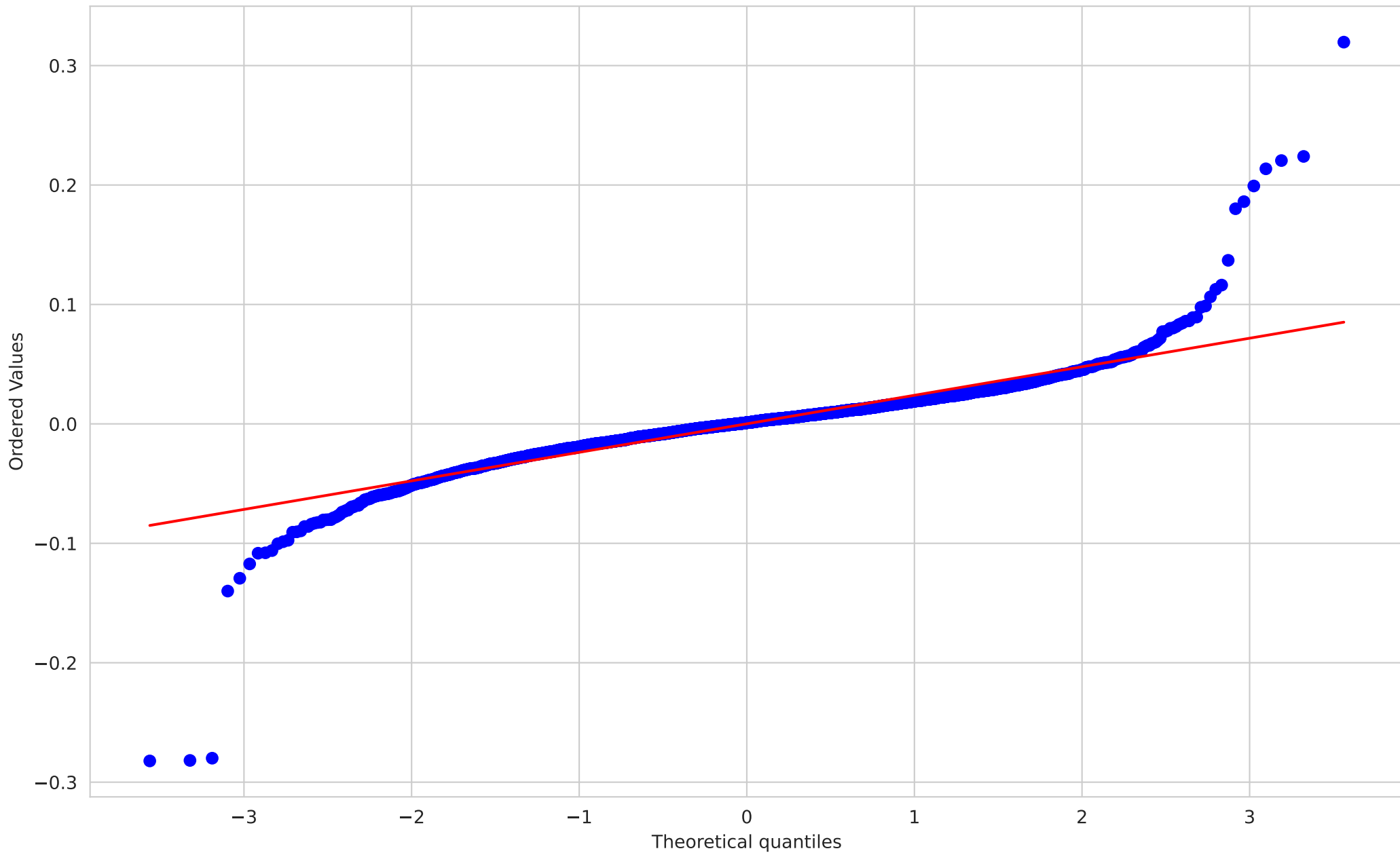
CL=F • Daily Log Returns



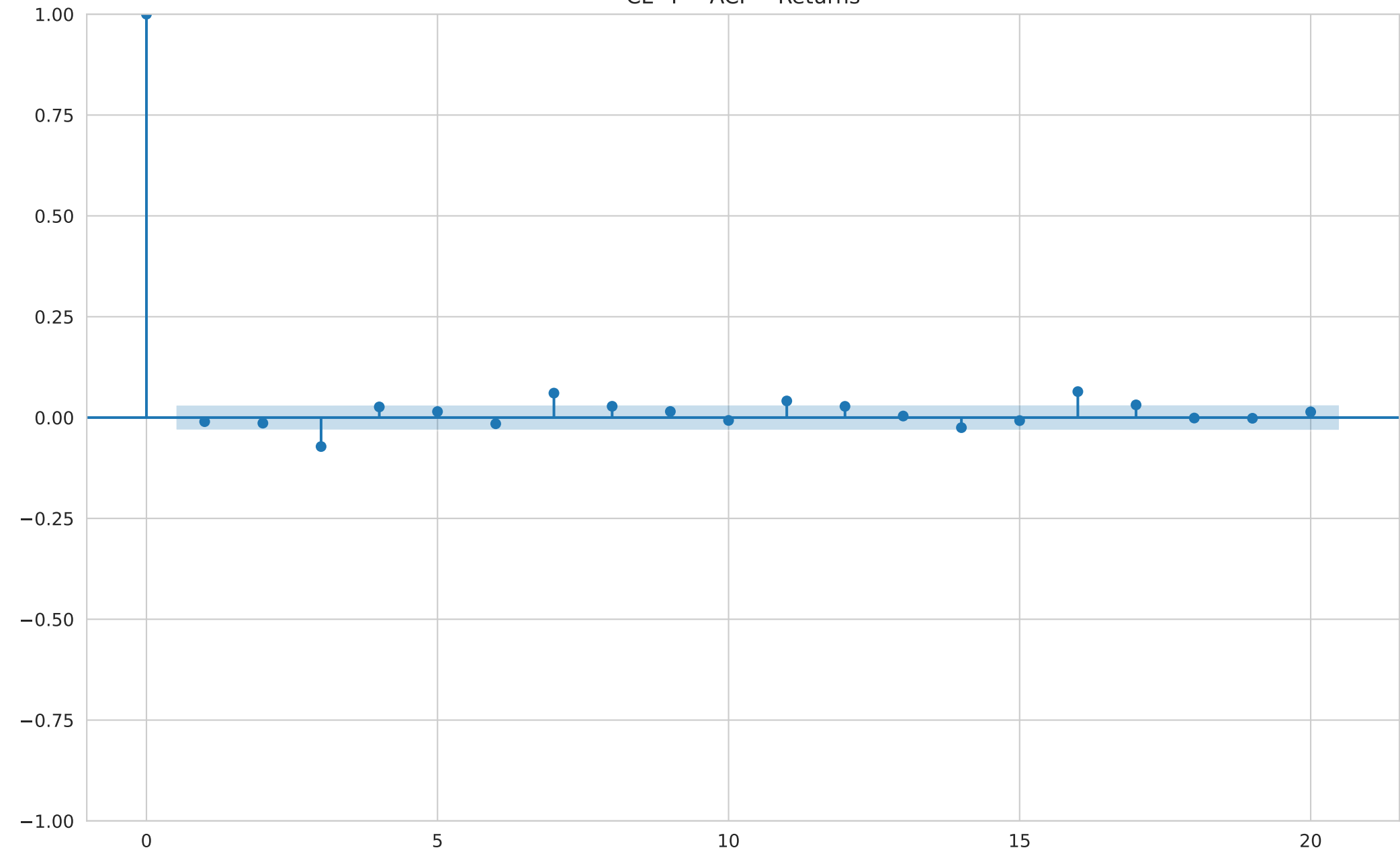
CL=F • Returns • Distribution



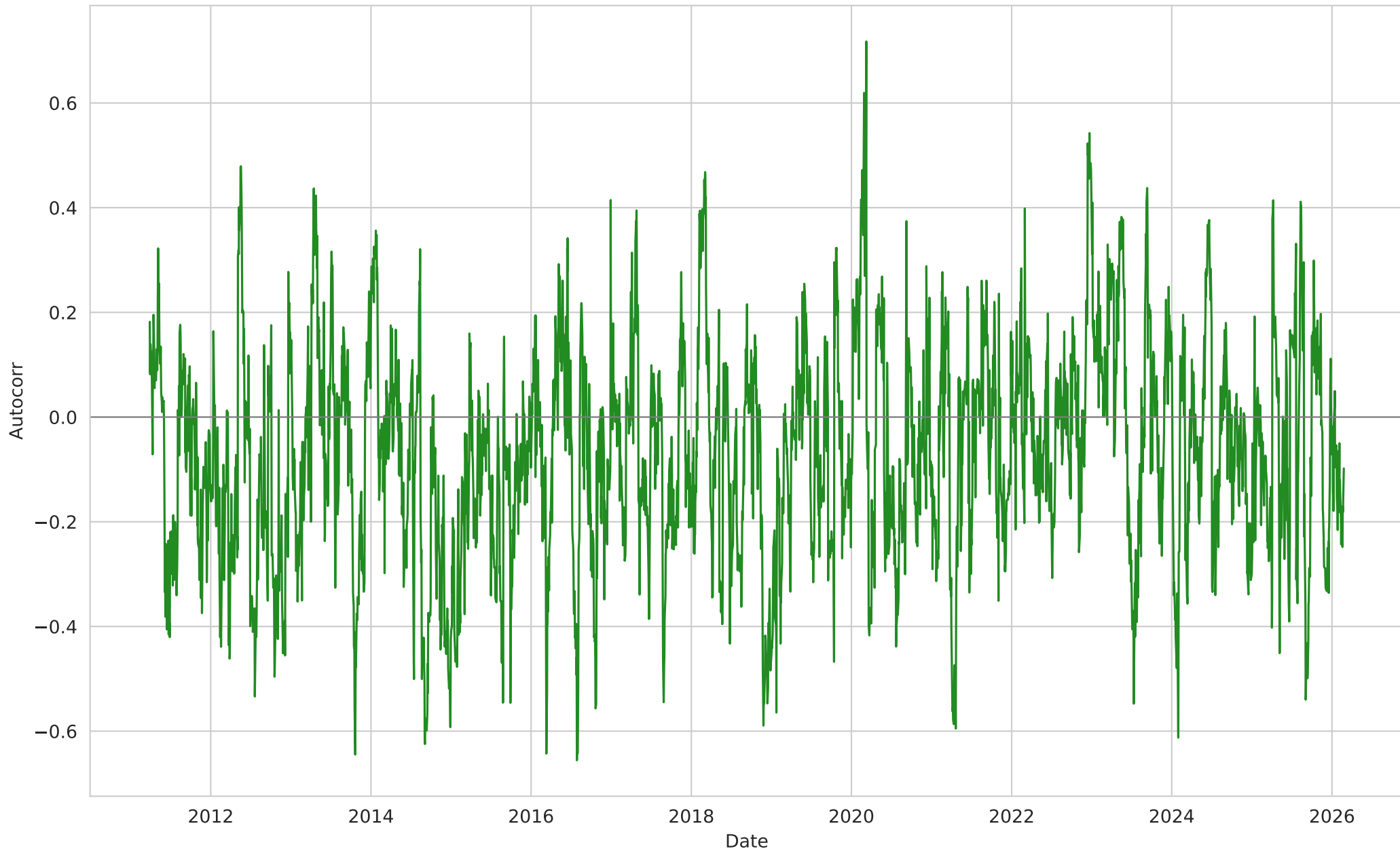
CL=F • Returns • Q-Q Plot vs Normal



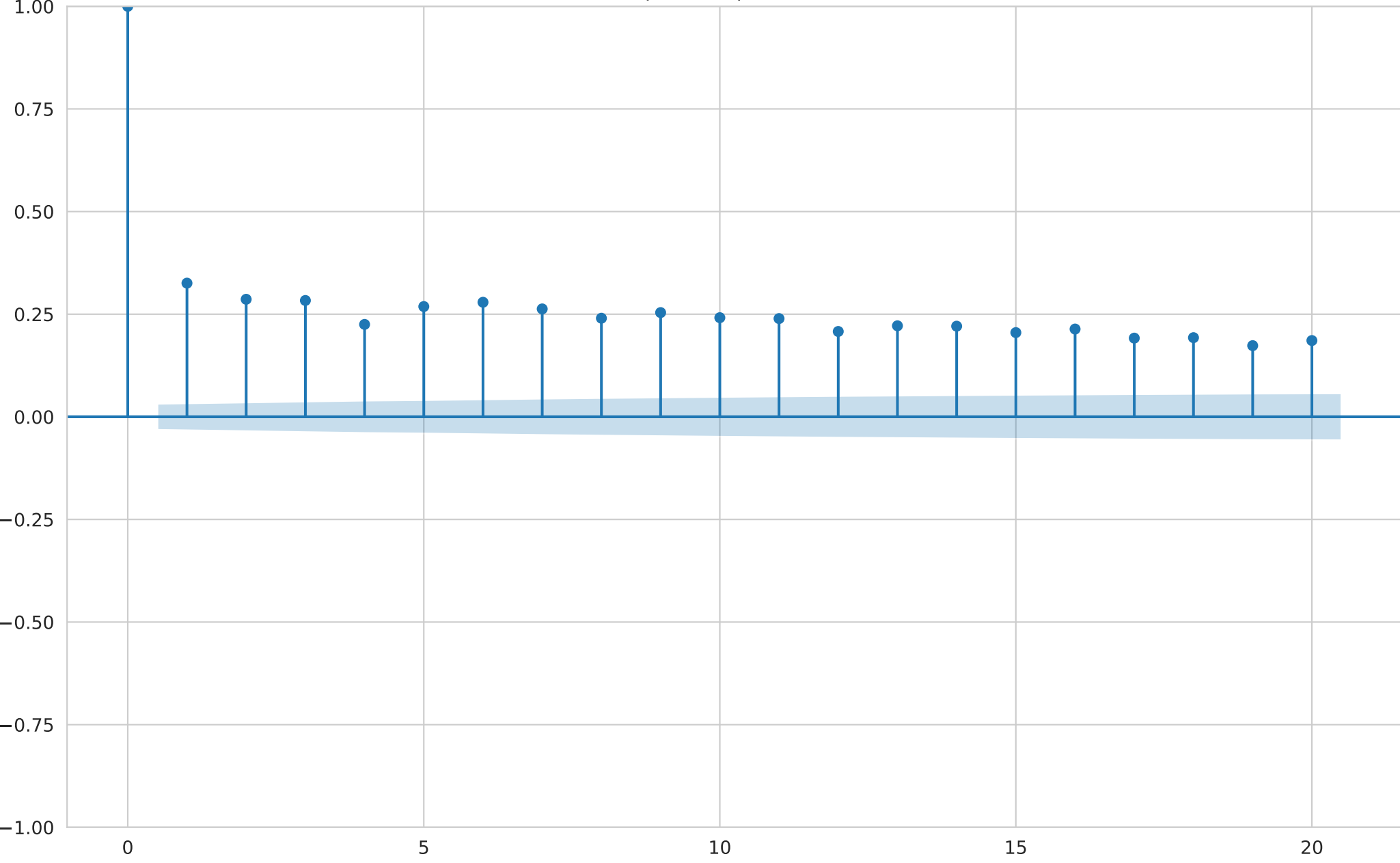
CL=F • ACF • Returns



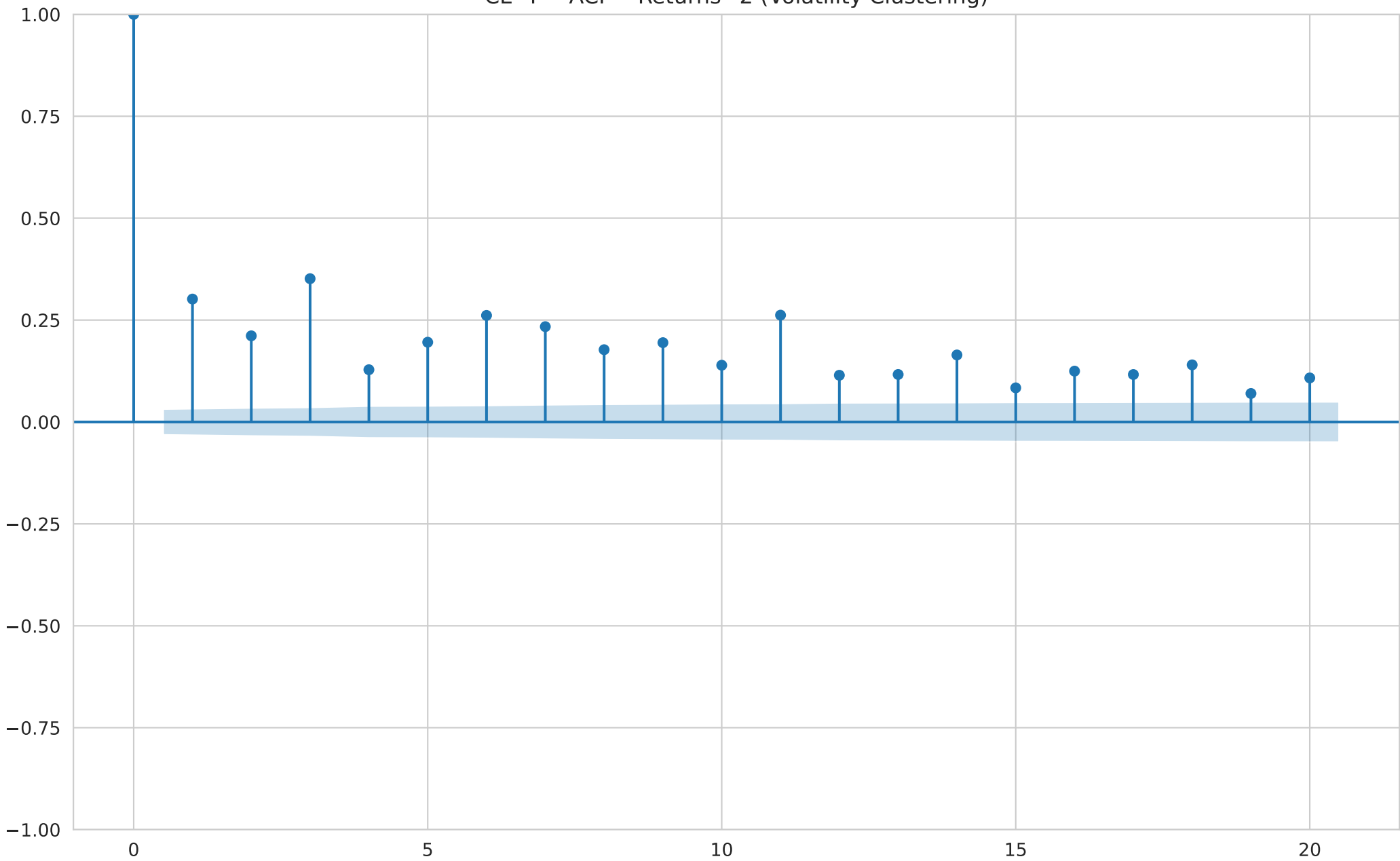
CL=F • Rolling Autocorrelation (lag=1, window=20)



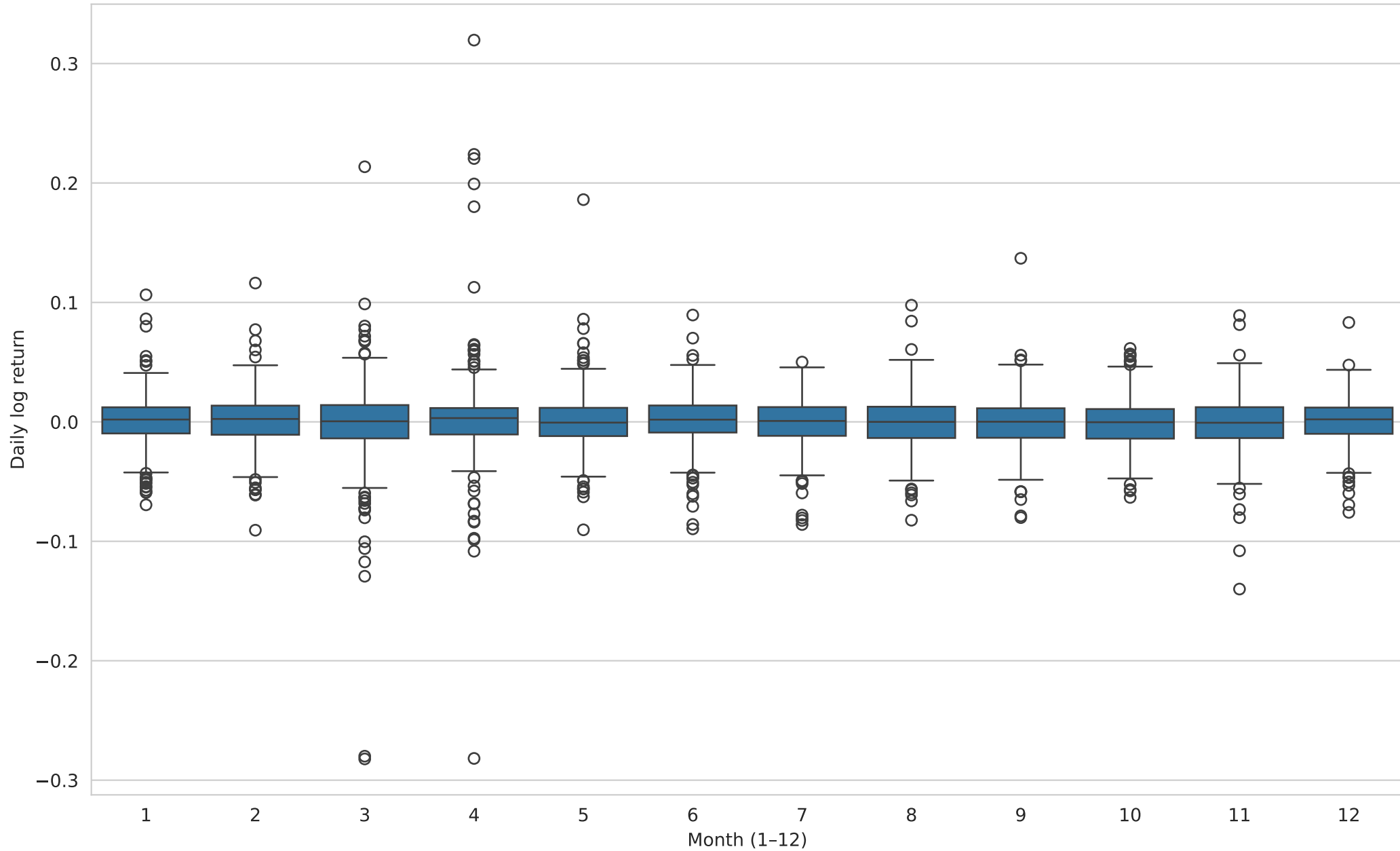
CL=F • ACF • |Returns| (Volatility Clustering)



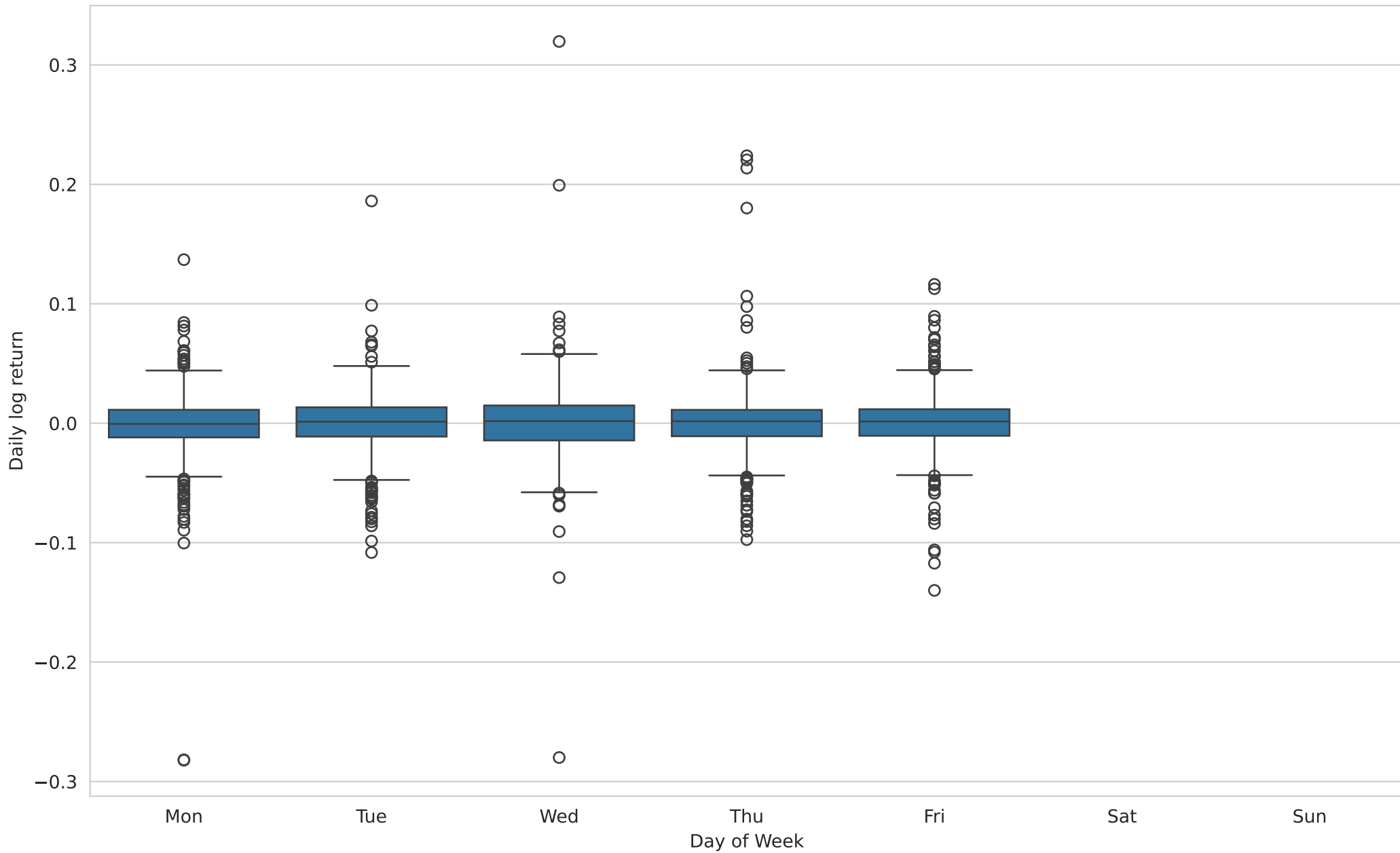
CL=F • ACF • Returns^2 (Volatility Clustering)



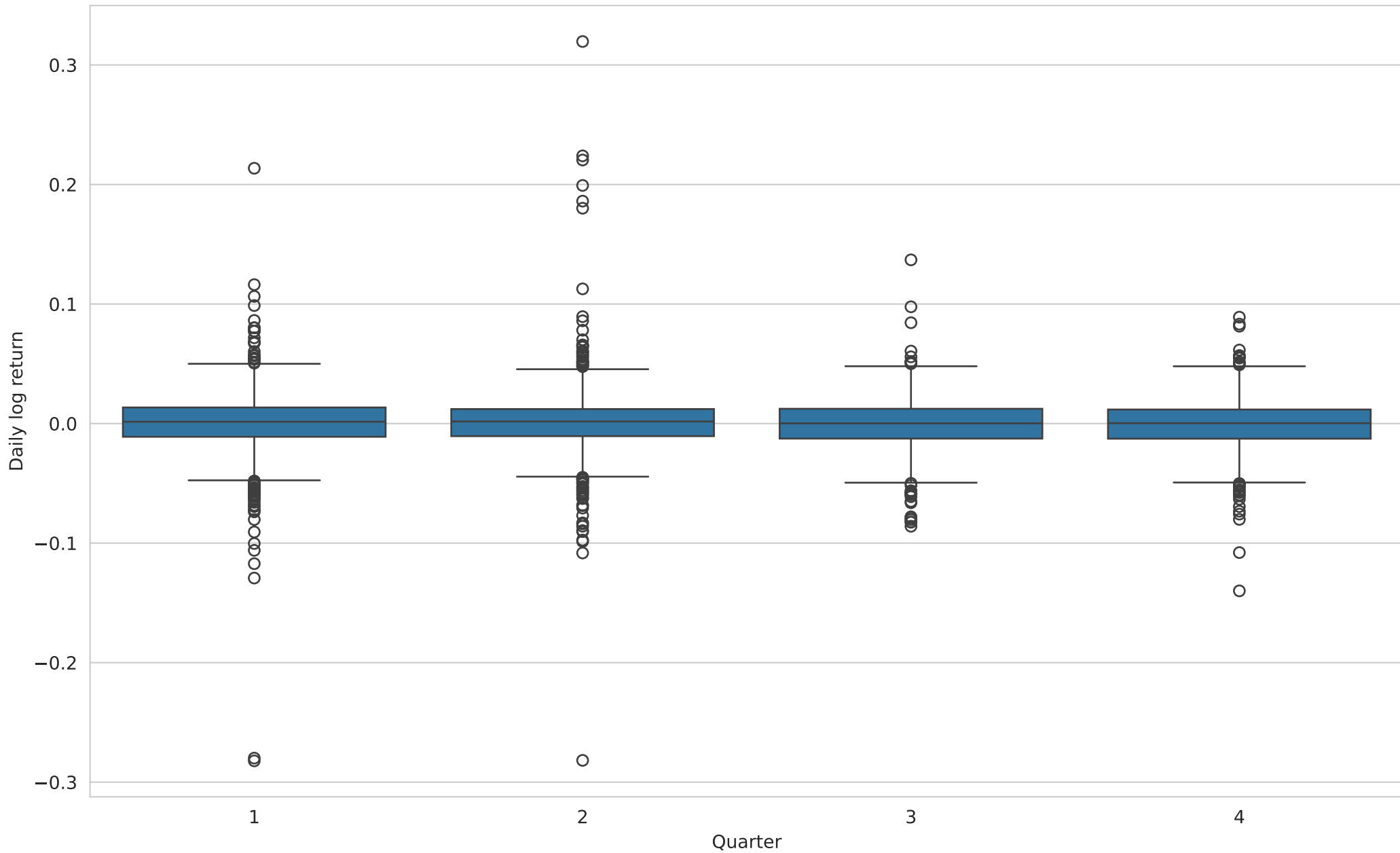
CL=F • Monthly Returns



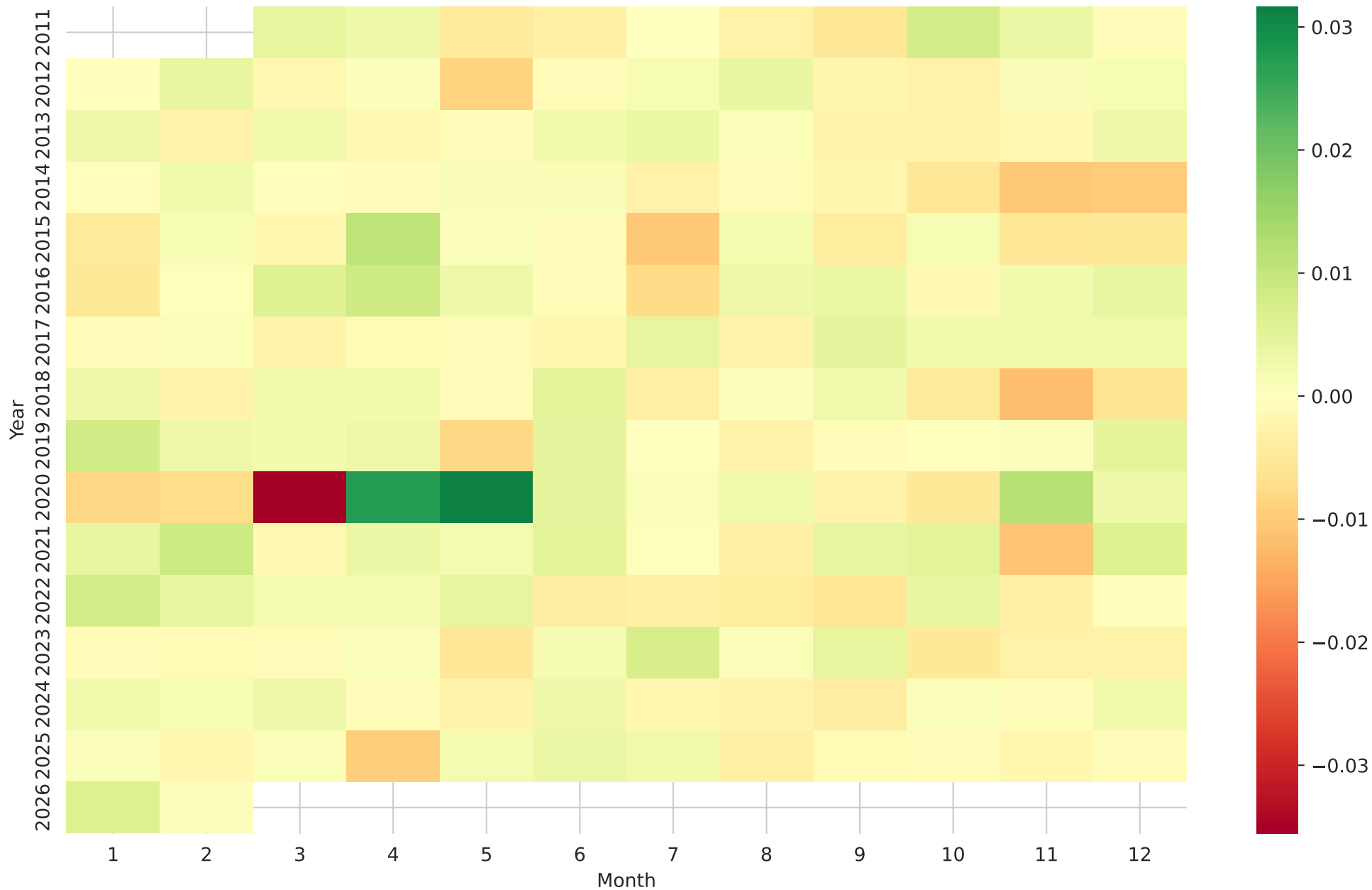
CL=F • Day-of-Week Returns



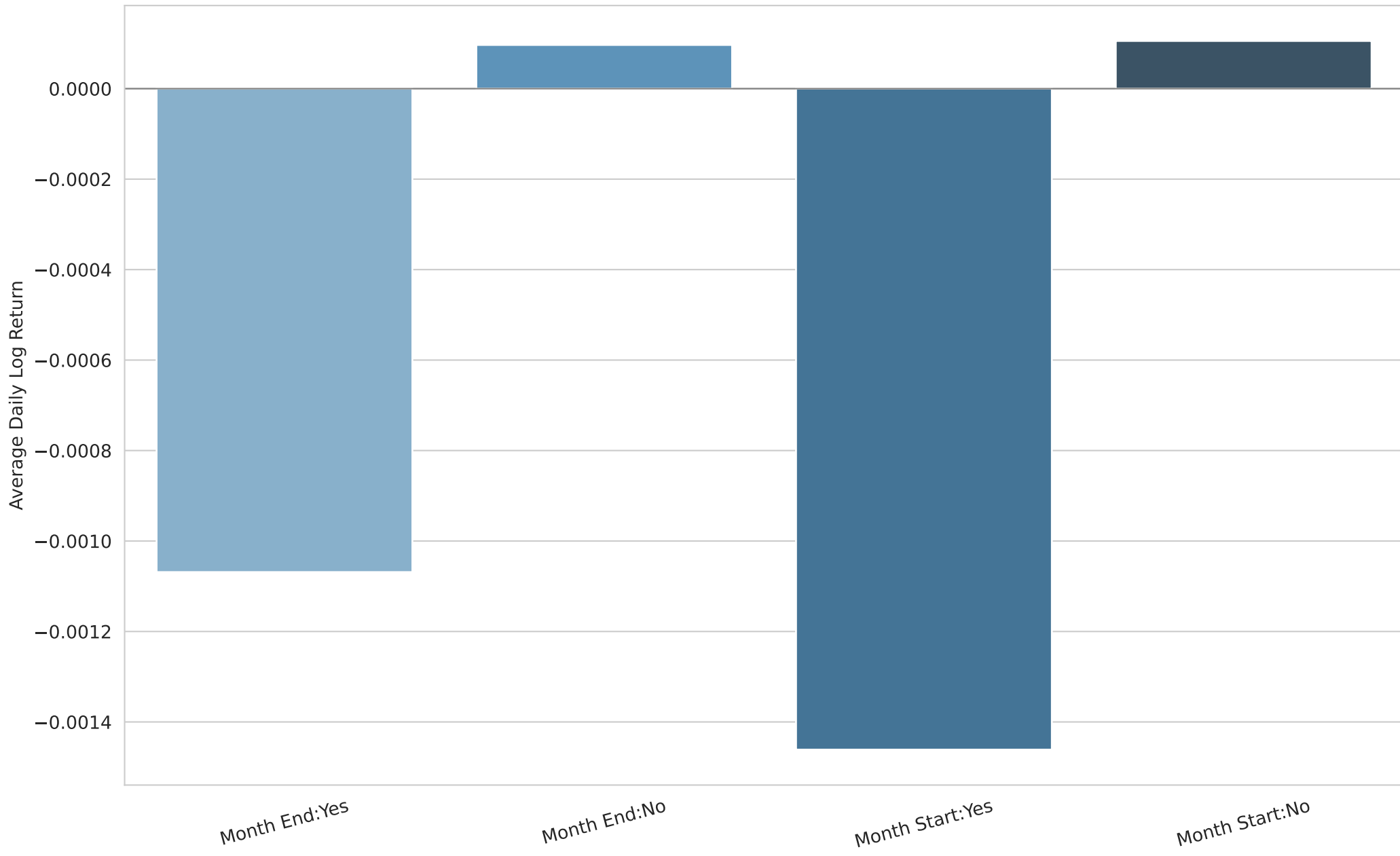
CL=F • Quarterly Returns



CL=F • Month×Year Heatmap (Avg Daily Returns)

