

# Refining Stock Report

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

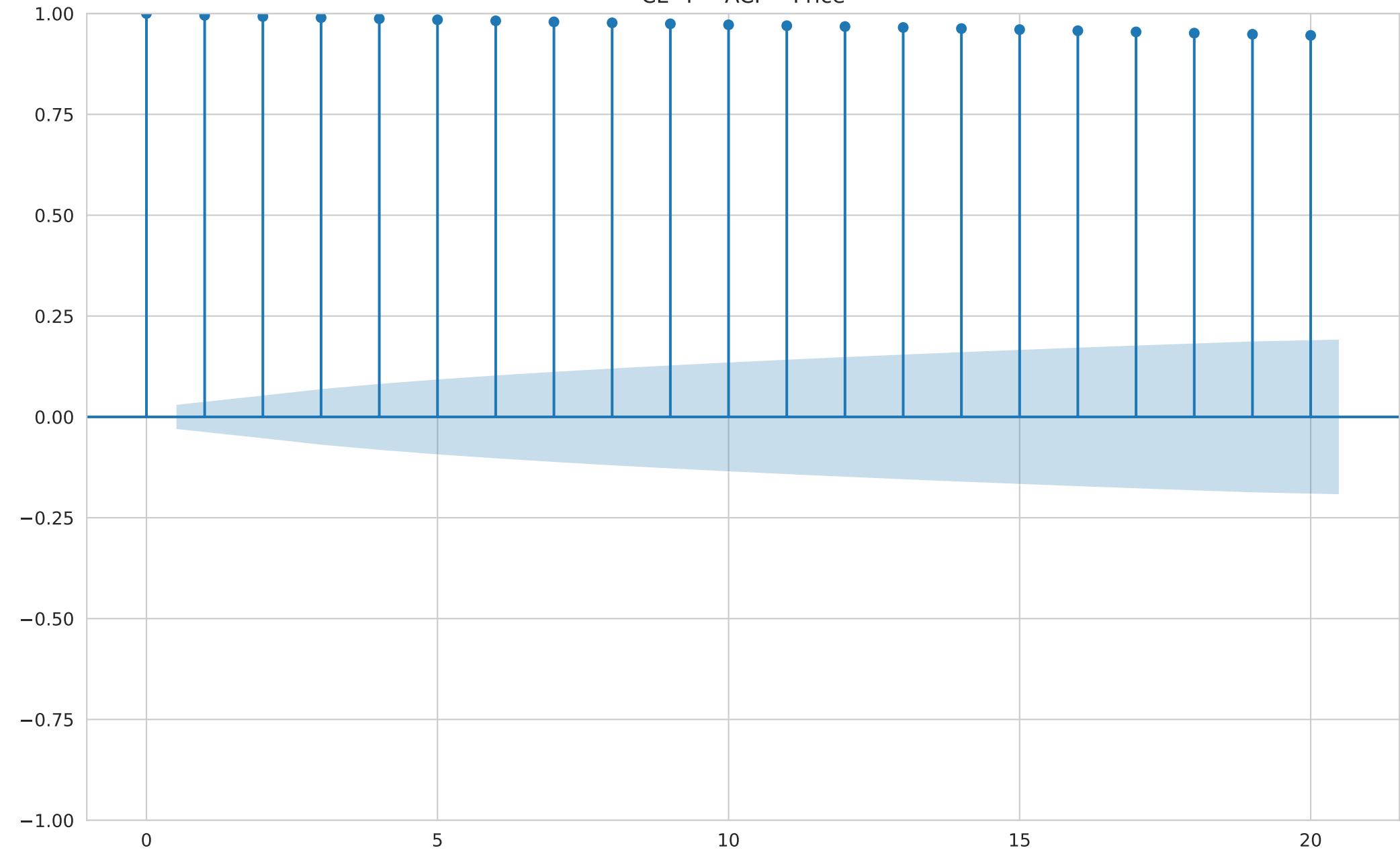
## Contents:

- 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( $r^2$ )
- 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



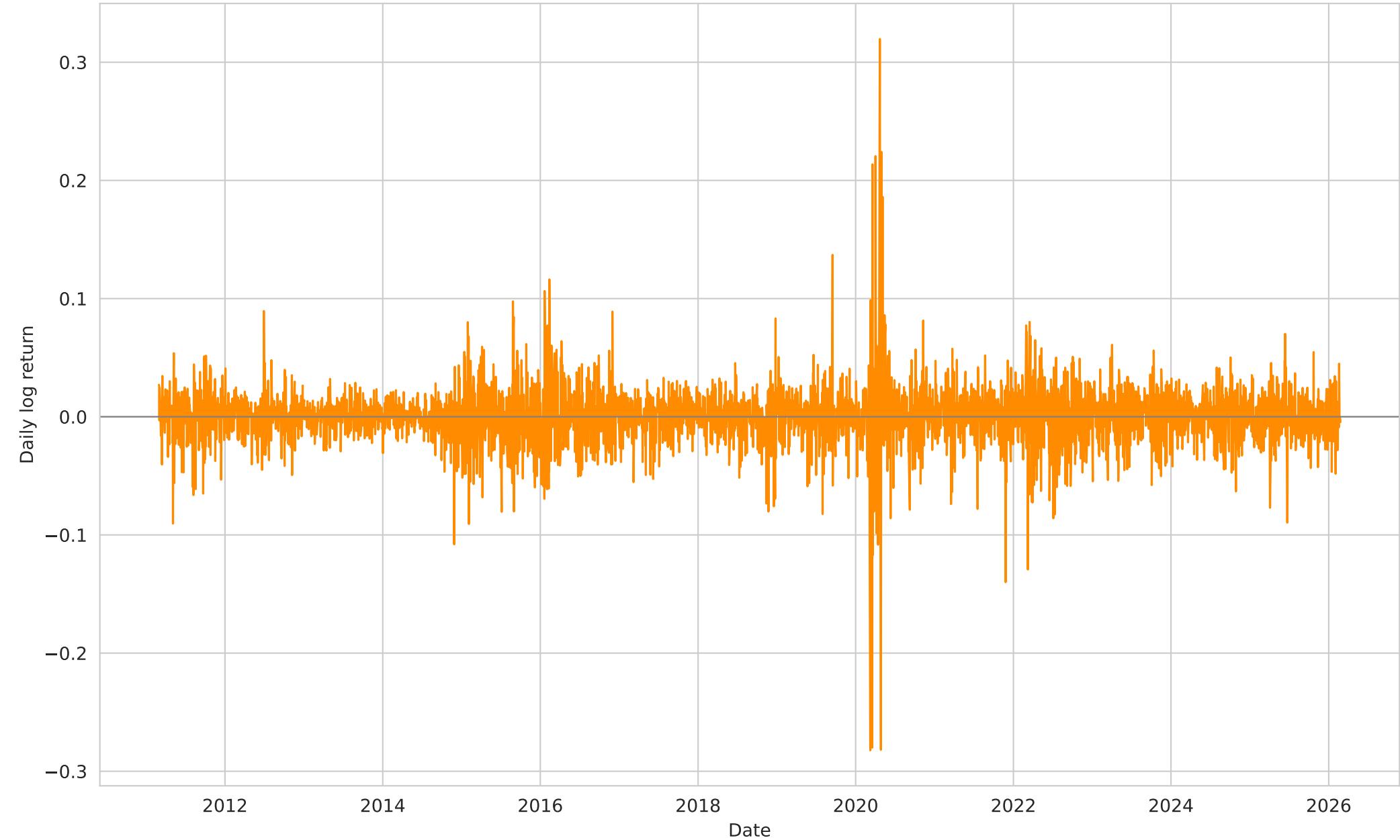
CL=F • ACF • Price



# CL=F • Moving Averages (5/10/20)



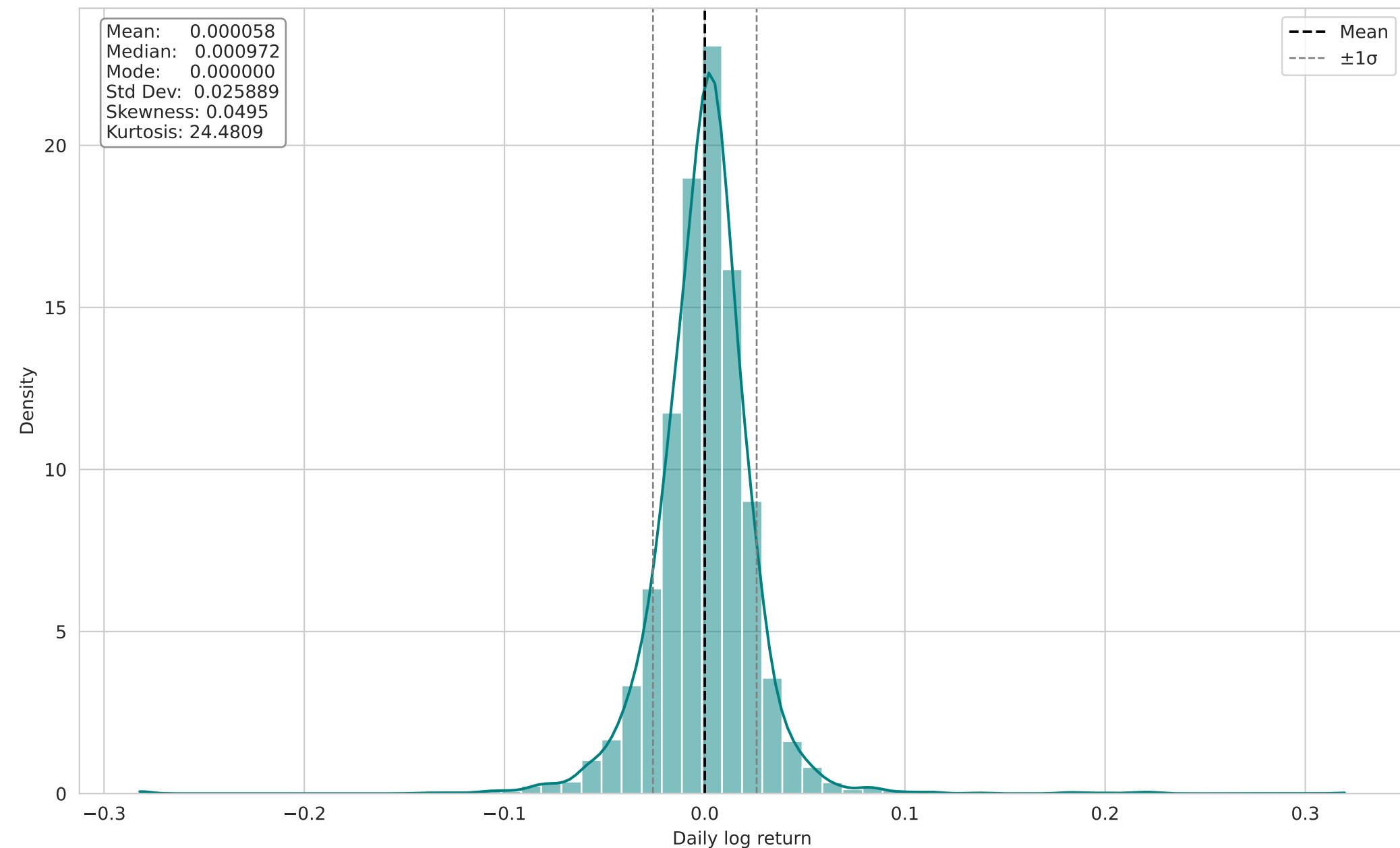
# CL=F • Daily Log Returns



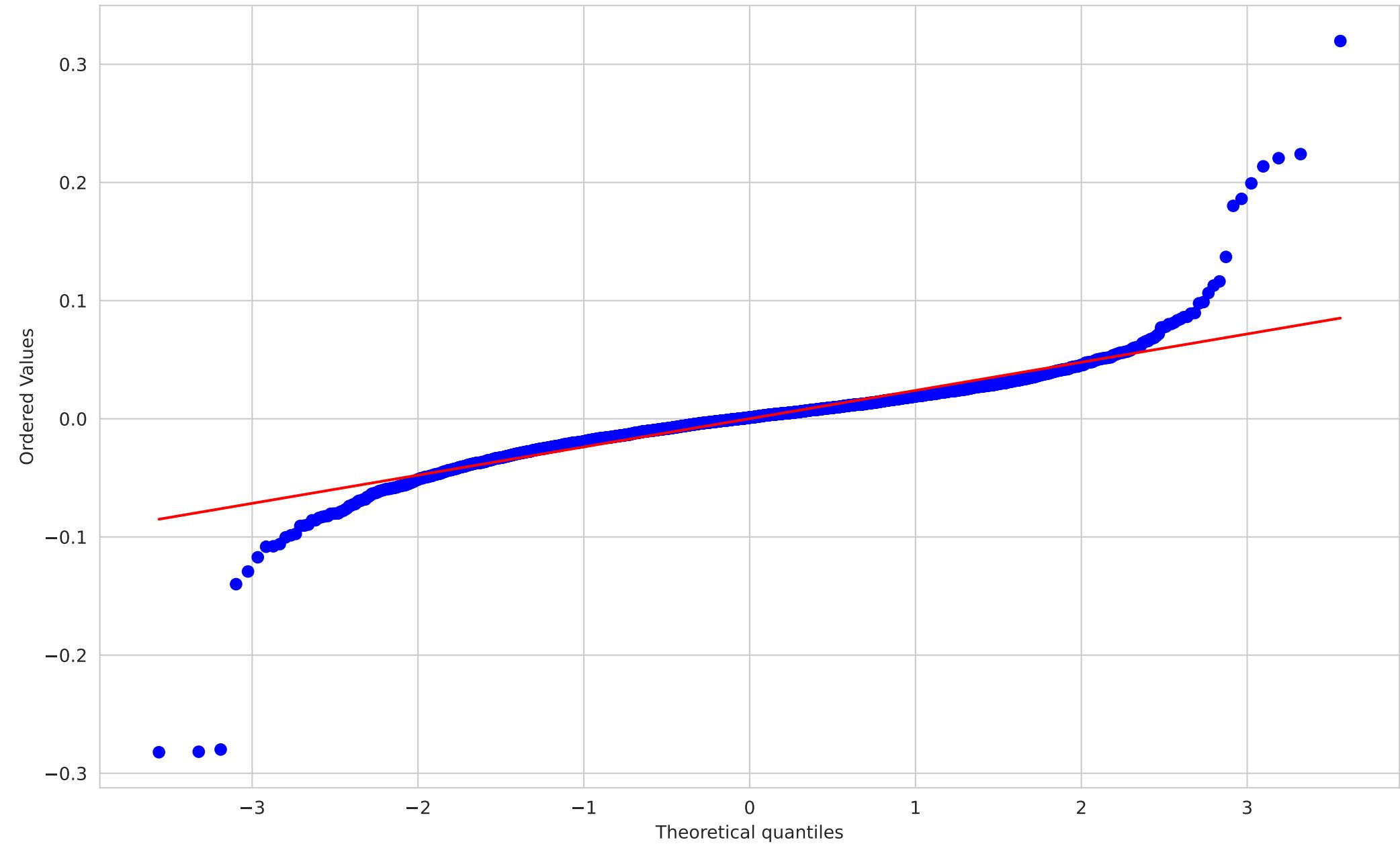
# CL=F • Returns • Distribution

Mean: 0.000058  
Median: 0.000972  
Mode: 0.000000  
Std Dev: 0.025889  
Skewness: 0.0495  
Kurtosis: 24.4809

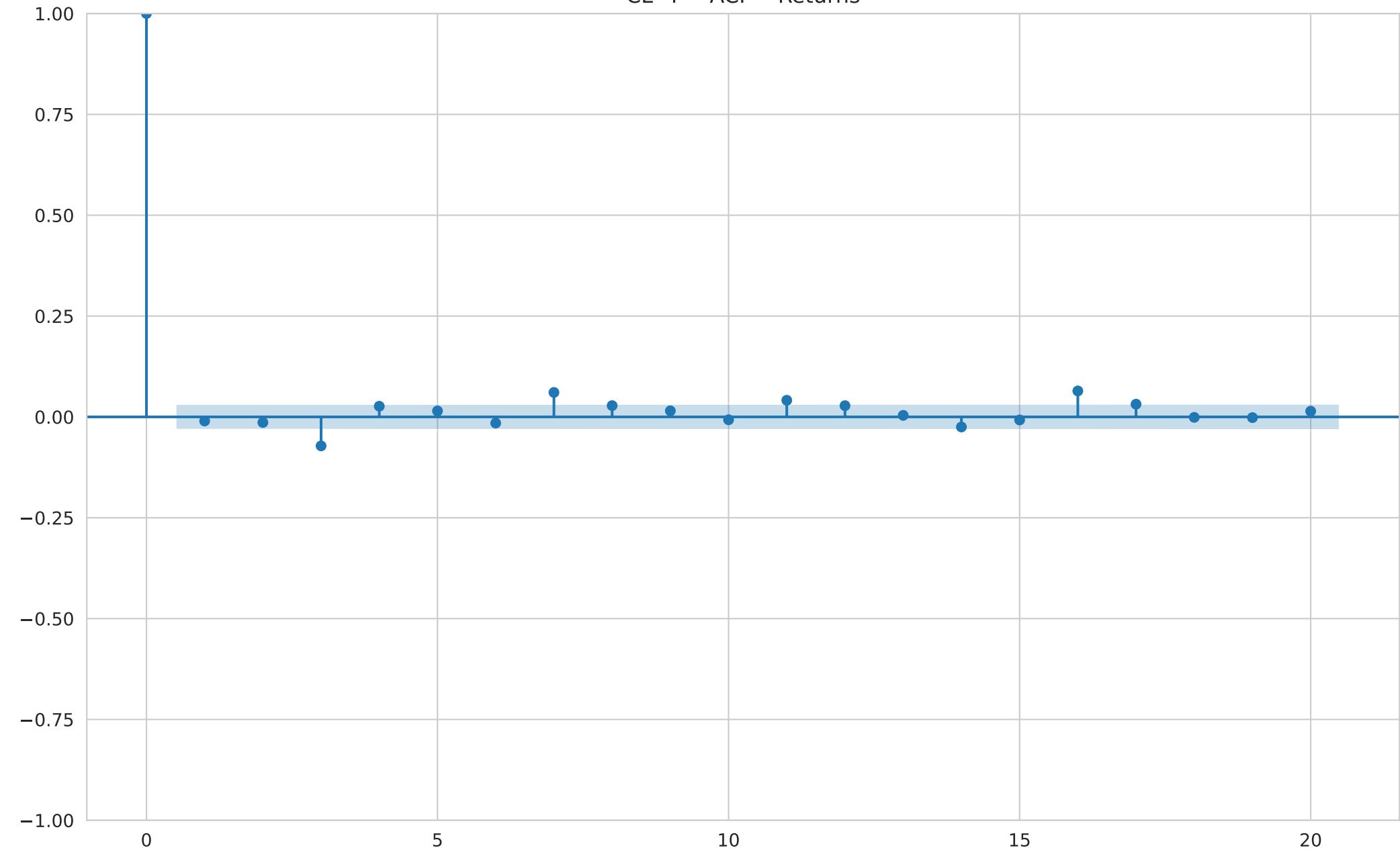
Mean  
 $\pm 1\sigma$



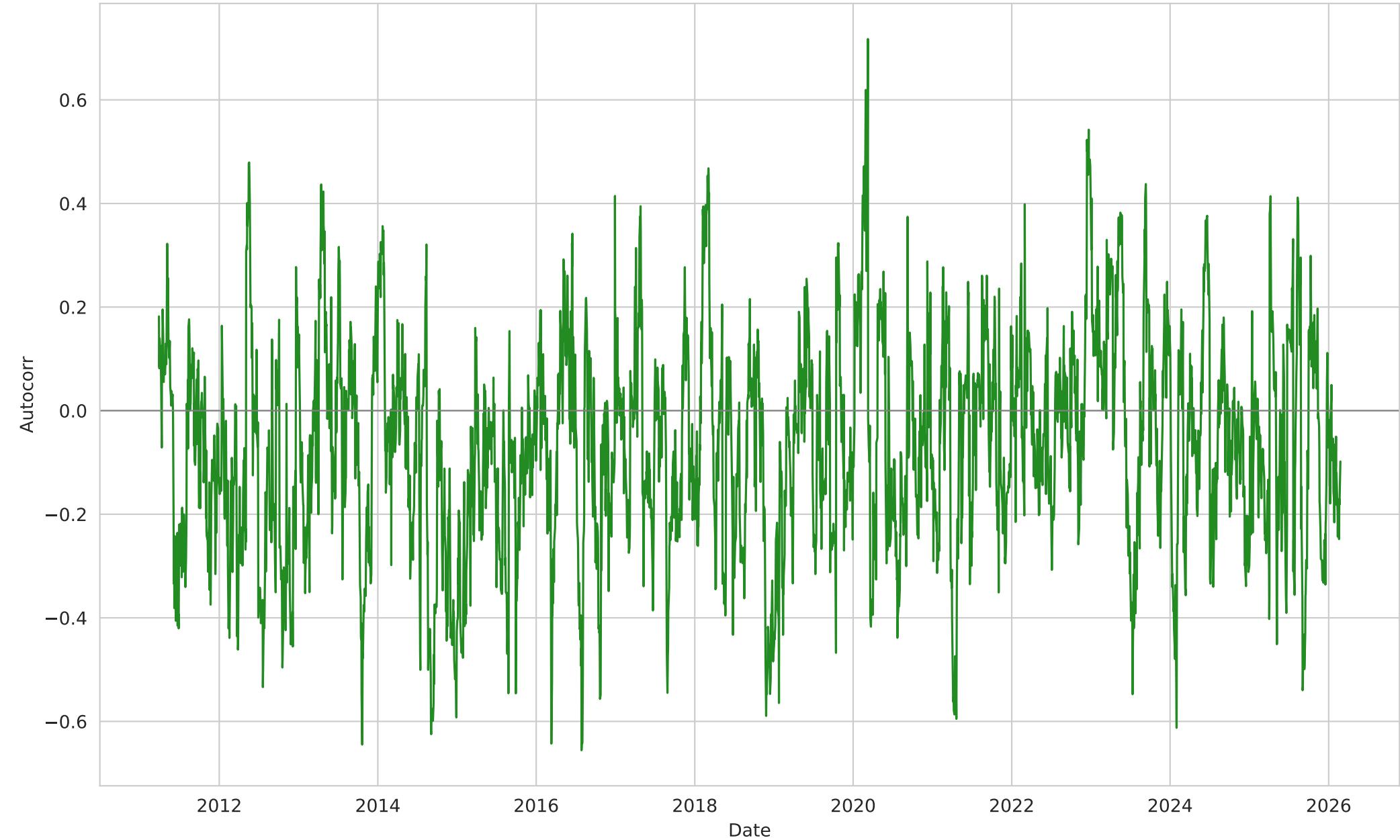
### CL=F • Returns • Q-Q Plot vs Normal



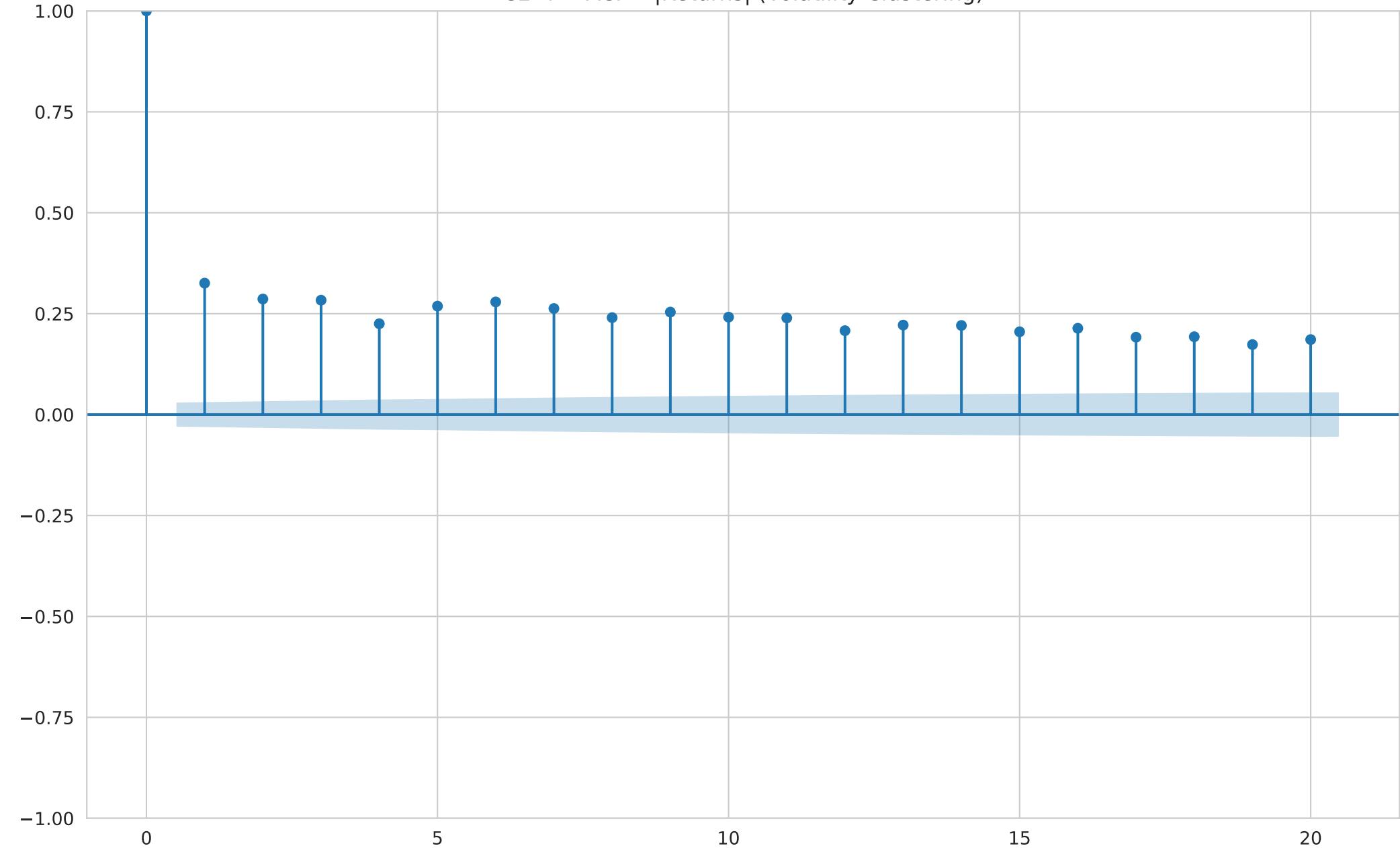
CL=F • ACF • Returns



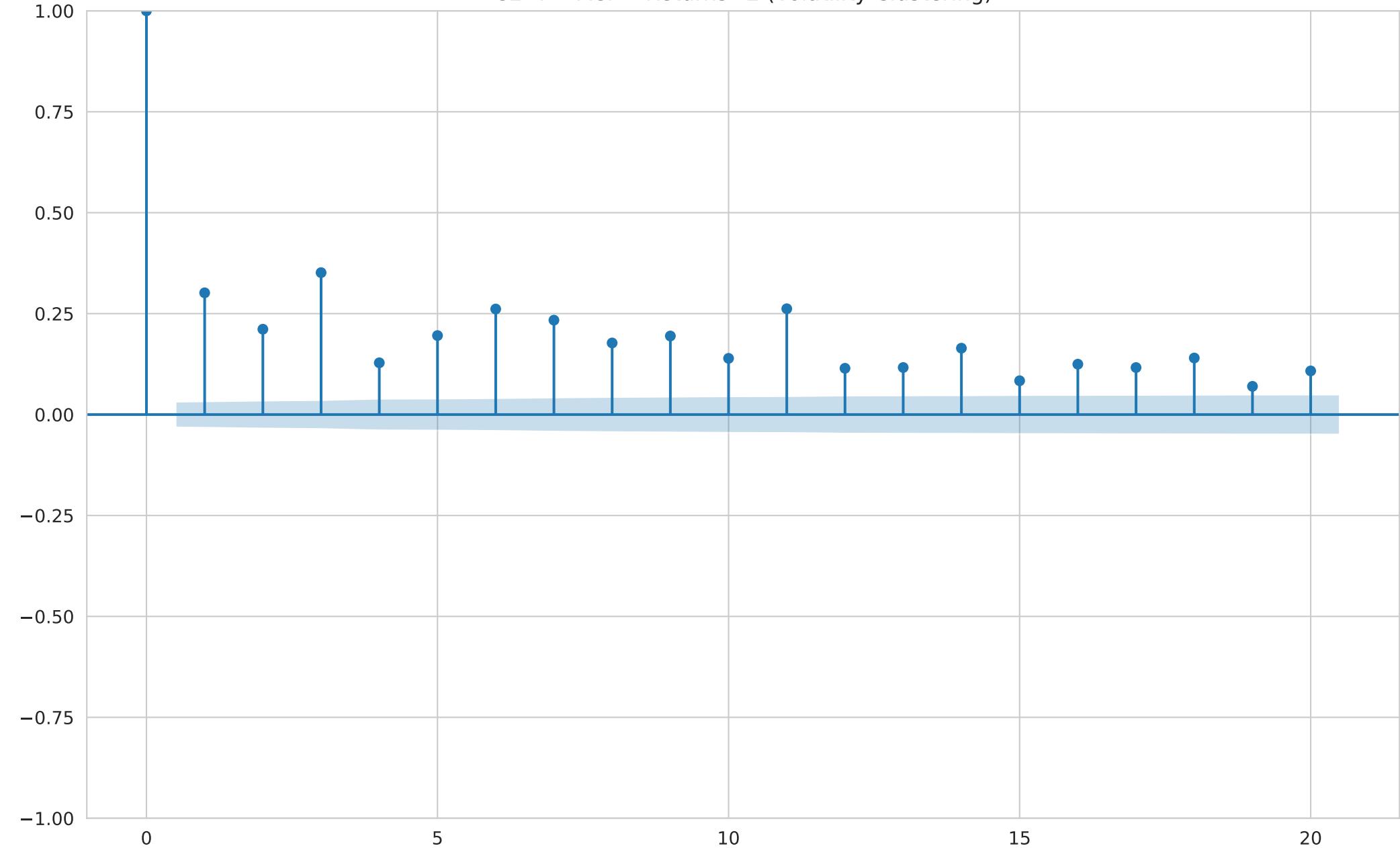
### CL=F • Rolling Autocorrelation (lag=1, window=20)



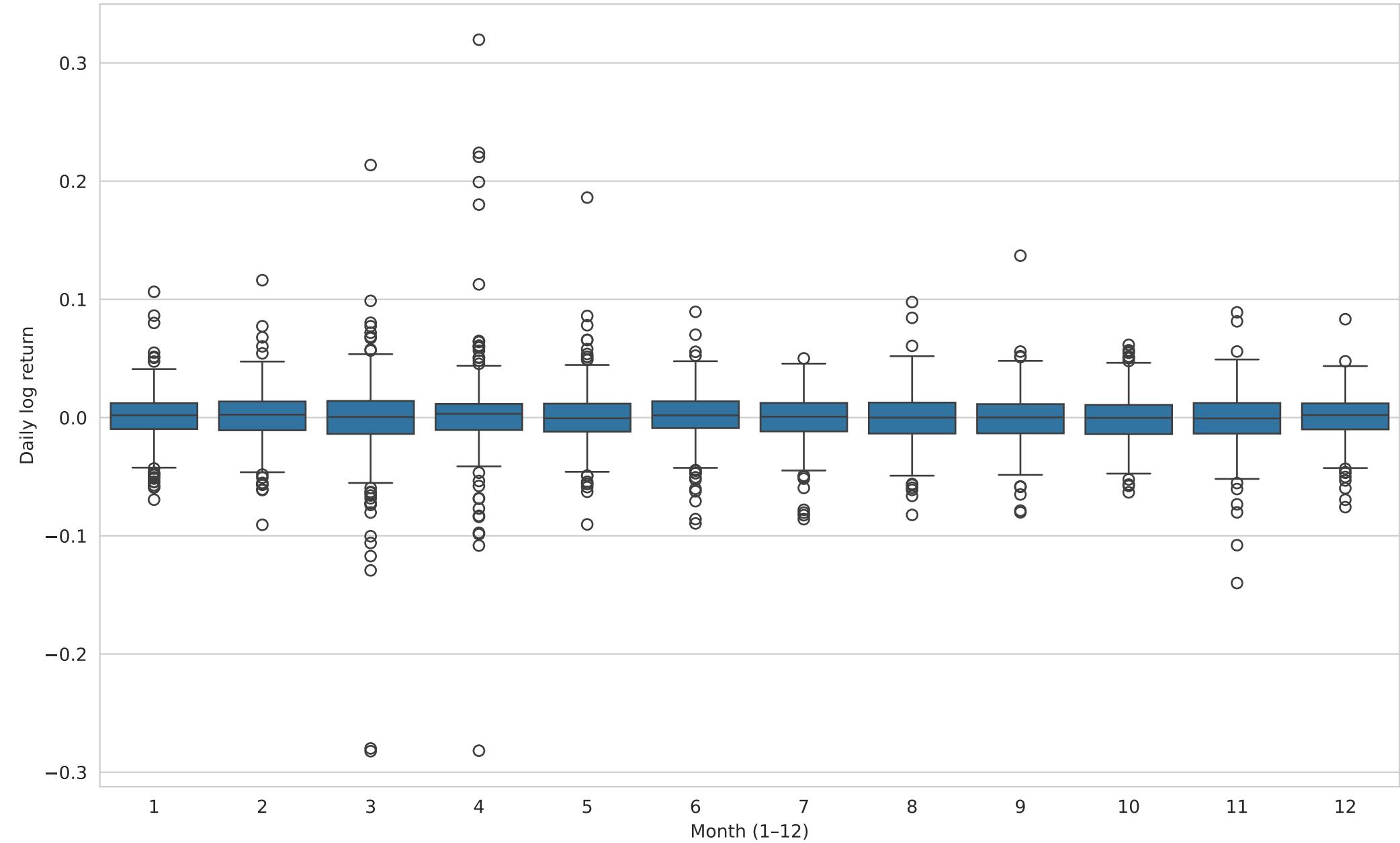
### CL=F • ACF • |Returns| (Volatility Clustering)



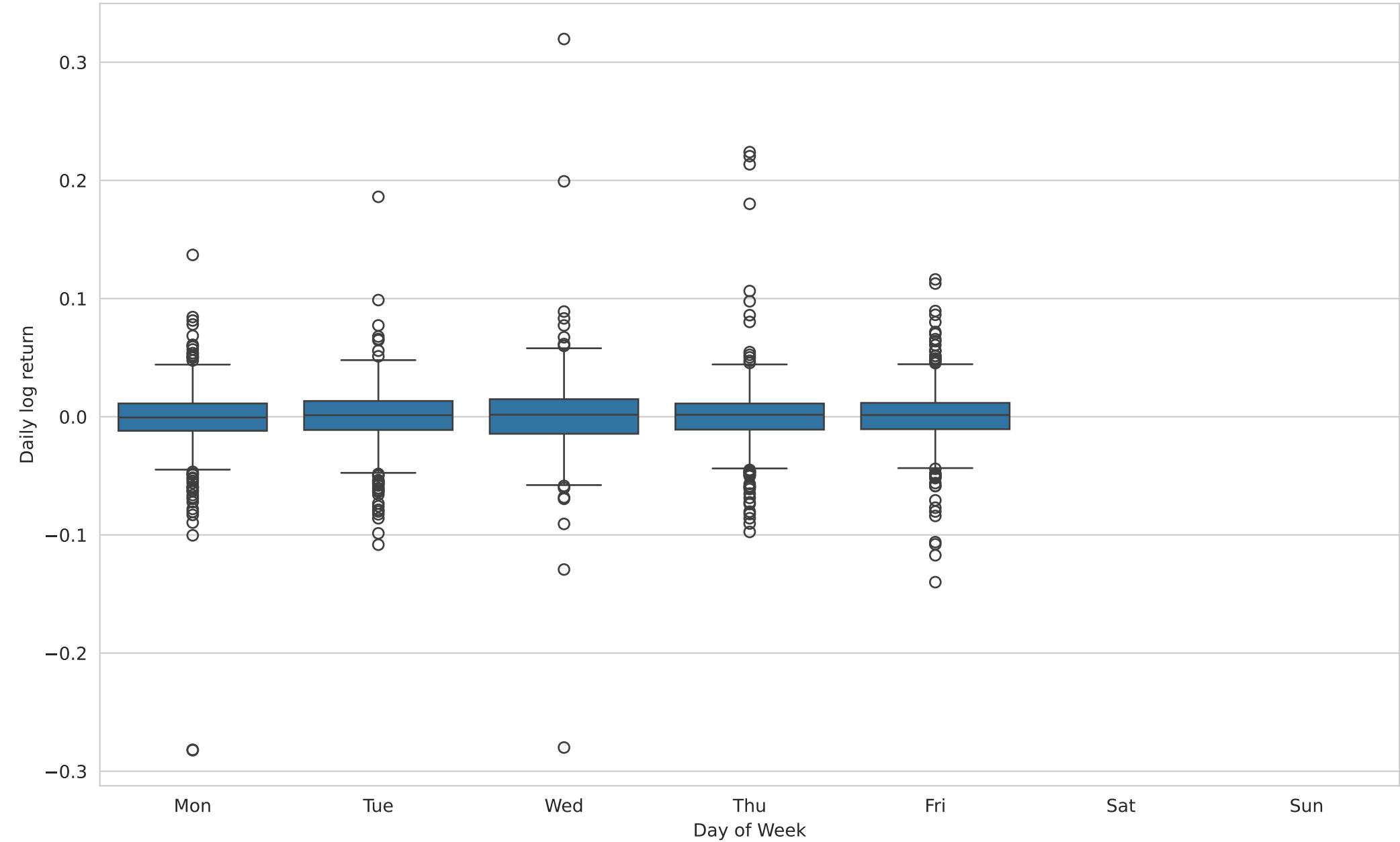
CL=F • ACF • Returns<sup>^2</sup> (Volatility Clustering)