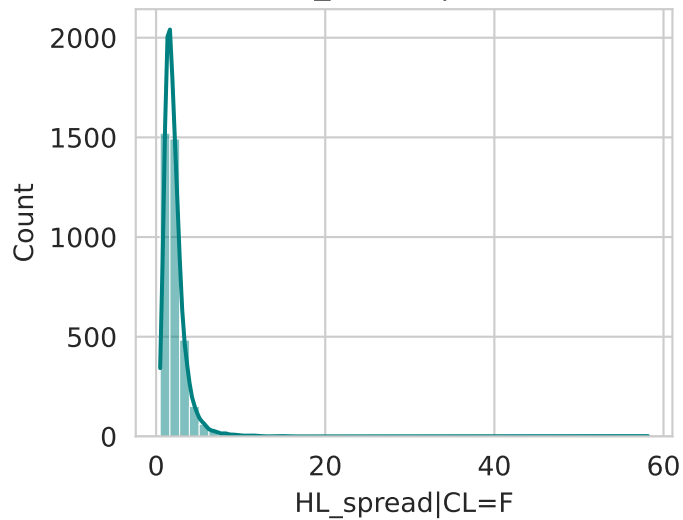


CL=F • Avg Returns: Month-End/Start vs Others

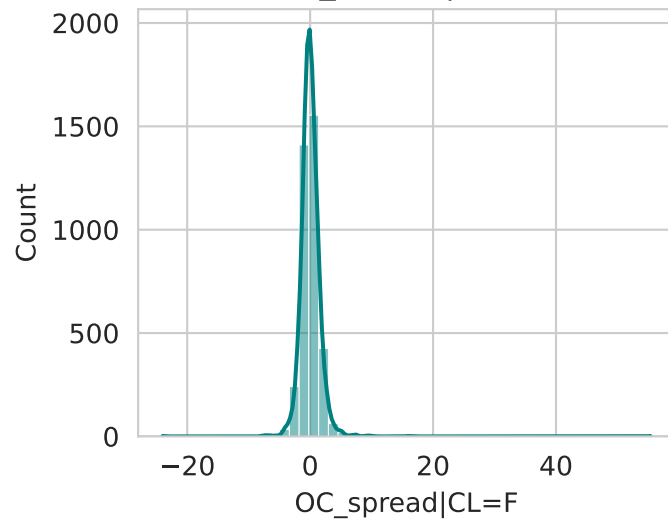


CL=F • Spreads

HL_spread|CL=F

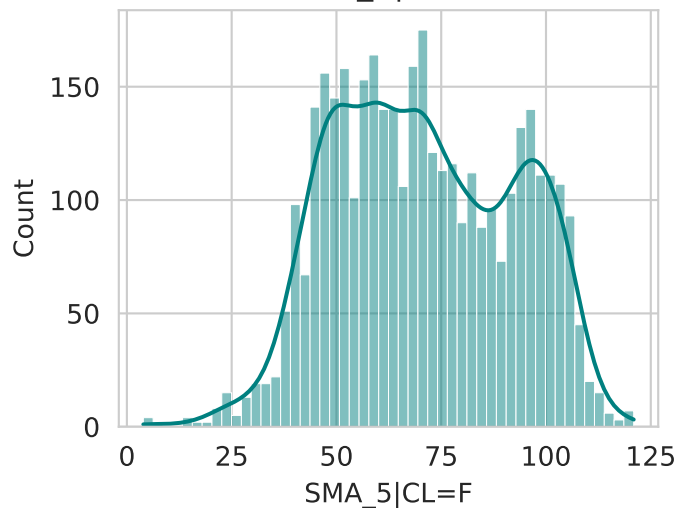


OC_spread|CL=F

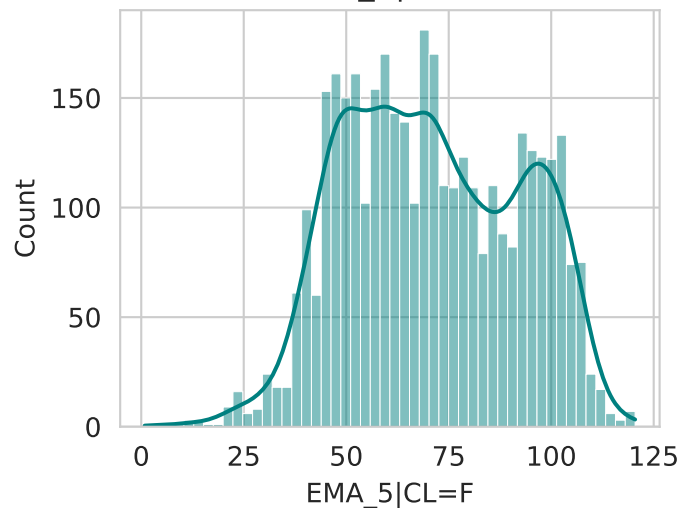


CL=F • Moving Averages / EMAs

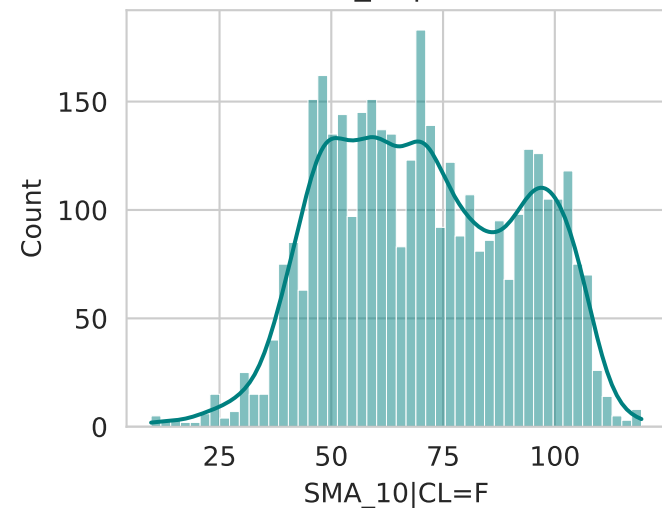
SMA_5|CL=F



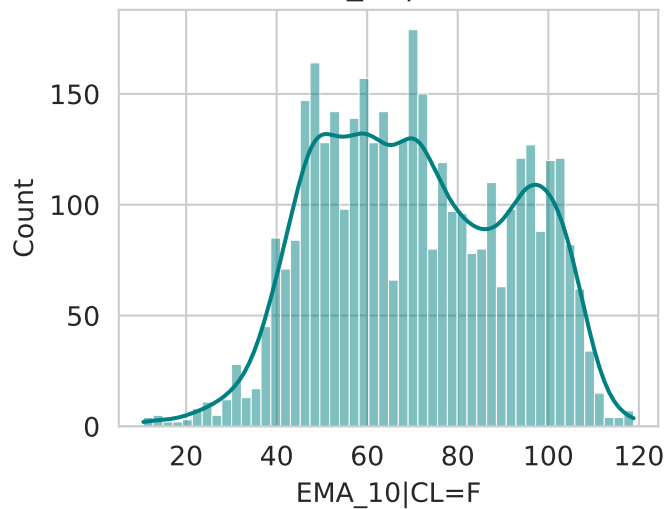
EMA_5|CL=F



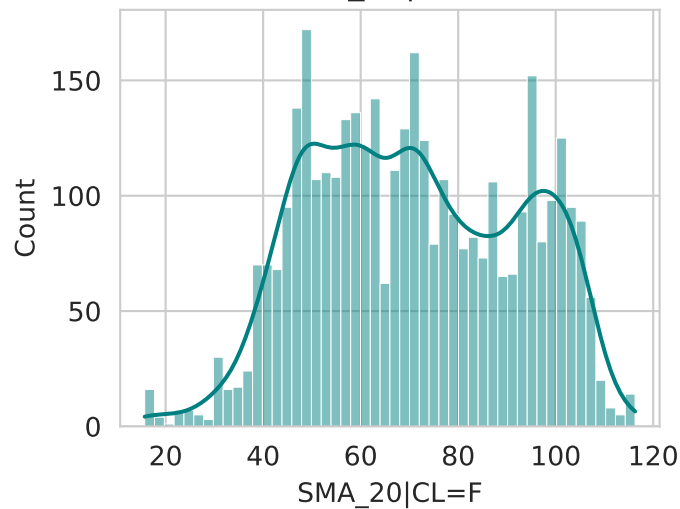
SMA_10|CL=F



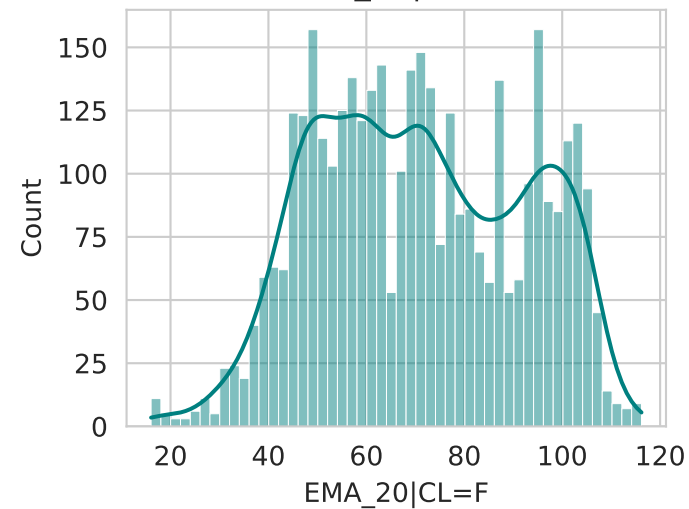
EMA_10|CL=F



SMA_20|CL=F

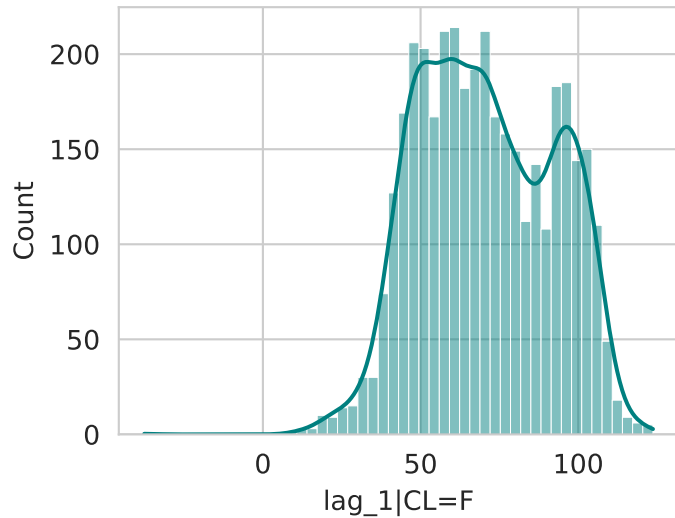


EMA_20|CL=F

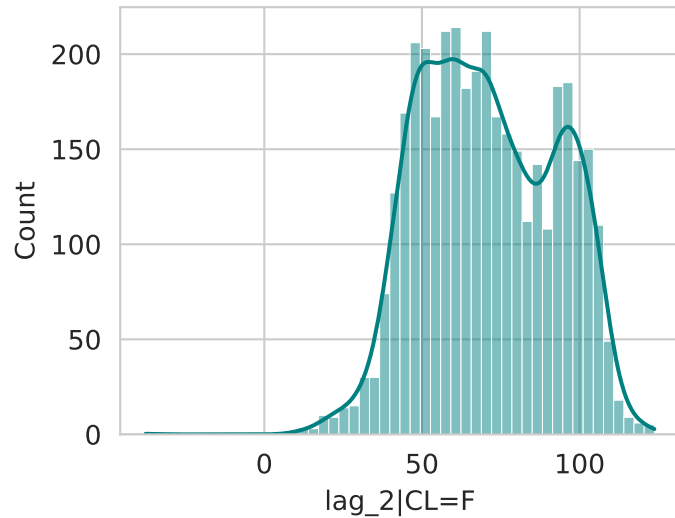


CL=F • Lagged Prices

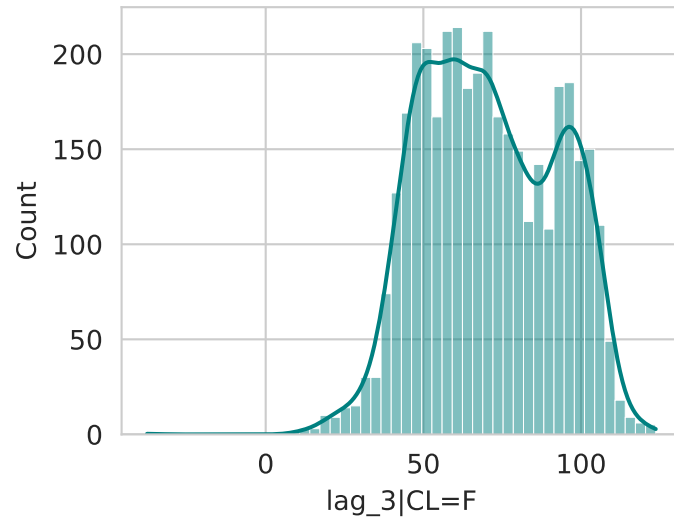
lag_1|CL=F



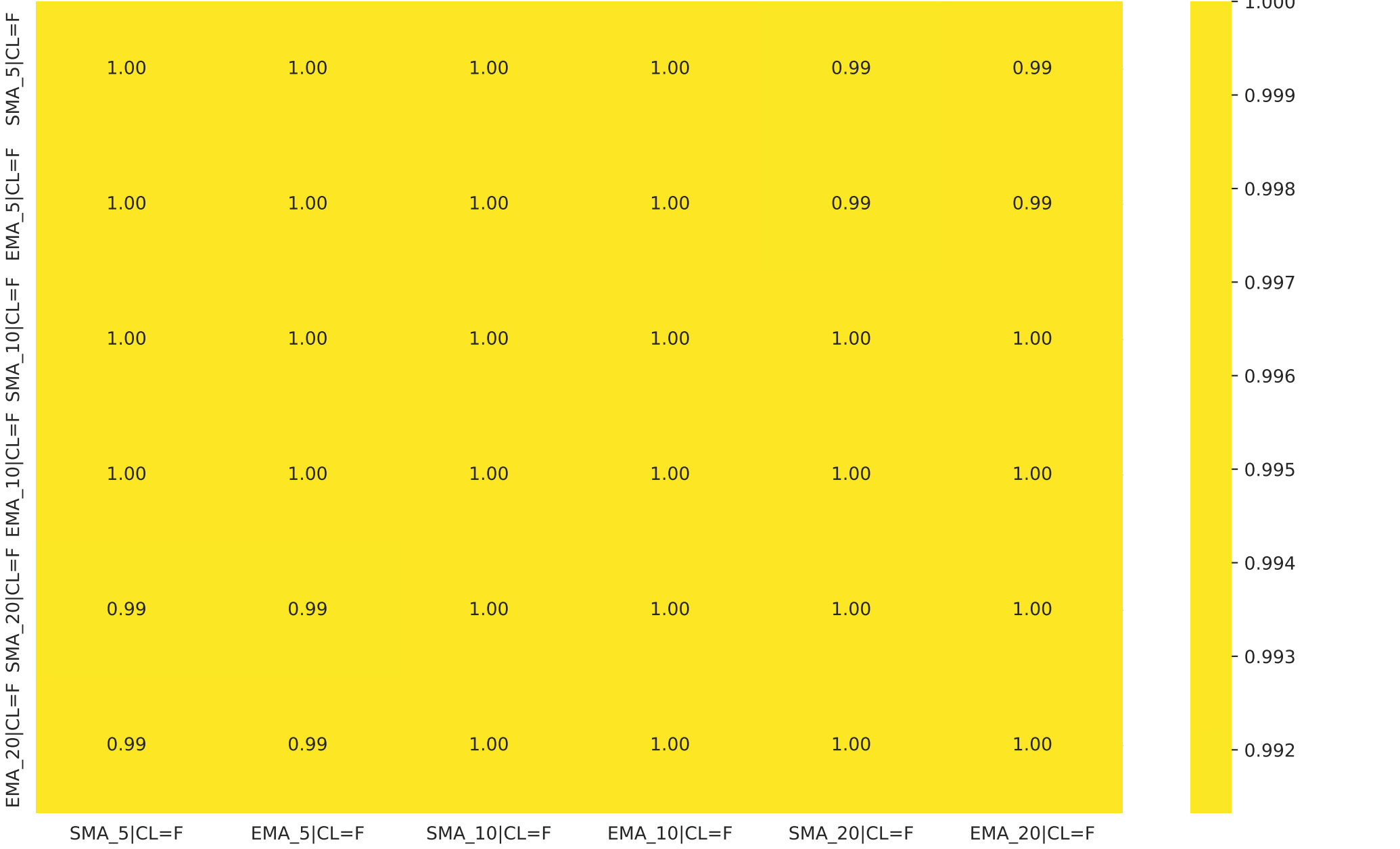
lag_2|CL=F



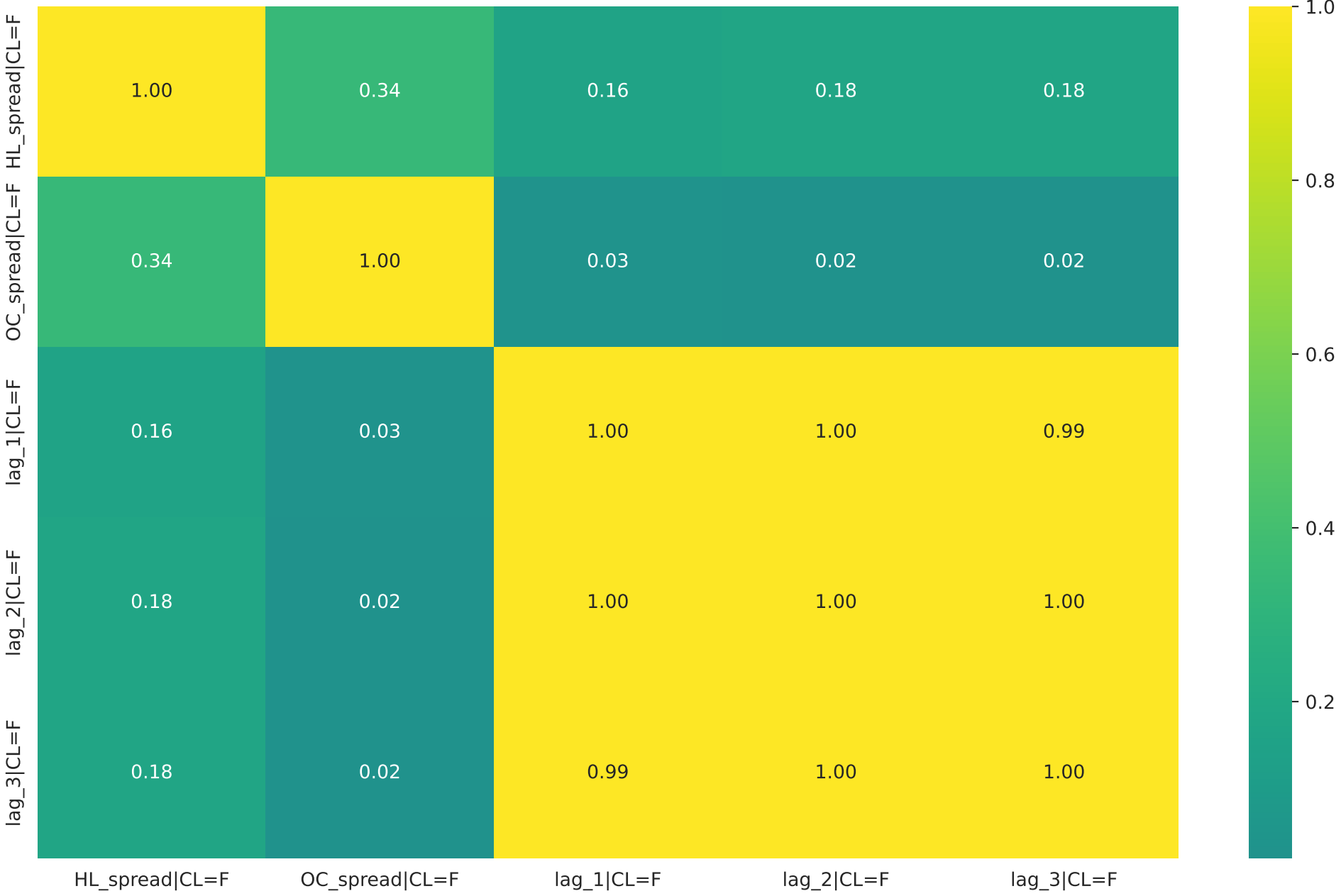
lag_3|CL=F



CL=F • Correlation • Moving Averages



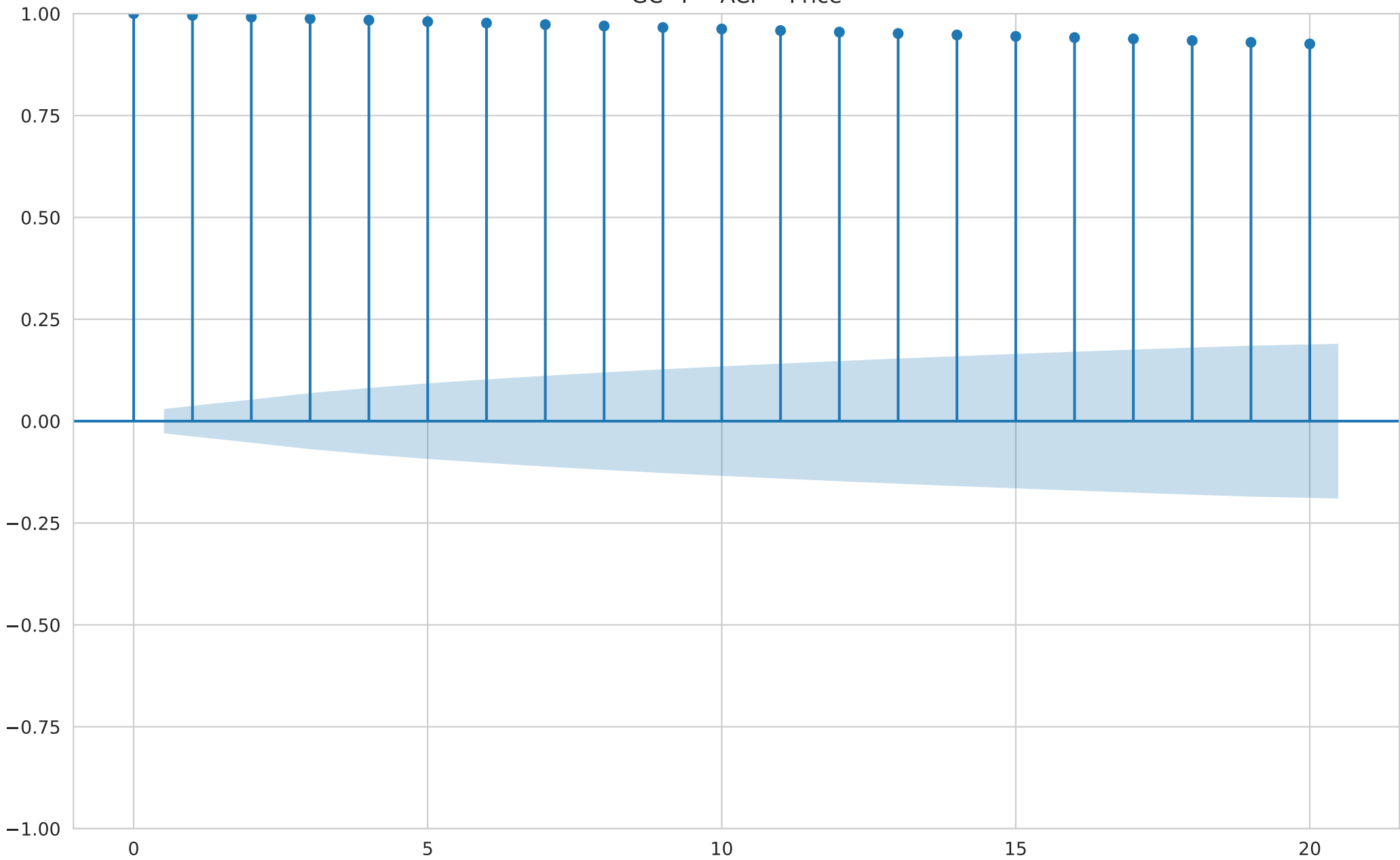
CL=F • Correlation • Spreads + Lags



GC=F • Price



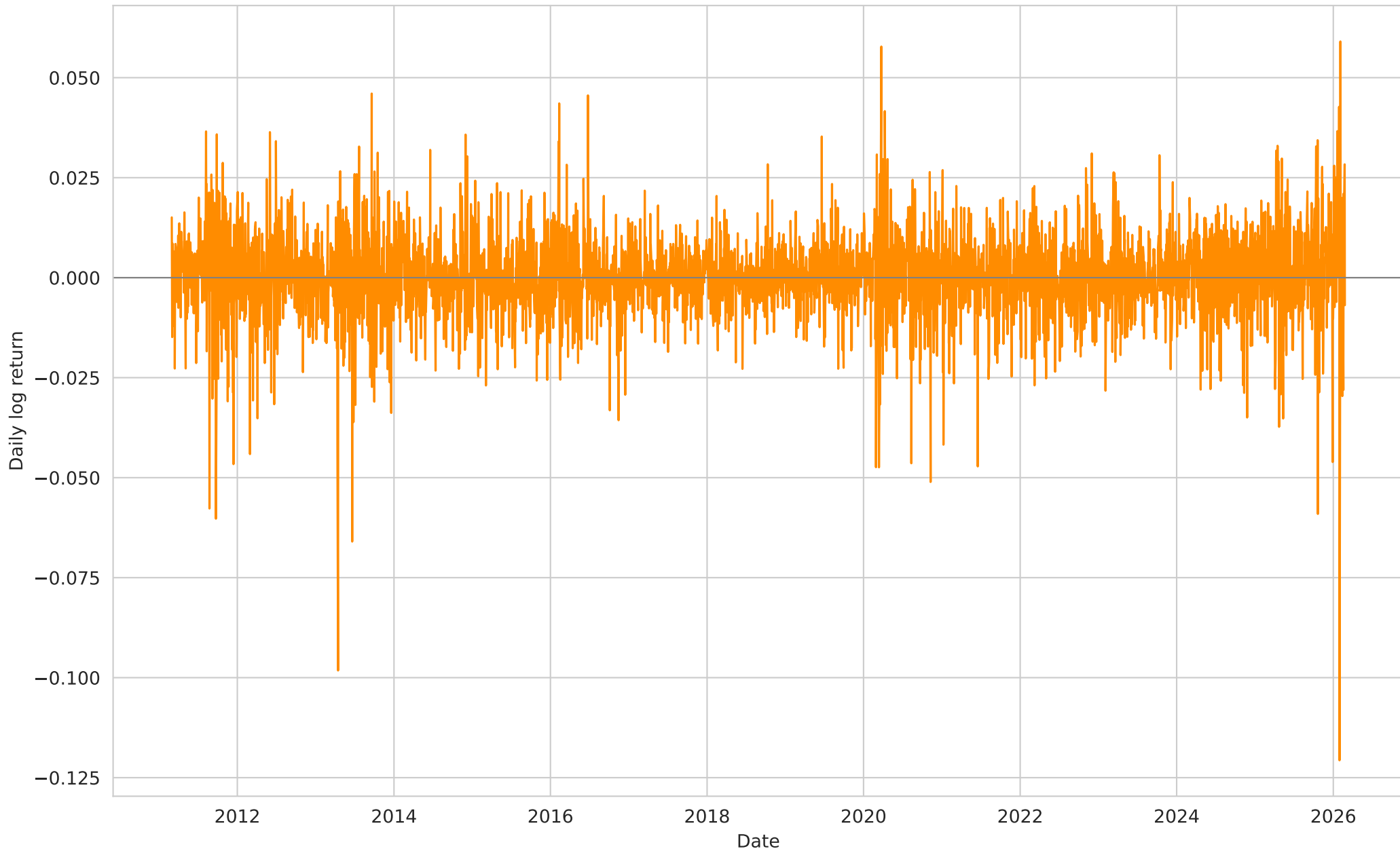
GC=F • ACF • Price



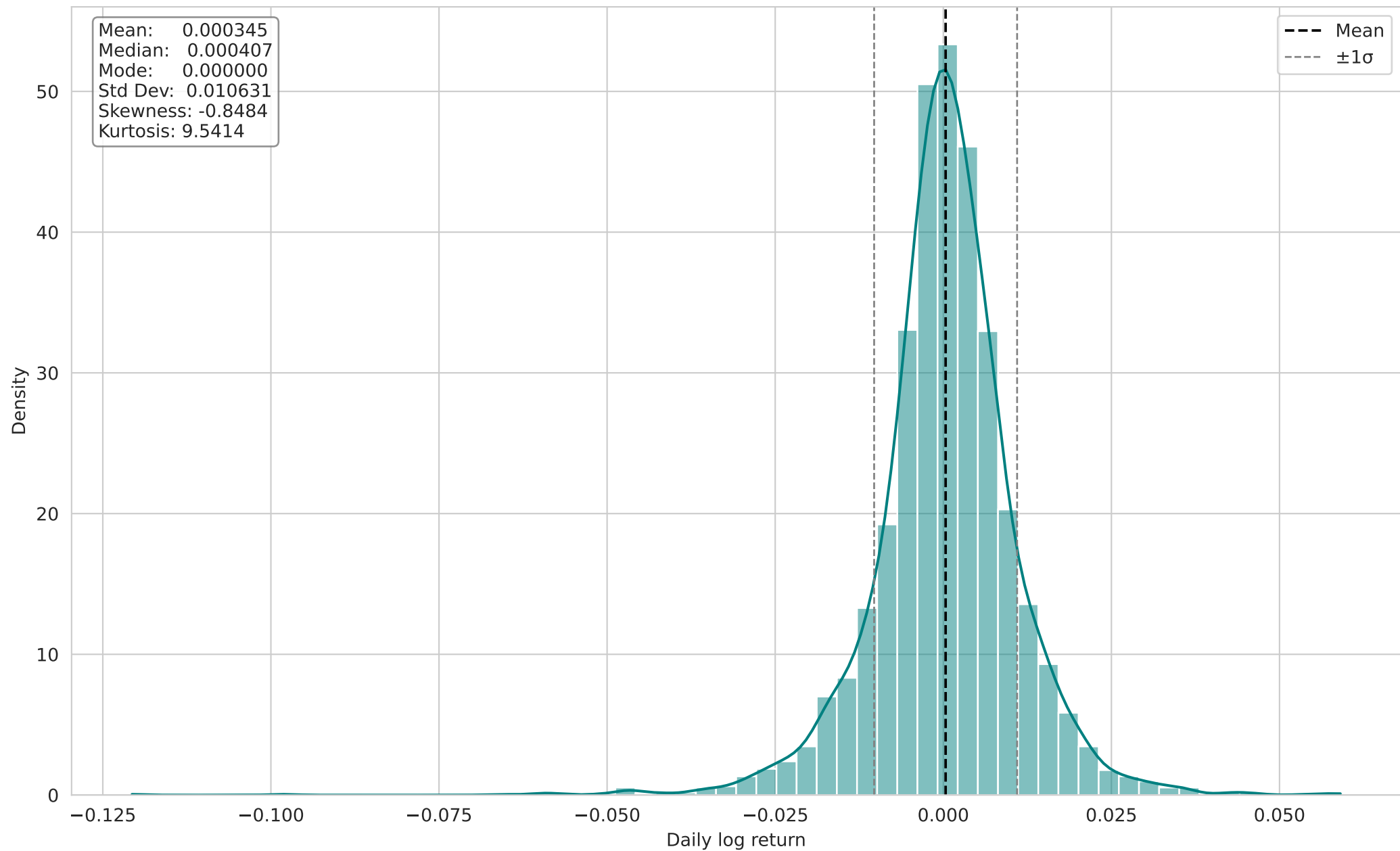
GC=F • Moving Averages (5/10/20)



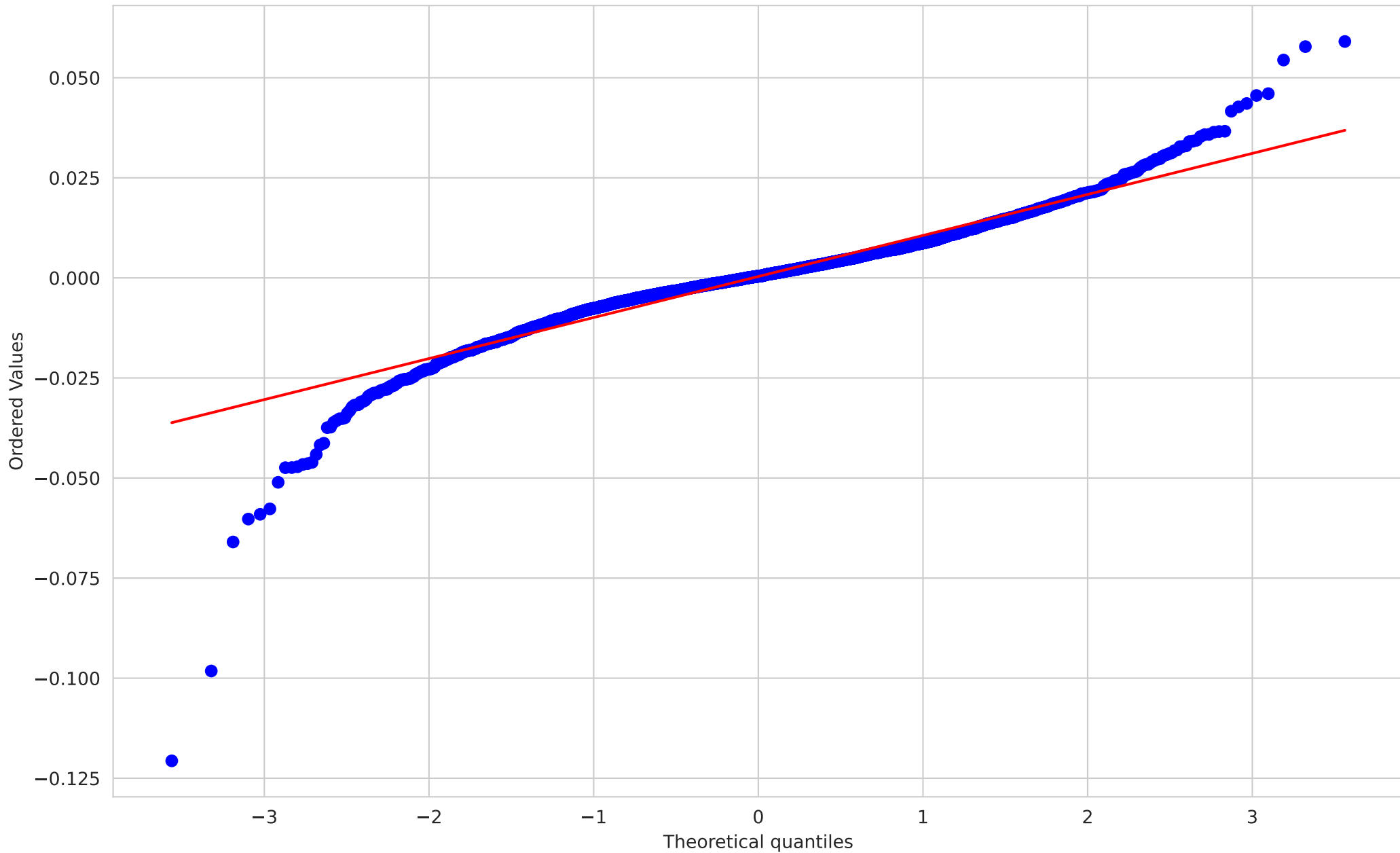
GC=F • Daily Log Returns



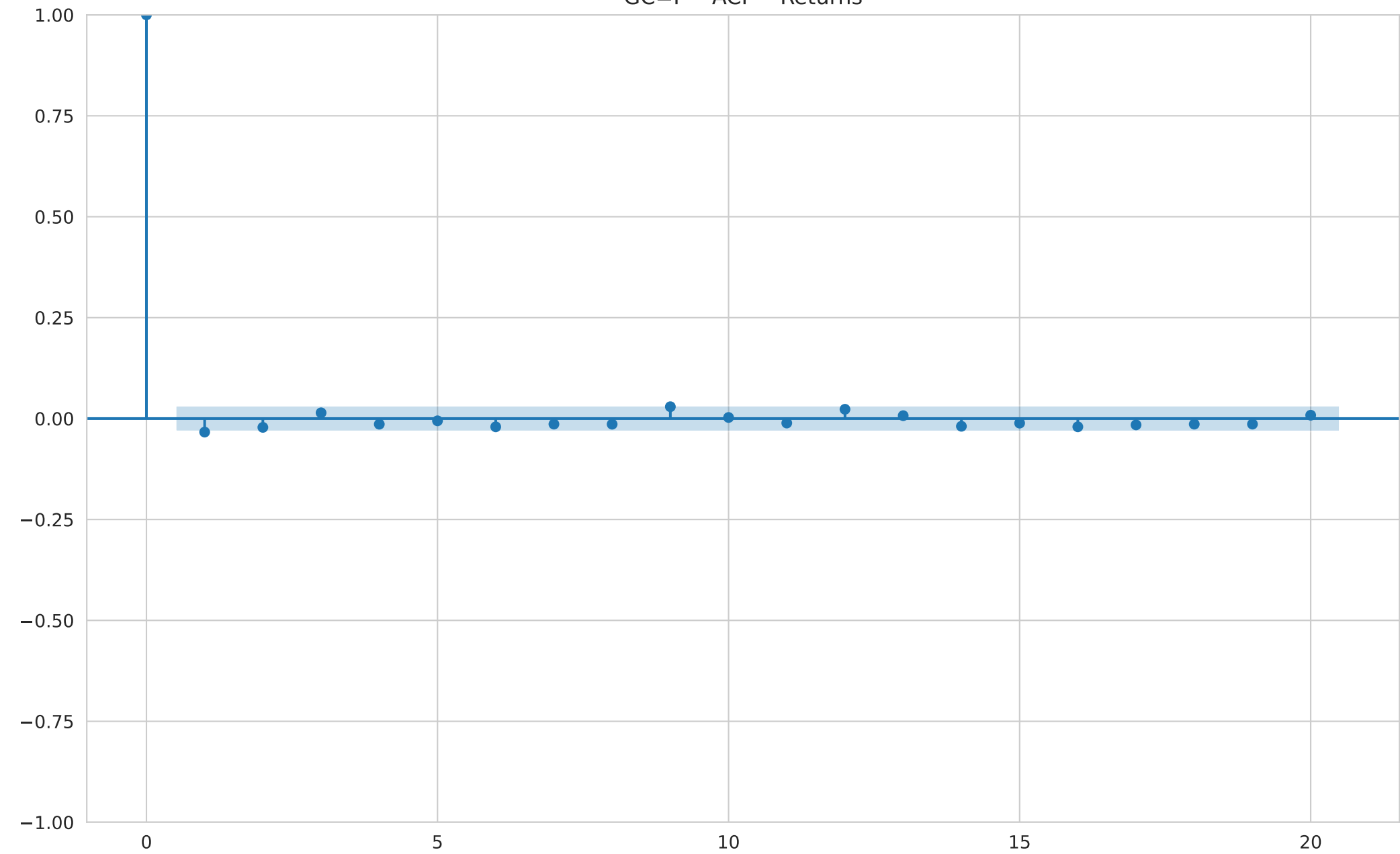
GC=F • Returns • Distribution



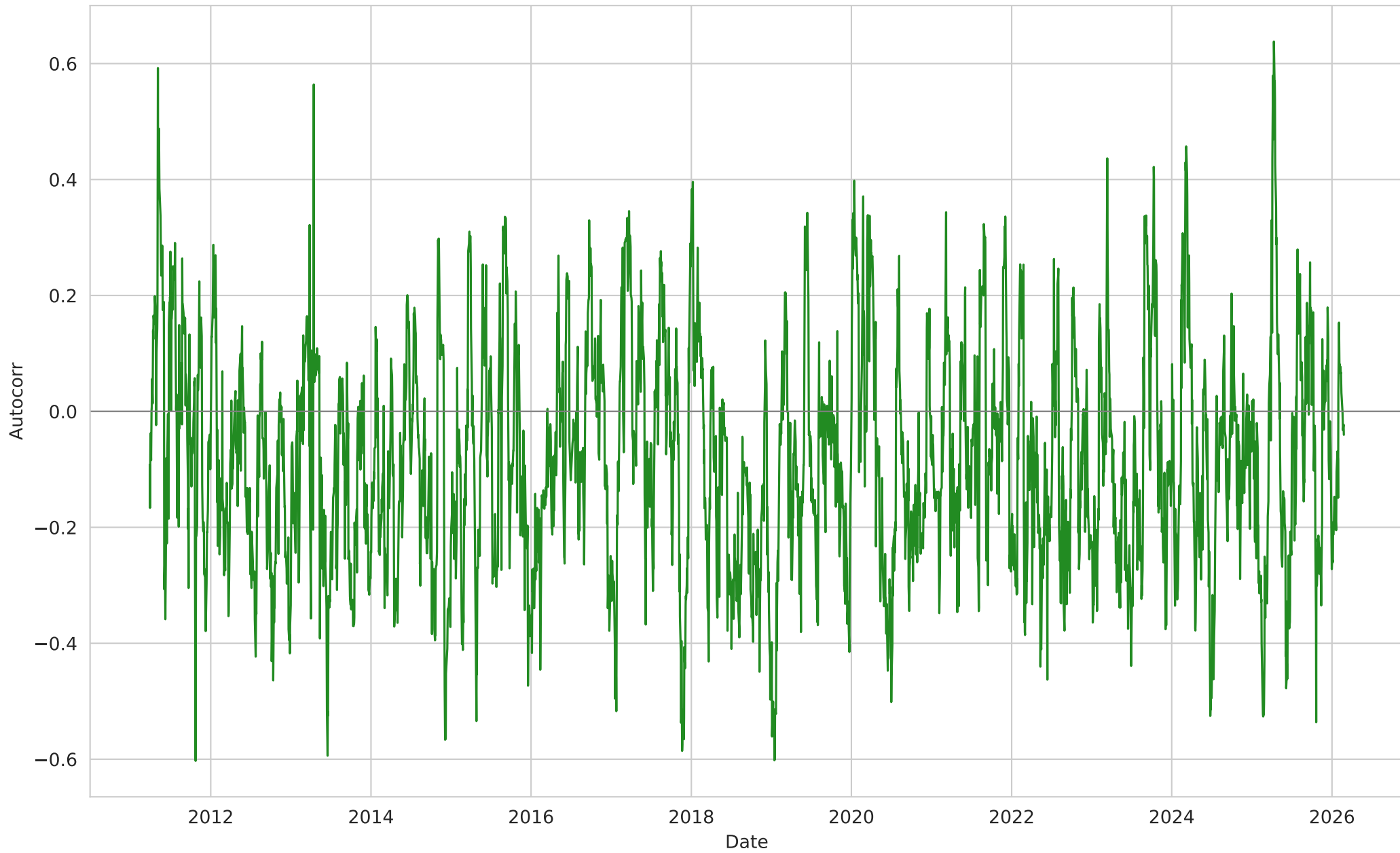
GC=F • Returns • Q-Q Plot vs Normal



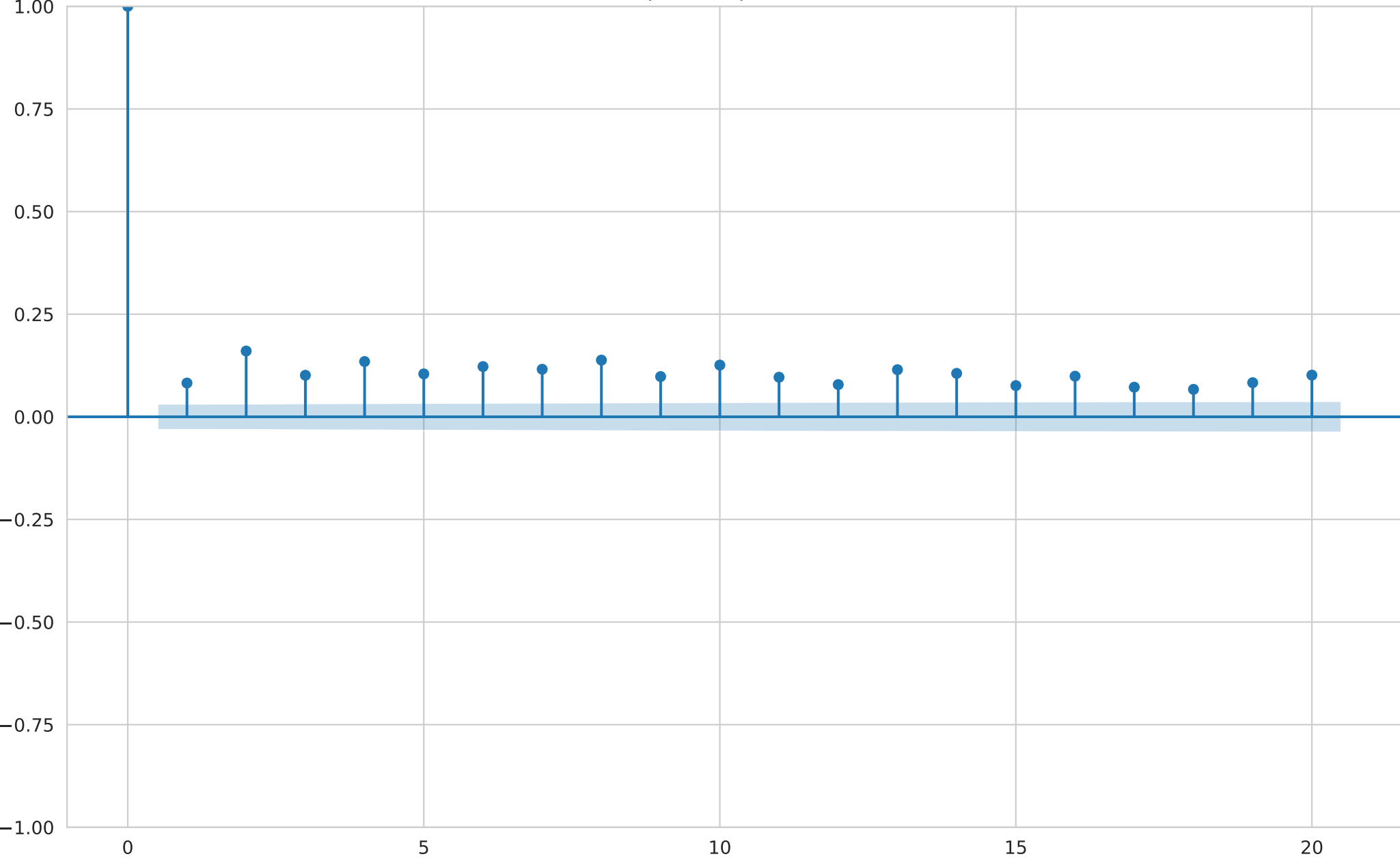
GC=F • ACF • Returns



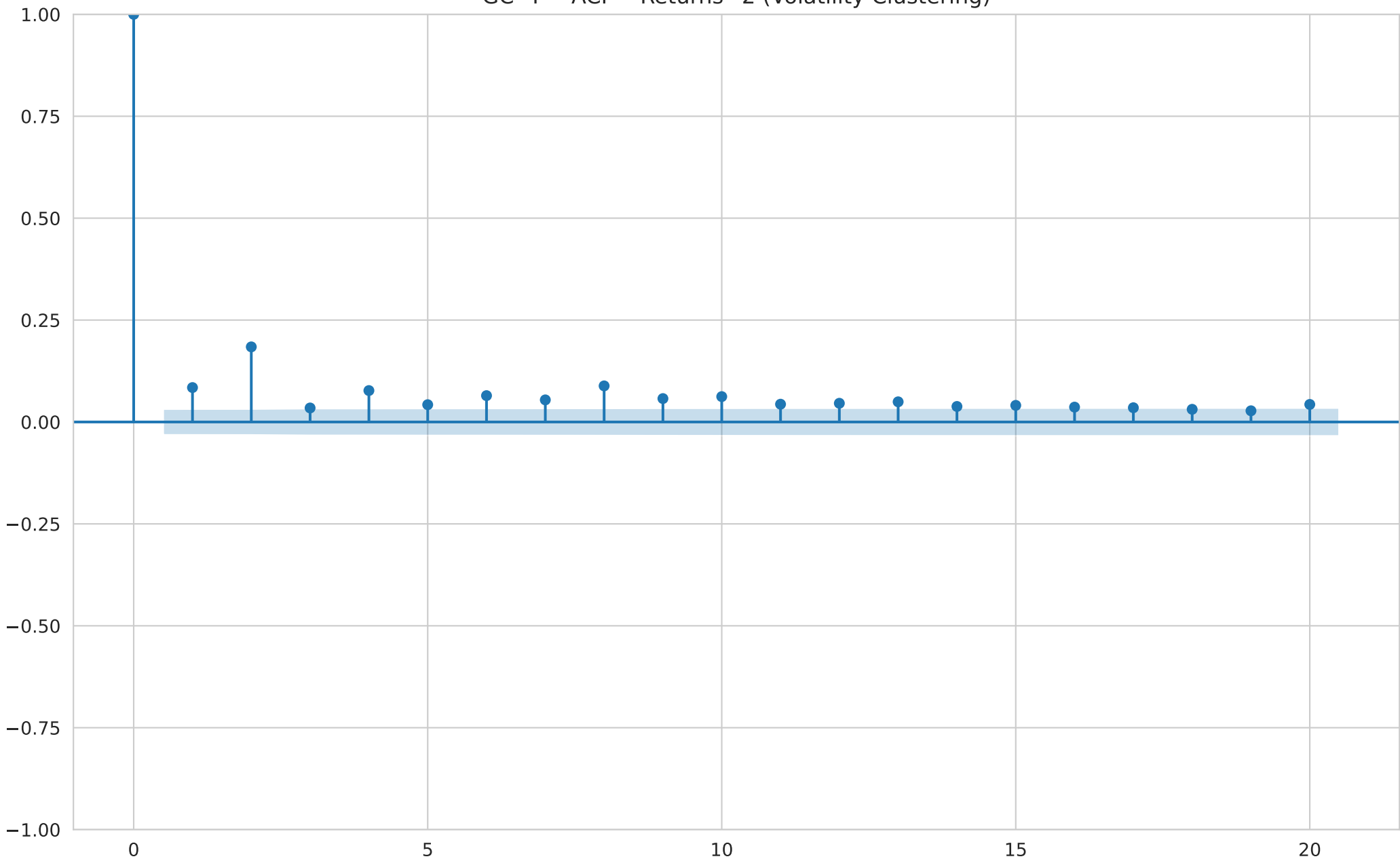
GC=F • Rolling Autocorrelation (lag=1, window=20)



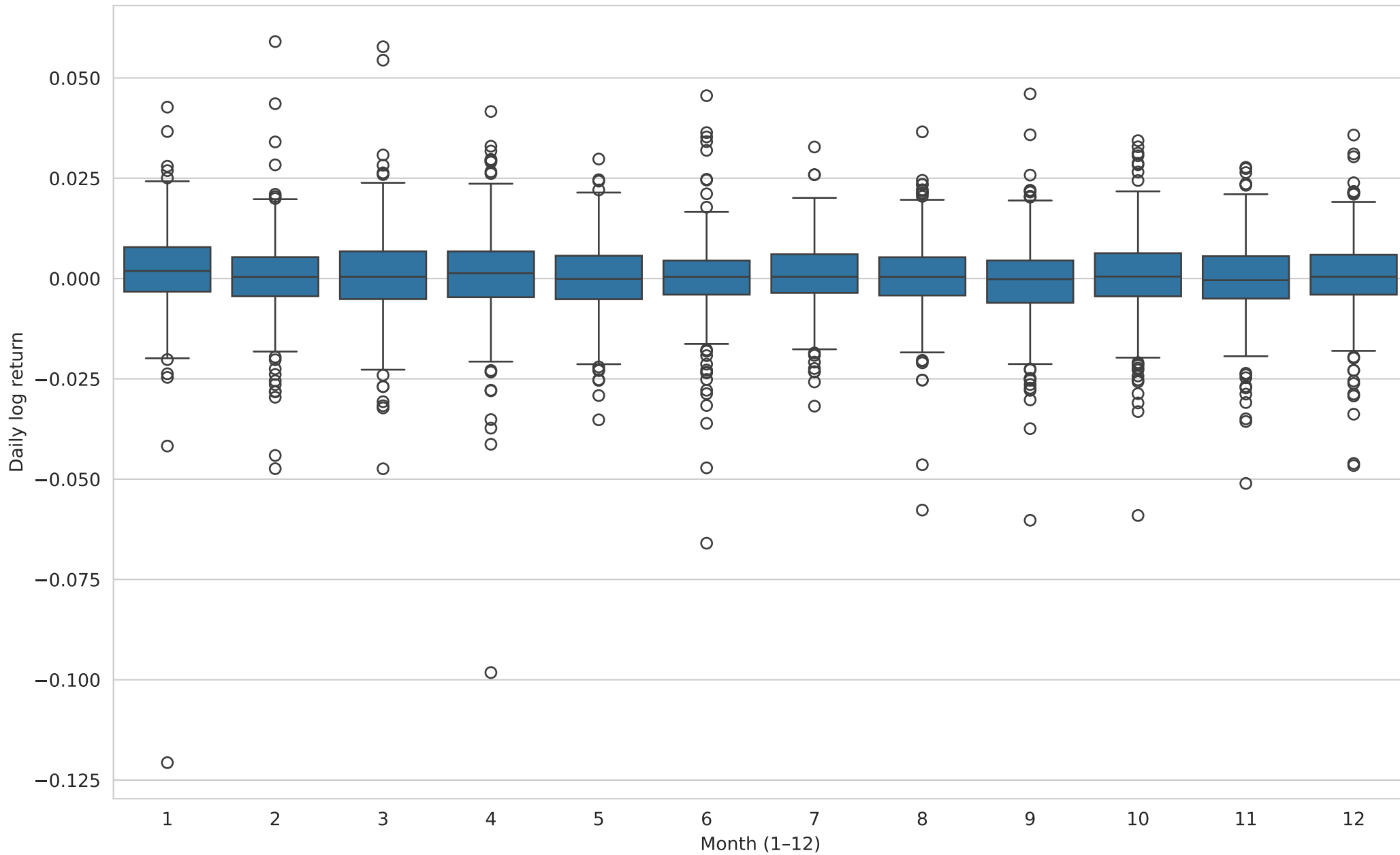
GC=F • ACF • |Returns| (Volatility Clustering)



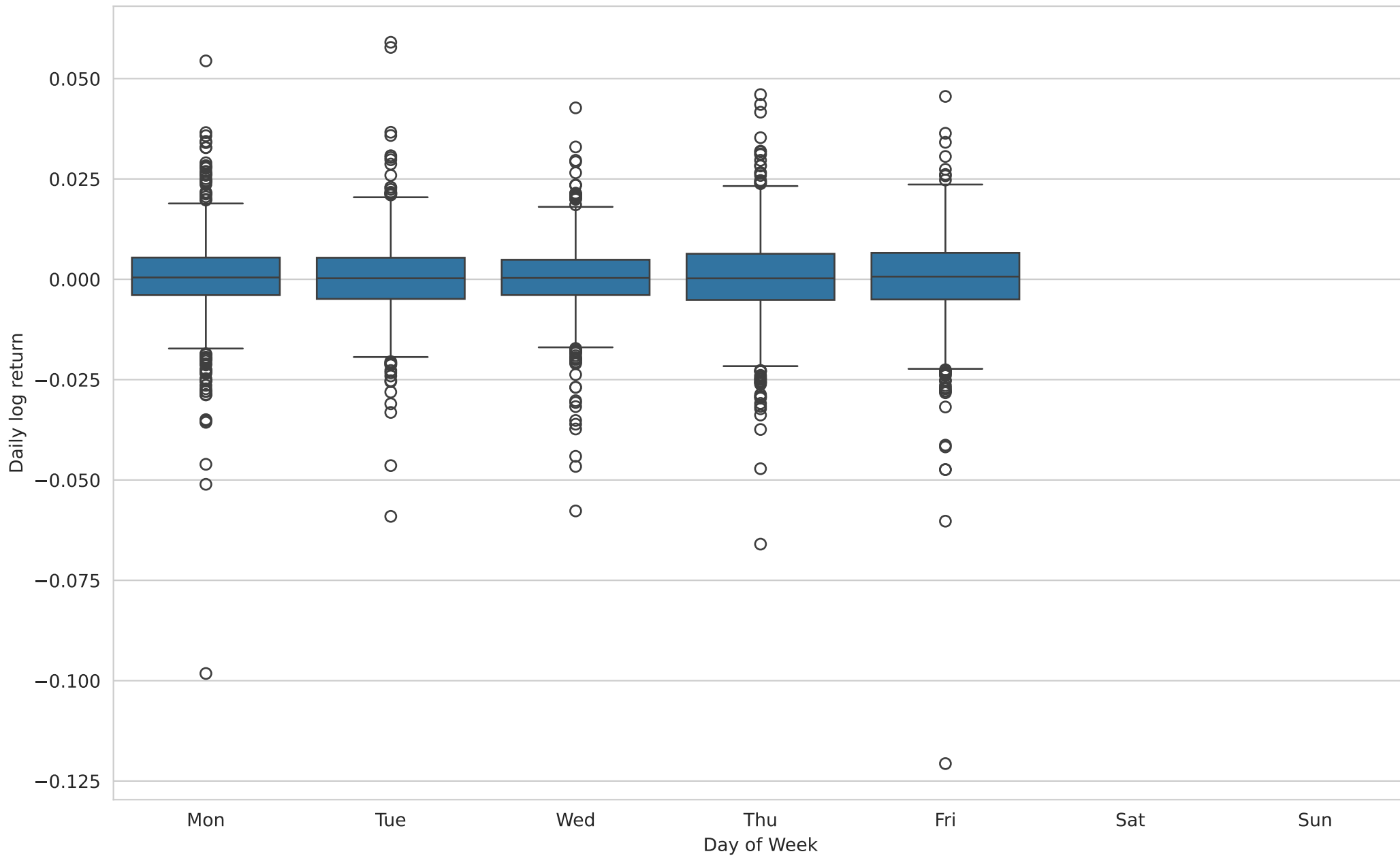
GC=F • ACF • Returns^2 (Volatility Clustering)



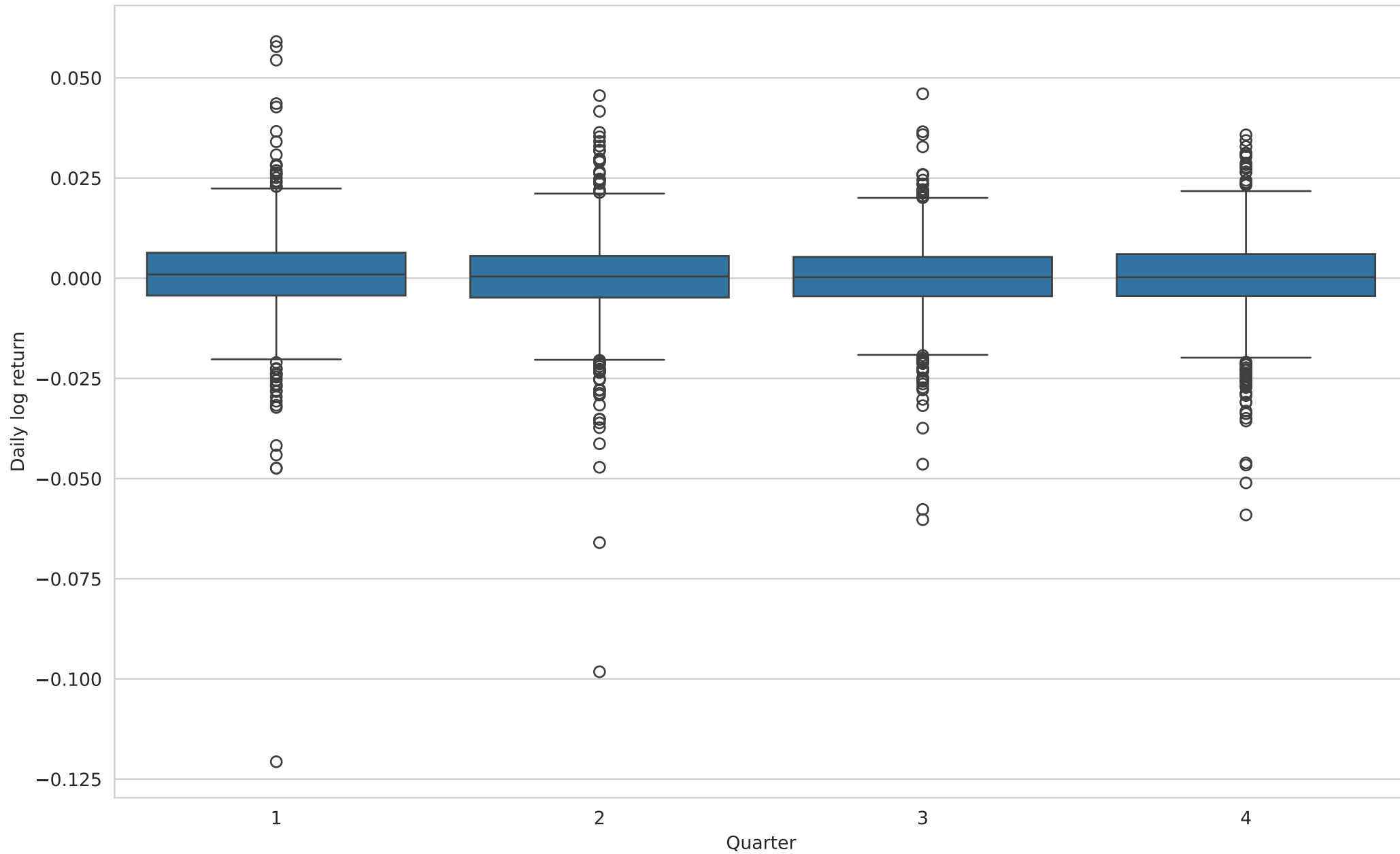
GC=F • Monthly Returns



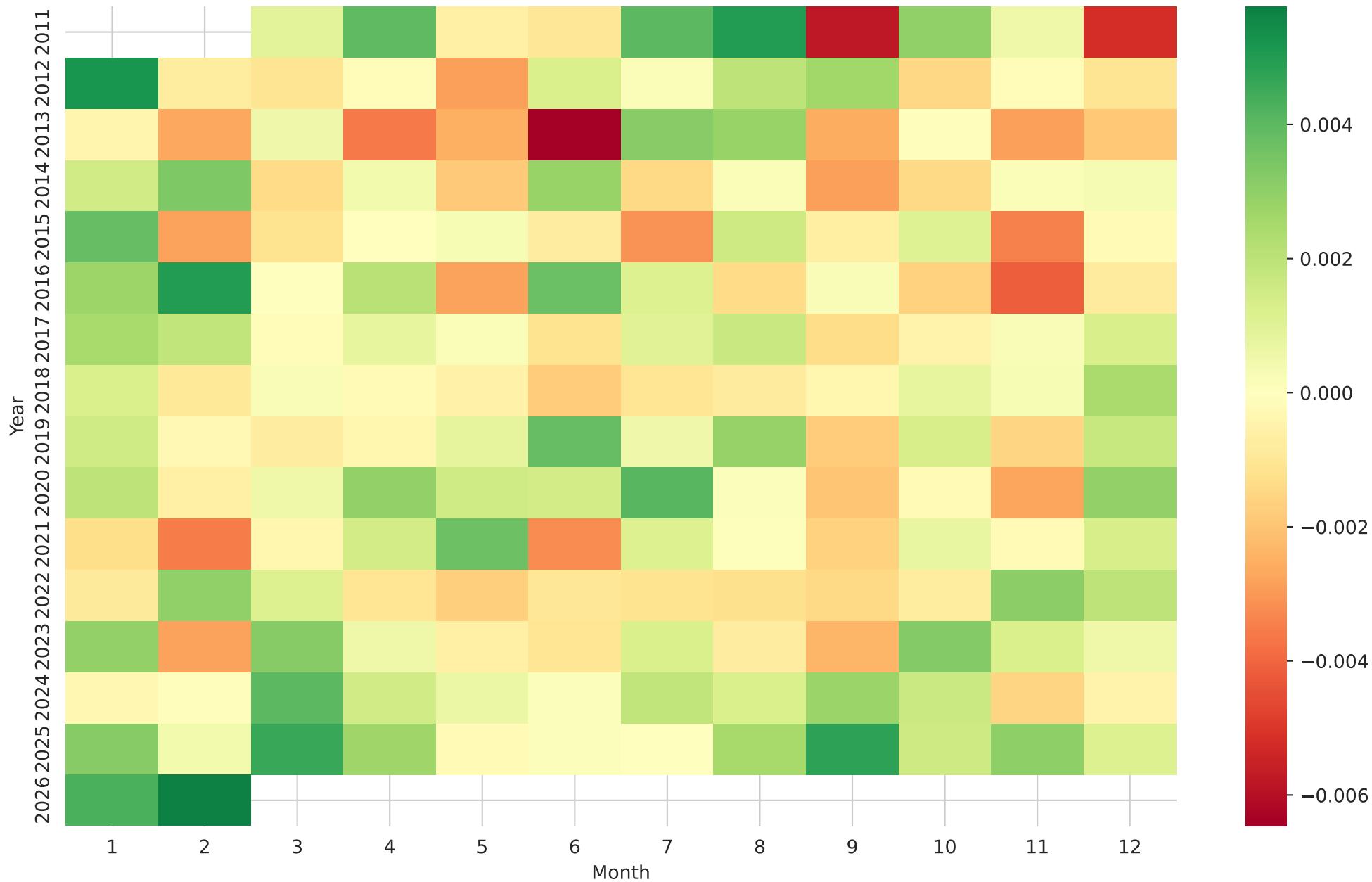
GC=F • Day-of-Week Returns



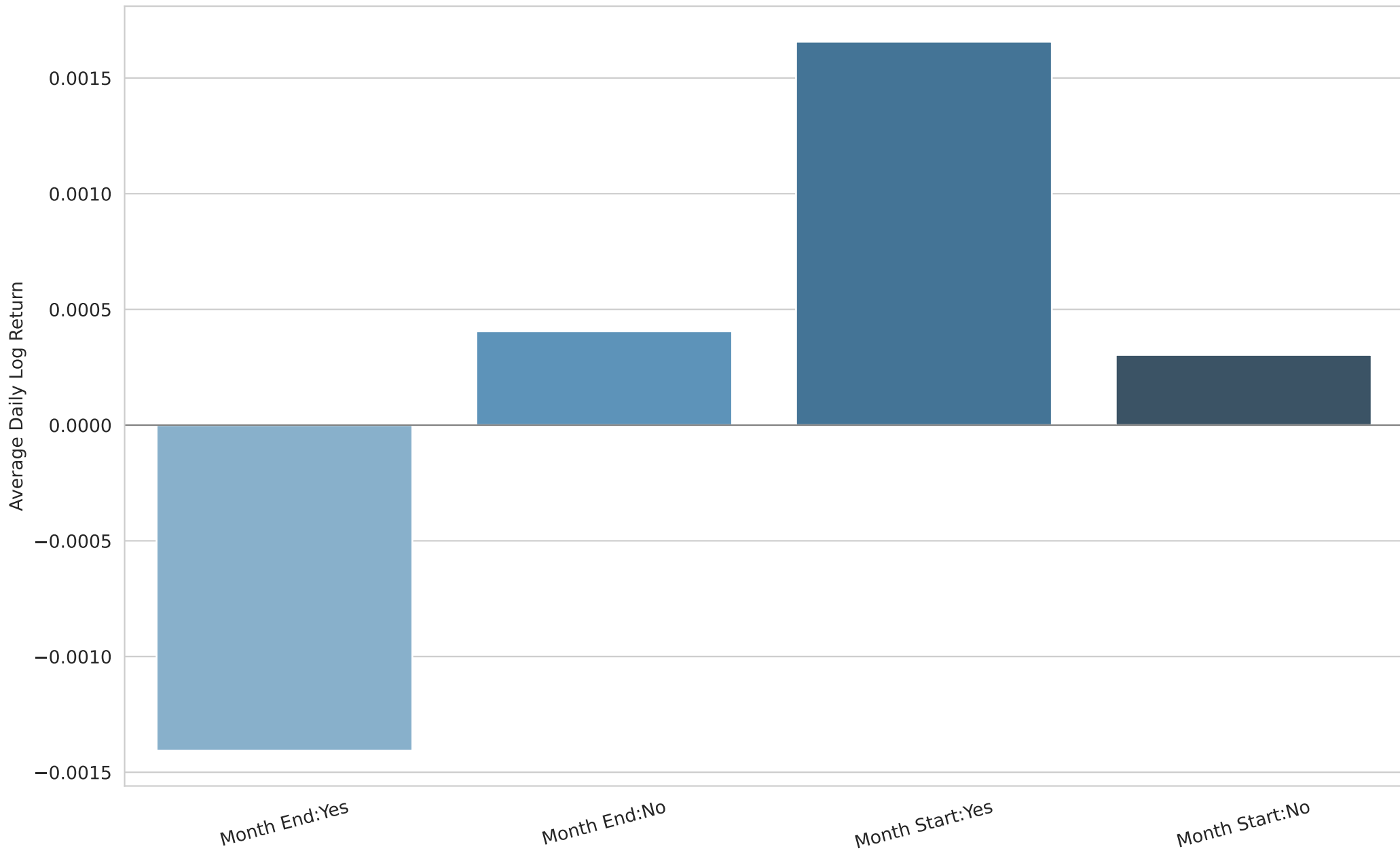
GC=F • Quarterly Returns



GC=F • Month×Year Heatmap (Avg Daily Returns)

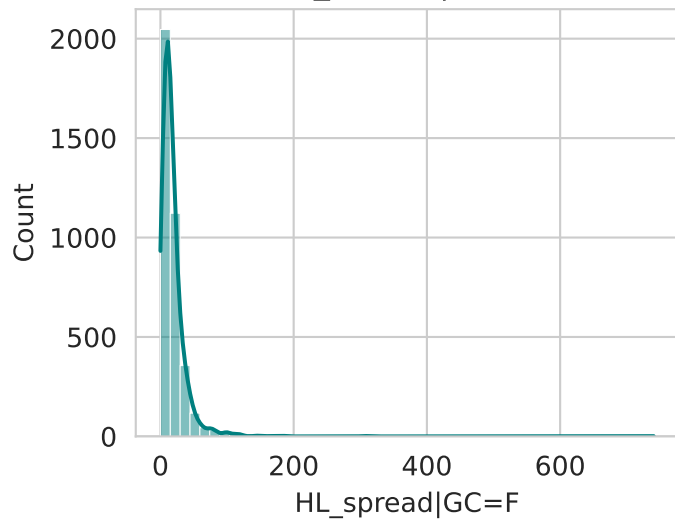


GC=F • Avg Returns: Month-End/Start vs Others

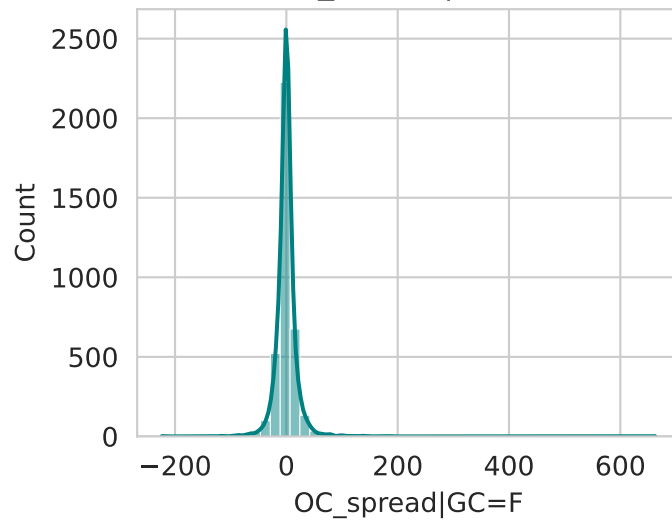


GC=F • Spreads

HL_spread|GC=F

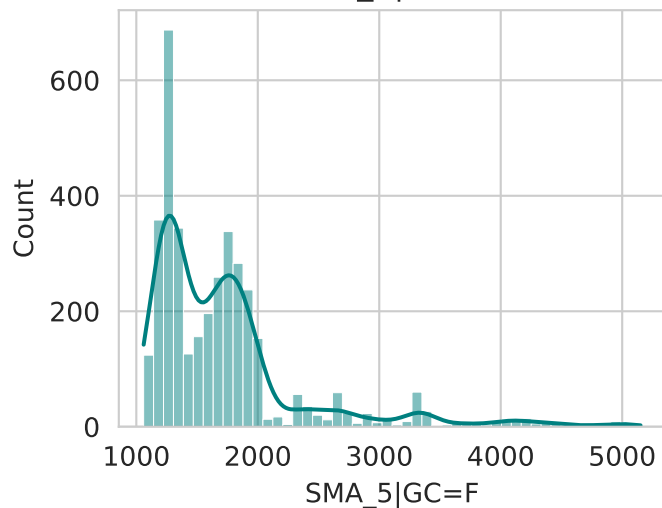


OC_spread|GC=F

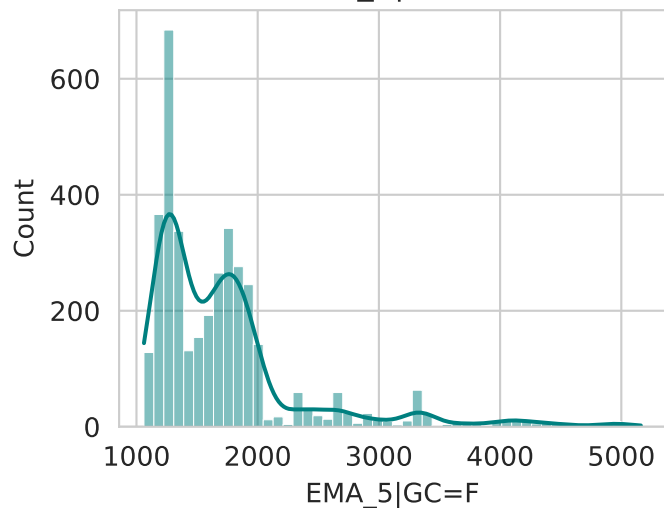


GC=F • Moving Averages / EMAs

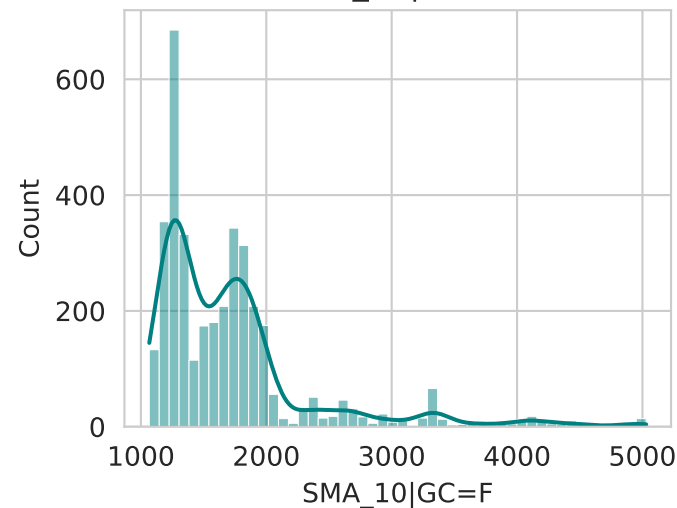
SMA_5|GC=F



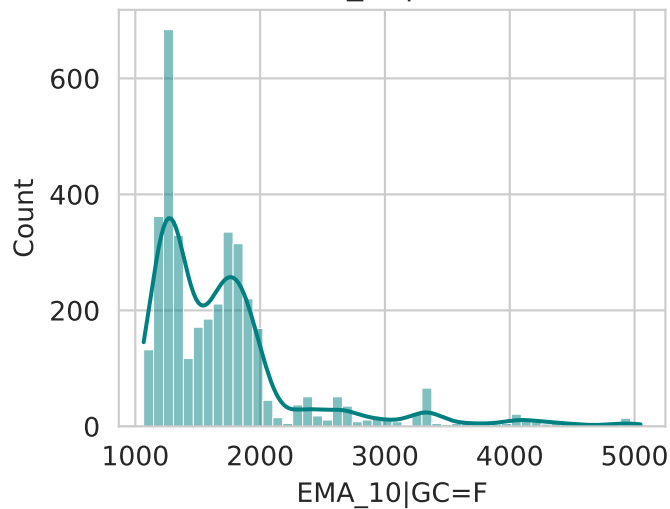
EMA_5|GC=F



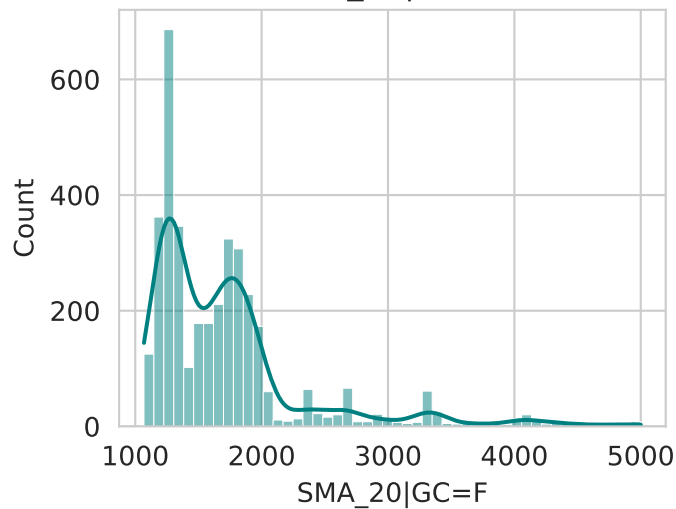
SMA_10|GC=F



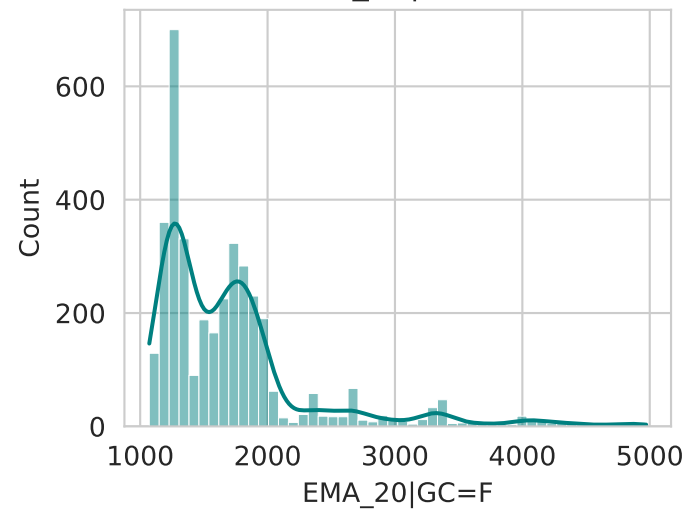
EMA_10|GC=F



SMA_20|GC=F

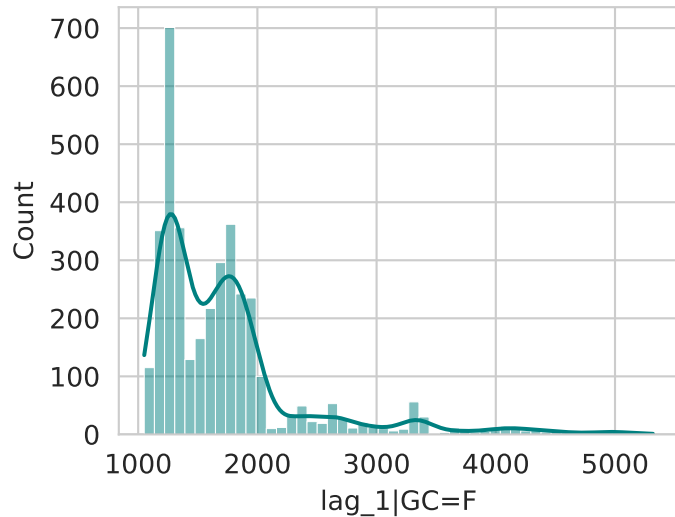


EMA_20|GC=F

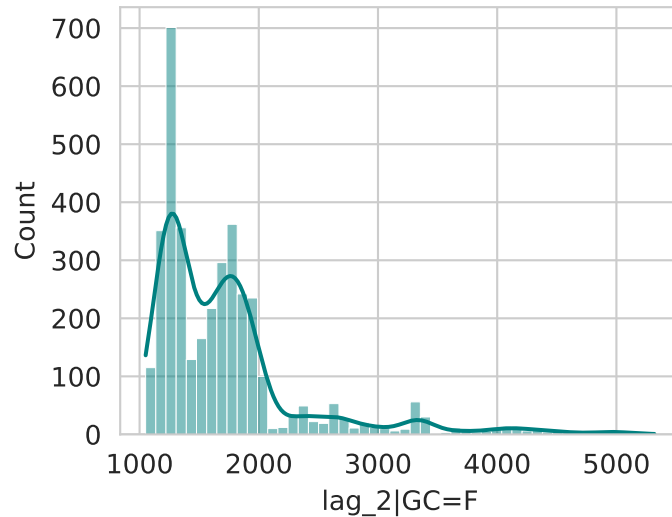


GC=F • Lagged Prices

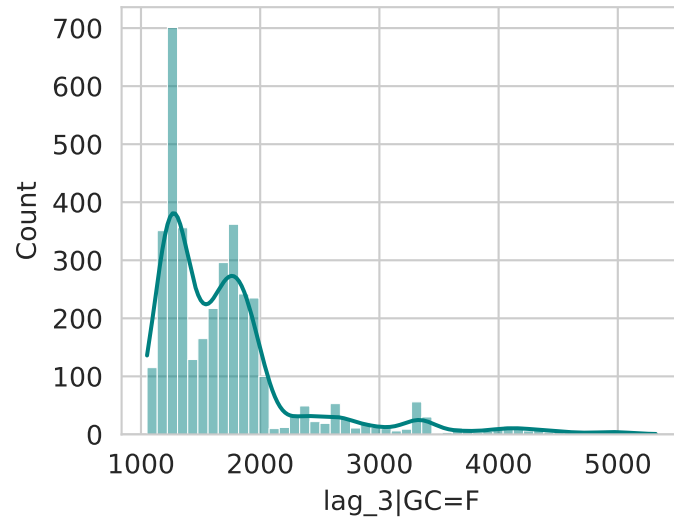
lag_1|GC=F



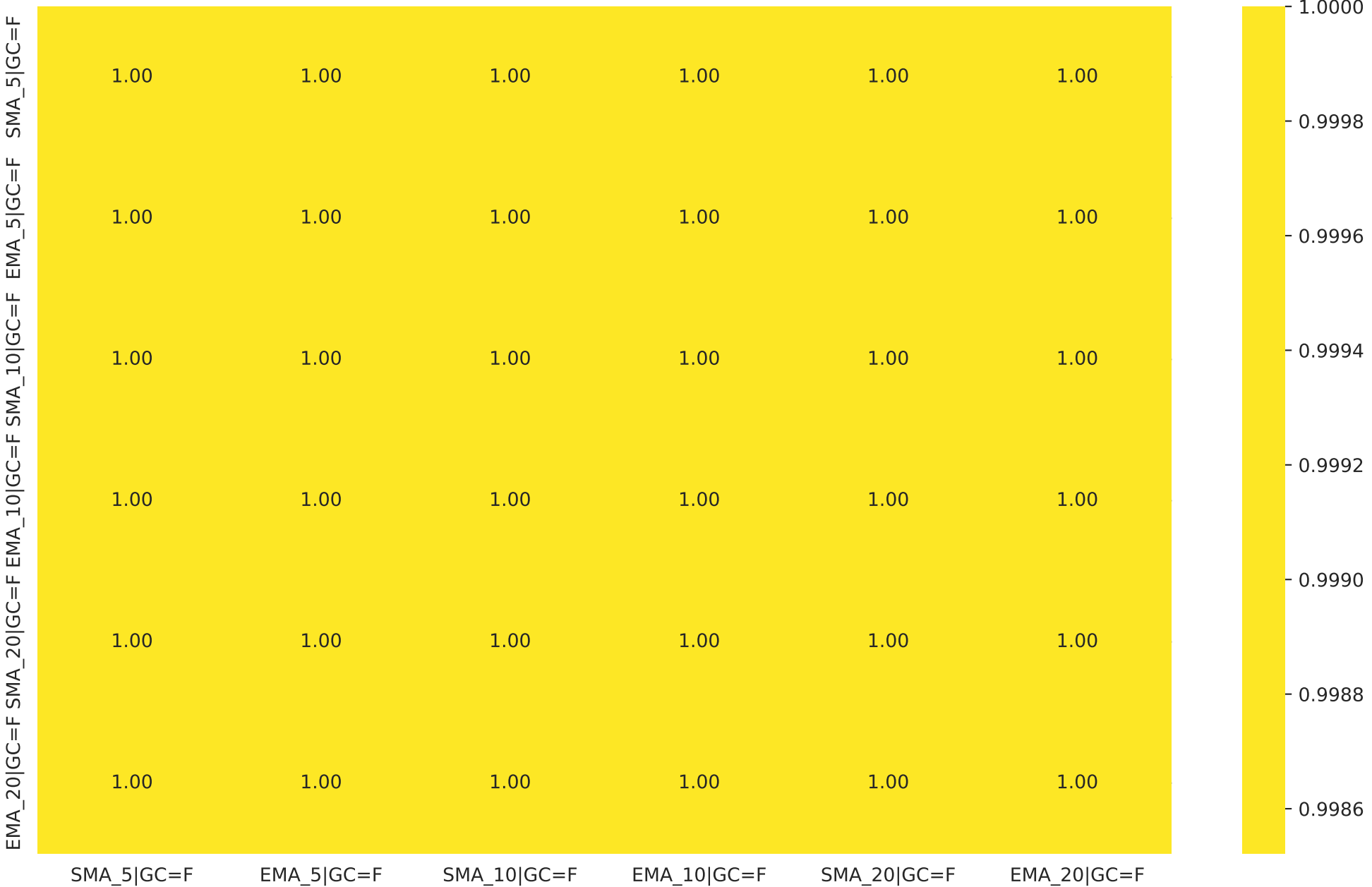
lag_2|GC=F



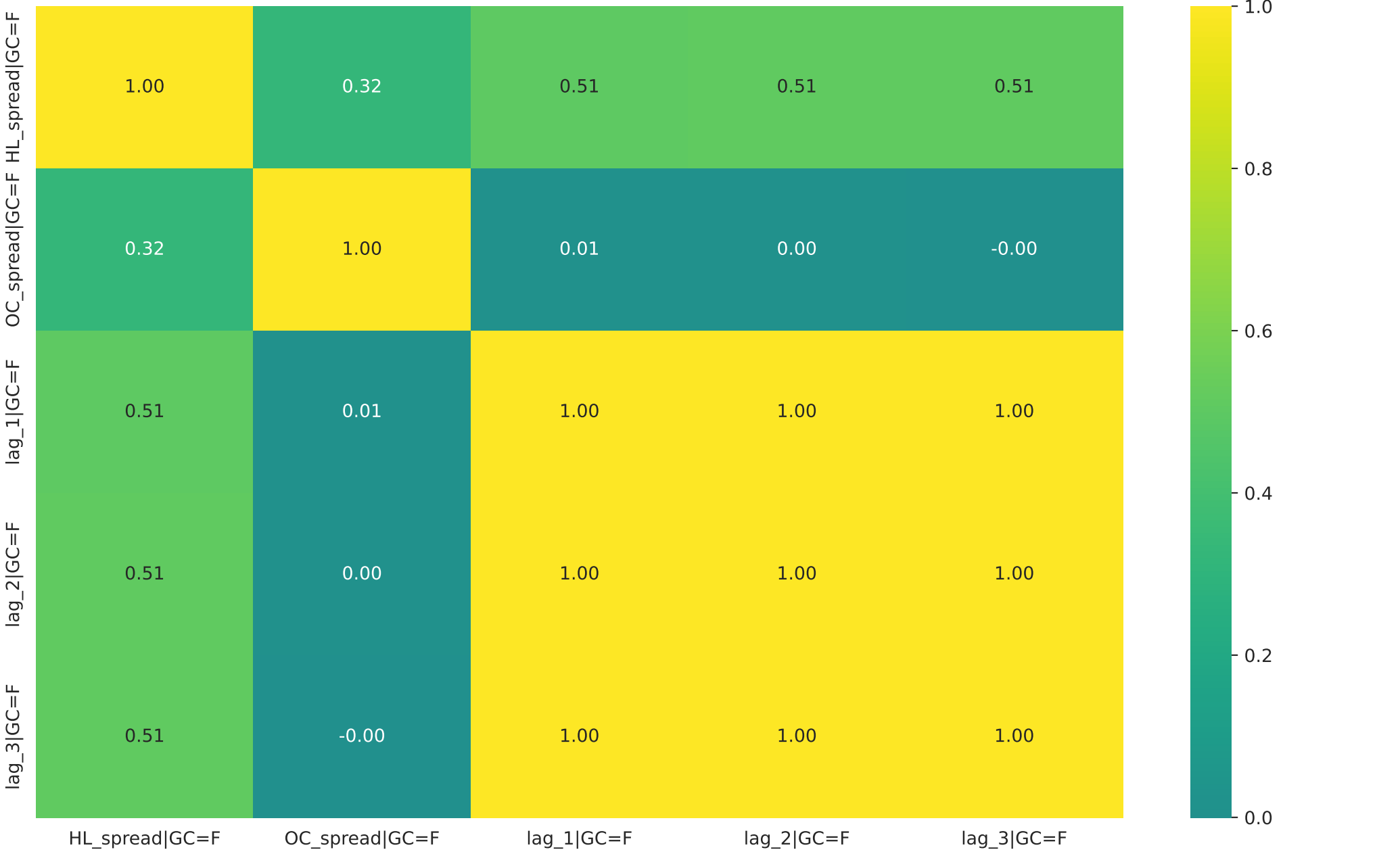
lag_3|GC=F



GC=F • Correlation • Moving Averages



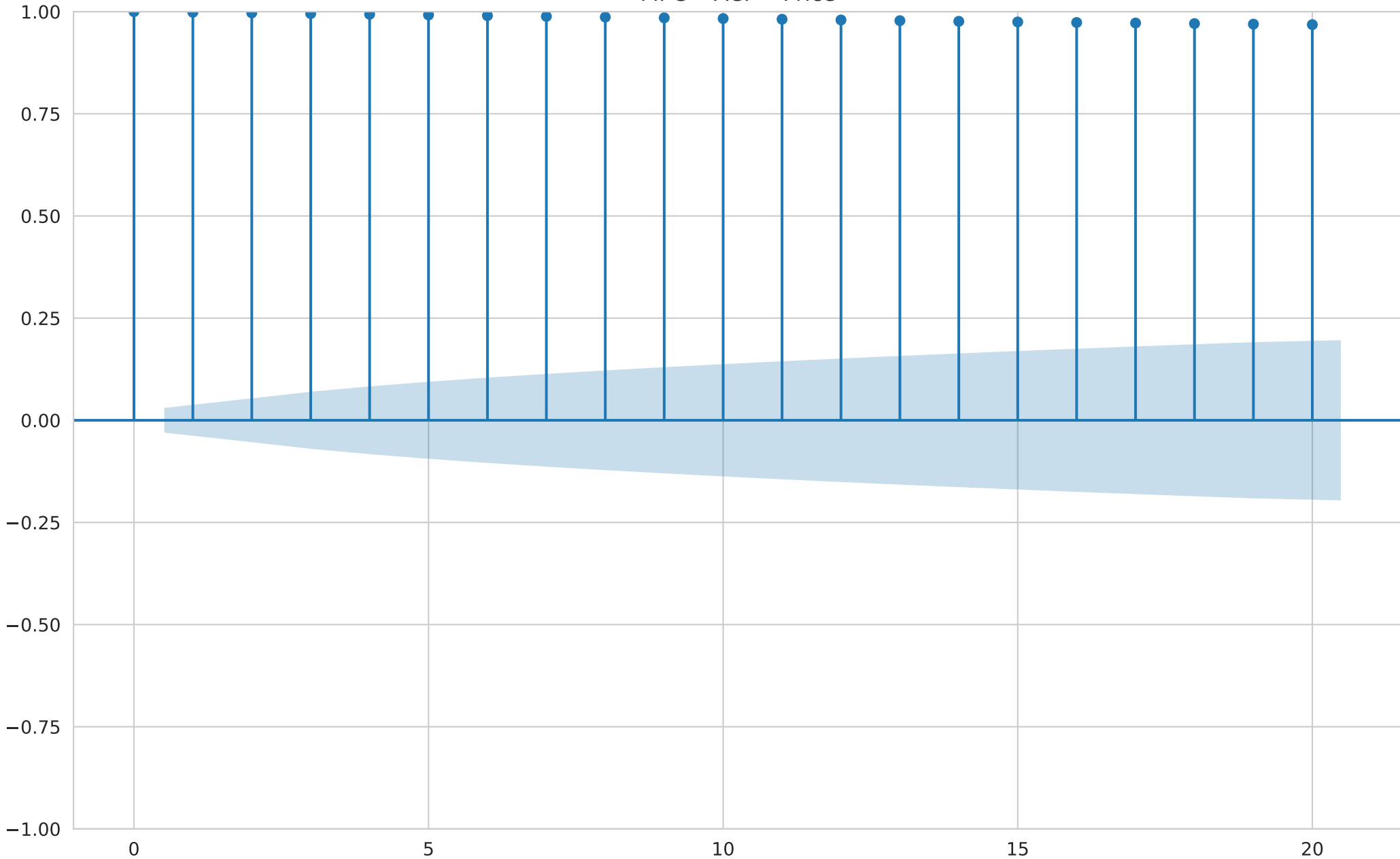
GC=F • Correlation • Spreads + Lags



MPC • Price



MPC • ACF • Price



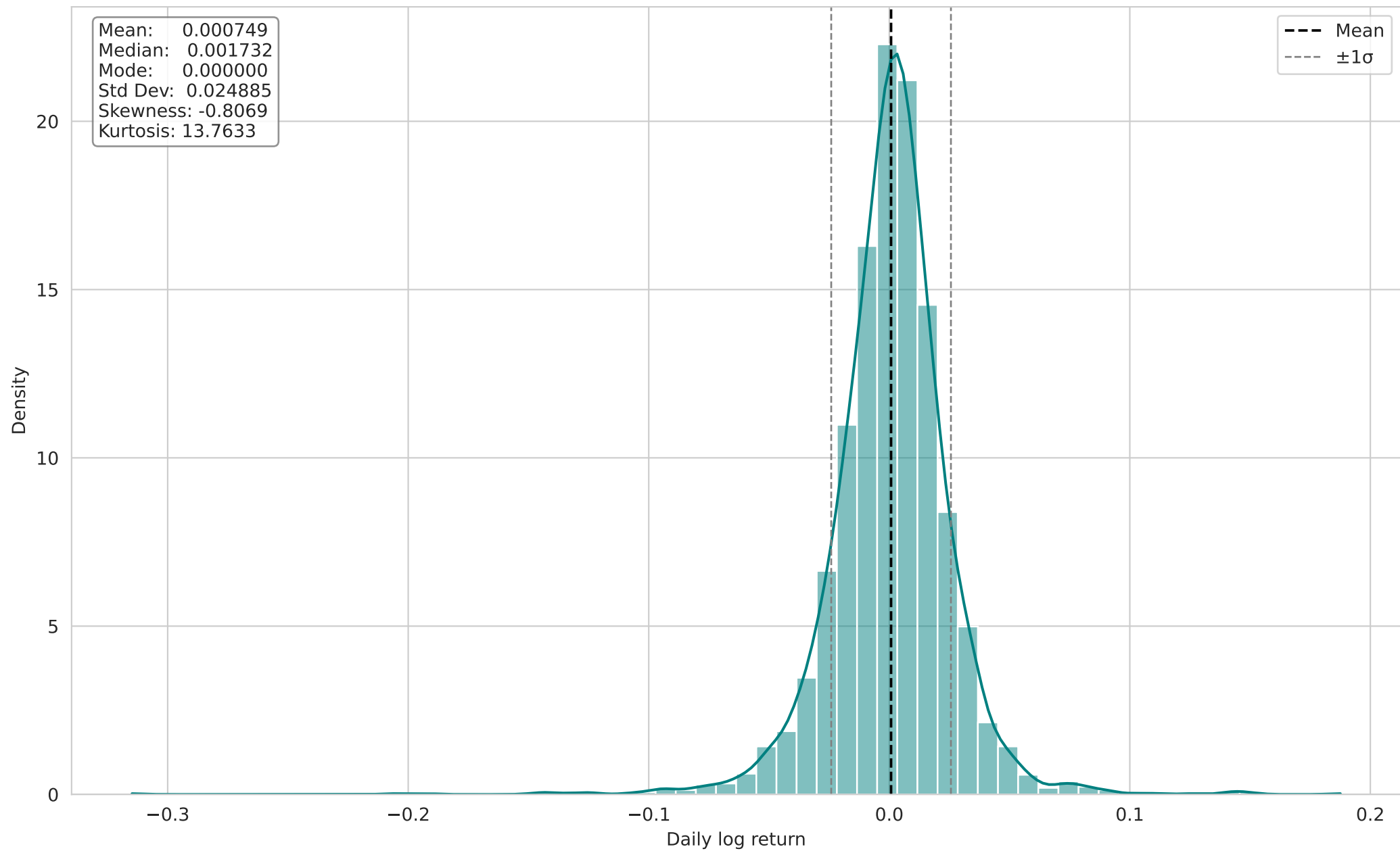
MPC • Moving Averages (5/10/20)



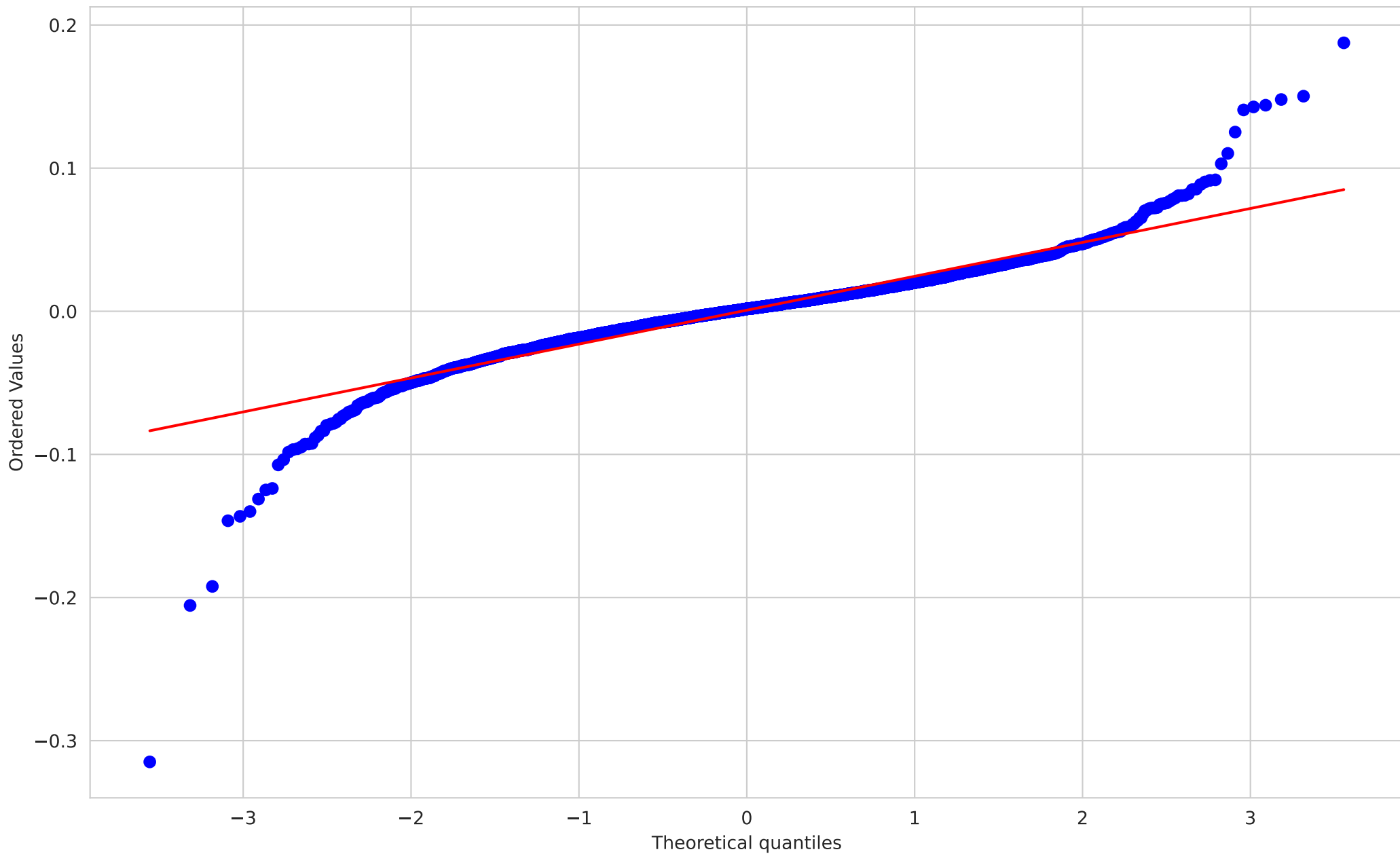
MPC • Daily Log Returns



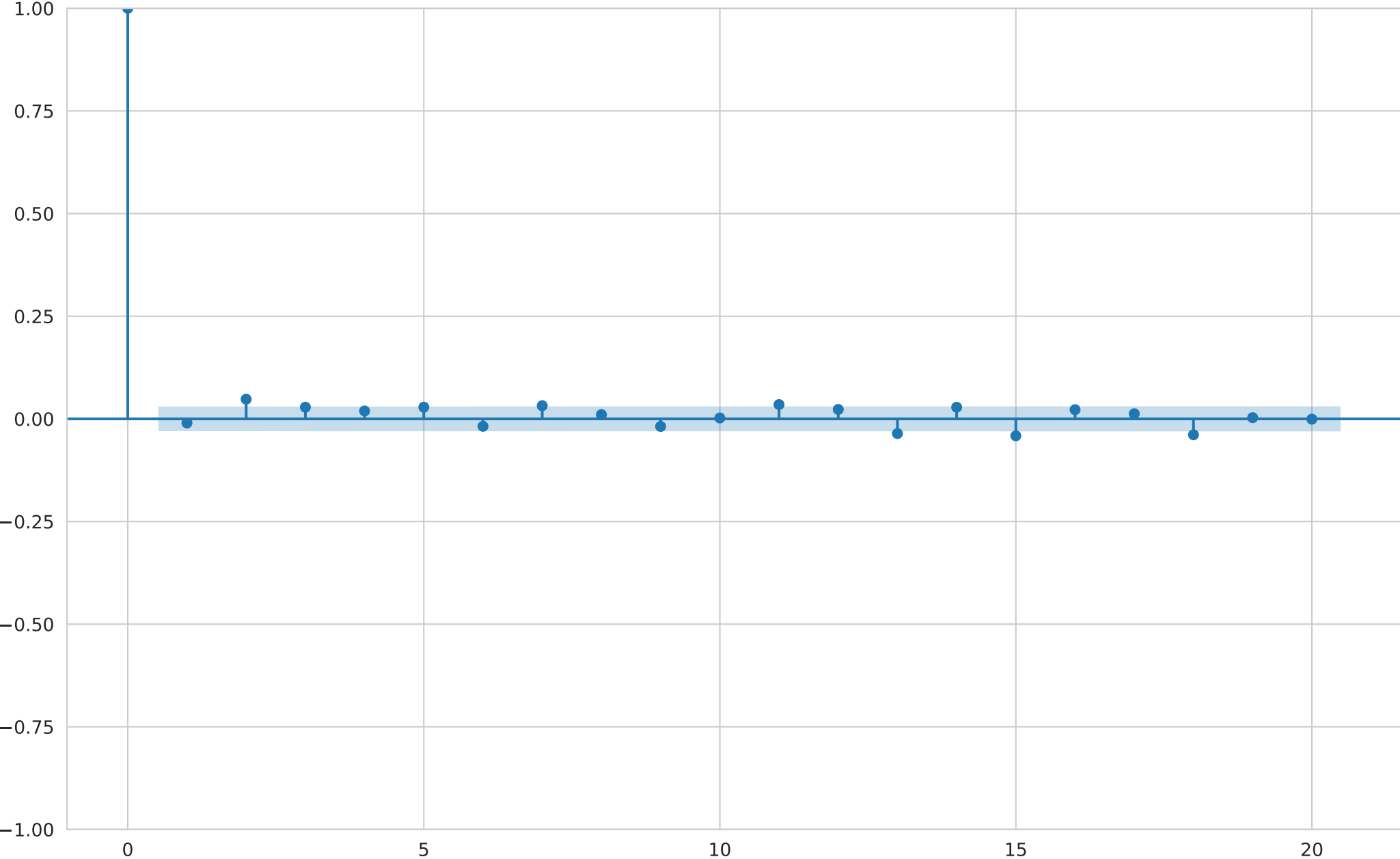
MPC • Returns • Distribution



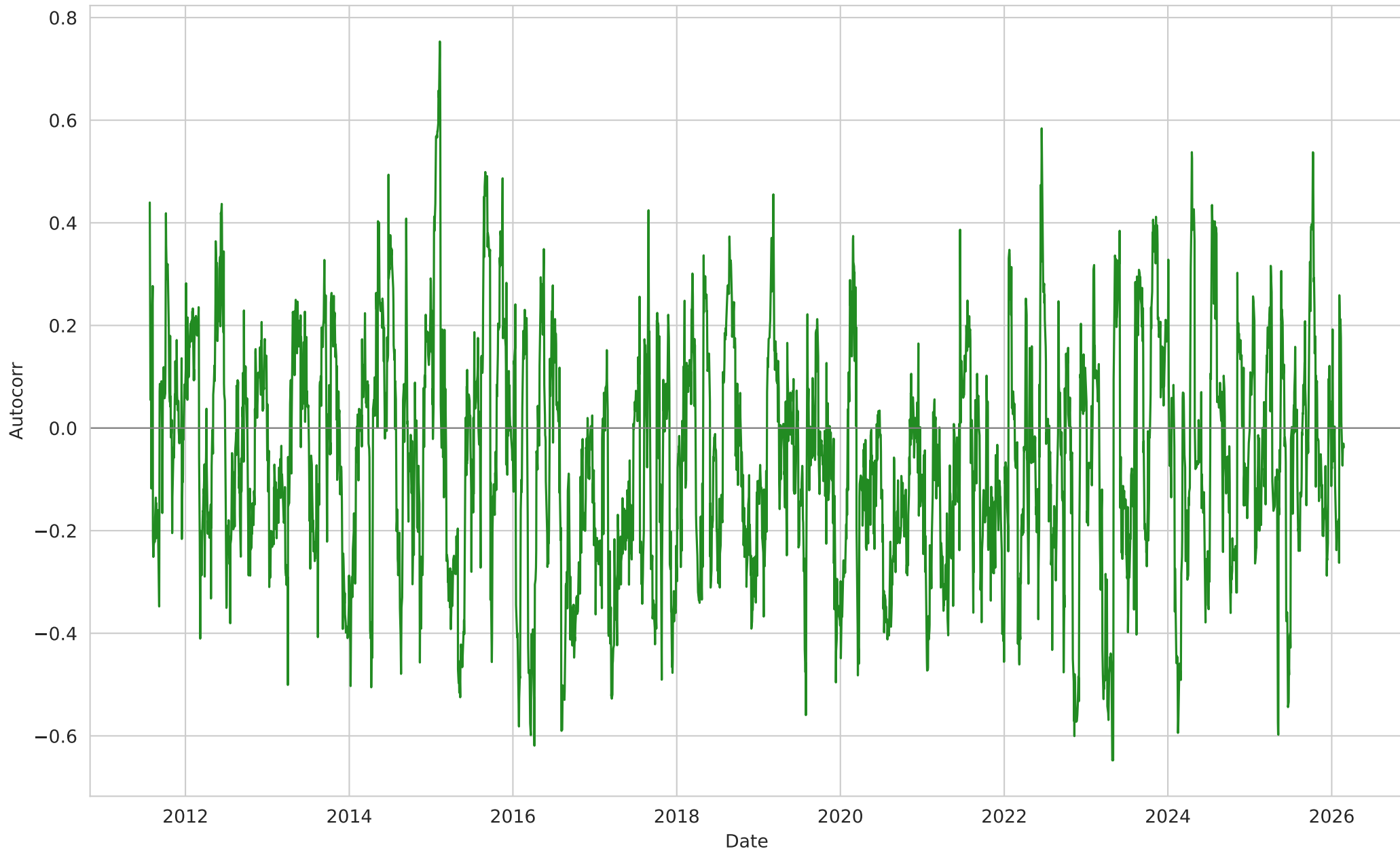
MPC • Returns • Q-Q Plot vs Normal



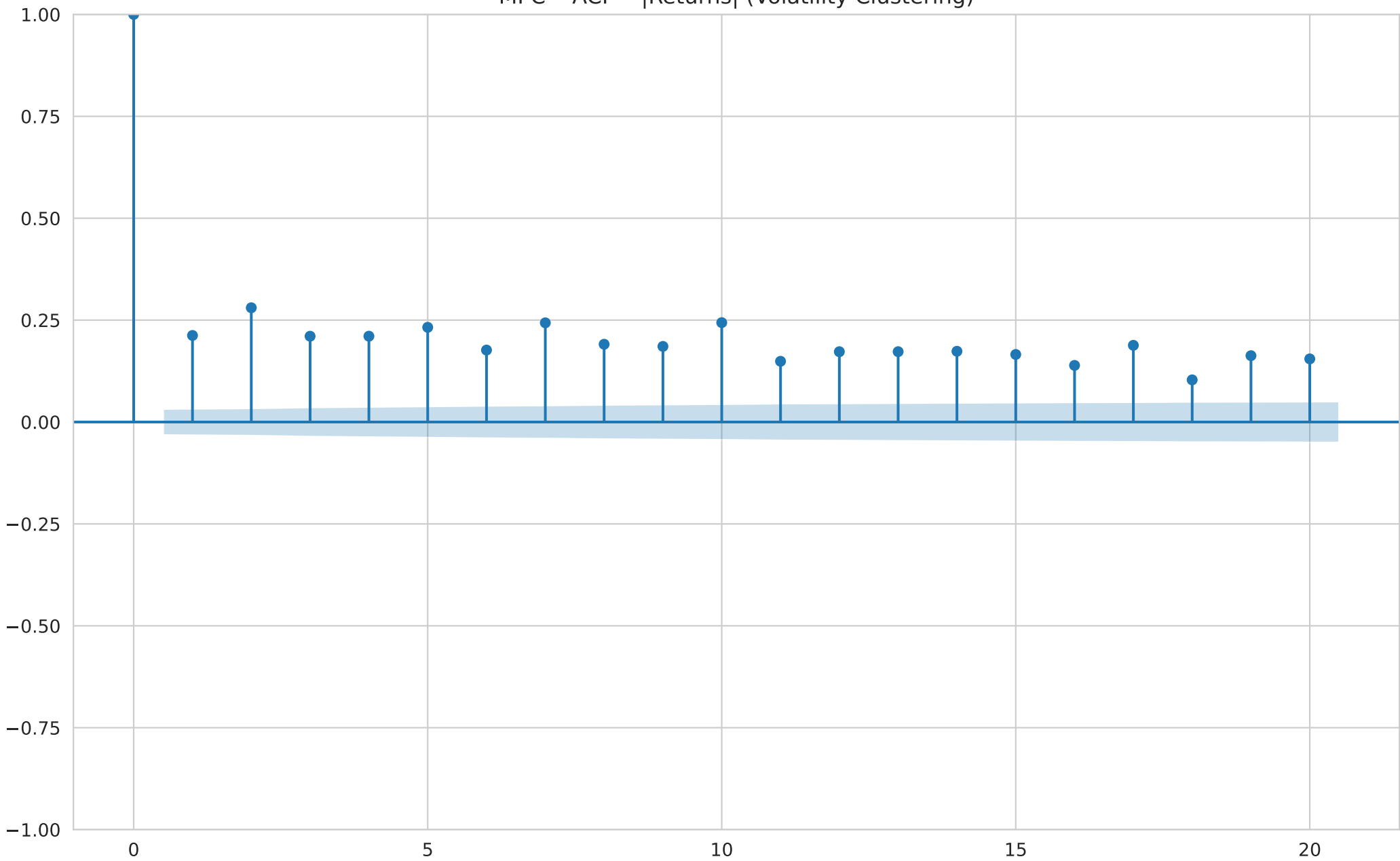
MPC • ACF • Returns



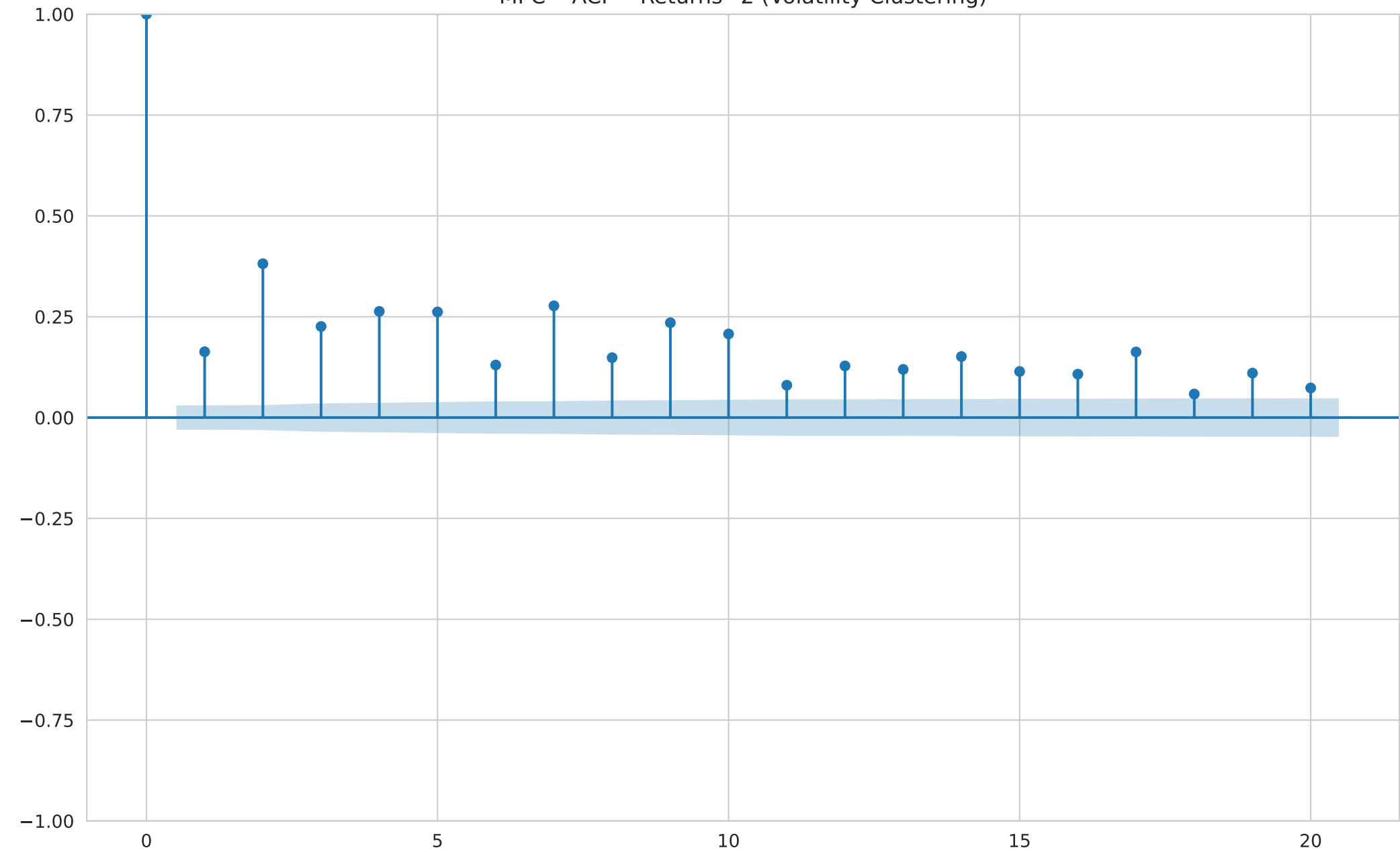
MPC • Rolling Autocorrelation (lag=1, window=20)



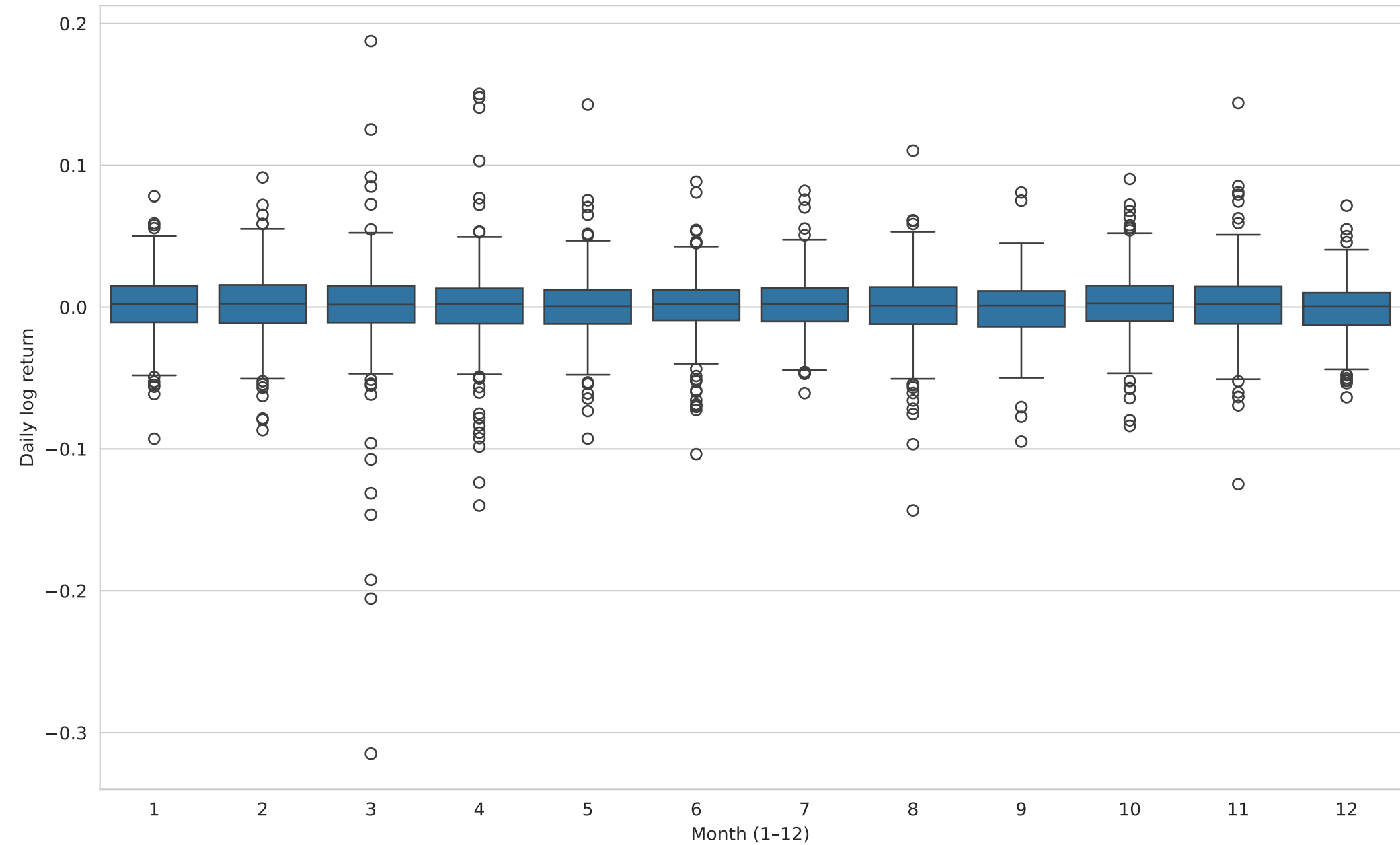
MPC • ACF • |Returns| (Volatility Clustering)



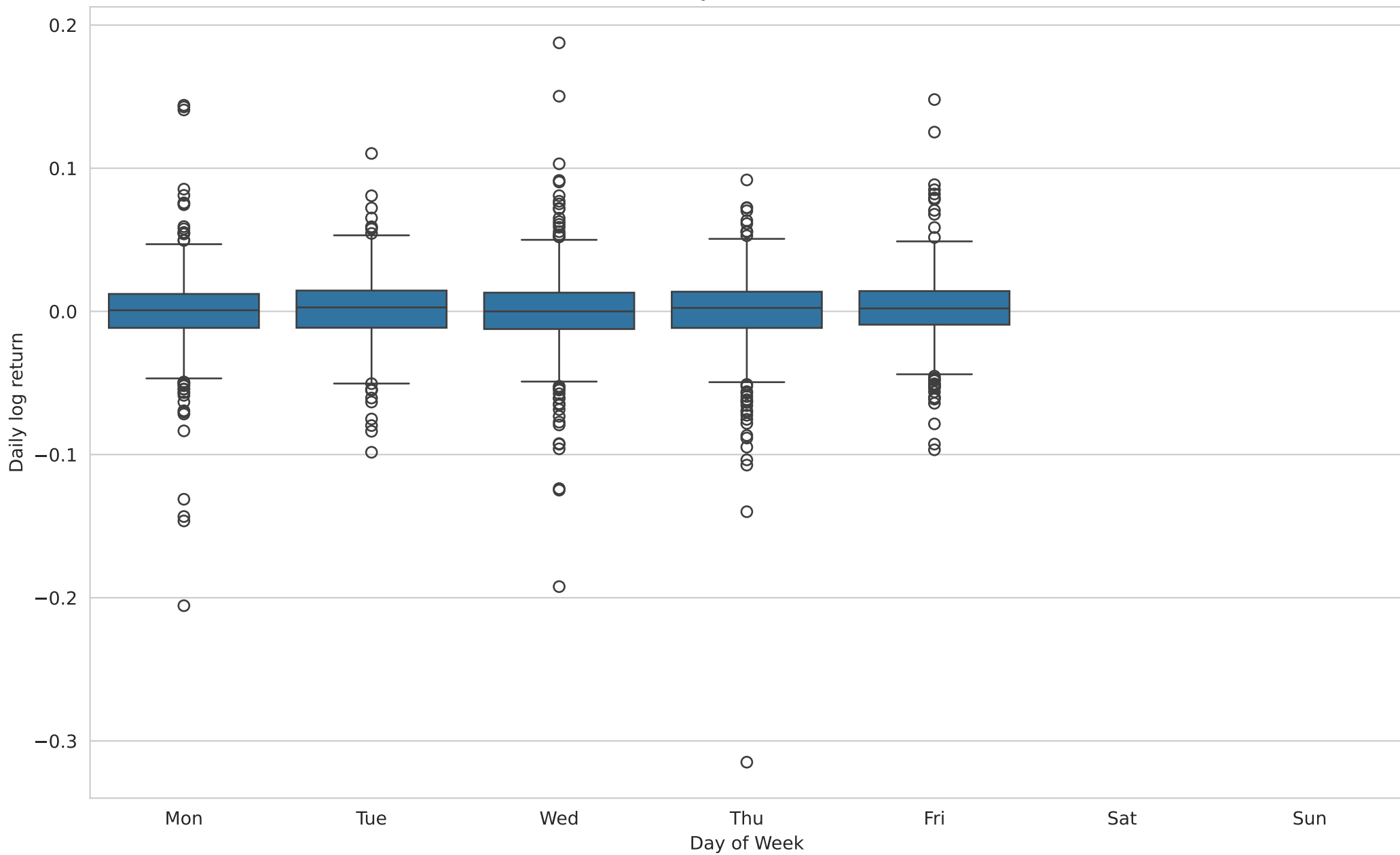
MPC • ACF • Returns^2 (Volatility Clustering)



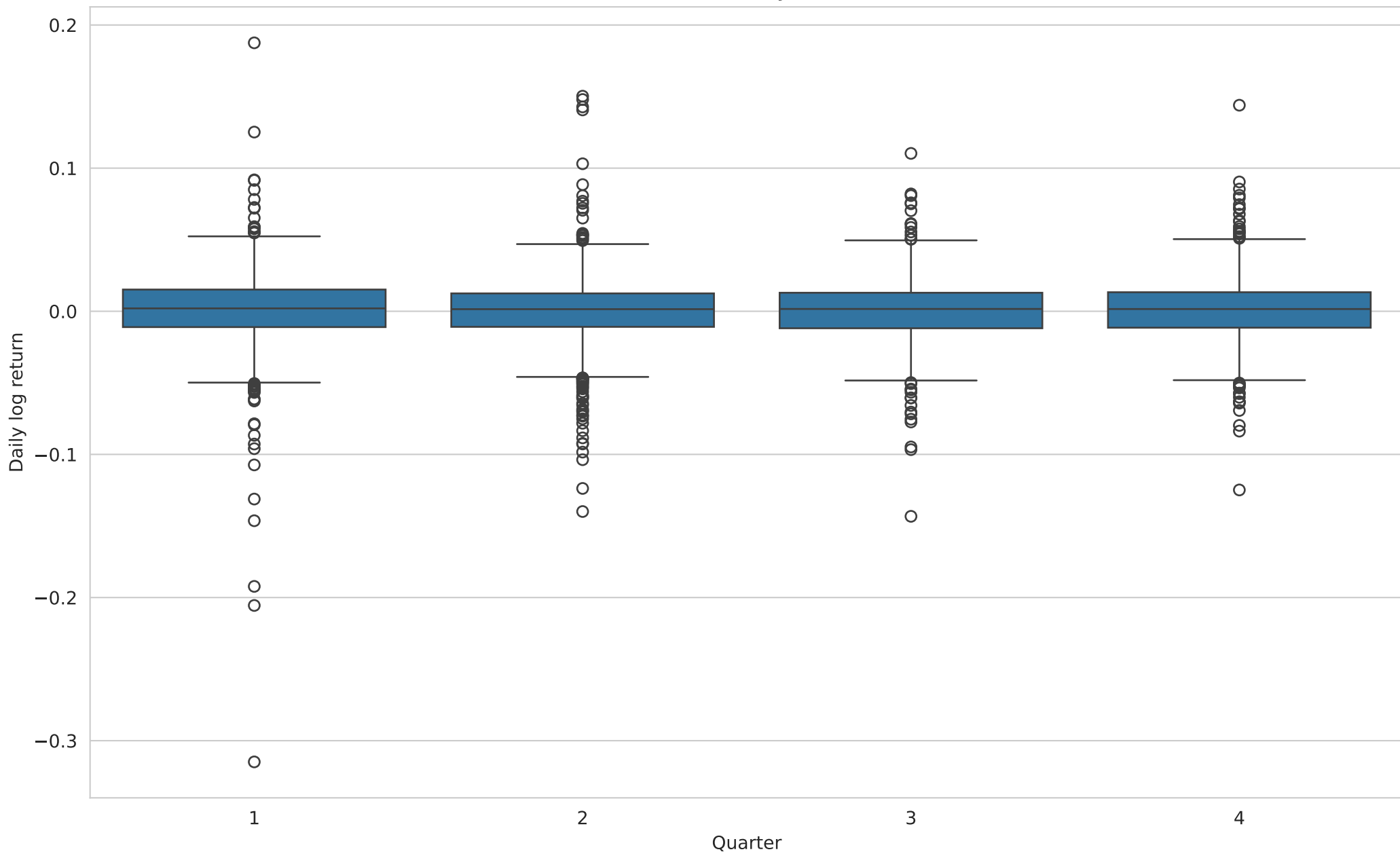
MPC • Monthly Returns



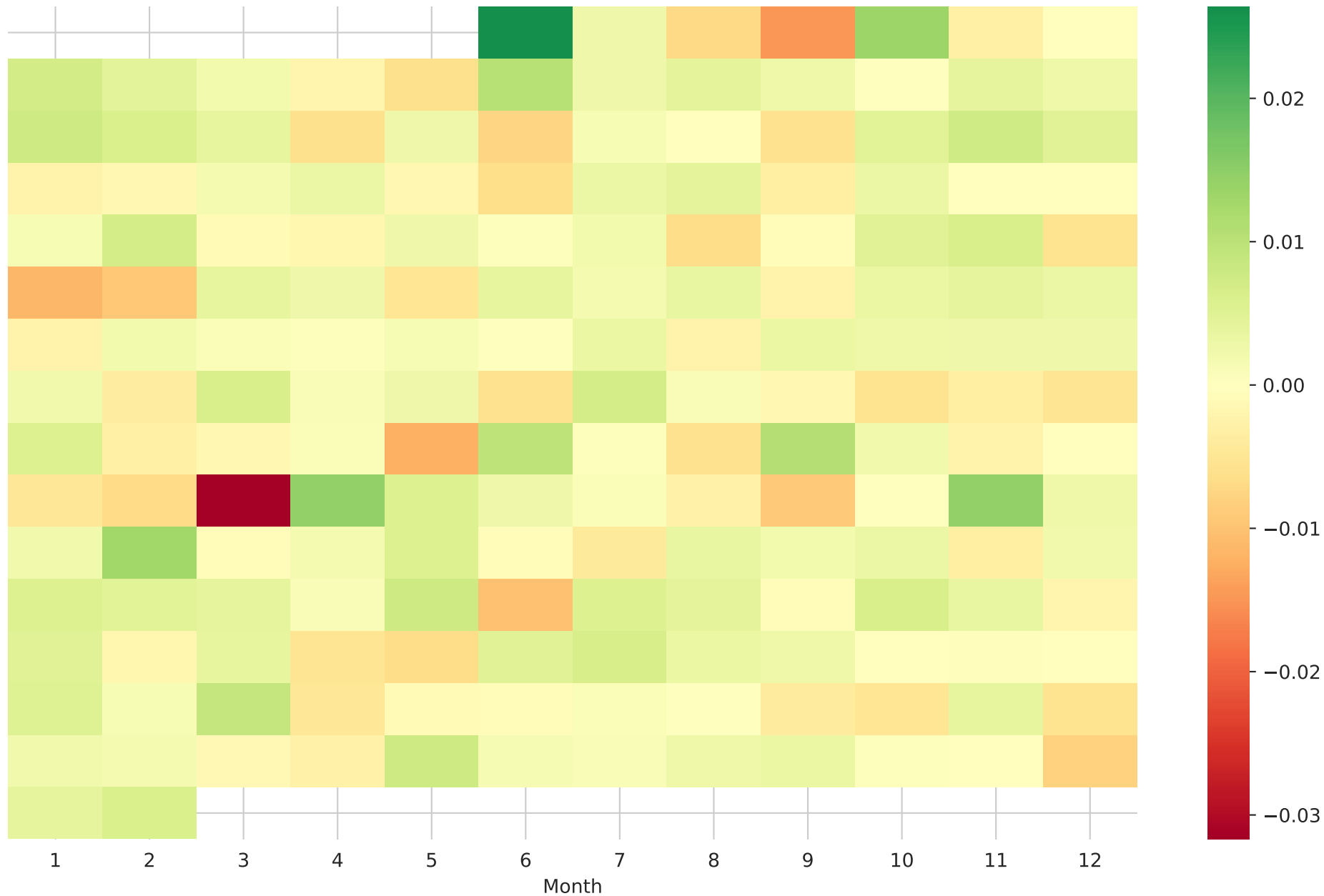
MPC • Day-of-Week Returns



MPC • Quarterly Returns

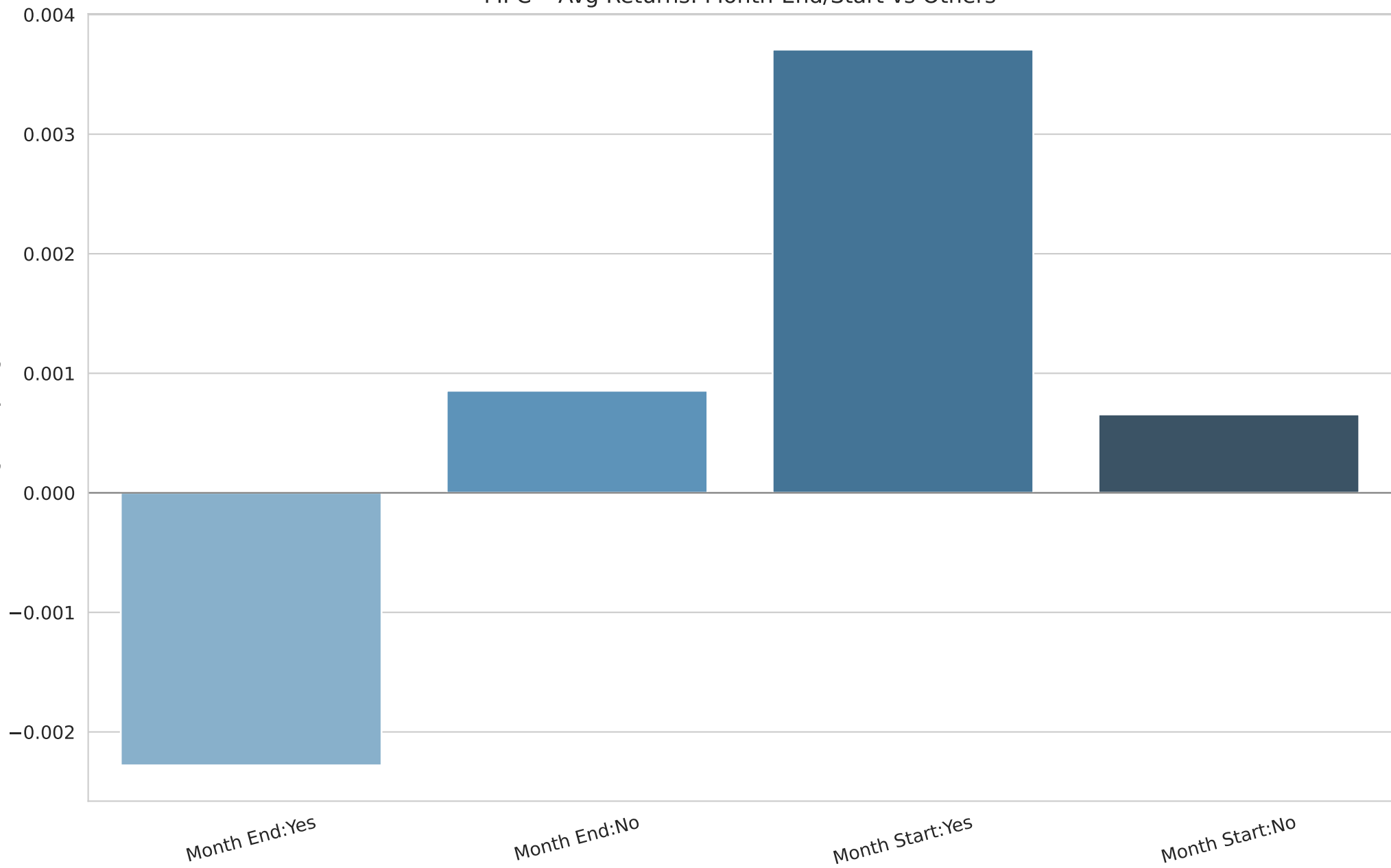


2026 2025 2024 2023 2022 2021 2020 2019 2018 2017 2016 2015 2014 2013 2012 2011



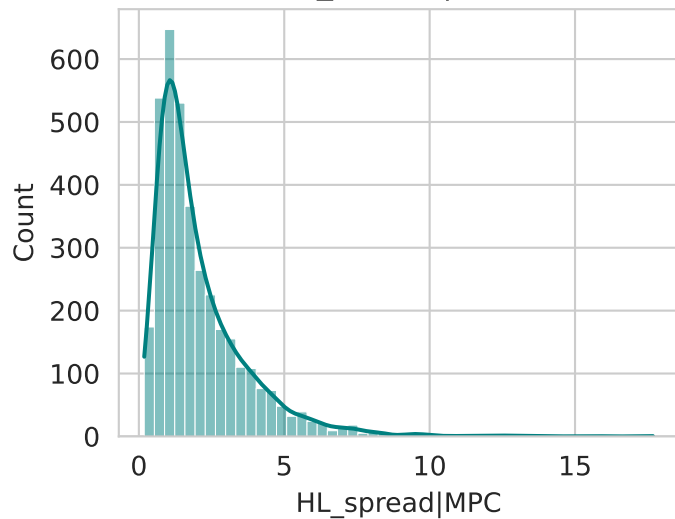
MPC • Avg Returns: Month-End/Start vs Others