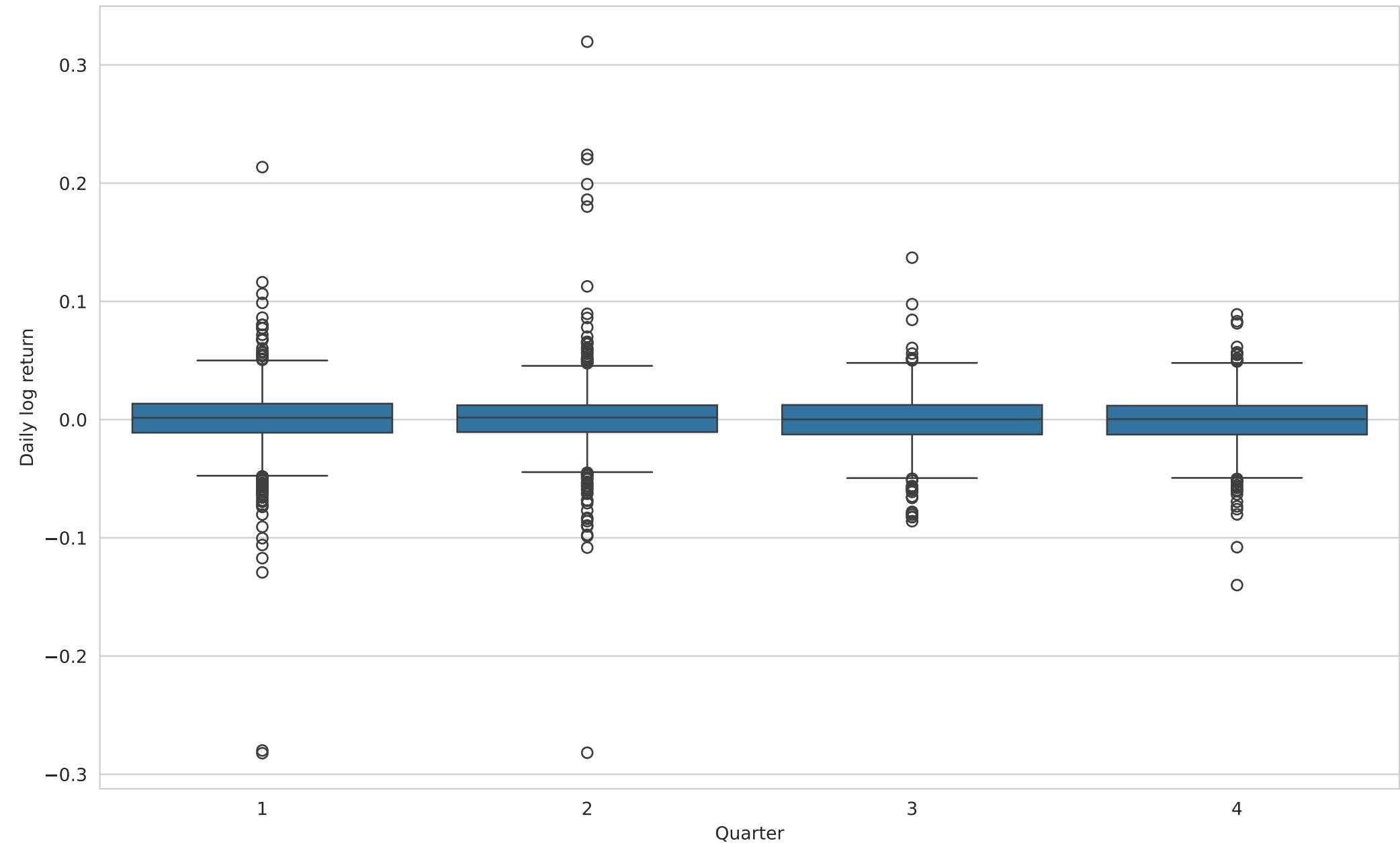
# CL=F • Monthly Returns



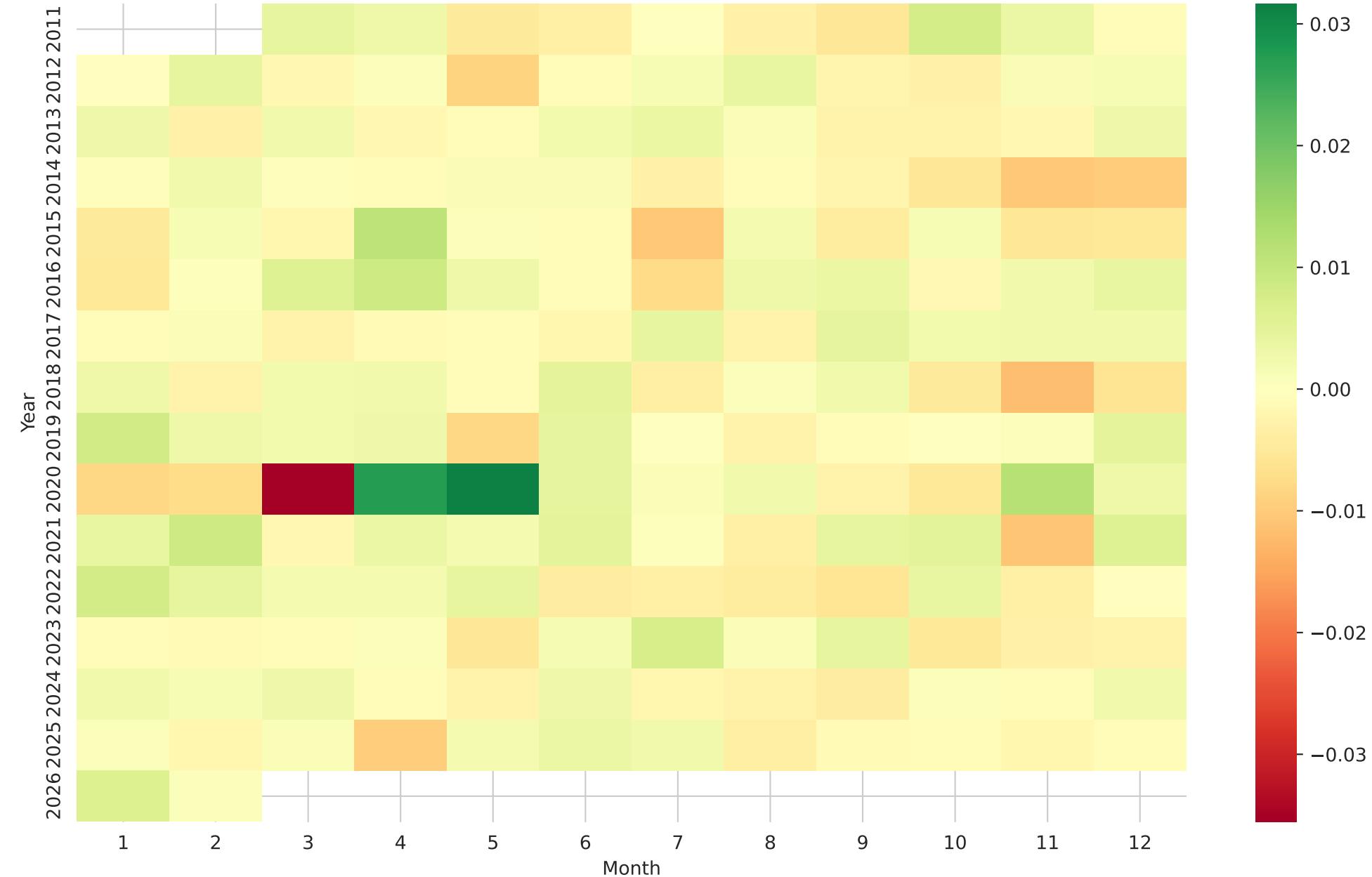
# CL=F • Day-of-Week Returns



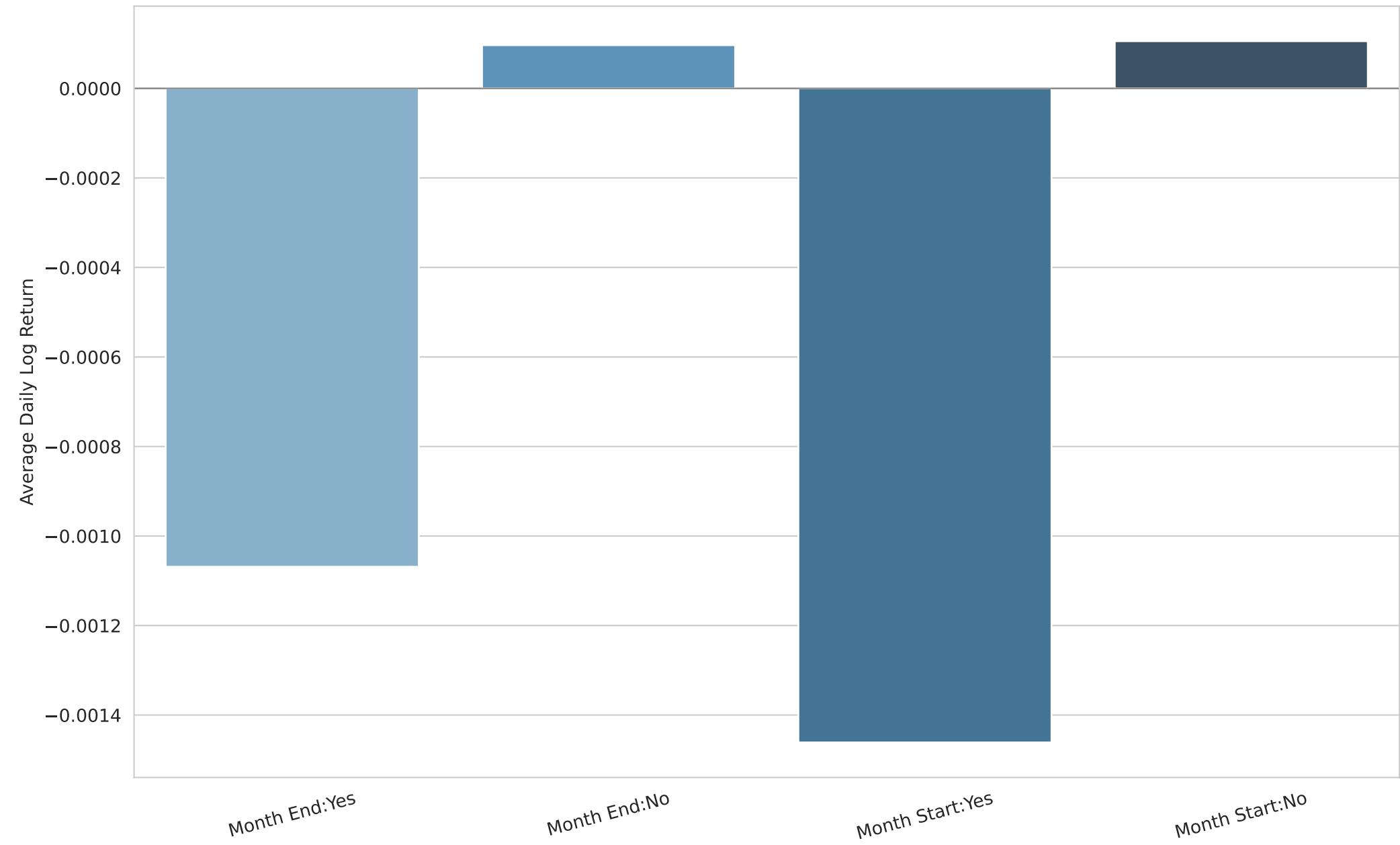
### CL=F • Quarterly Returns



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

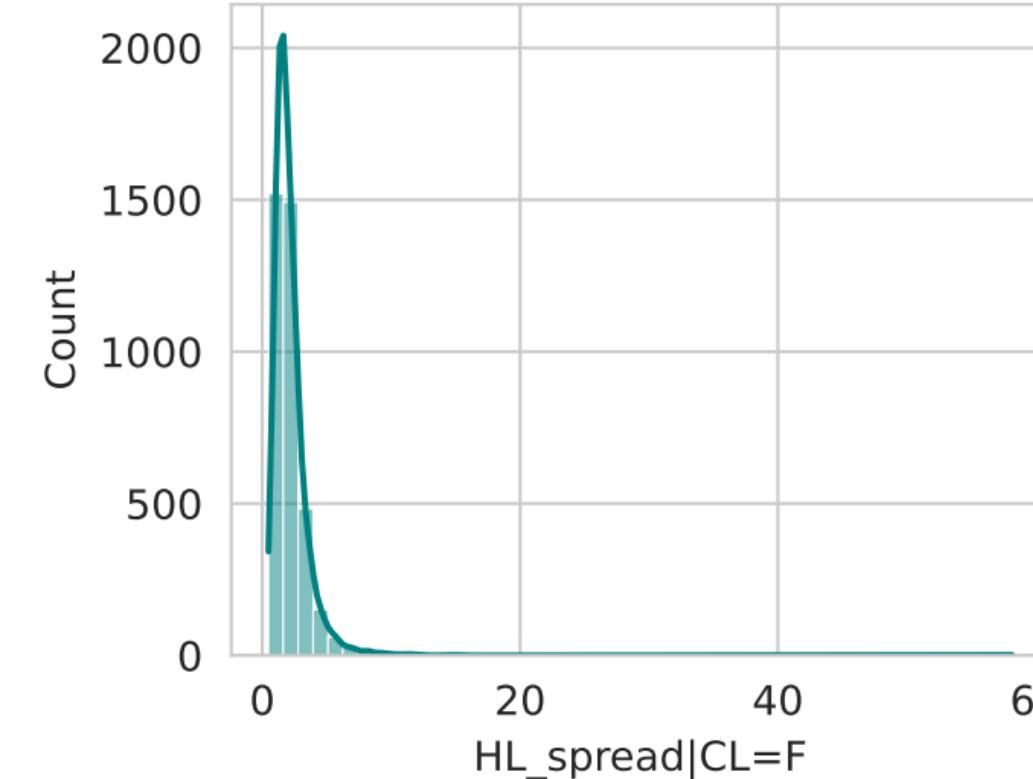


### CL=F • Avg Returns: Month-End/Start vs Others

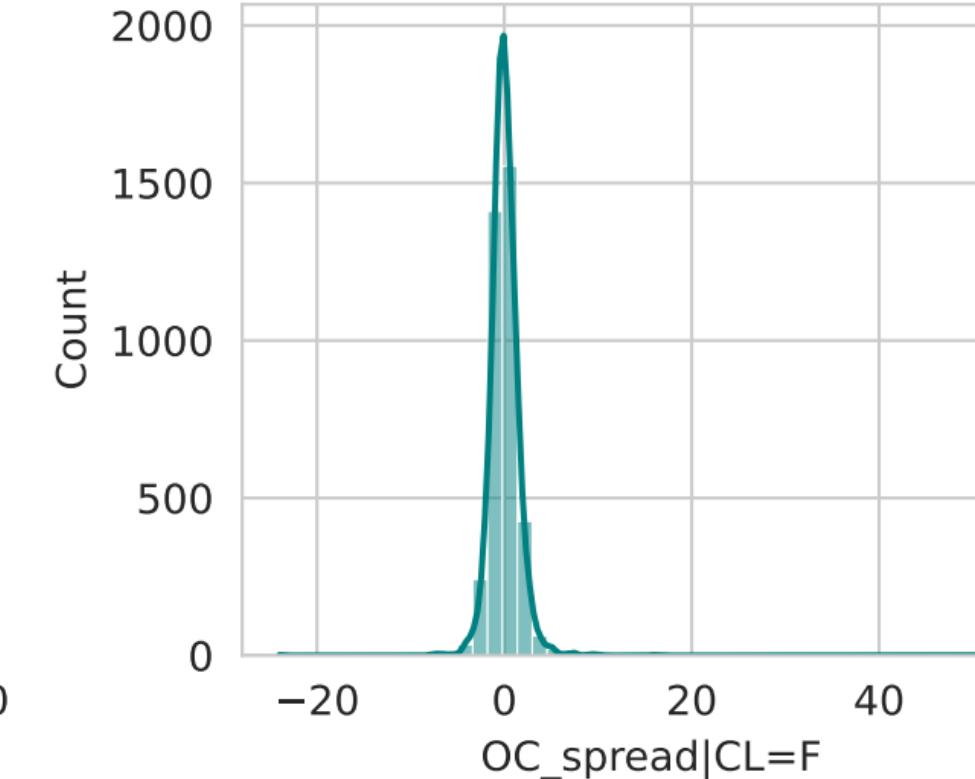


# CL=F • Spreads

HL\_spread|CL=F

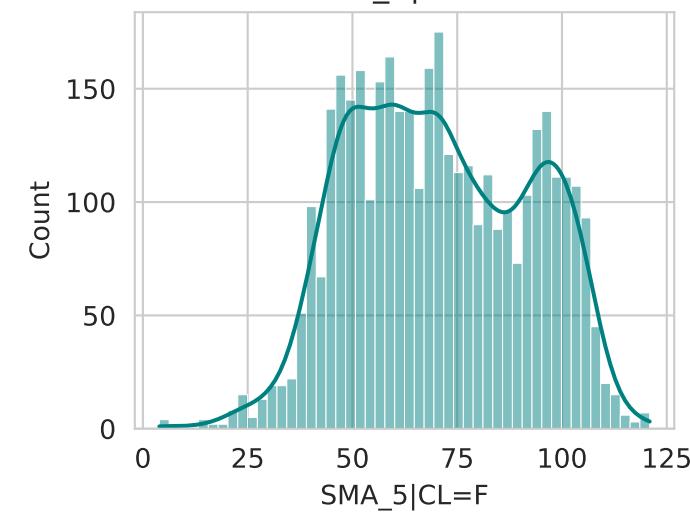


OC\_spread|CL=F

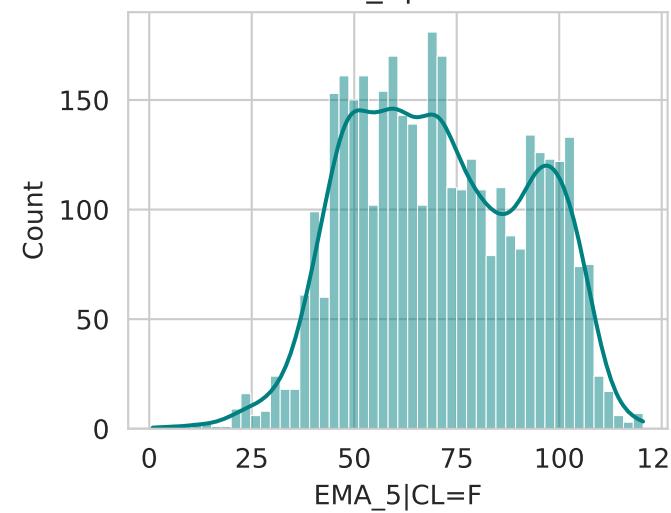


# CL=F • Moving Averages / EMAs

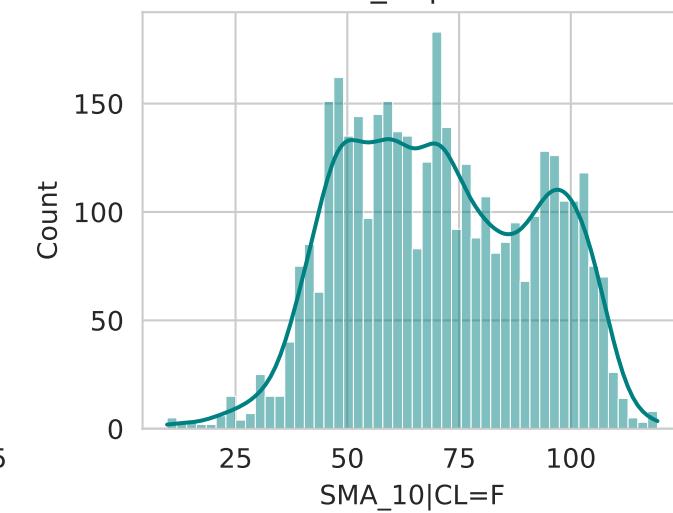
SMA\_5|CL=F



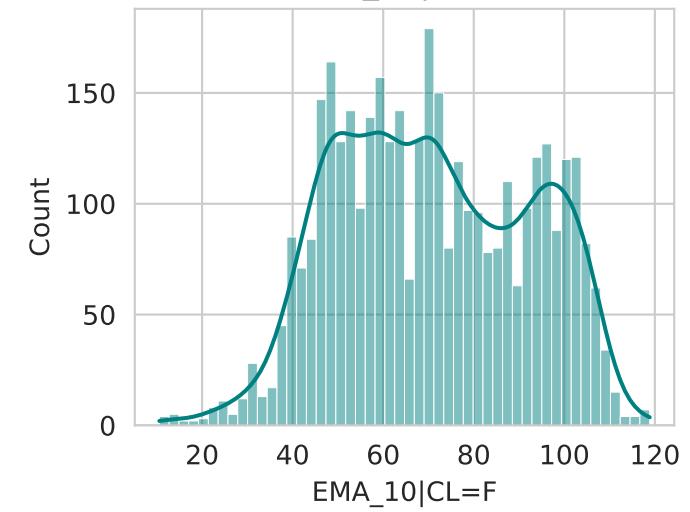
EMA\_5|CL=F



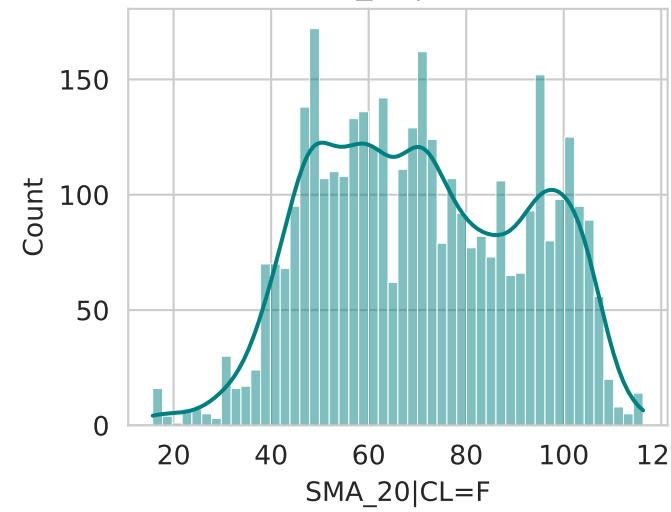
SMA\_10|CL=F



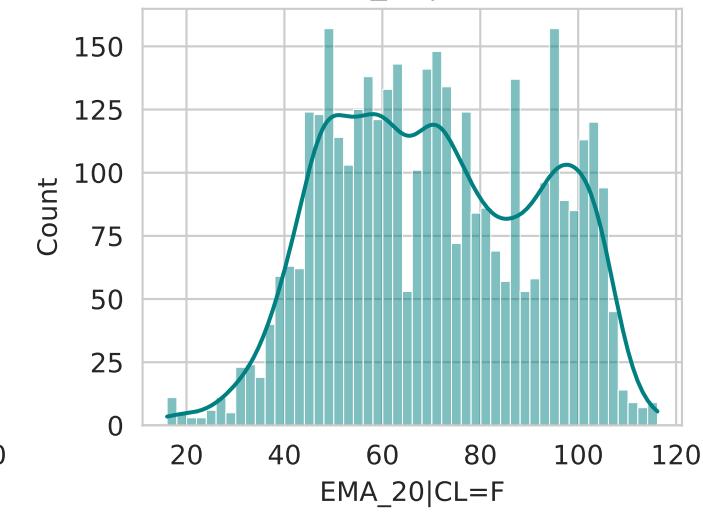
EMA\_10|CL=F



SMA\_20|CL=F

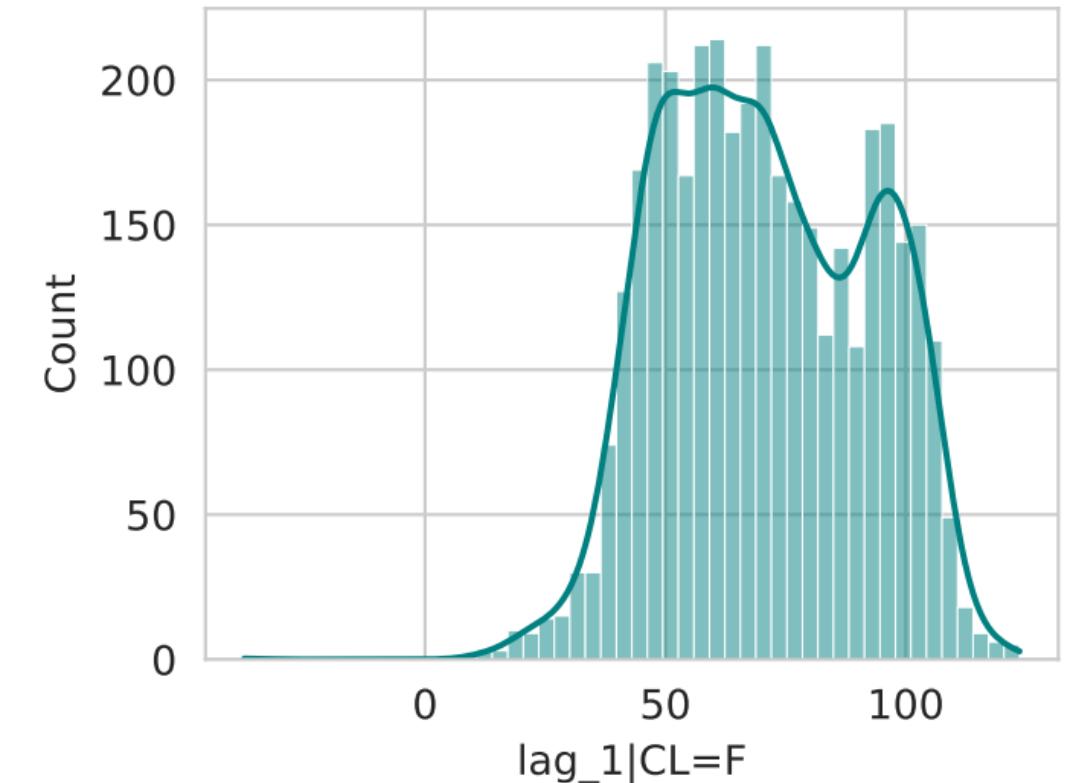


EMA\_20|CL=F

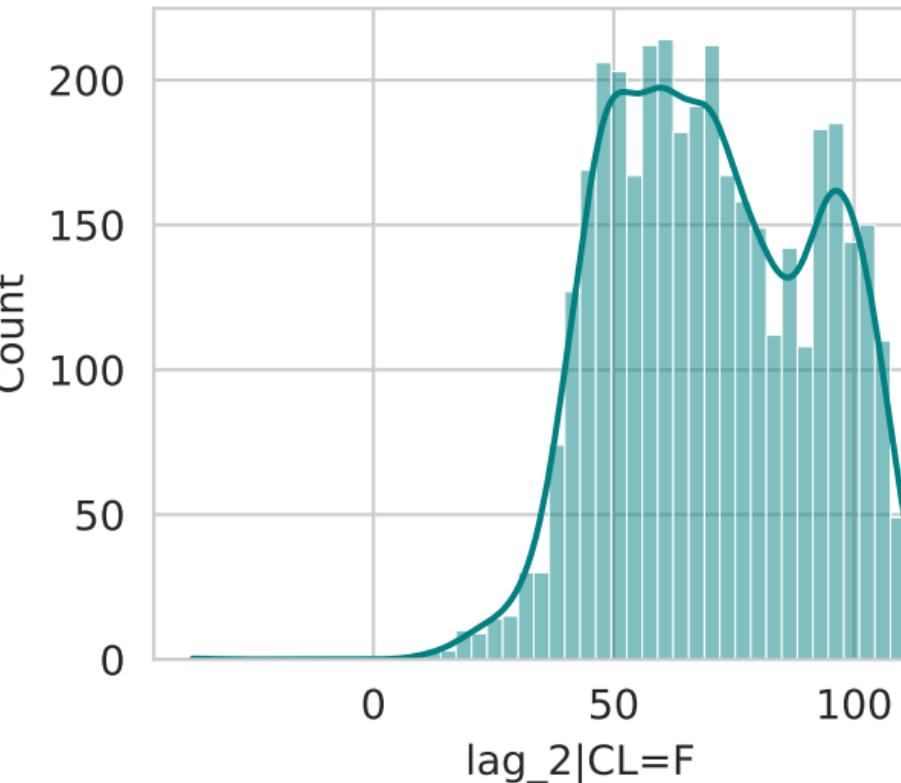


# CL=F • Lagged Prices

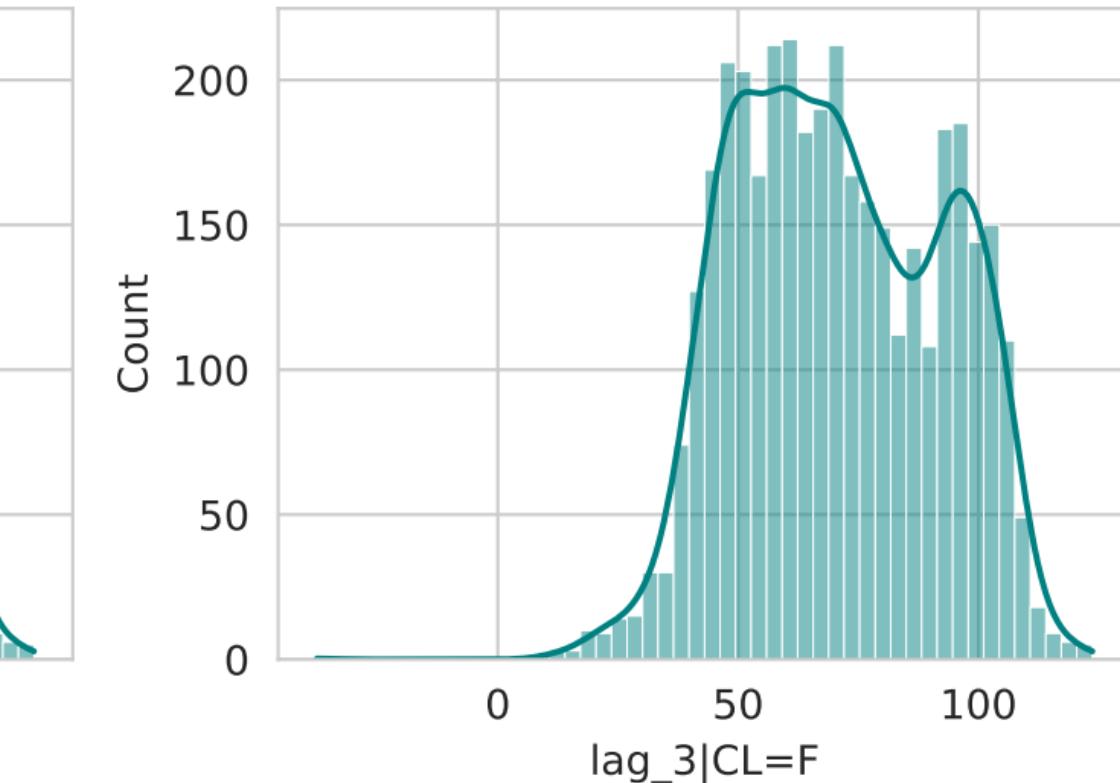
lag\_1|CL=F



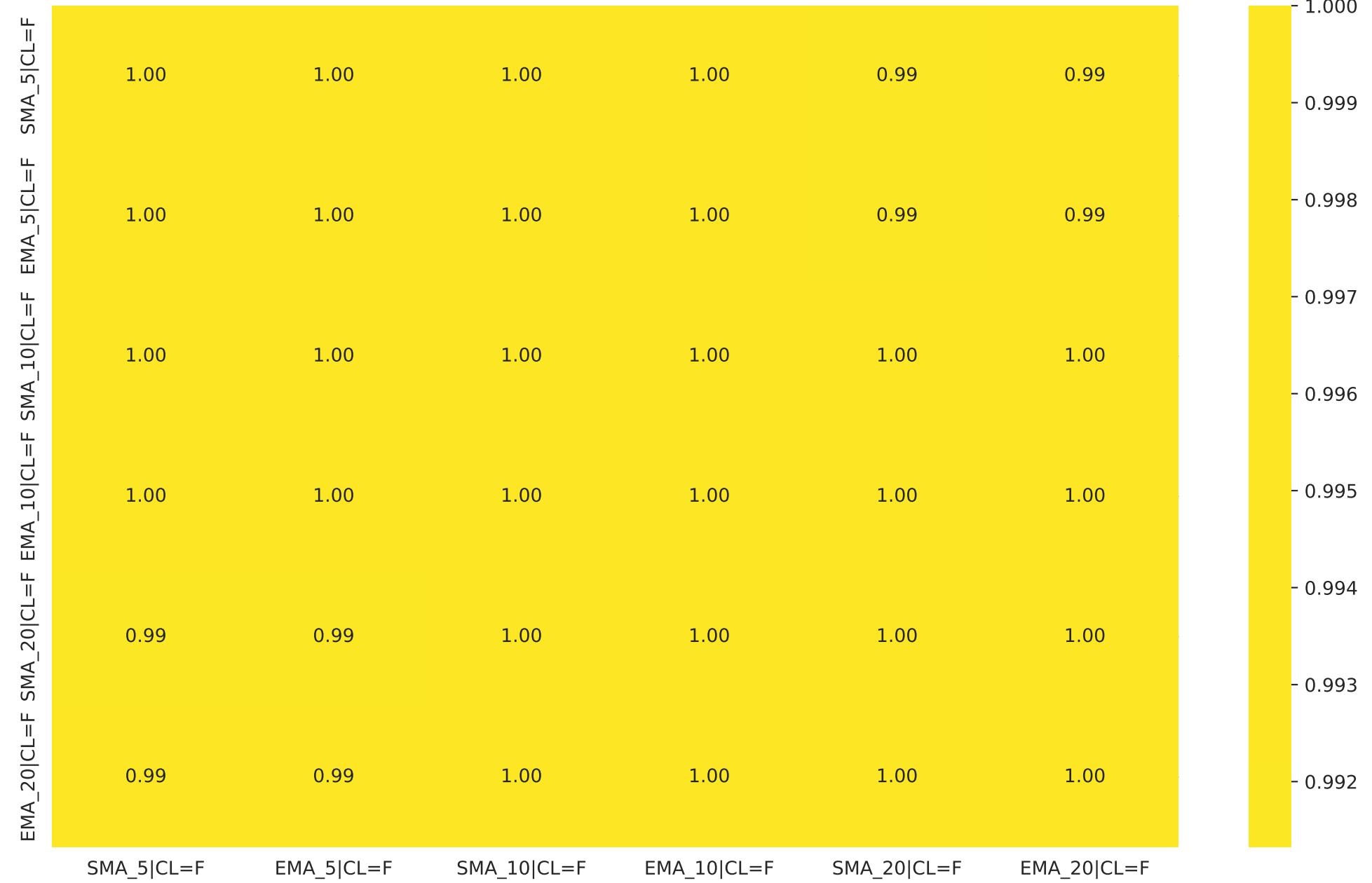
lag\_2|CL=F



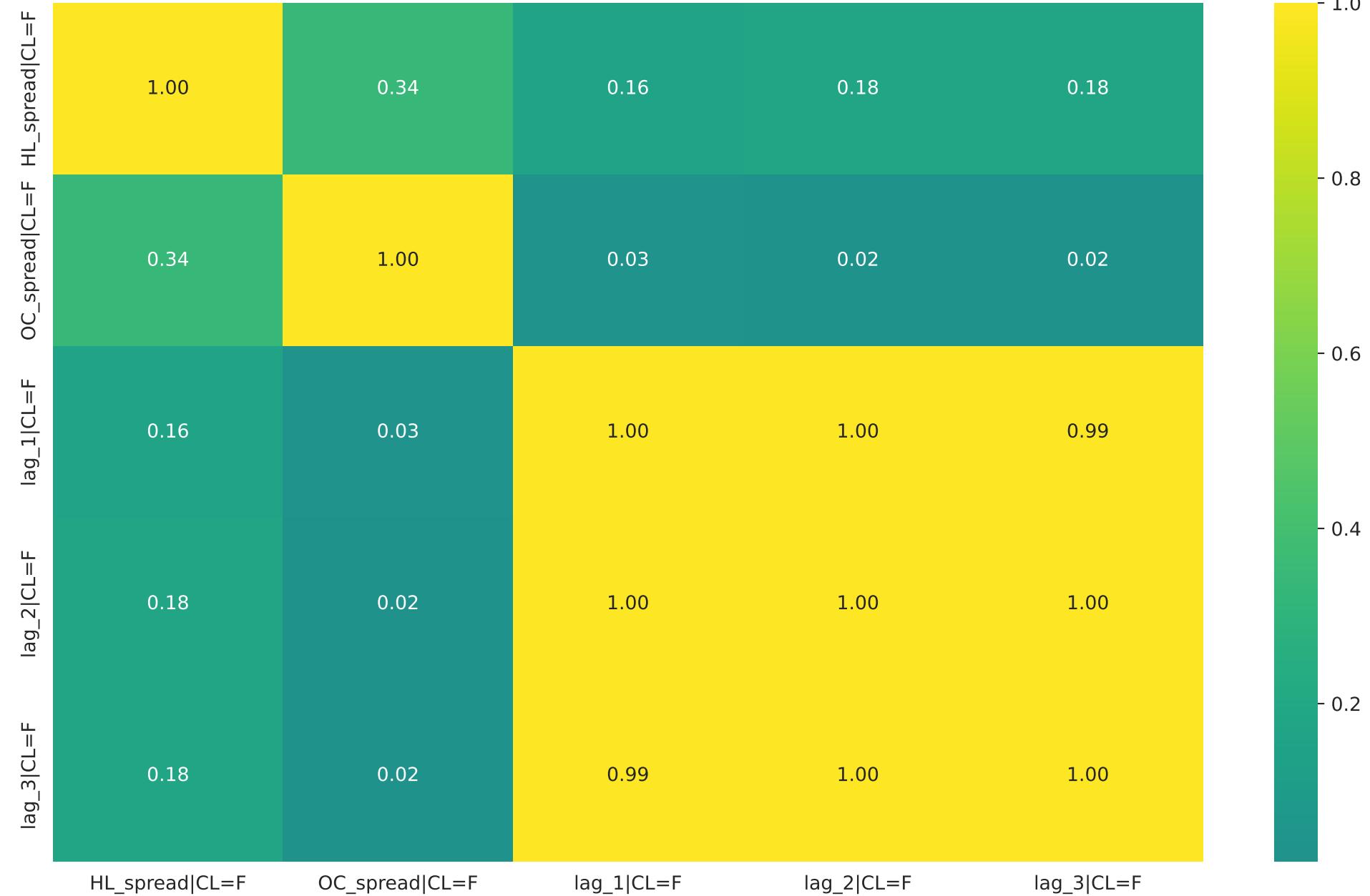
lag\_3|CL=F



## CL=F • Correlation • Moving Averages



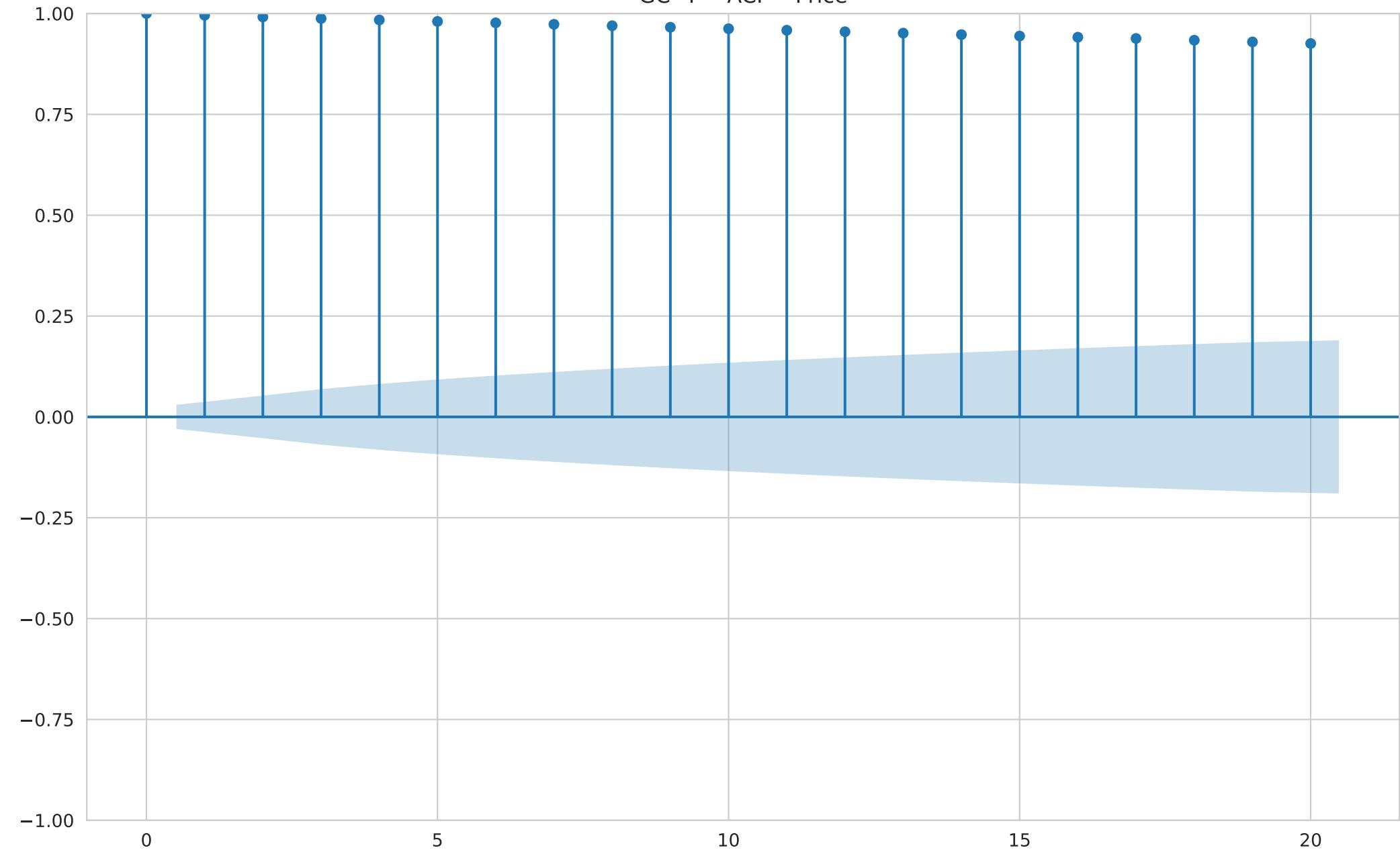
CL=F • Correlation • Spreads + Lags



# GC=F • Price



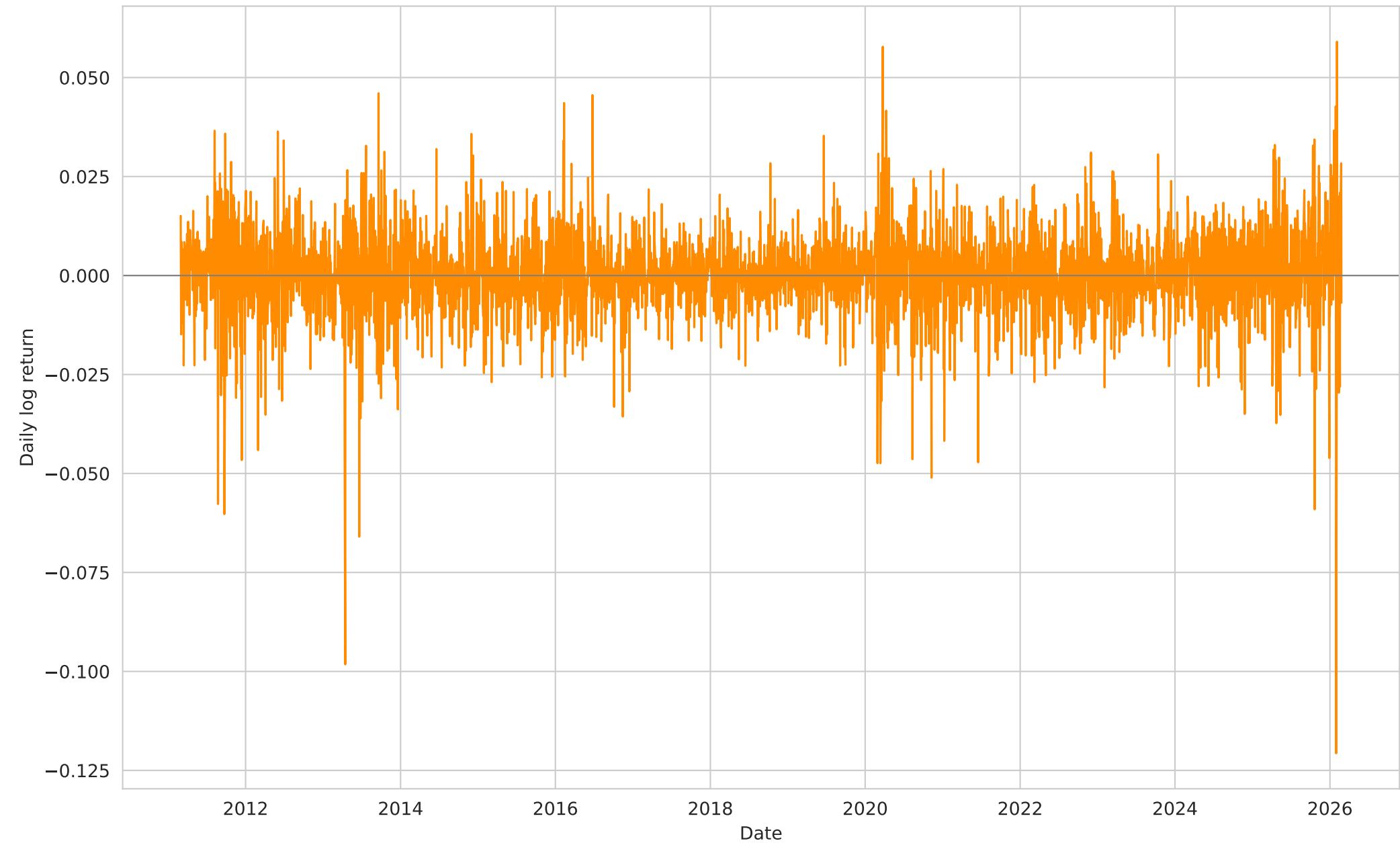
GC=F • ACF • Price



# GC=F • Moving Averages (5/10/20)



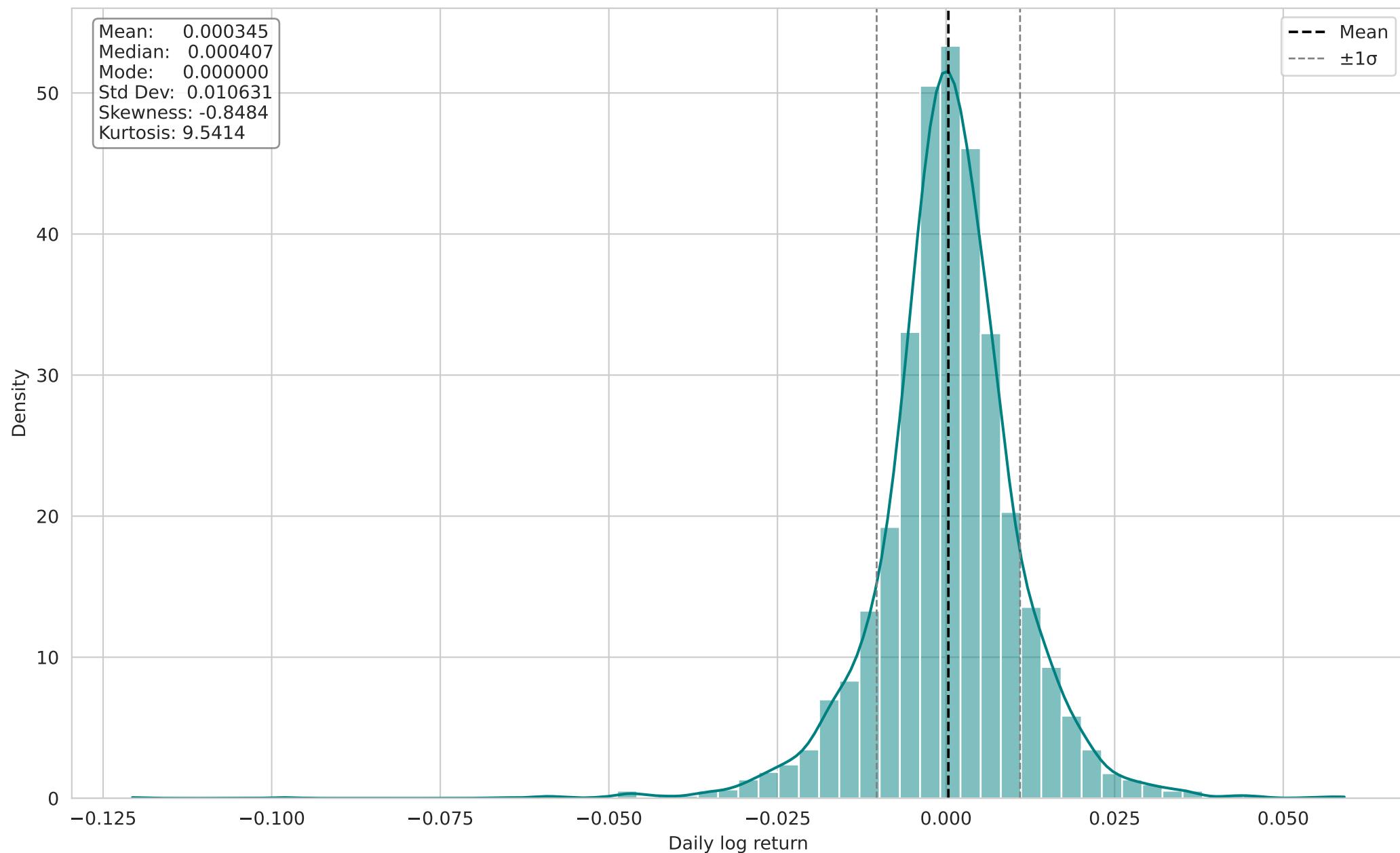
# GC=F • Daily Log Returns



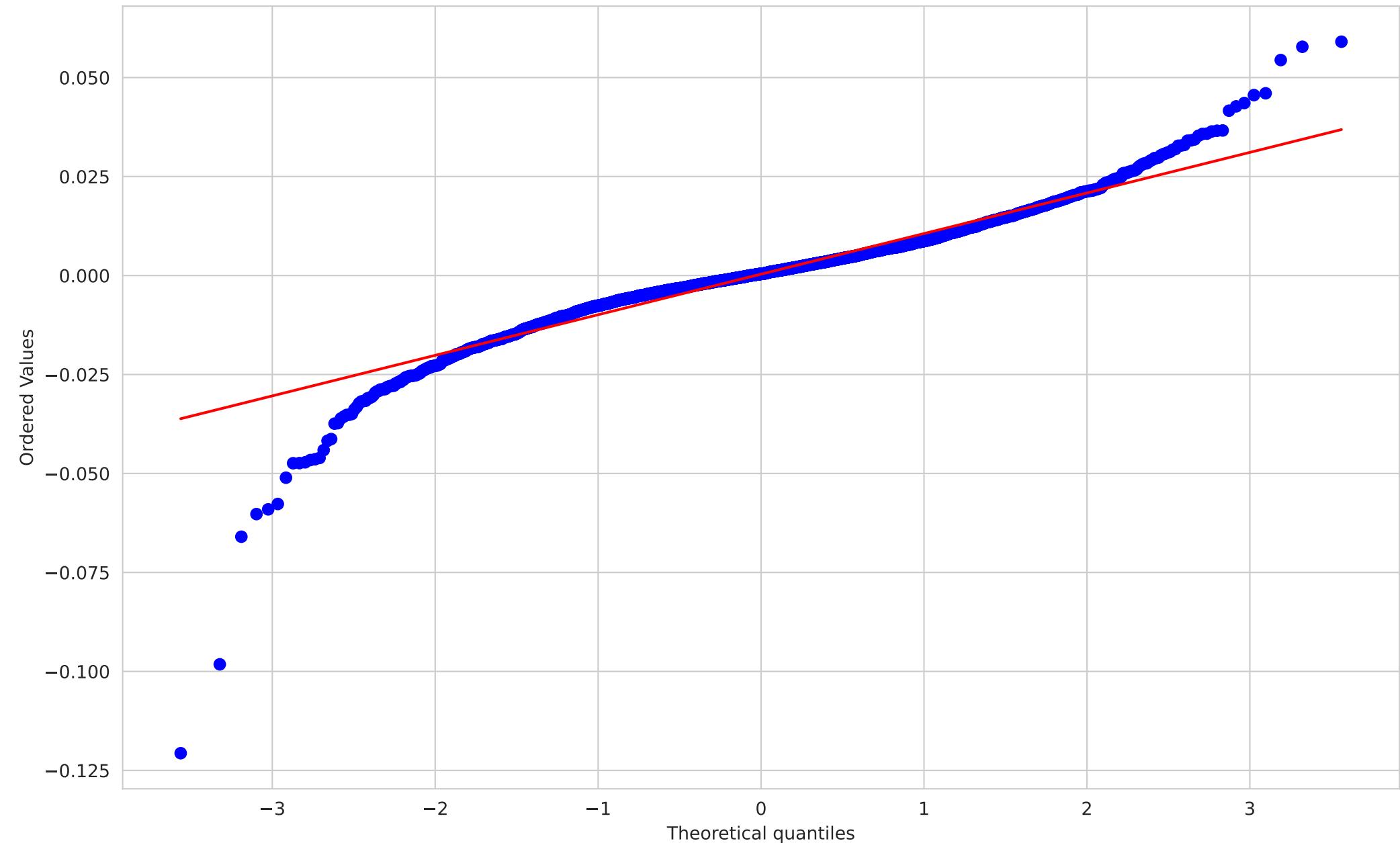
# GC=F • Returns • Distribution

Mean: 0.000345  
Median: 0.000407  
Mode: 0.000000  
Std Dev: 0.010631  
Skewness: -0.8484  
Kurtosis: 9.5414

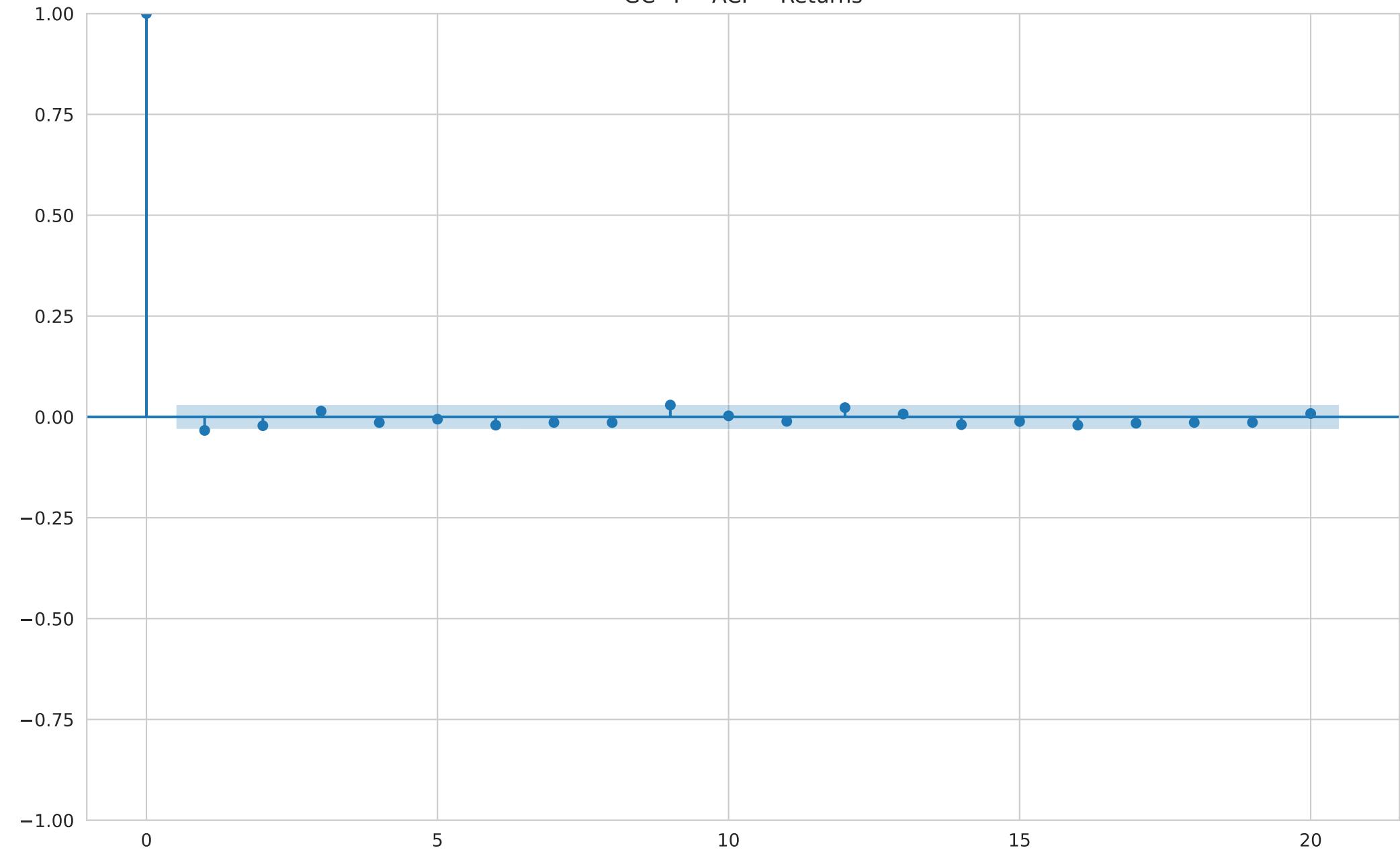
--- Mean  
----  $\pm 1\sigma$



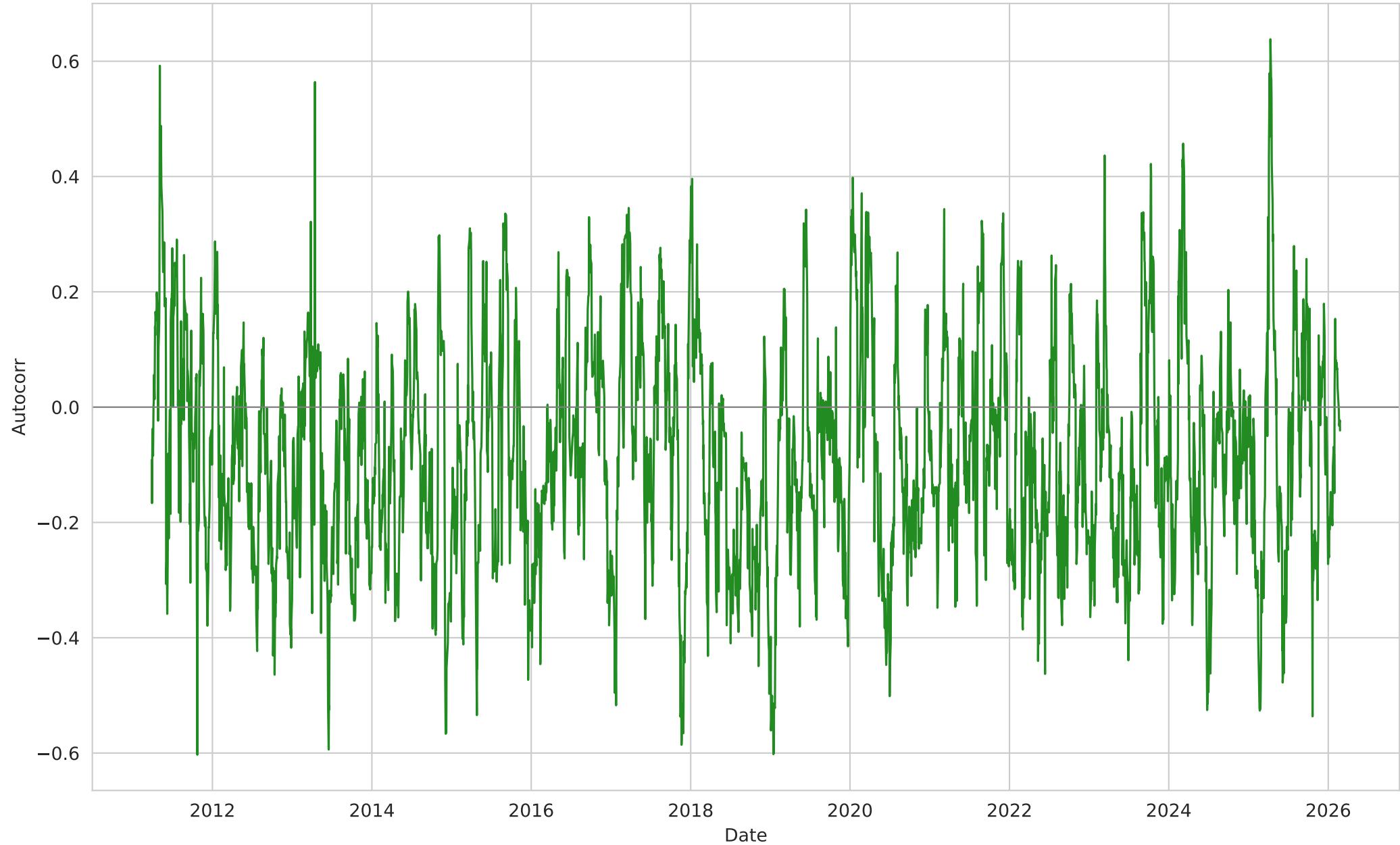
GC=F • Returns • Q-Q Plot vs Normal



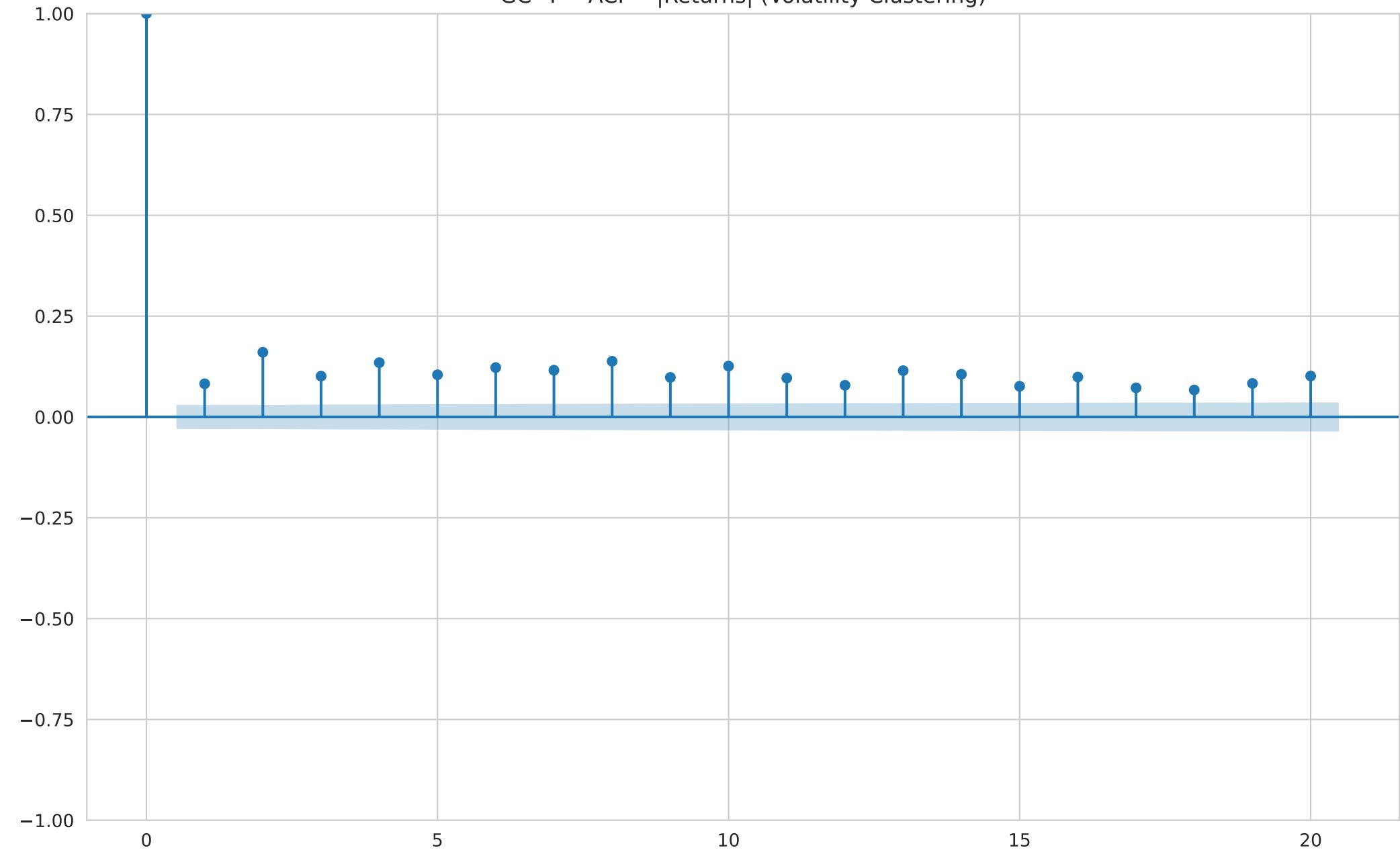
### GC=F • ACF • Returns



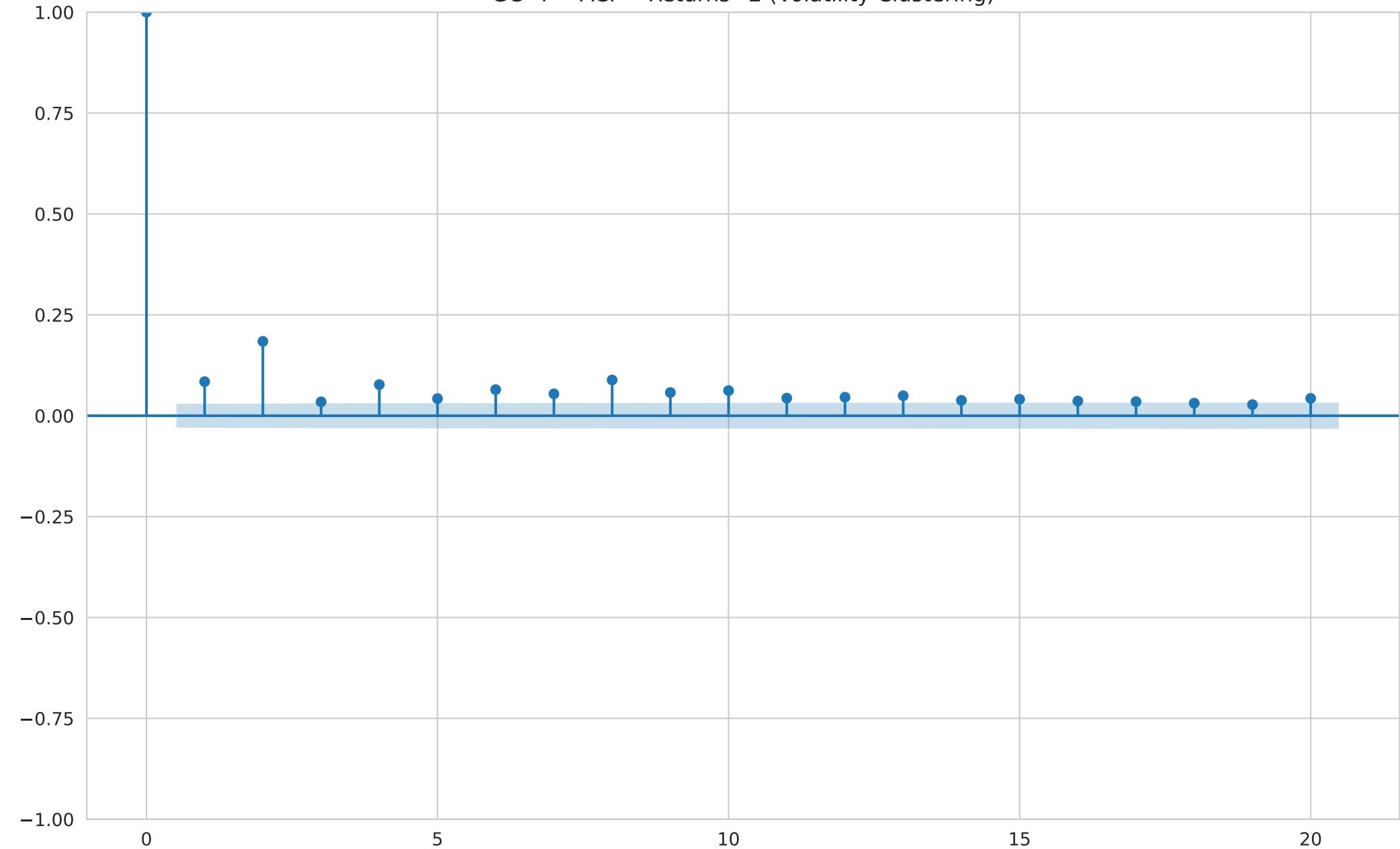
### GC=F • Rolling Autocorrelation (lag=1, window=20)