Average Daily Log Return

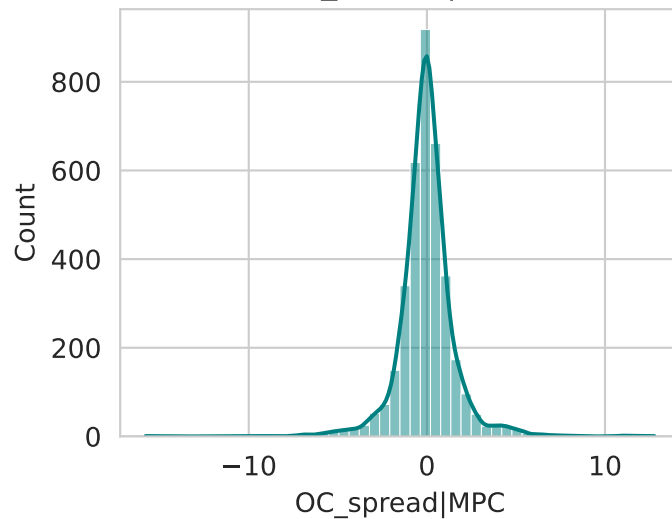


MPC • Spreads

HL_spread|MPC

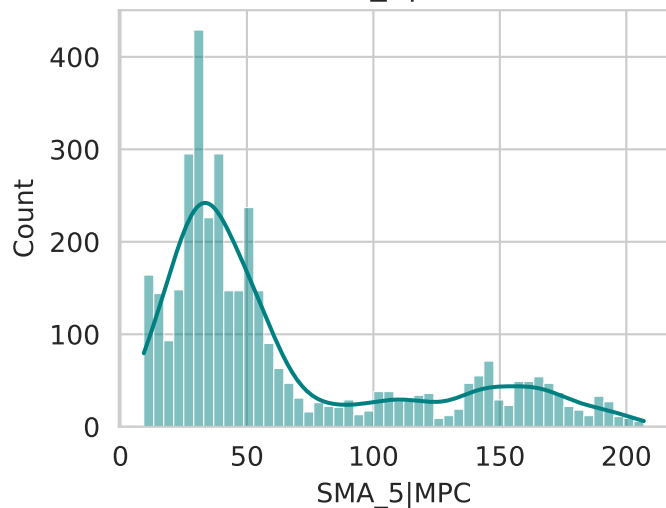


OC_spread|MPC

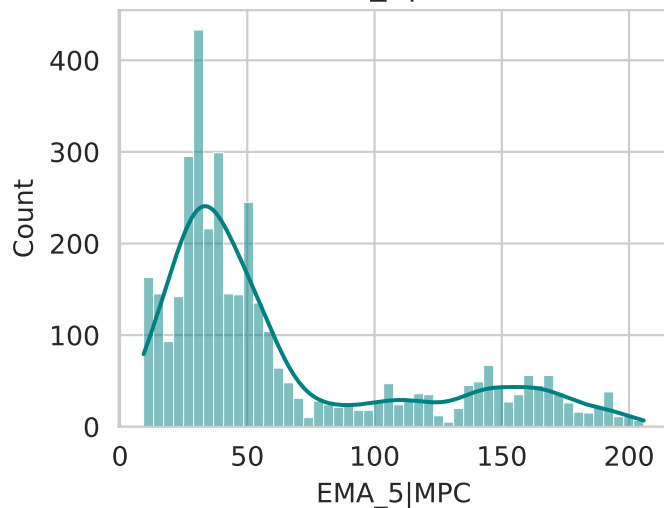


MPC • Moving Averages / EMAs

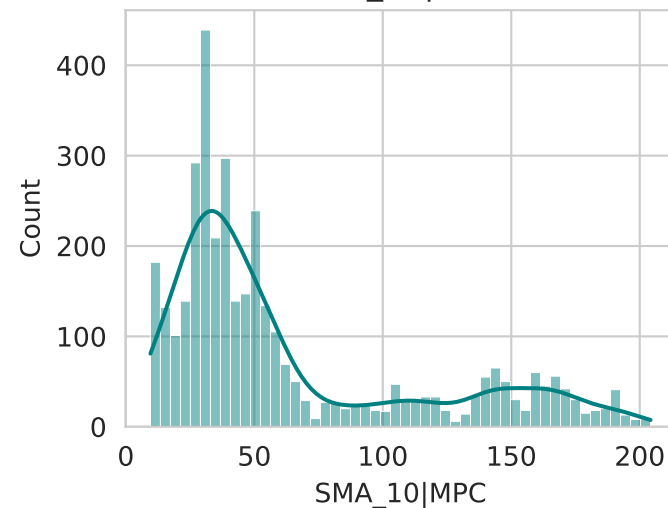
SMA_5|MPC



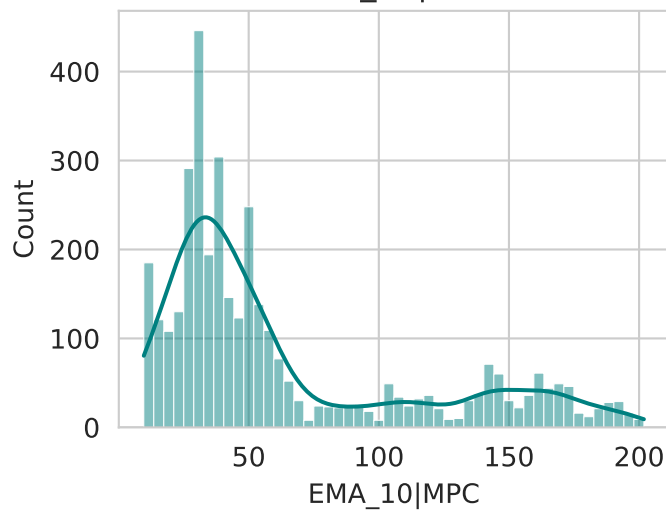
EMA_5|MPC



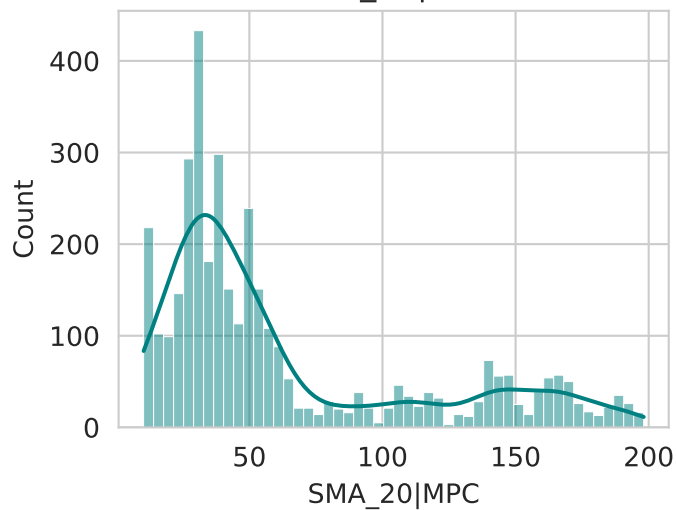
SMA_10|MPC



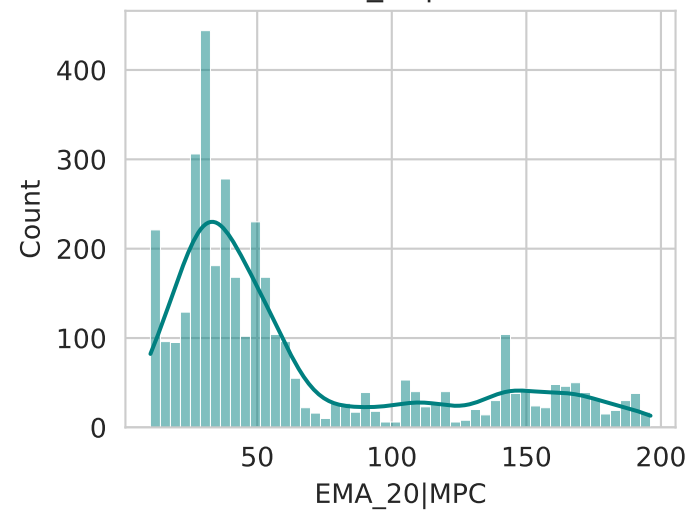
EMA_10|MPC



SMA_20|MPC

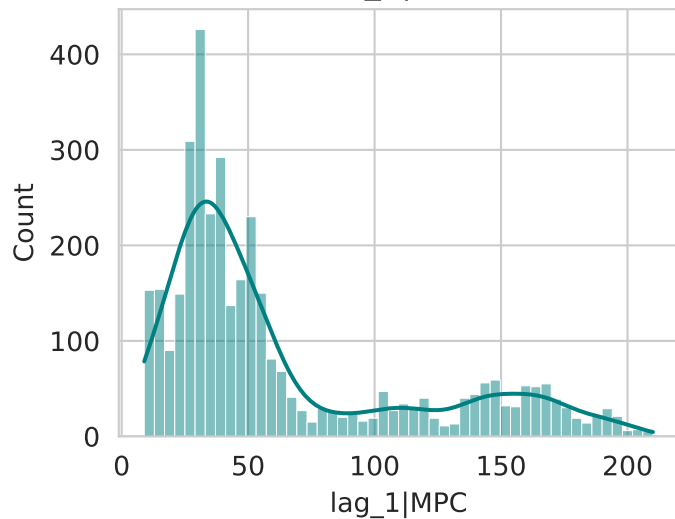


EMA_20|MPC

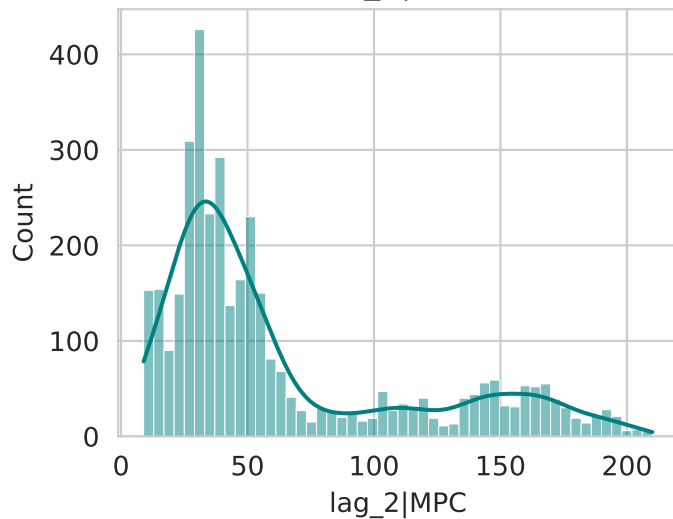


MPC • Lagged Prices

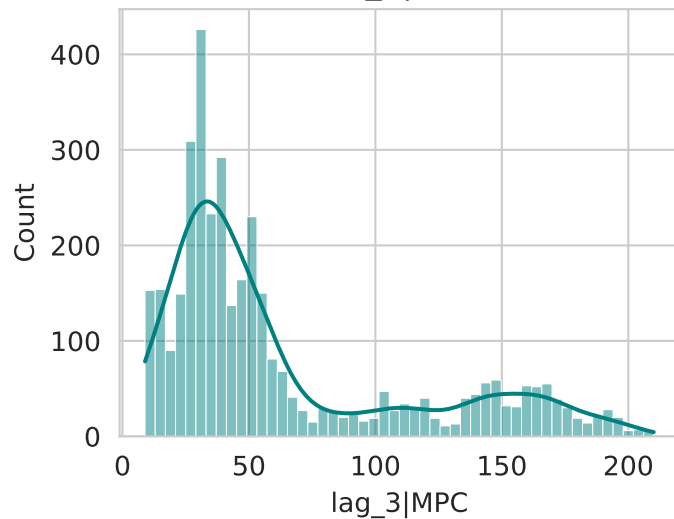
lag_1|MPC



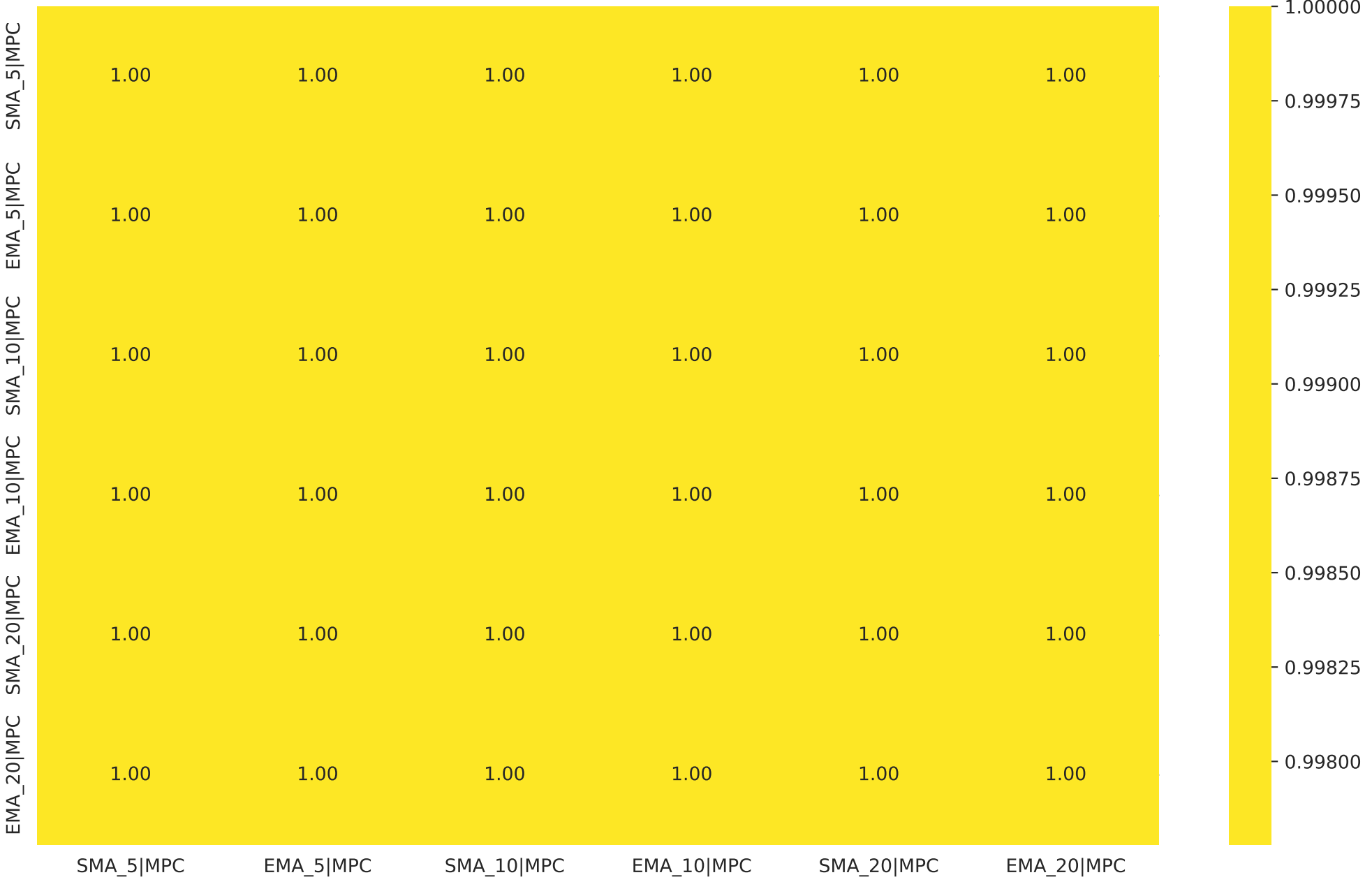
lag_2|MPC



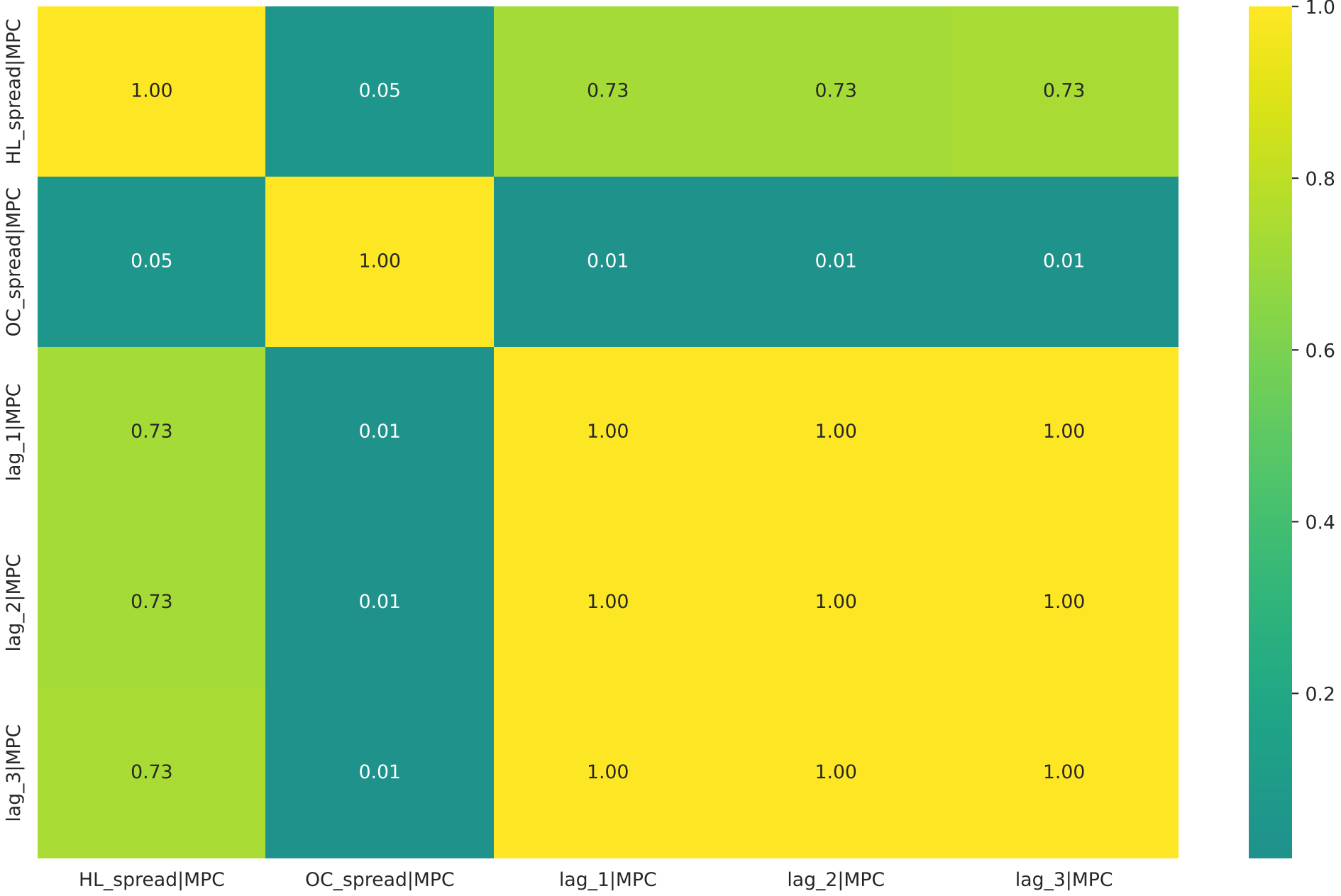
lag_3|MPC



MPC • Correlation • Moving Averages



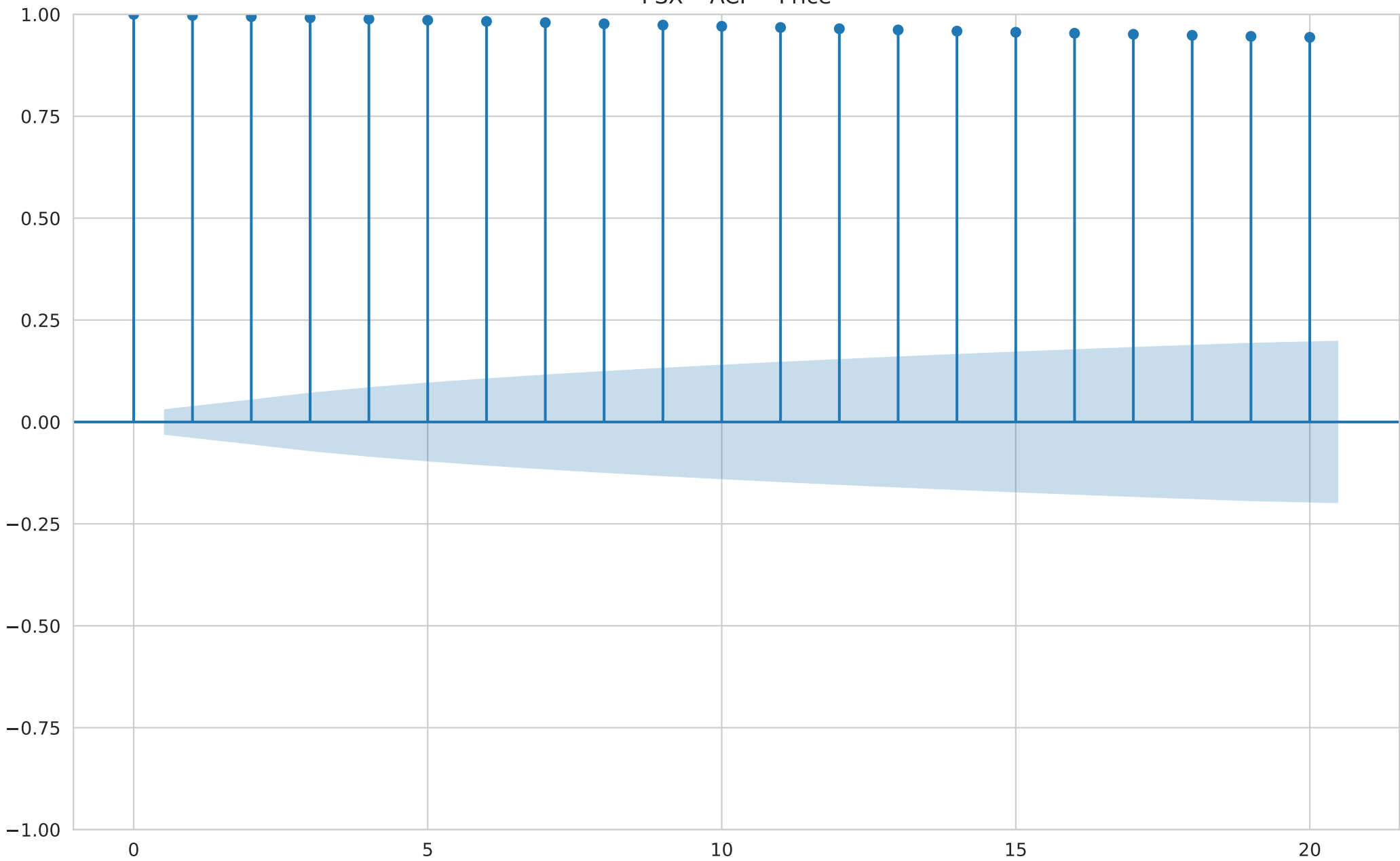
MPC • Correlation • Spreads + Lags



PSX • Price



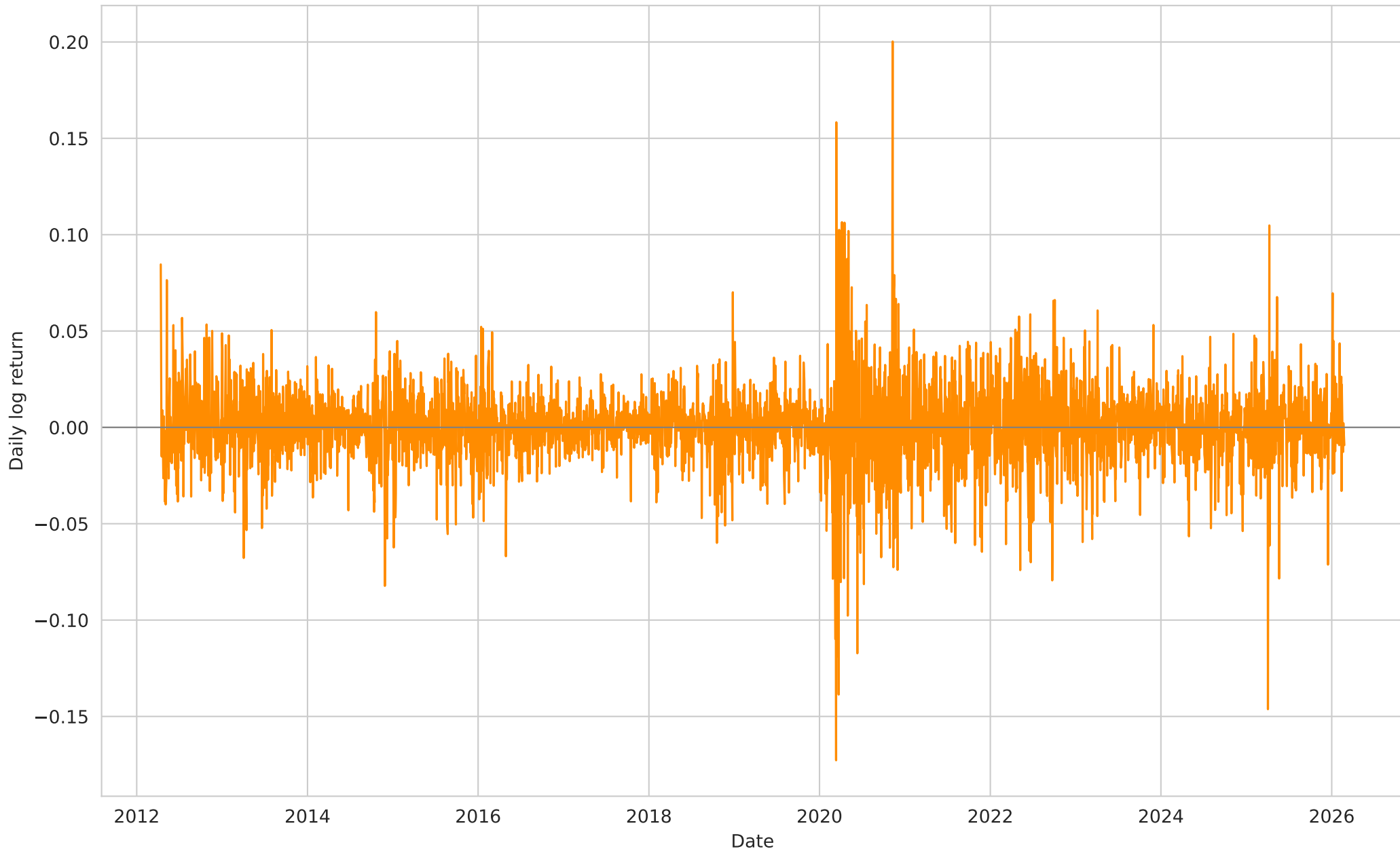
PSX • ACF • Price



PSX • Moving Averages (5/10/20)



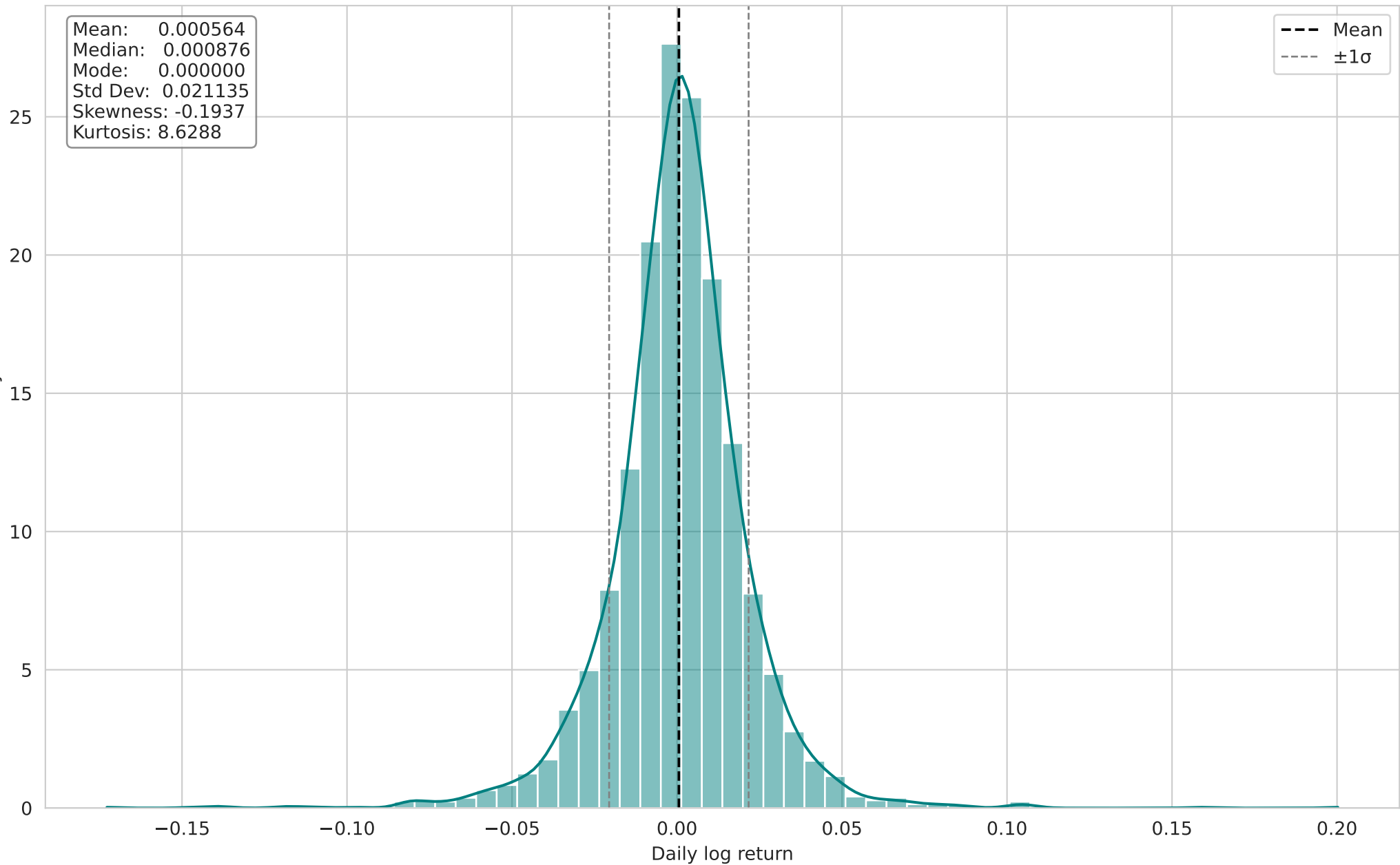
PSX • Daily Log Returns



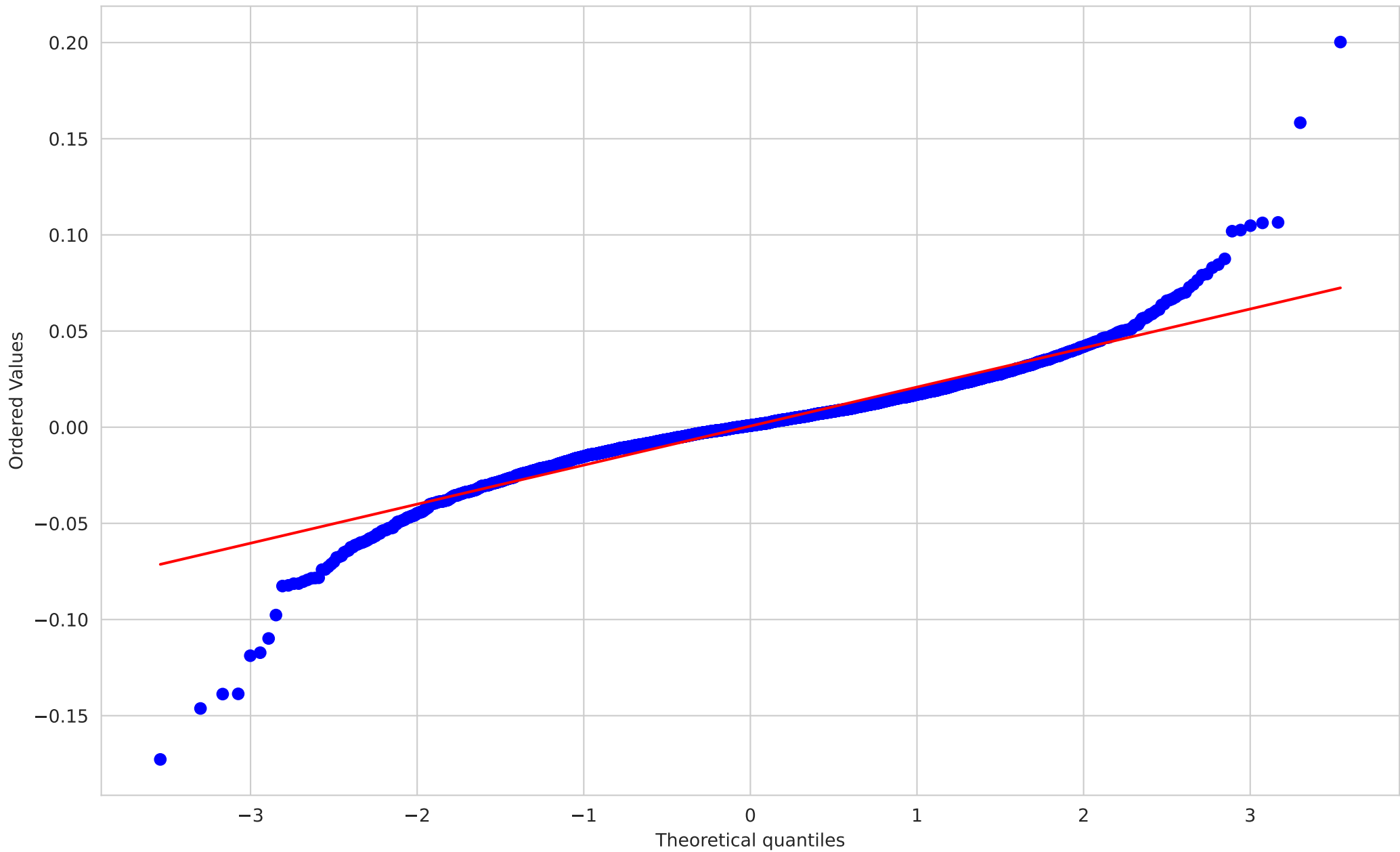
PSX • Returns • Distribution

Mean: 0.000564
 Median: 0.000876
 Mode: 0.000000
 Std Dev: 0.021135
 Skewness: -0.1937
 Kurtosis: 8.6288

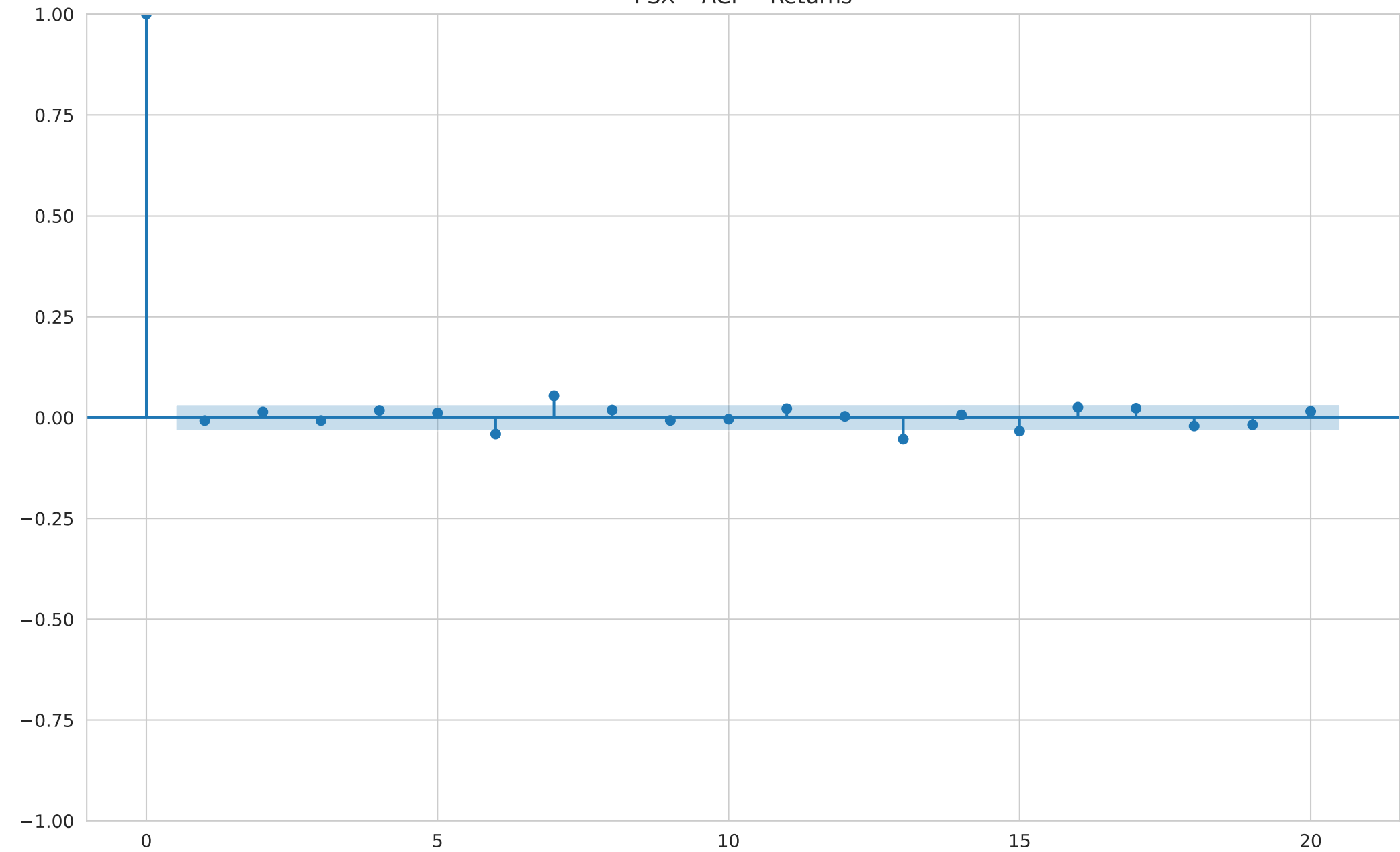
--- Mean
 - - - $\pm 1\sigma$



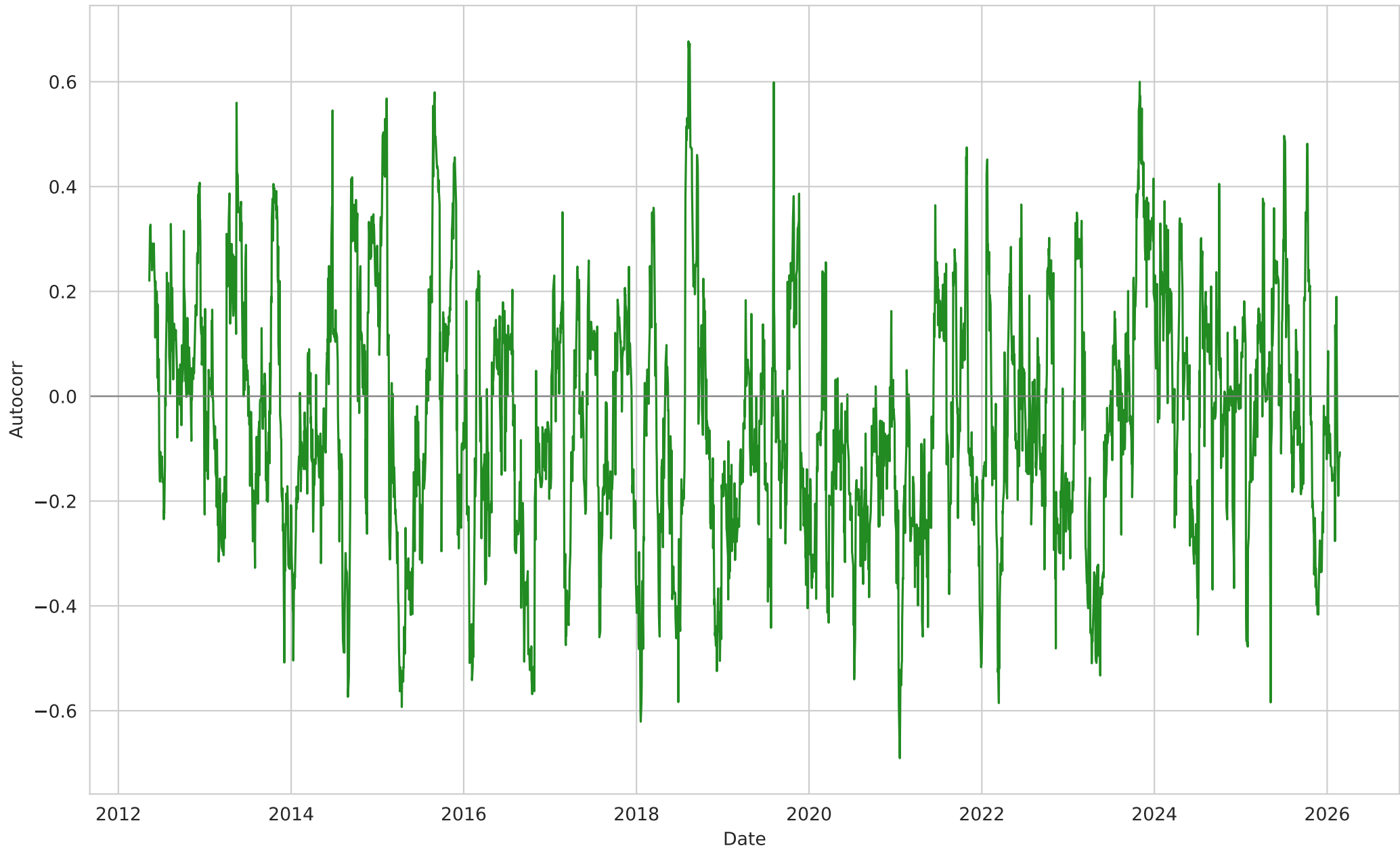
PSX • Returns • Q-Q Plot vs Normal



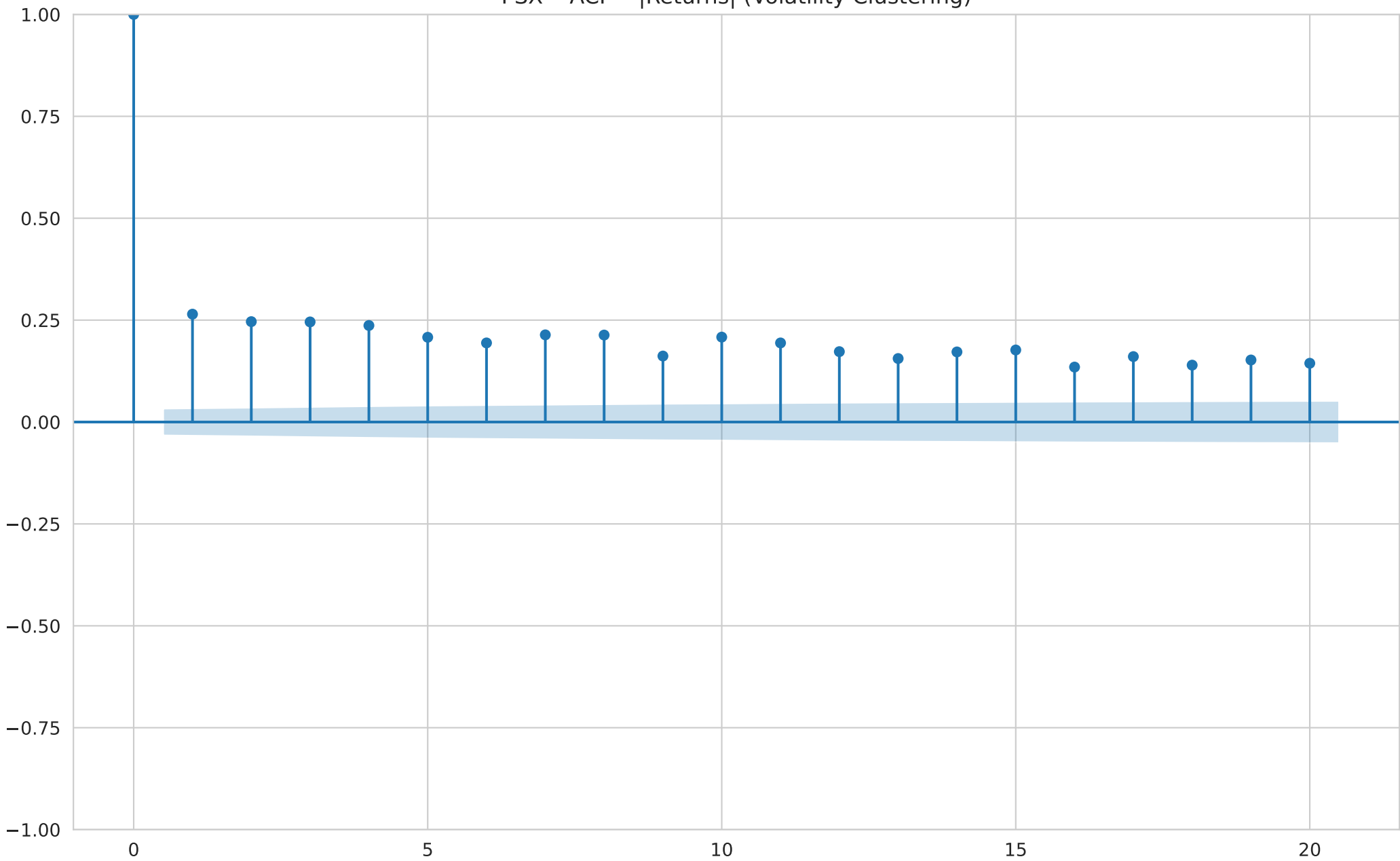
PSX • ACF • Returns



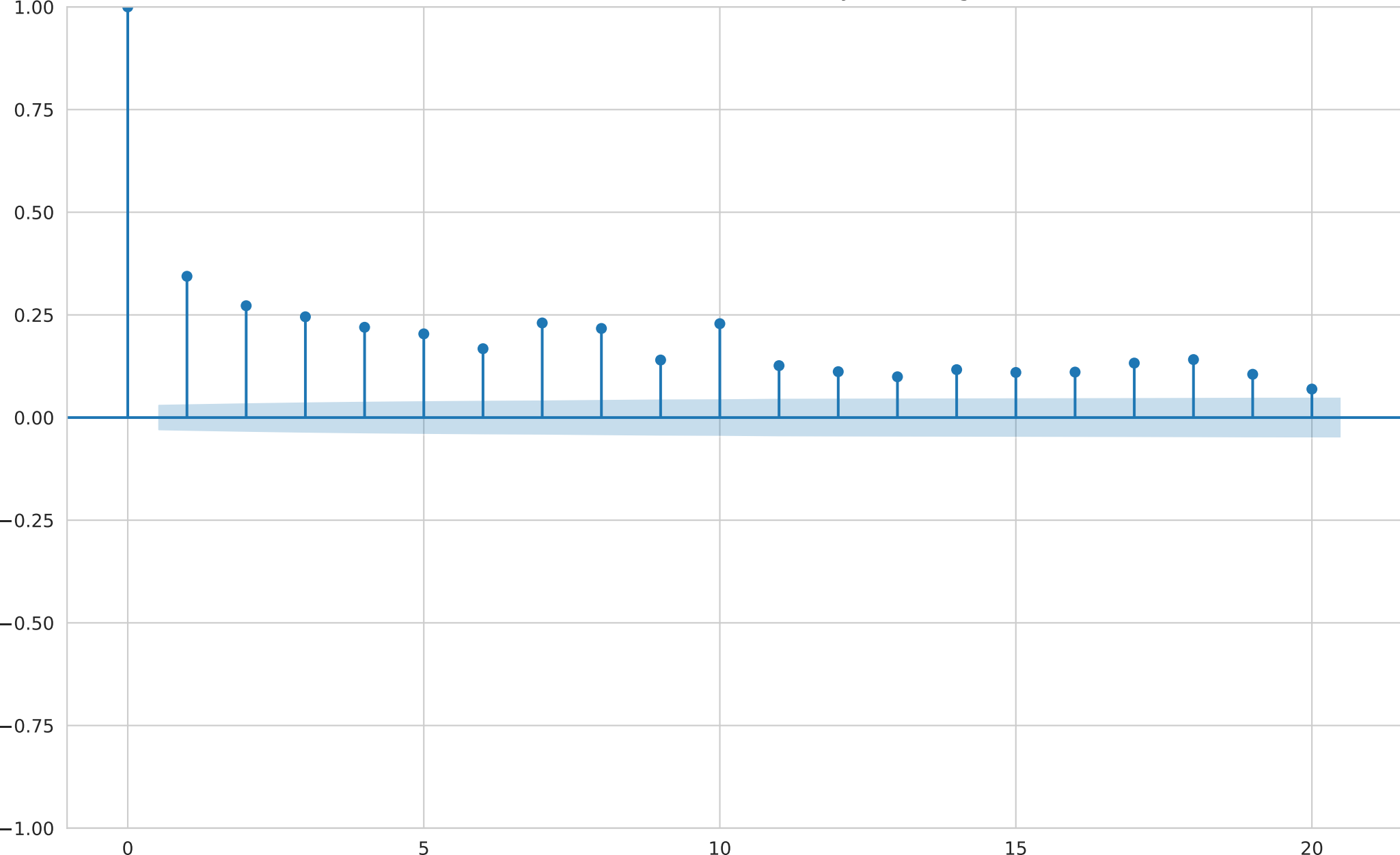
PSX • Rolling Autocorrelation (lag=1, window=20)



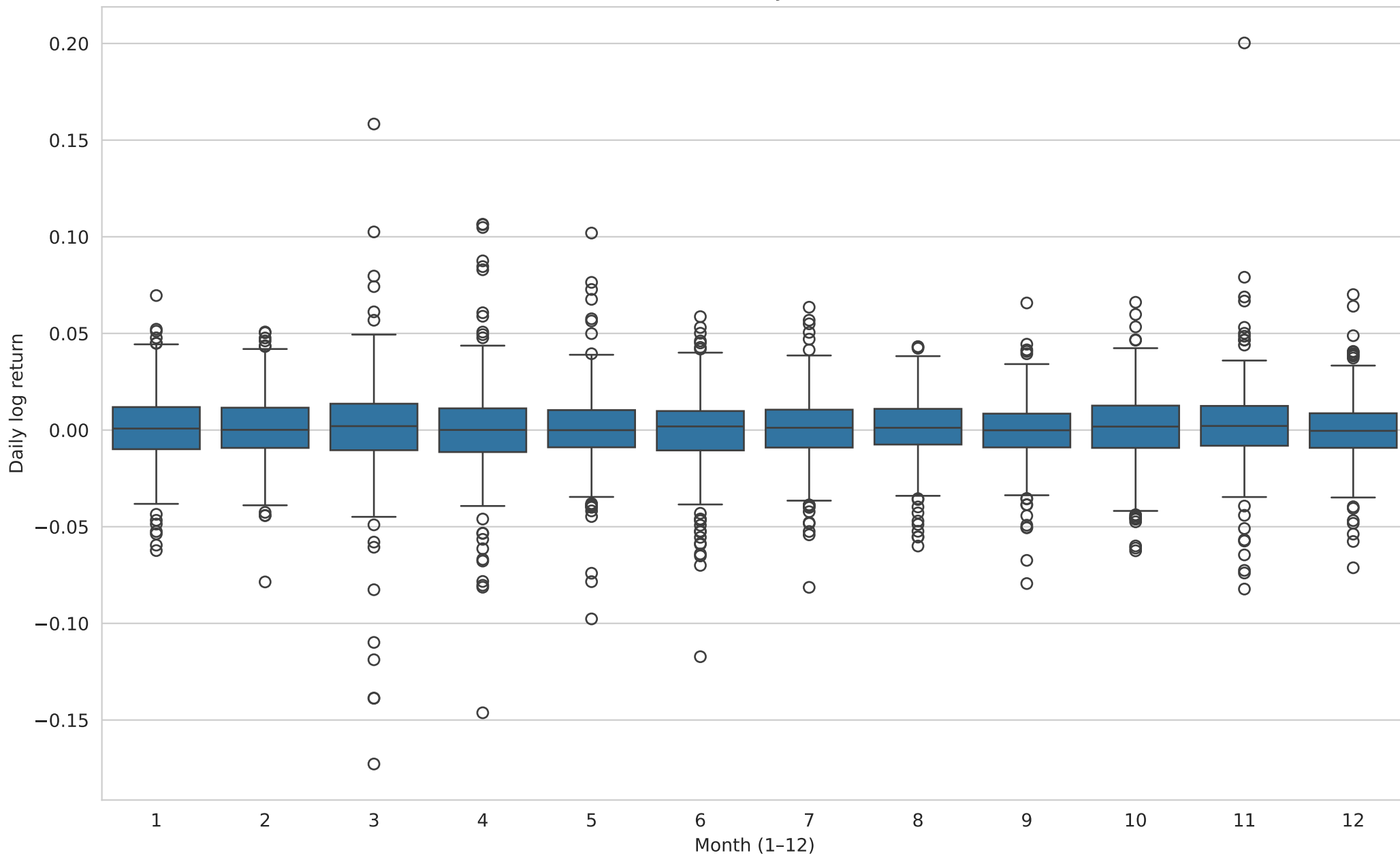
PSX • ACF • |Returns| (Volatility Clustering)



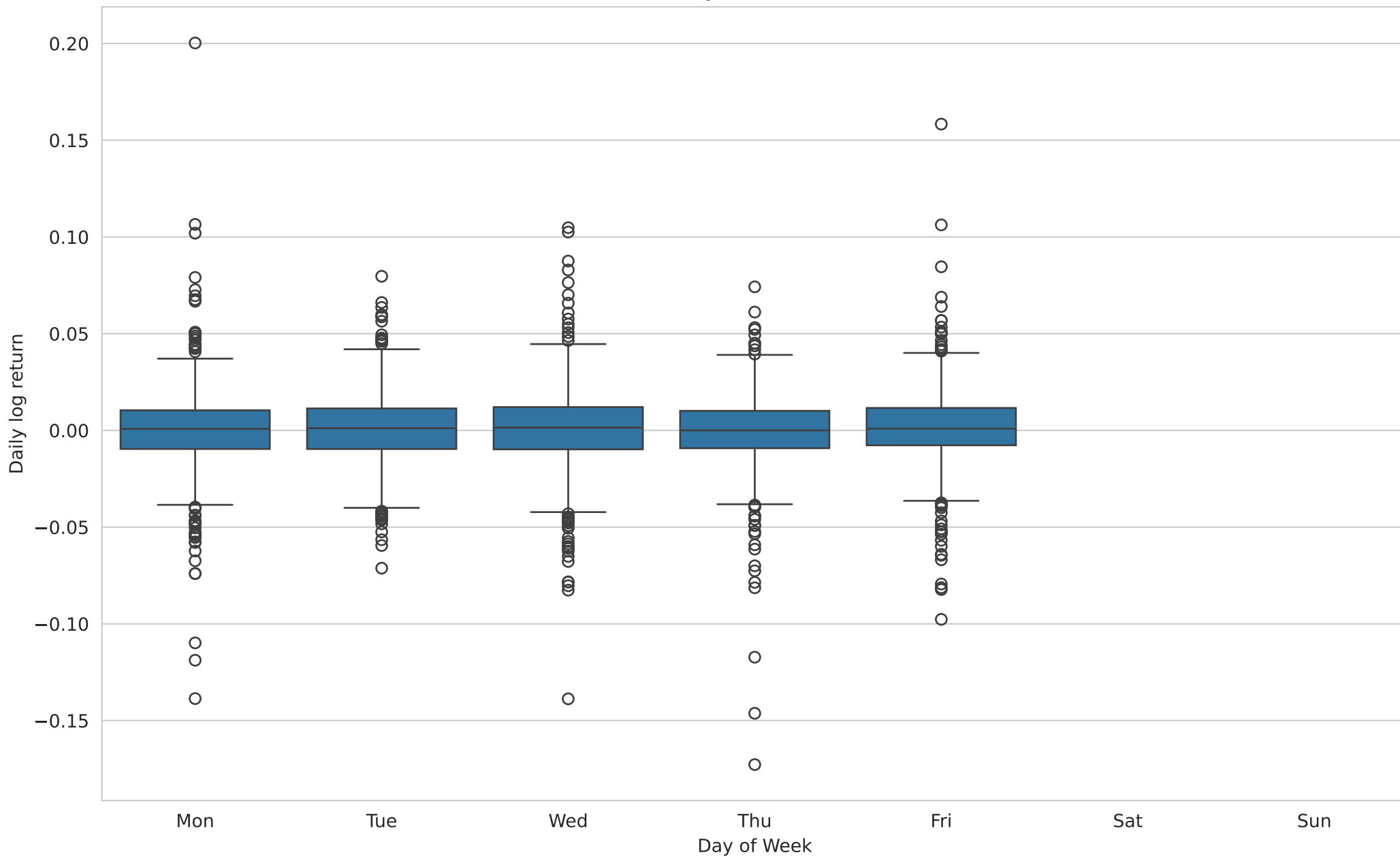
PSX • ACF • Returns^2 (Volatility Clustering)



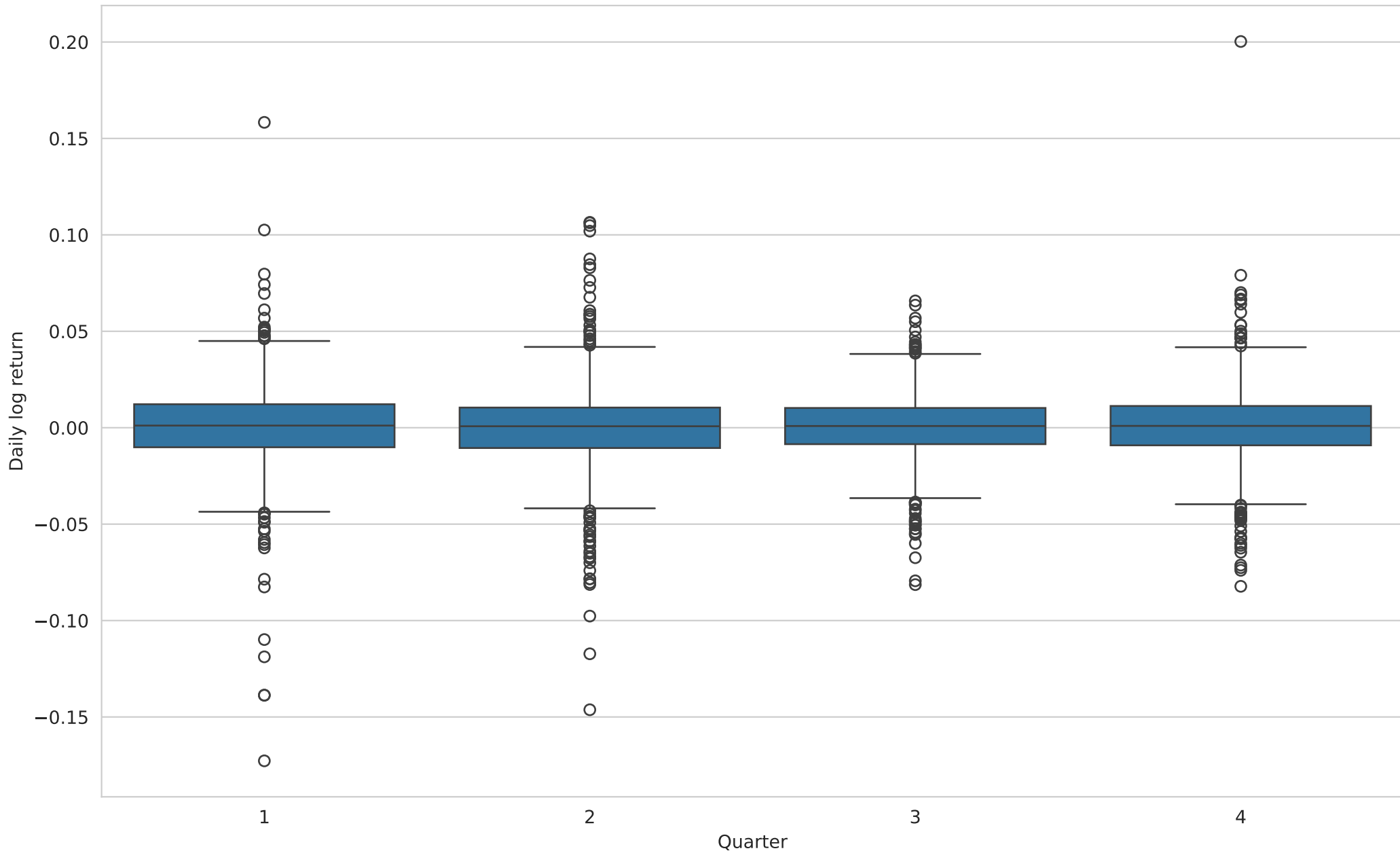
PSX • Monthly Returns



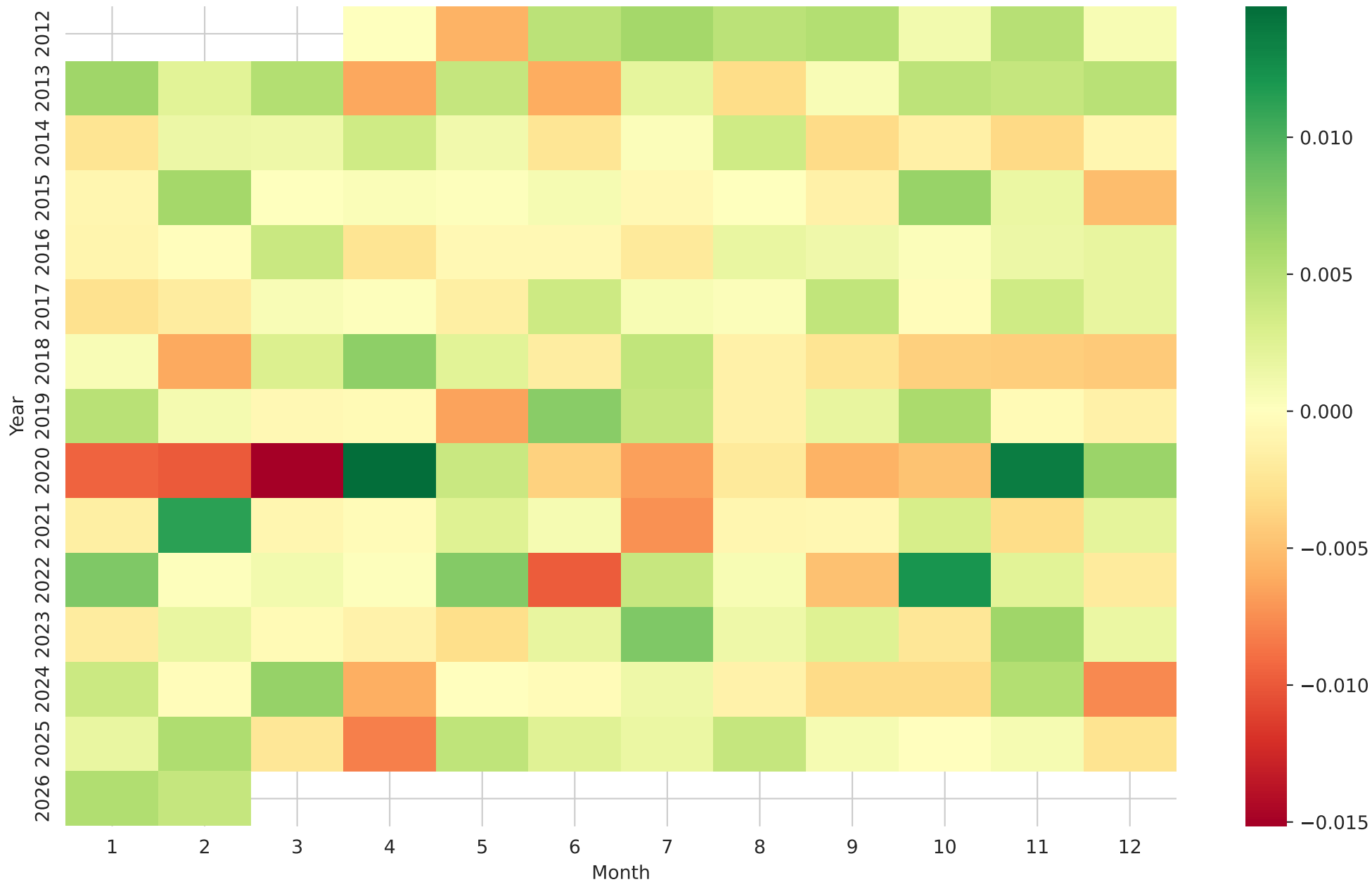
PSX • Day-of-Week Returns



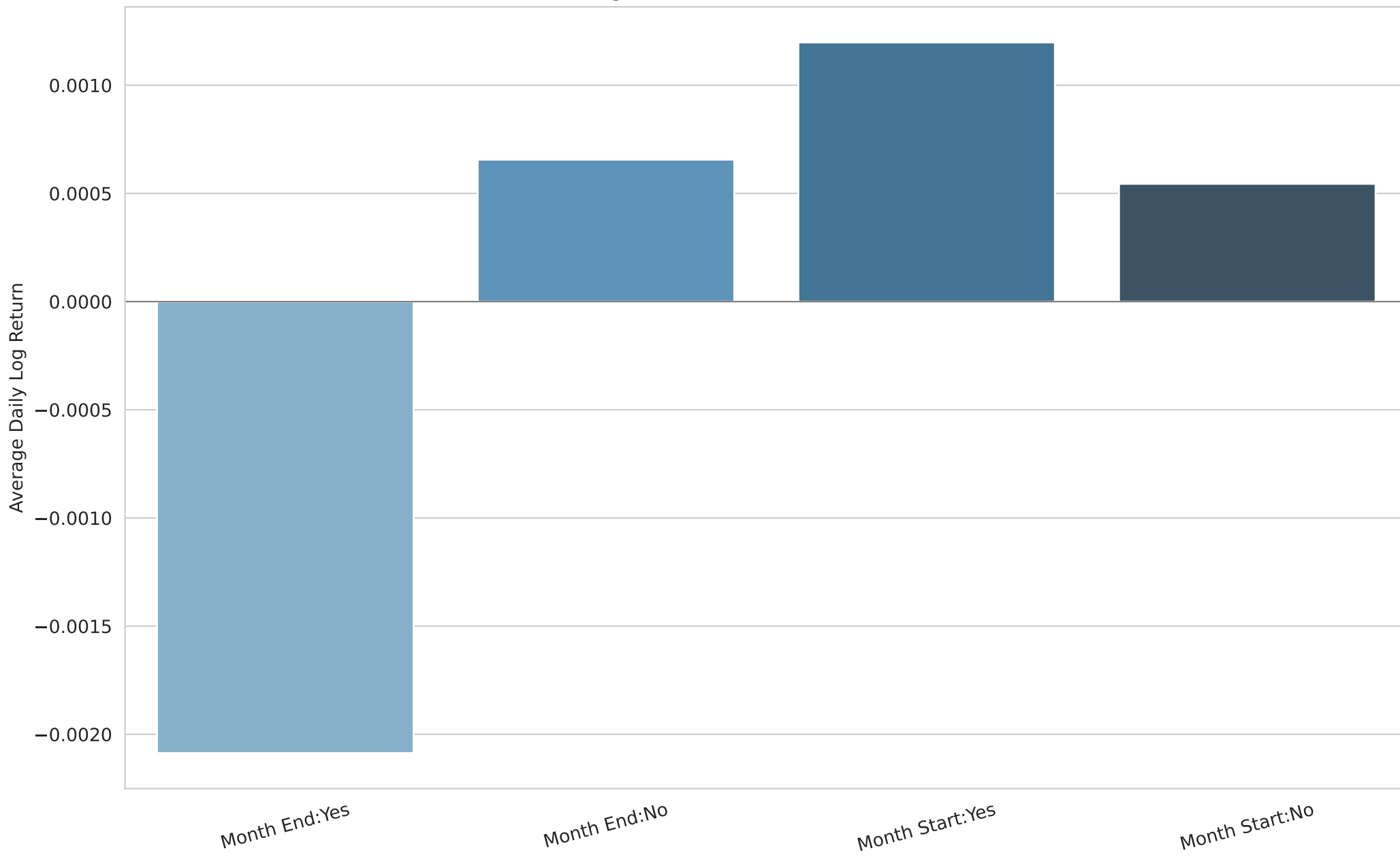
PSX • Quarterly Returns



PSX • Month×Year Heatmap (Avg Daily Returns)