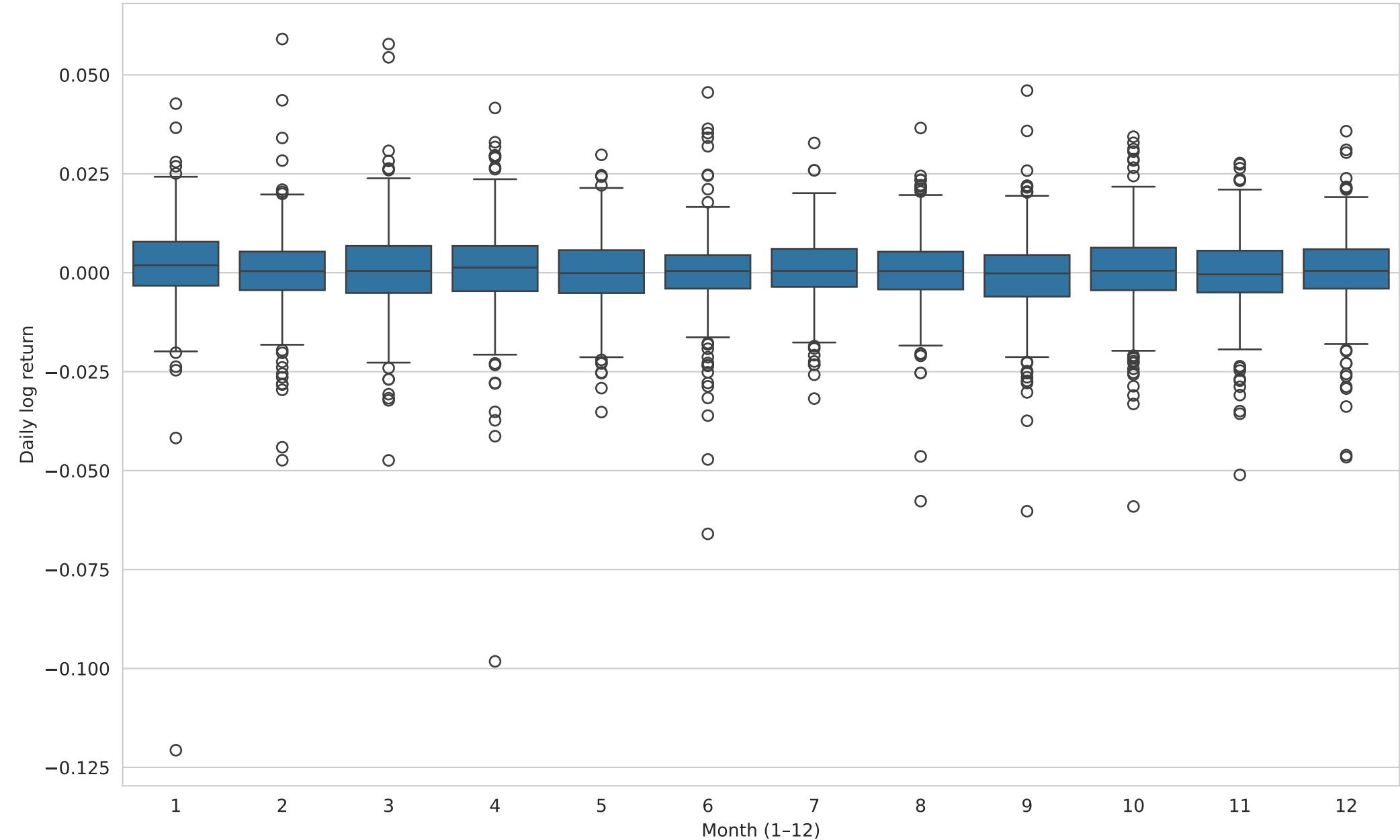
GC=F • ACF • |Returns| (Volatility Clustering)



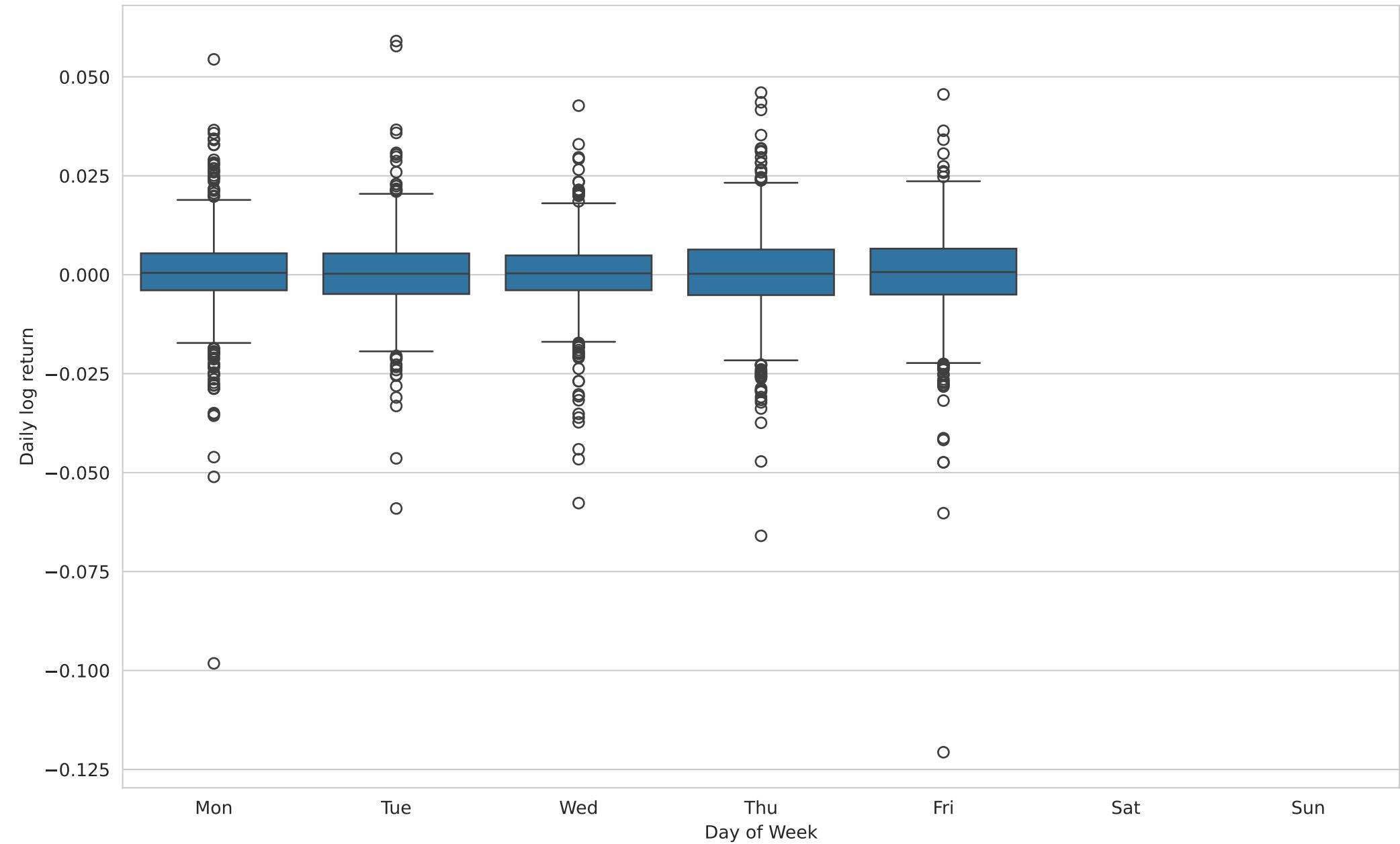
GC=F • ACF • Returns<sup>2</sup> (Volatility Clustering)



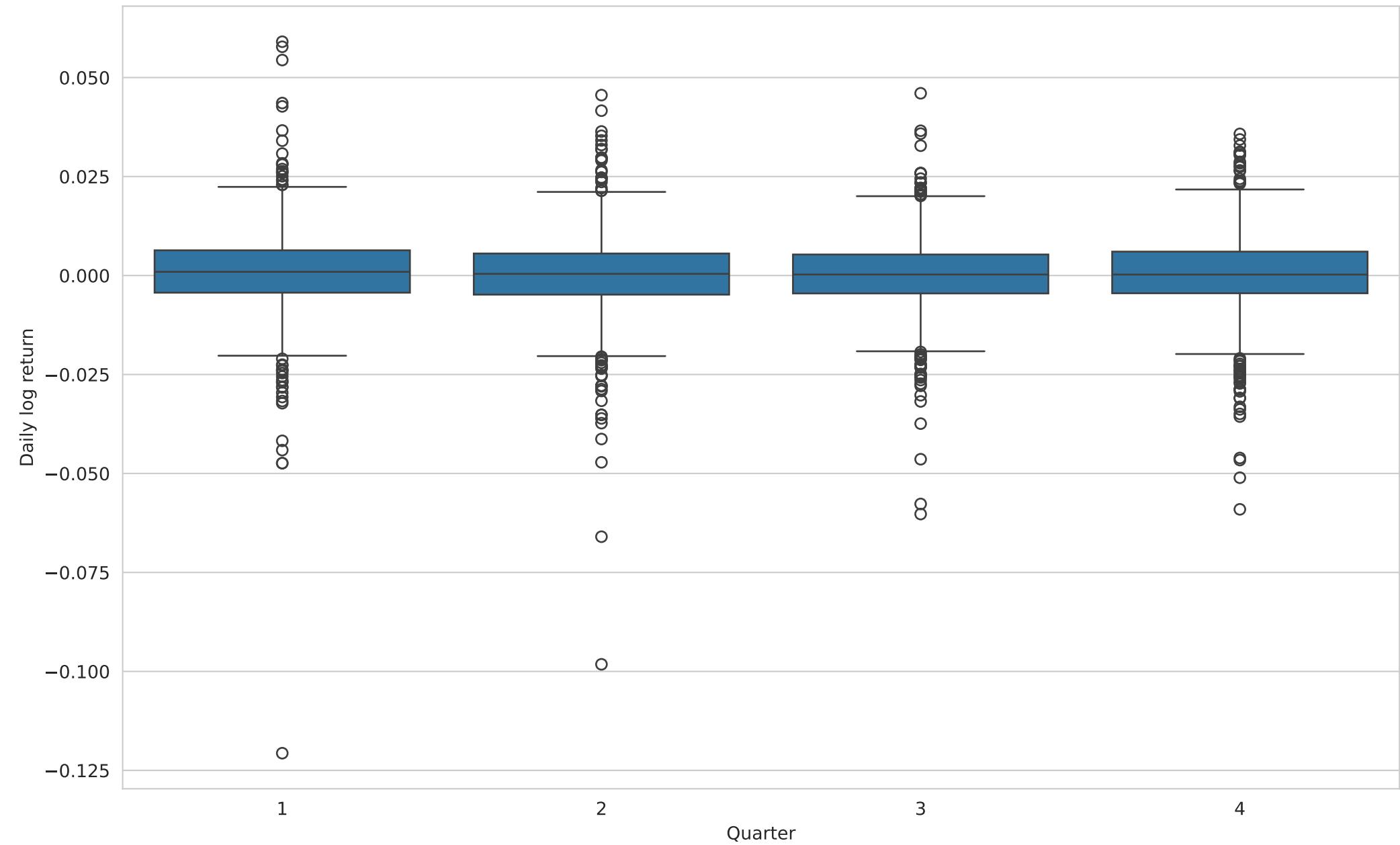
# GC=F • Monthly Returns



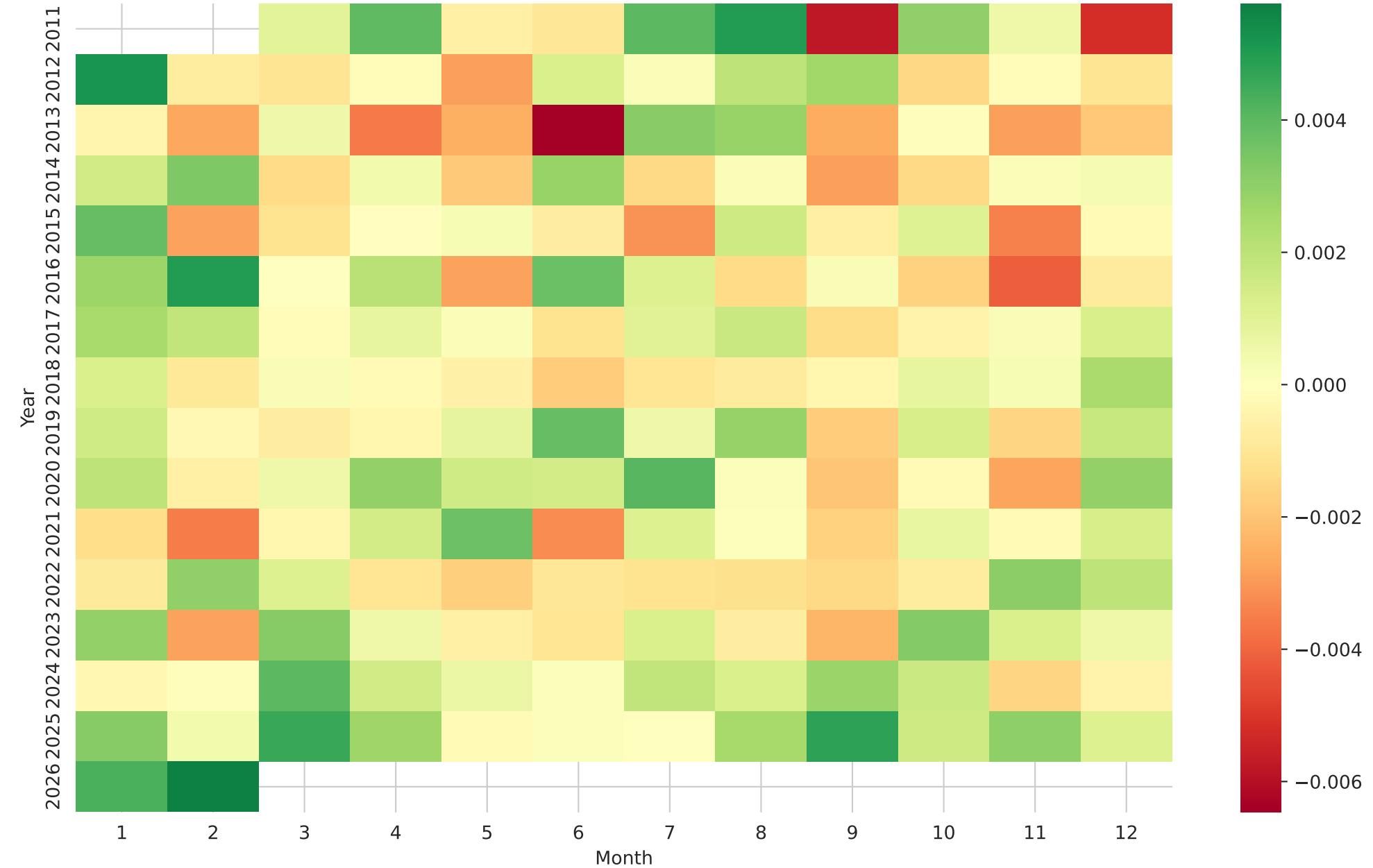
# GC=F • Day-of-Week Returns



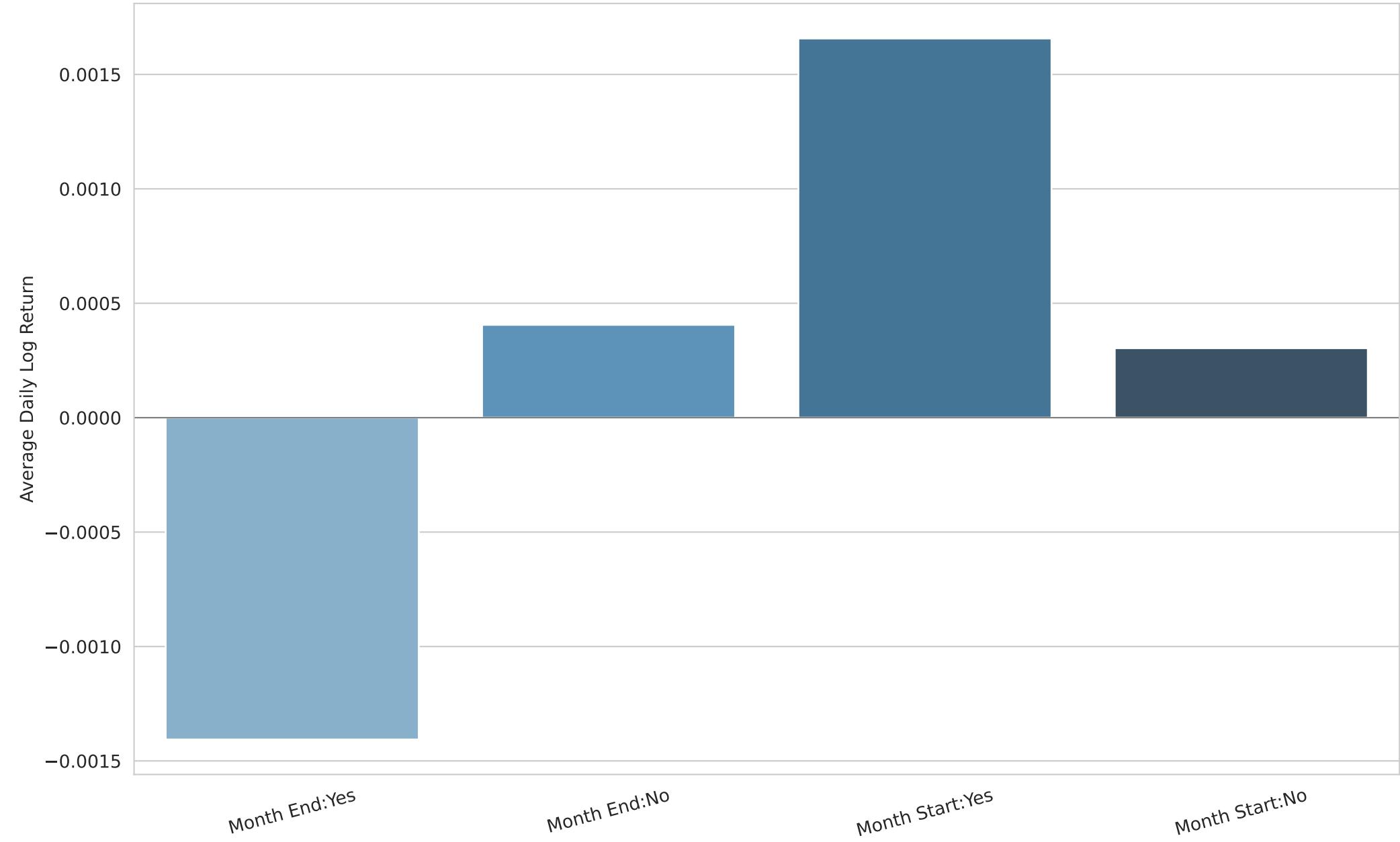
### GC=F • Quarterly Returns



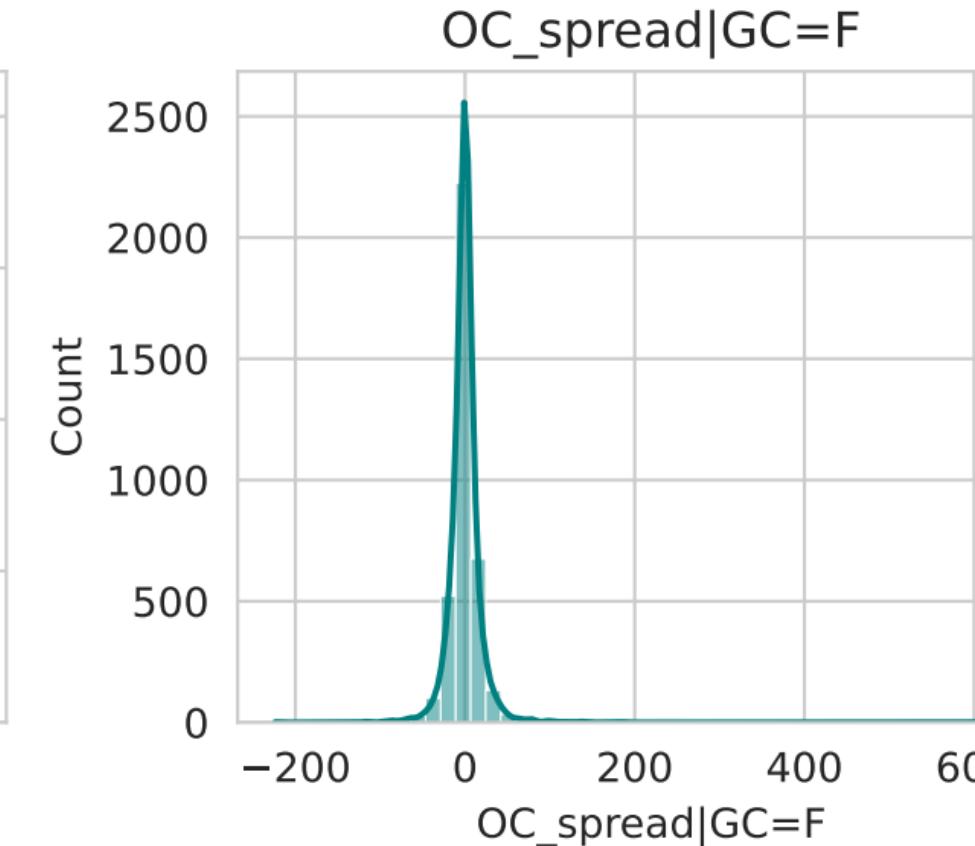
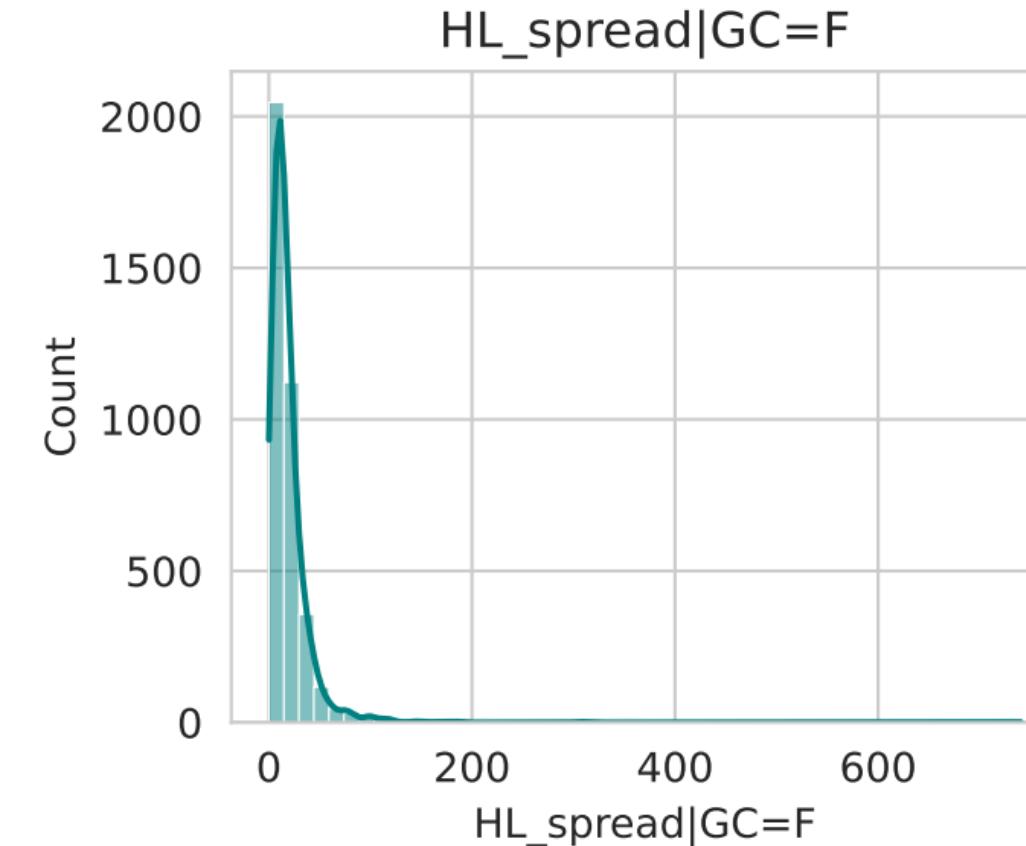
GC=F • Month×Year Heatmap (Avg Daily Returns)



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

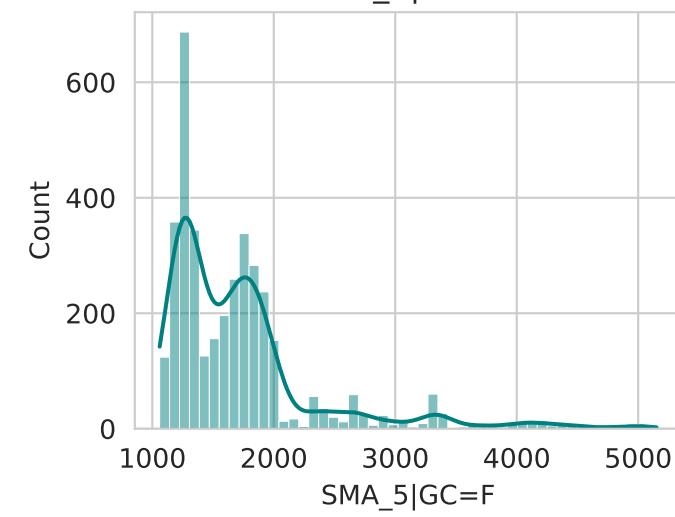


# GC=F • Spreads

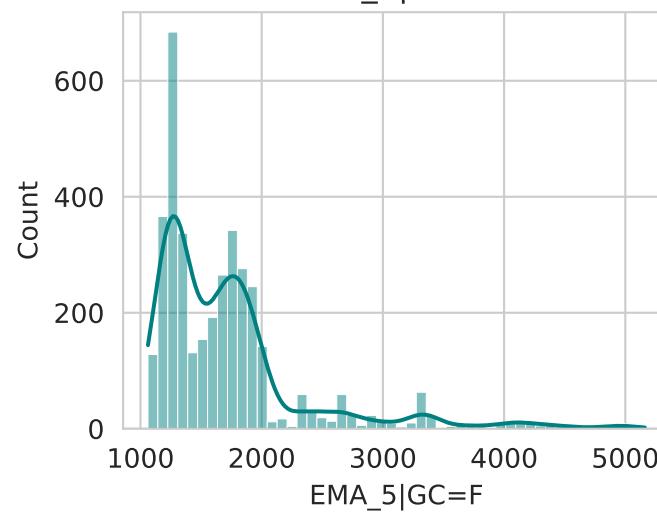


# GC=F • Moving Averages / EMAs

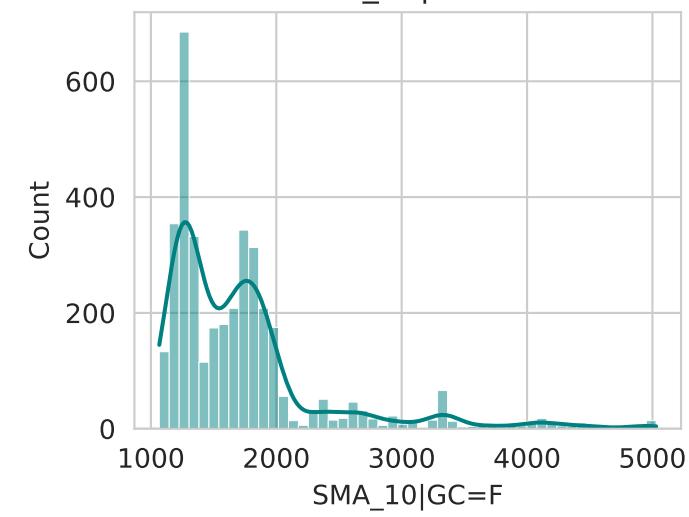
SMA\_5|GC=F



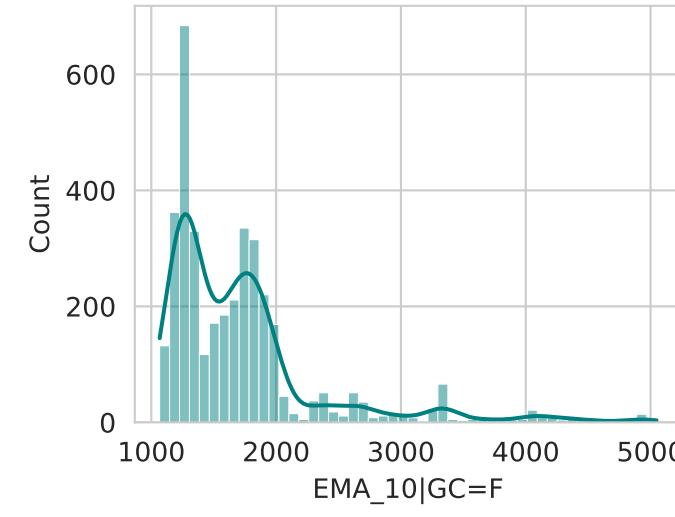
EMA\_5|GC=F



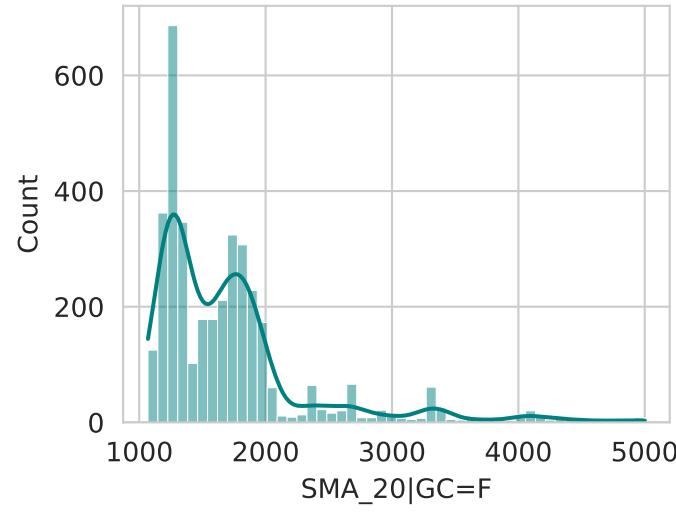
SMA\_10|GC=F



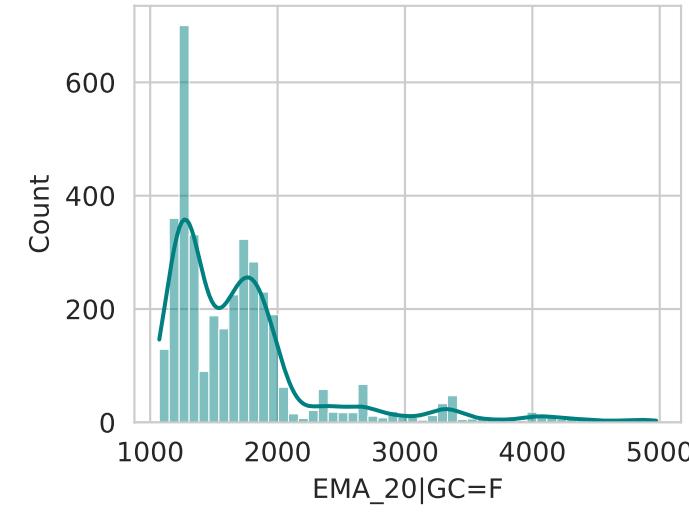
EMA\_10|GC=F



SMA\_20|GC=F

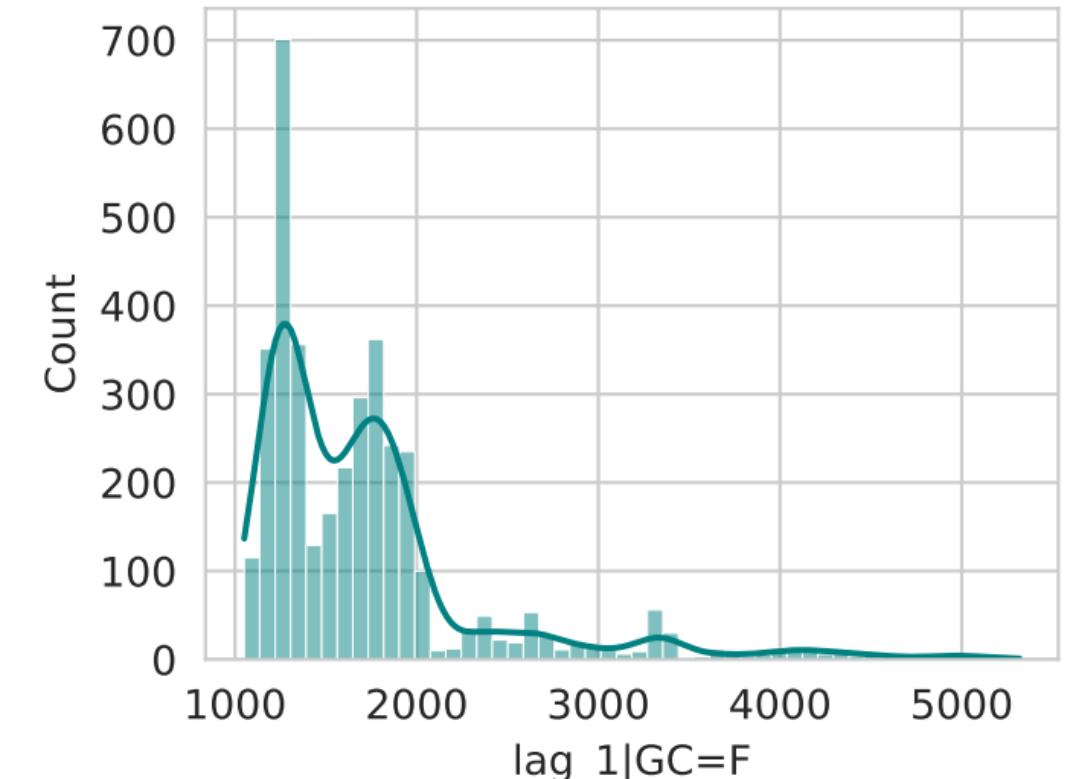


EMA\_20|GC=F

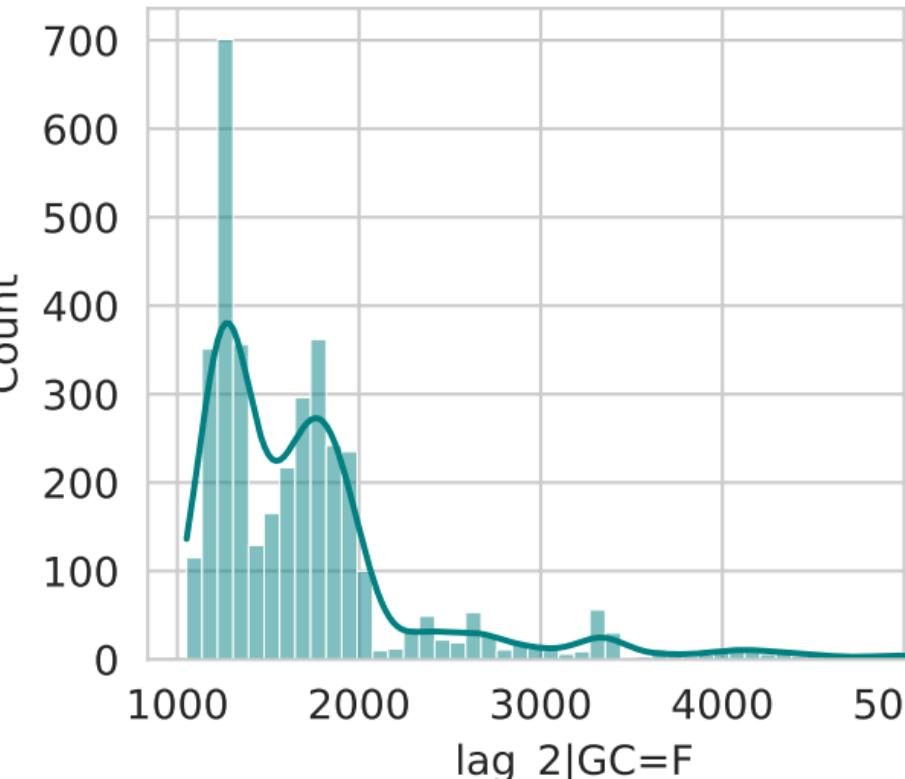


# GC=F • Lagged Prices

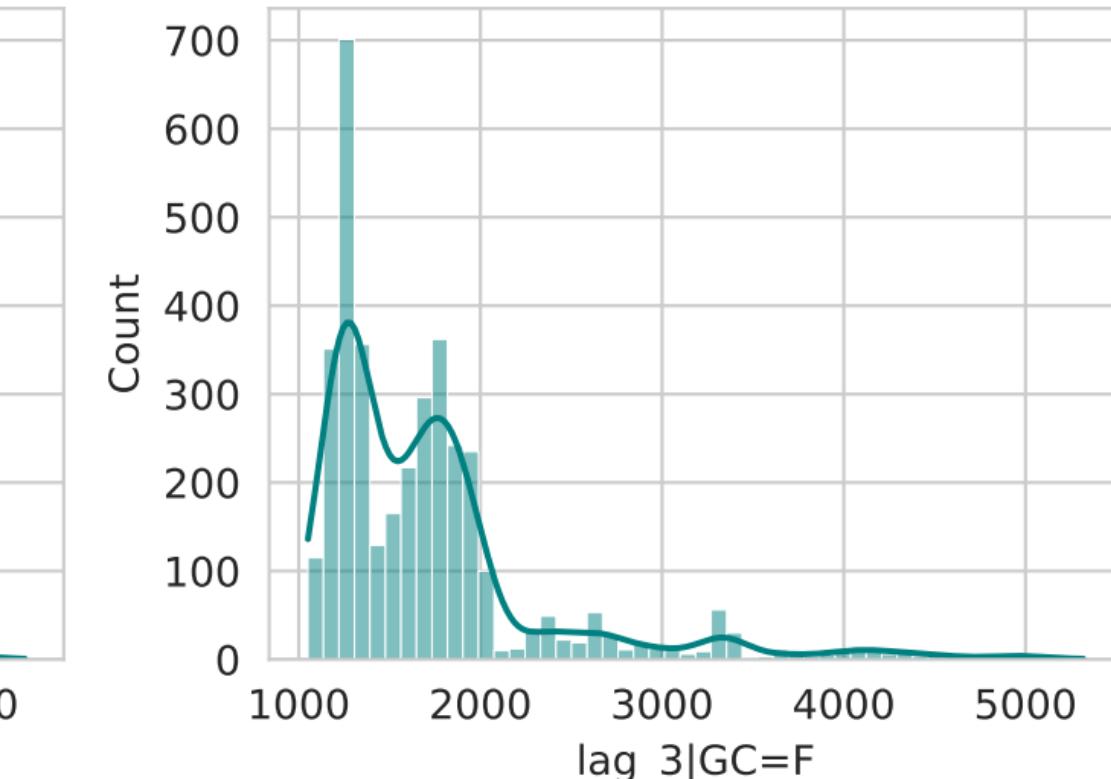
lag\_1|GC=F



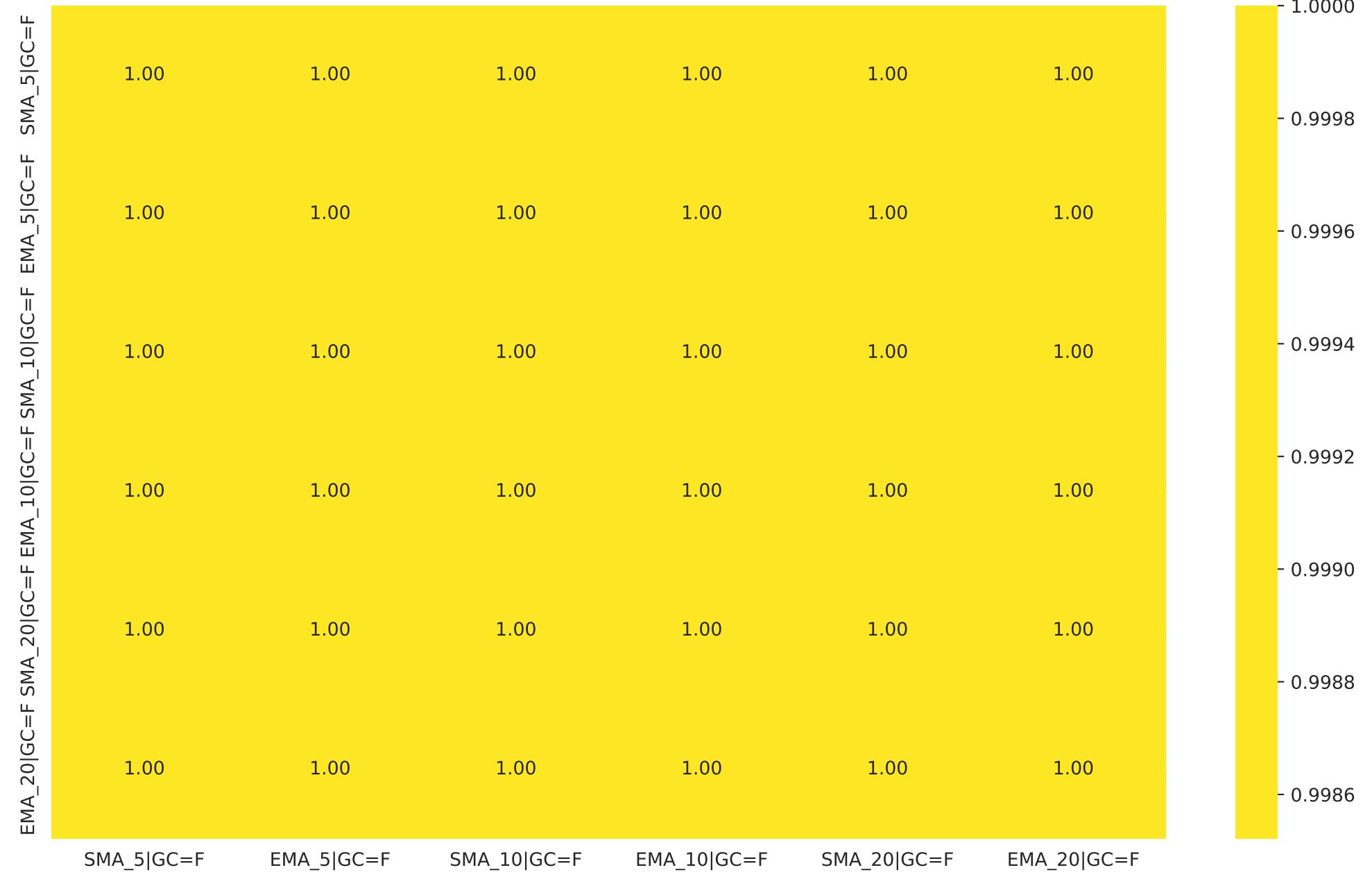
lag\_2|GC=F



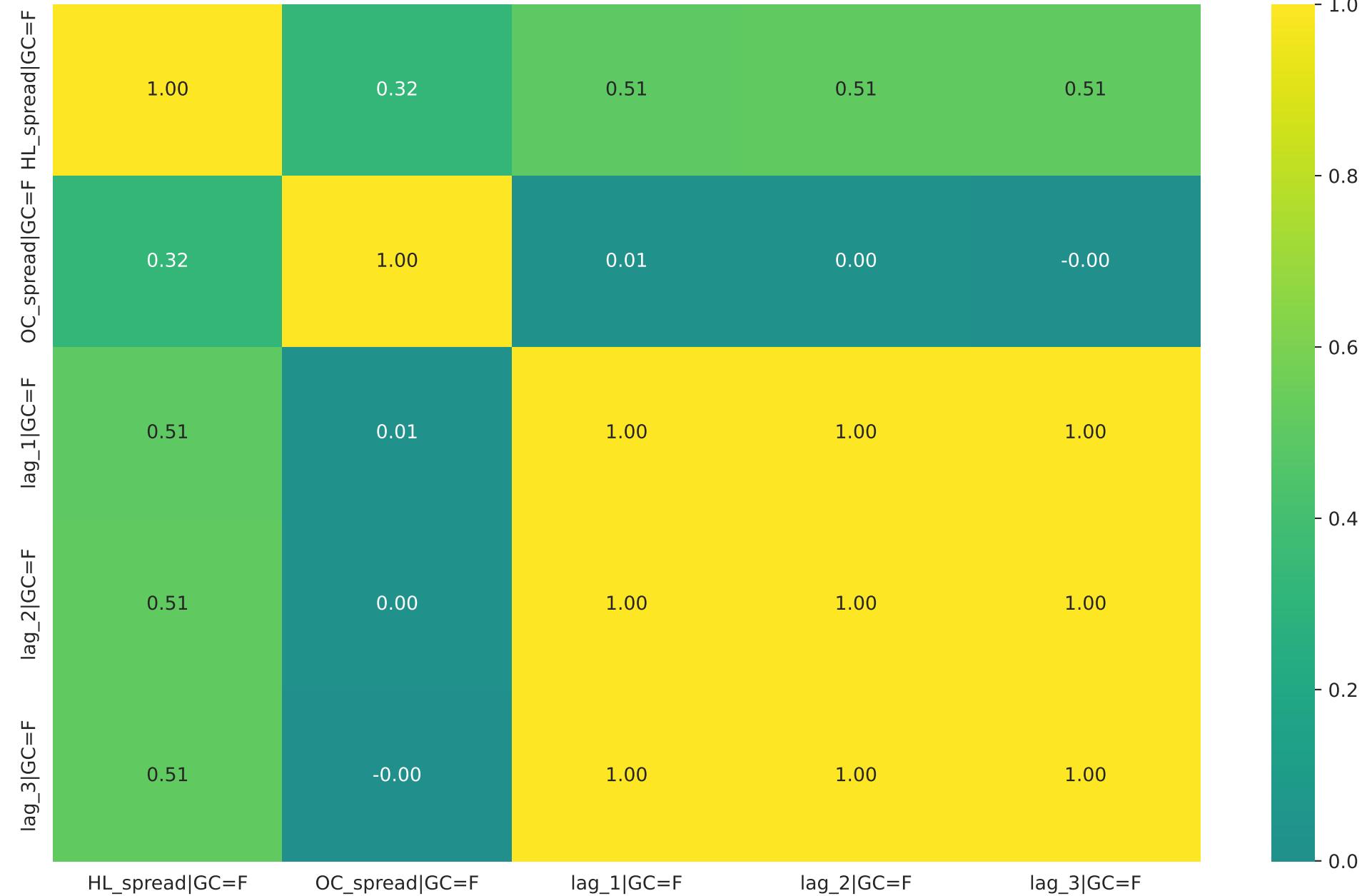
lag\_3|GC=F



## GC=F • Correlation • Moving Averages



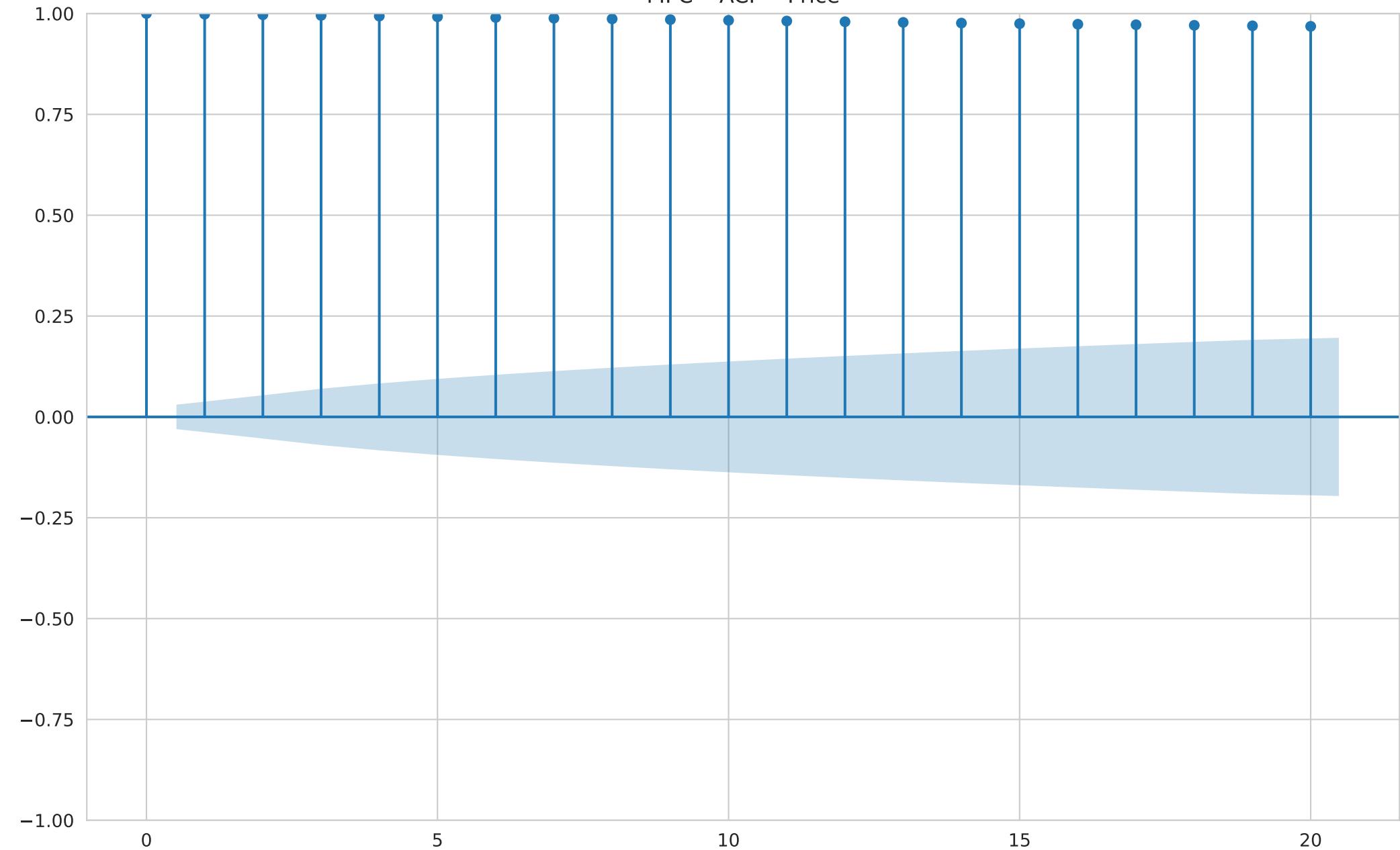
## GC=F • Correlation • Spreads + Lags



# MPC • Price



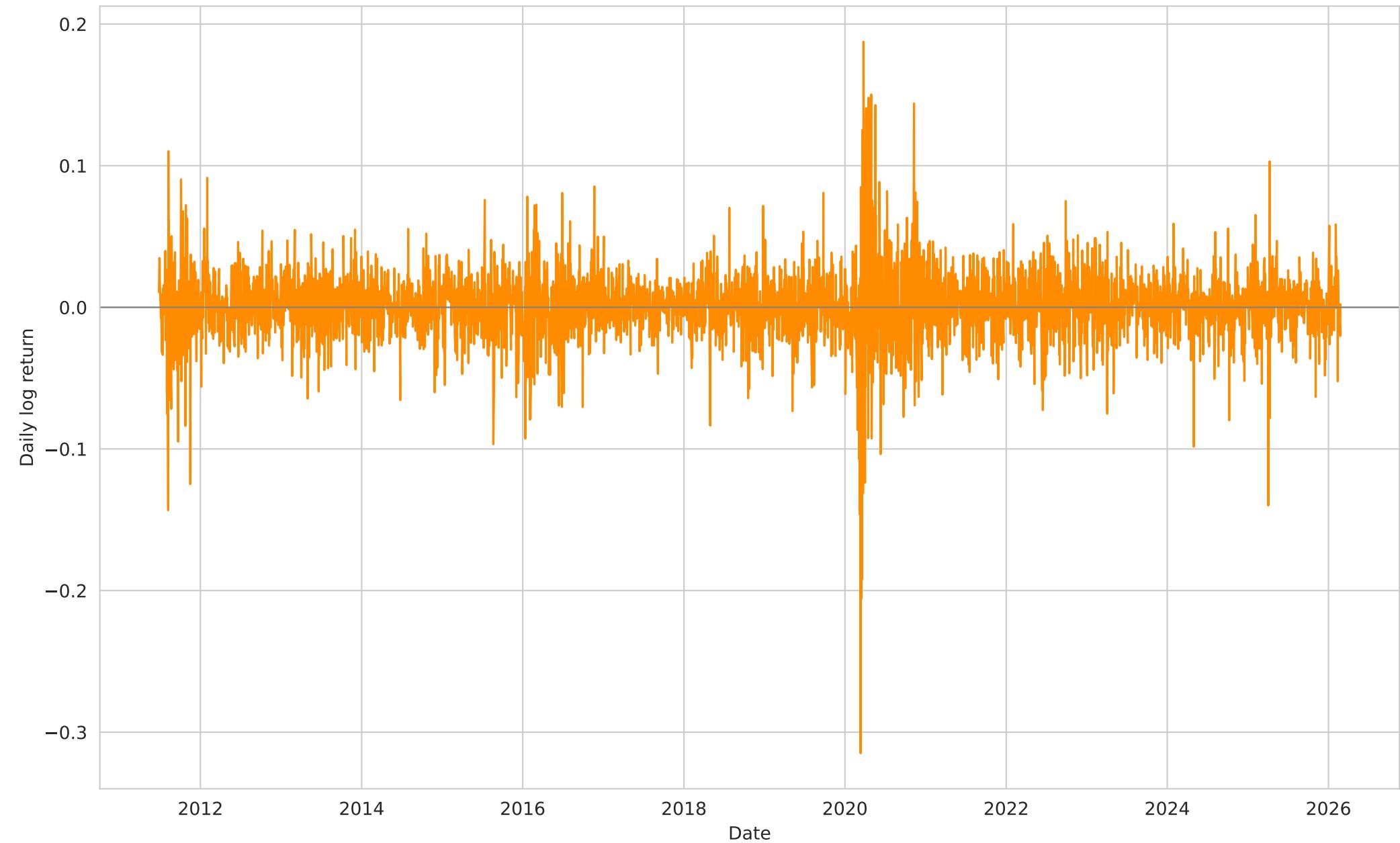
### MPC • ACF • Price



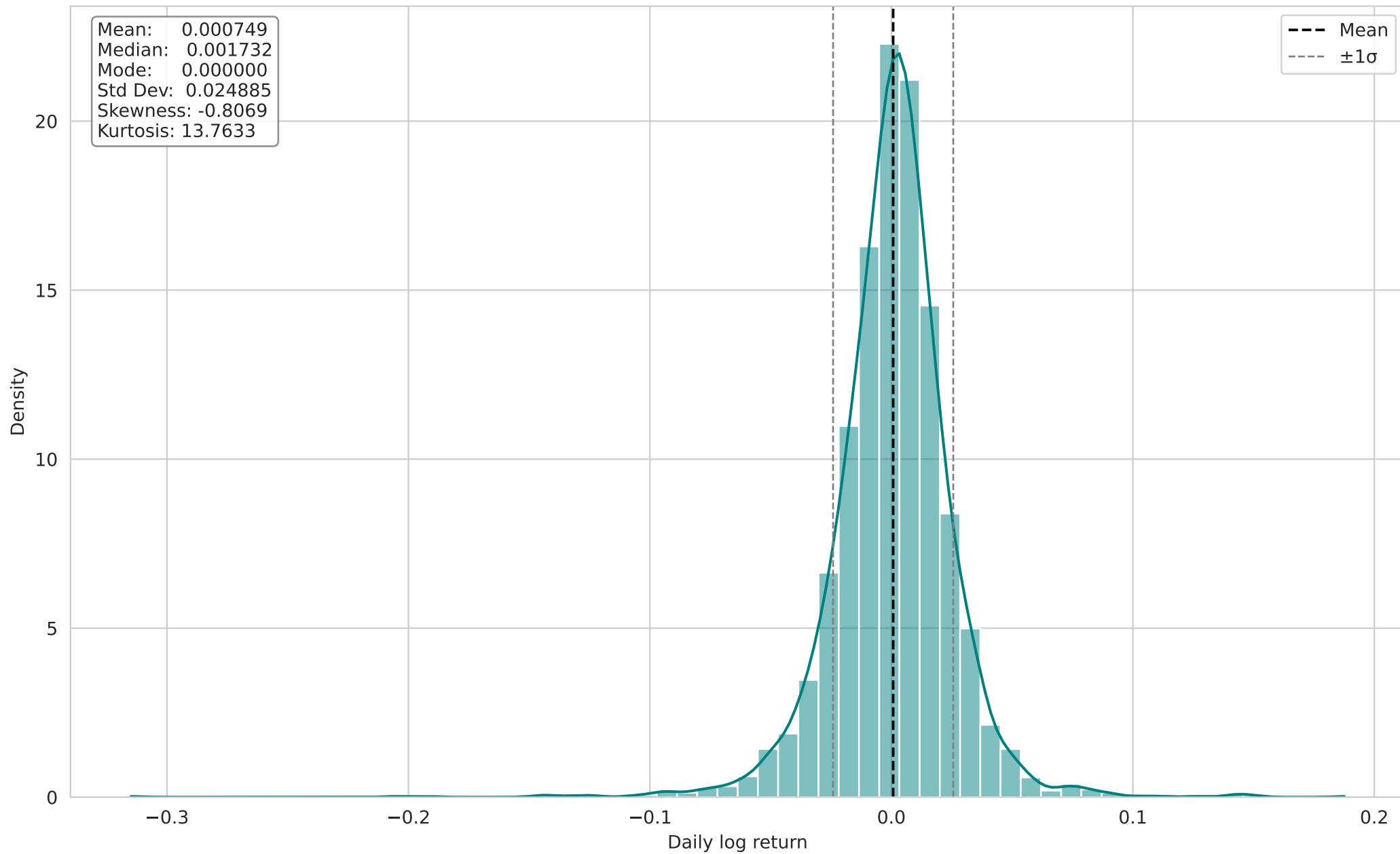
# MPC • Moving Averages (5/10/20)



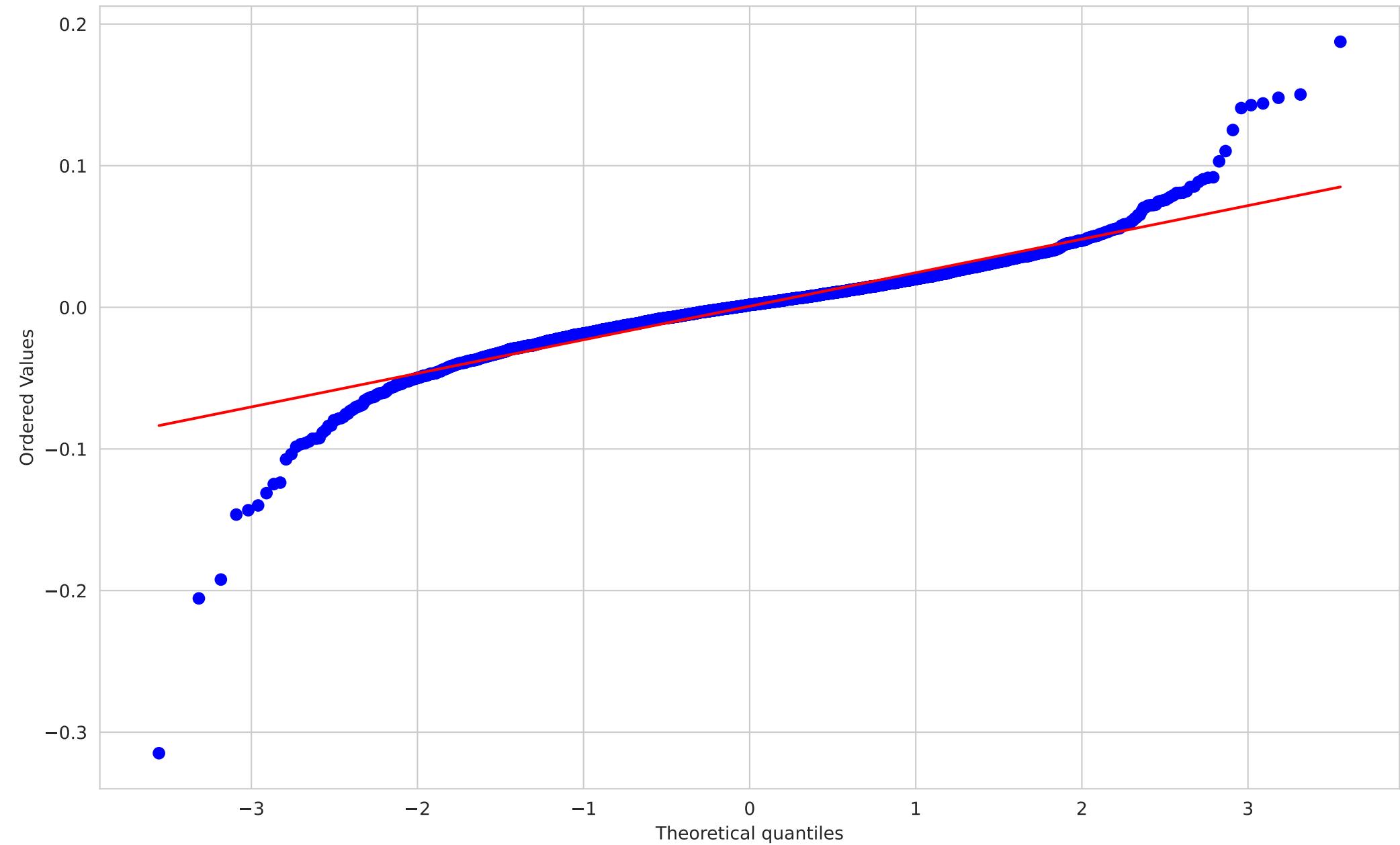
### MPC • Daily Log Returns



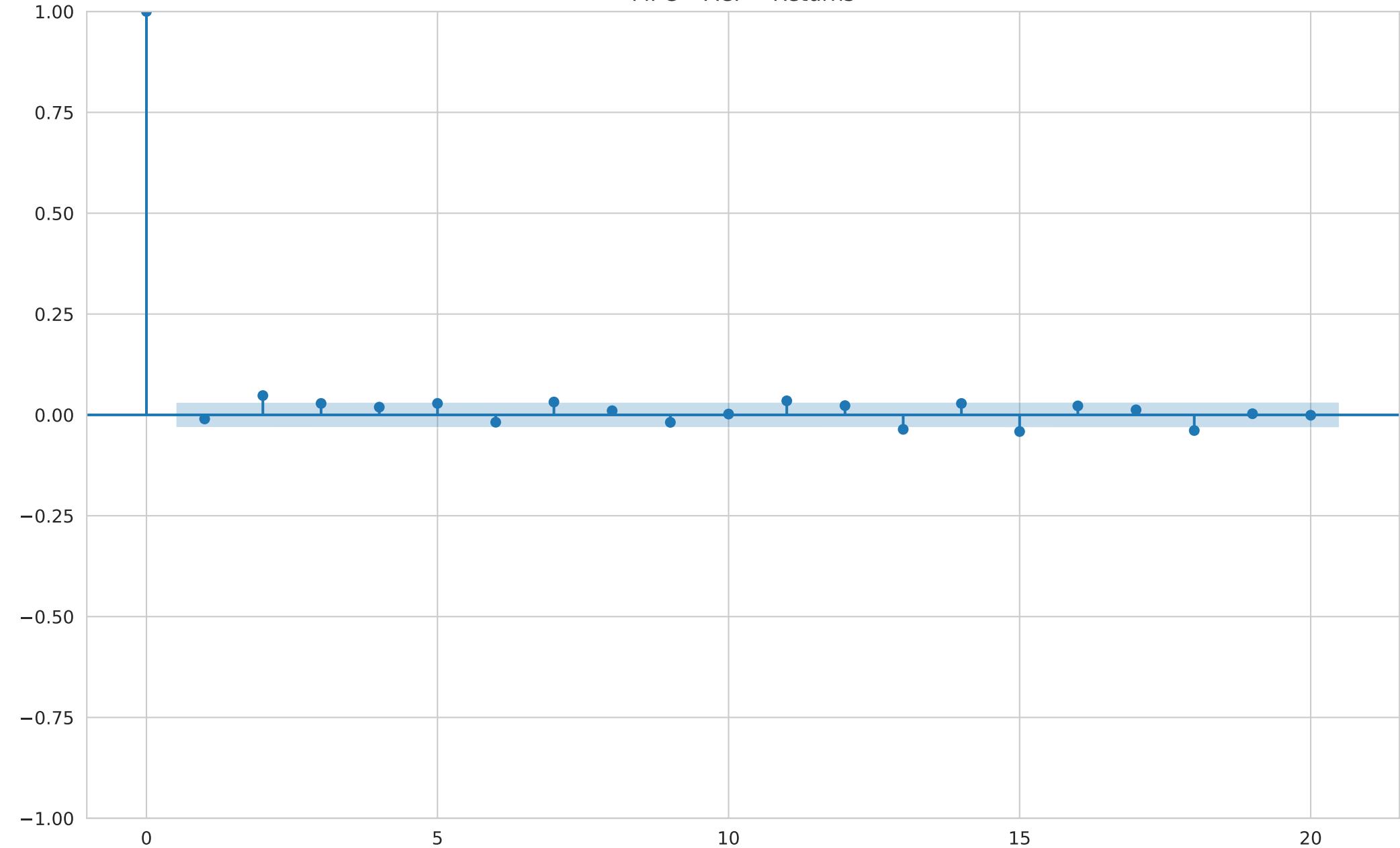
### MPC • Returns • Distribution



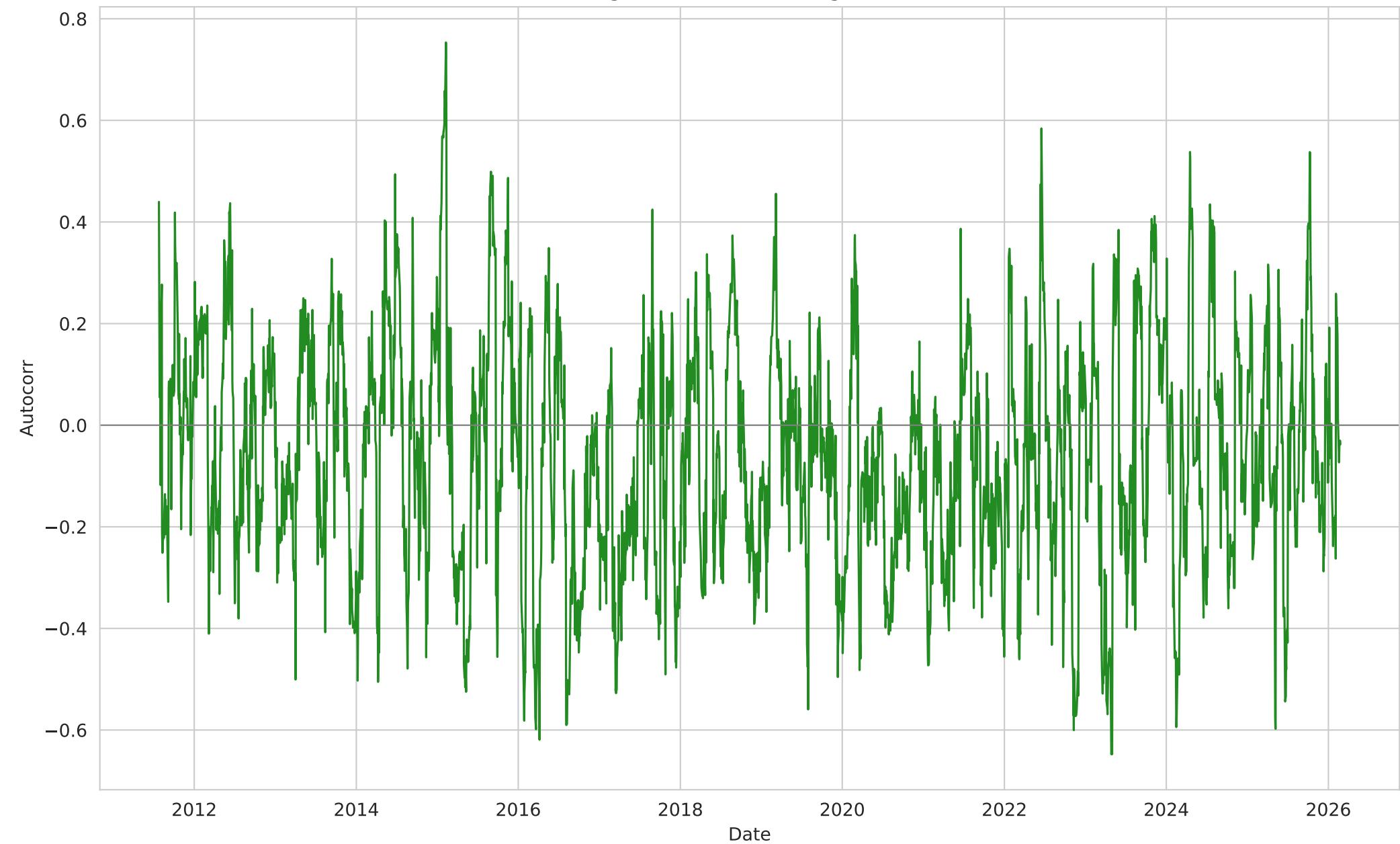
MPC • Returns • Q-Q Plot vs Normal



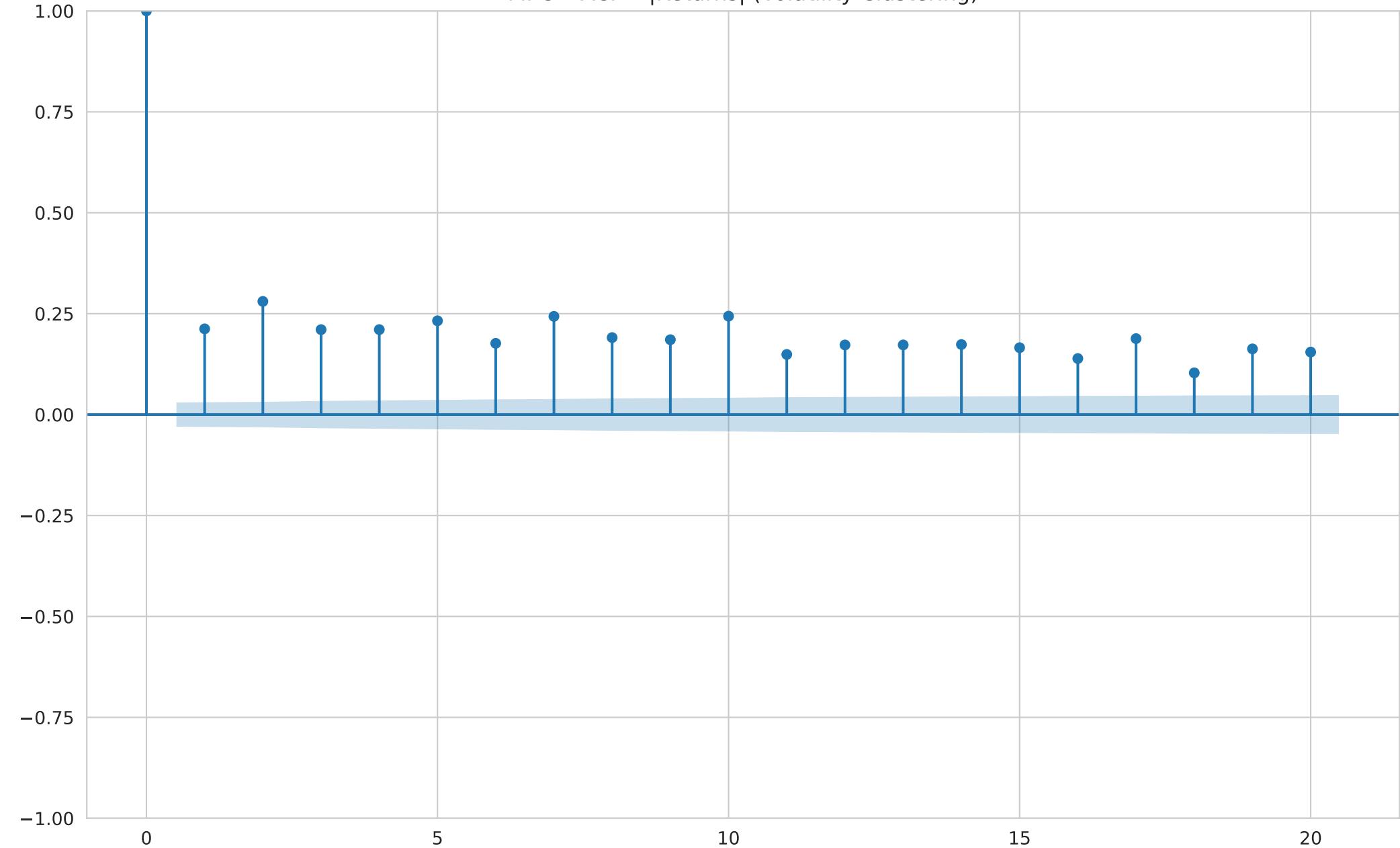
### MPC • ACF • Returns



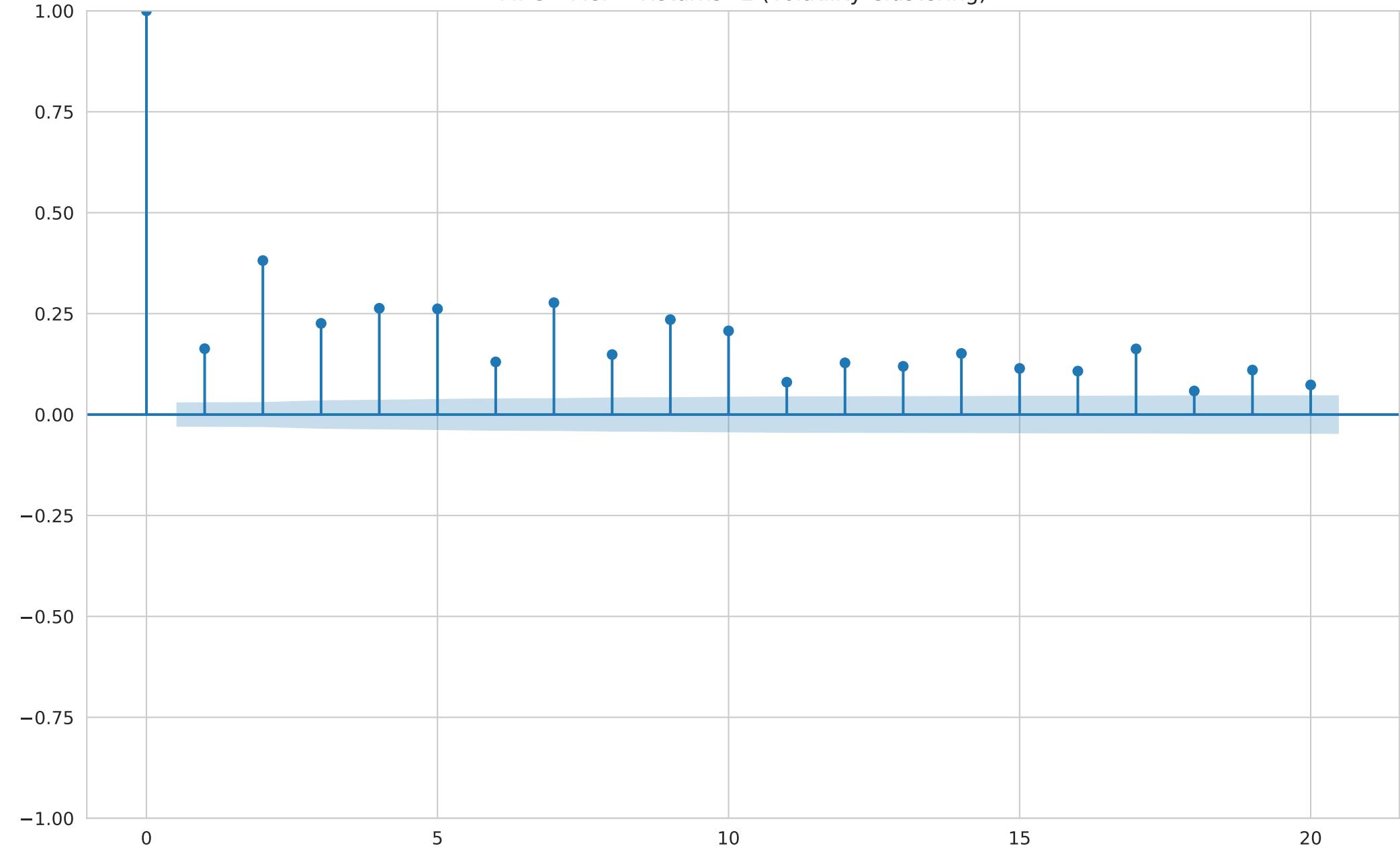
### MPC • Rolling Autocorrelation (lag=1, window=20)



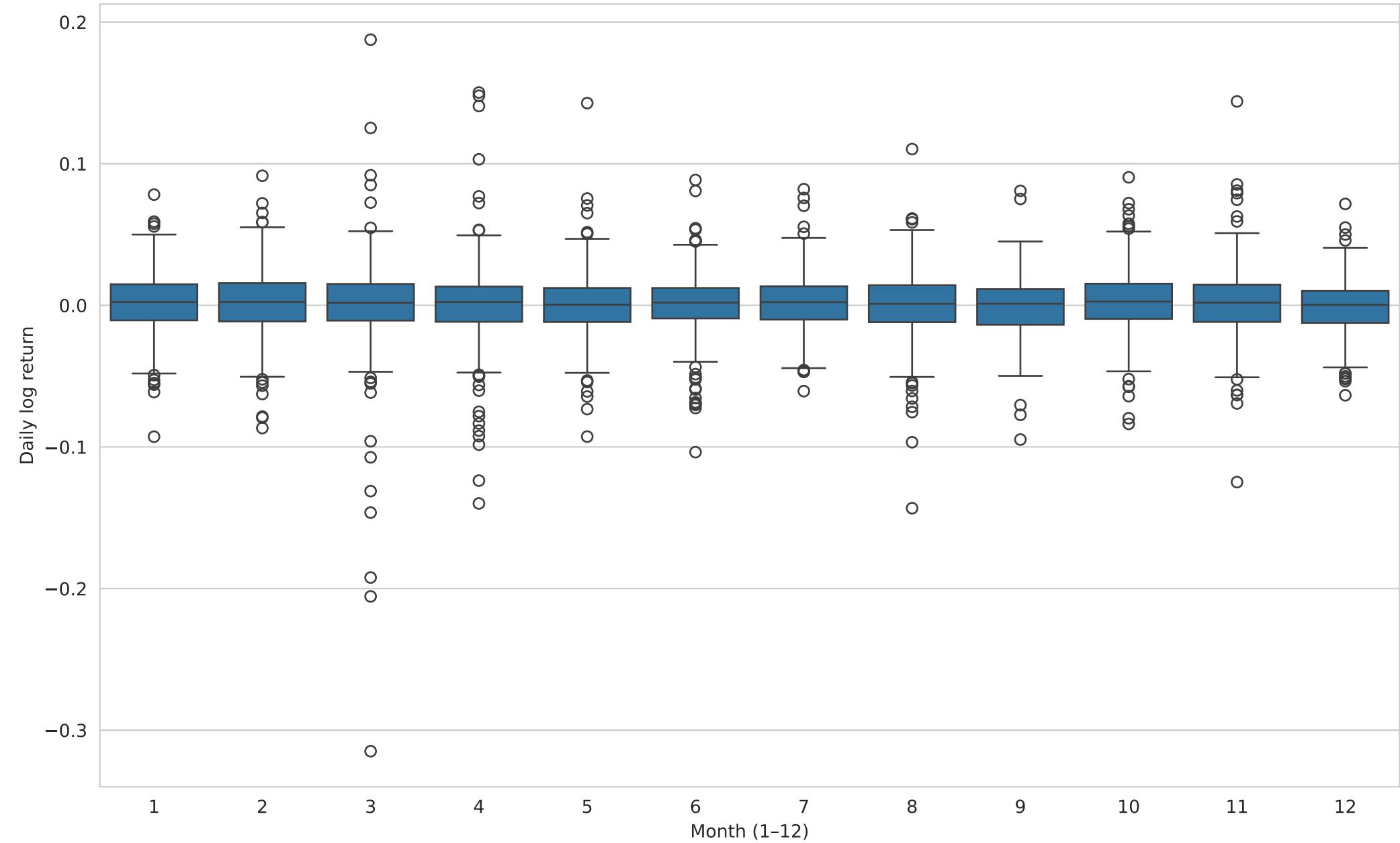
### MPC • ACF • $|Returns|$ (Volatility Clustering)



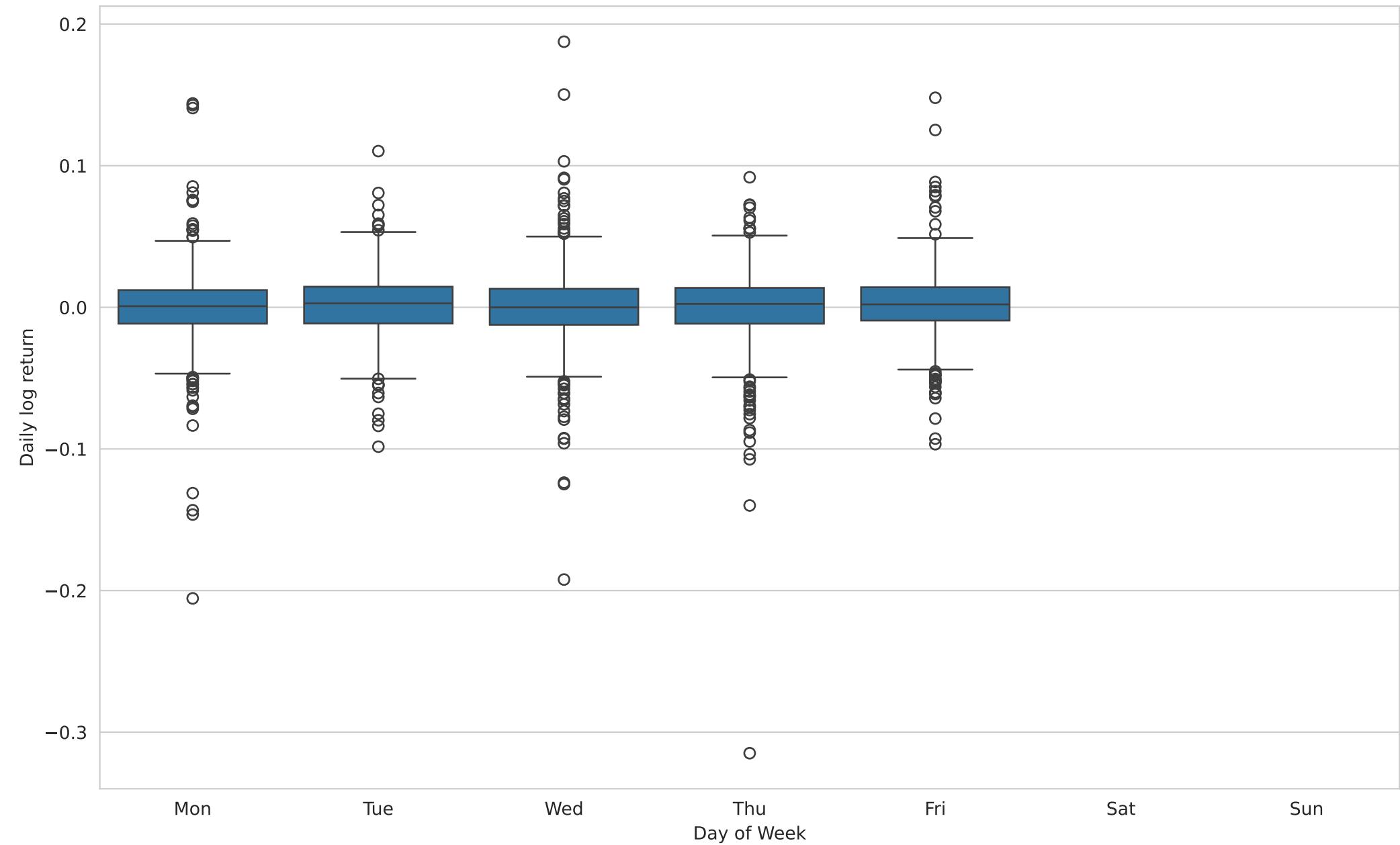
### MPC • ACF • Returns<sup>2</sup> (Volatility Clustering)



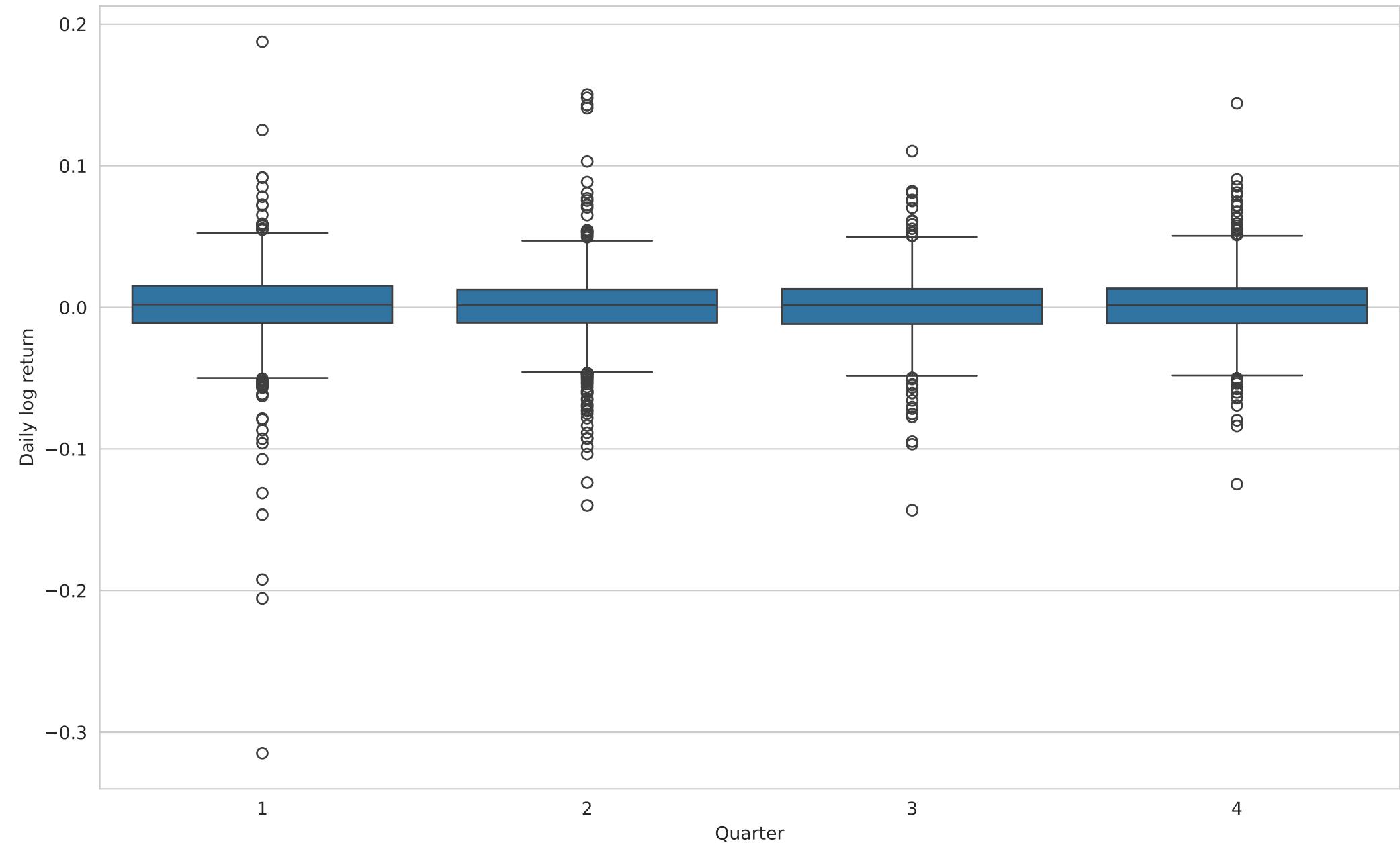
### MPC • Monthly Returns



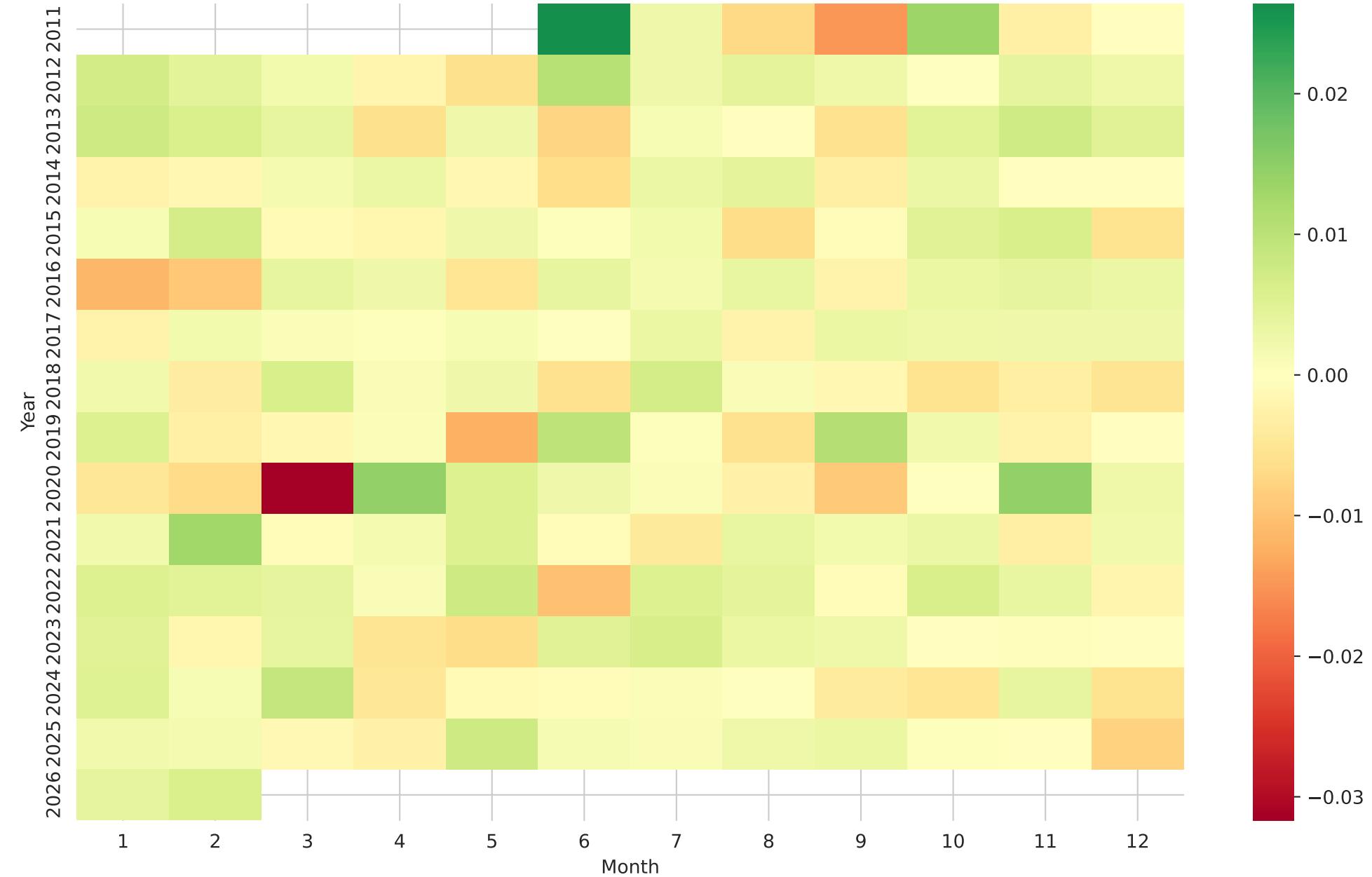
### MPC • Day-of-Week Returns



### MPC • Quarterly Returns

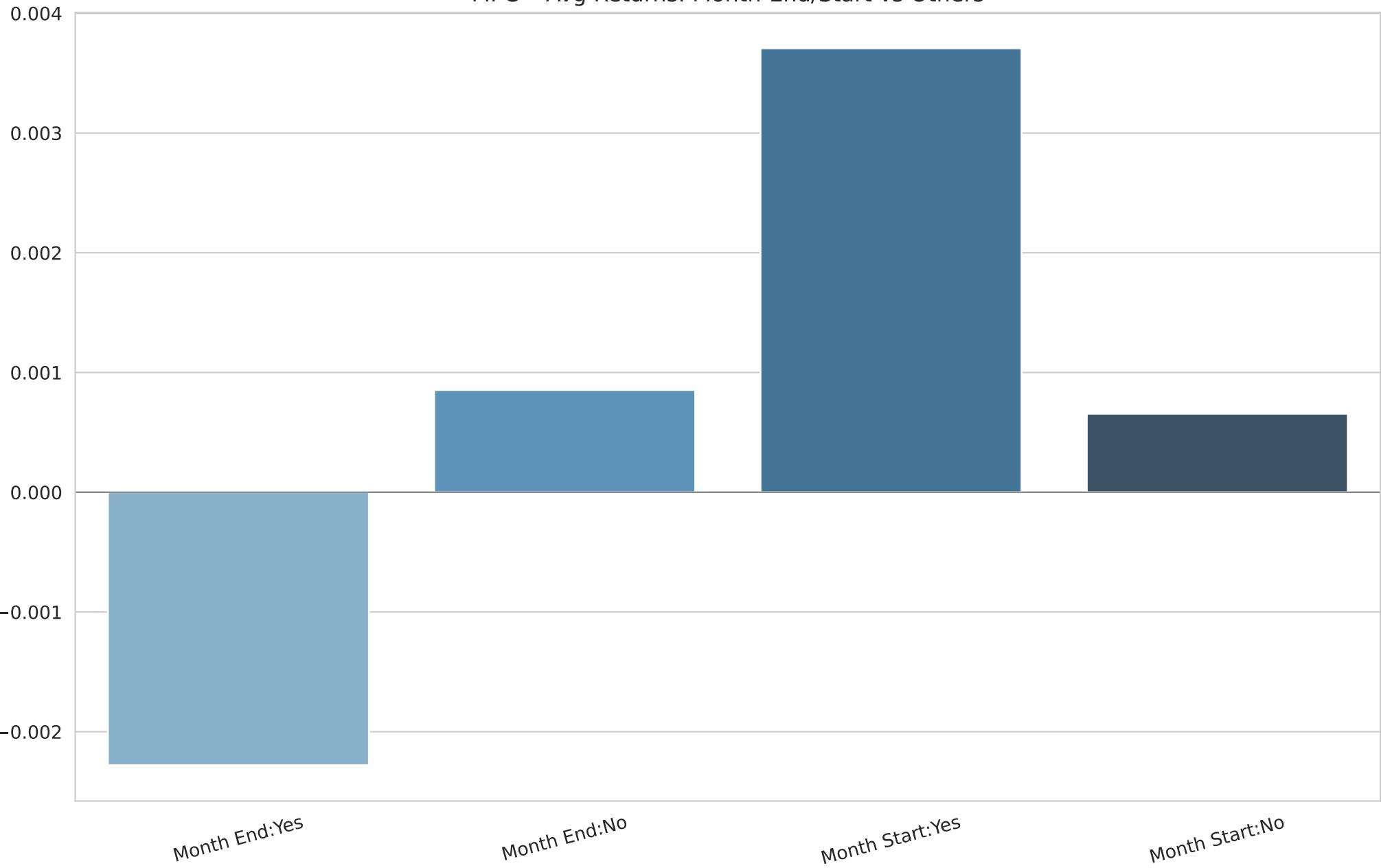


MPC • Month x Year Heatmap (Avg Daily Returns)

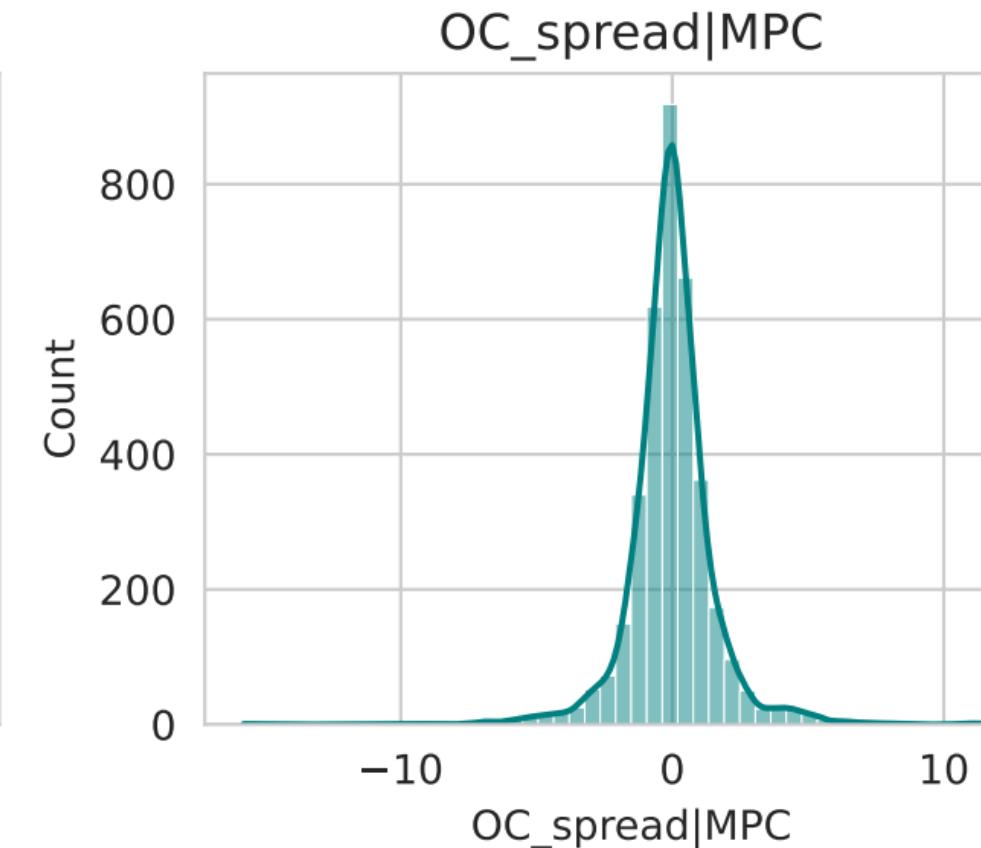
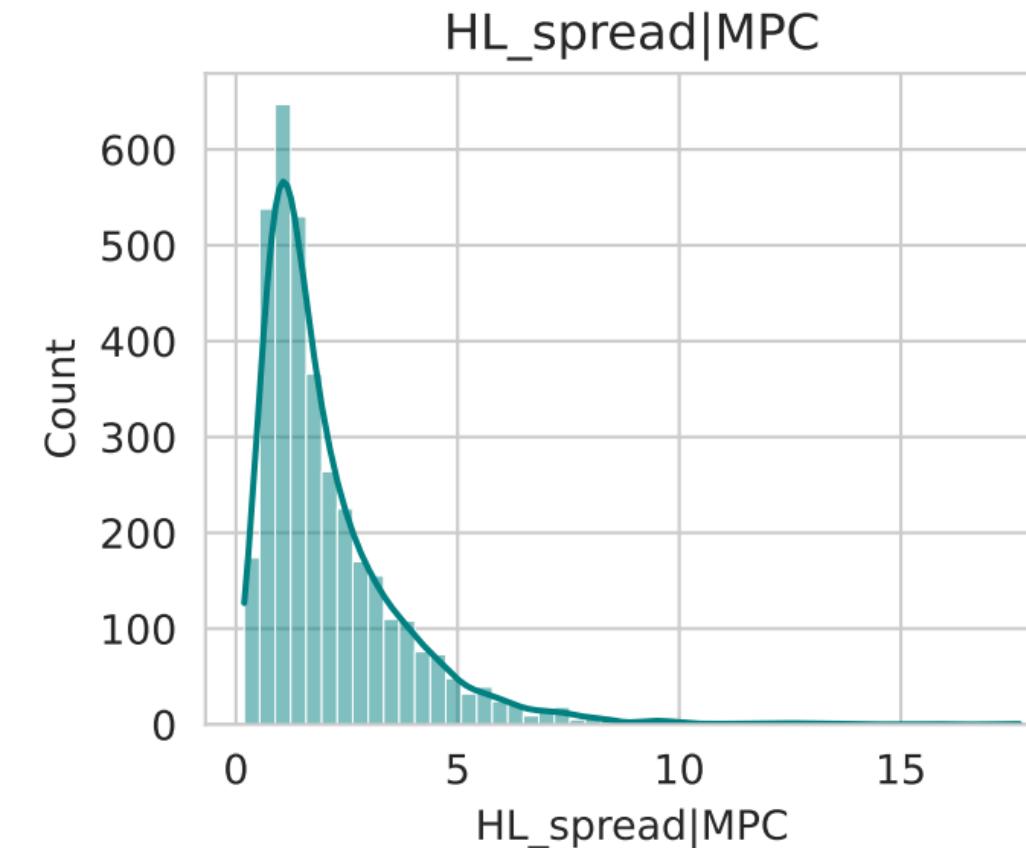