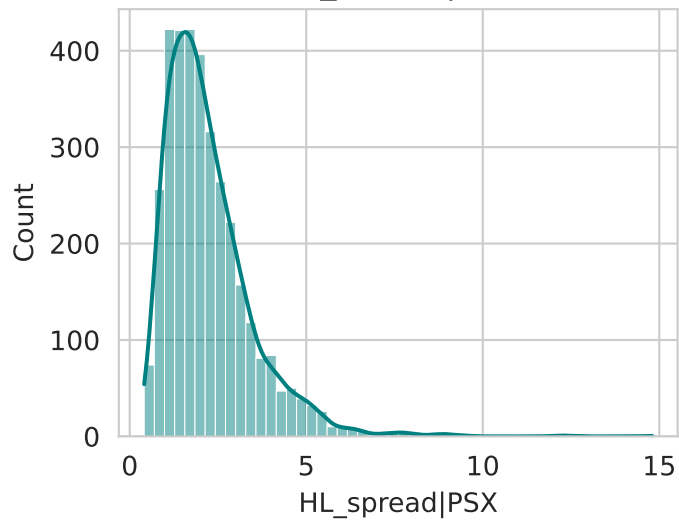


PSX • Avg Returns: Month-End/Start vs Others

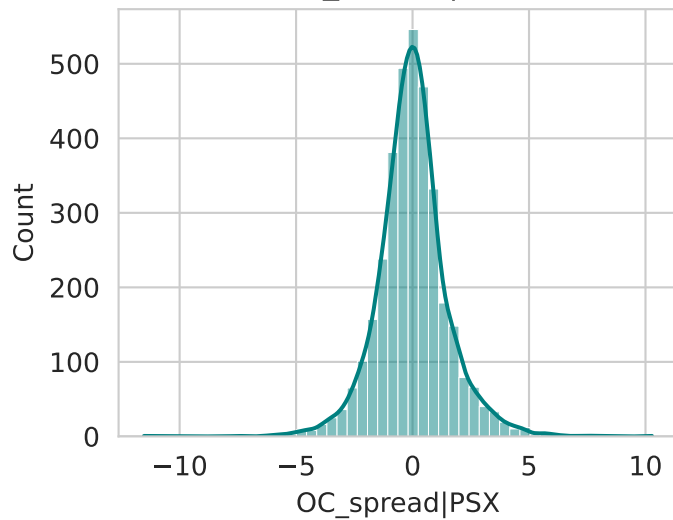


PSX • Spreads

HL_spread|PSX

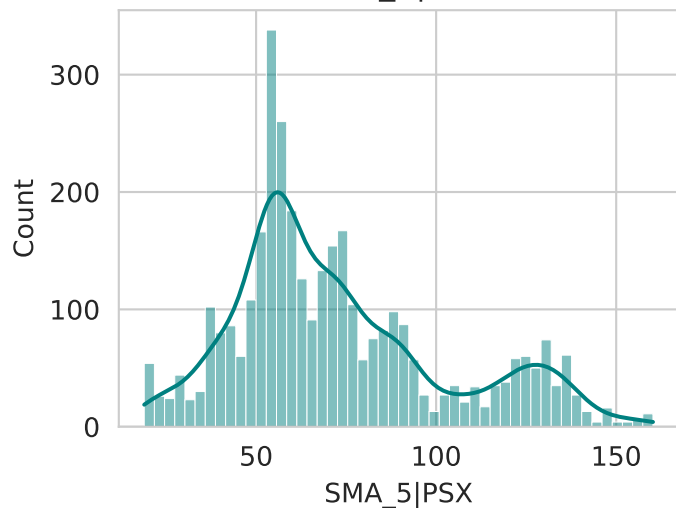


OC_spread|PSX

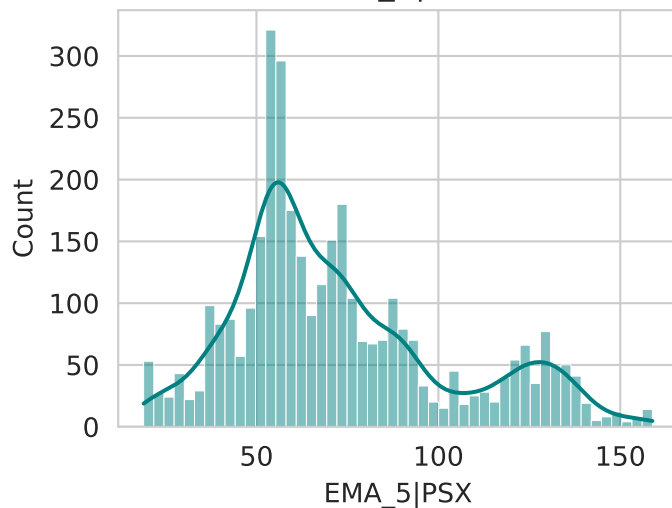


PSX • Moving Averages / EMAs

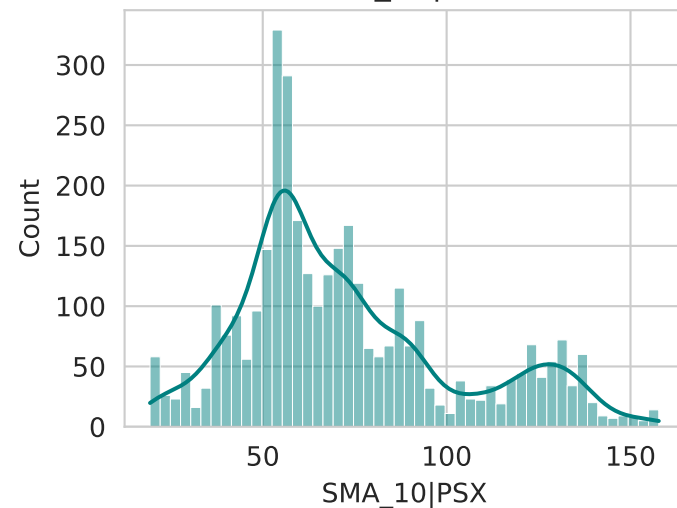
SMA_5|PSX



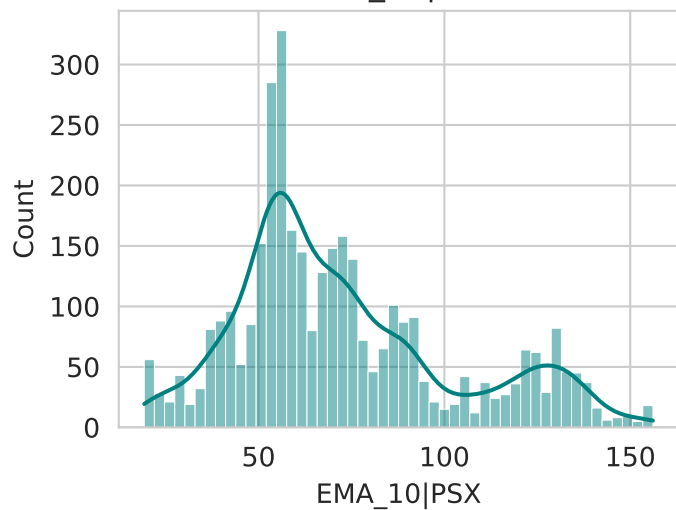
EMA_5|PSX



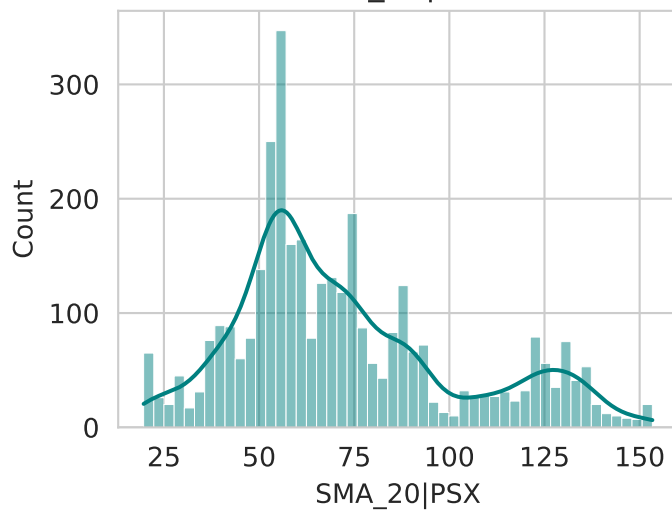
SMA_10|PSX



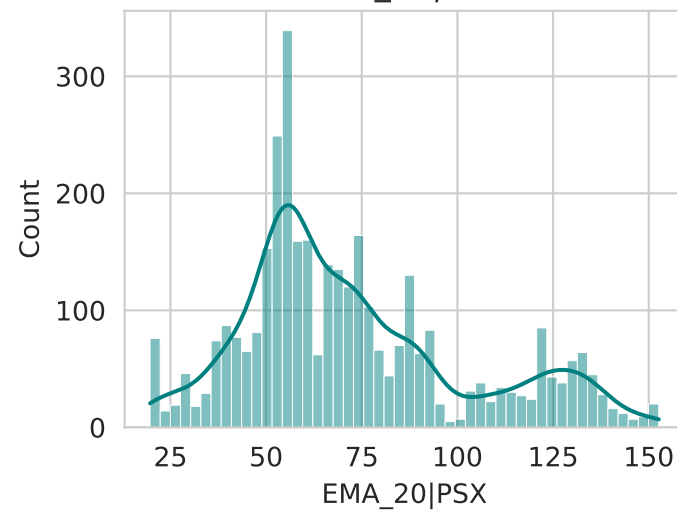
EMA_10|PSX



SMA_20|PSX

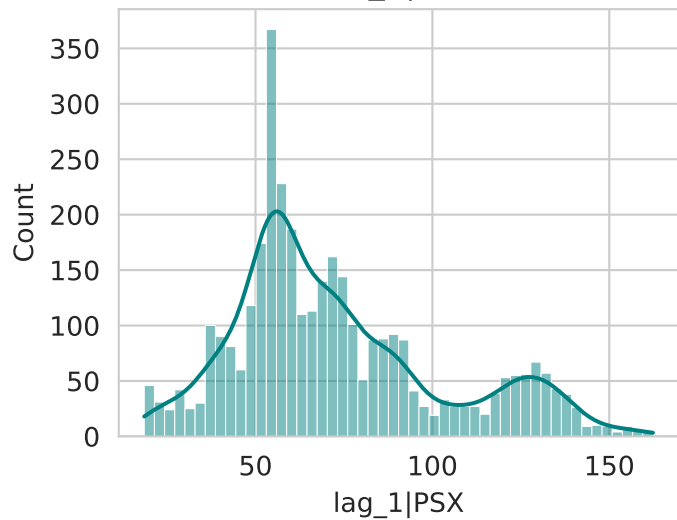


EMA_20|PSX

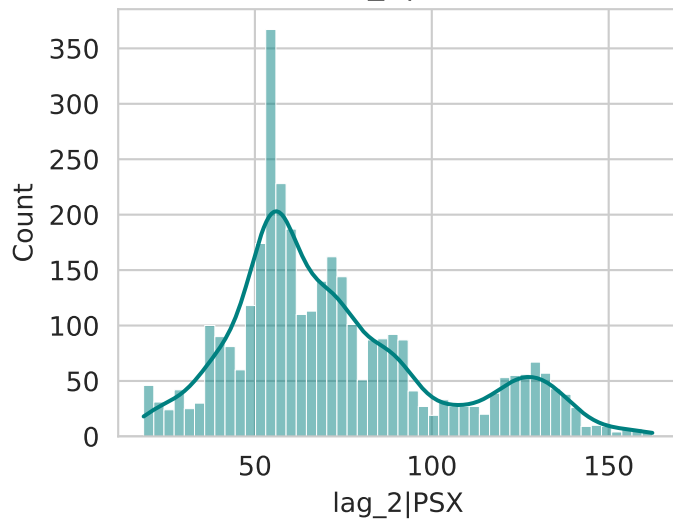


PSX • Lagged Prices

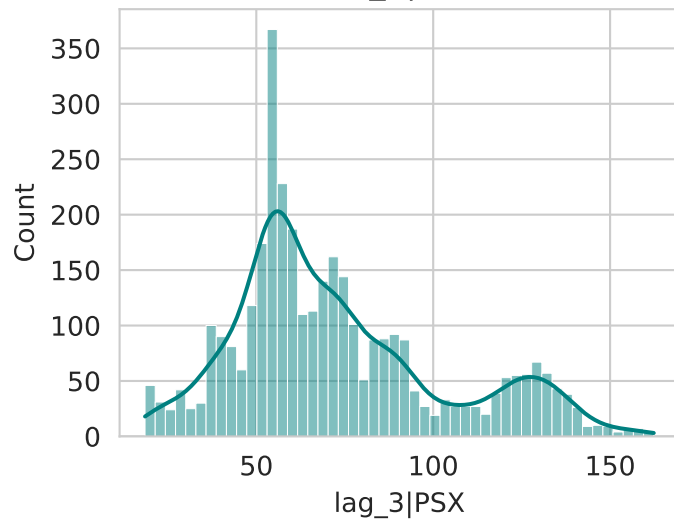
lag_1|PSX



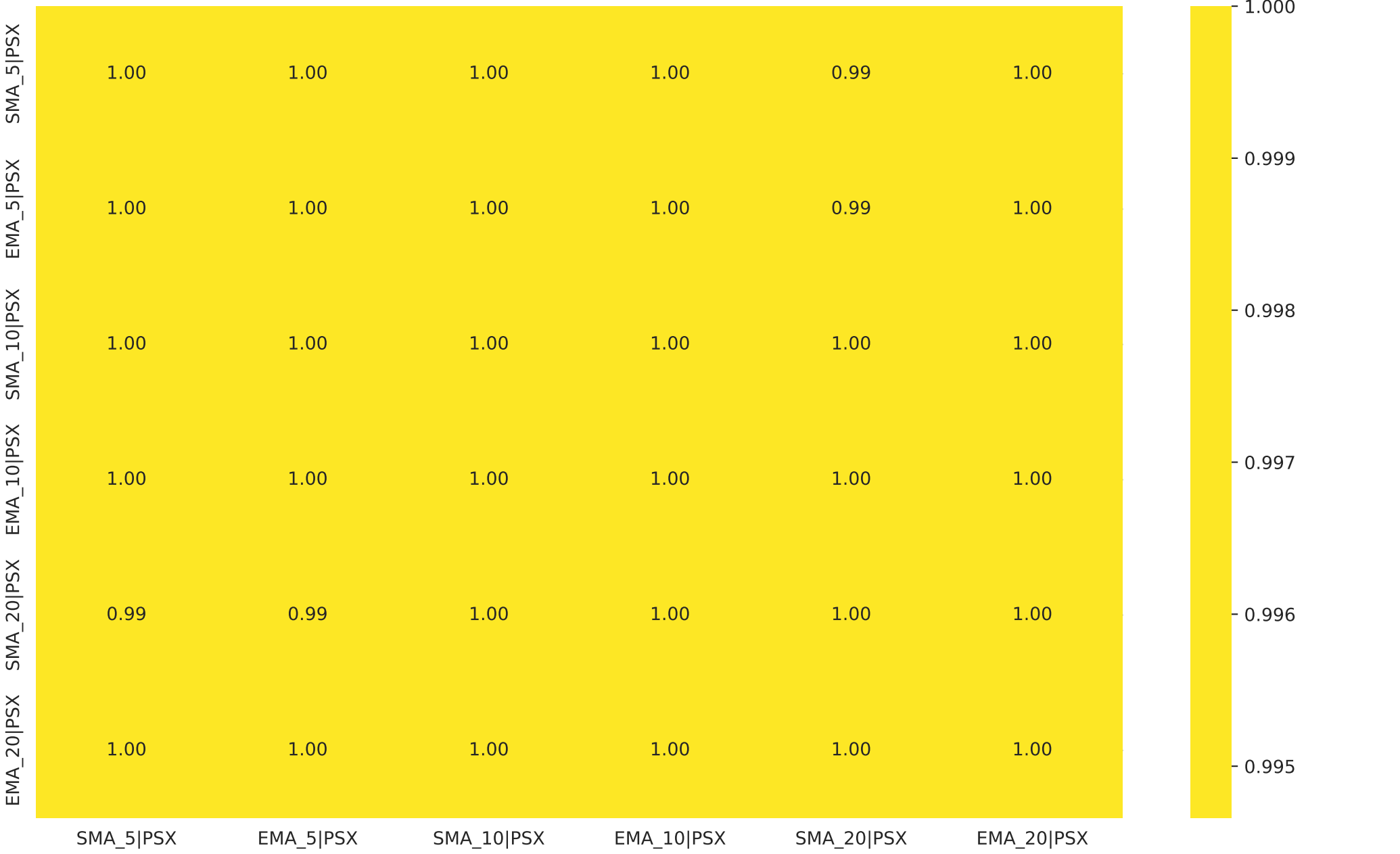
lag_2|PSX



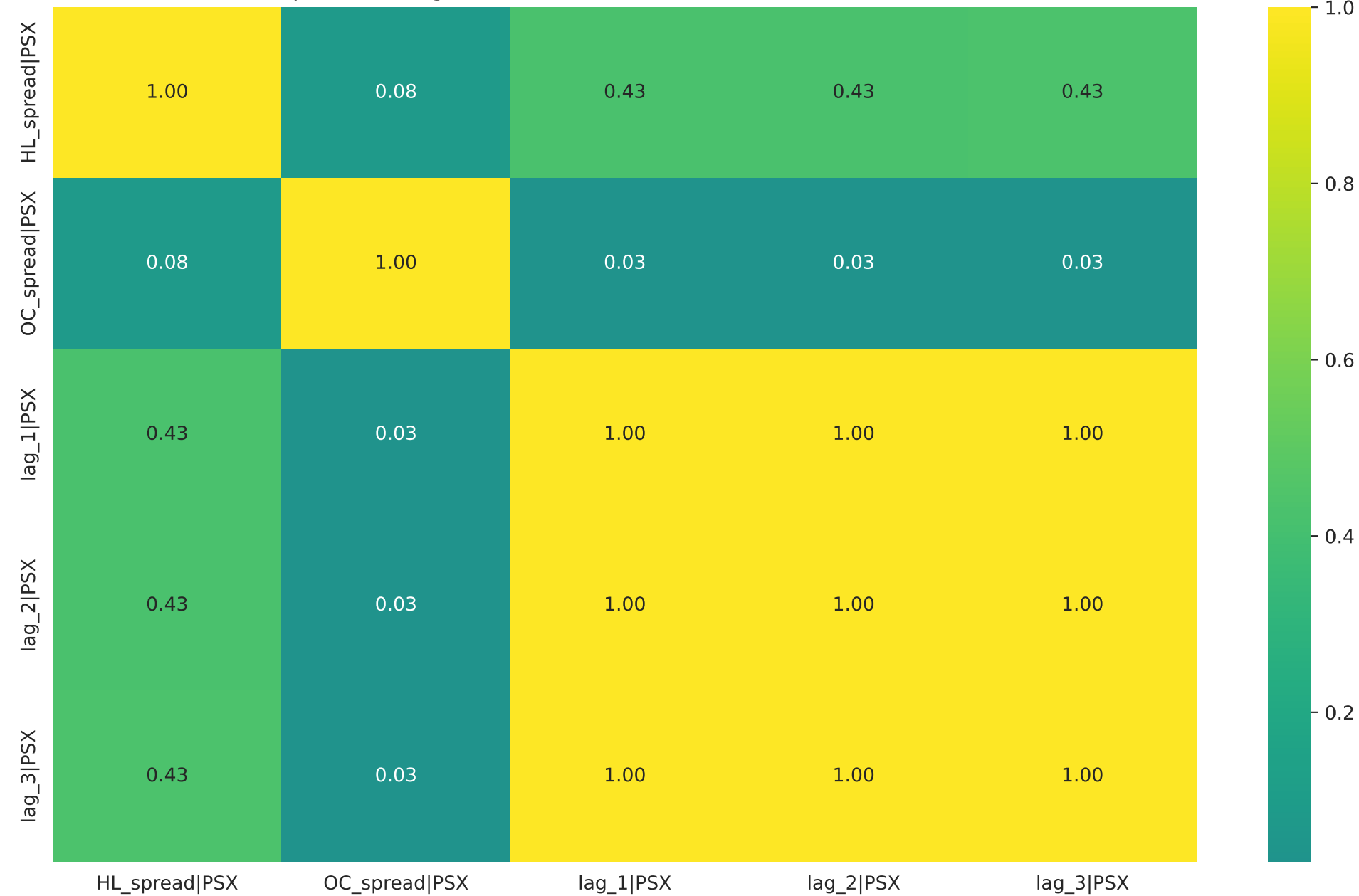
lag_3|PSX



PSX • Correlation • Moving Averages



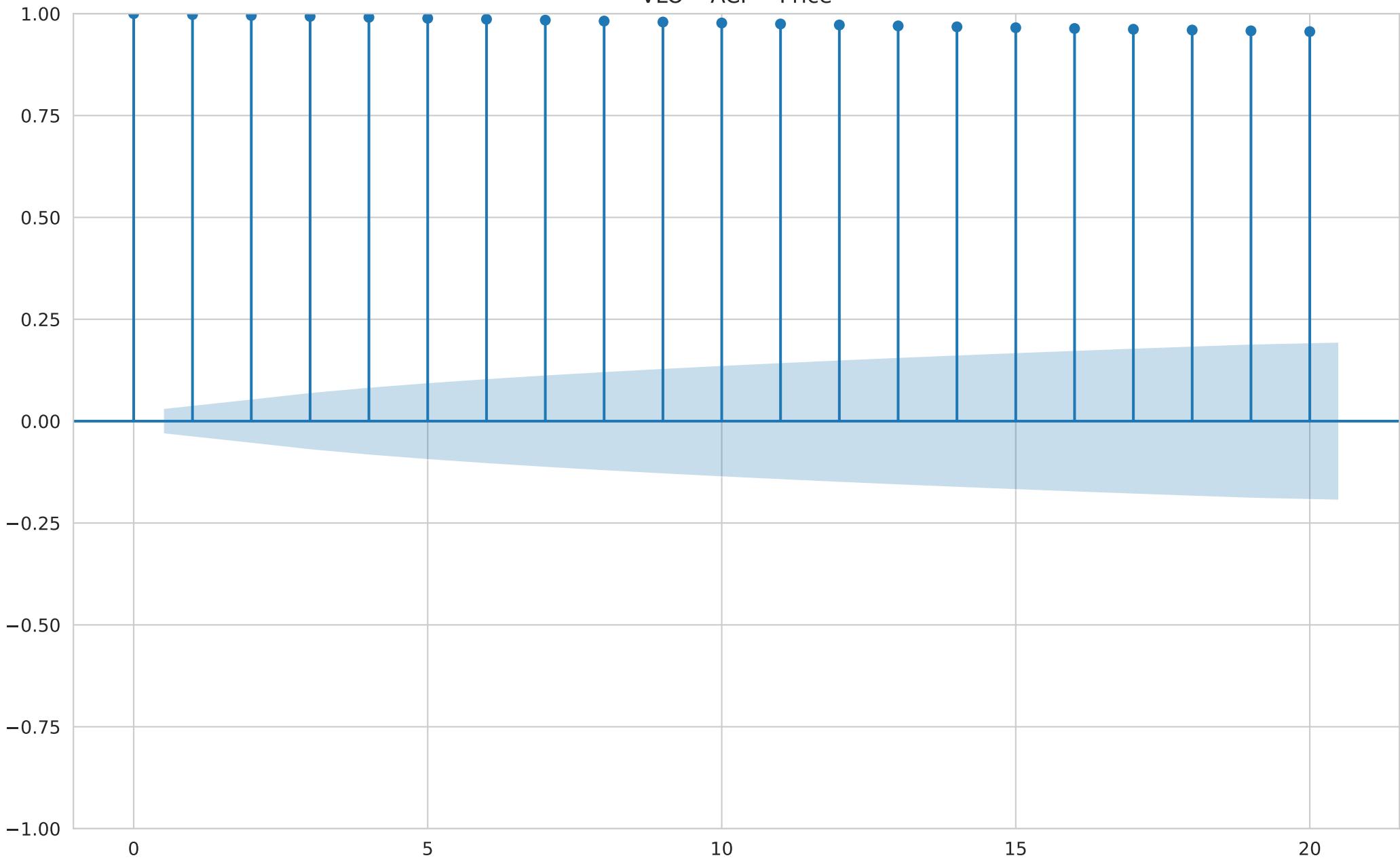
PSX • Correlation • Spreads + Lags



VLO • Price



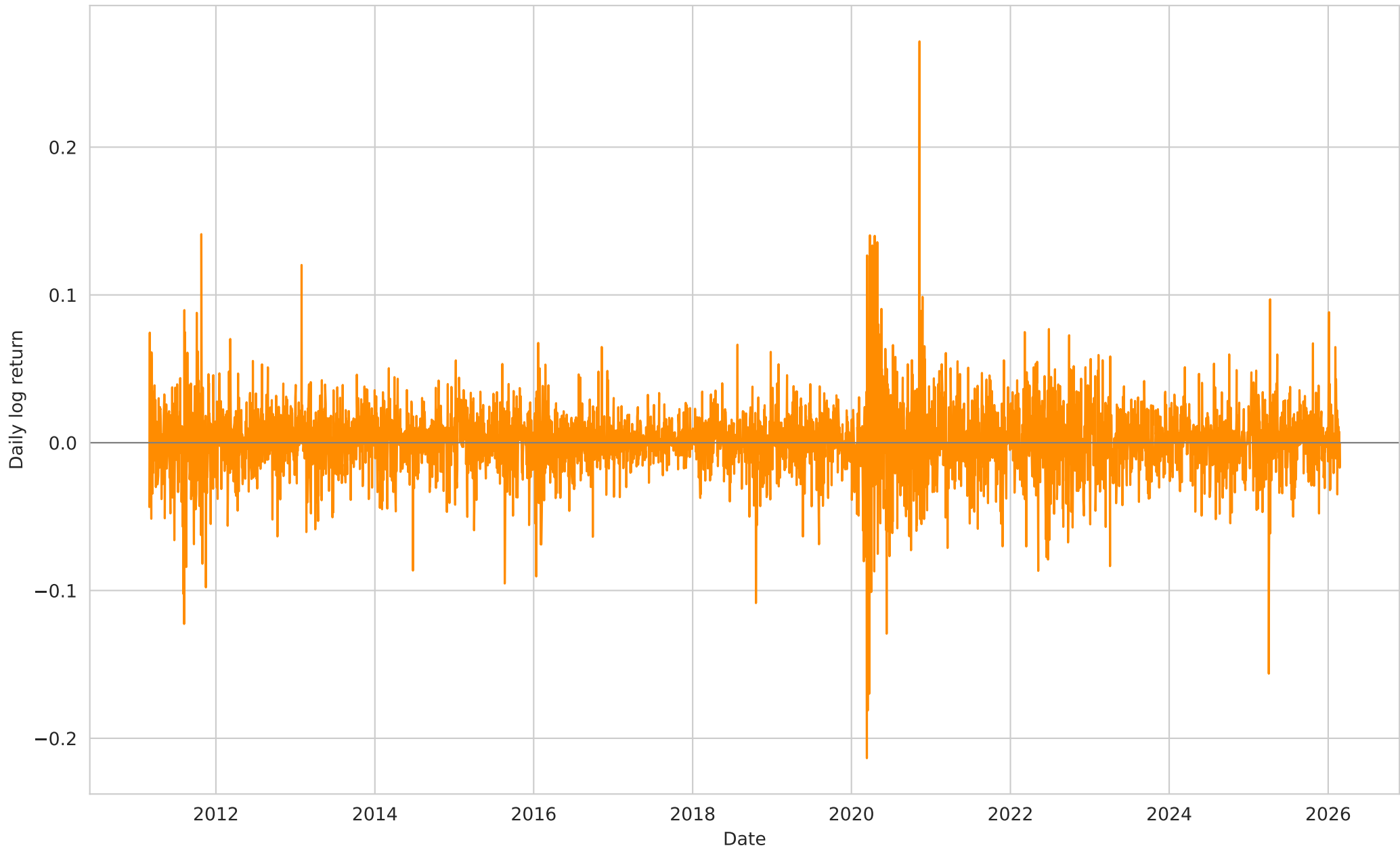
VLO • ACF • Price



VLO • Moving Averages (5/10/20)



VLO • Daily Log Returns



VLO • Returns • Distribution

Mean: 0.000676
 Median: 0.000995
 Mode: 0.000000
 Std Dev: 0.024537
 Skewness: -0.0218
 Kurtosis: 10.1698

--- Mean
 --- $\pm 1\sigma$

Density

20

15

10

5

0

-0.2

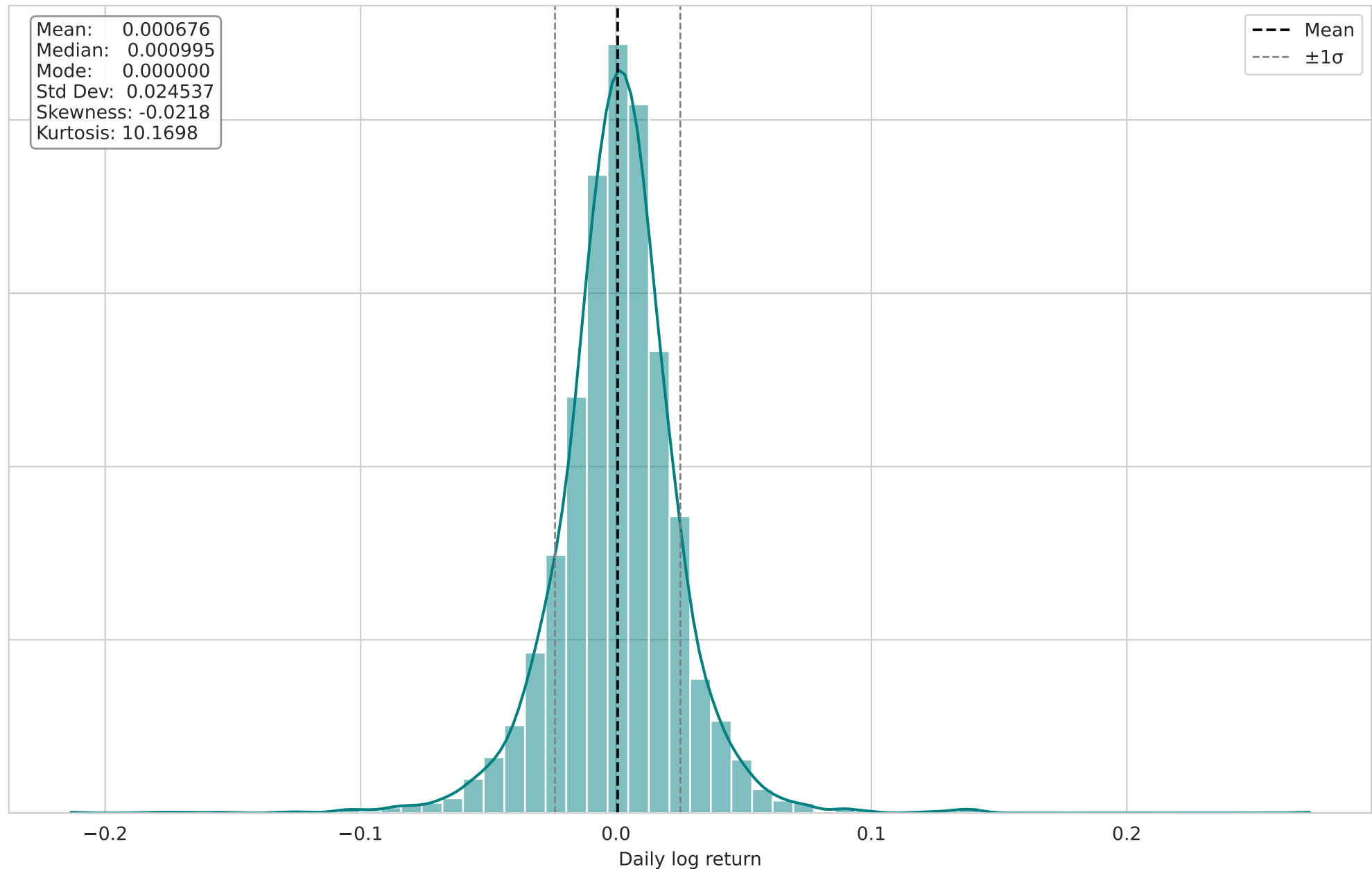
-0.1

0.0

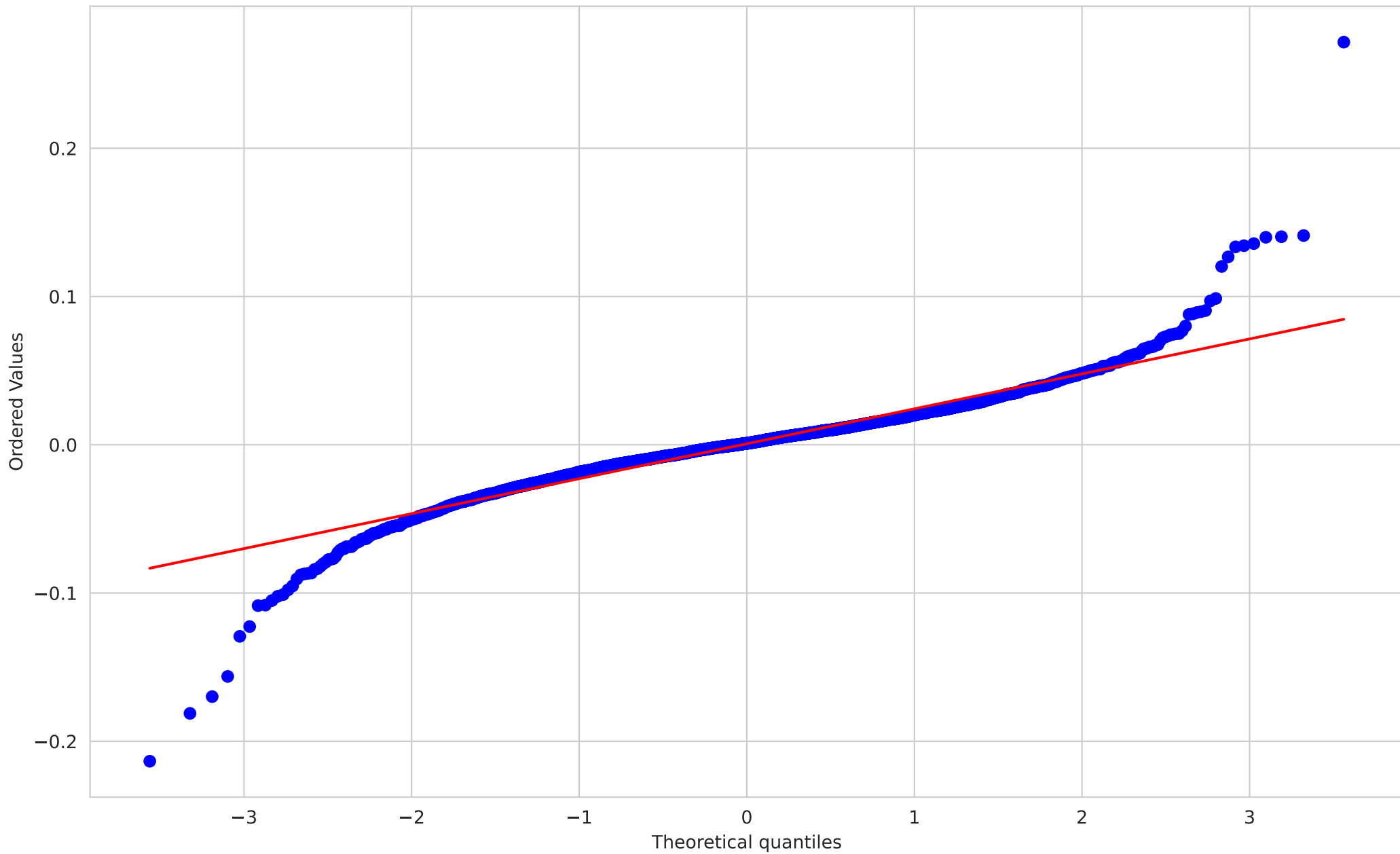
0.1

0.2

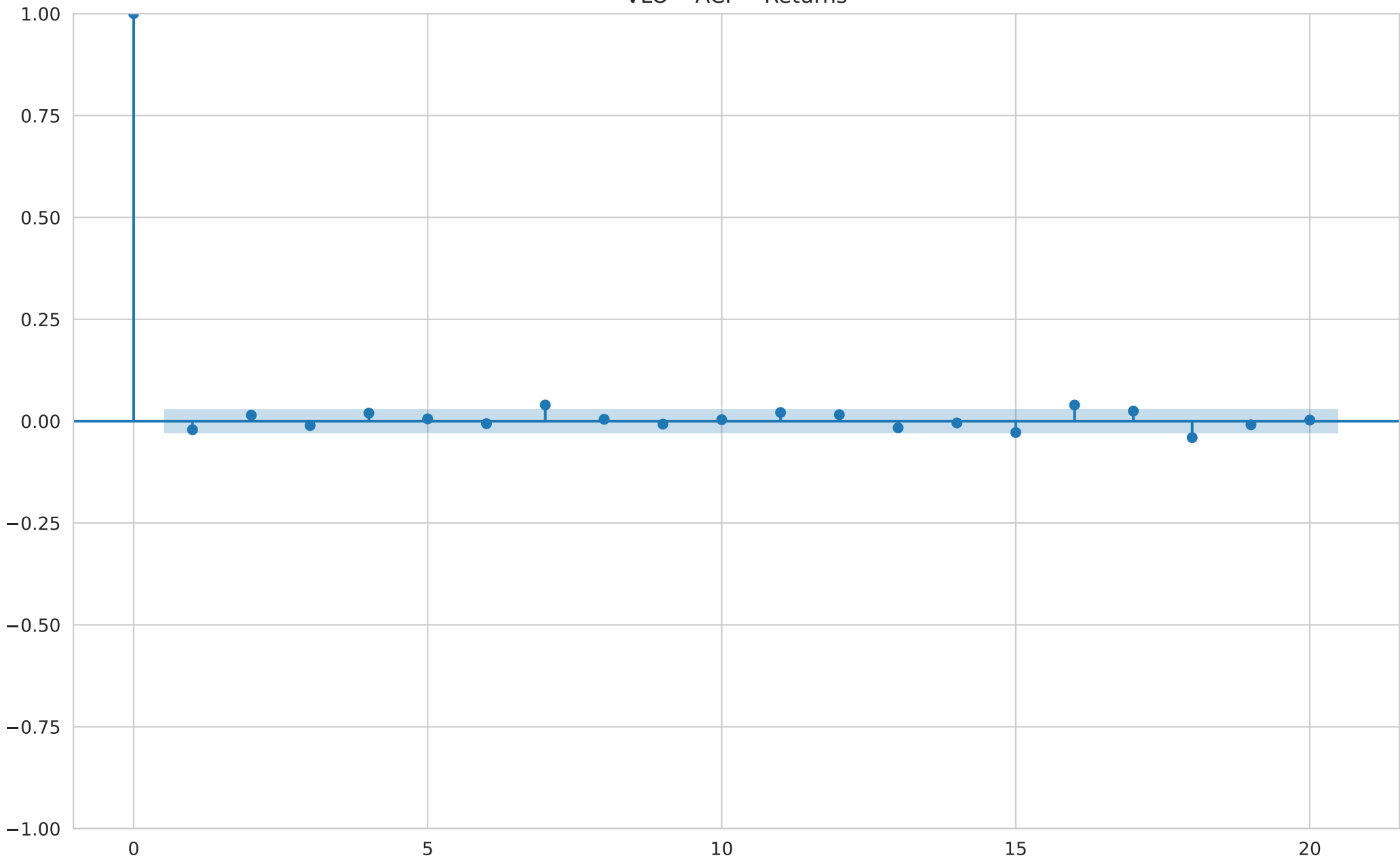
Daily log return



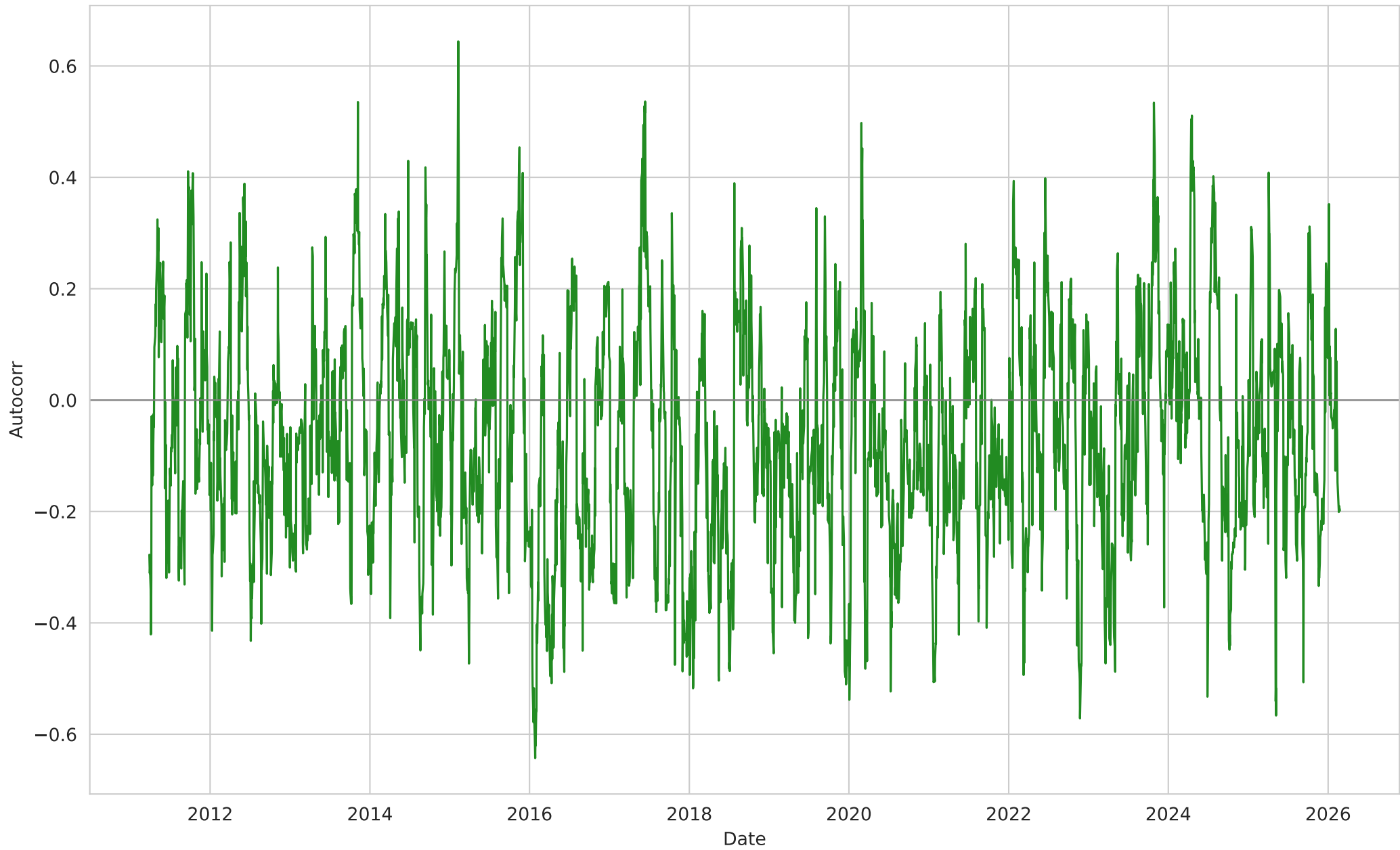
VLO • Returns • Q-Q Plot vs Normal



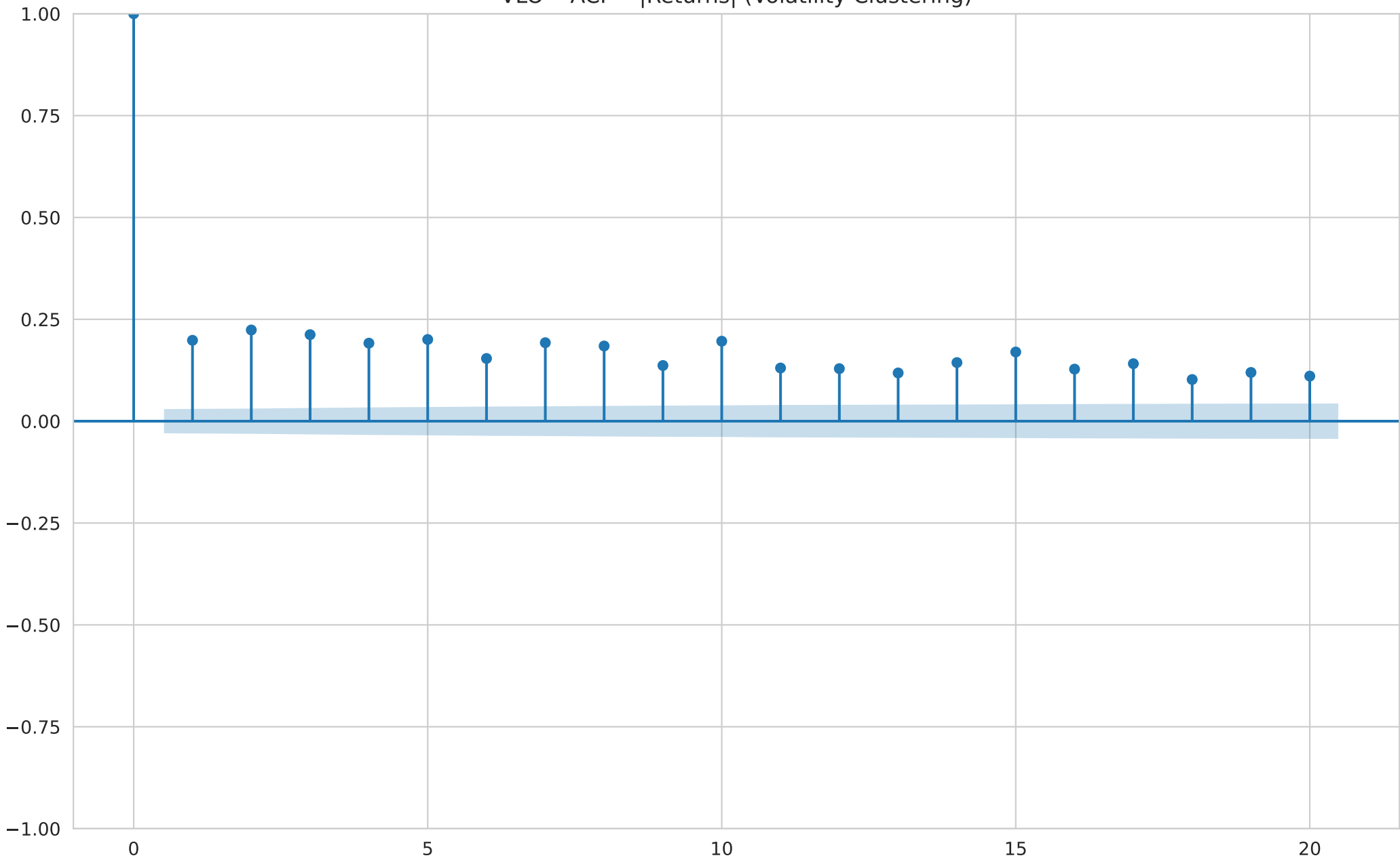
VLO • ACF • Returns



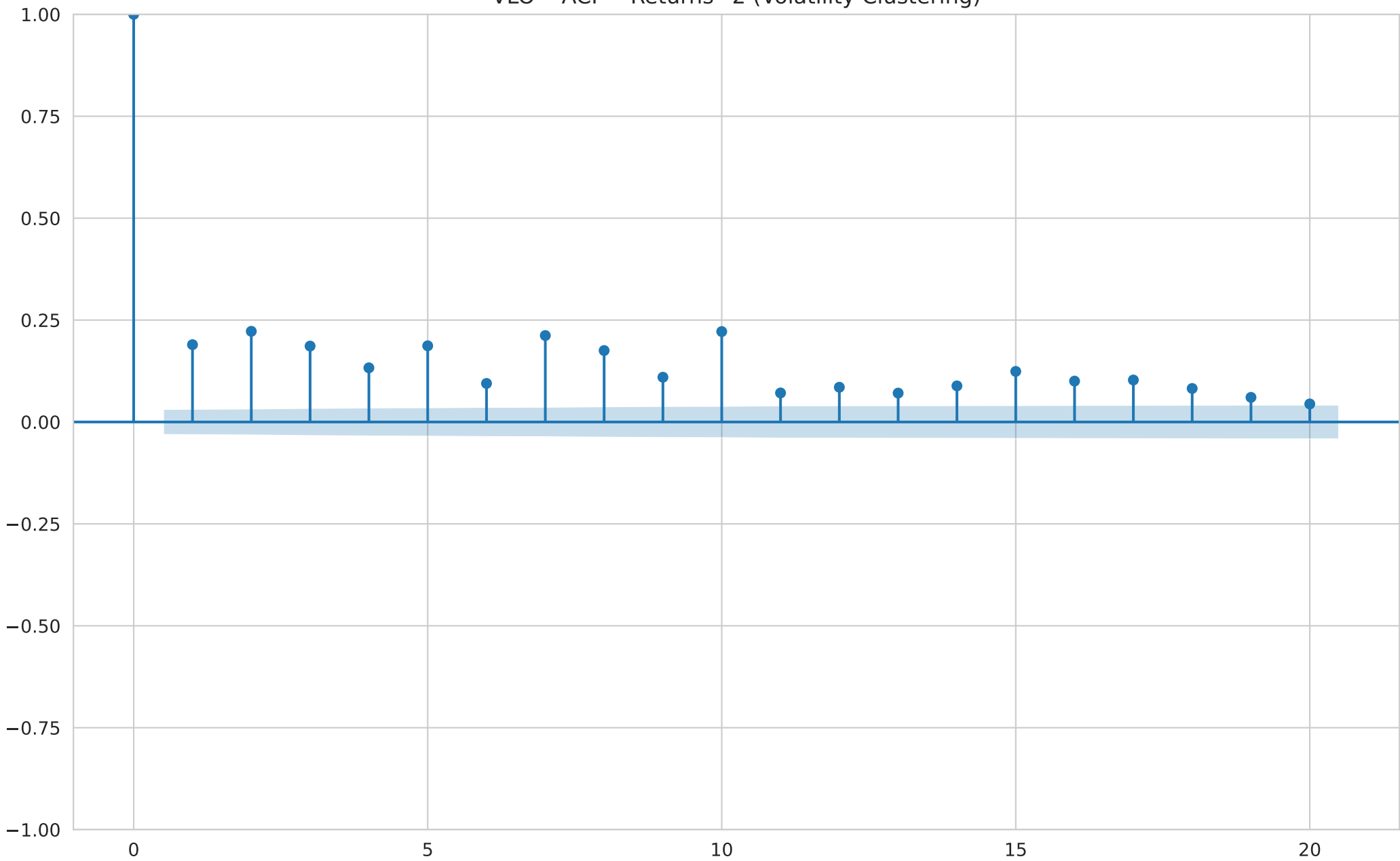
VLO • Rolling Autocorrelation (lag=1, window=20)



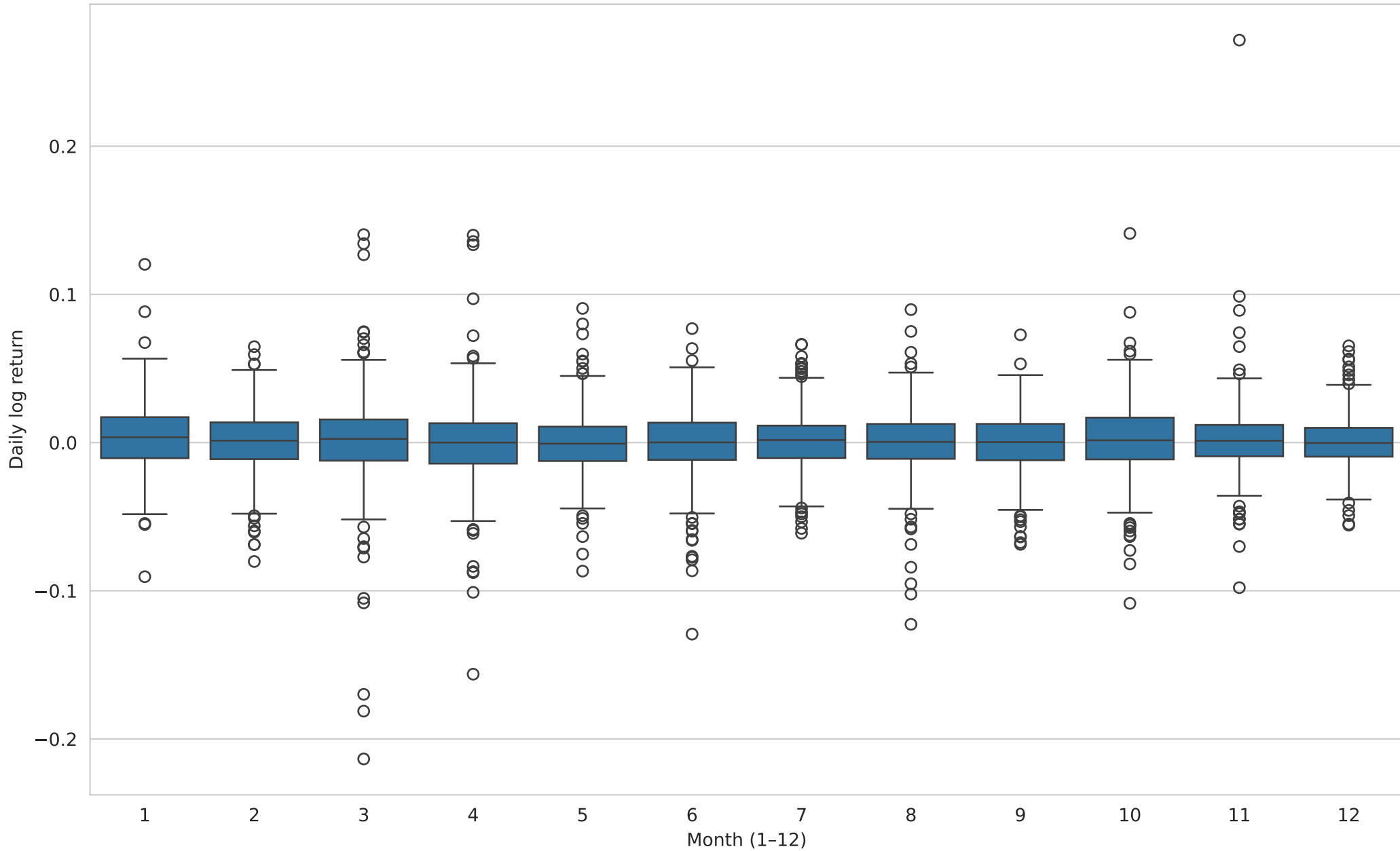
VLO • ACF • |Returns| (Volatility Clustering)



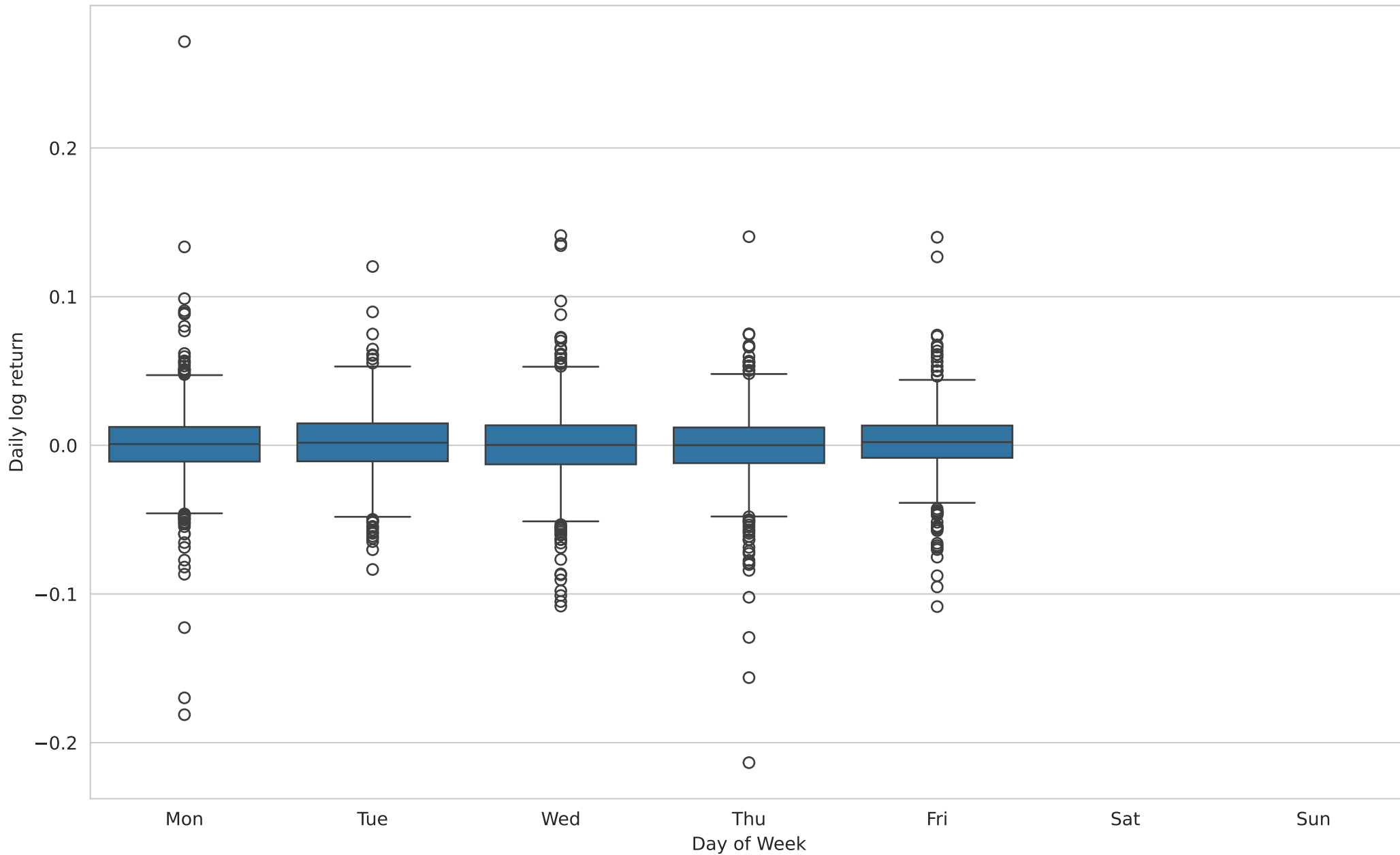
VLO • ACF • Returns² (Volatility Clustering)