### MPC • Avg Returns: Month-End/Start vs Others

Average Daily Log Return

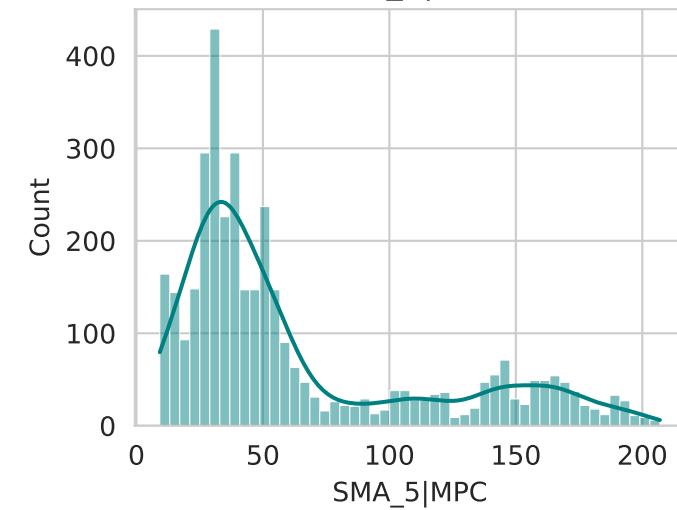


## MPC • Spreads

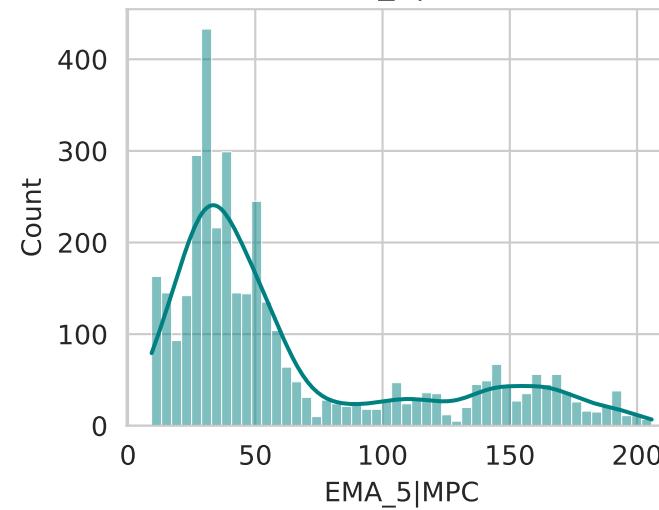


# MPC • Moving Averages / EMAs

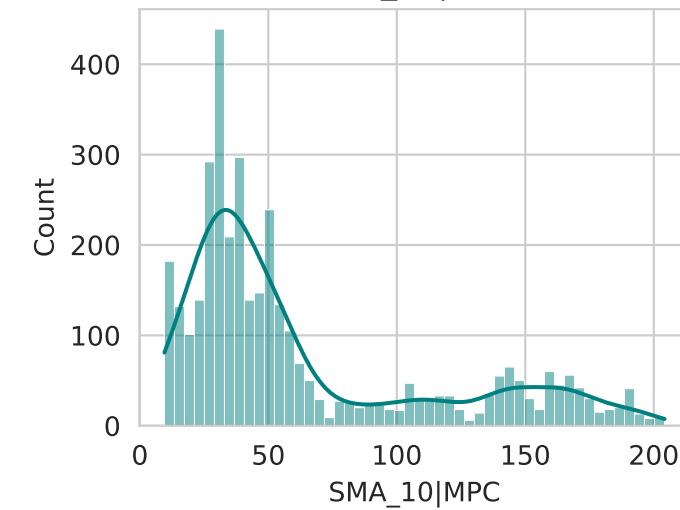
SMA\_5|MPC



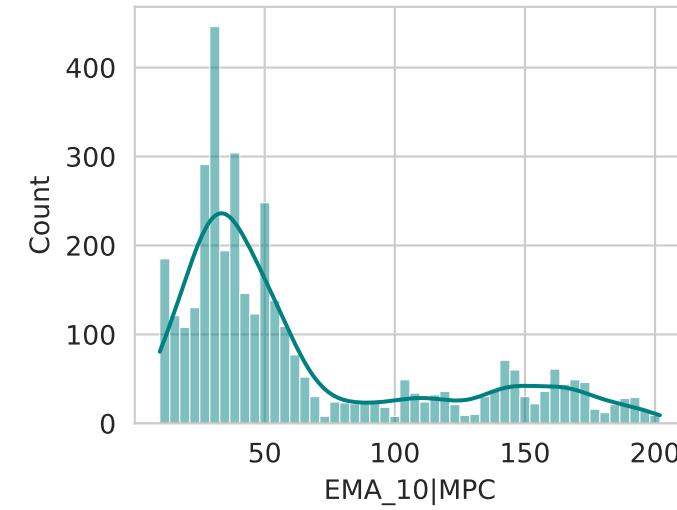
EMA\_5|MPC



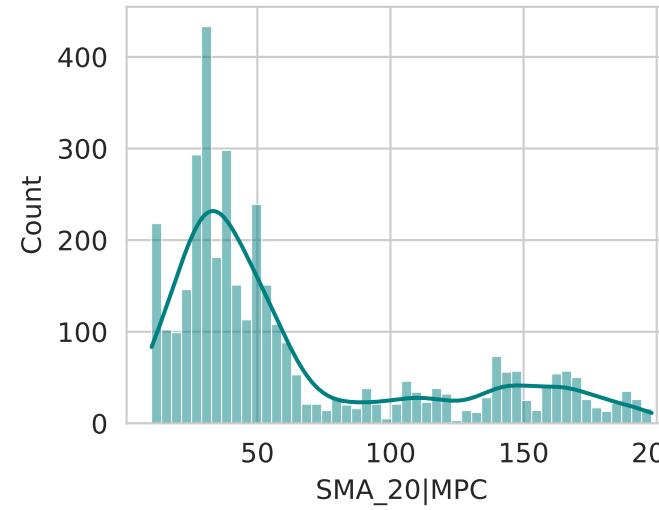
SMA\_10|MPC



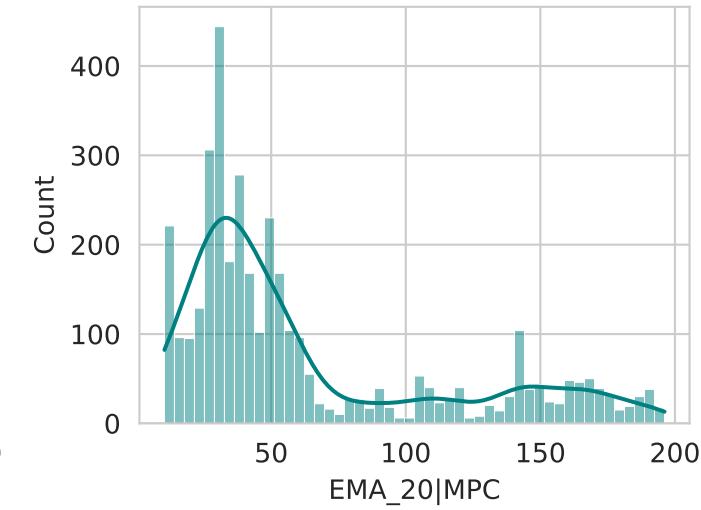
EMA\_10|MPC



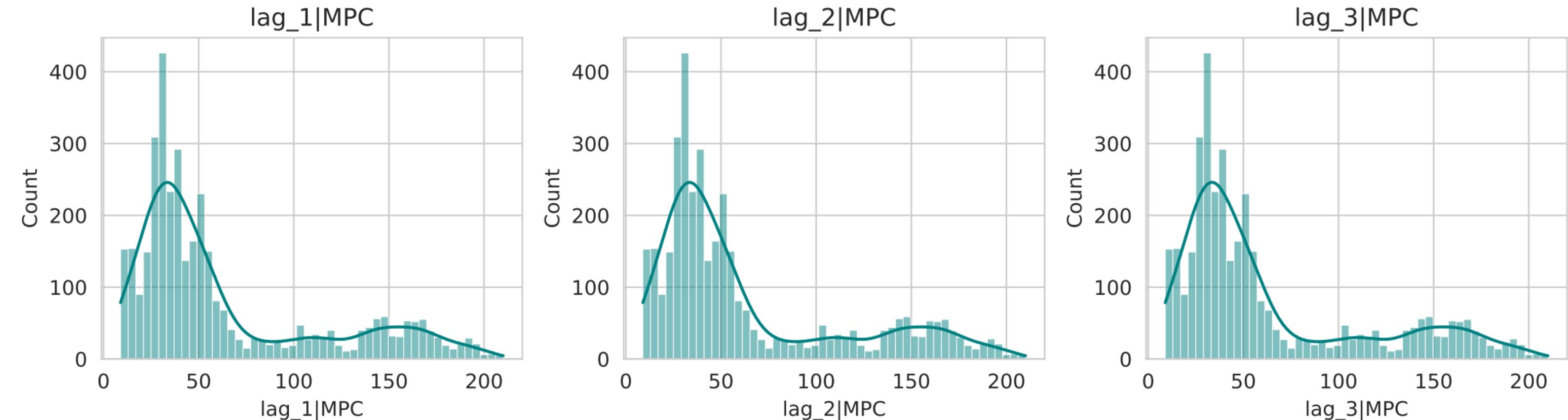
SMA\_20|MPC



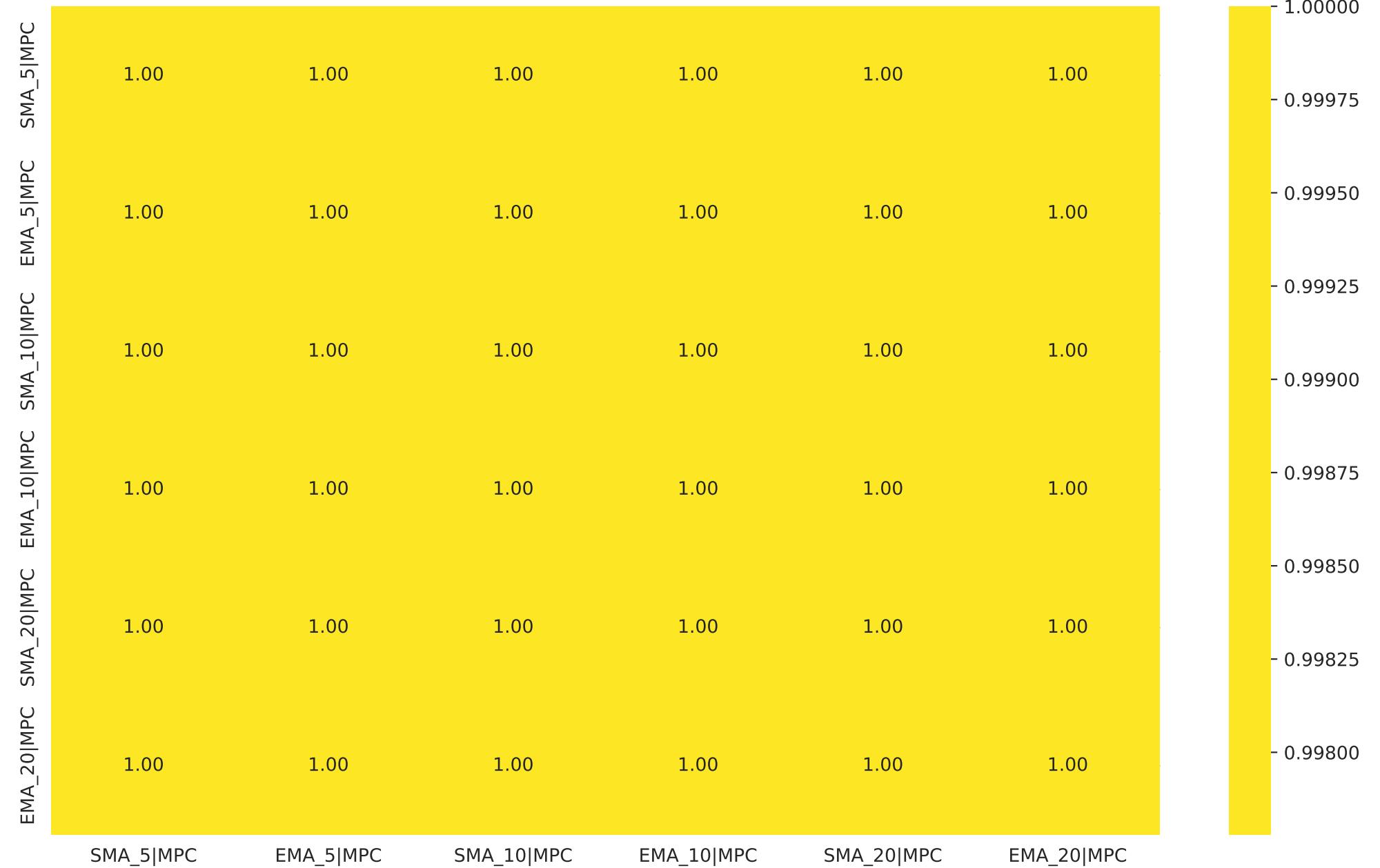
EMA\_20|MPC



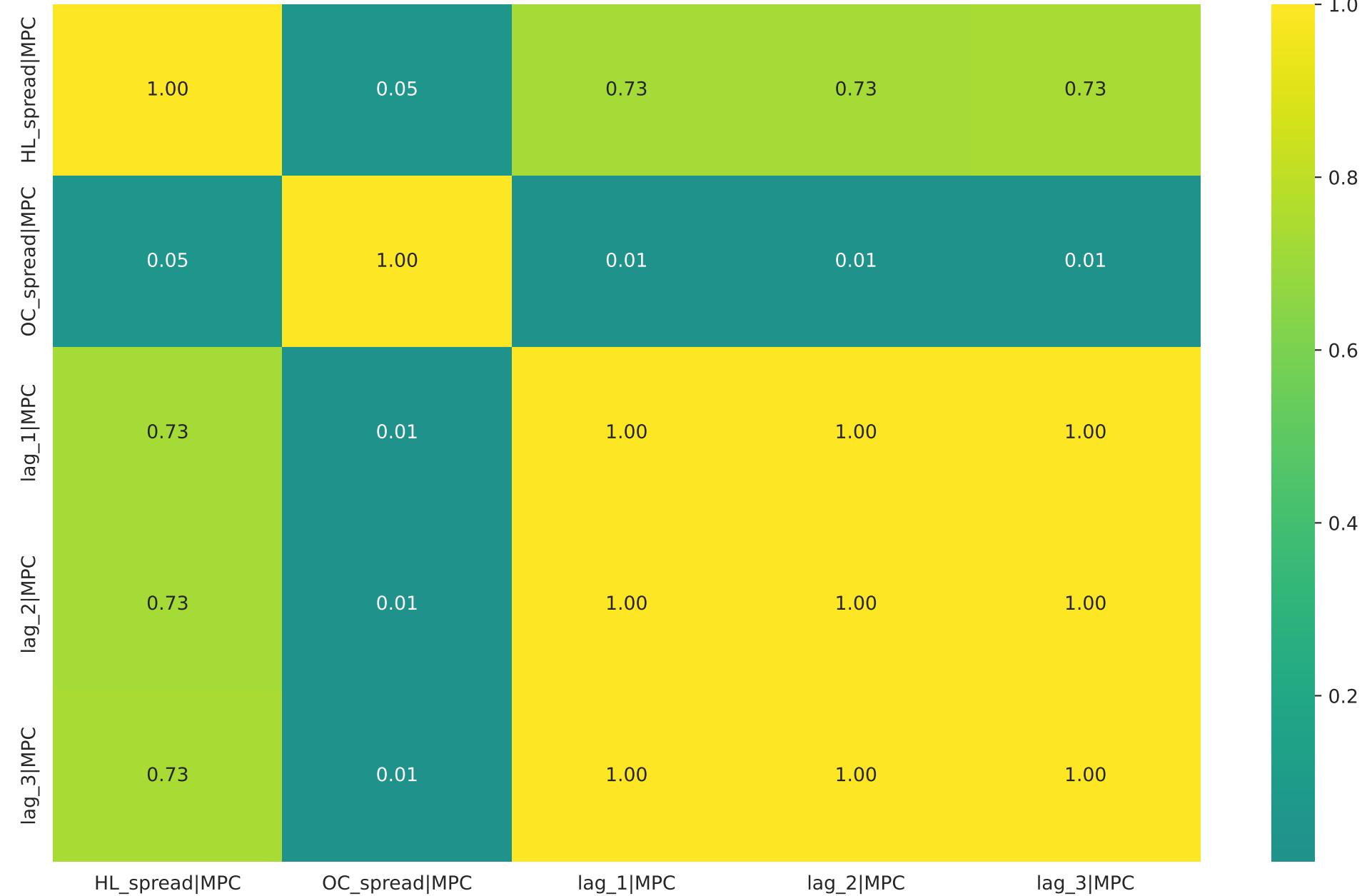
# MPC • Lagged Prices



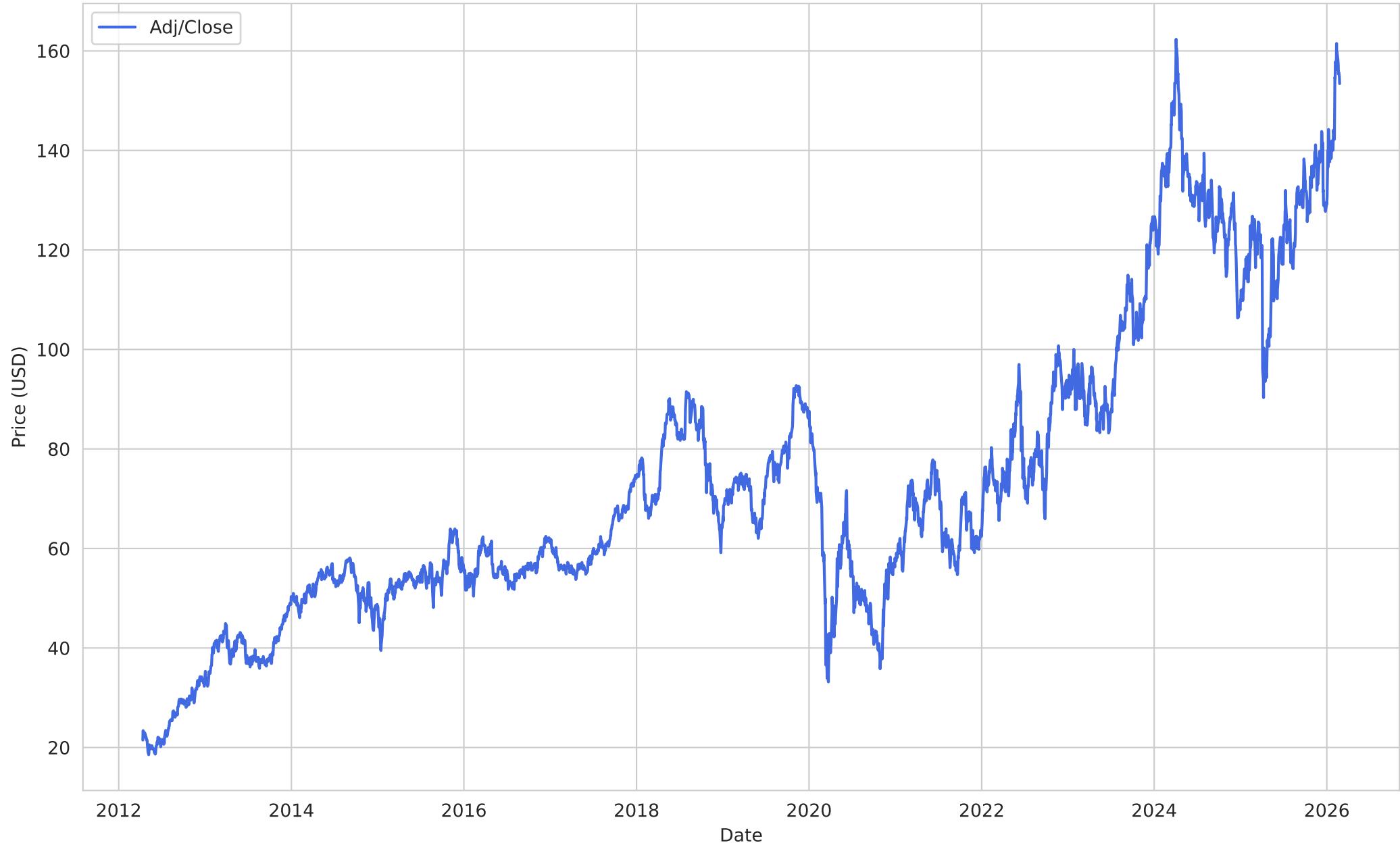
# MPC • Correlation • Moving Averages



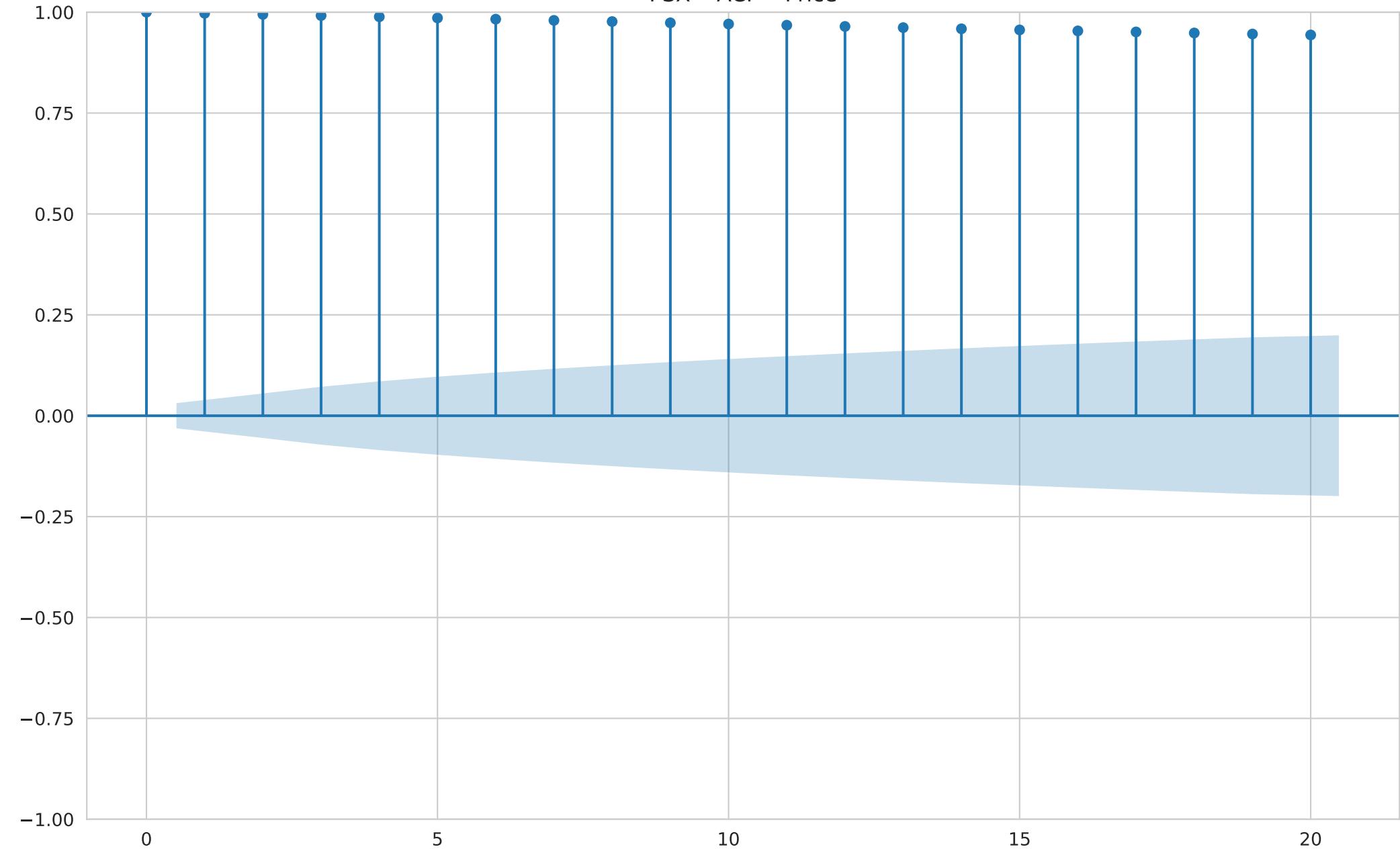
## MPC • Correlation • Spreads + Lags



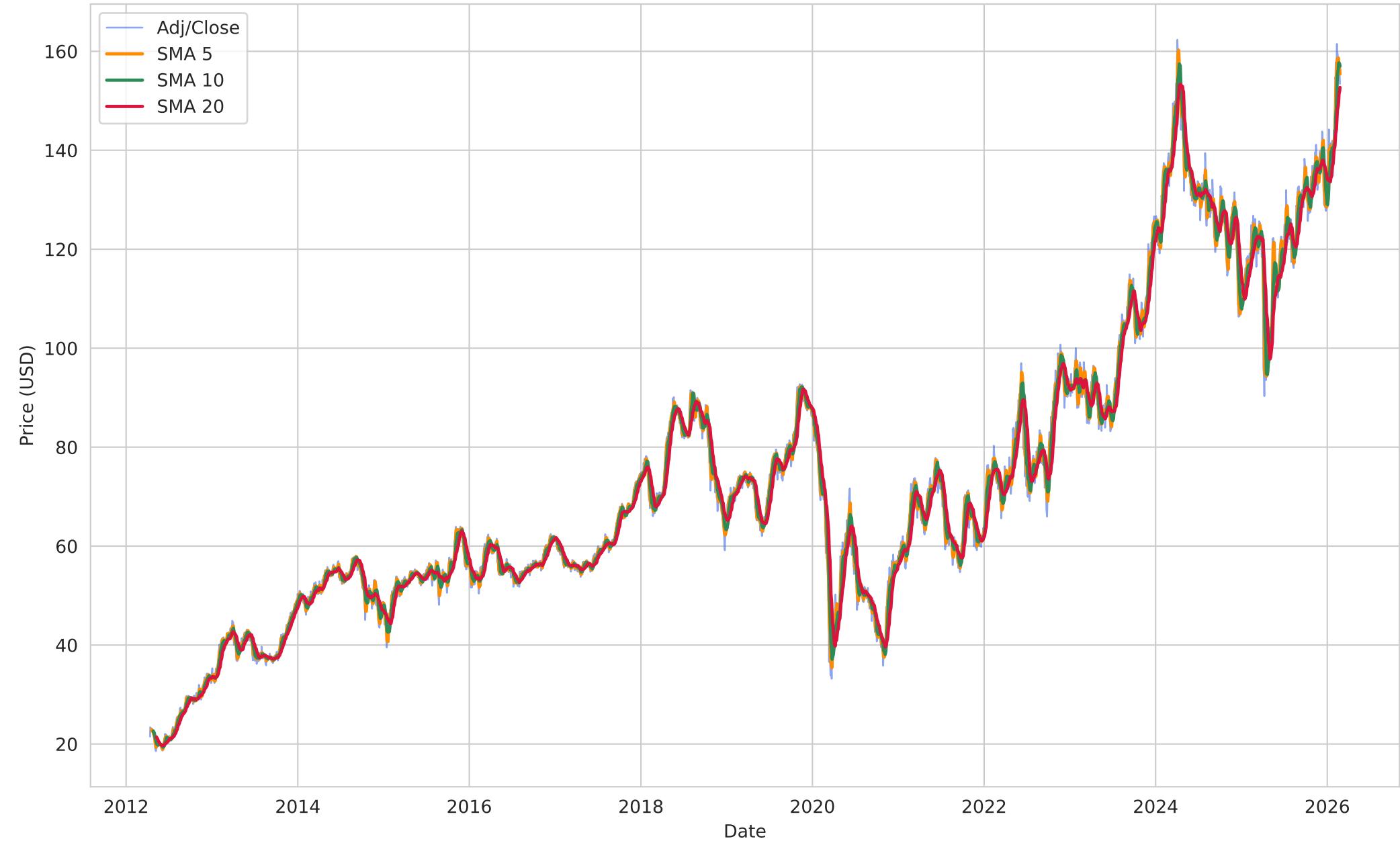
# PSX • Price



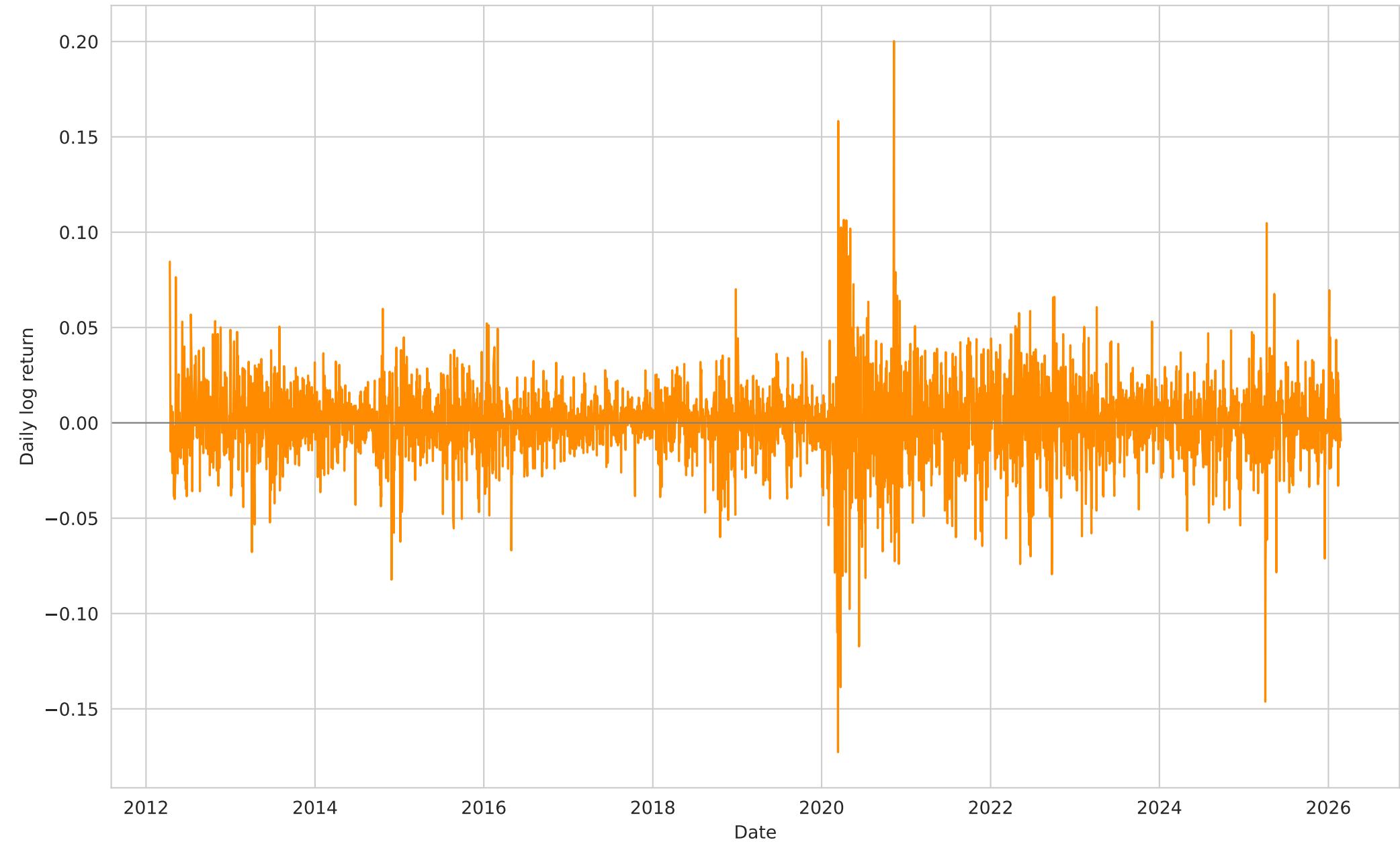
PSX • ACF • Price



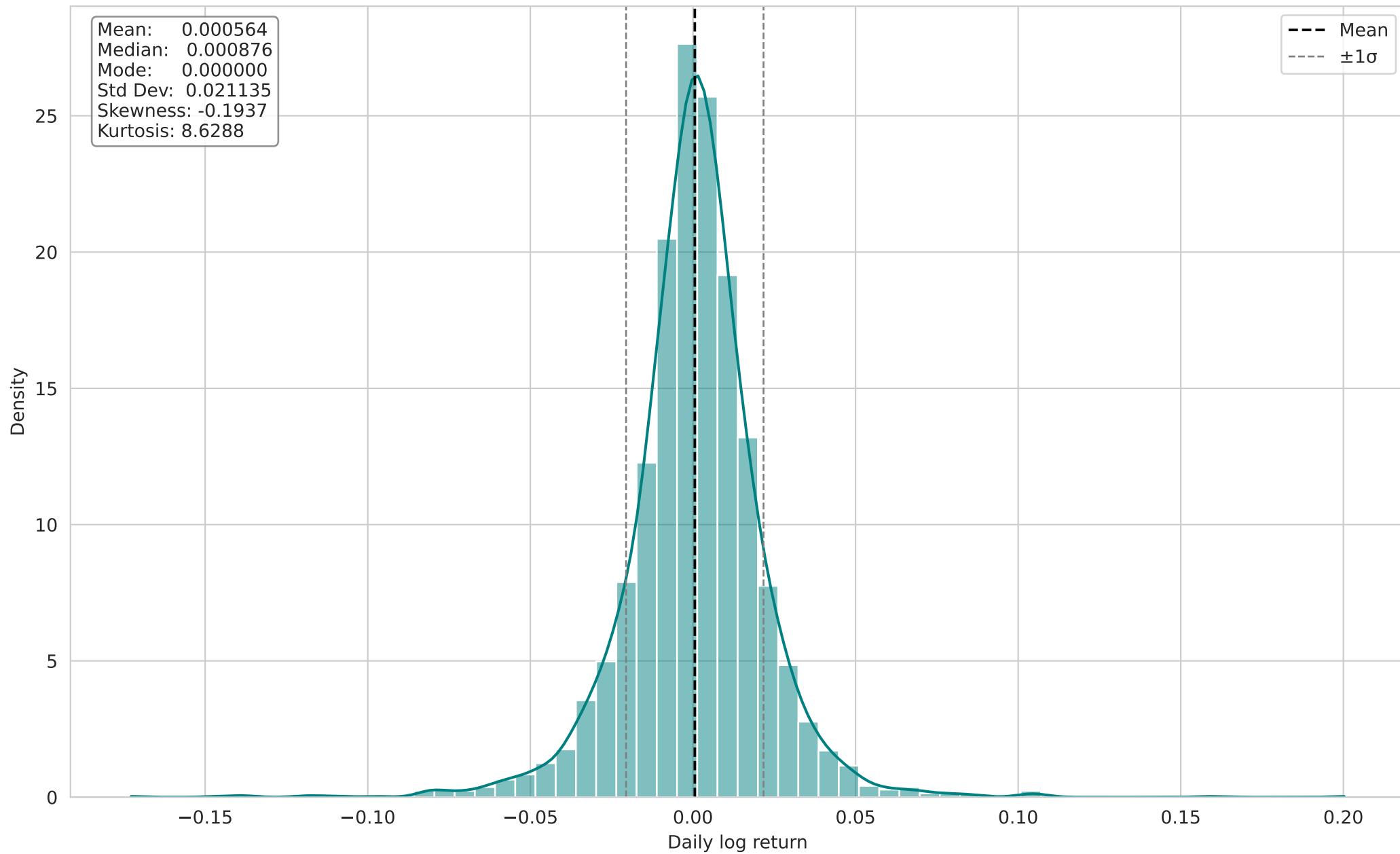
# PSX • Moving Averages (5/10/20)



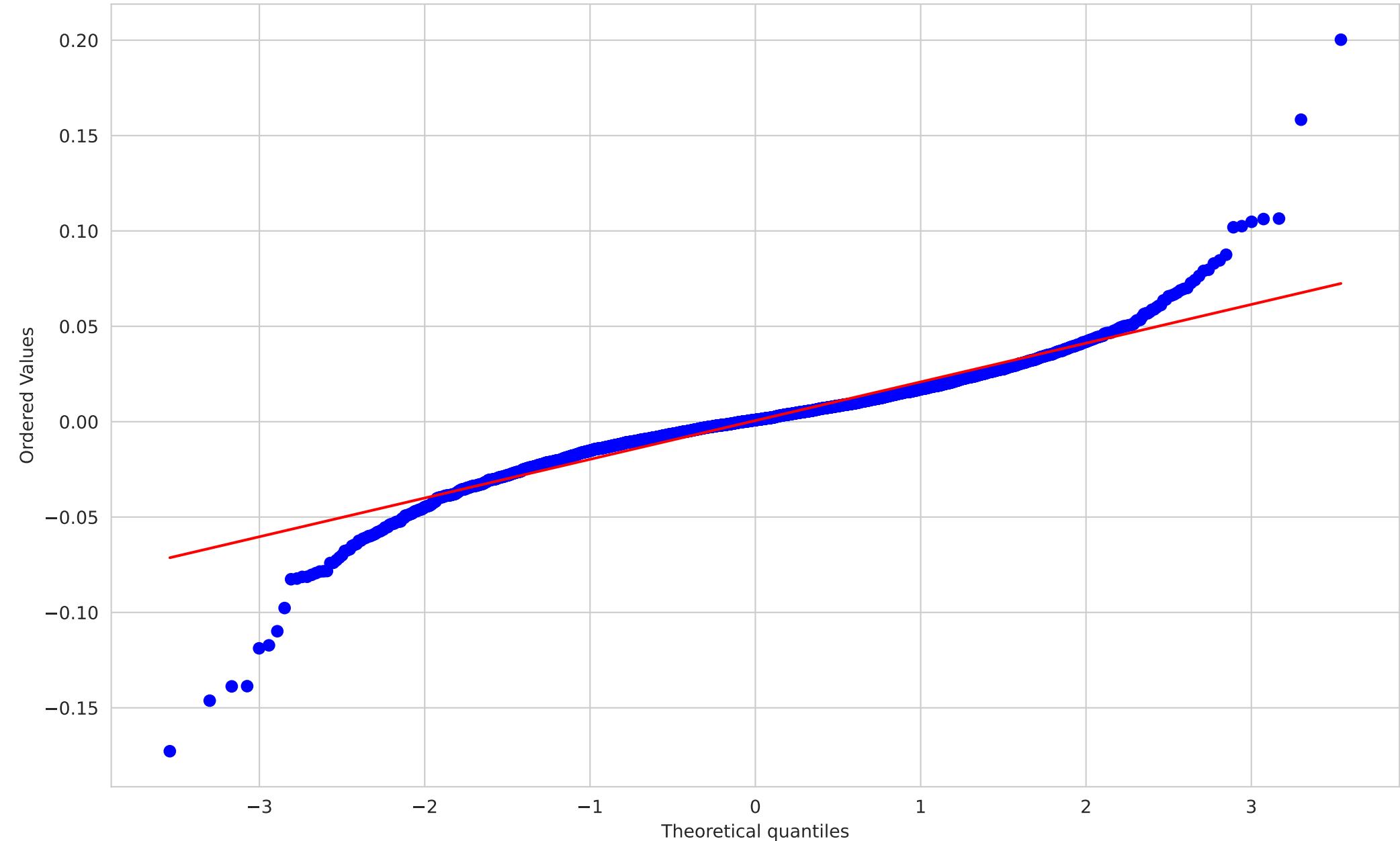
# PSX • Daily Log Returns



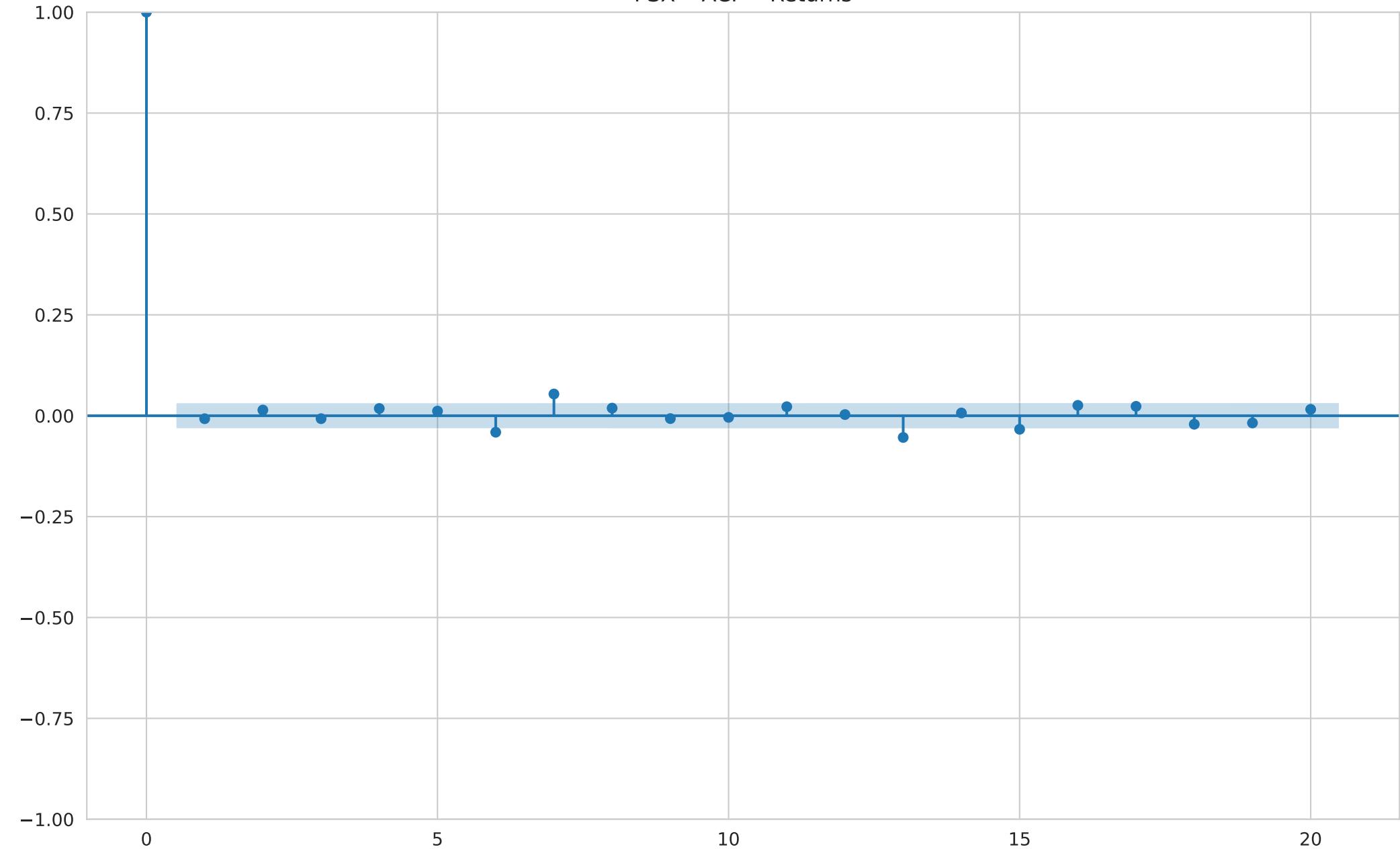
# PSX • Returns • Distribution



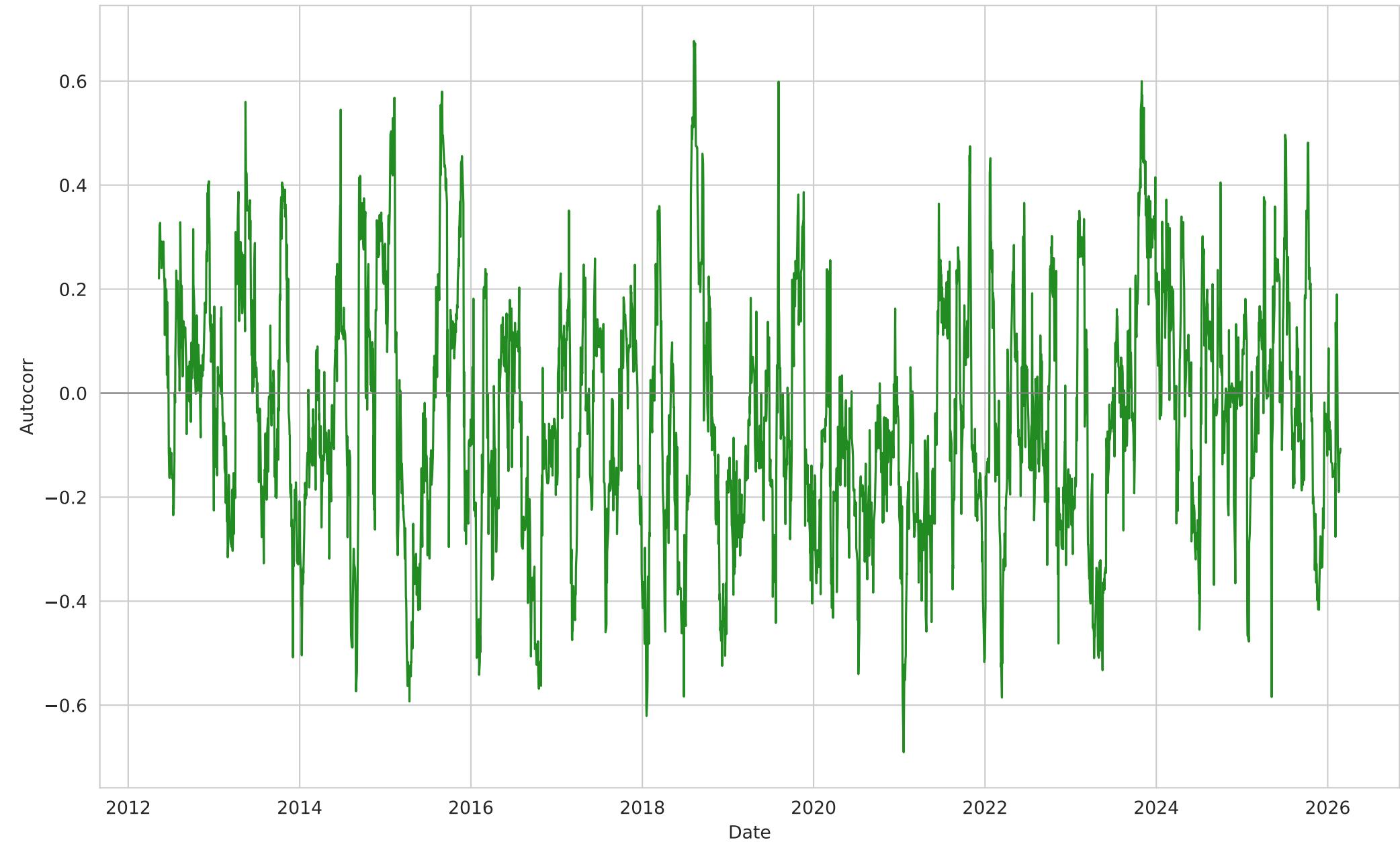
### PSX • Returns • Q-Q Plot vs Normal



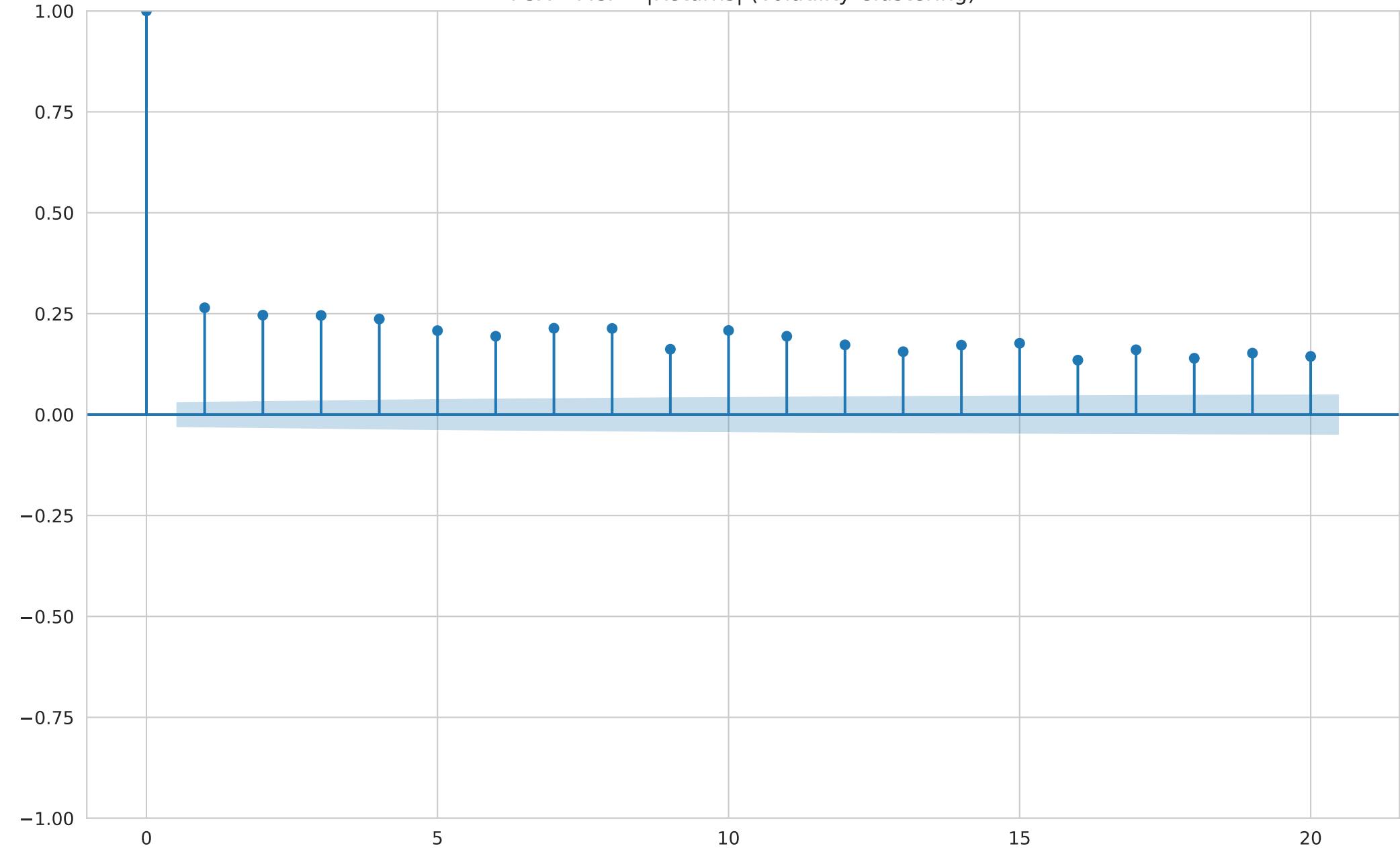
PSX • ACF • Returns



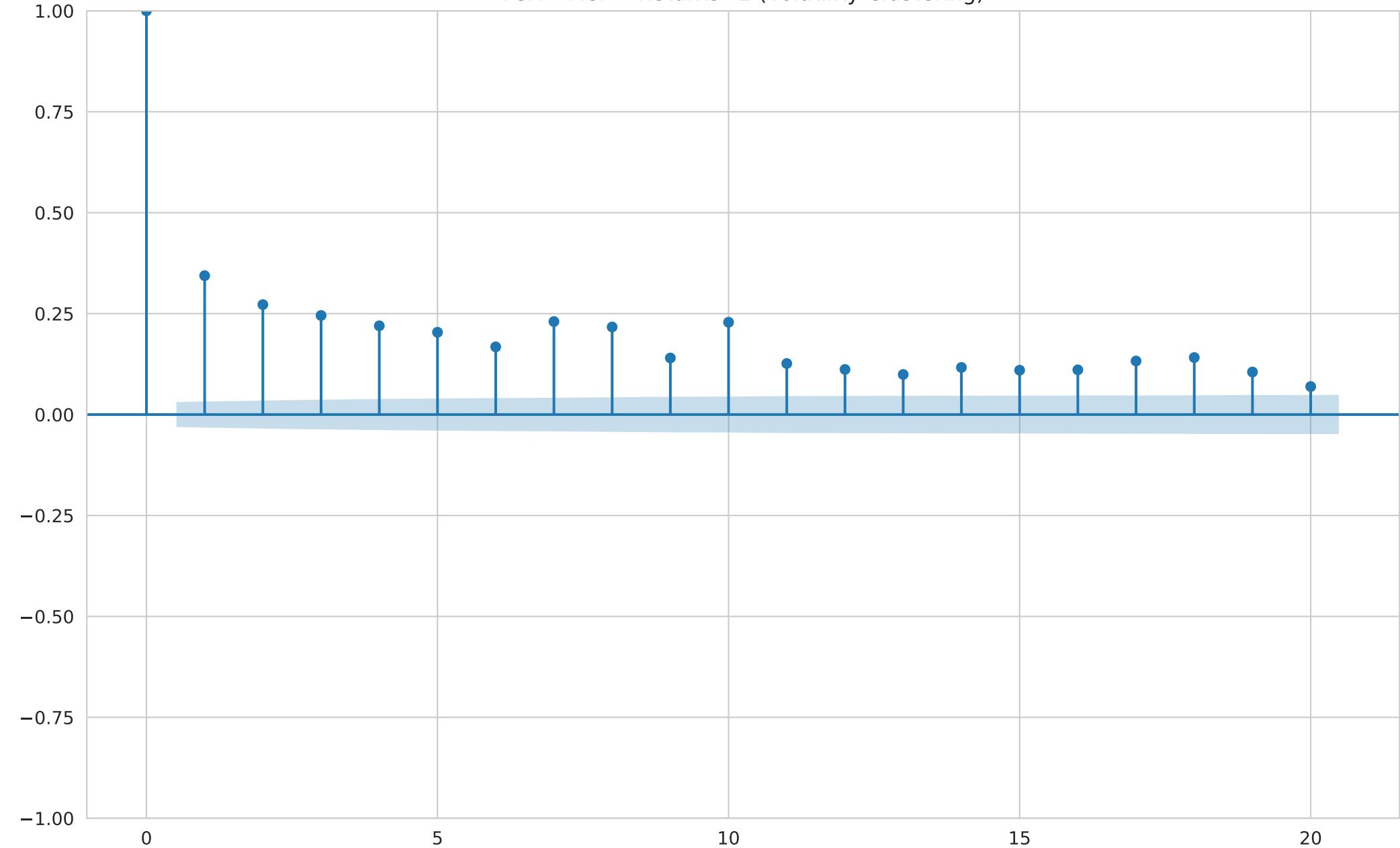
### PSX • Rolling Autocorrelation (lag=1, window=20)