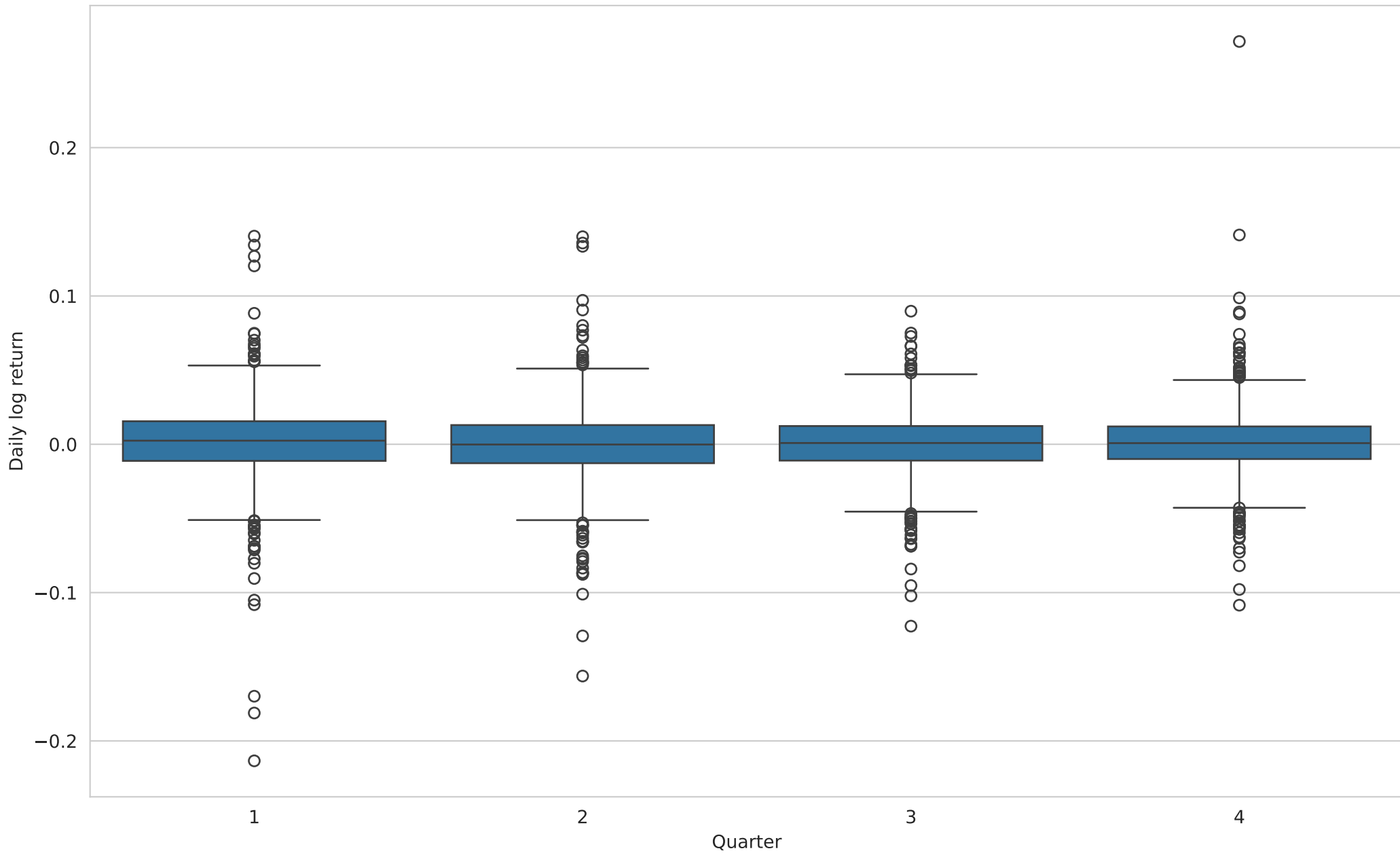
VLO • Monthly Returns



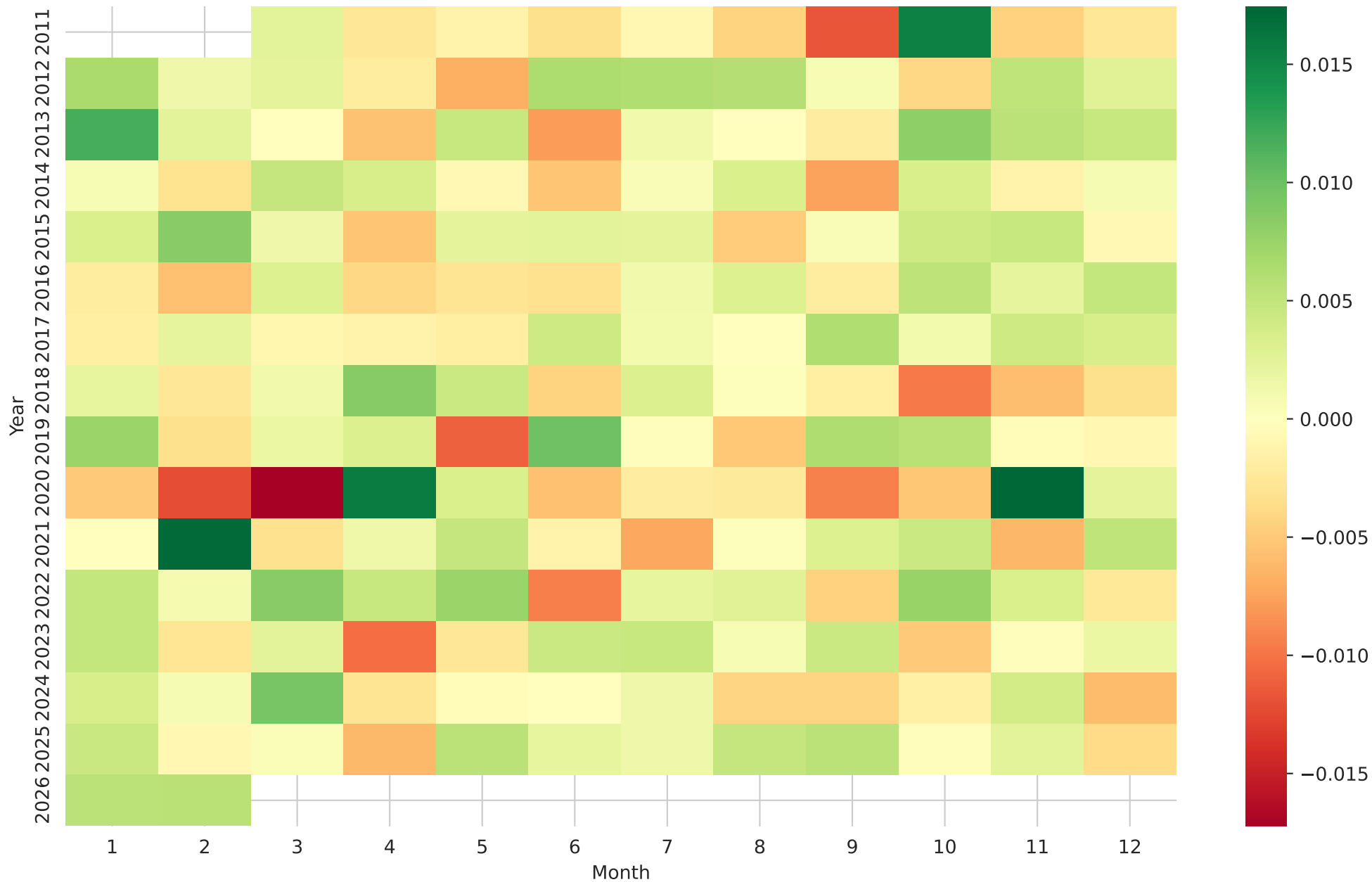
VLO • Day-of-Week Returns



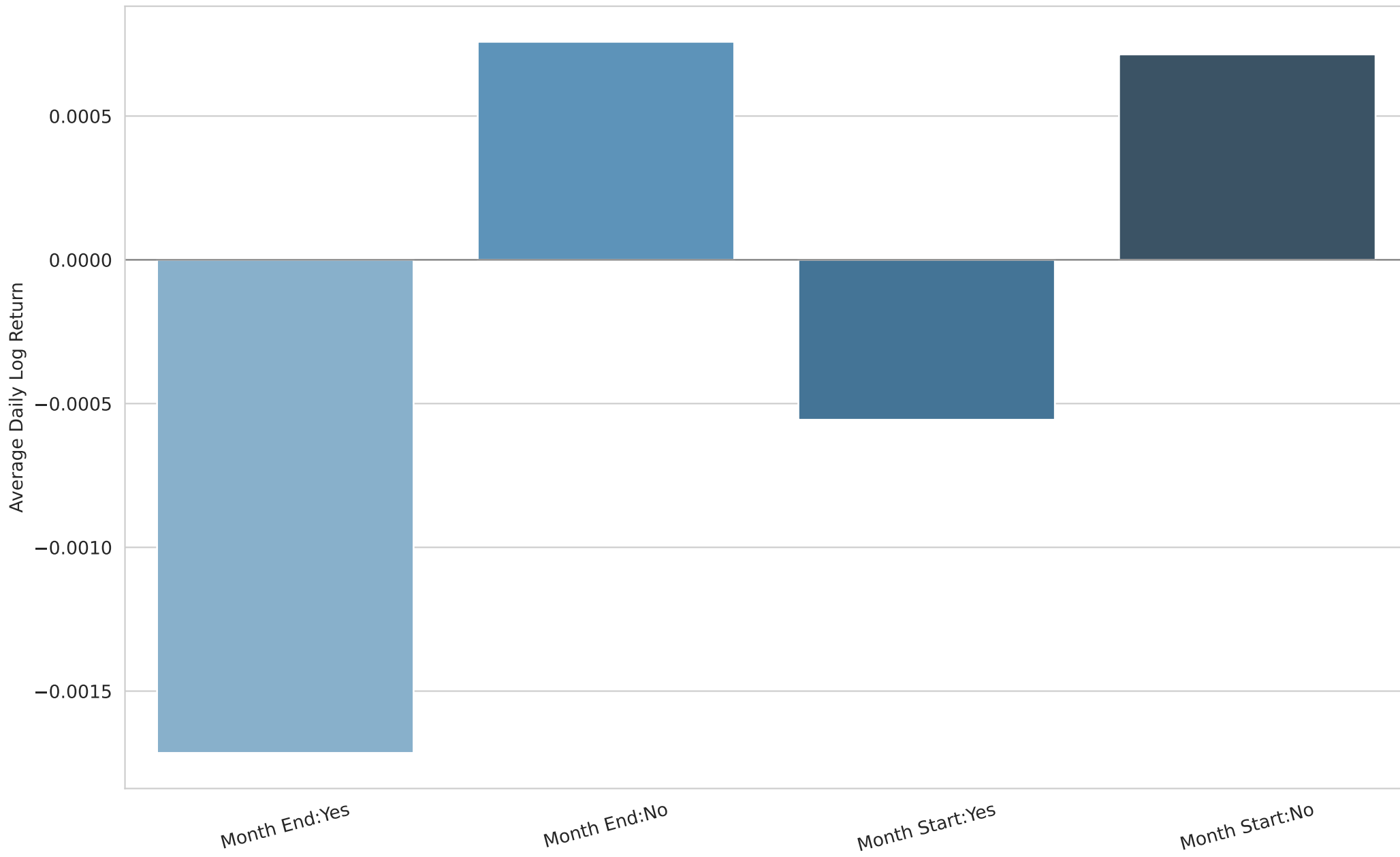
VLO • Quarterly Returns



VLO • Month×Year Heatmap (Avg Daily Returns)

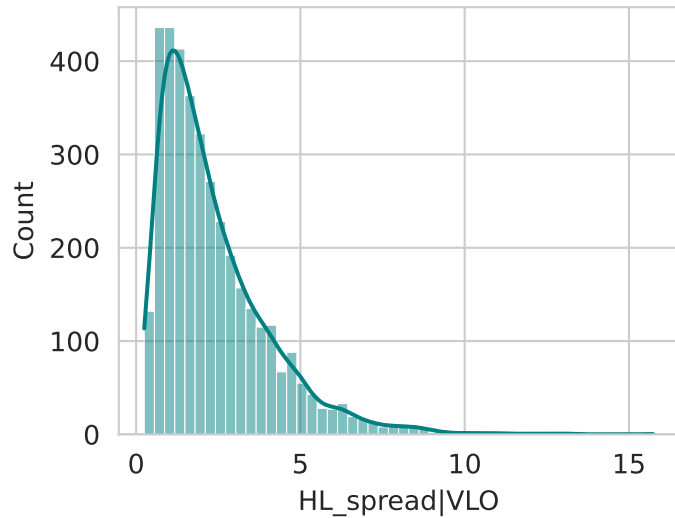


VLO • Avg Returns: Month-End/Start vs Others

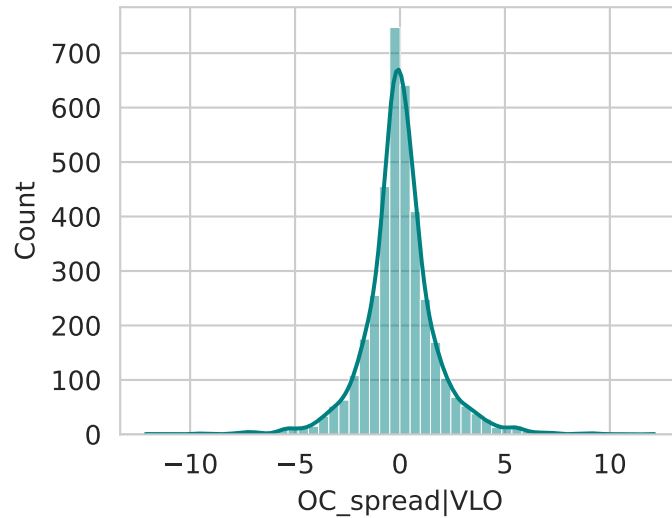


VLO • Spreads

HL_spread|VLO

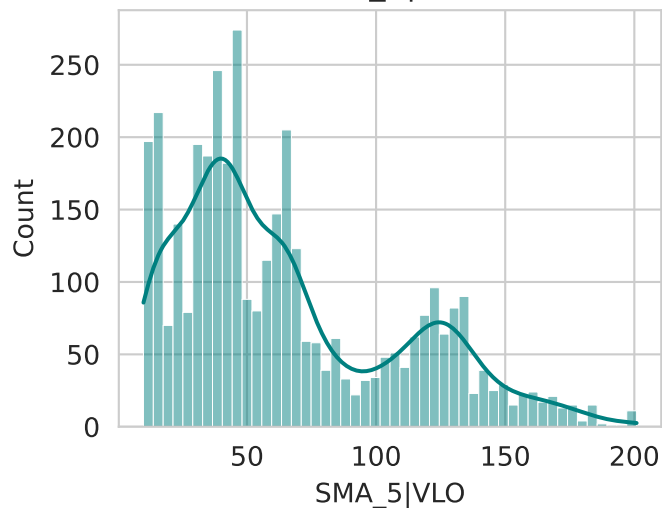


OC_spread|VLO

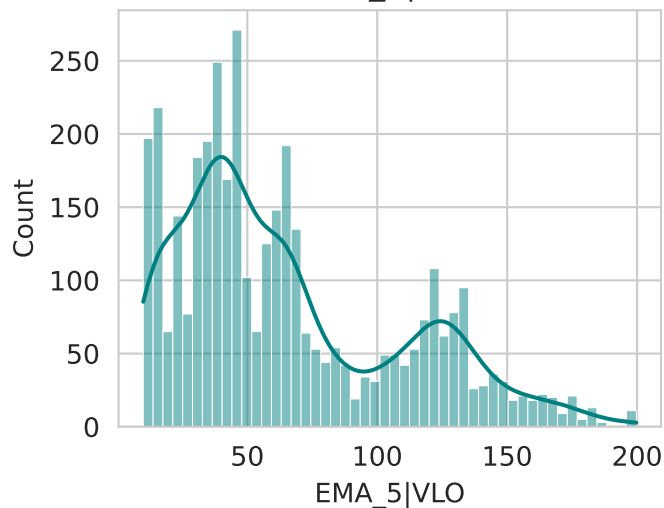


VLO • Moving Averages / EMAs

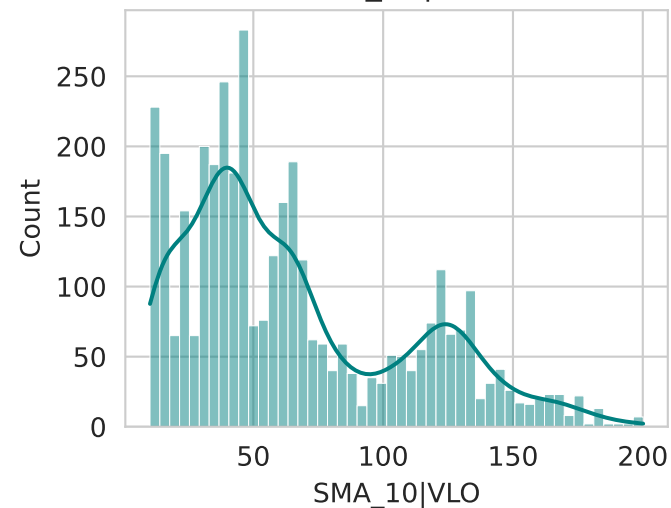
SMA_5|VLO



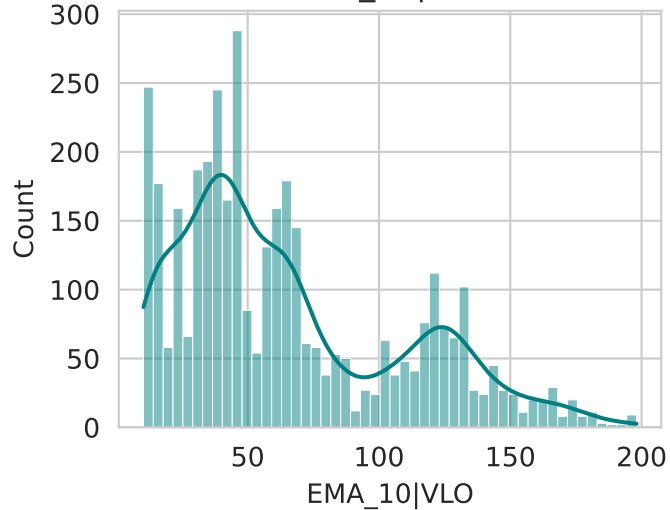
EMA_5|VLO



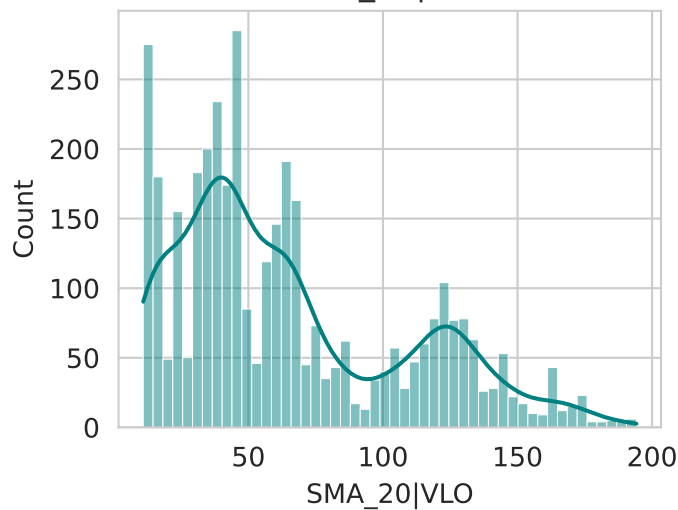
SMA_10|VLO



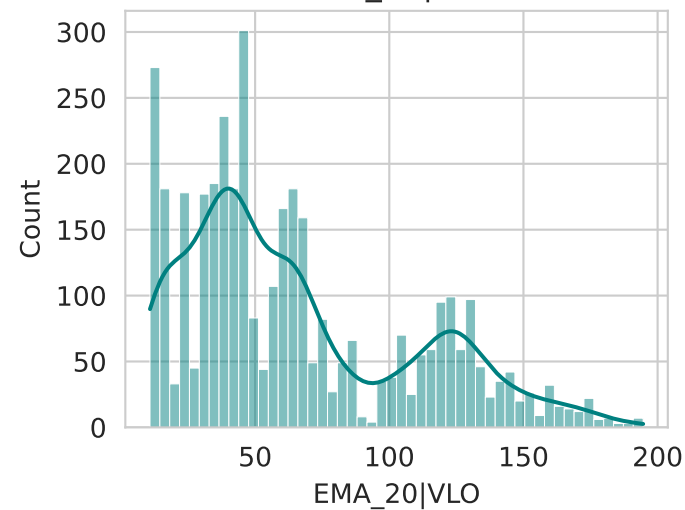
EMA_10|VLO



SMA_20|VLO

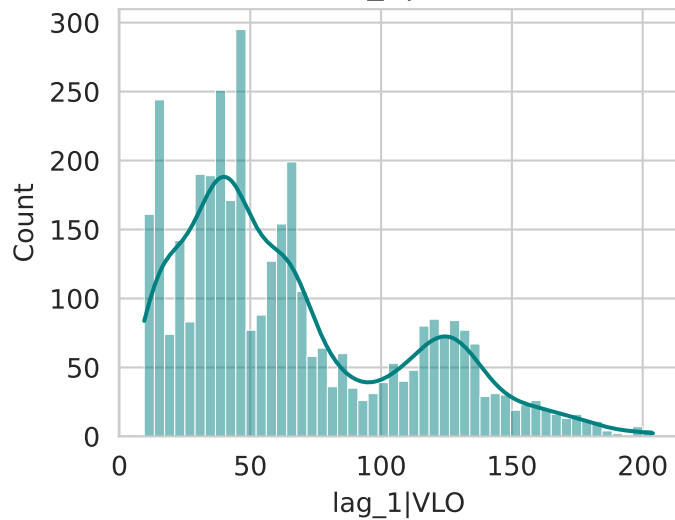


EMA_20|VLO

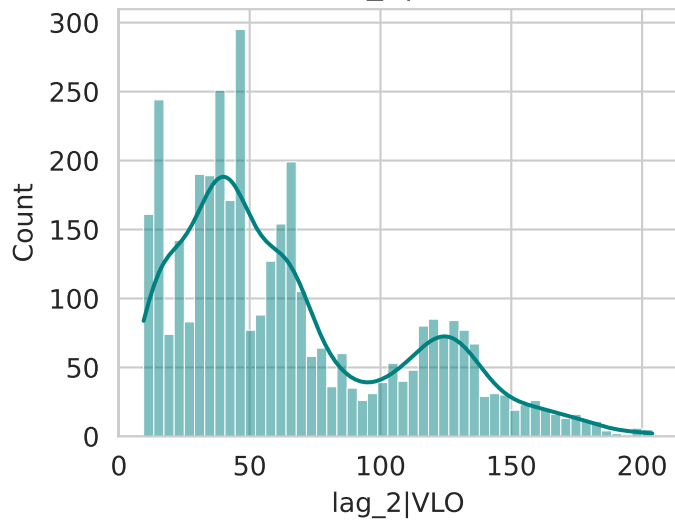


VLO • Lagged Prices

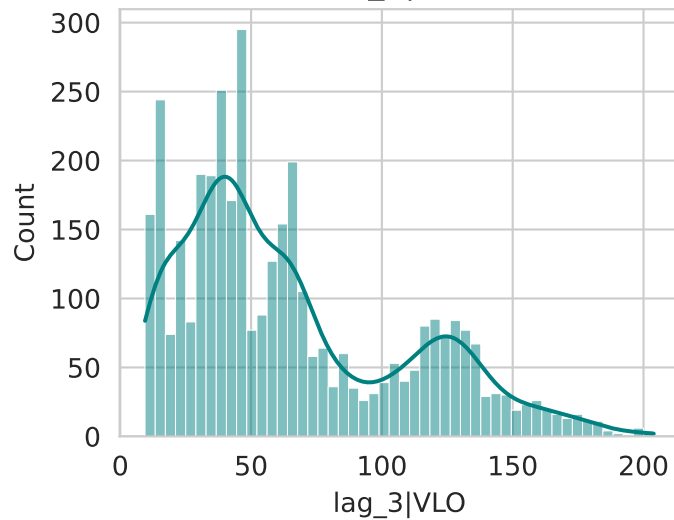
lag_1|VLO



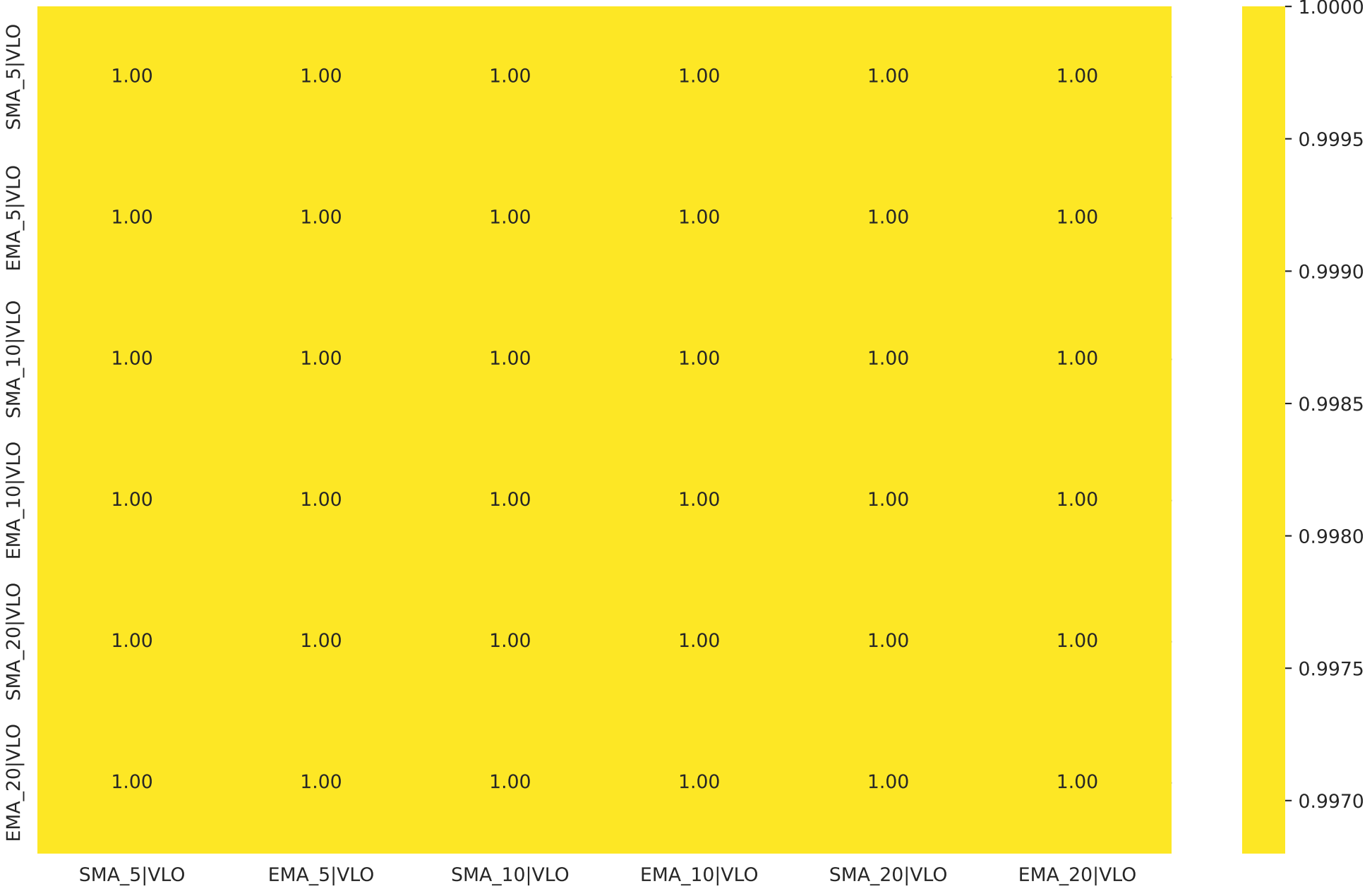
lag_2|VLO



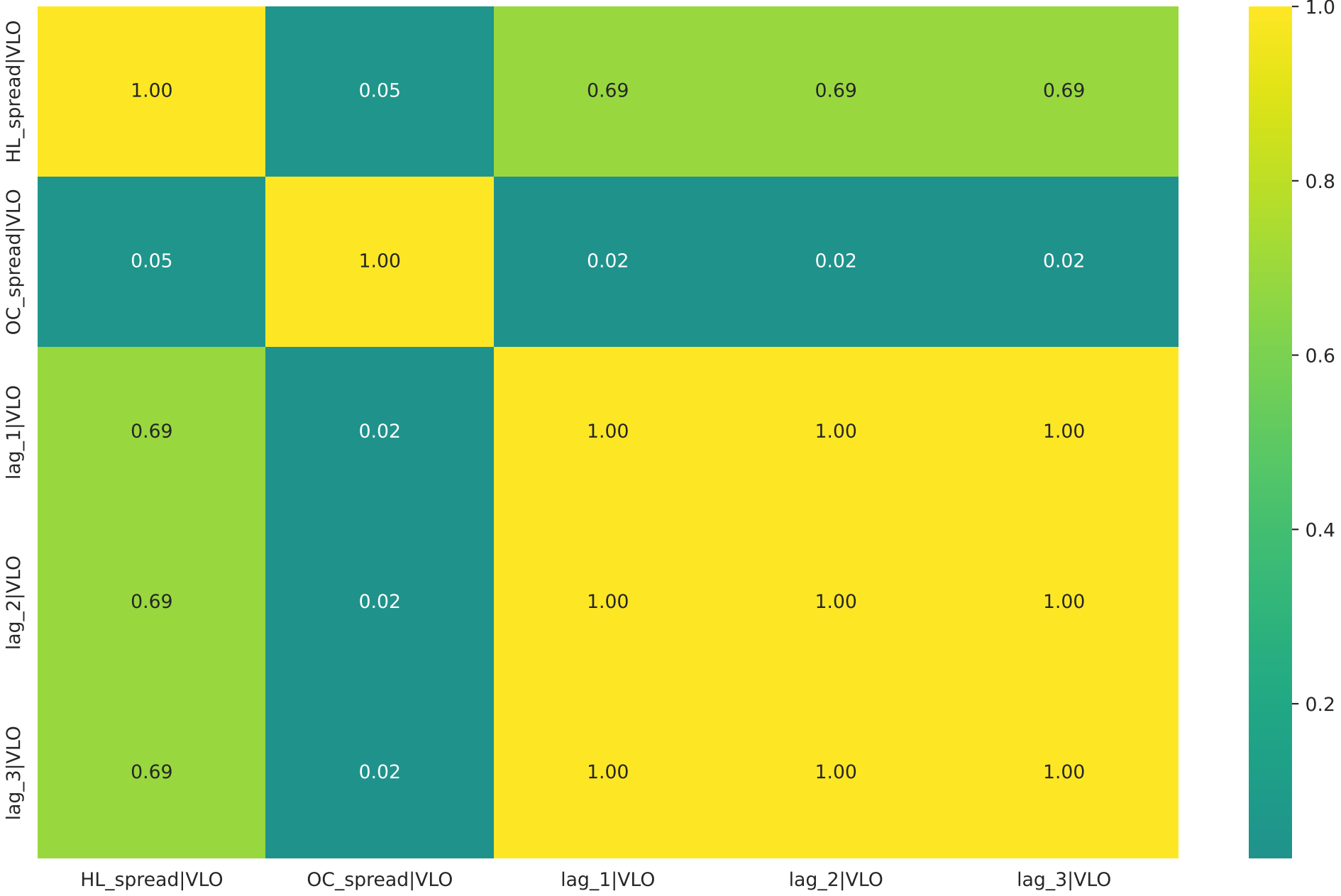
lag_3|VLO



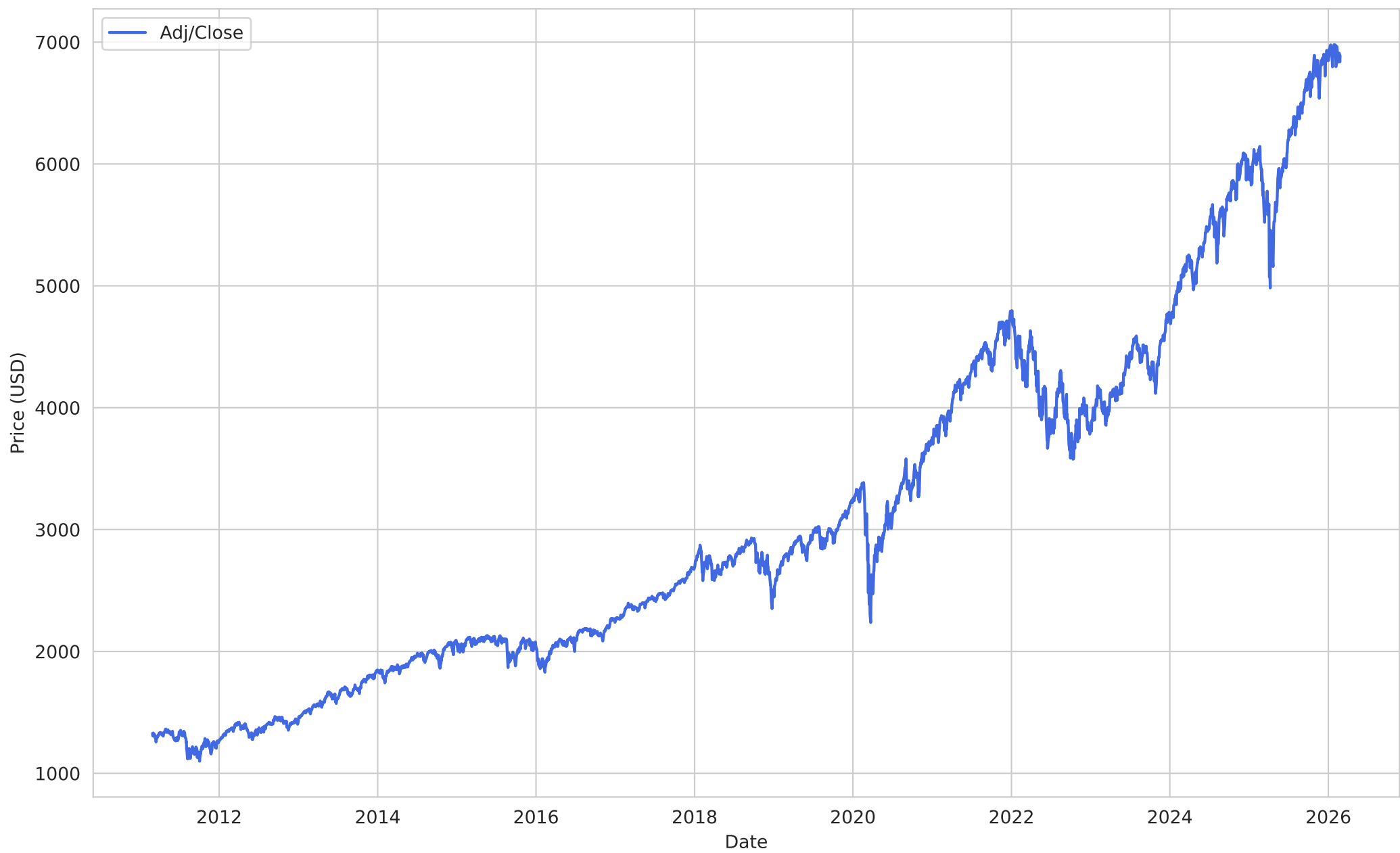
VLO • Correlation • Moving Averages



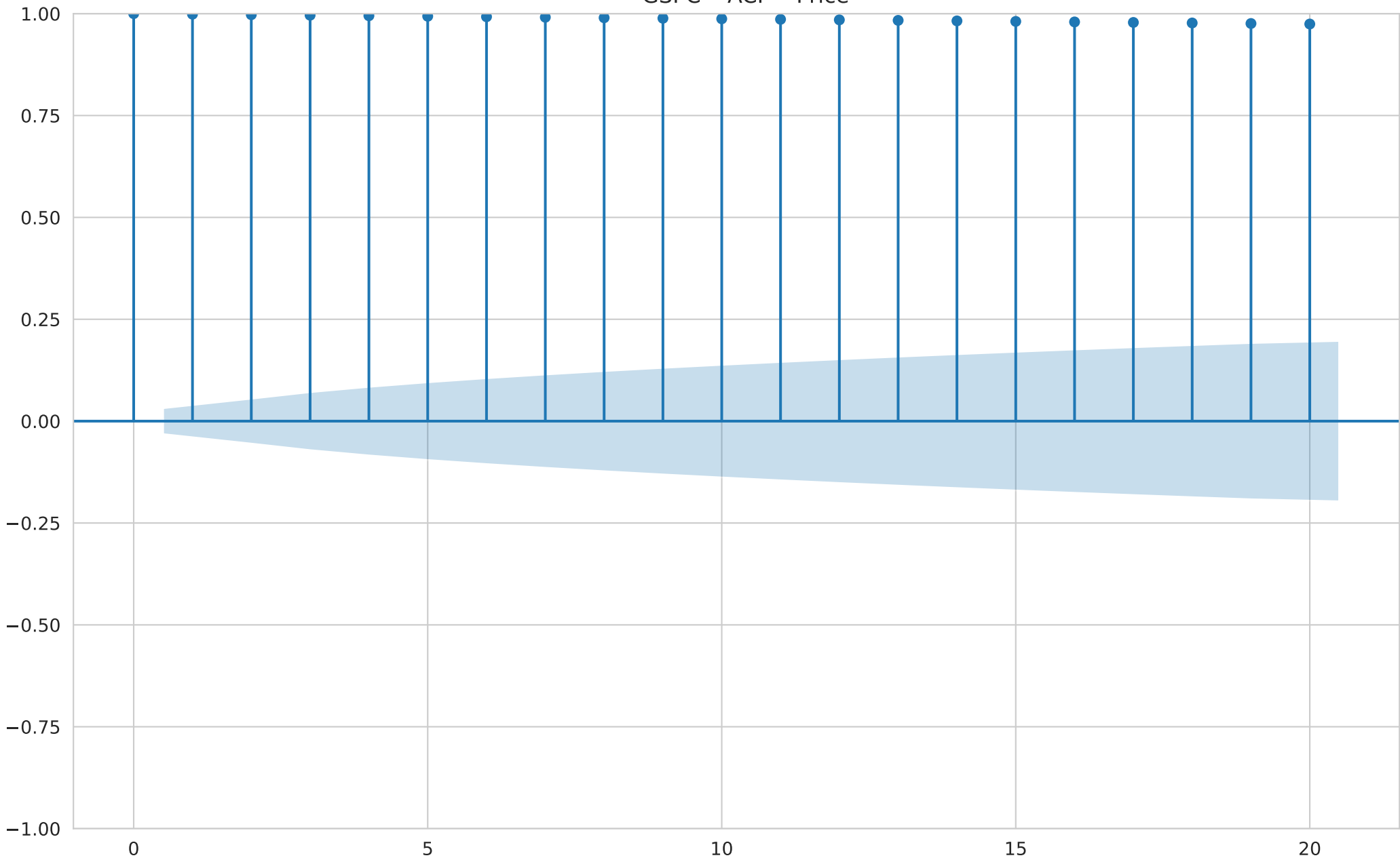
VLO • Correlation • Spreads + Lags



^GSPC • Price



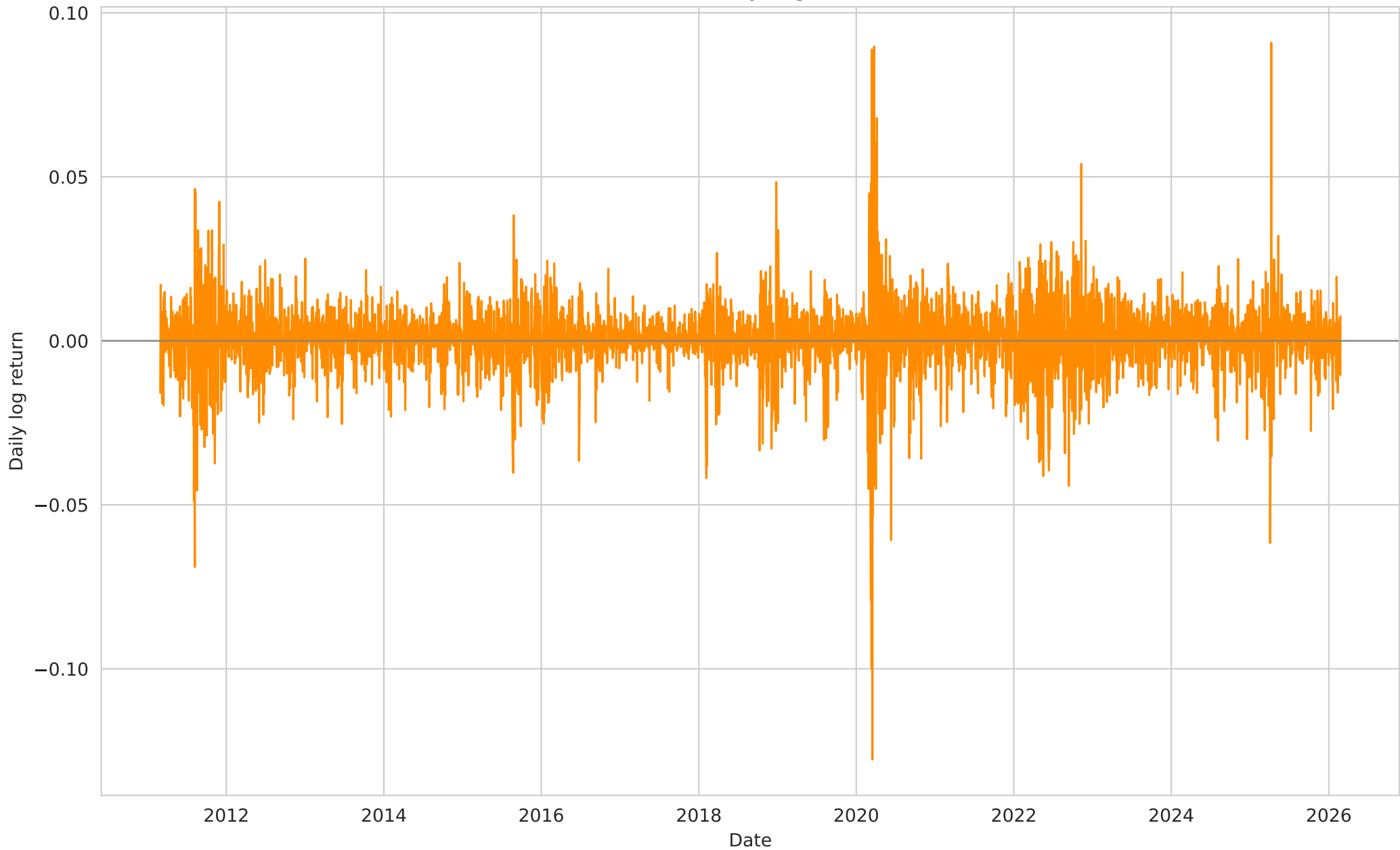
^GSPC • ACF • Price



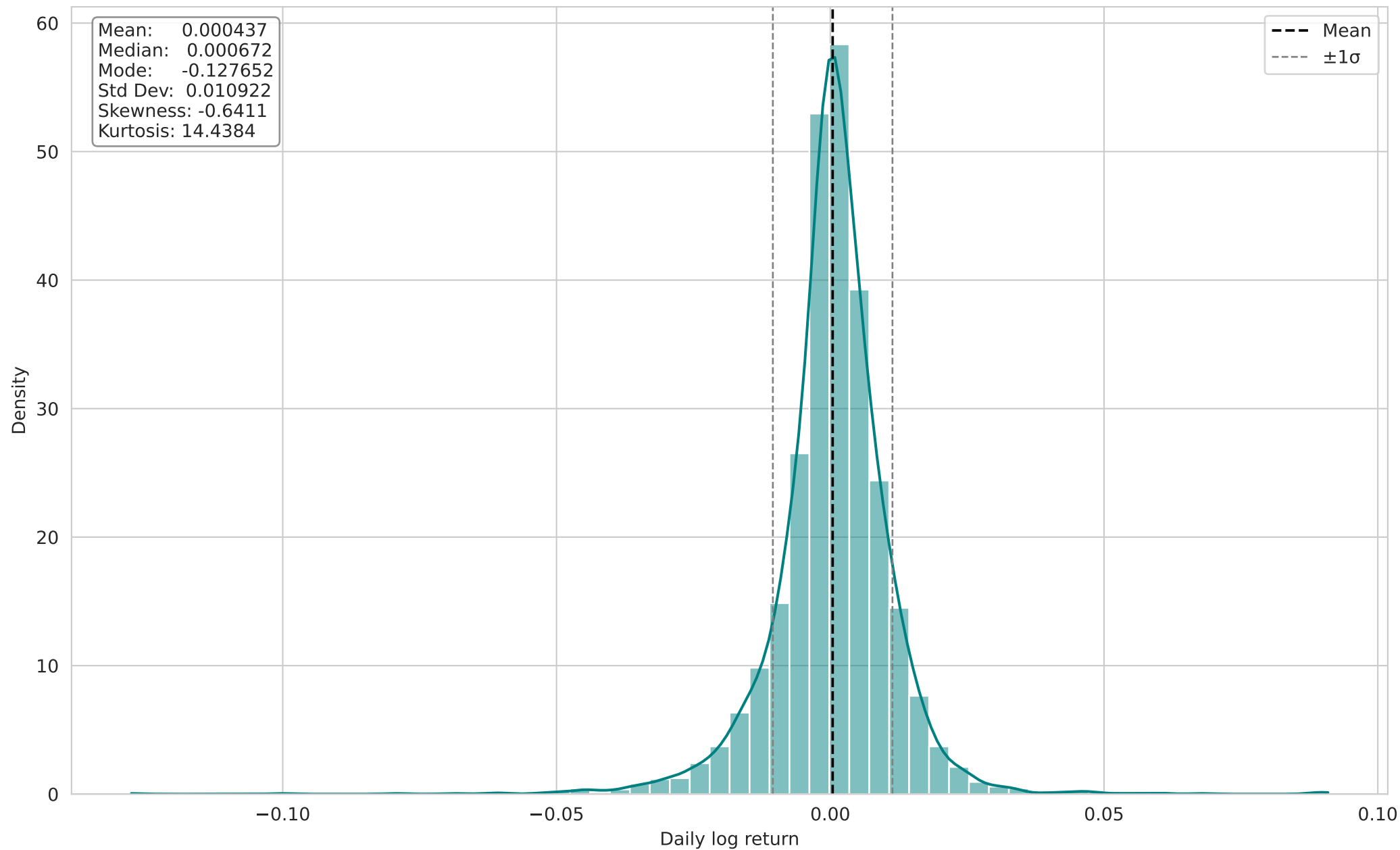
^GSPC • Moving Averages (5/10/20)



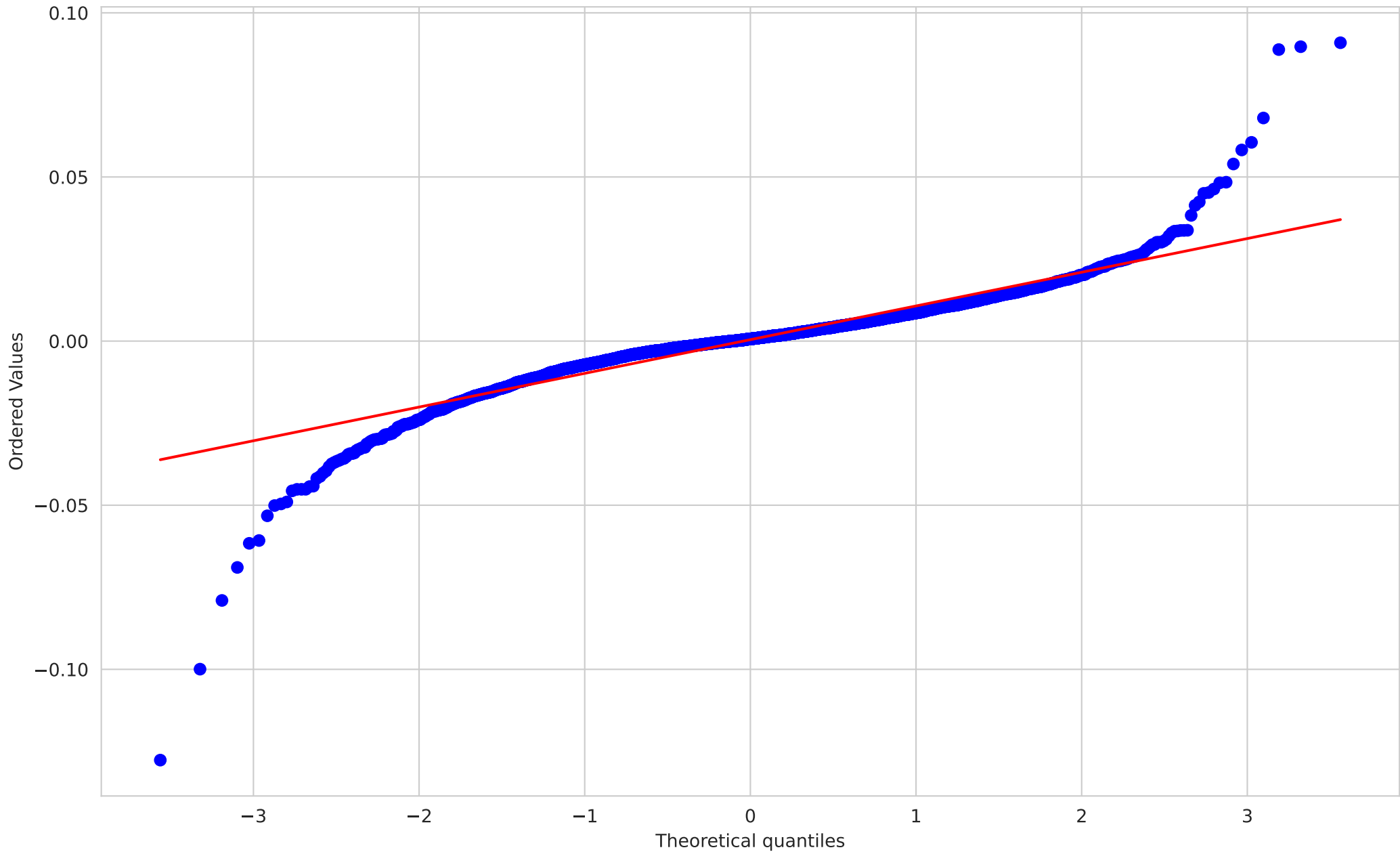
^GSPC • Daily Log Returns



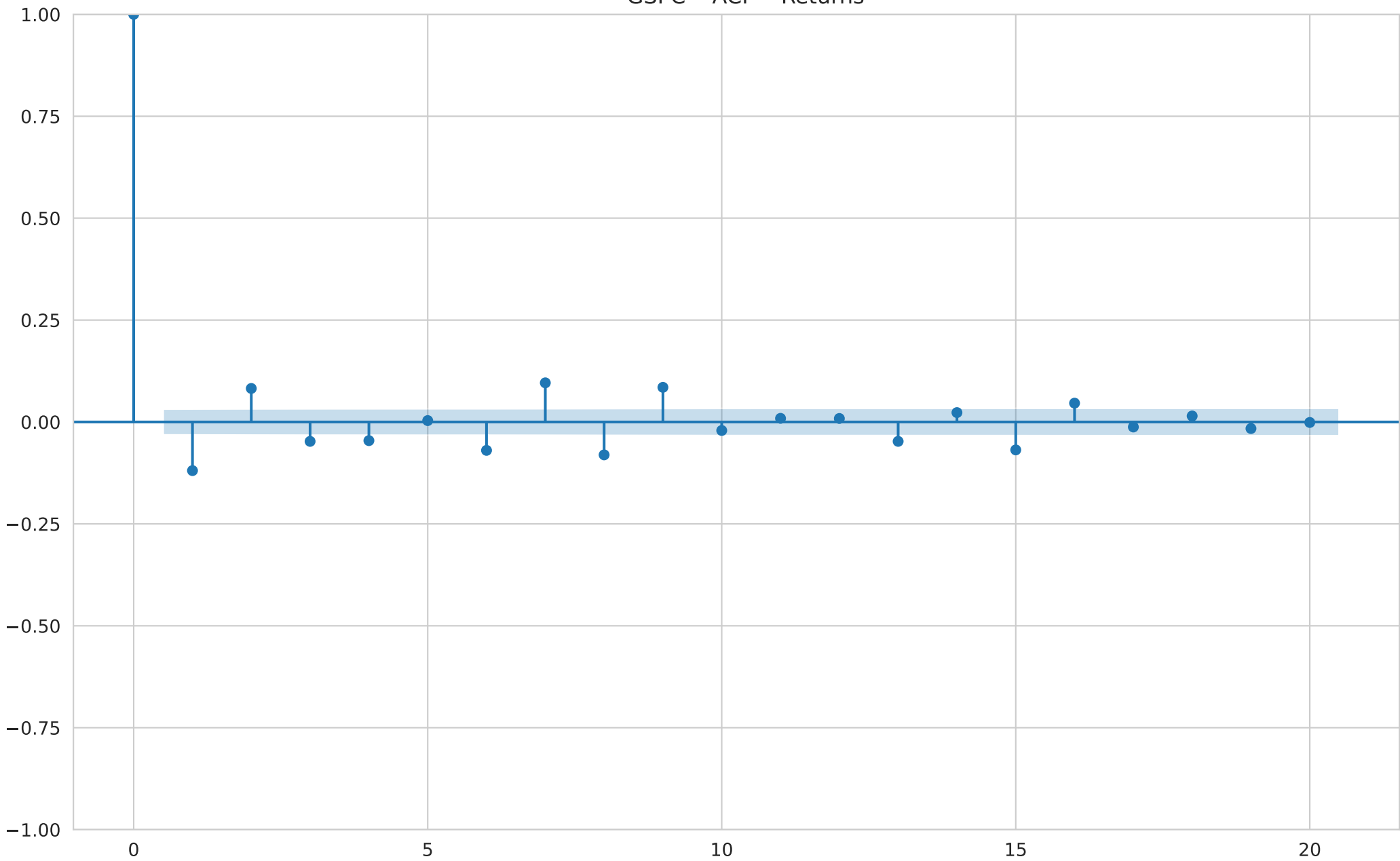
^GSPC • Returns • Distribution



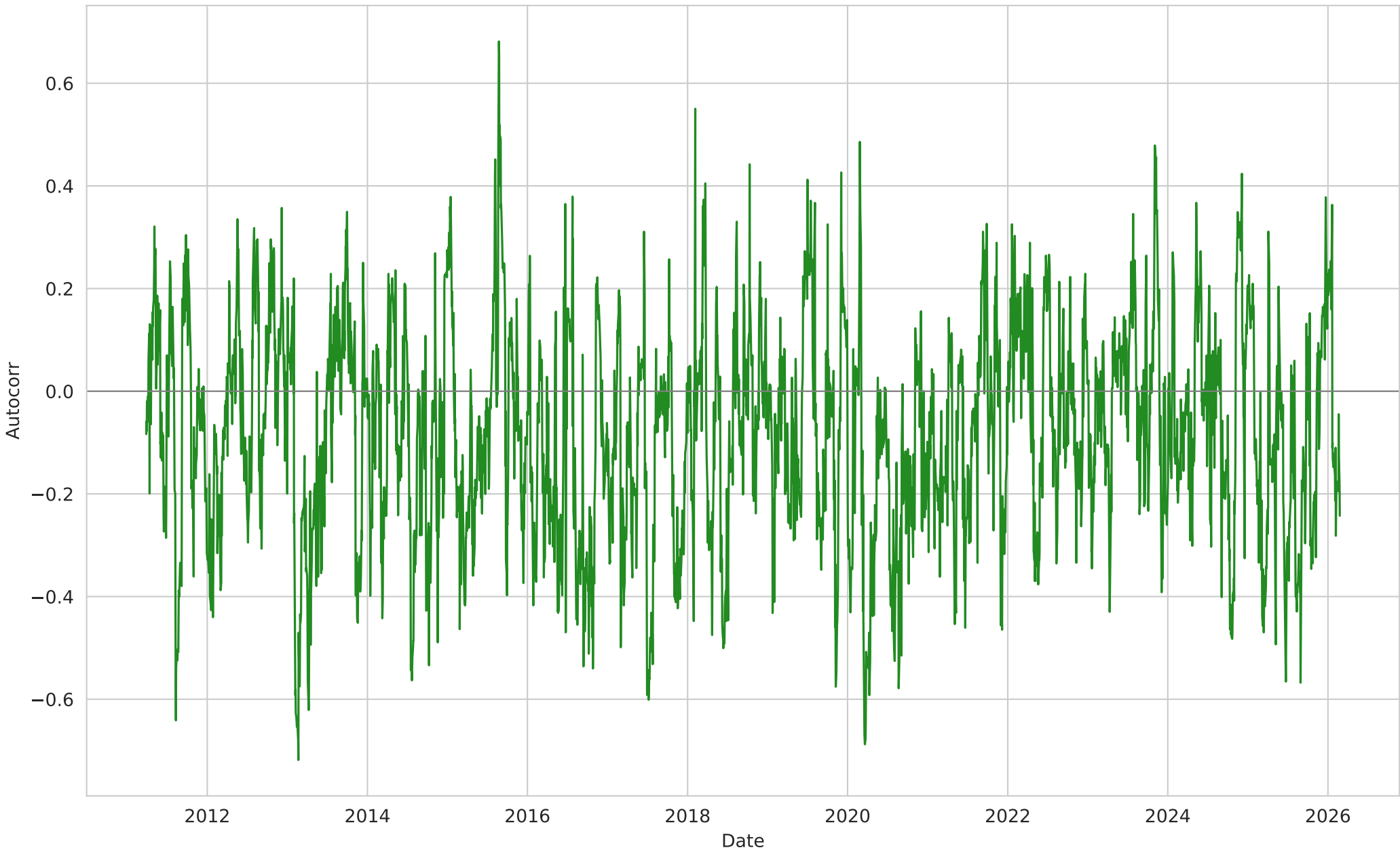
^GSPC • Returns • Q-Q Plot vs Normal



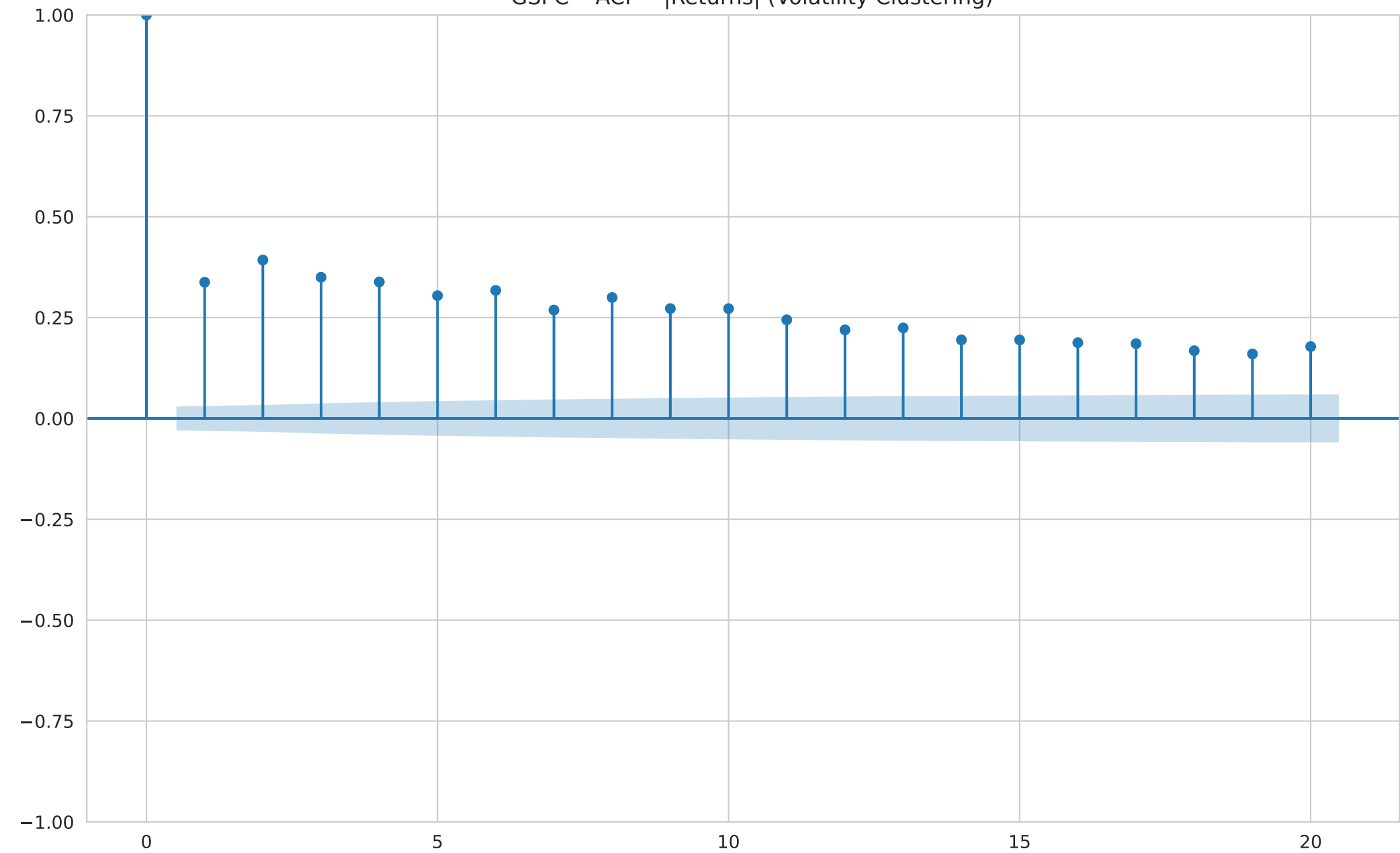
^GSPC • ACF • Returns



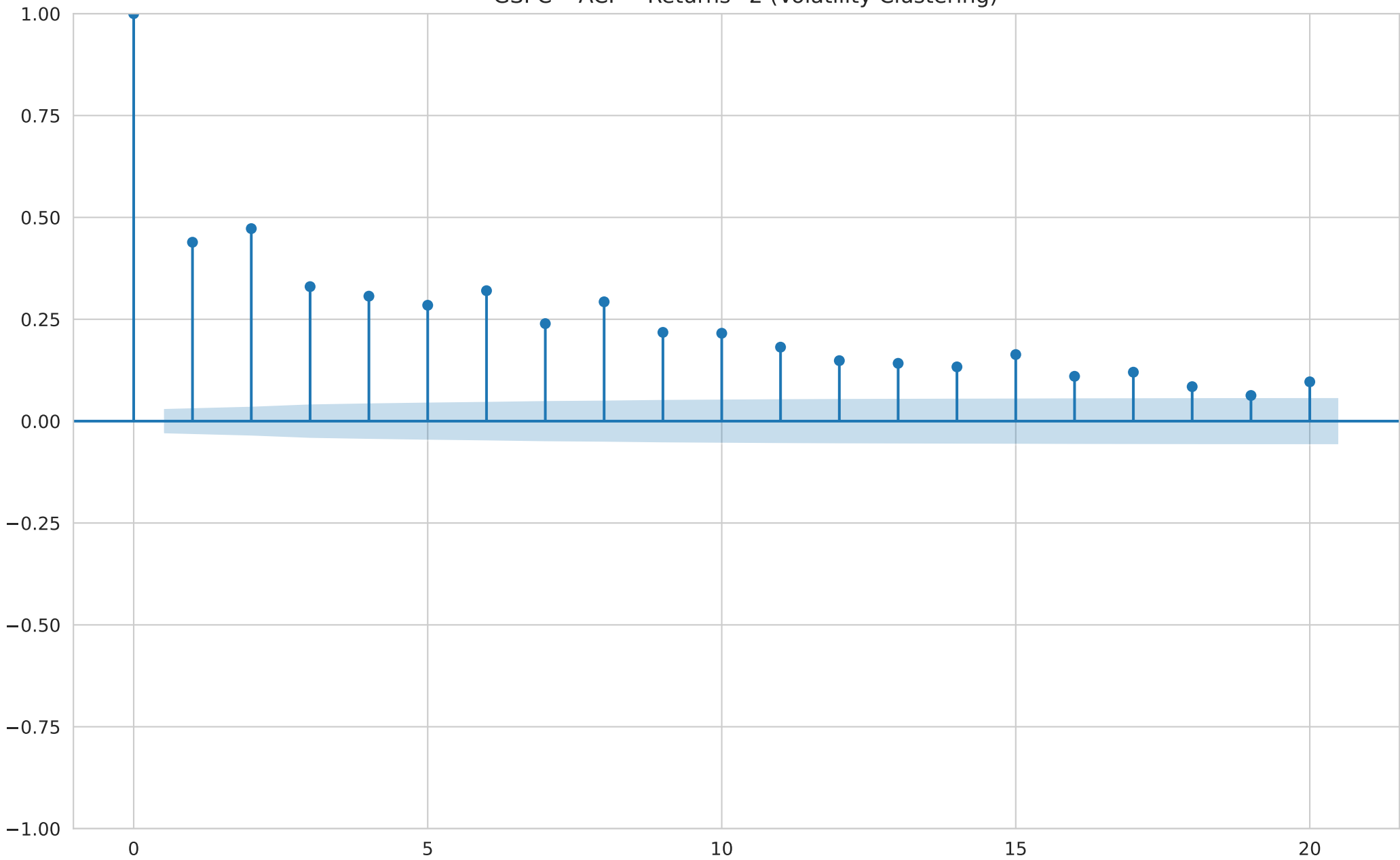
^GSPC • Rolling Autocorrelation (lag=1, window=20)



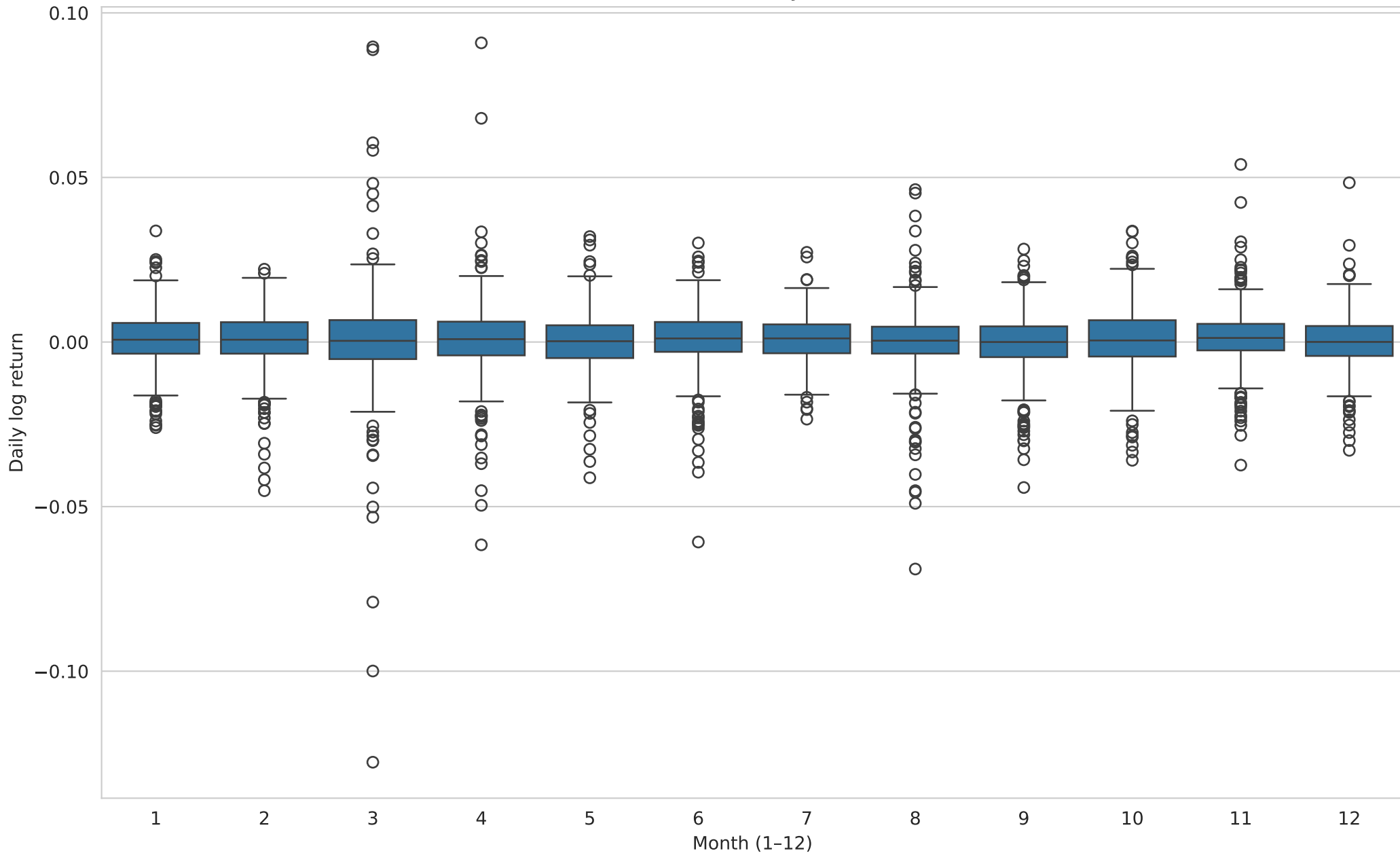
^GSPC • ACF • |Returns| (Volatility Clustering)



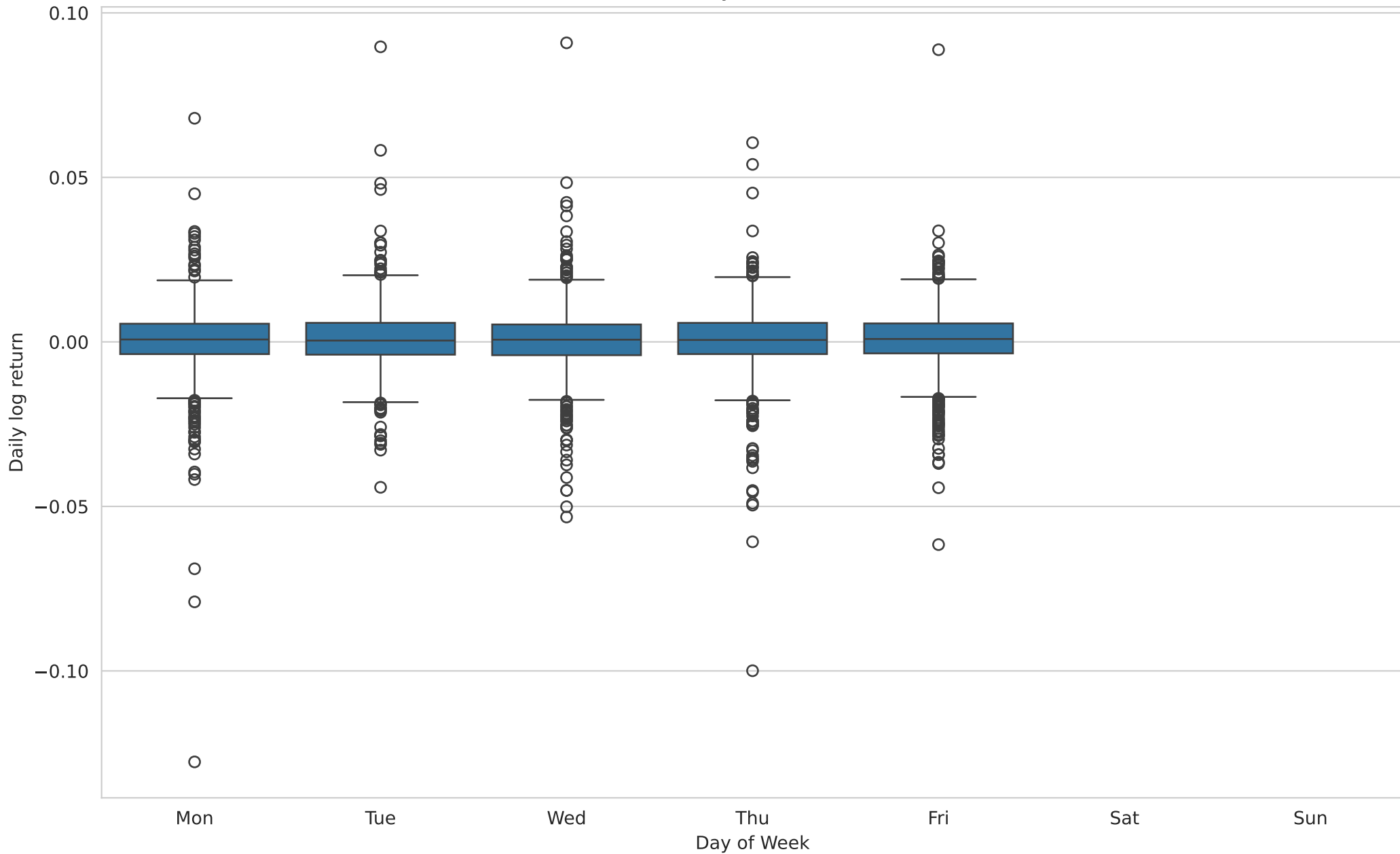
^GSPC • ACF • Returns^2 (Volatility Clustering)



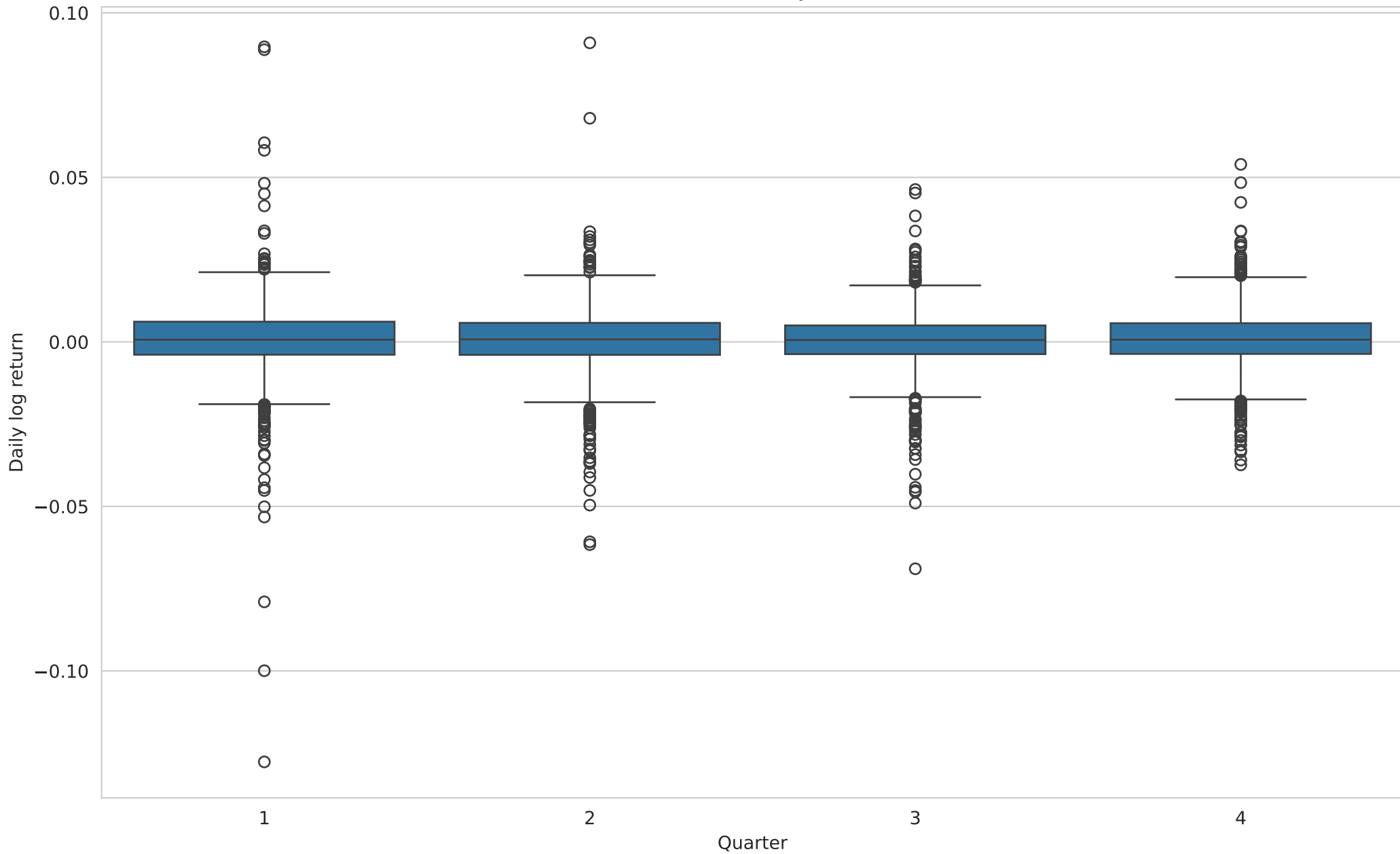
^GSPC • Monthly Returns



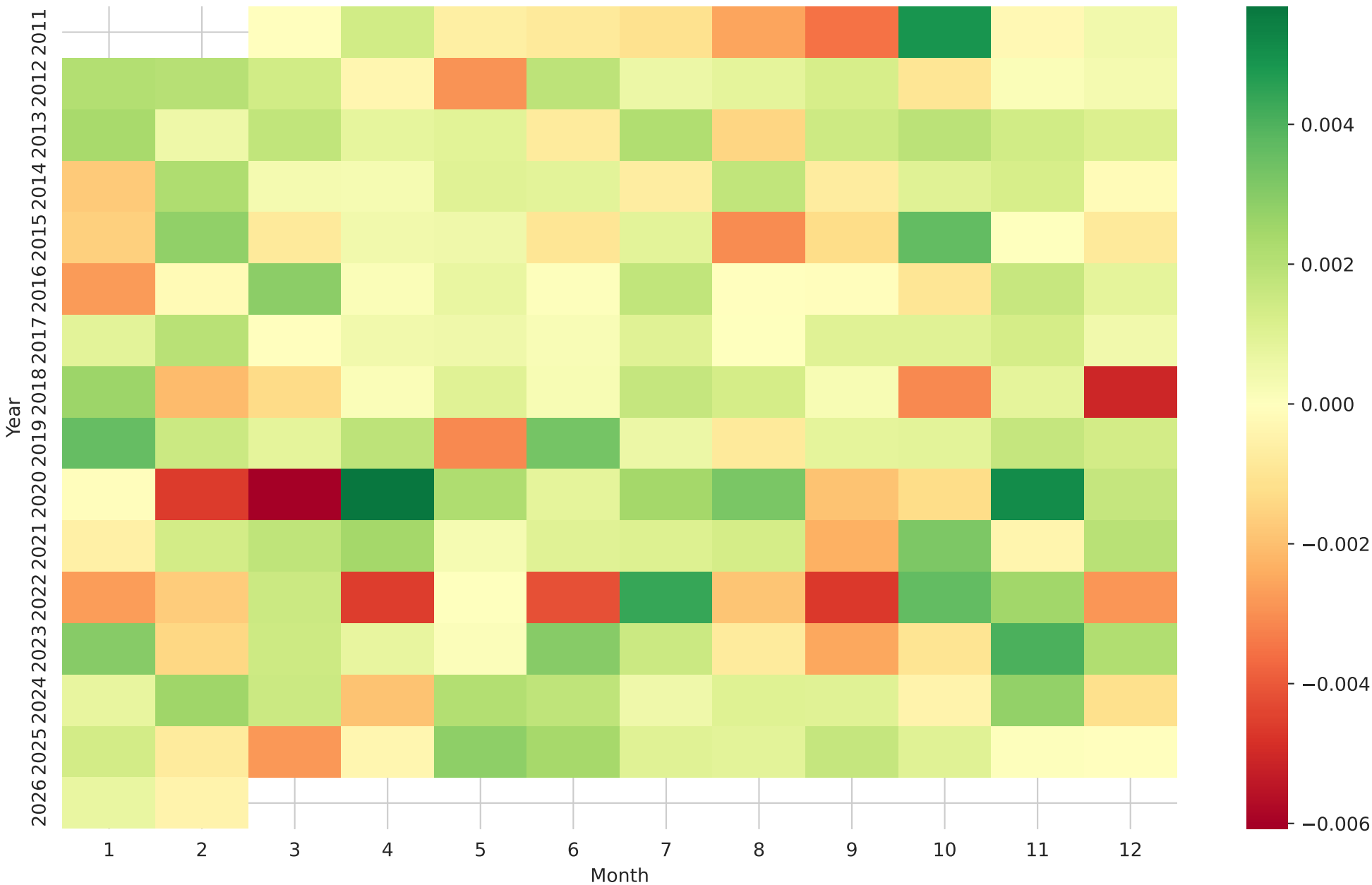
^GSPC • Day-of-Week Returns



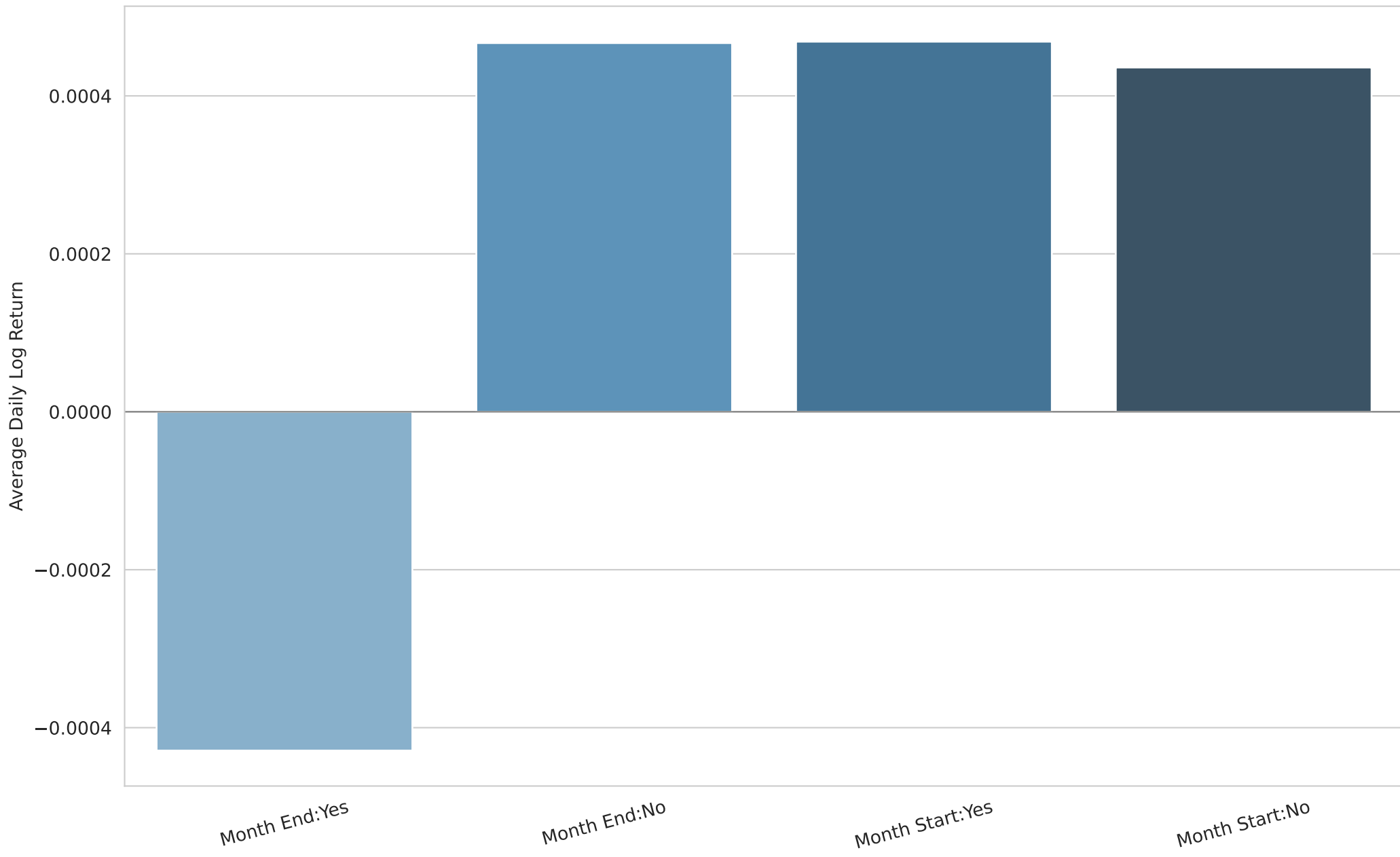
^GSPC • Quarterly Returns



^GSPC • Month×Year Heatmap (Avg Daily Returns)

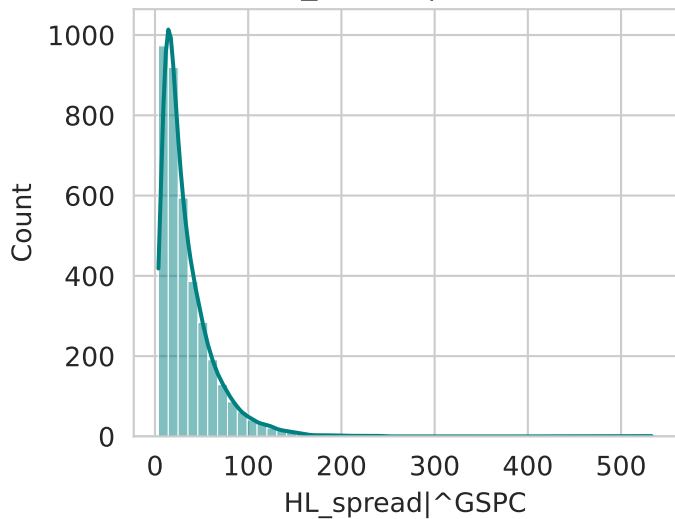


^GSPC • Avg Returns: Month-End/Start vs Others

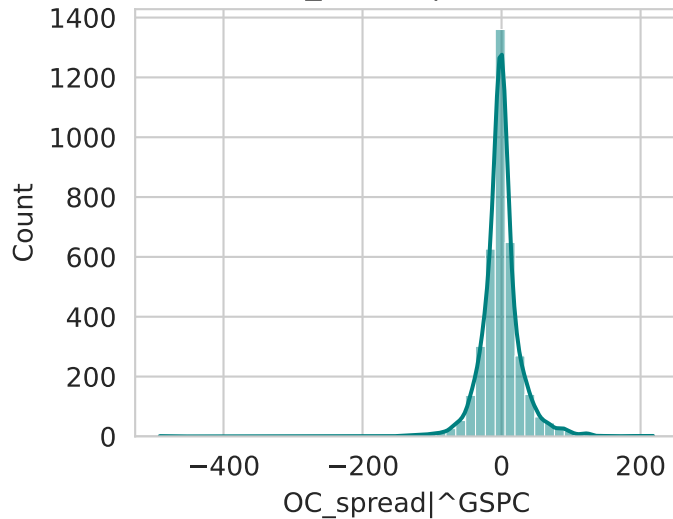


$\hat{G}SPC \bullet Spreads$

HL_spread| $\hat{G}SPC$

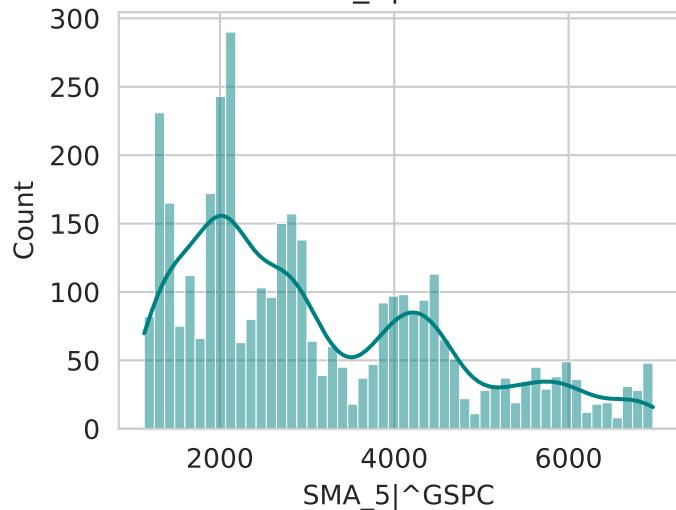


OC_spread| $\hat{G}SPC$

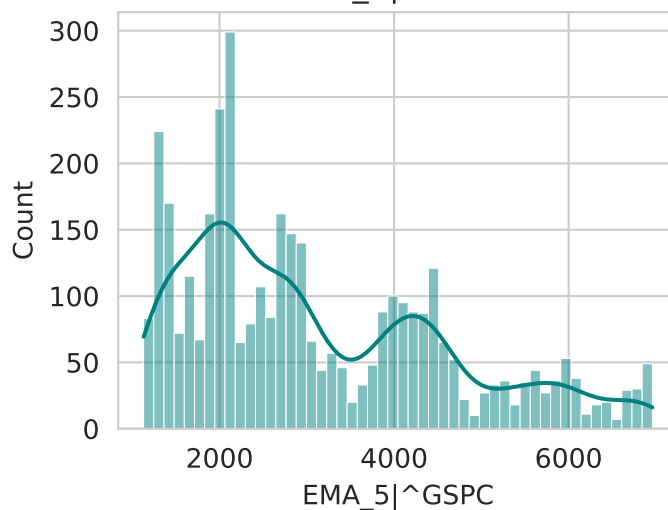


\wedge GSPC • Moving Averages / EMAs

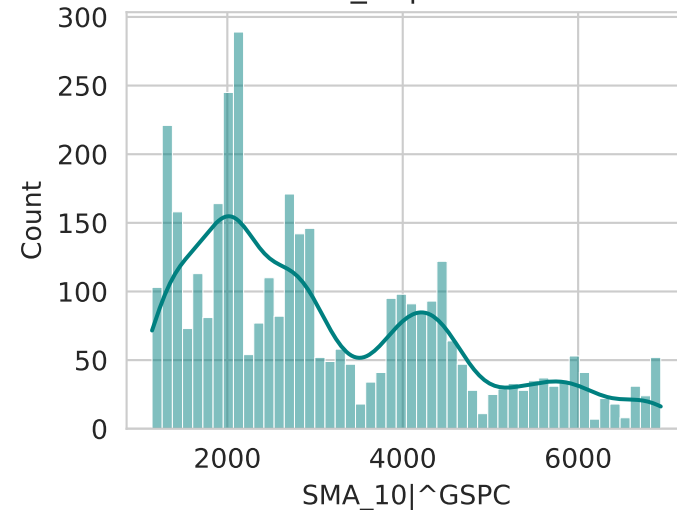
SMA_5| \wedge GSPC



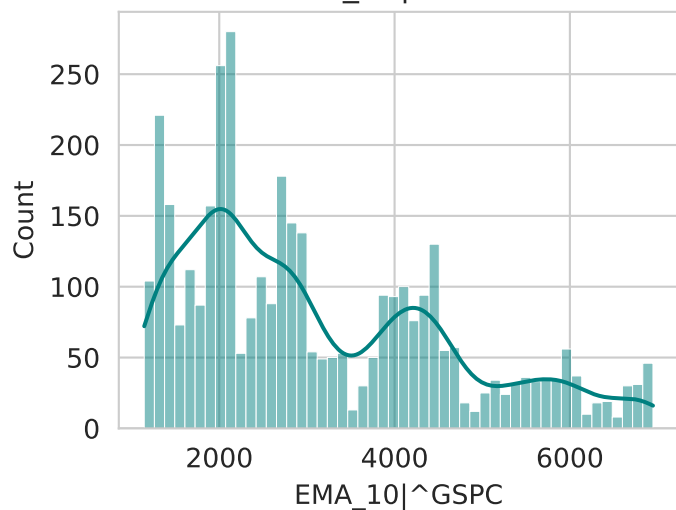
EMA_5| \wedge GSPC



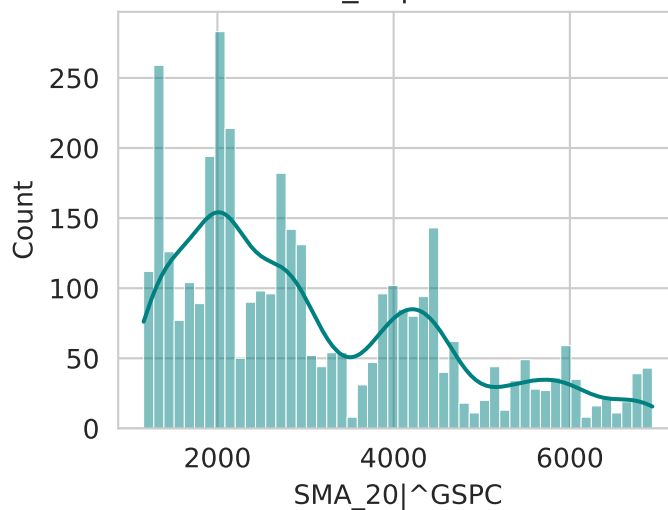
SMA_10| \wedge GSPC



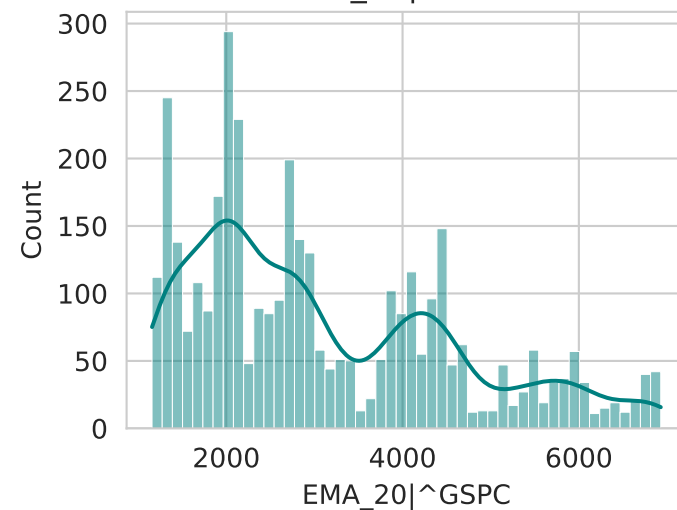
EMA_10| \wedge GSPC



SMA_20| \wedge GSPC

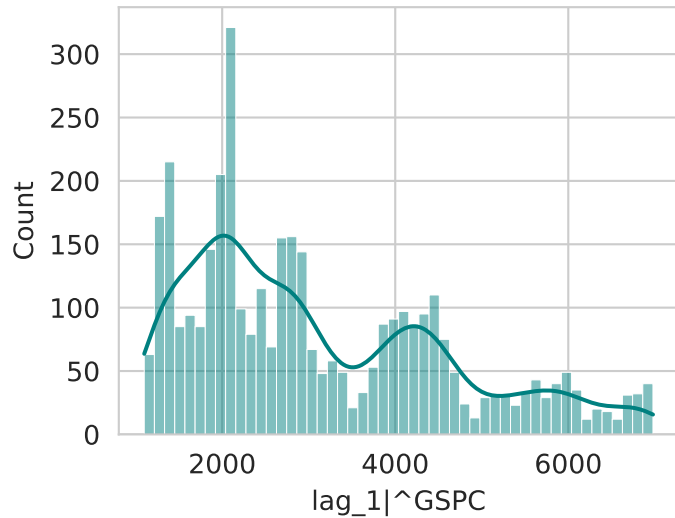


EMA_20| \wedge GSPC

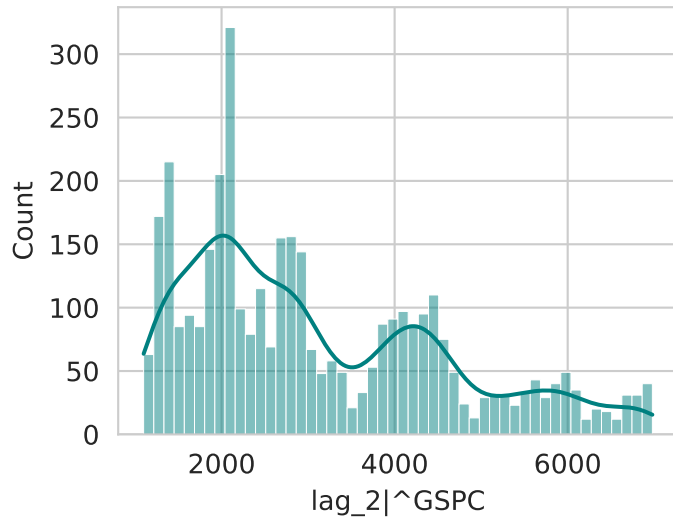


\wedge GSPC • Lagged Prices

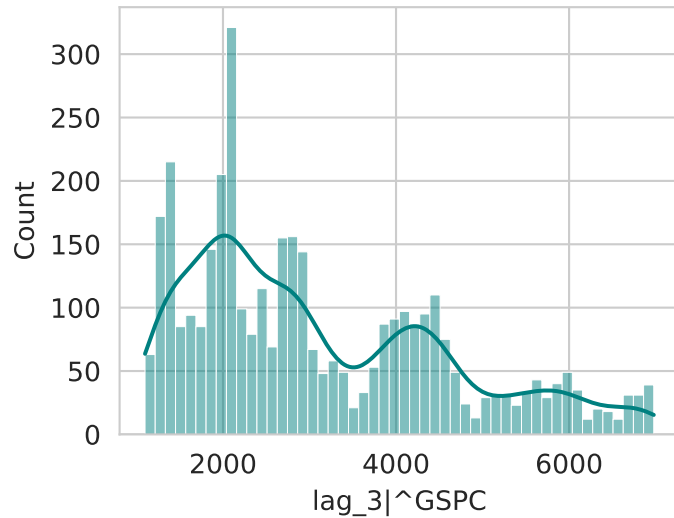
lag_1| \wedge GSPC



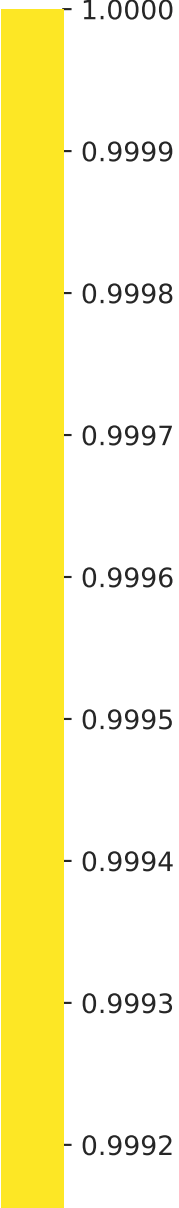
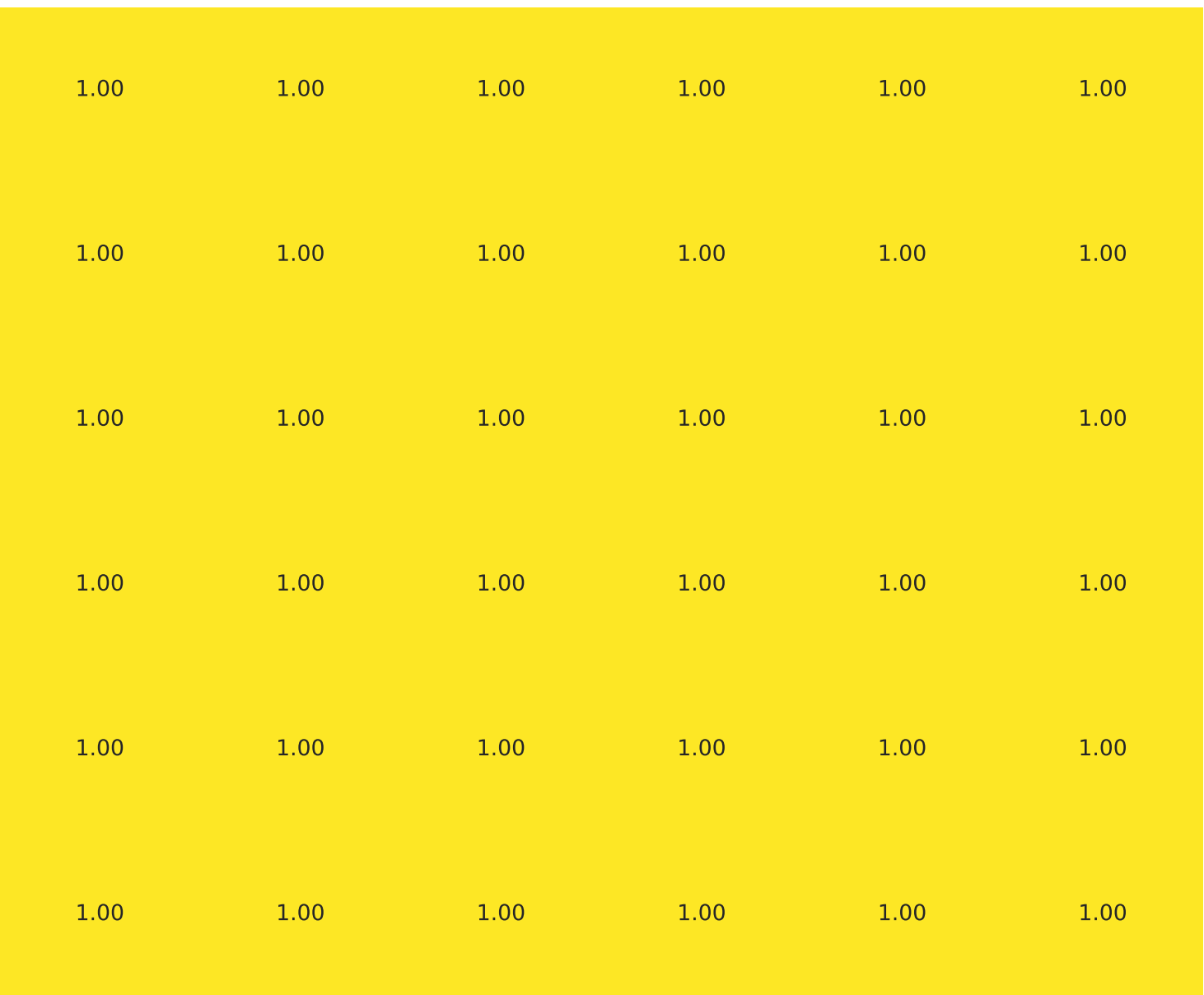
lag_2| \wedge GSPC



lag_3| \wedge GSPC



^GSPC • Correlation • Moving Averages



^GSPC • Correlation • Spreads + Lags



^VIX • Price

Adj/Close

Price (USD)

80
70
60
50
40
30
20
10

2012

2014

2016

2018

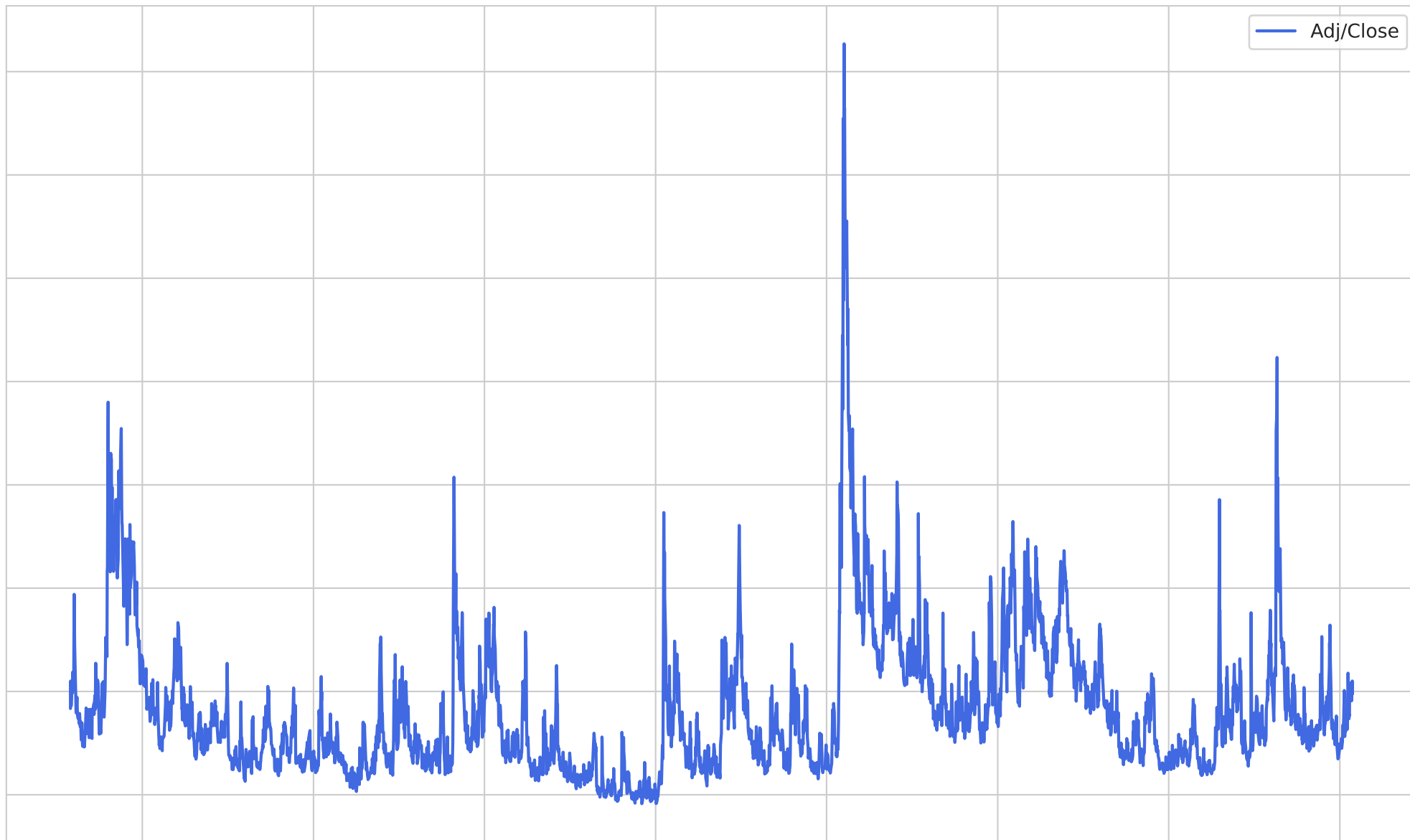
2020

2022

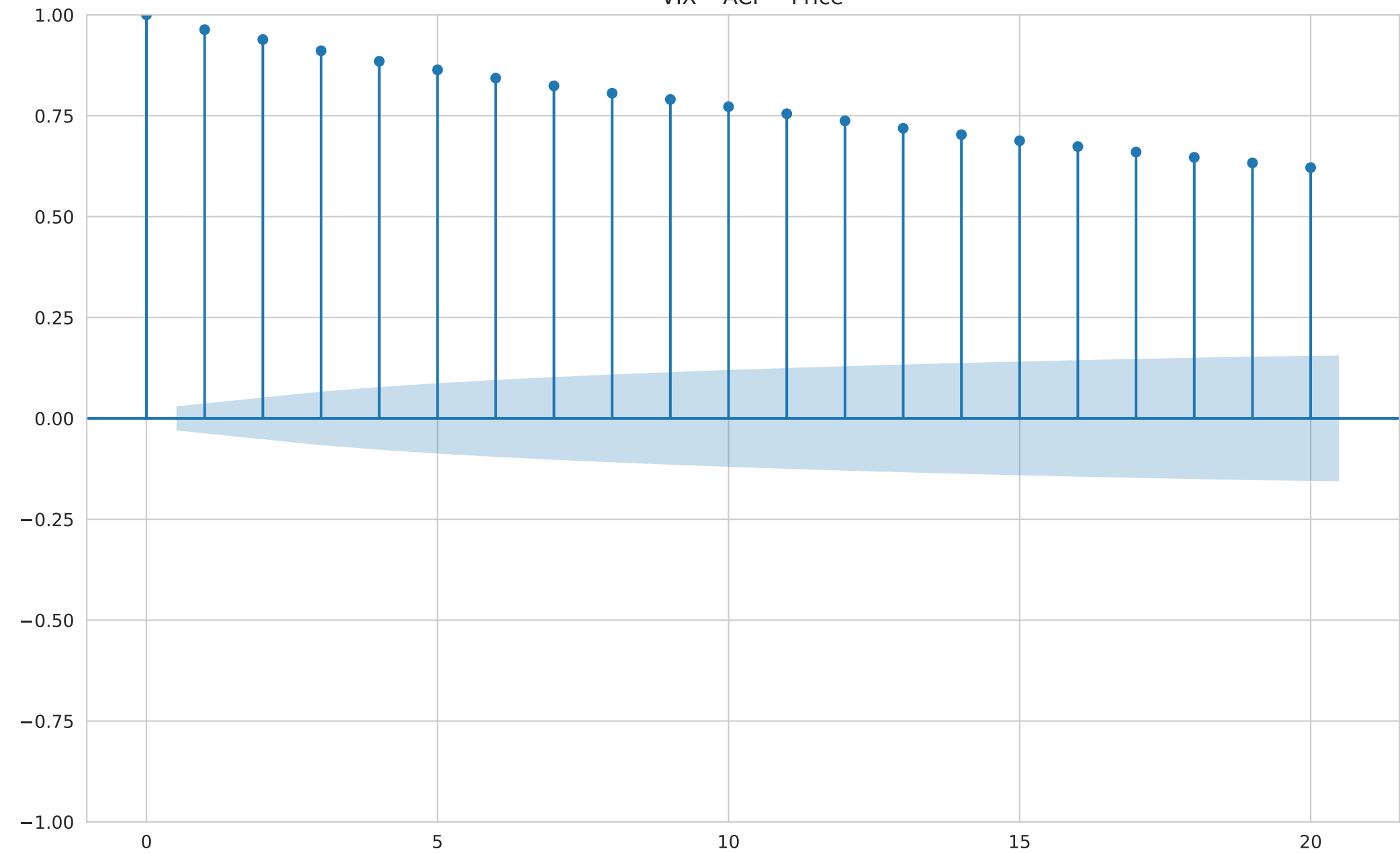
2024

2026

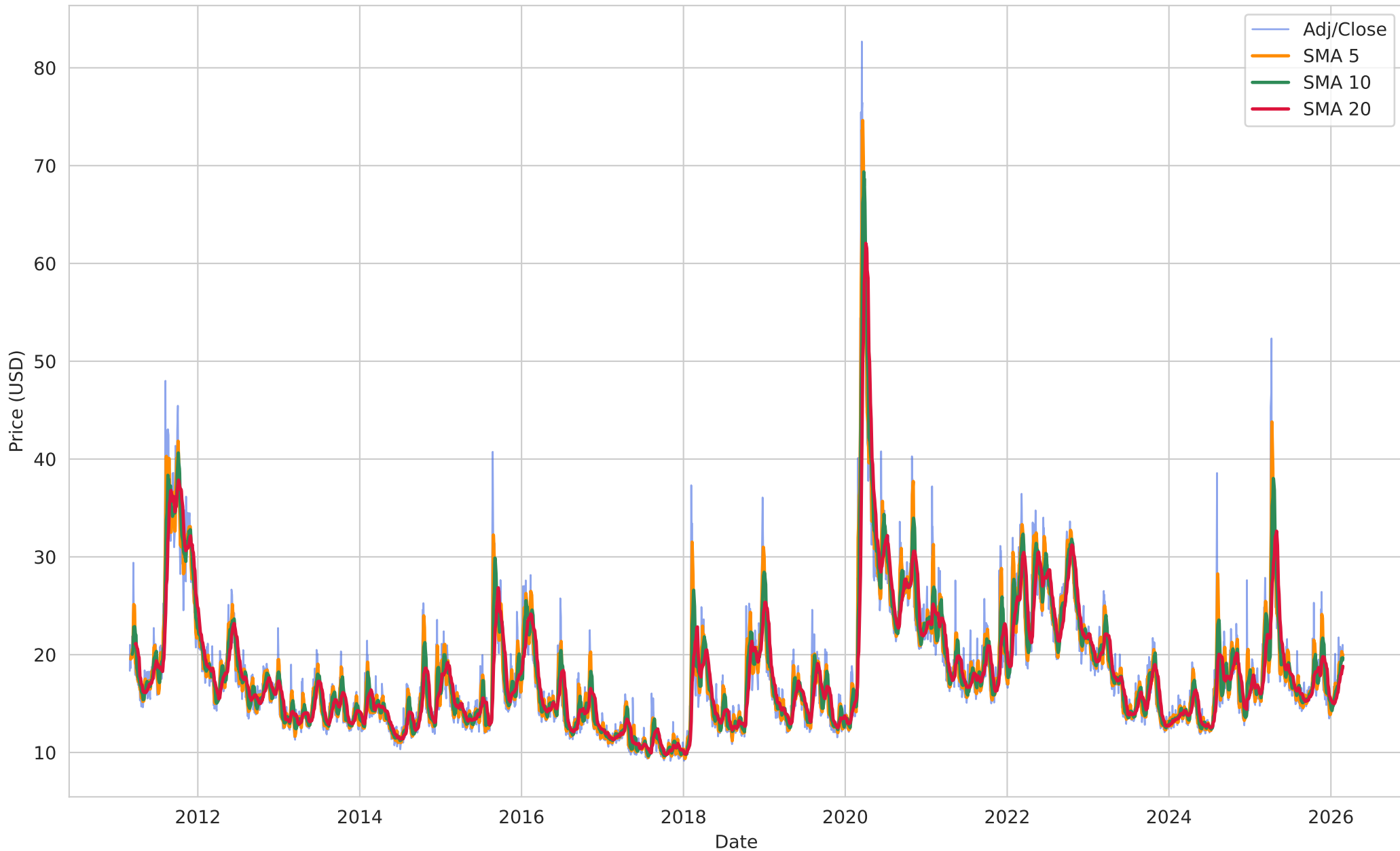
Date



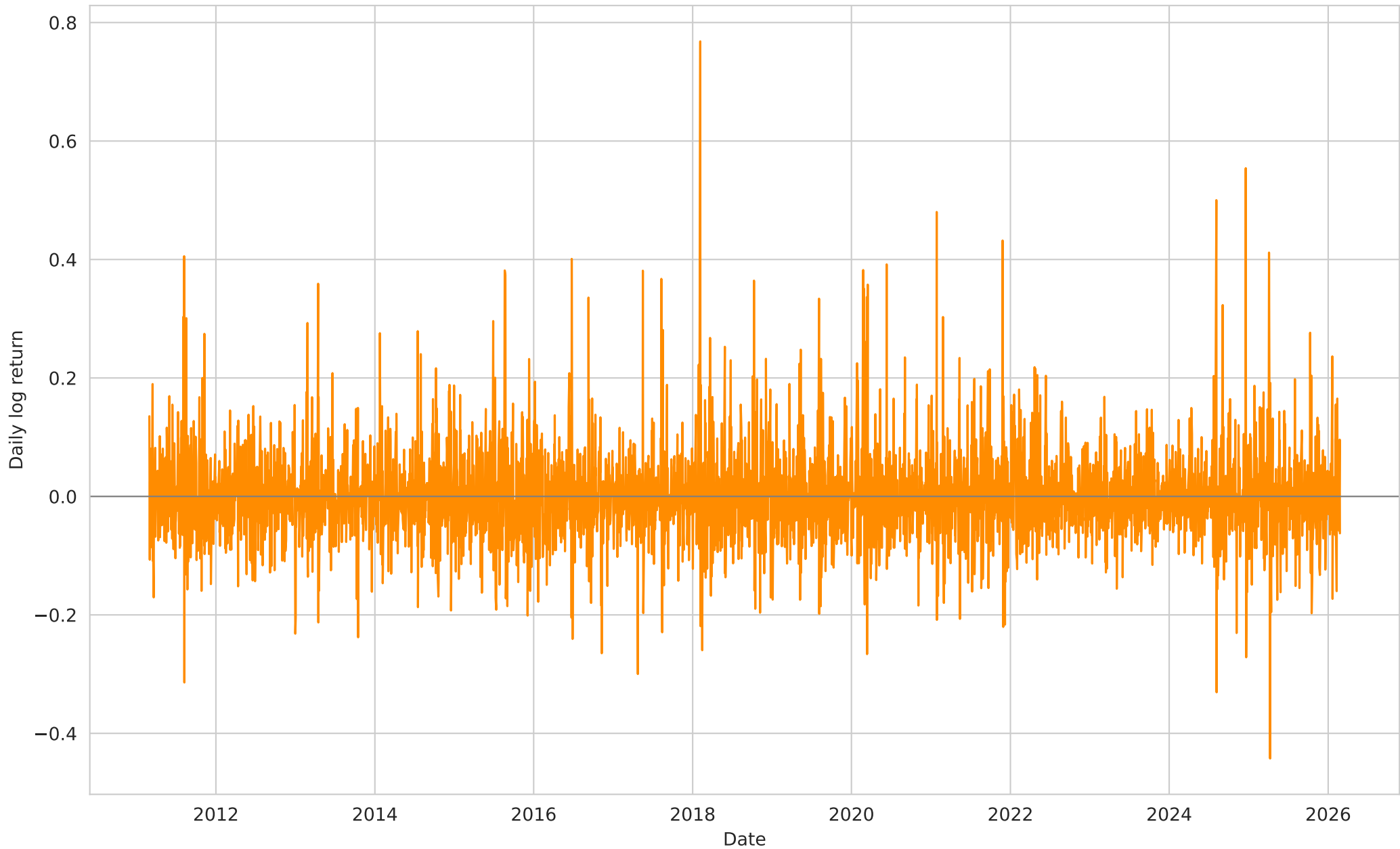
\hat{VIX} • ACF • Price



^VIX • Moving Averages (5/10/20)



^VIX • Daily Log Returns



^VIX • Returns • Distribution

Mean: 0.000019
Median: -0.006368
Mode: 0.000000
Std Dev: 0.078601
Skewness: 1.1356
Kurtosis: 6.8910