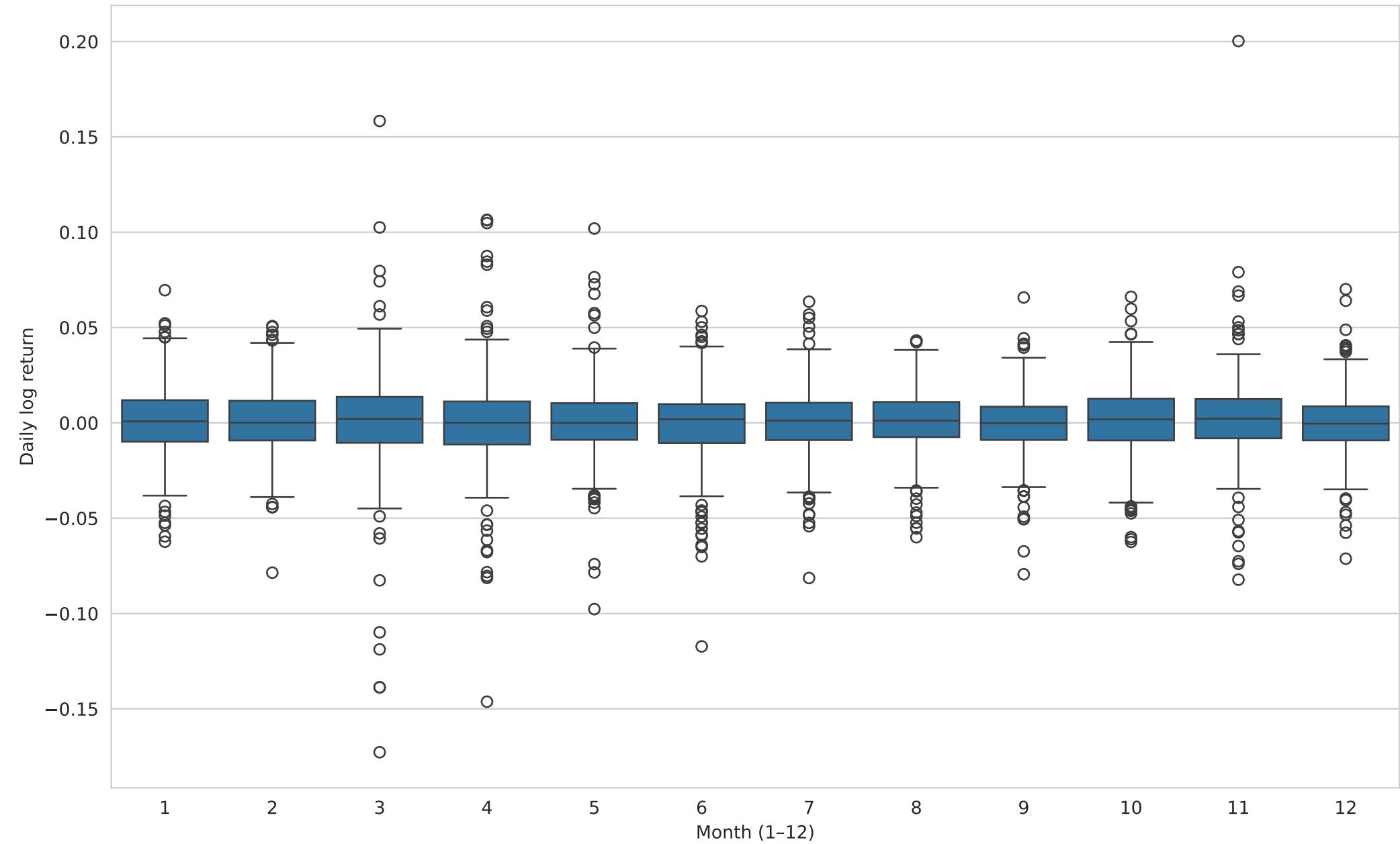
### PSX • ACF • $|Returns|$ (Volatility Clustering)



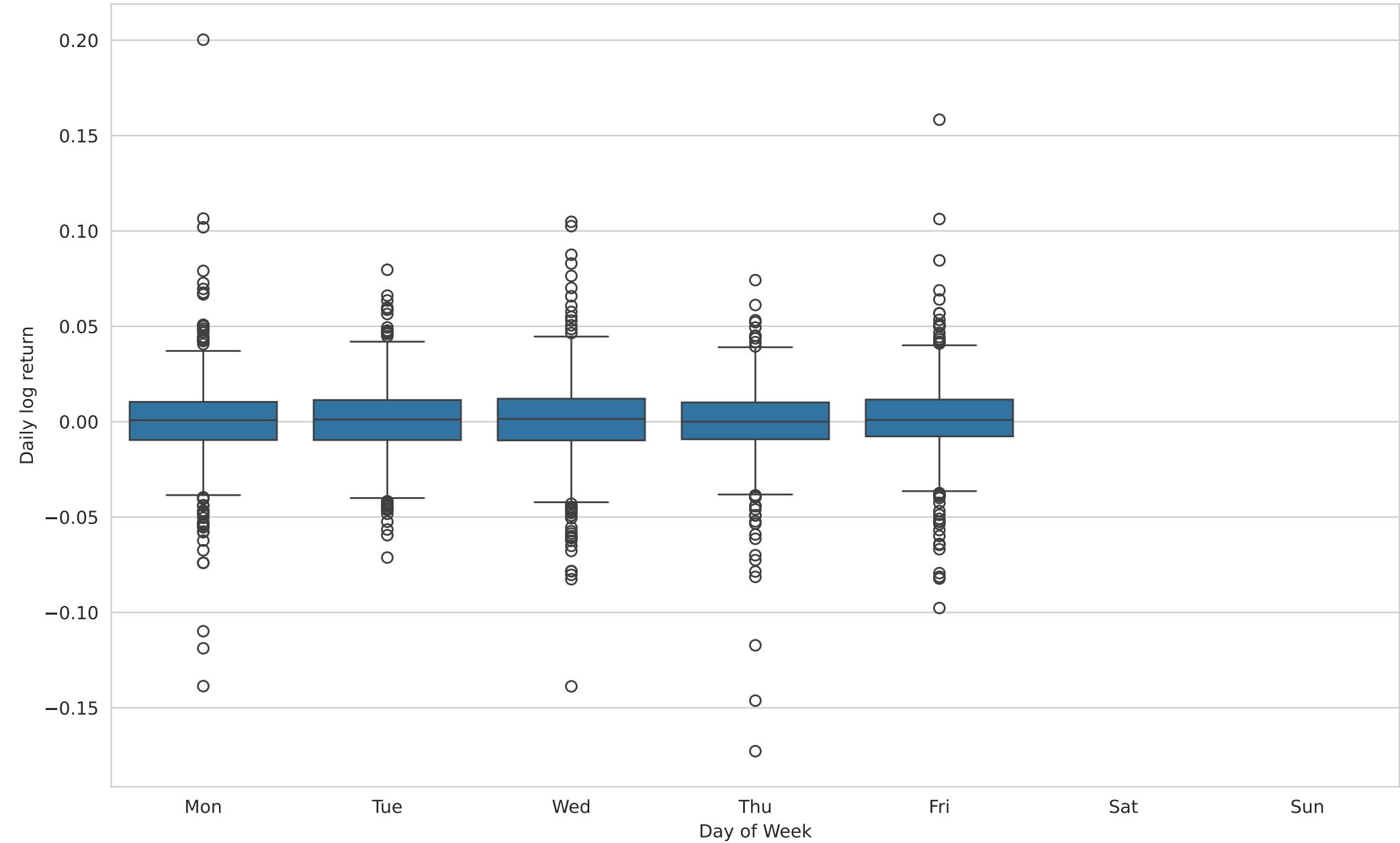
PSX • ACF • Returns<sup>^2</sup> (Volatility Clustering)



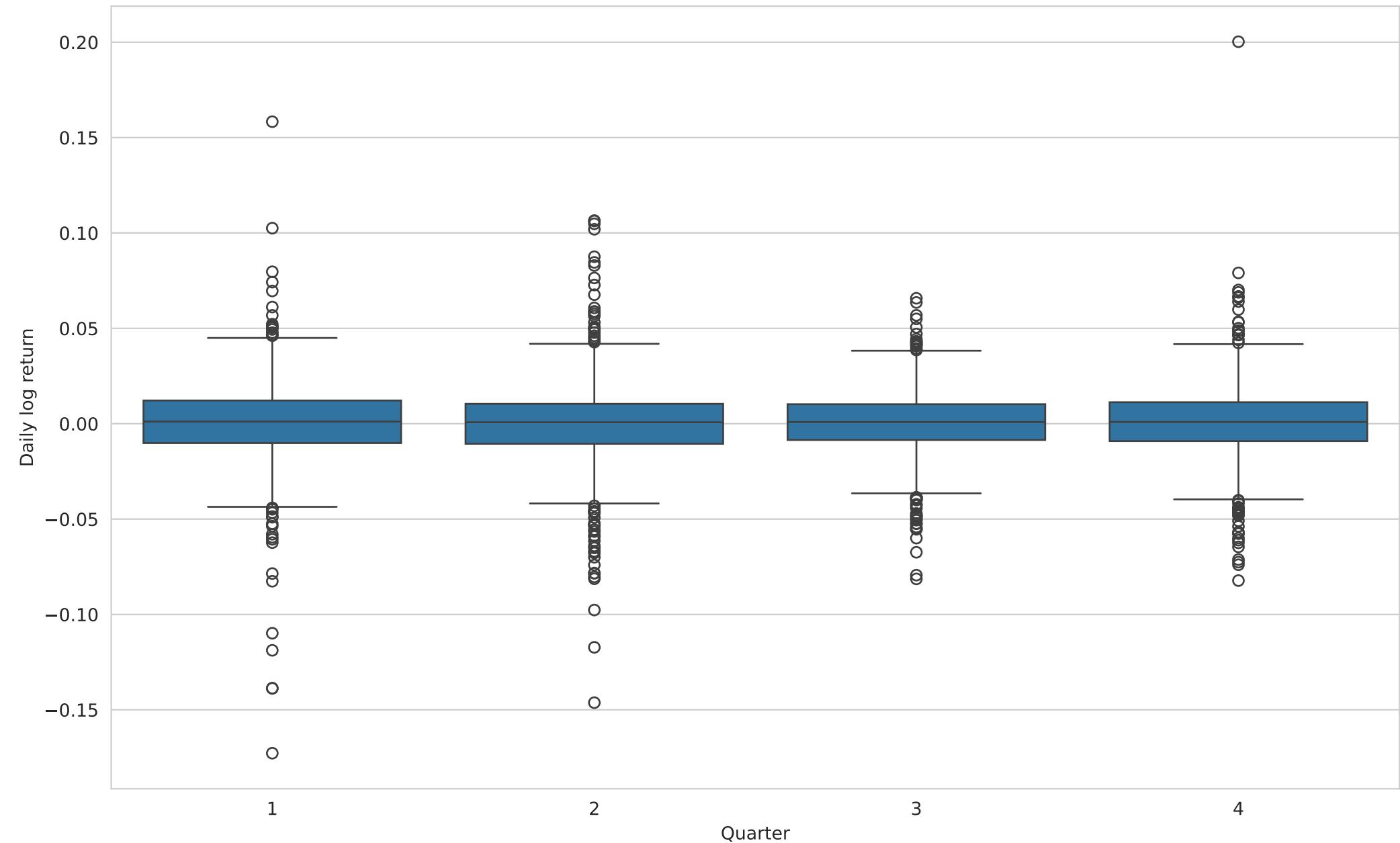
# PSX • Monthly Returns



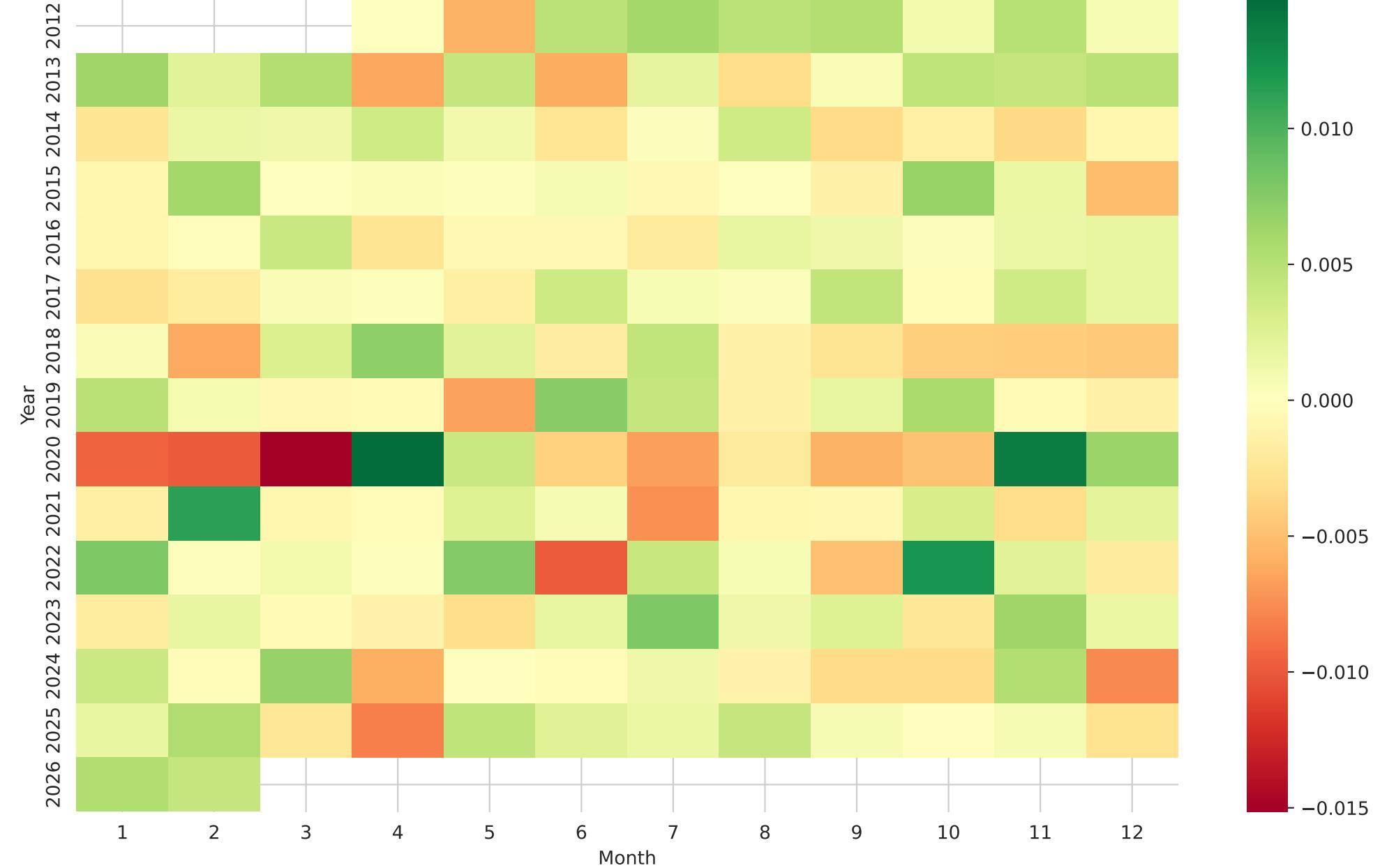
# PSX • Day-of-Week Returns



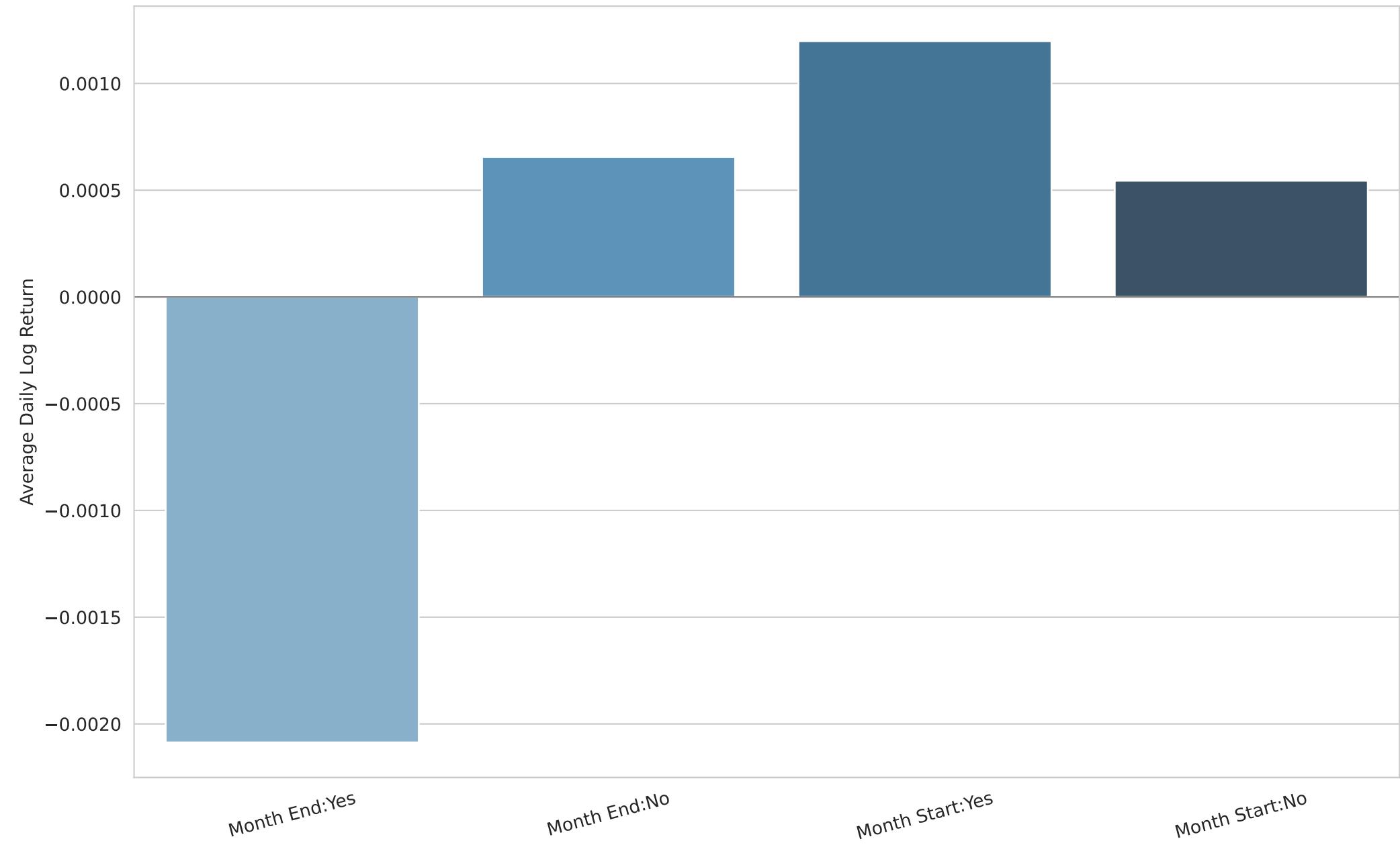
# PSX • Quarterly Returns



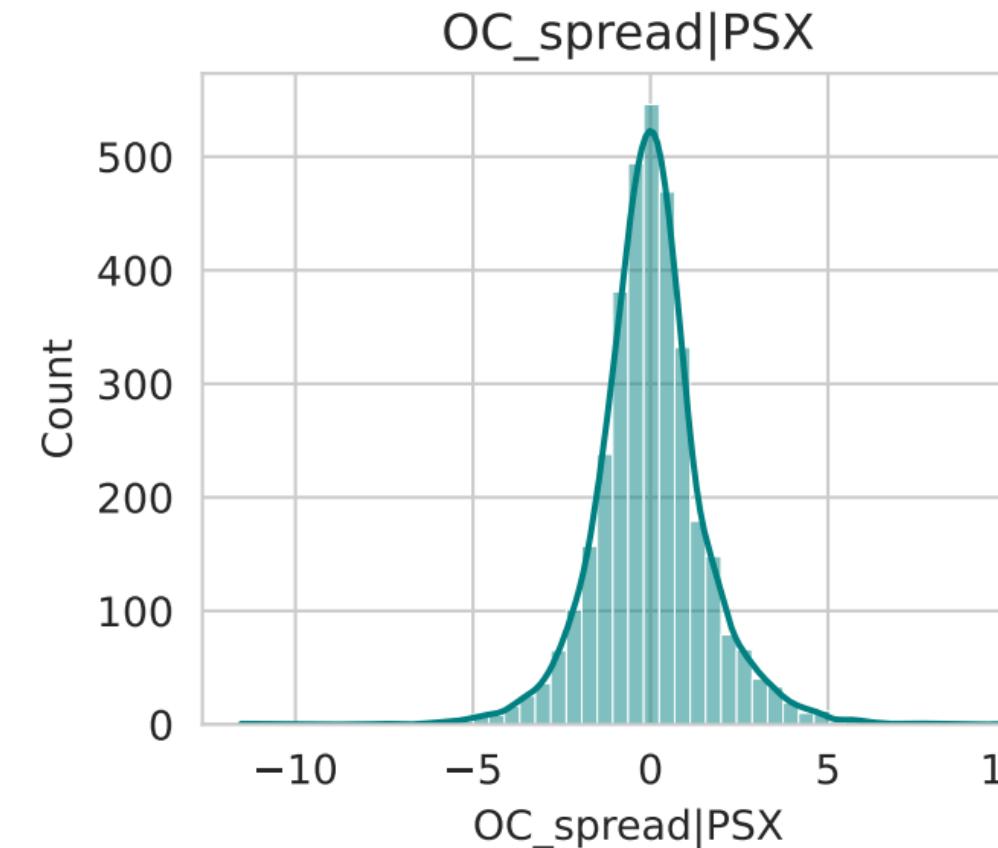
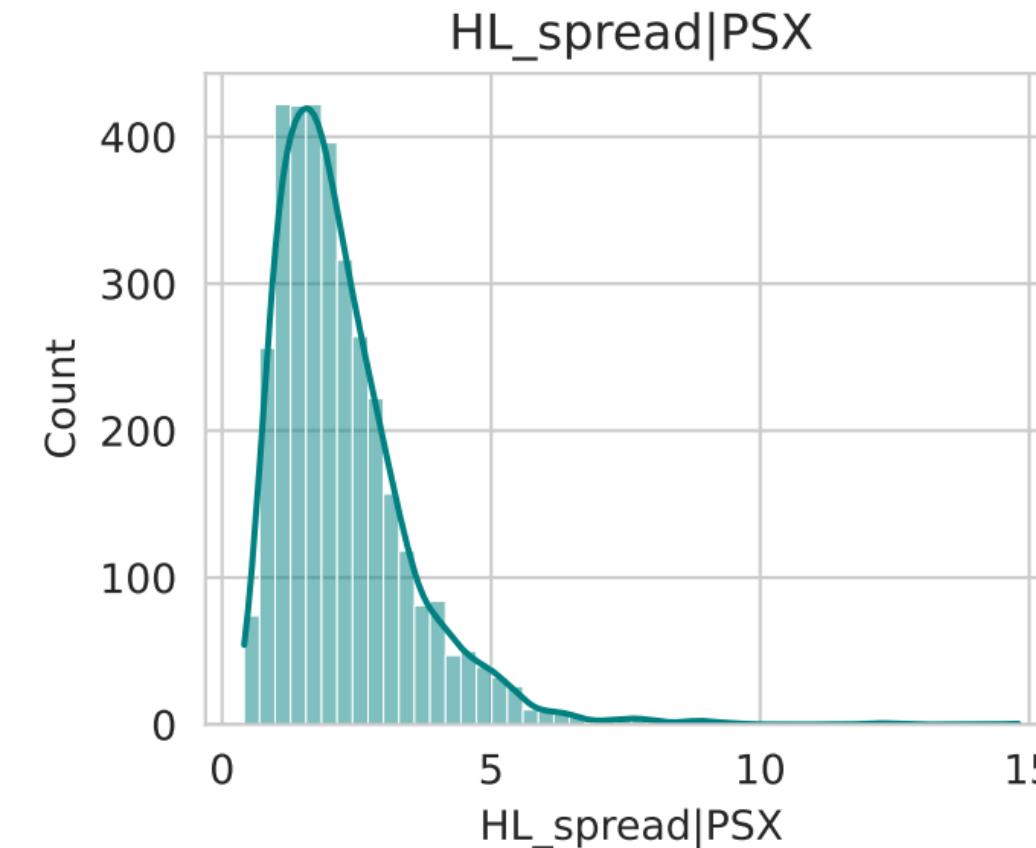
PSX • Month×Year Heatmap (Avg Daily Returns)



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

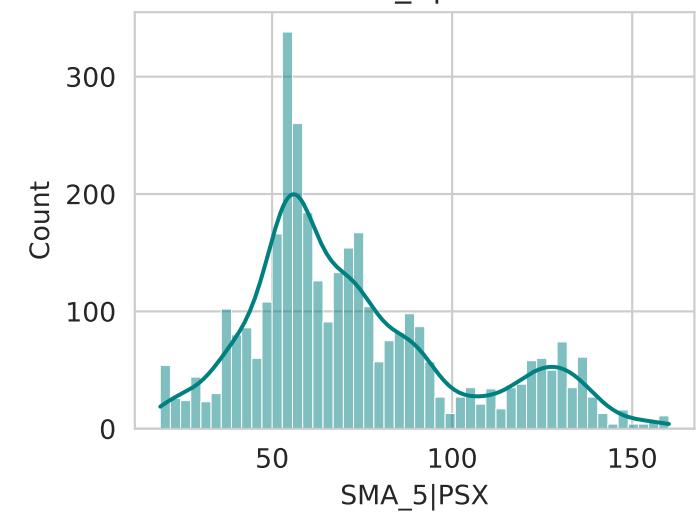


# PSX • Spreads

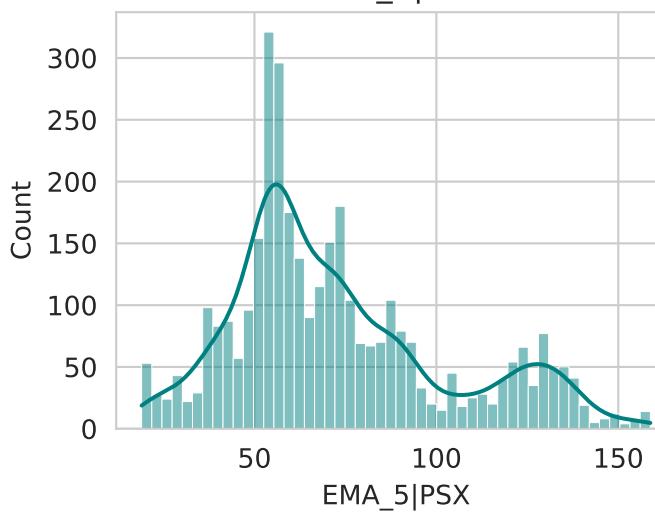


# PSX • Moving Averages / EMAs

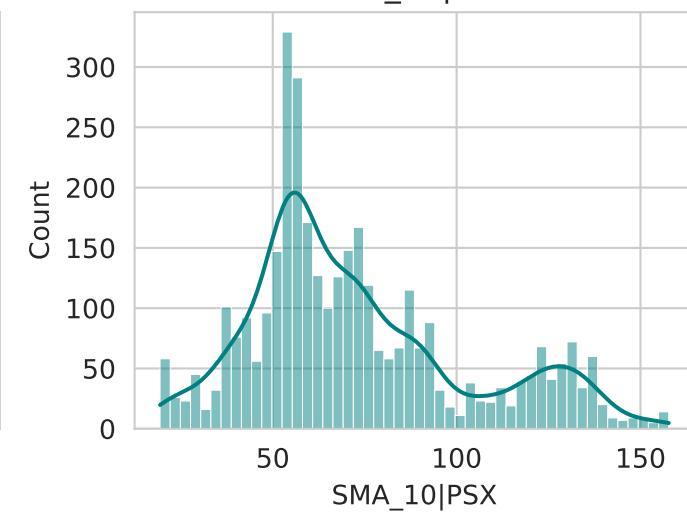
SMA\_5|PSX



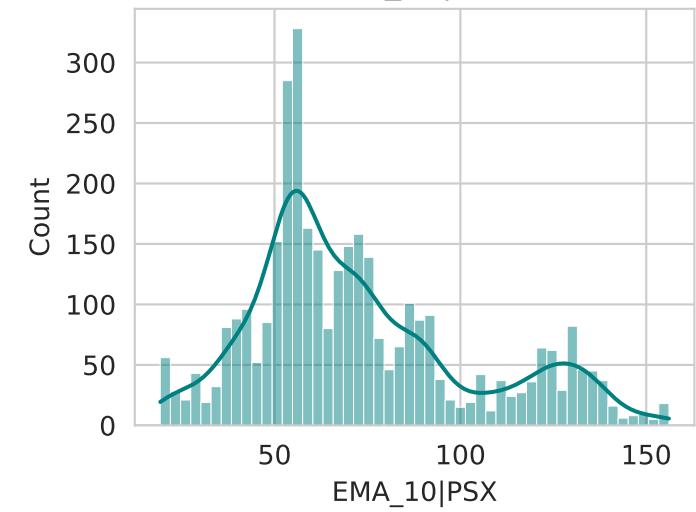
EMA\_5|PSX



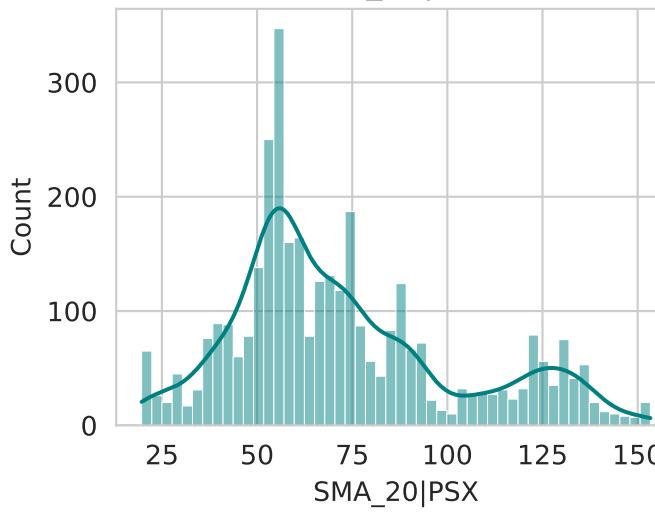
SMA\_10|PSX



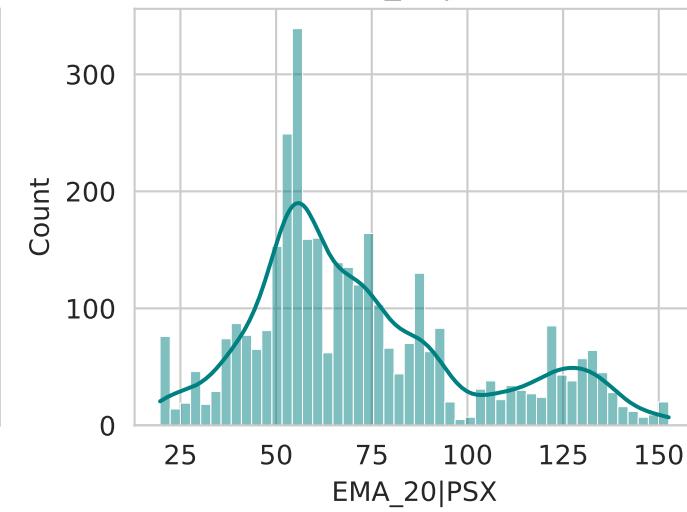
EMA\_10|PSX



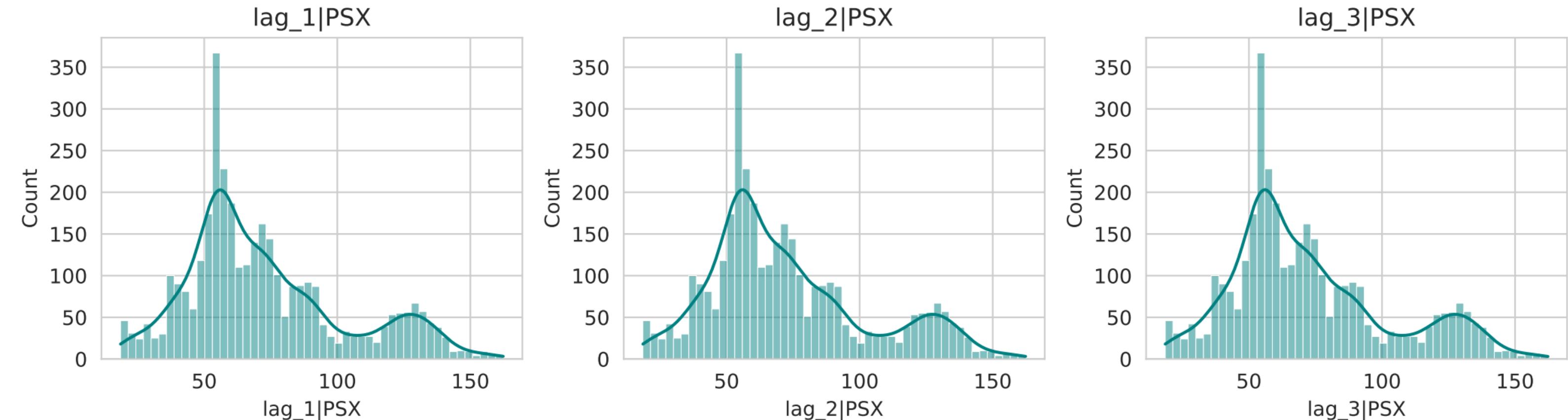
SMA\_20|PSX



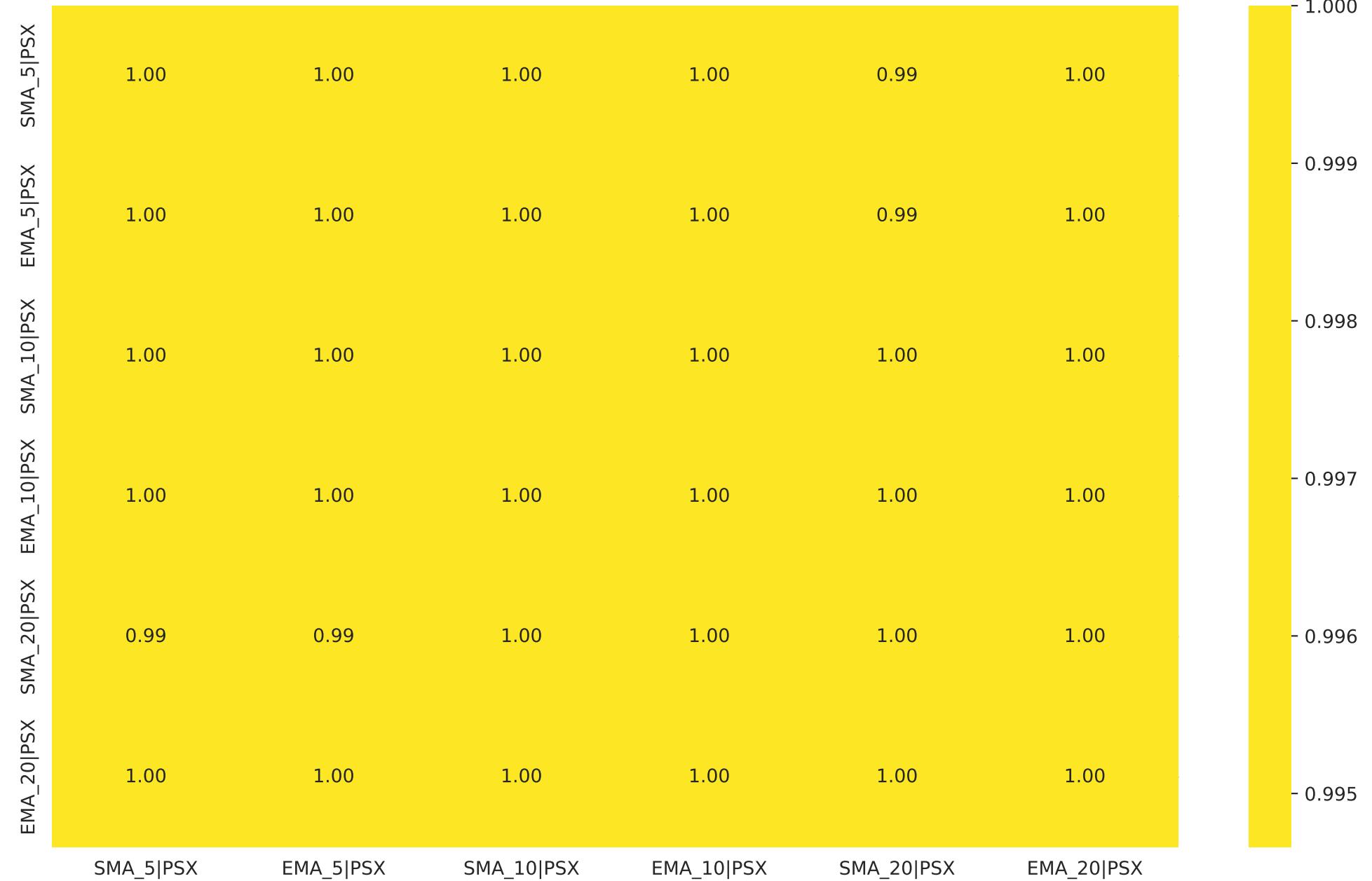
EMA\_20|PSX



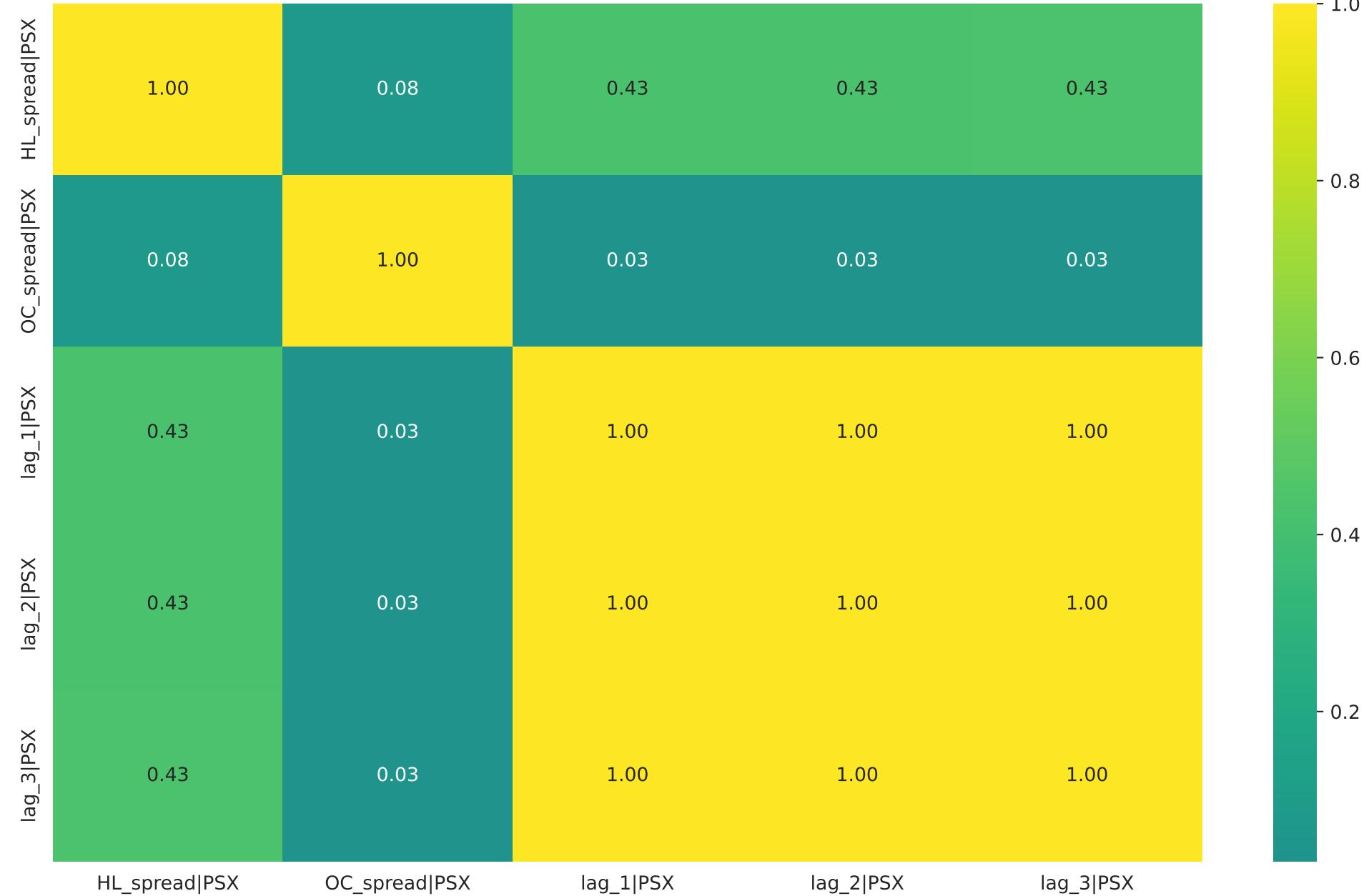
# PSX • Lagged Prices



## PSX • Correlation • Moving Averages



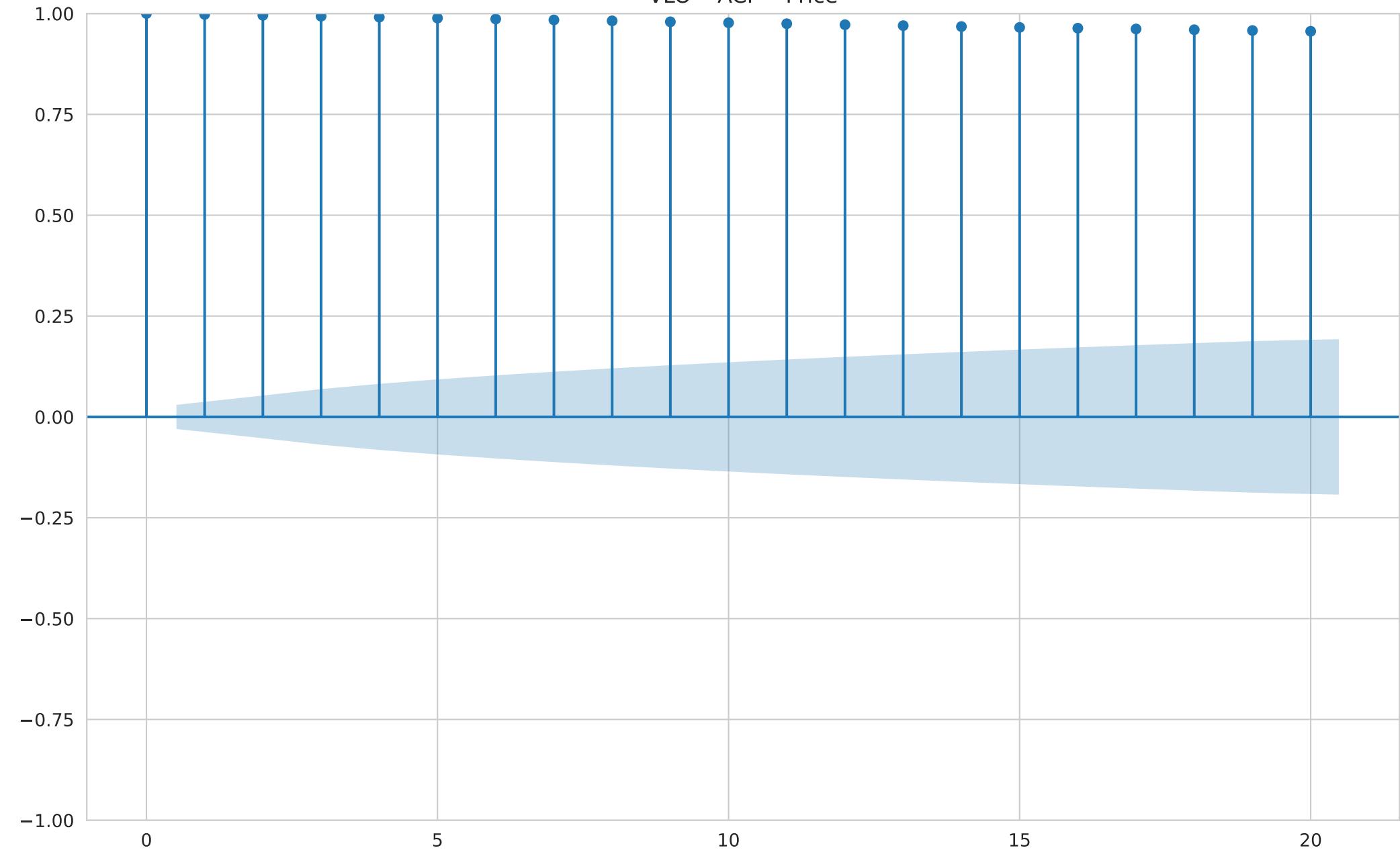
## PSX • Correlation • Spreads + Lags



# VLO • Price



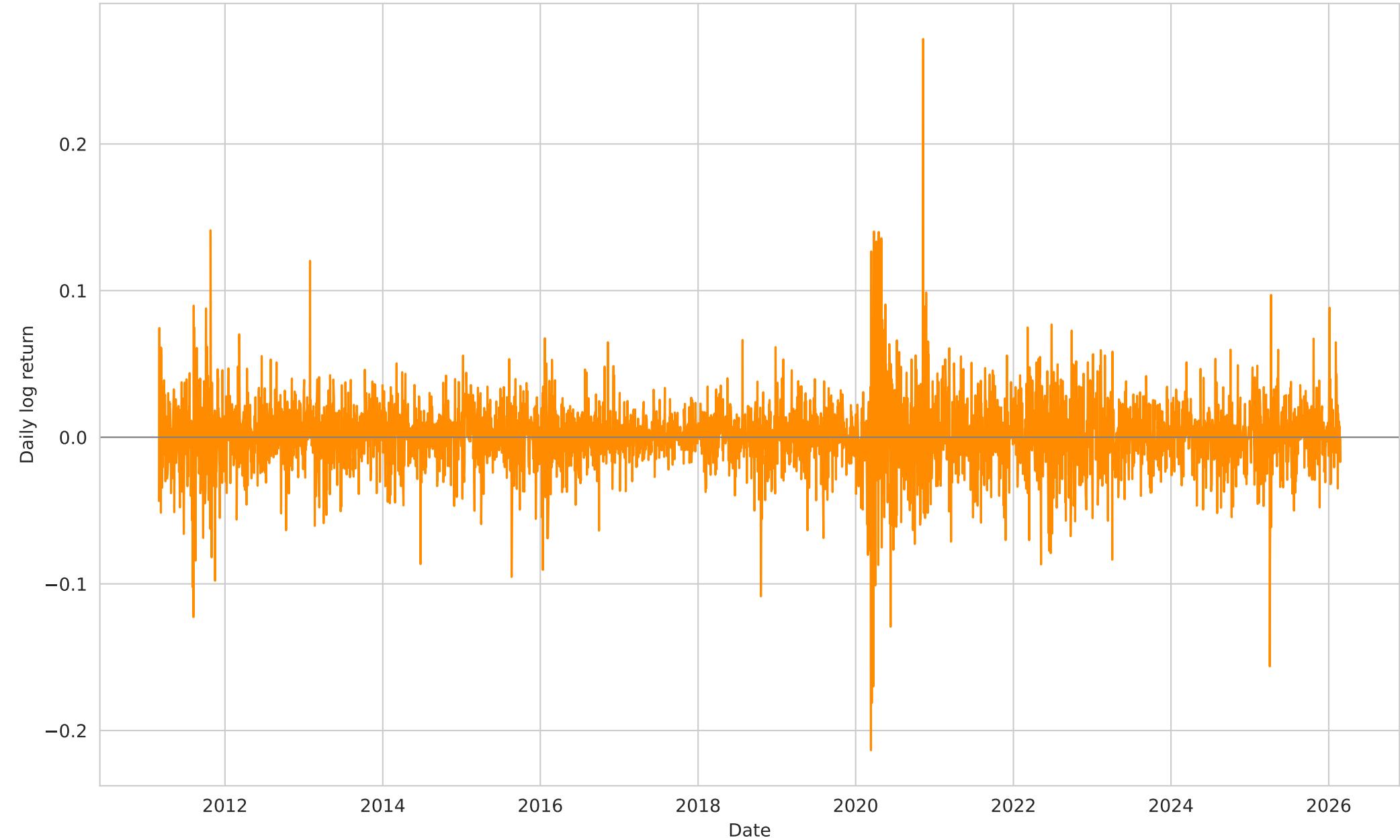
### VLO • ACF • Price



# VLO • Moving Averages (5/10/20)



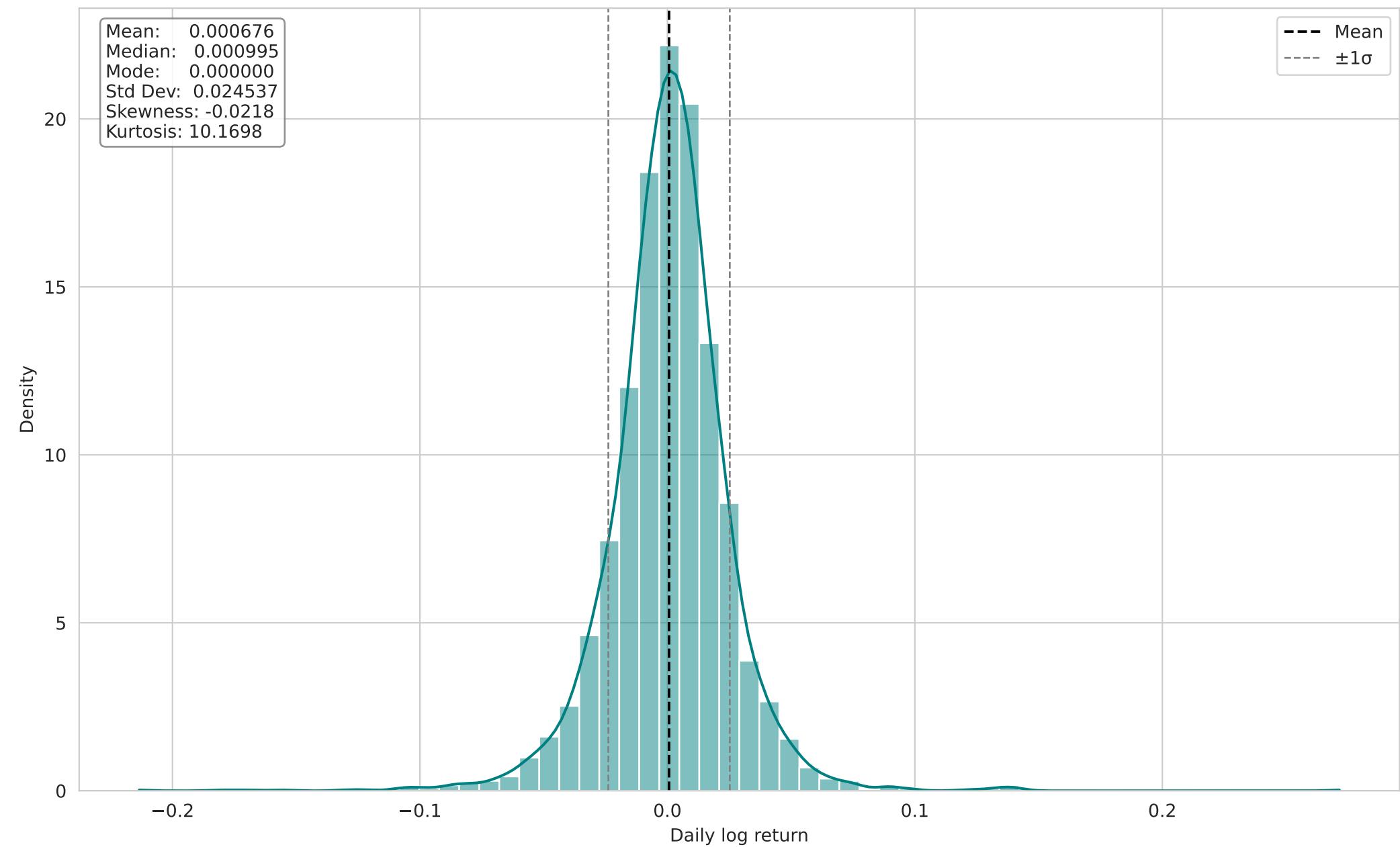
# VLO • Daily Log Returns



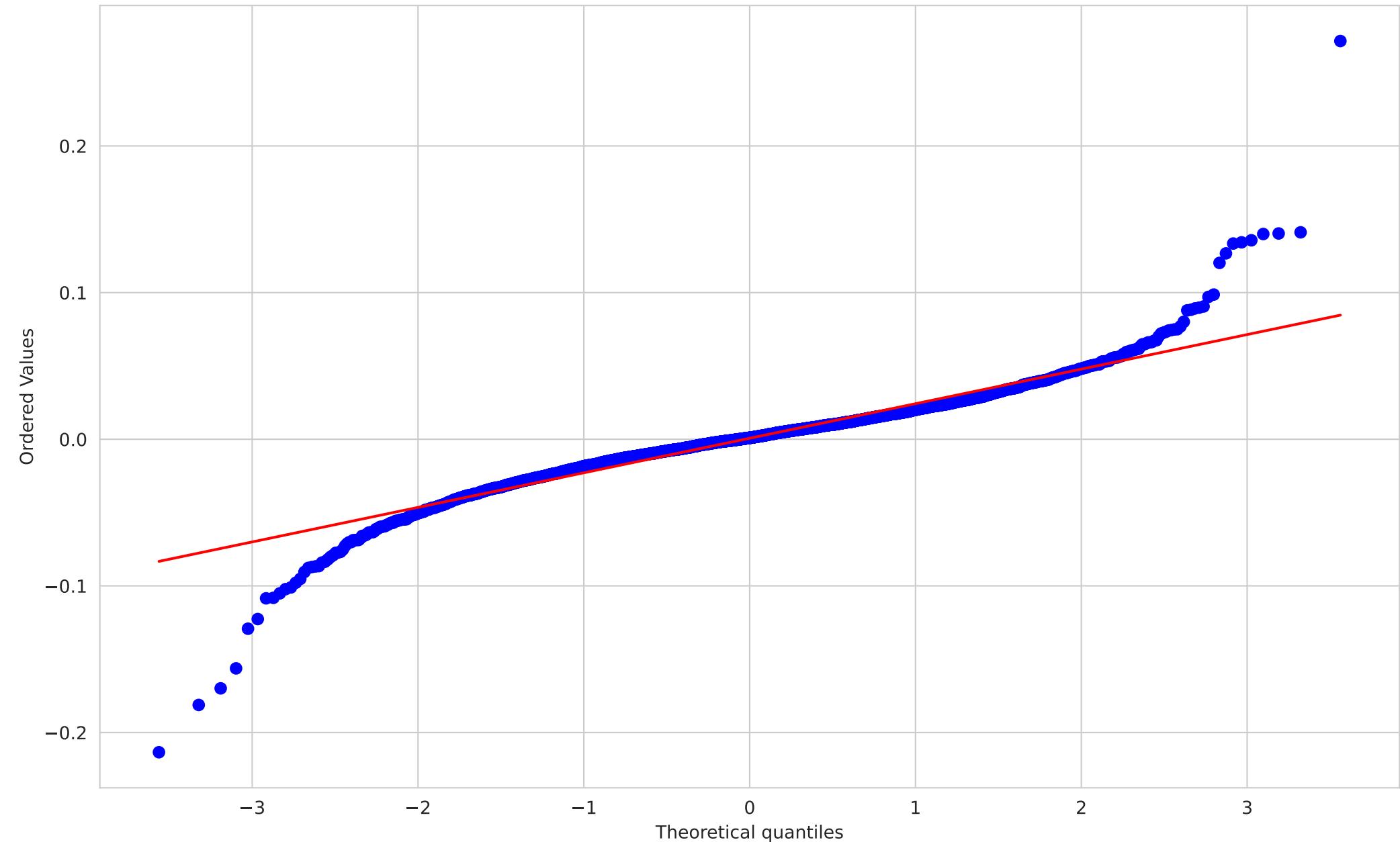
# VLO • Returns • Distribution

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

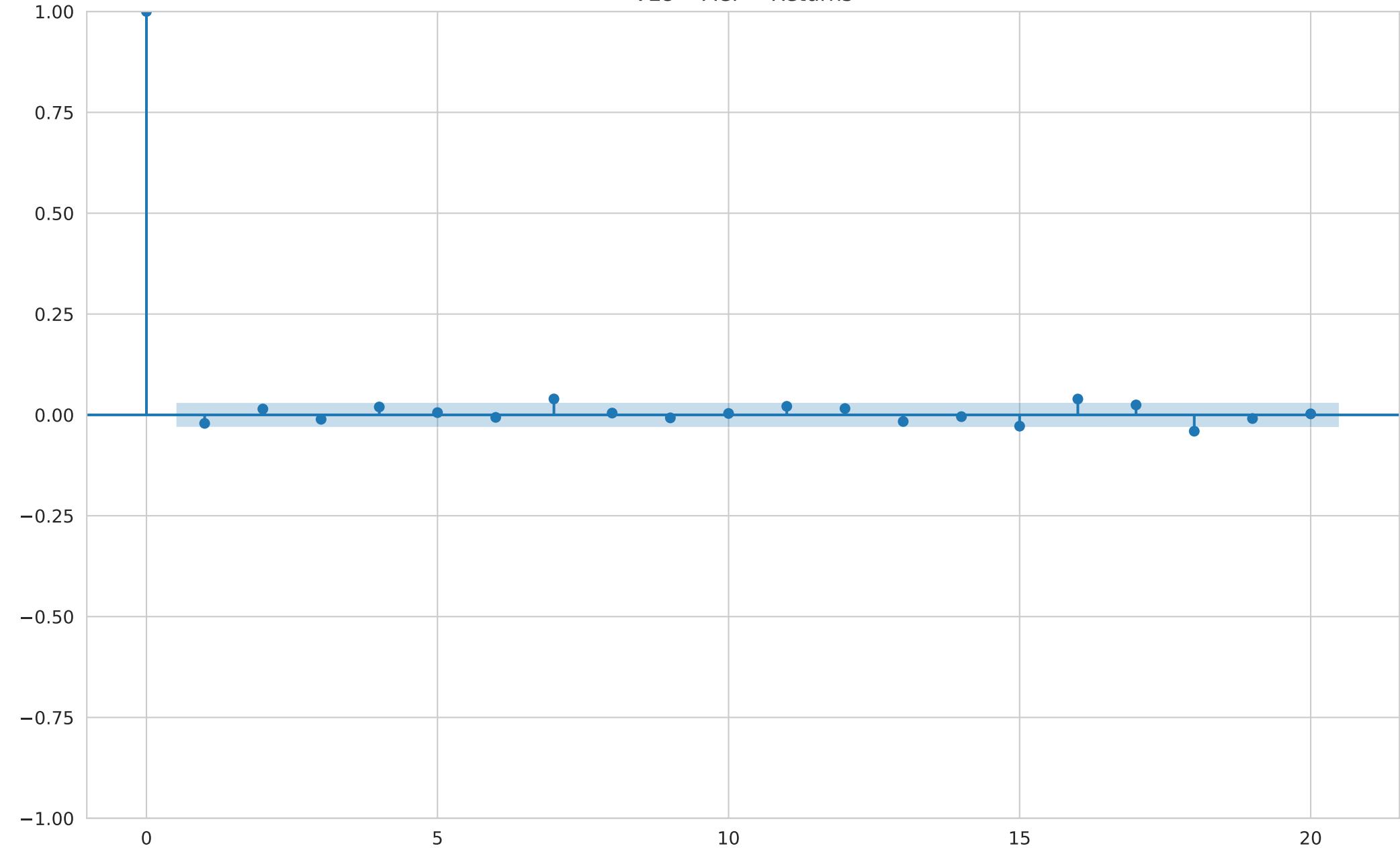
--- Mean  
----  $\pm 1\sigma$



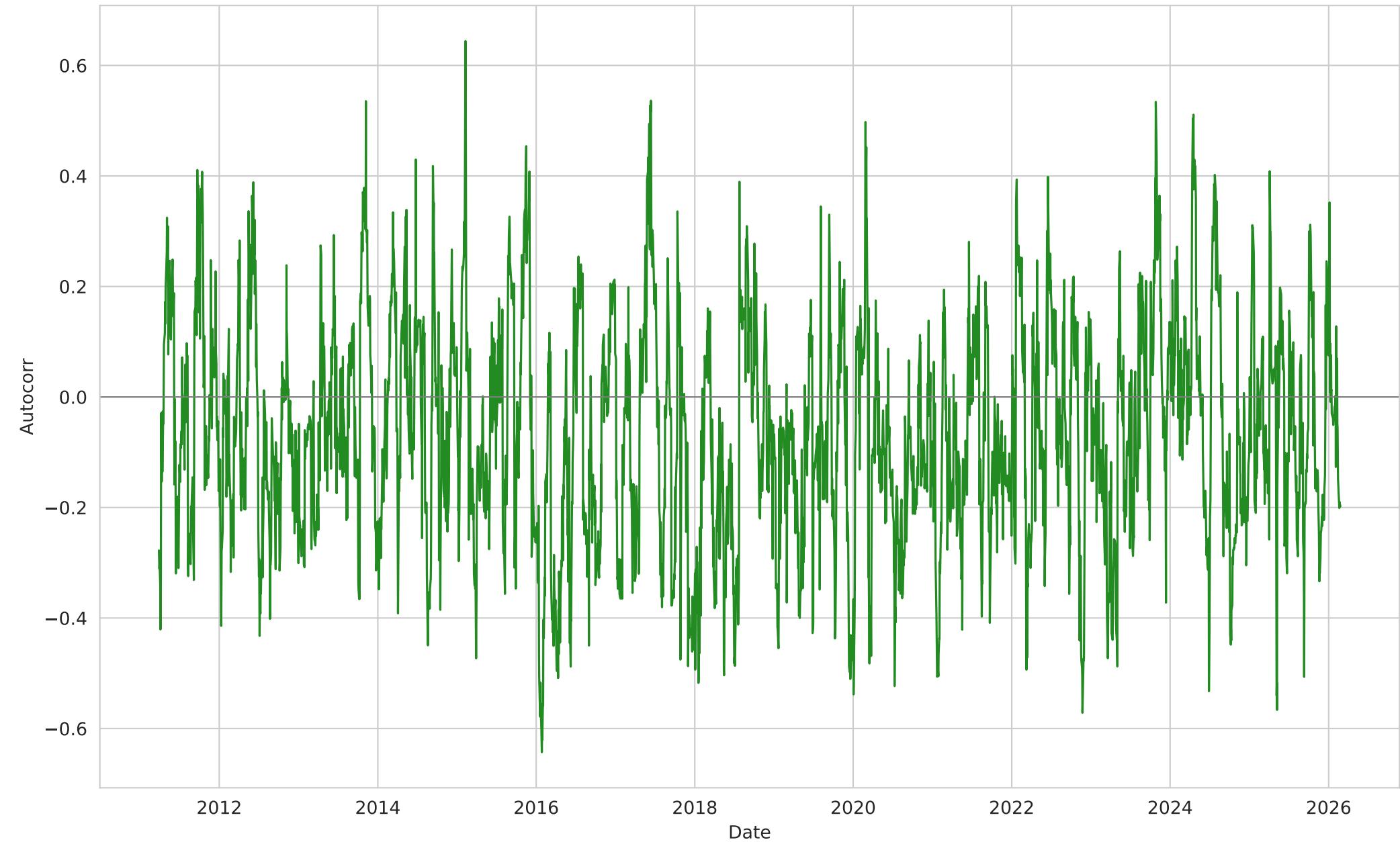
VLO • Returns • Q-Q Plot vs Normal



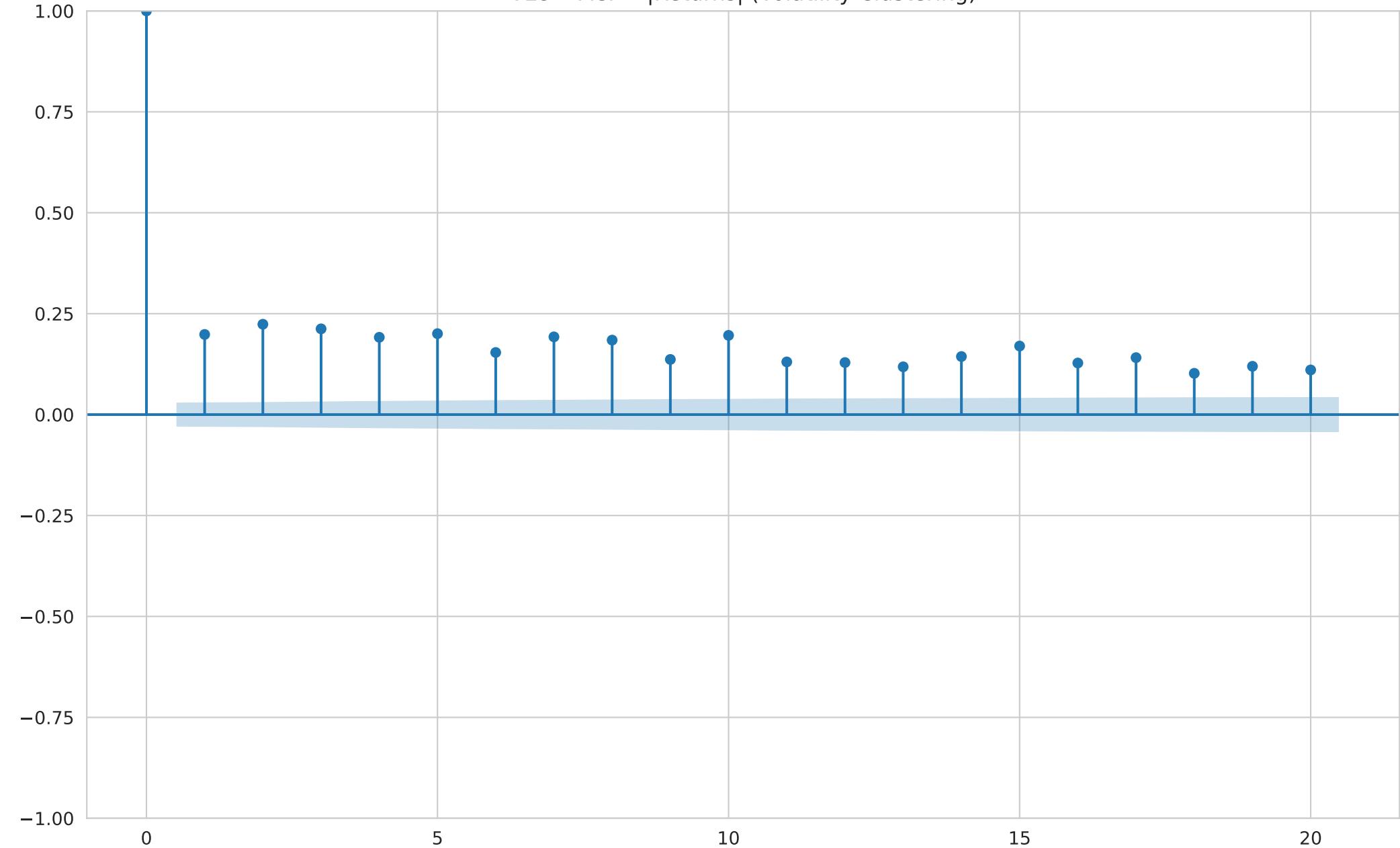
### VLO • ACF • Returns



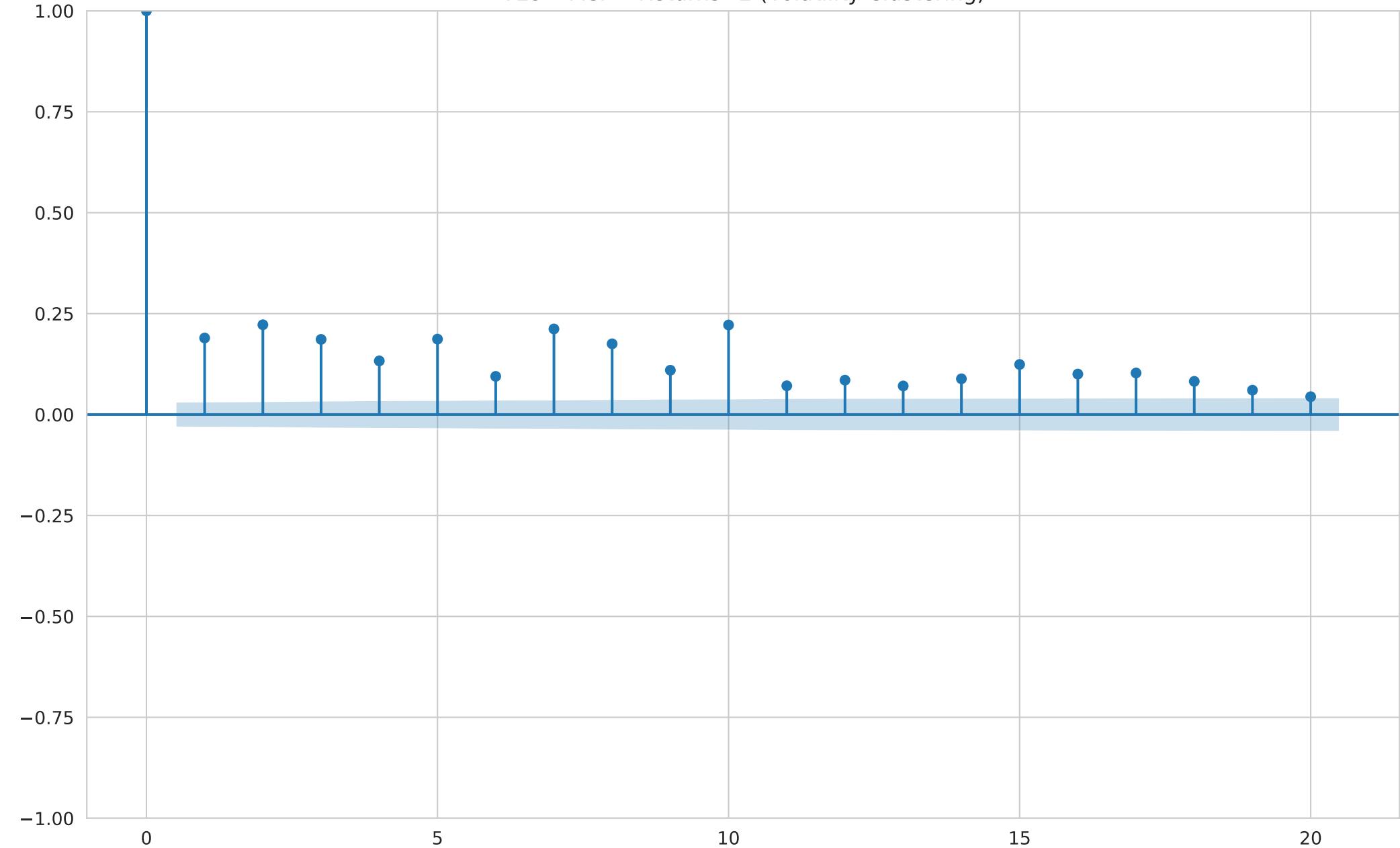
### VLO • Rolling Autocorrelation (lag=1, window=20)



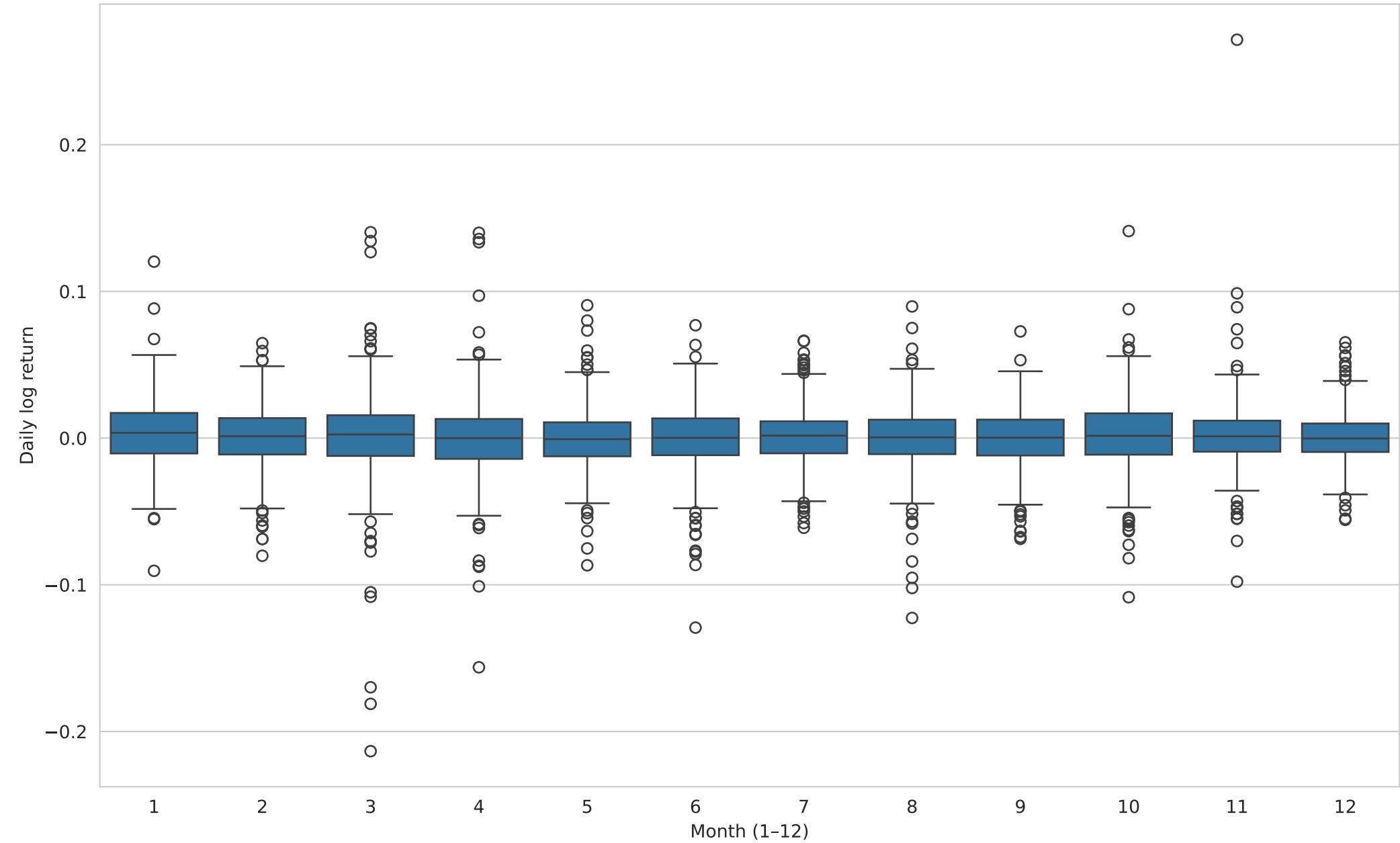
### VLO • ACF • |Returns| (Volatility Clustering)



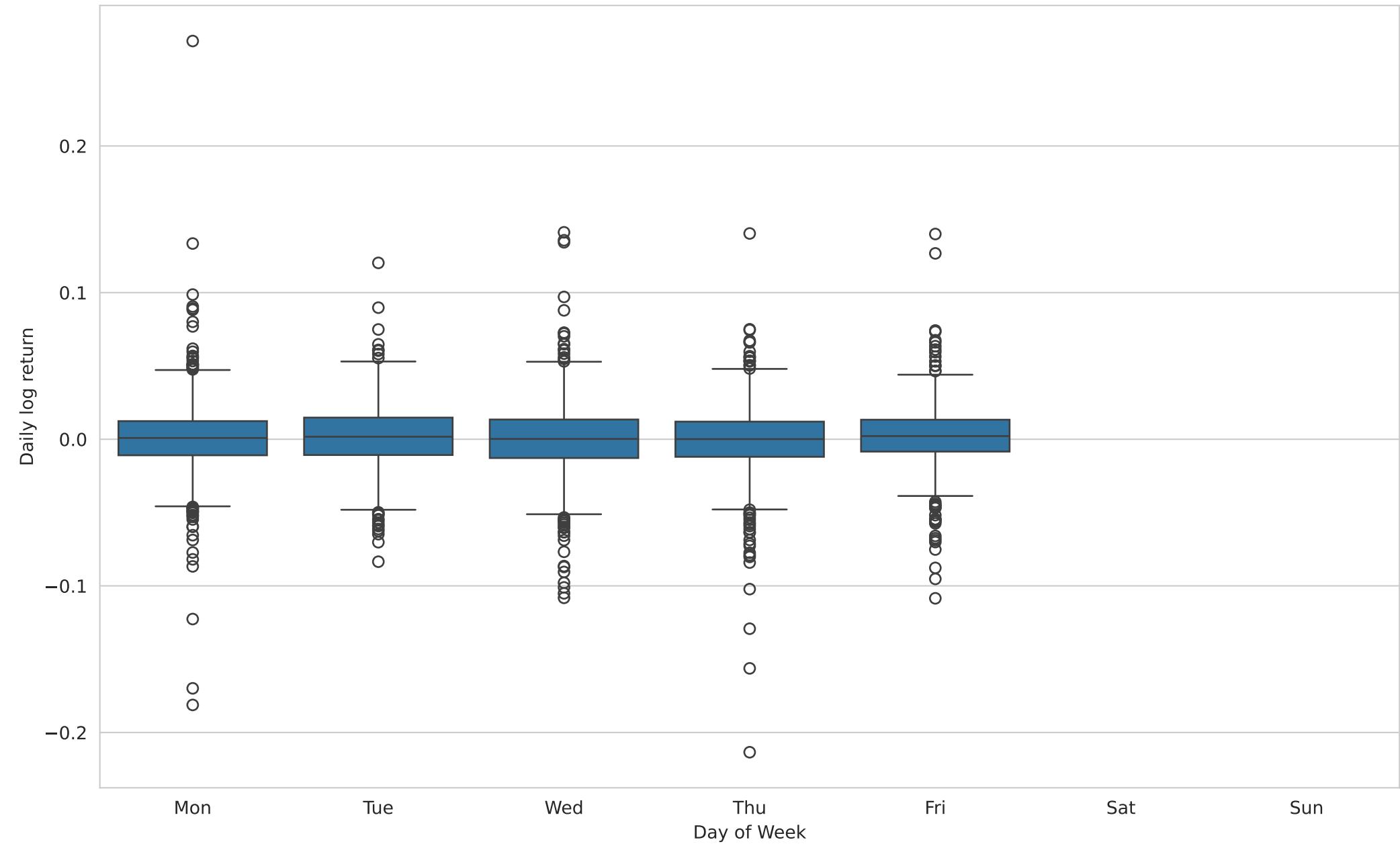
### VLO • ACF • Returns<sup>2</sup> (Volatility Clustering)



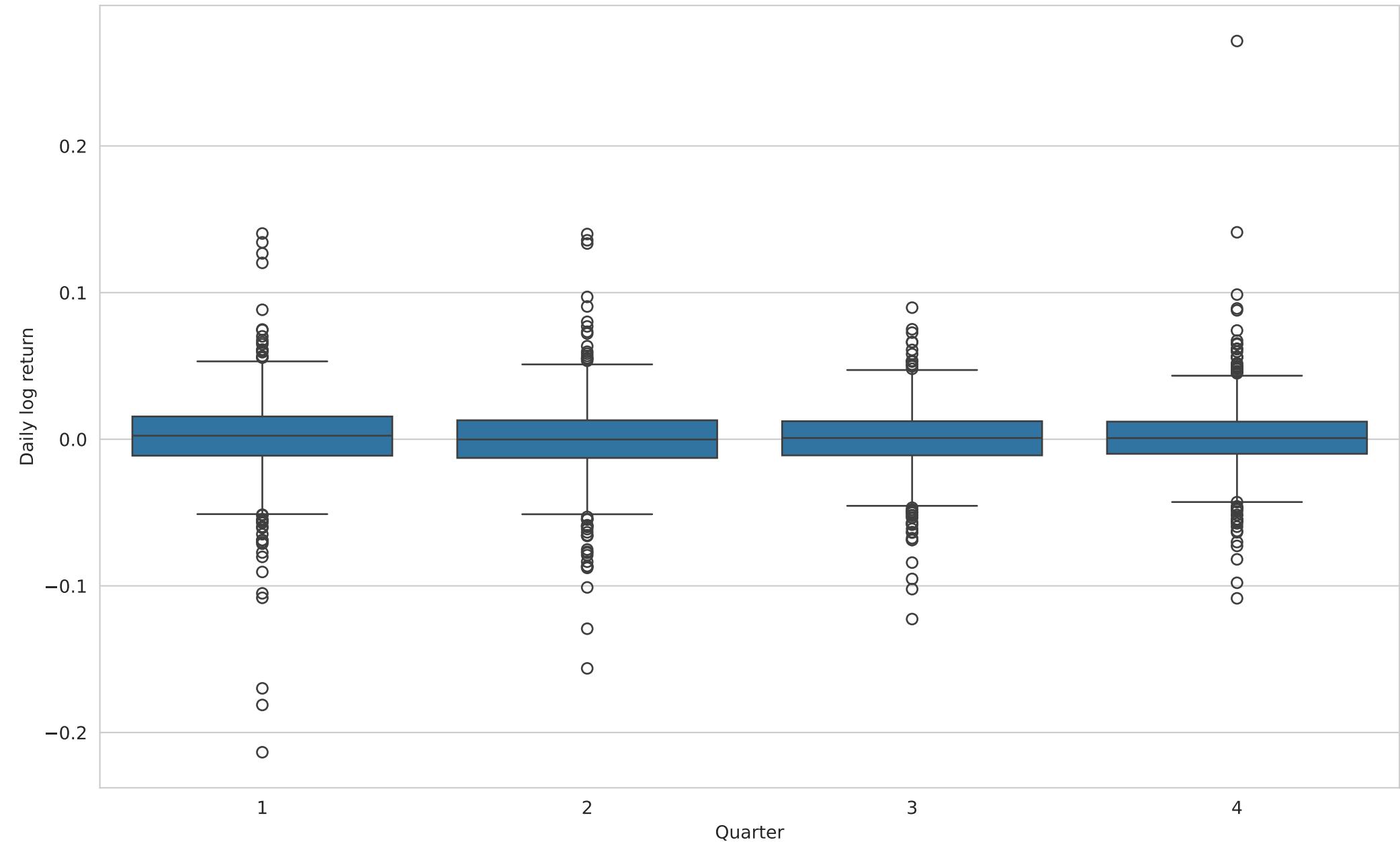
### VLO • Monthly Returns



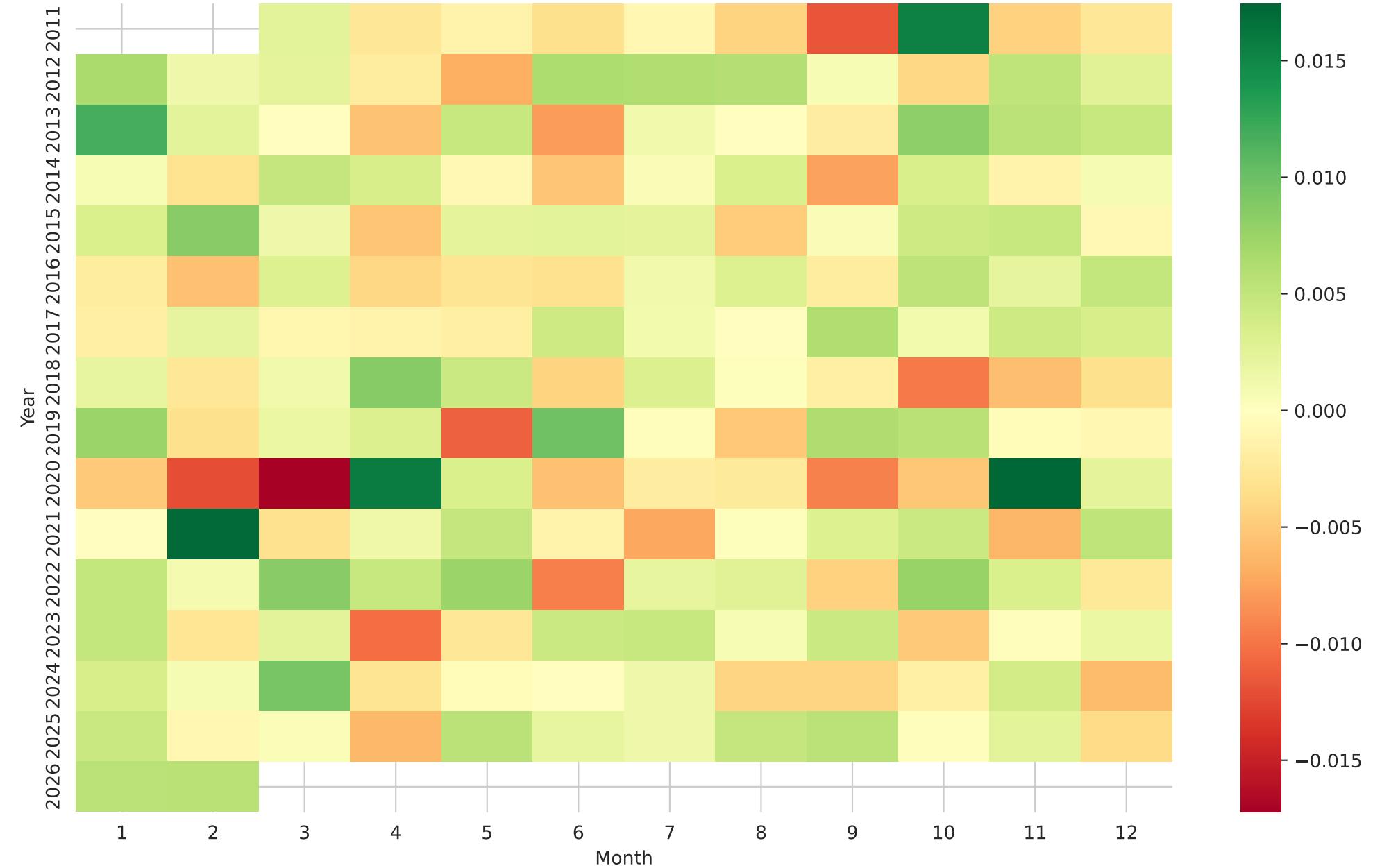
# VLO • Day-of-Week Returns



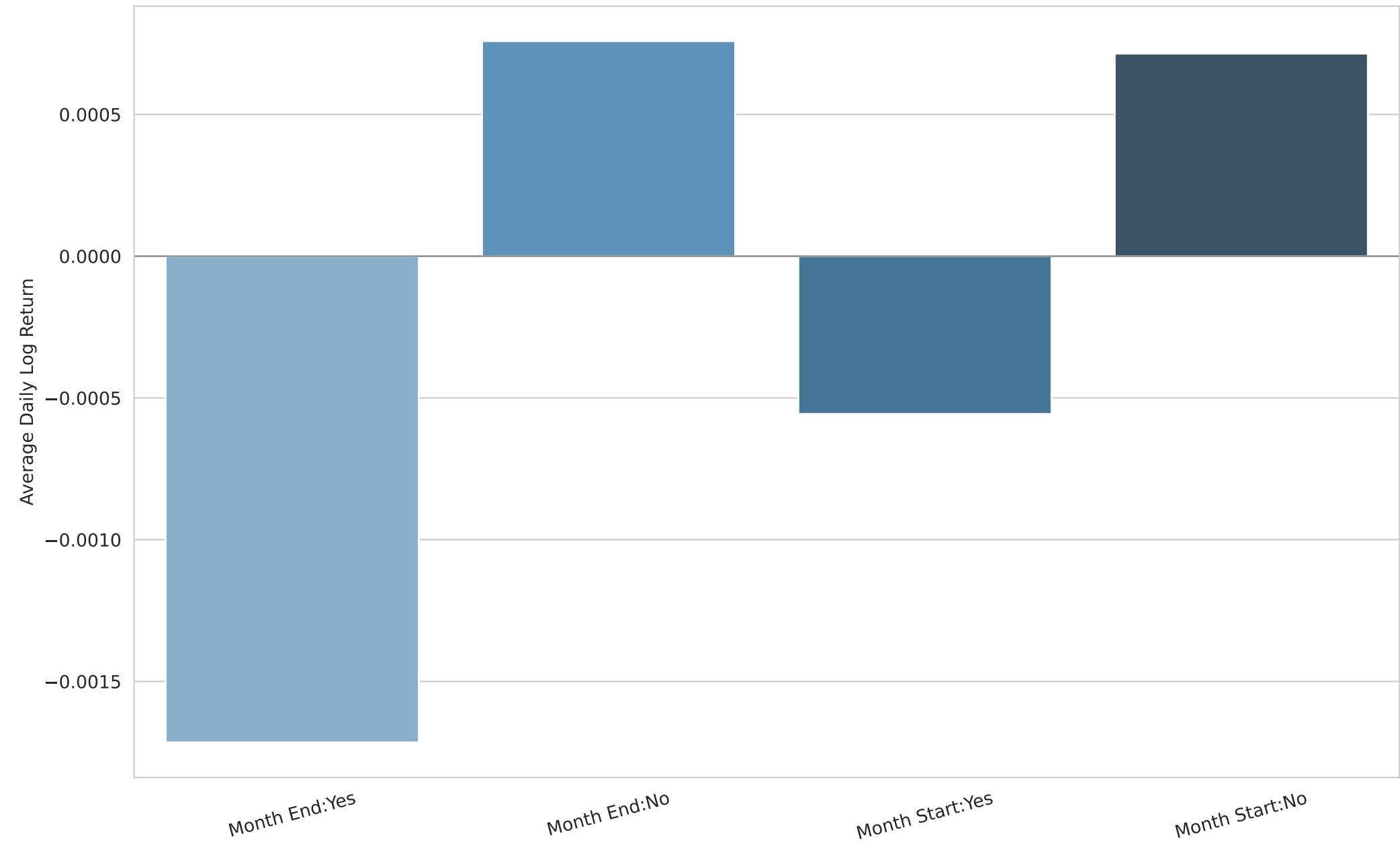
# VLO • Quarterly Returns



VLO • Month×Year Heatmap (Avg Daily Returns)