--- Mean
- - - $\pm 1\sigma$

Density

0

1

2

3

4

5

6

7

-0.4

-0.2

0.0

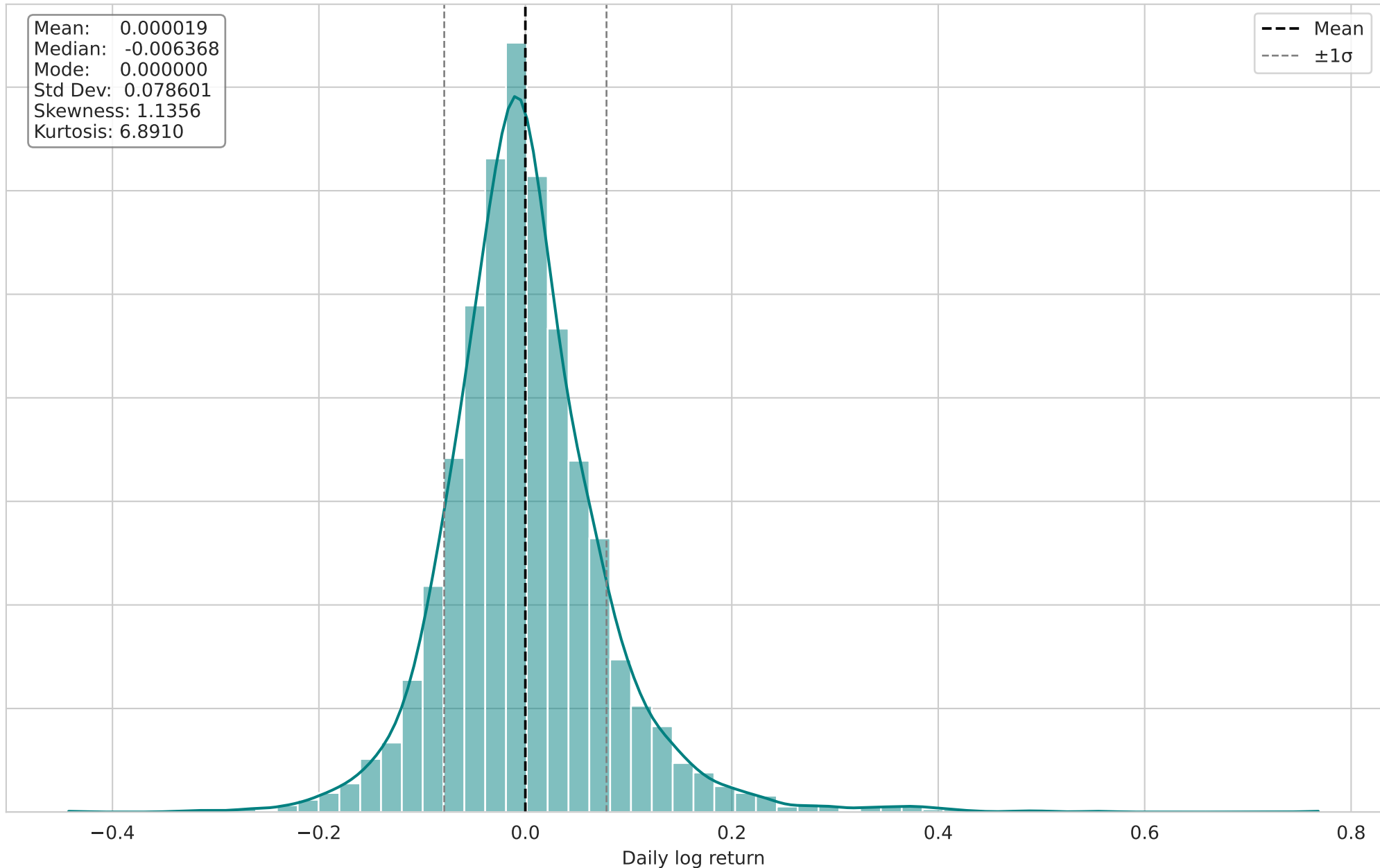
0.2

0.4

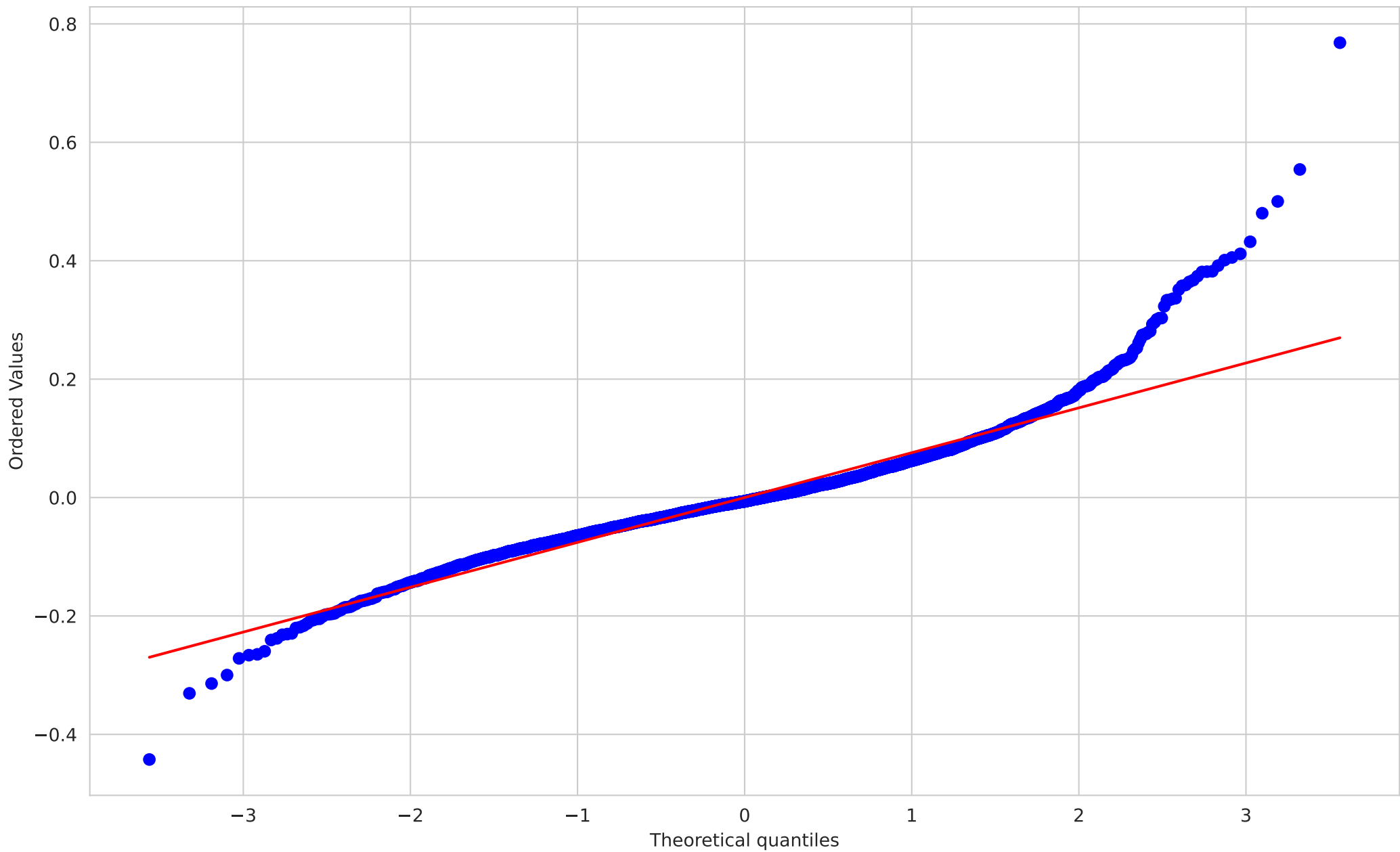
0.6

0.8

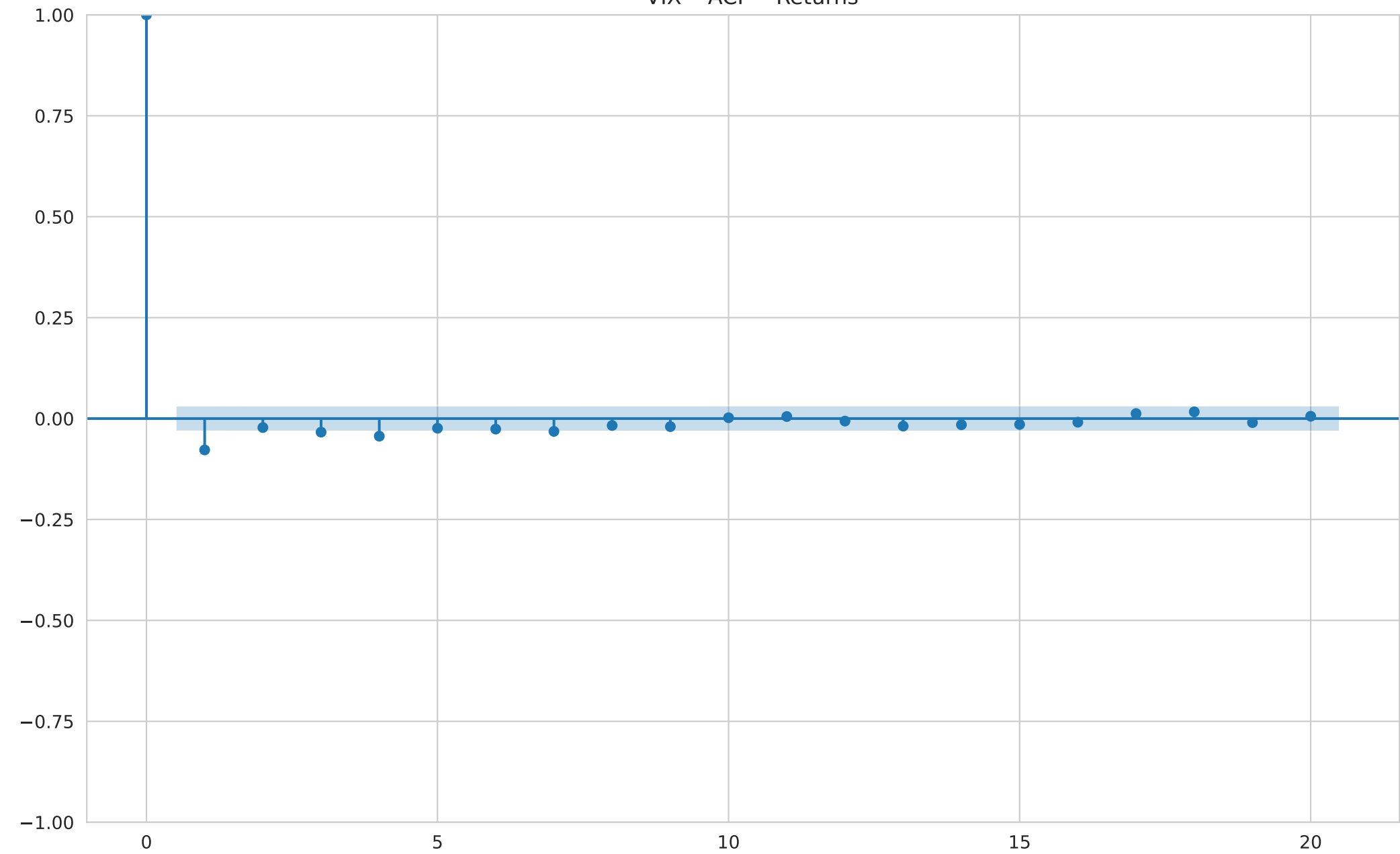
Daily log return



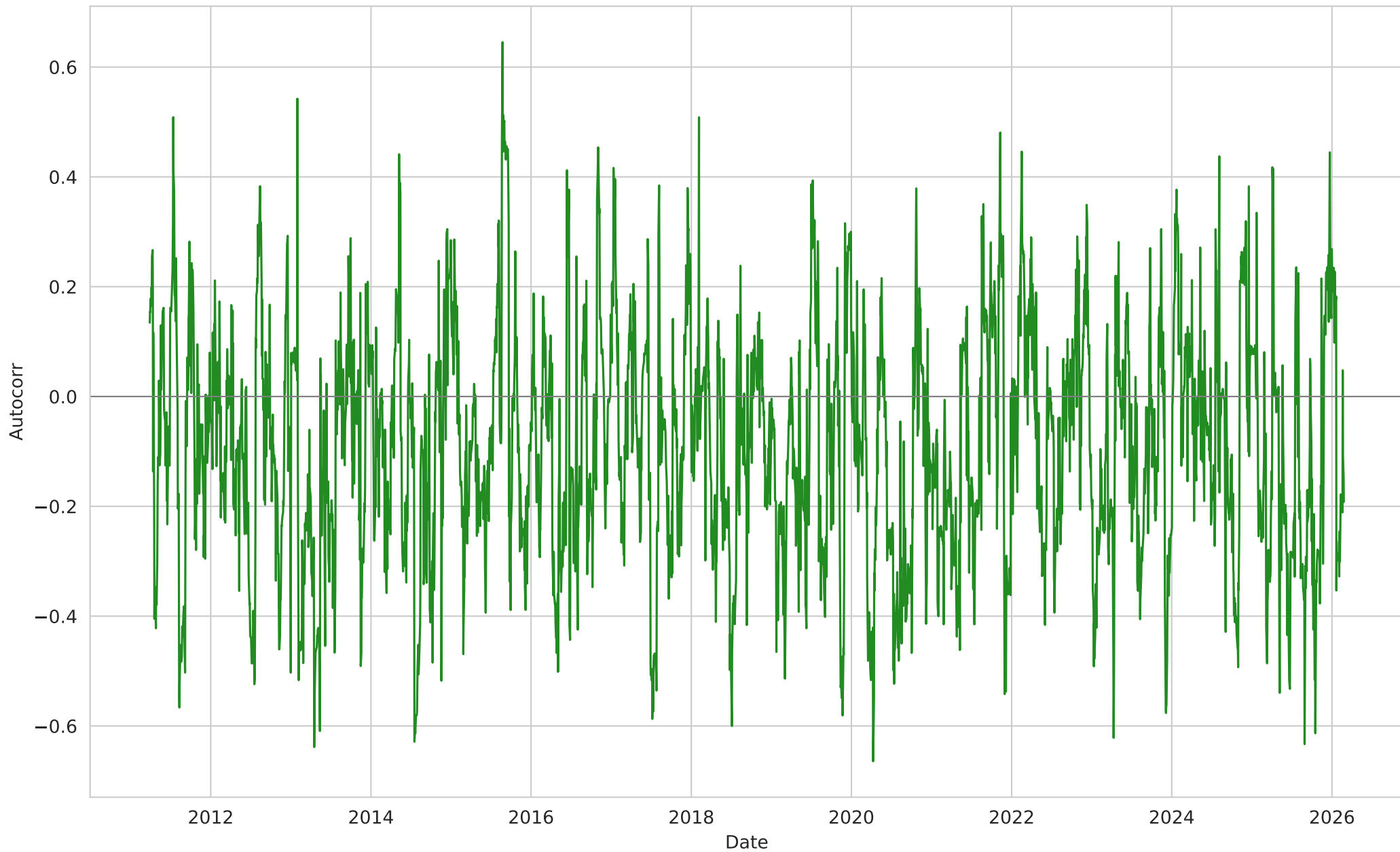
^VIX • Returns • Q-Q Plot vs Normal



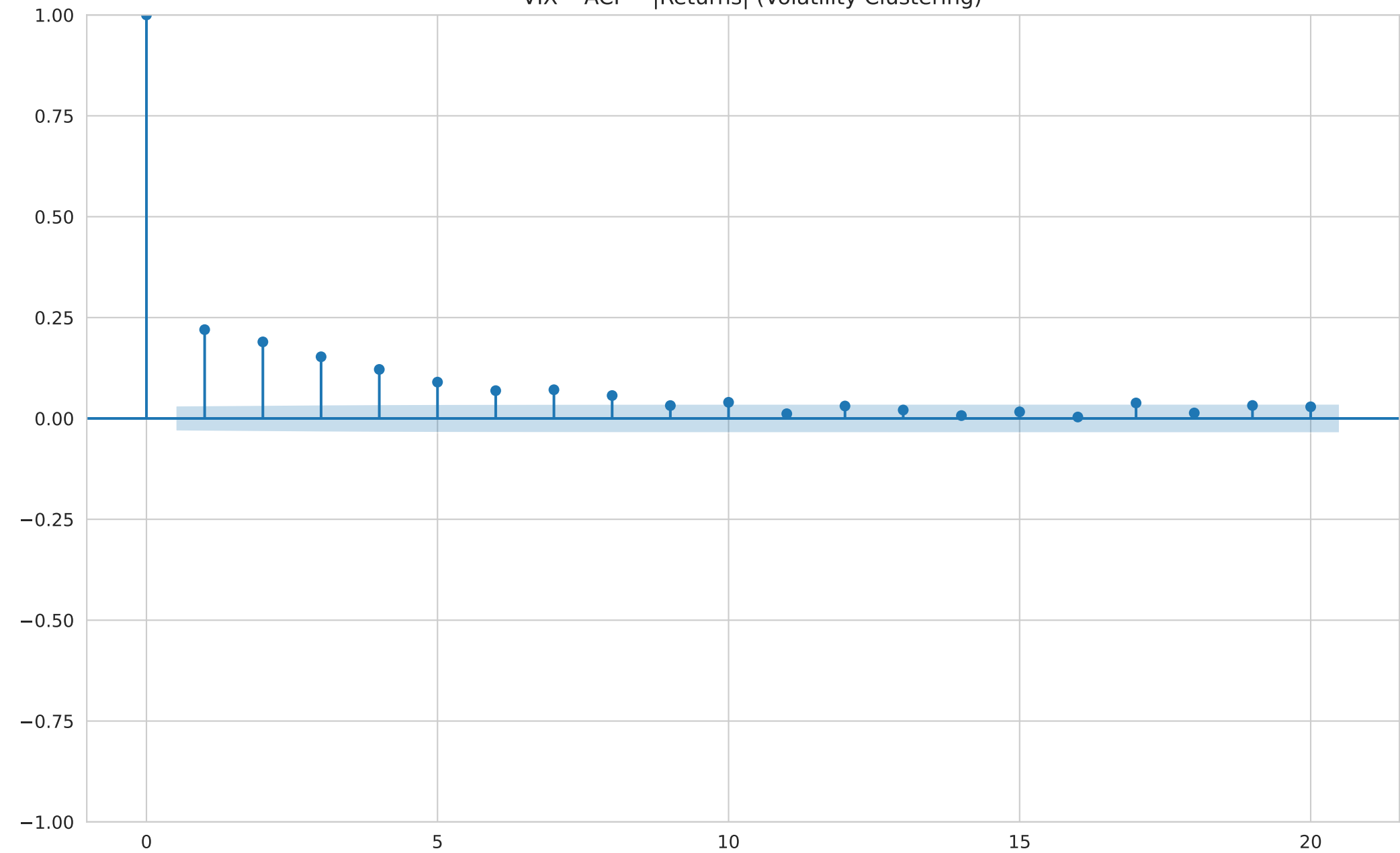
^VIX • ACF • Returns



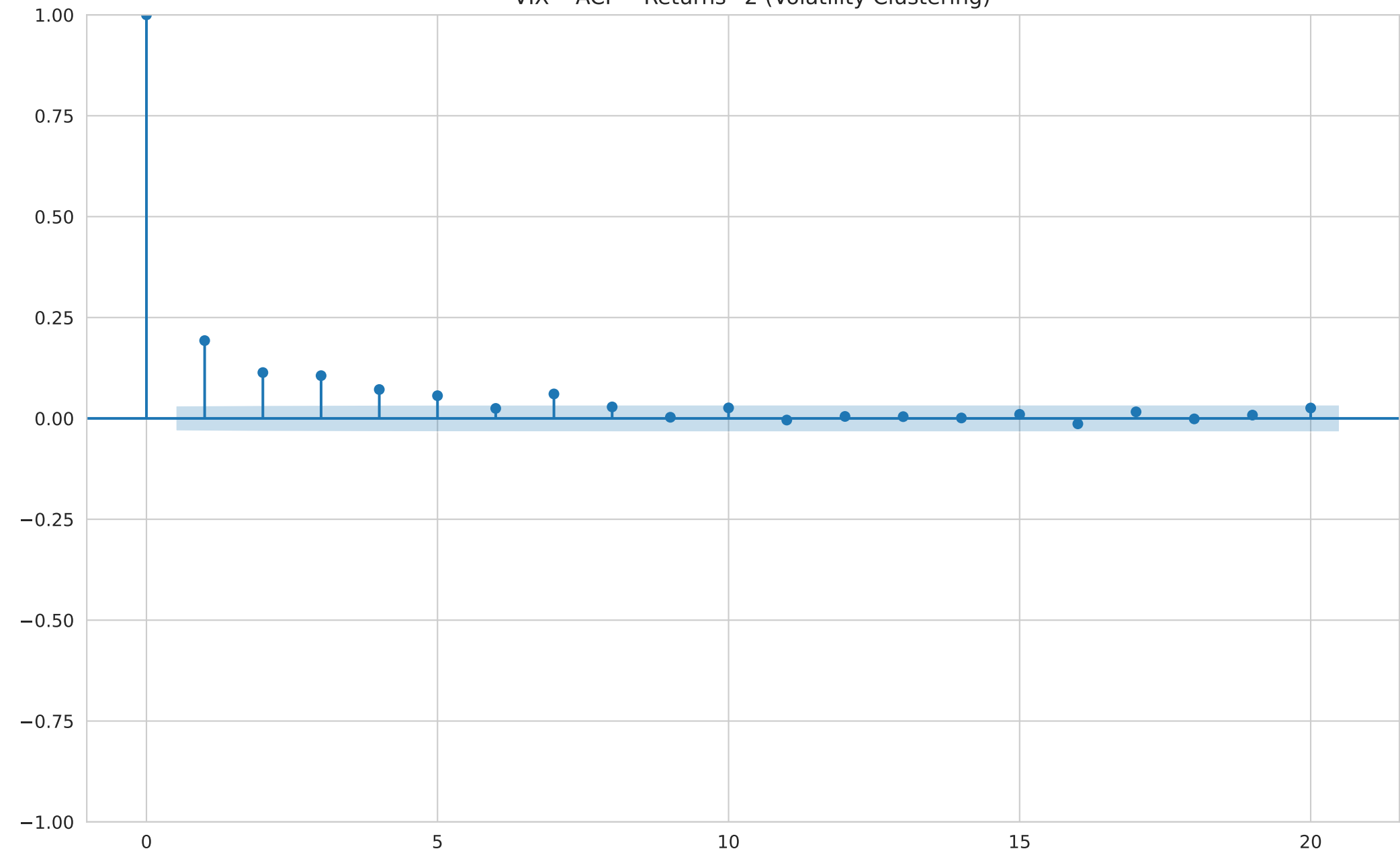
^VIX • Rolling Autocorrelation (lag=1, window=20)



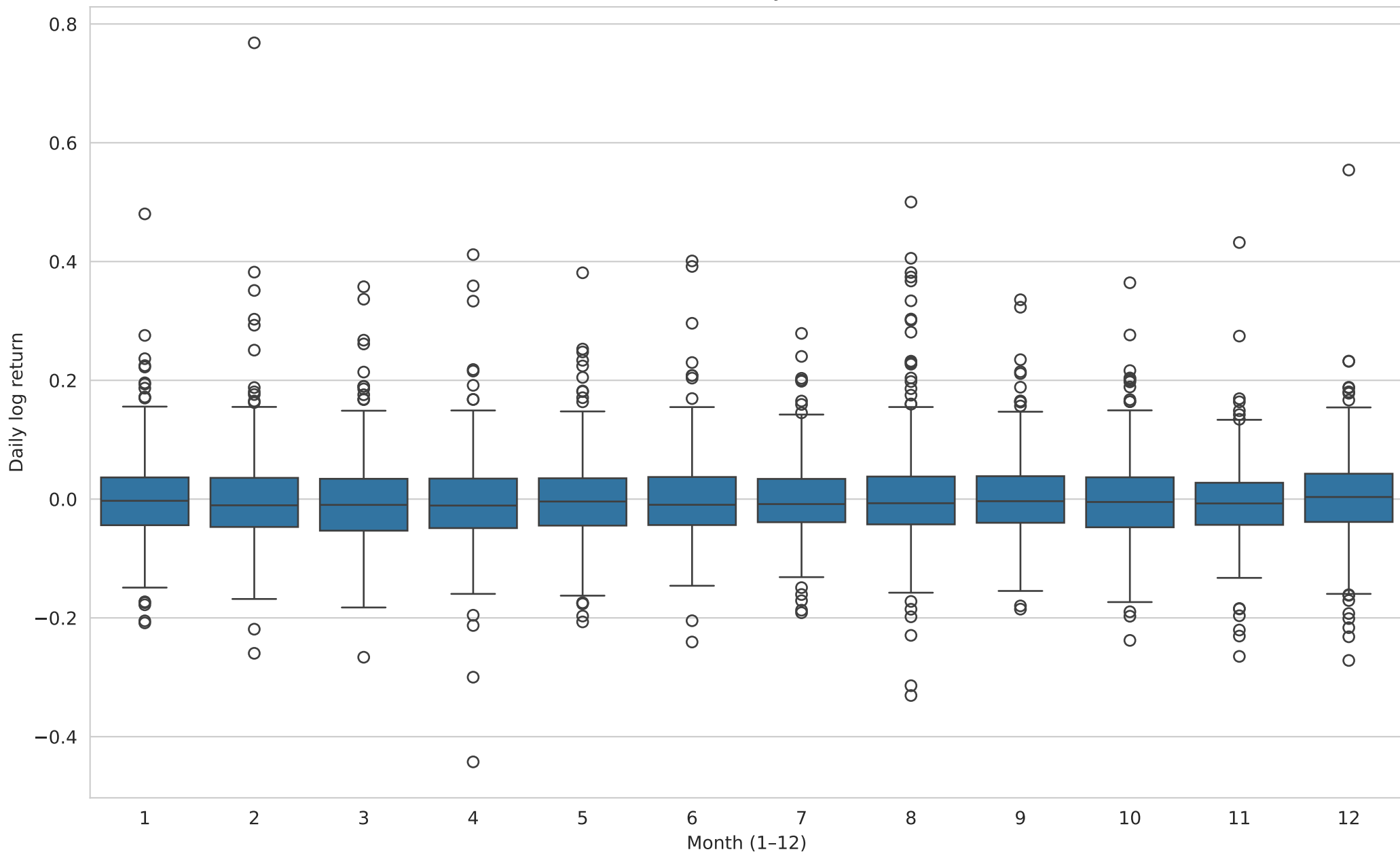
^VIX • ACF • |Returns| (Volatility Clustering)



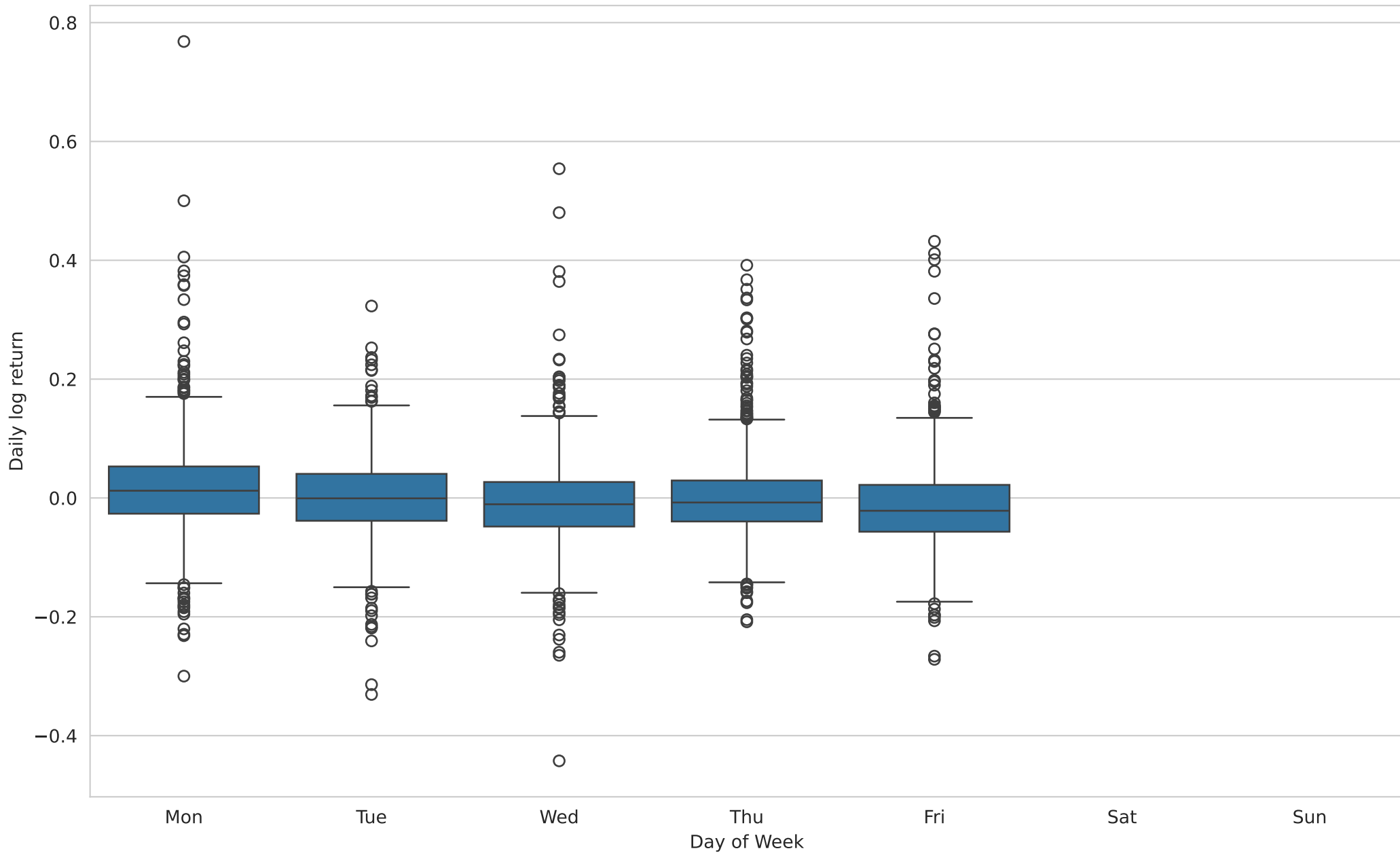
\hat{VIX} • ACF • Returns^2 (Volatility Clustering)



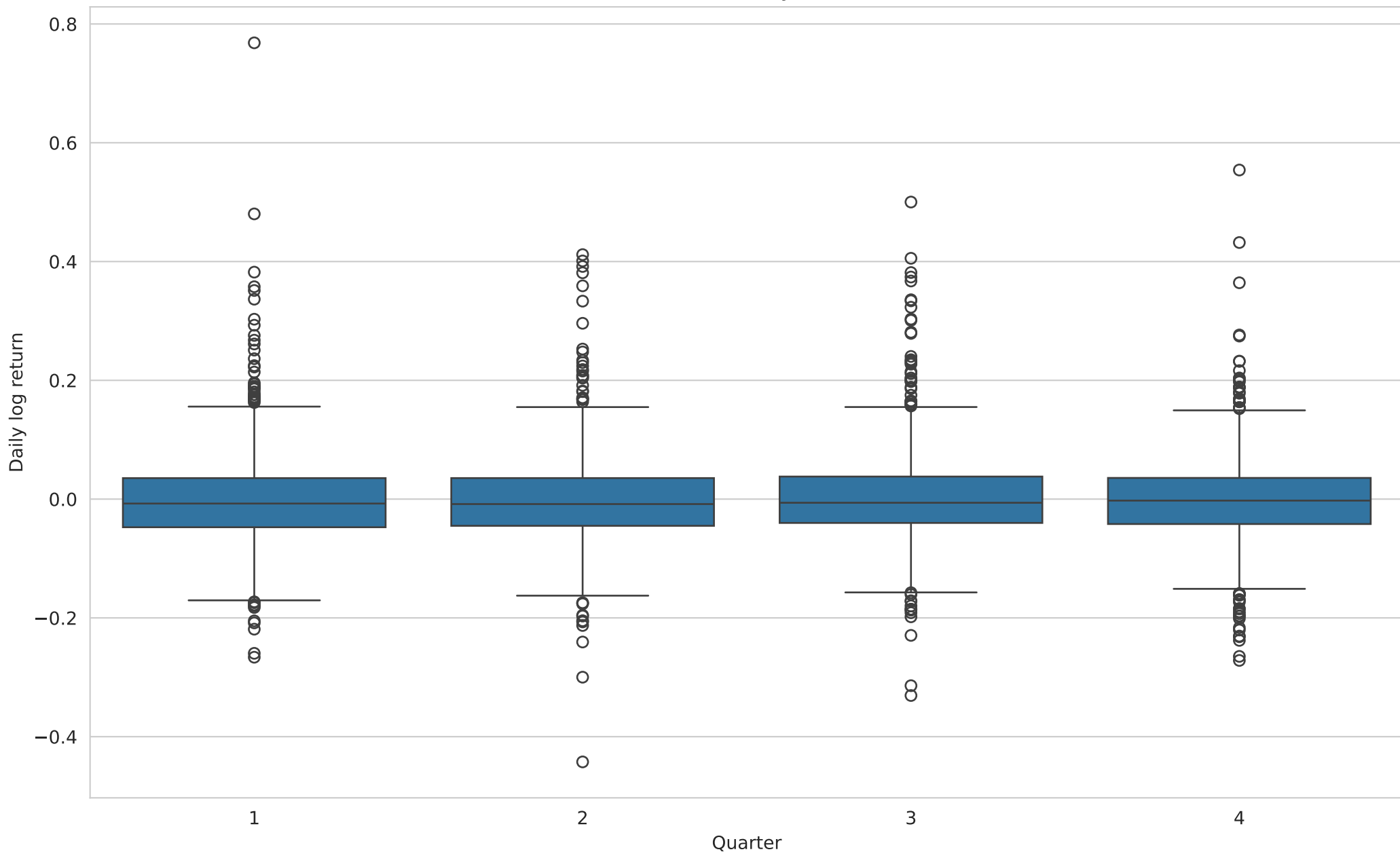
^VIX • Monthly Returns



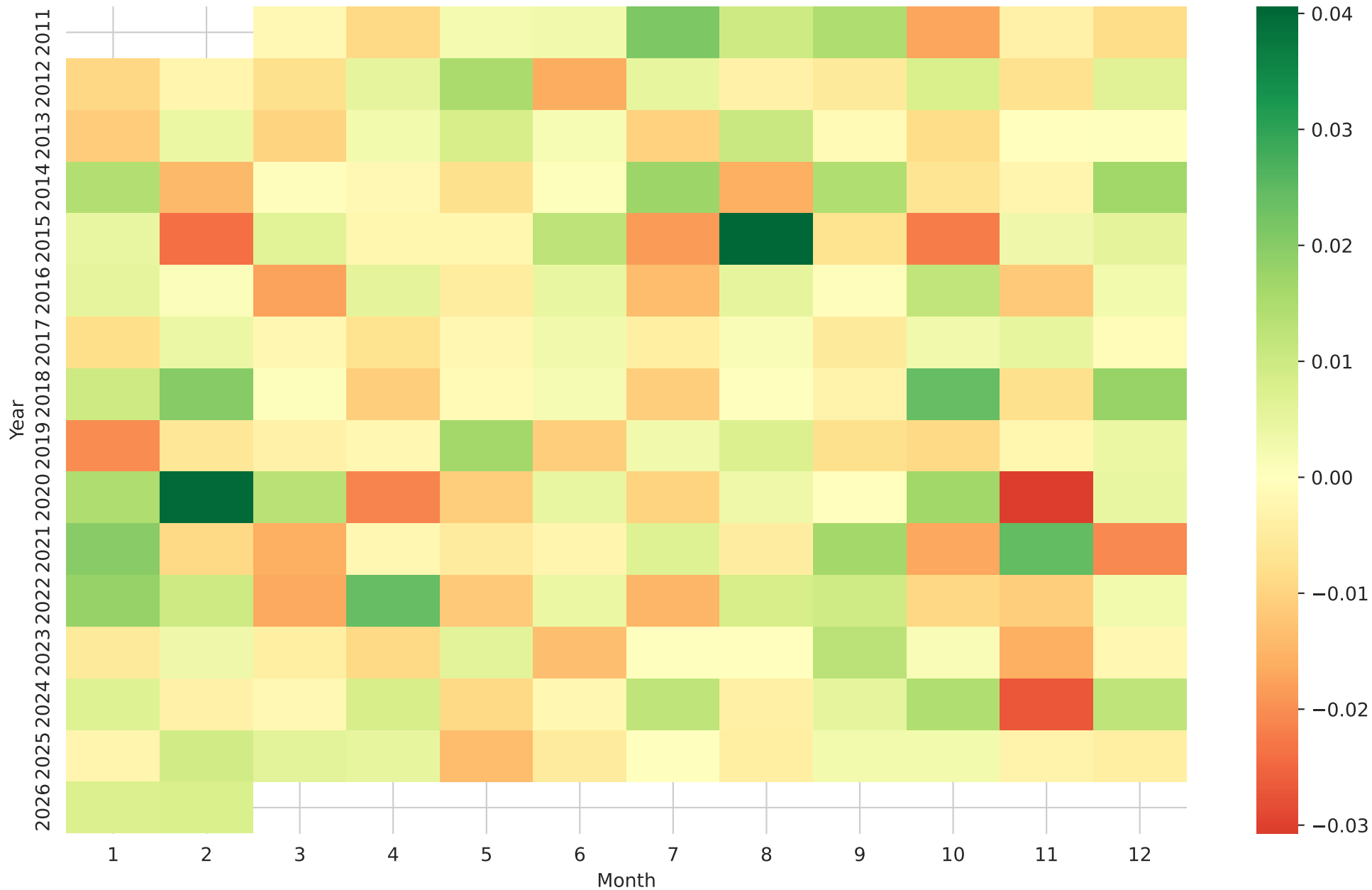
\wedge VIX • Day-of-Week Returns



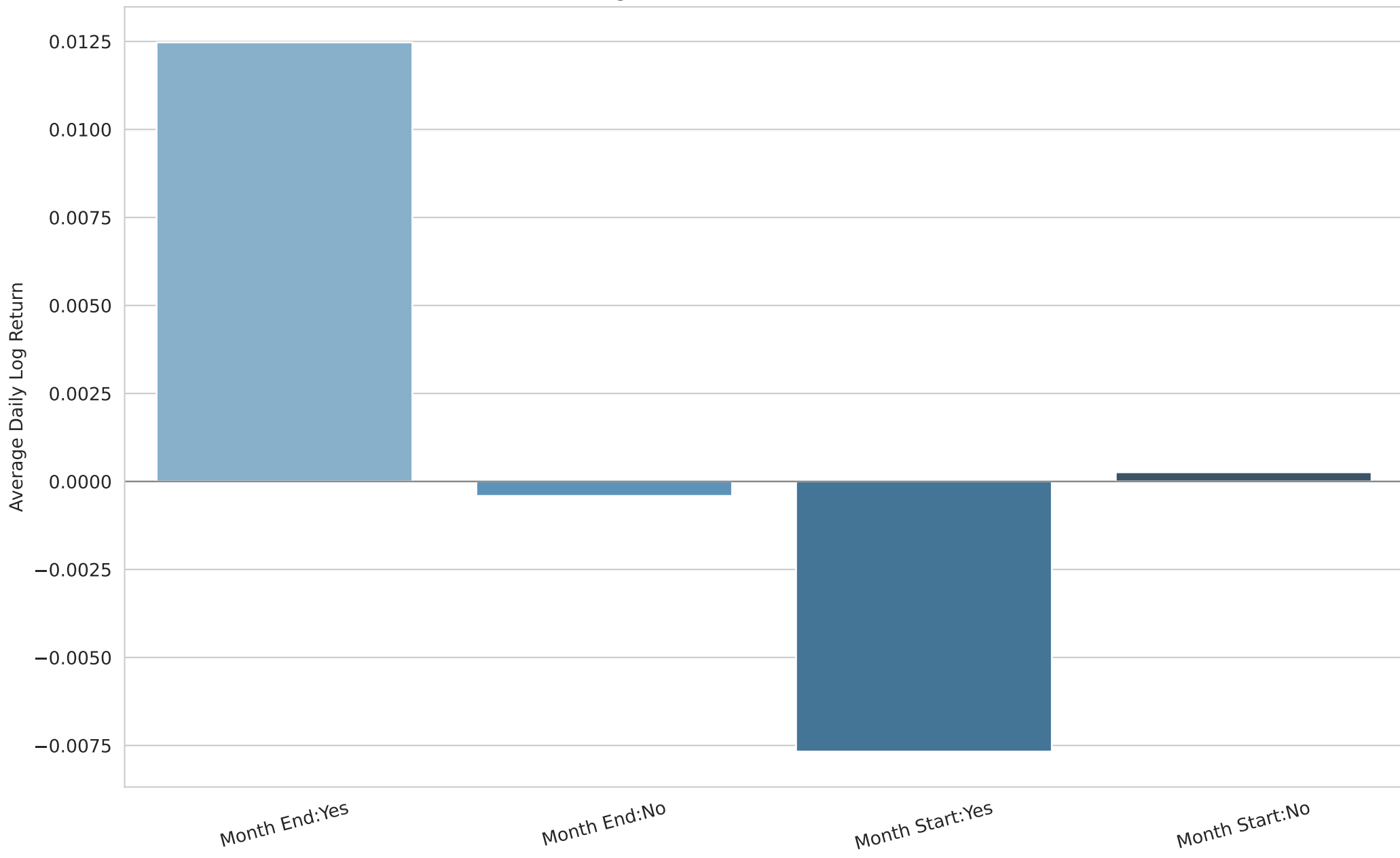
^VIX • Quarterly Returns



^VIX • Month×Year Heatmap (Avg Daily Returns)

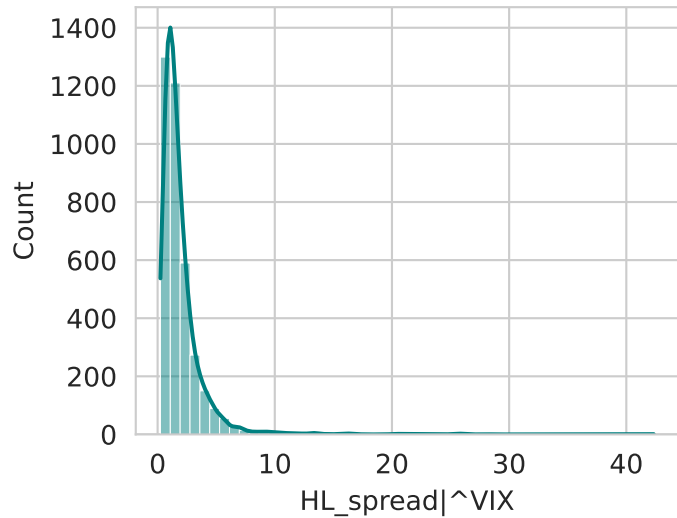


^VIX • Avg Returns: Month-End/Start vs Others

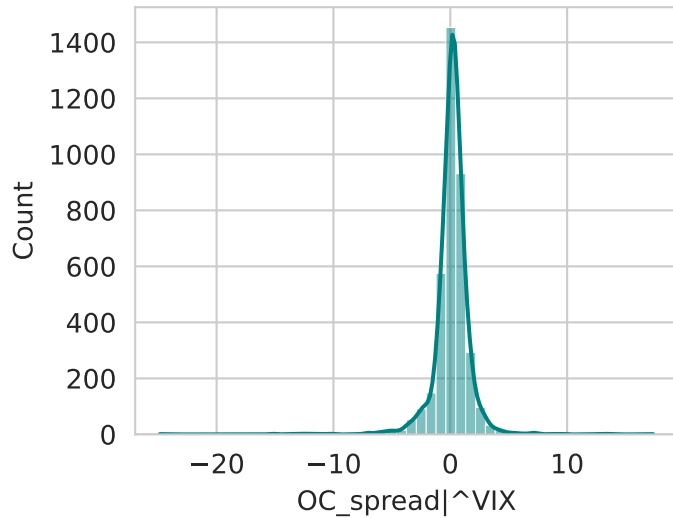


\wedge VIX • Spreads

HL_spread| \wedge VIX

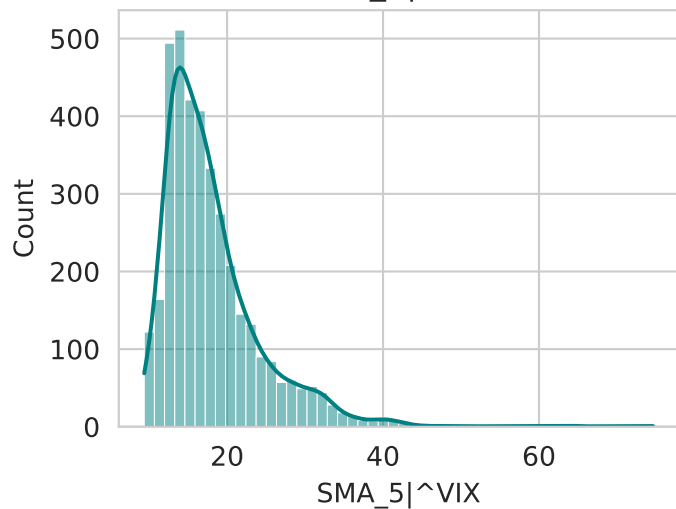


OC_spread| \wedge VIX

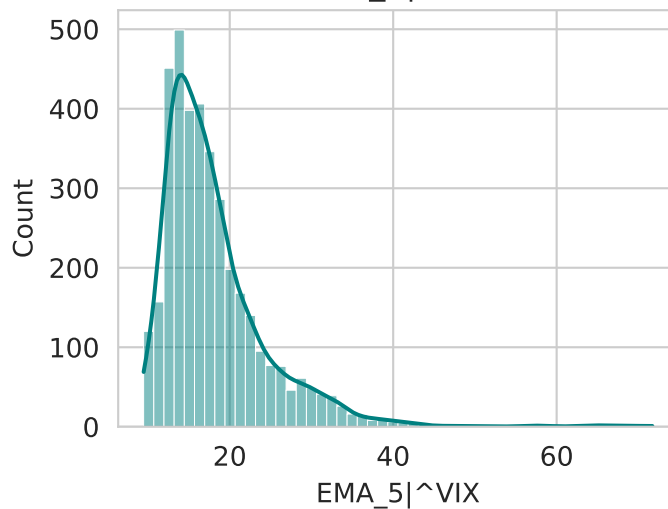


\hat{VIX} • Moving Averages / EMAs

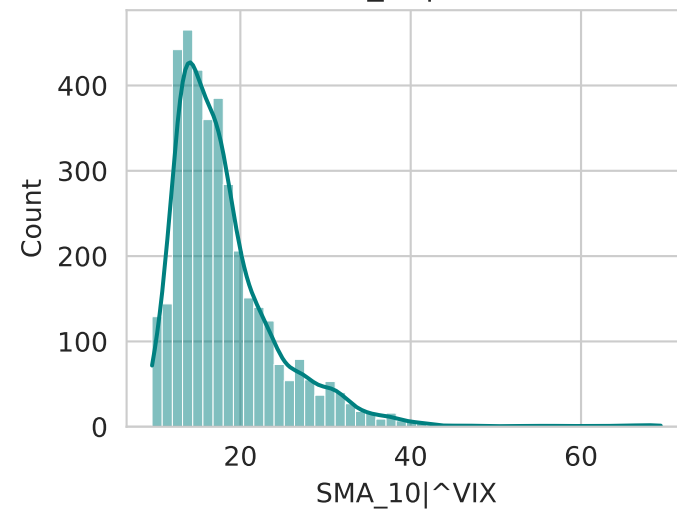
SMA_5| \hat{VIX}



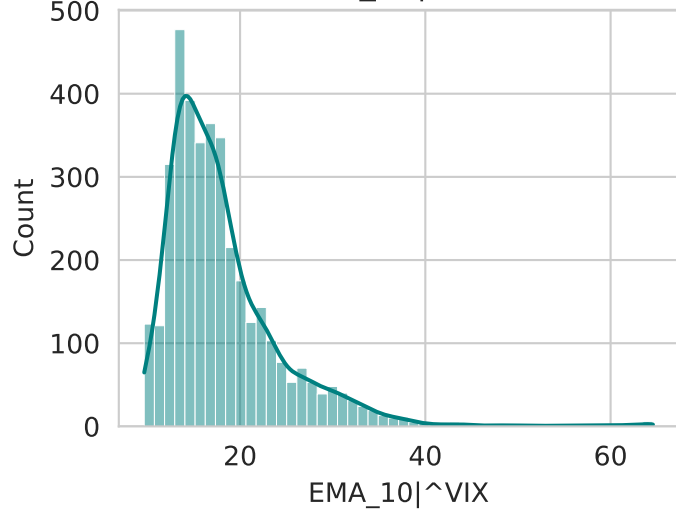
EMA_5| \hat{VIX}



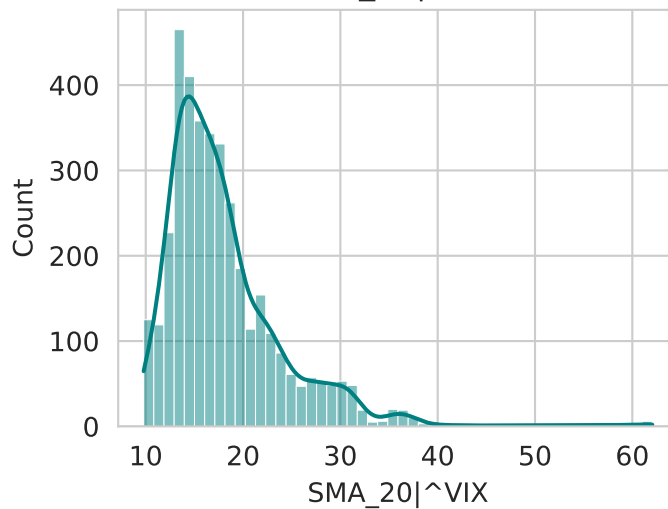
SMA_10| \hat{VIX}



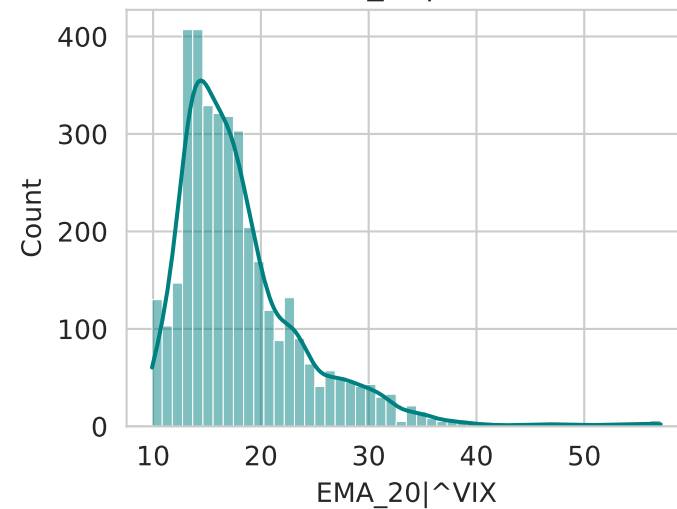
EMA_10| \hat{VIX}



SMA_20| \hat{VIX}

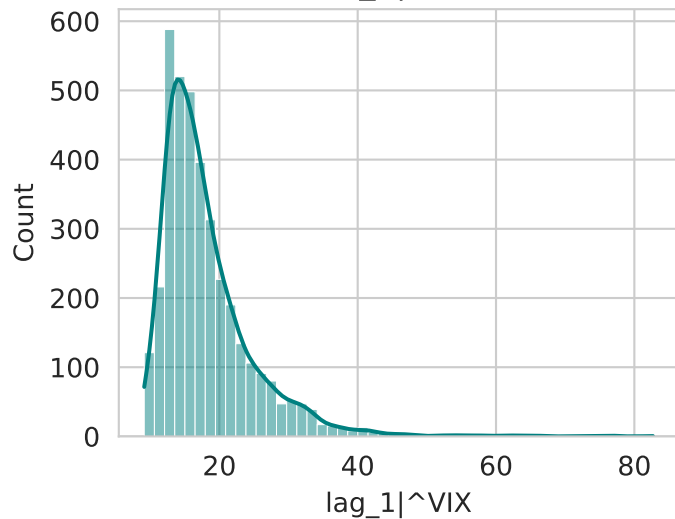


EMA_20| \hat{VIX}

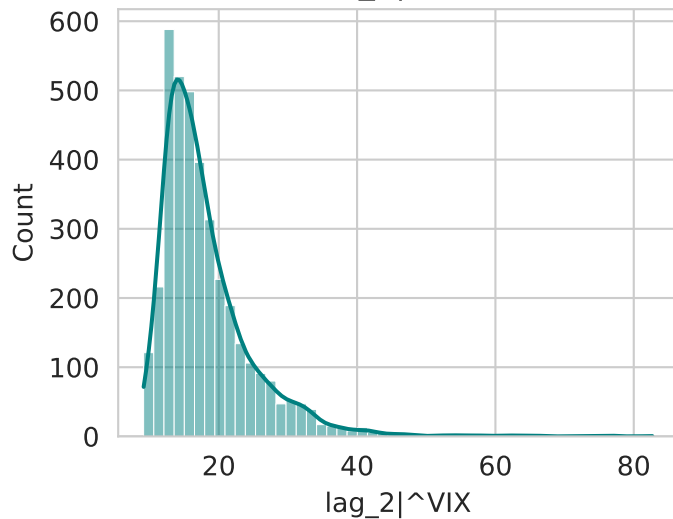


\hat{VIX} • Lagged Prices

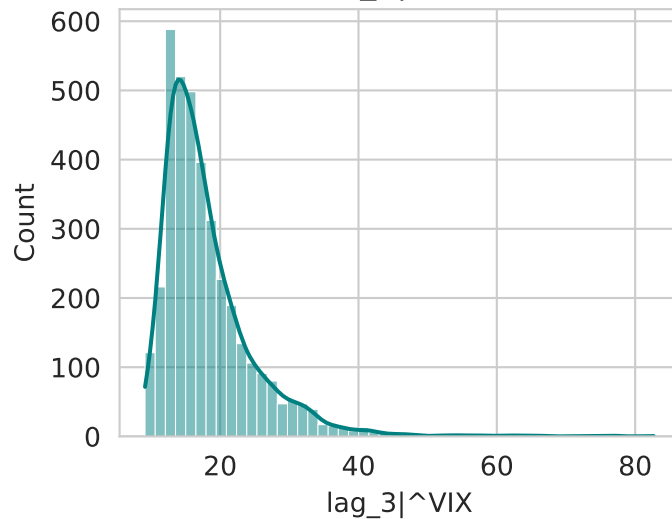
lag_1| \hat{VIX}



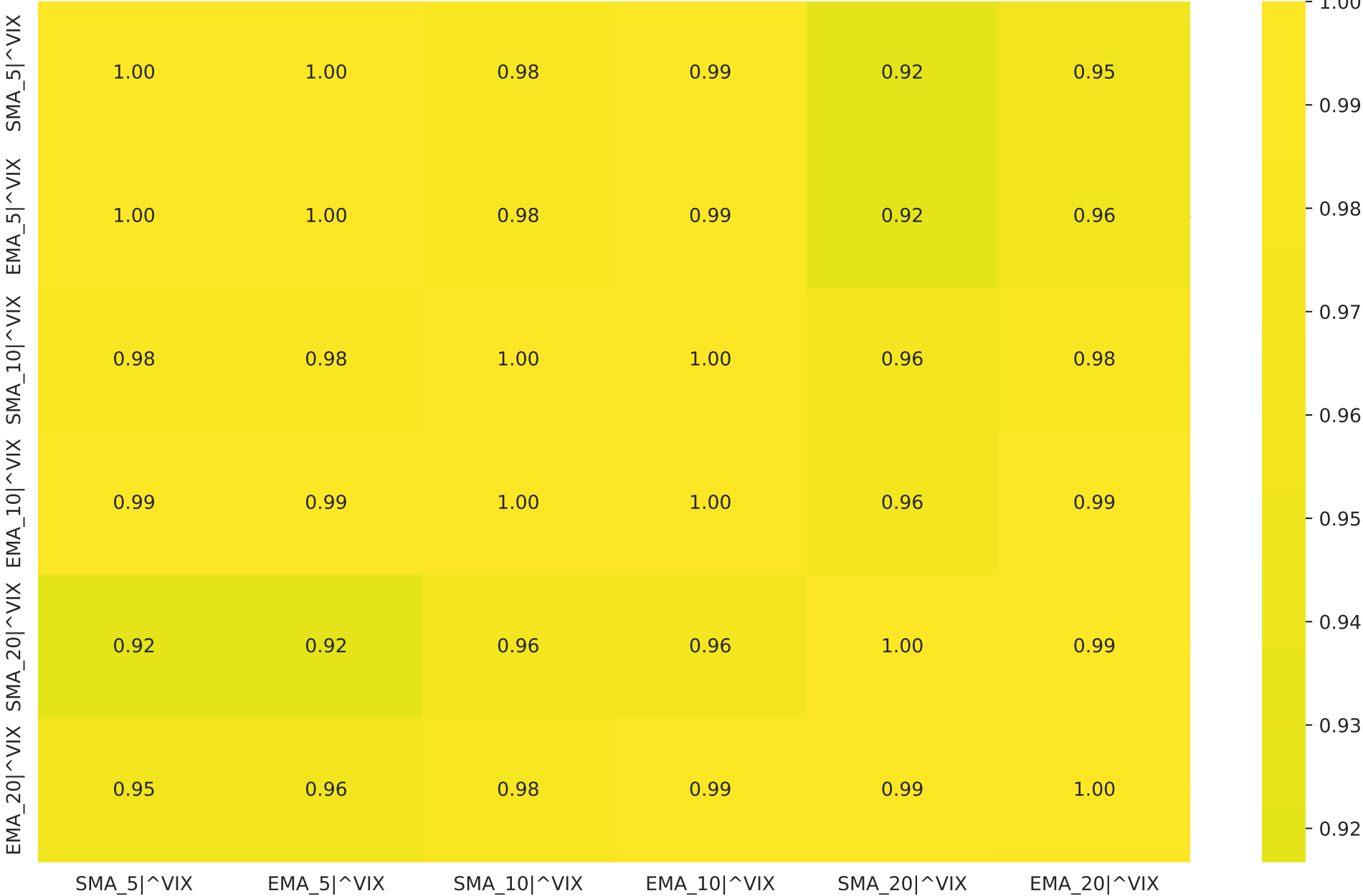
lag_2| \hat{VIX}



lag_3| \hat{VIX}



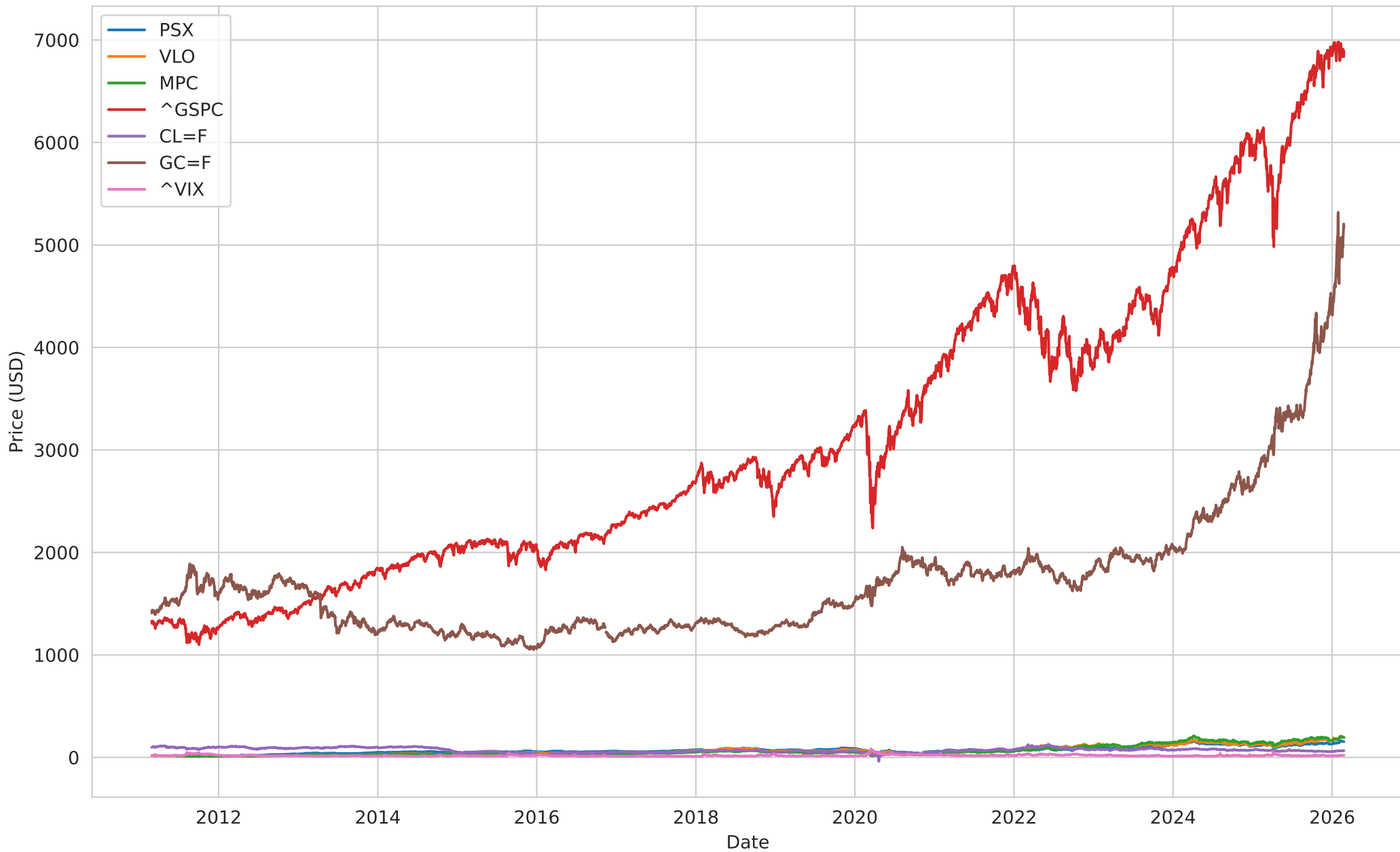
^VIX • Correlation • Moving Averages



^VIX • Correlation • Spreads + Lags



Cross-Ticker • Adjusted/Close Prices



Cross-Ticker • Log Return Correlation