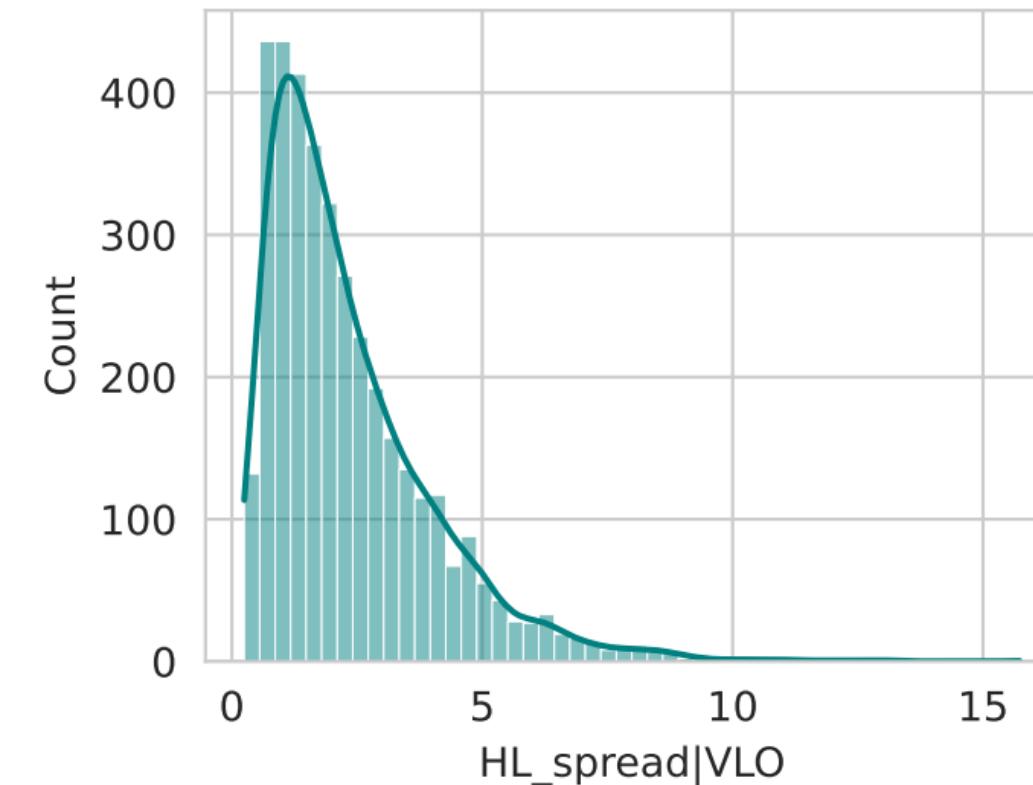


### VLO • Avg Returns: Month-End/Start vs Others

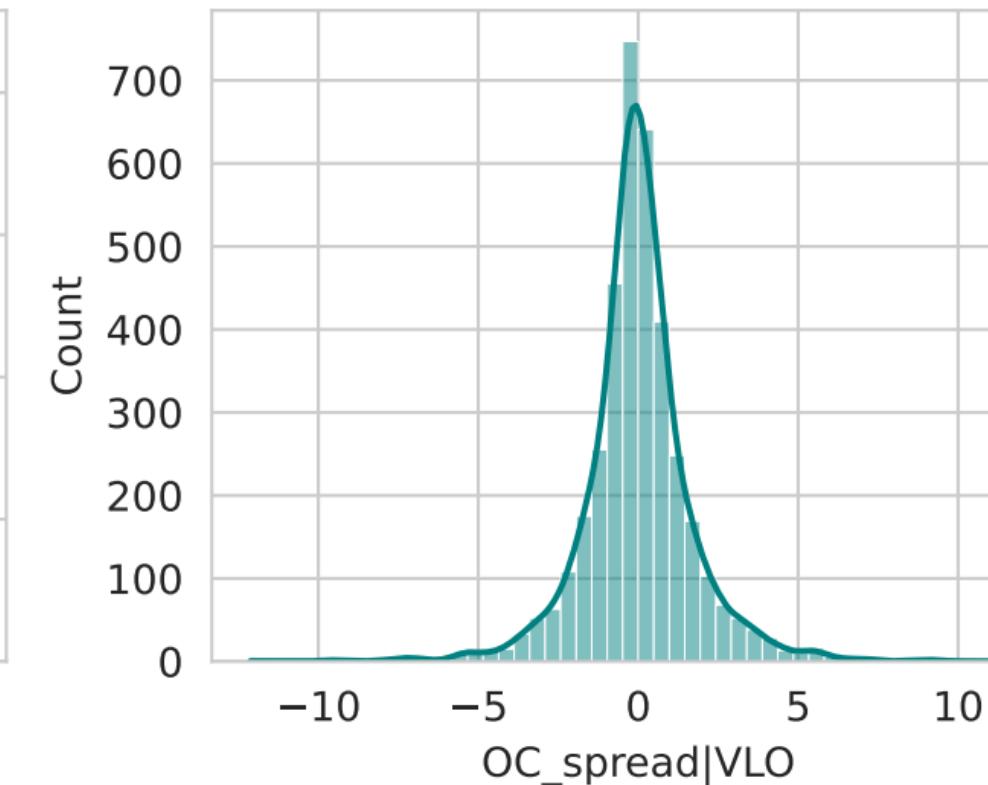


# VLO • Spreads

HL\_spread|VLO

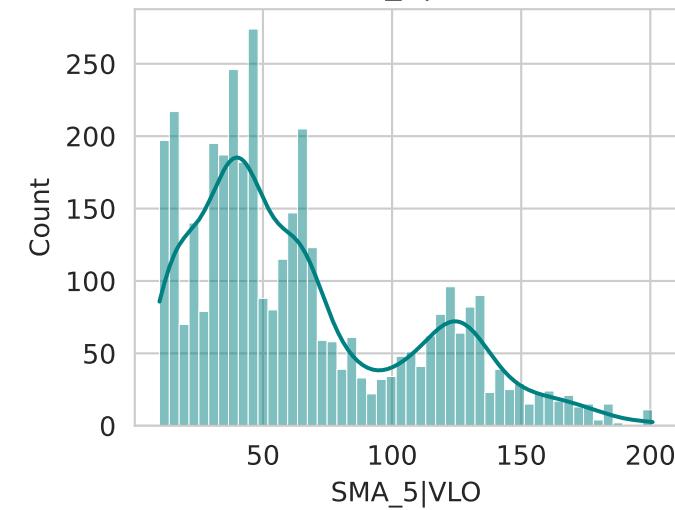


OC\_spread|VLO

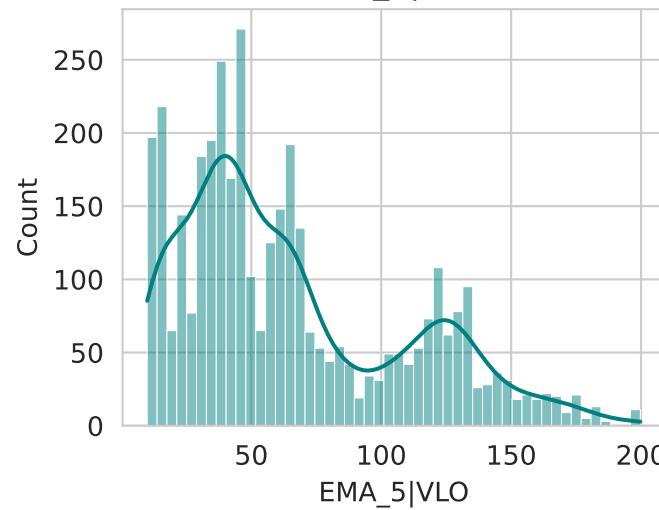


# VLO • Moving Averages / EMAs

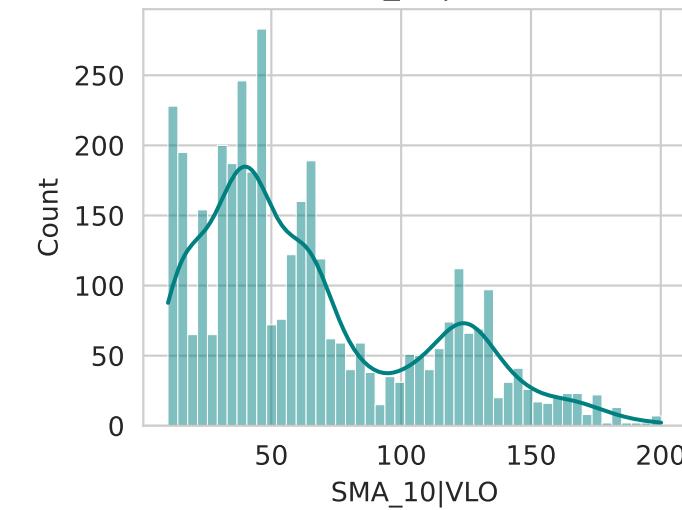
SMA\_5|VLO



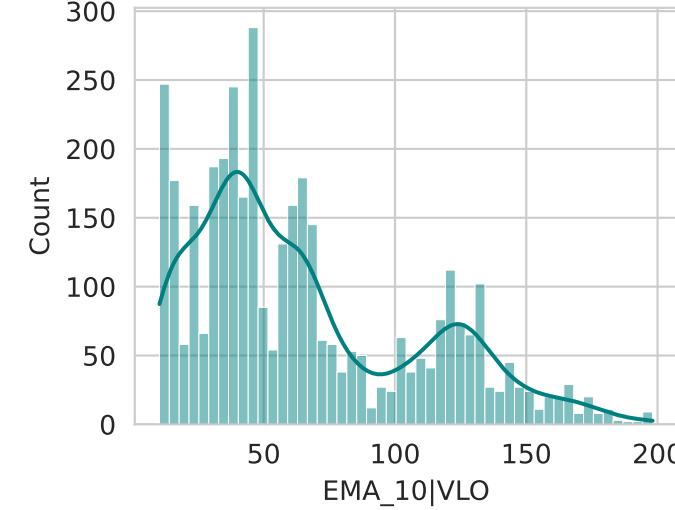
EMA\_5|VLO



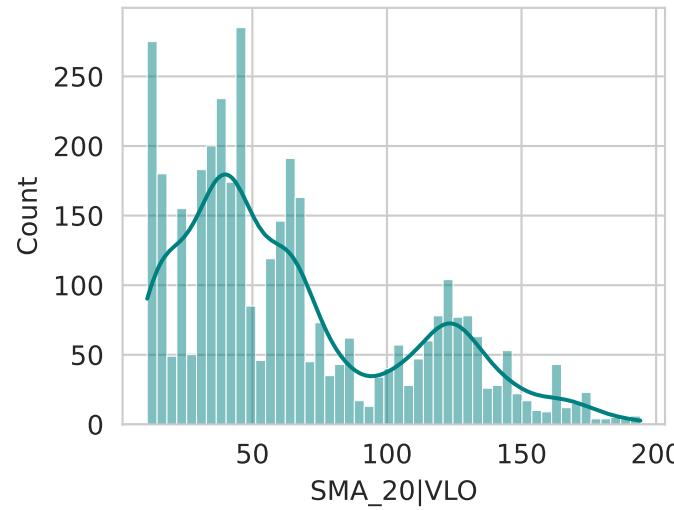
SMA\_10|VLO



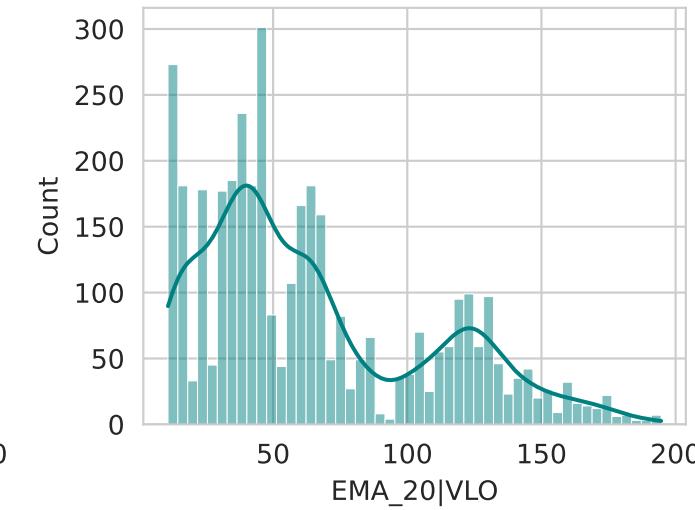
EMA\_10|VLO



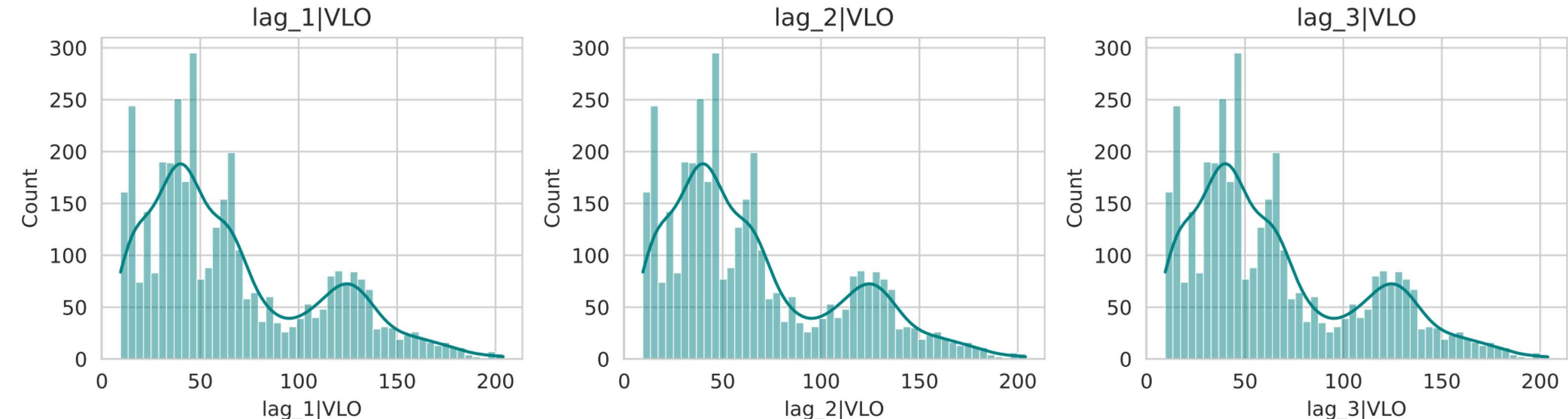
SMA\_20|VLO



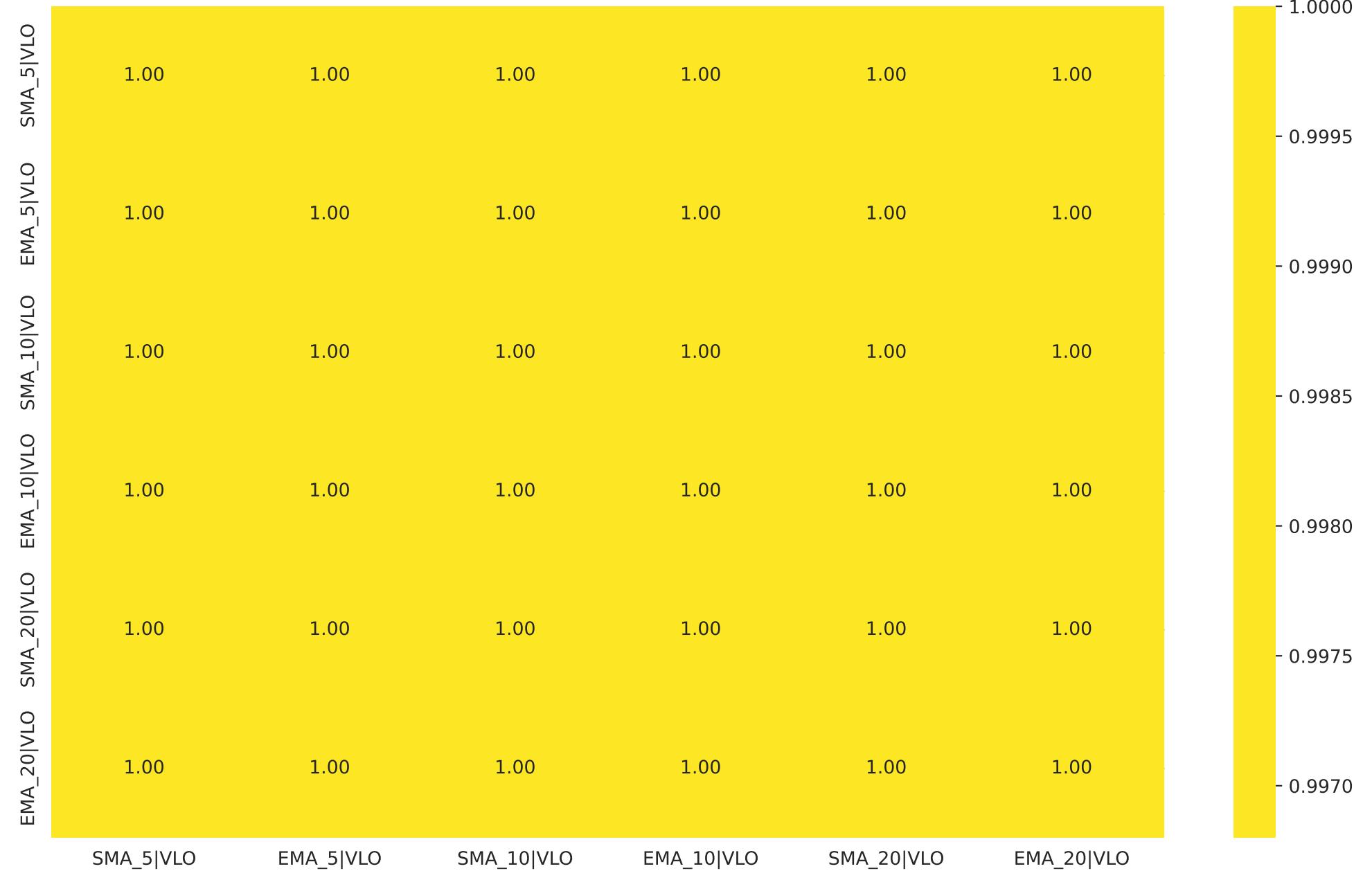
EMA\_20|VLO



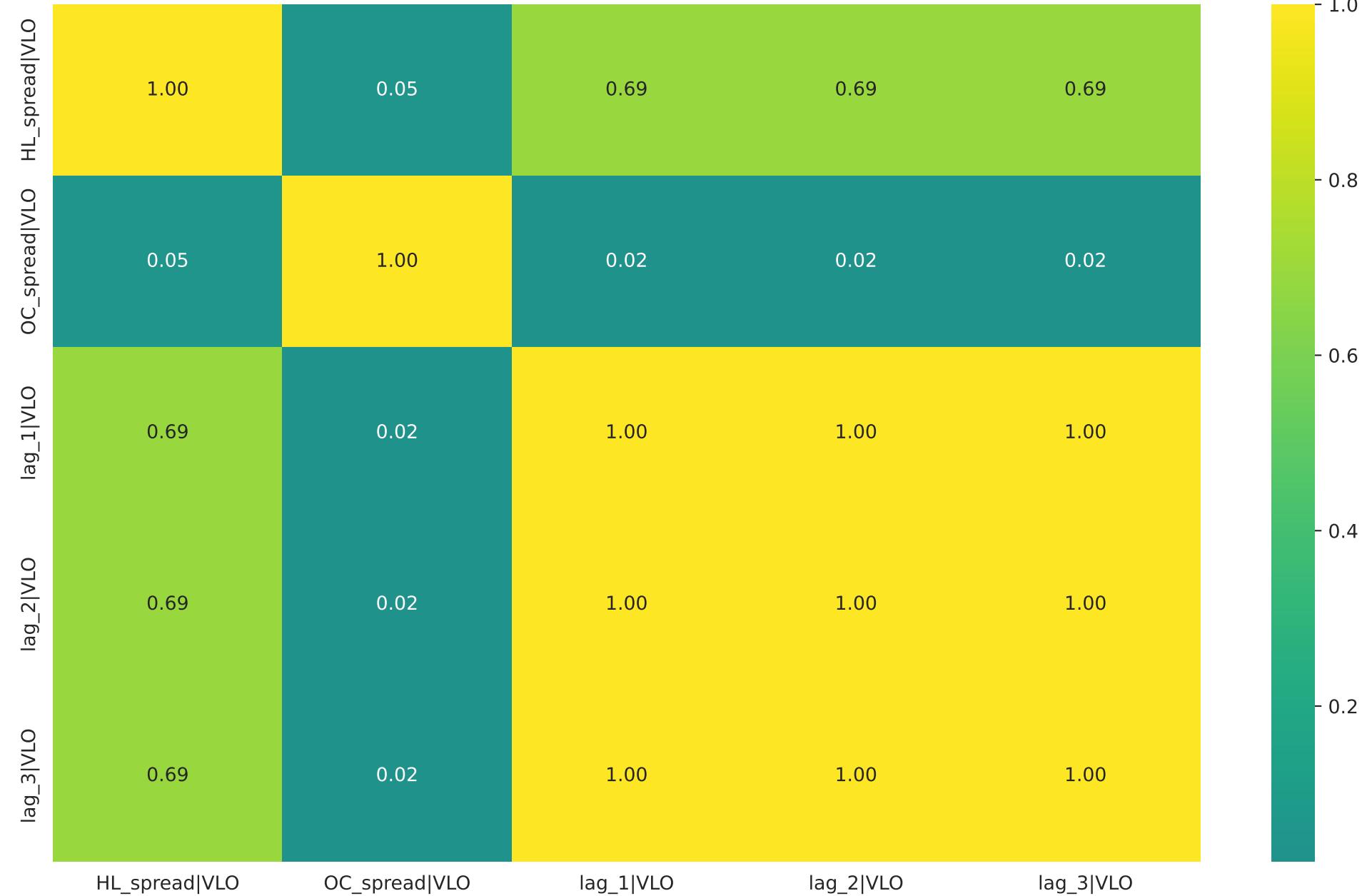
# VLO • Lagged Prices



# VLO • Correlation • Moving Averages



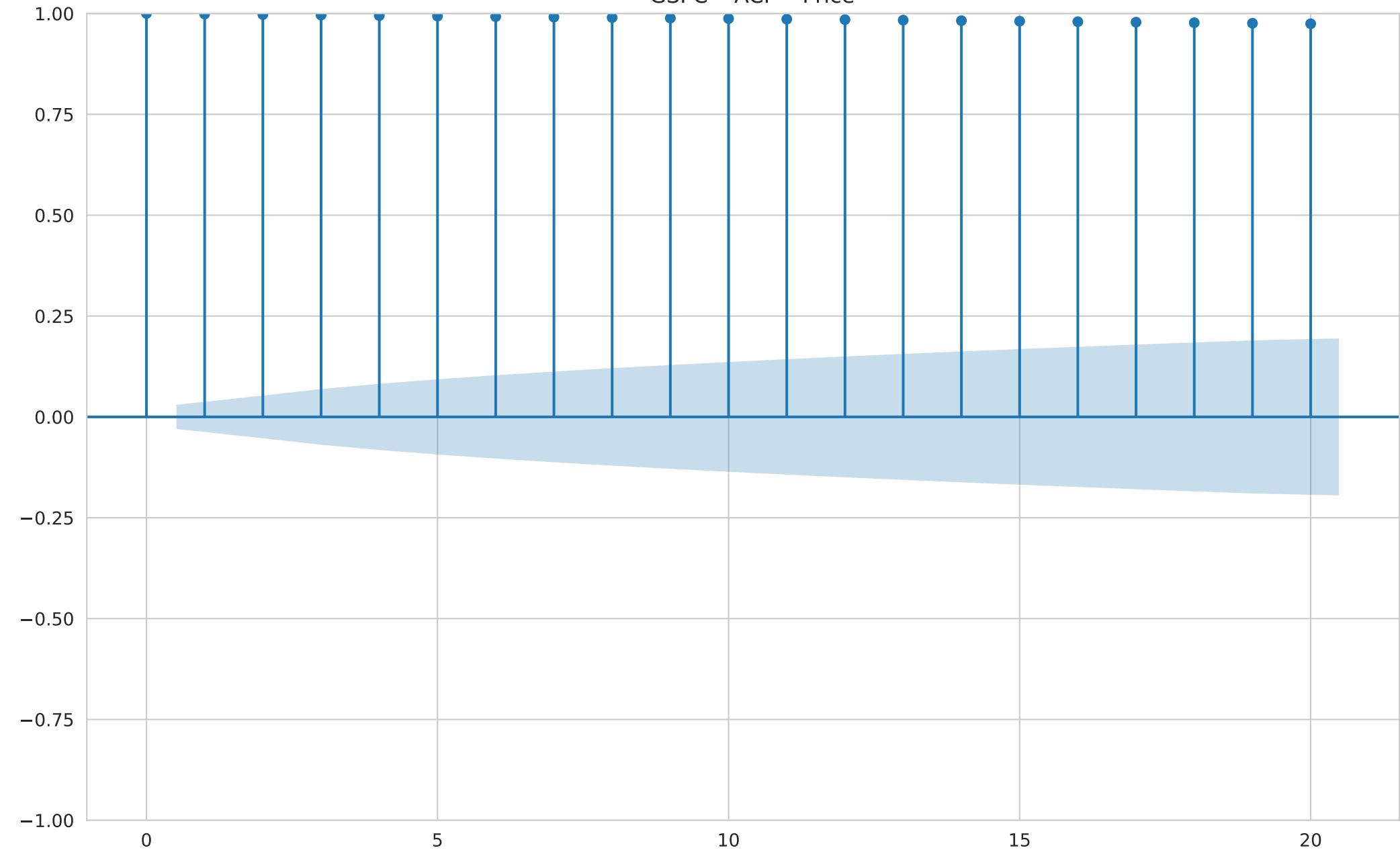
## VLO • Correlation • Spreads + Lags



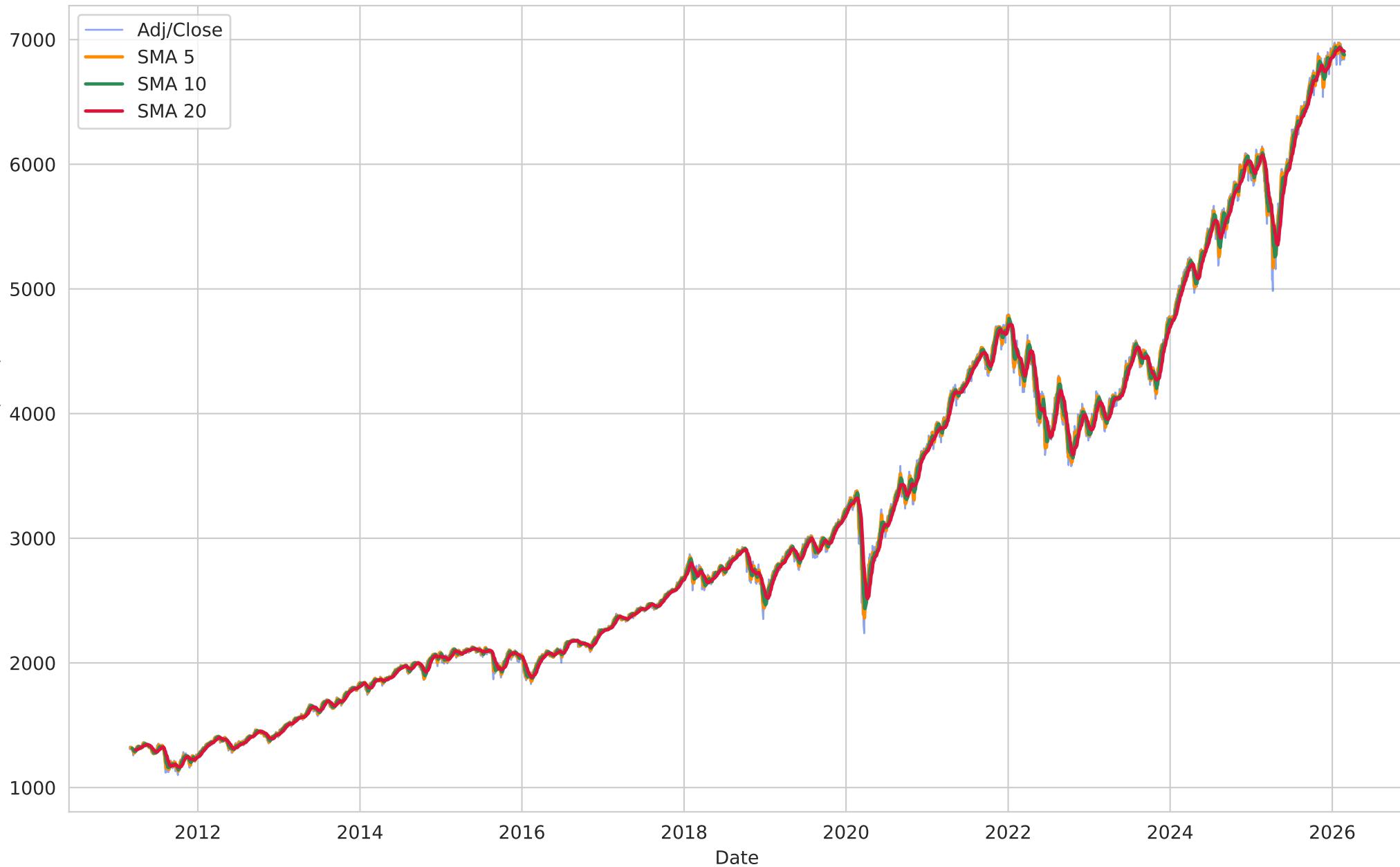
# $\wedge$ GSPC • Price



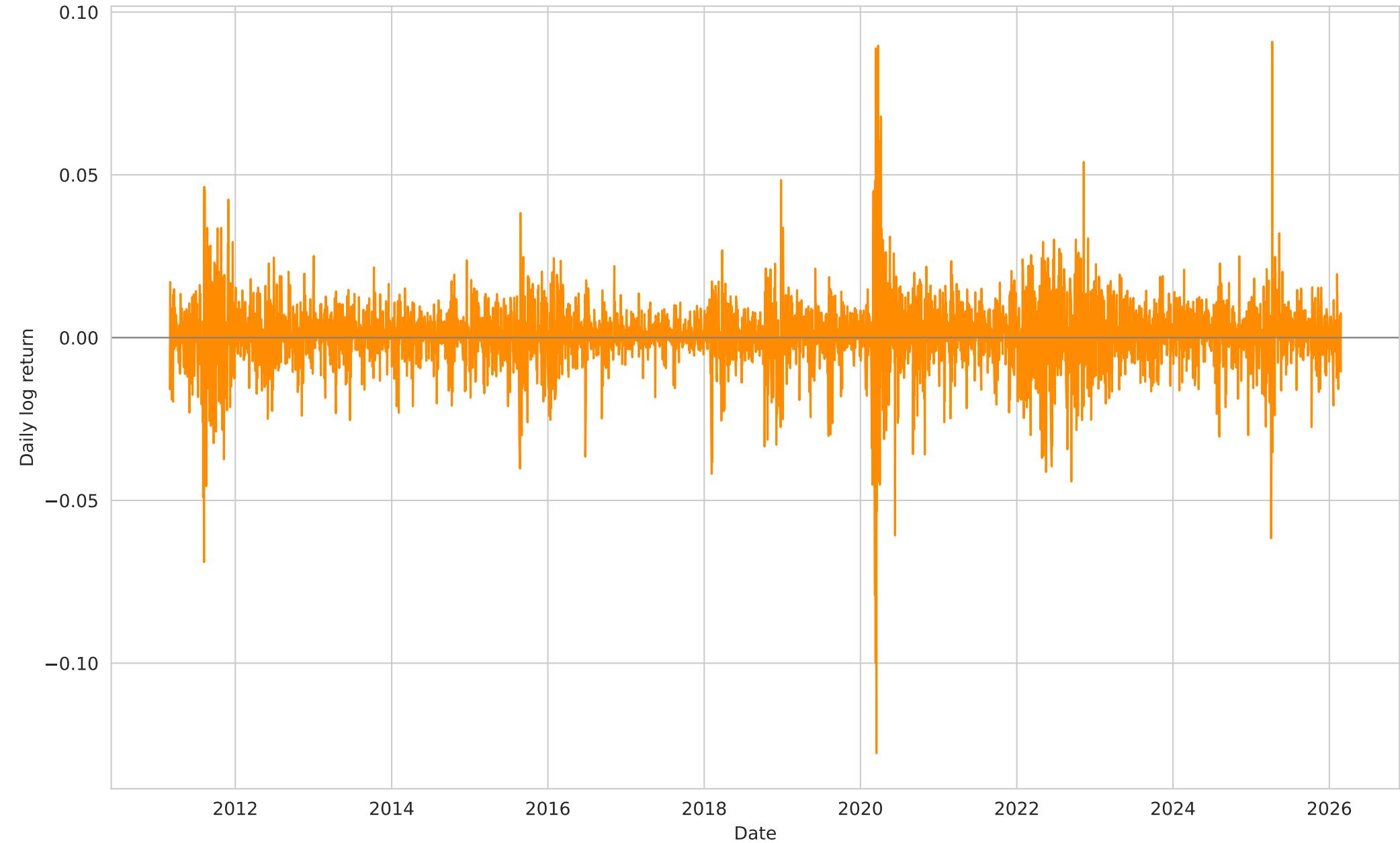
$\wedge$ GSPC • ACF • Price



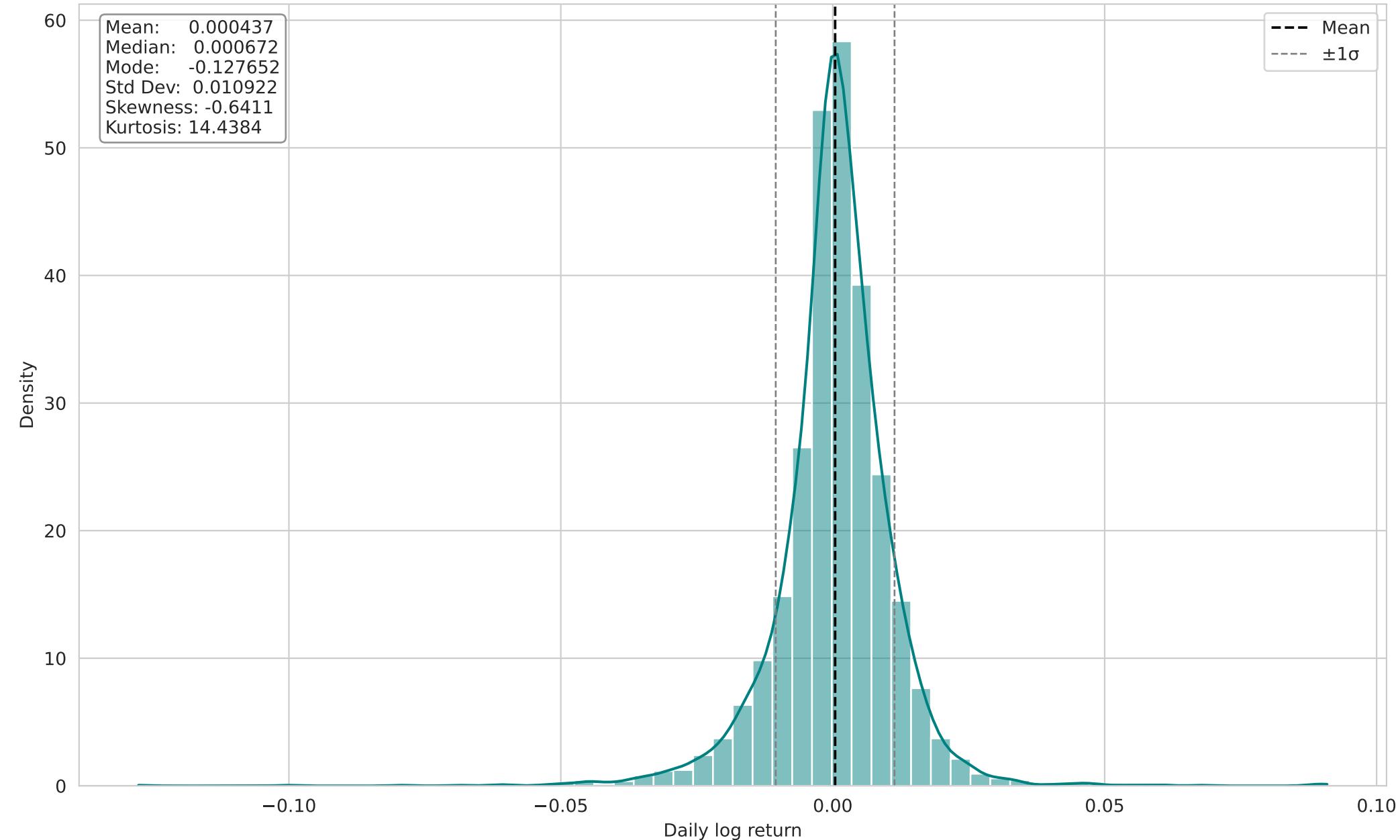
# $\wedge$ GSPC • Moving Averages (5/10/20)



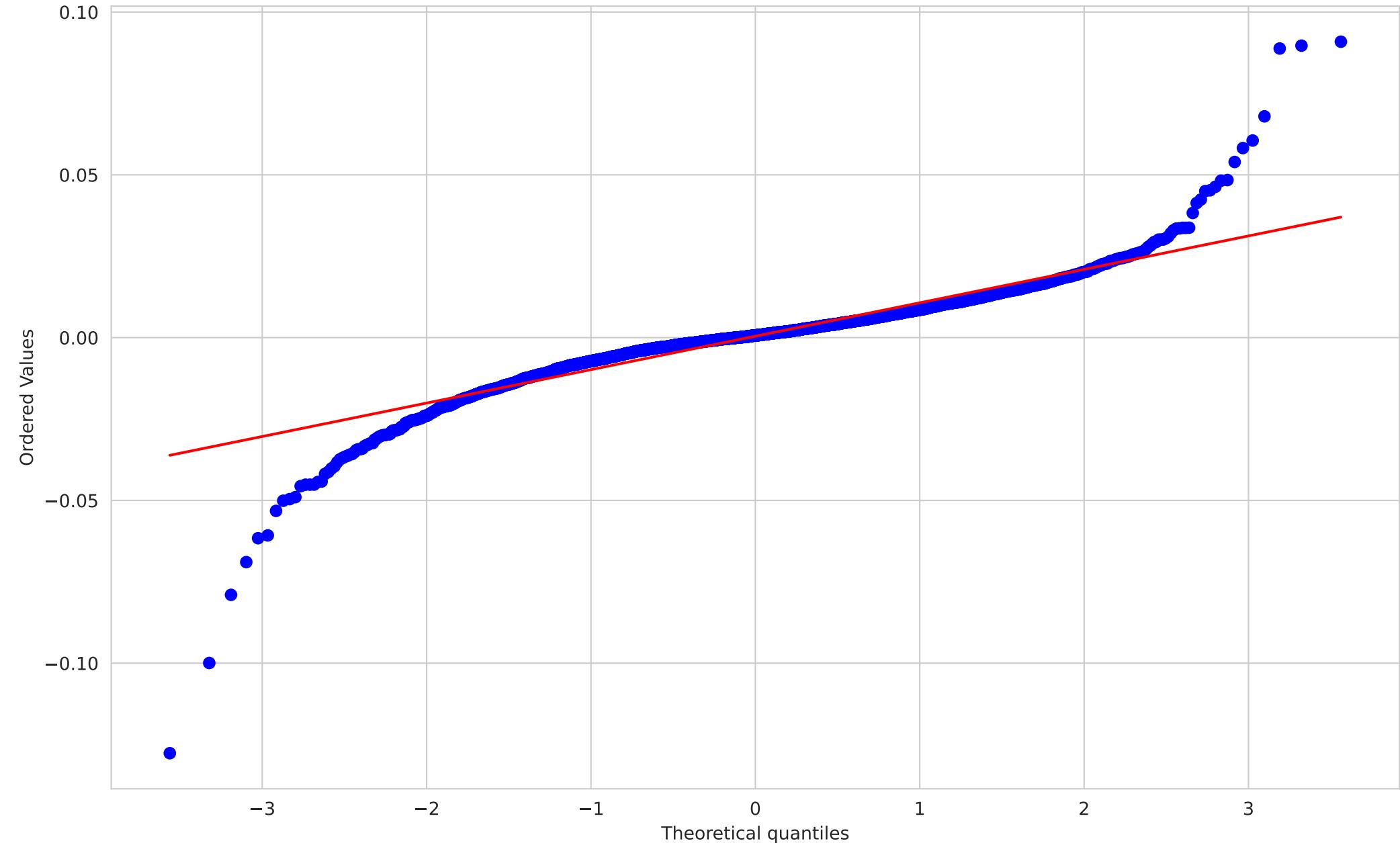
$\wedge$ GSPC • Daily Log Returns



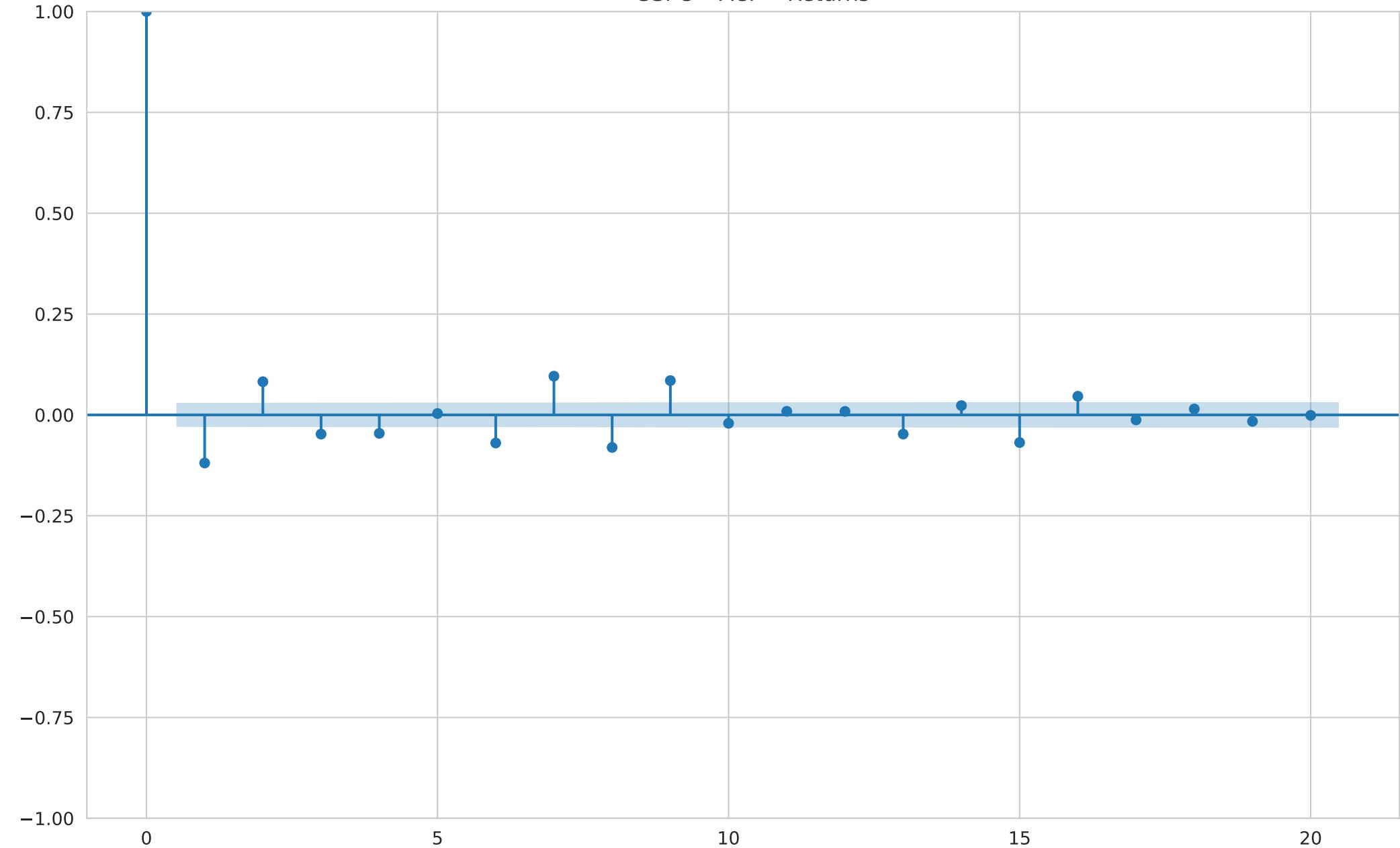
### $^{\wedge}\text{GSPC} \bullet \text{Returns} \bullet \text{Distribution}$



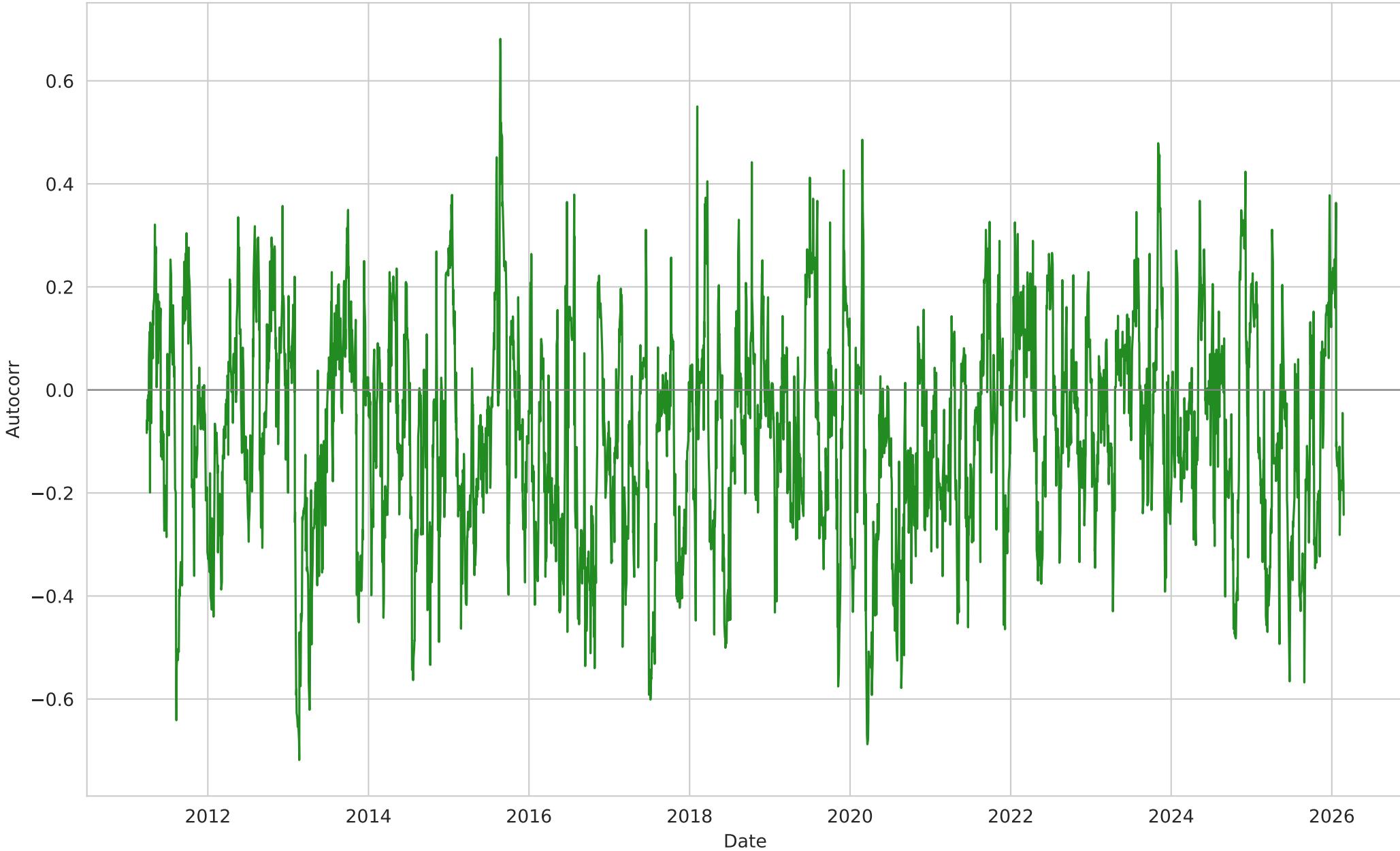
$\wedge$ GSPC • Returns • Q-Q Plot vs Normal



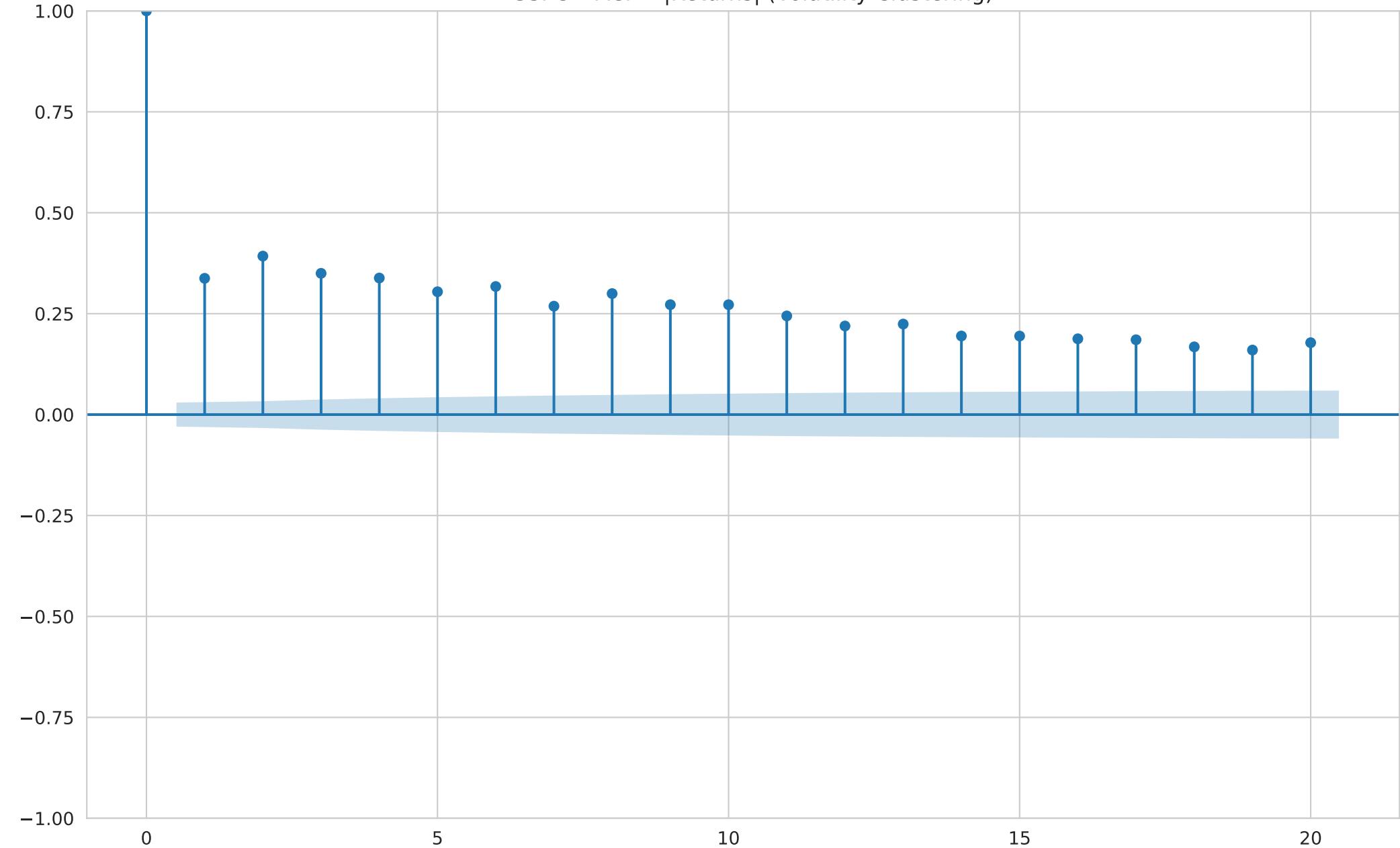
$\wedge$ GSPC • ACF • Returns



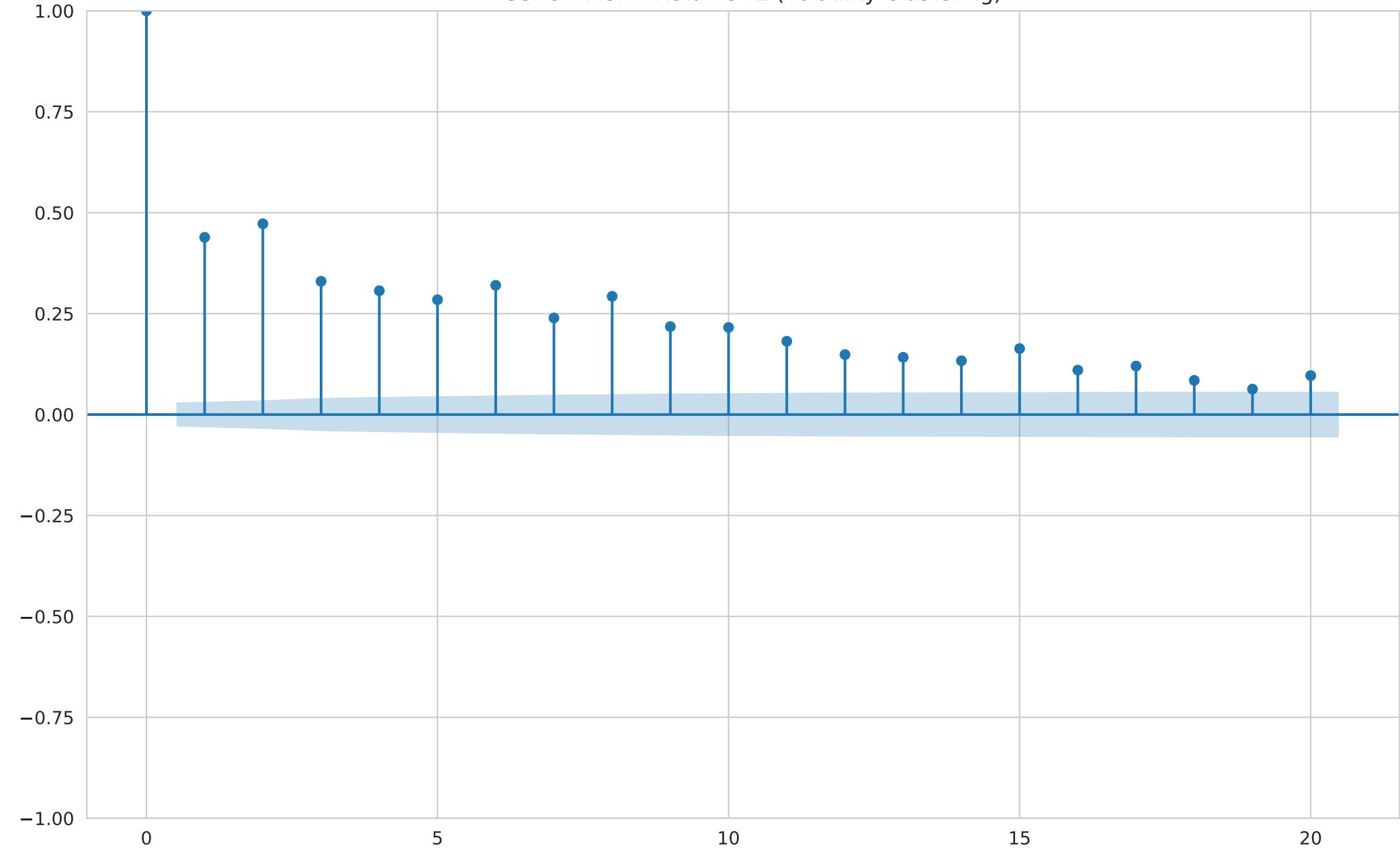
$\wedge$ GSPC • Rolling Autocorrelation (lag=1, window=20)



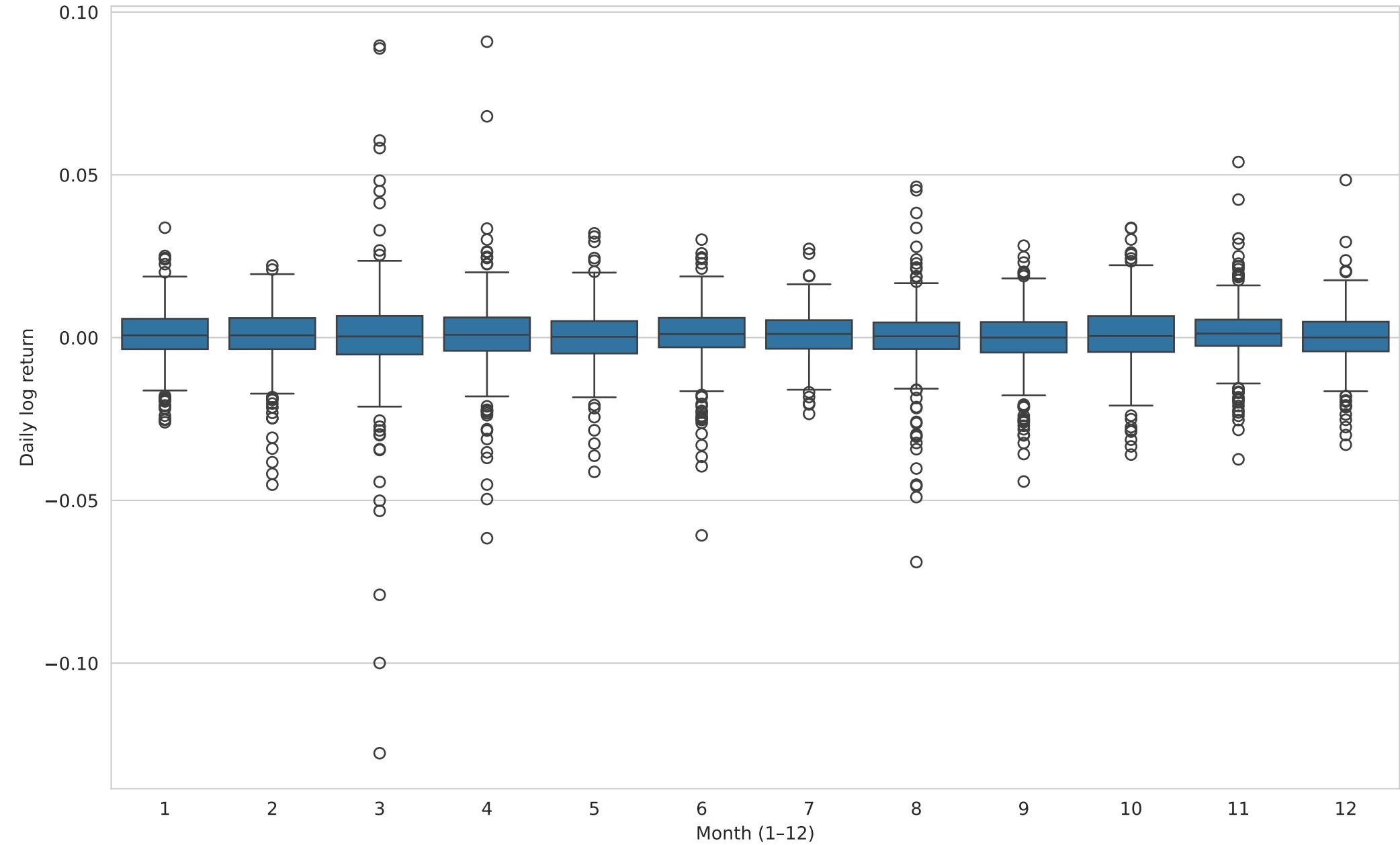
$\wedge$ GSPC • ACF •  $|$ Returns $|$  (Volatility Clustering)



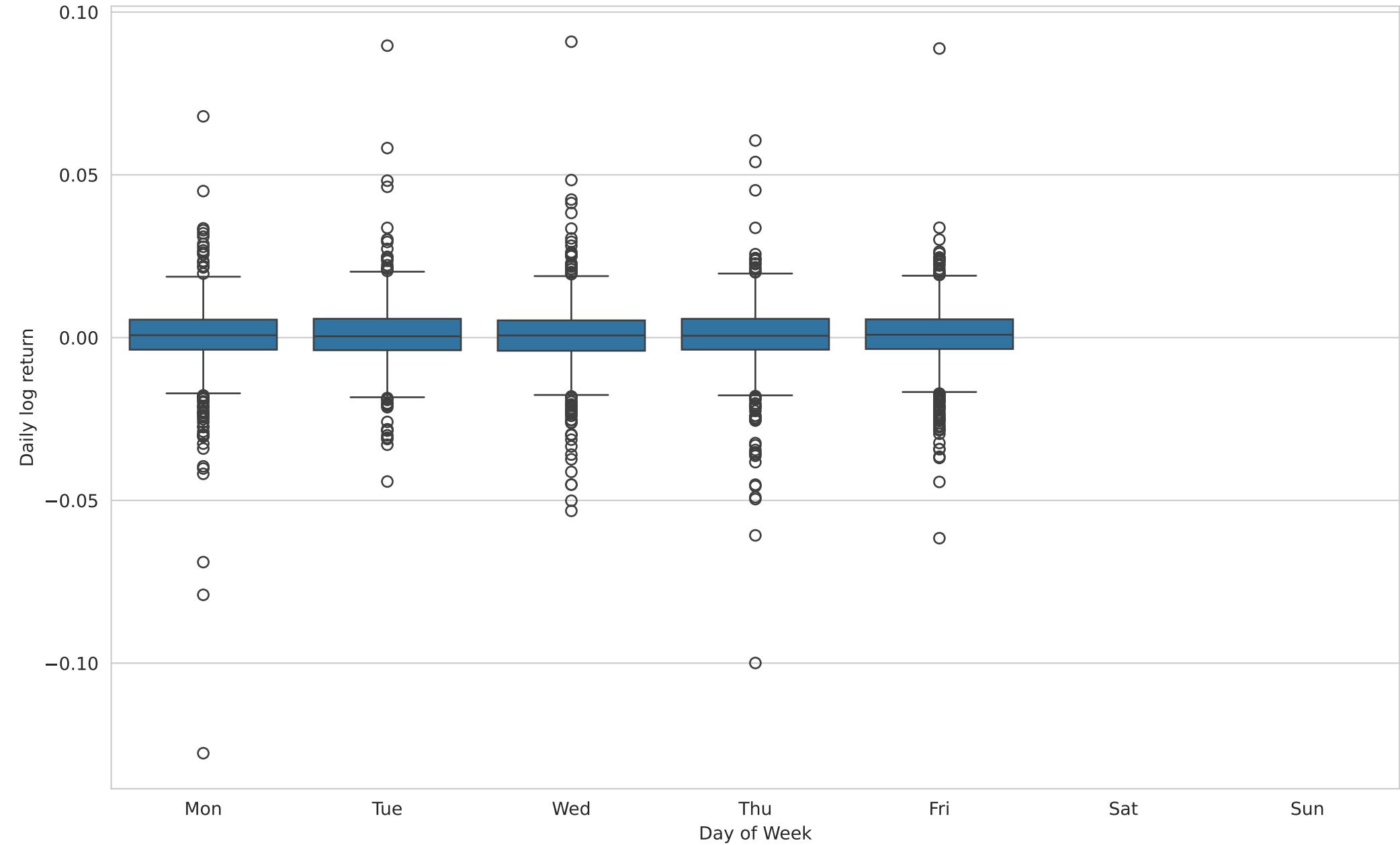
### $\wedge$ GSPC • ACF • Returns $\wedge$ 2 (Volatility Clustering)



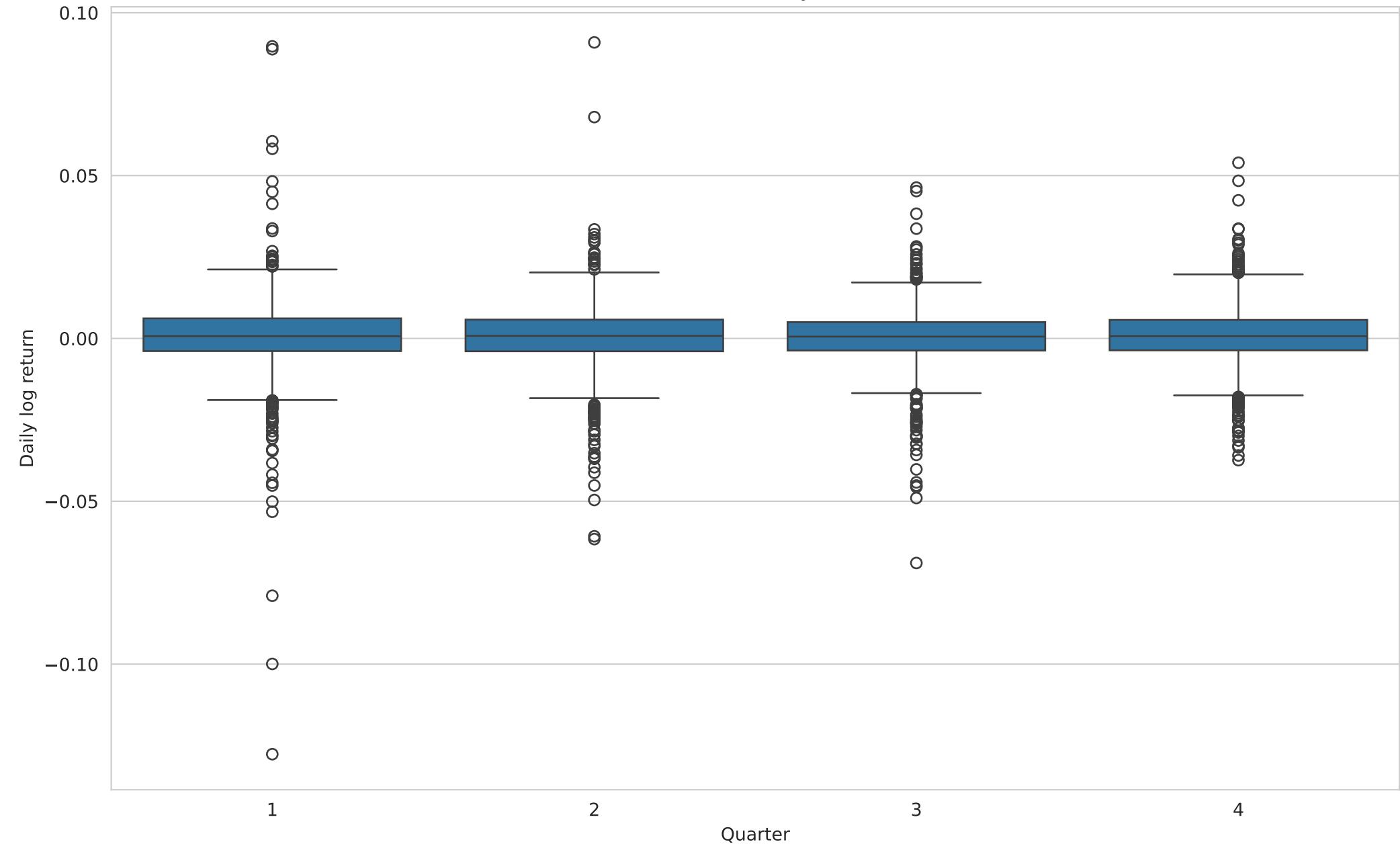
### $\wedge$ GSPC • Monthly Returns



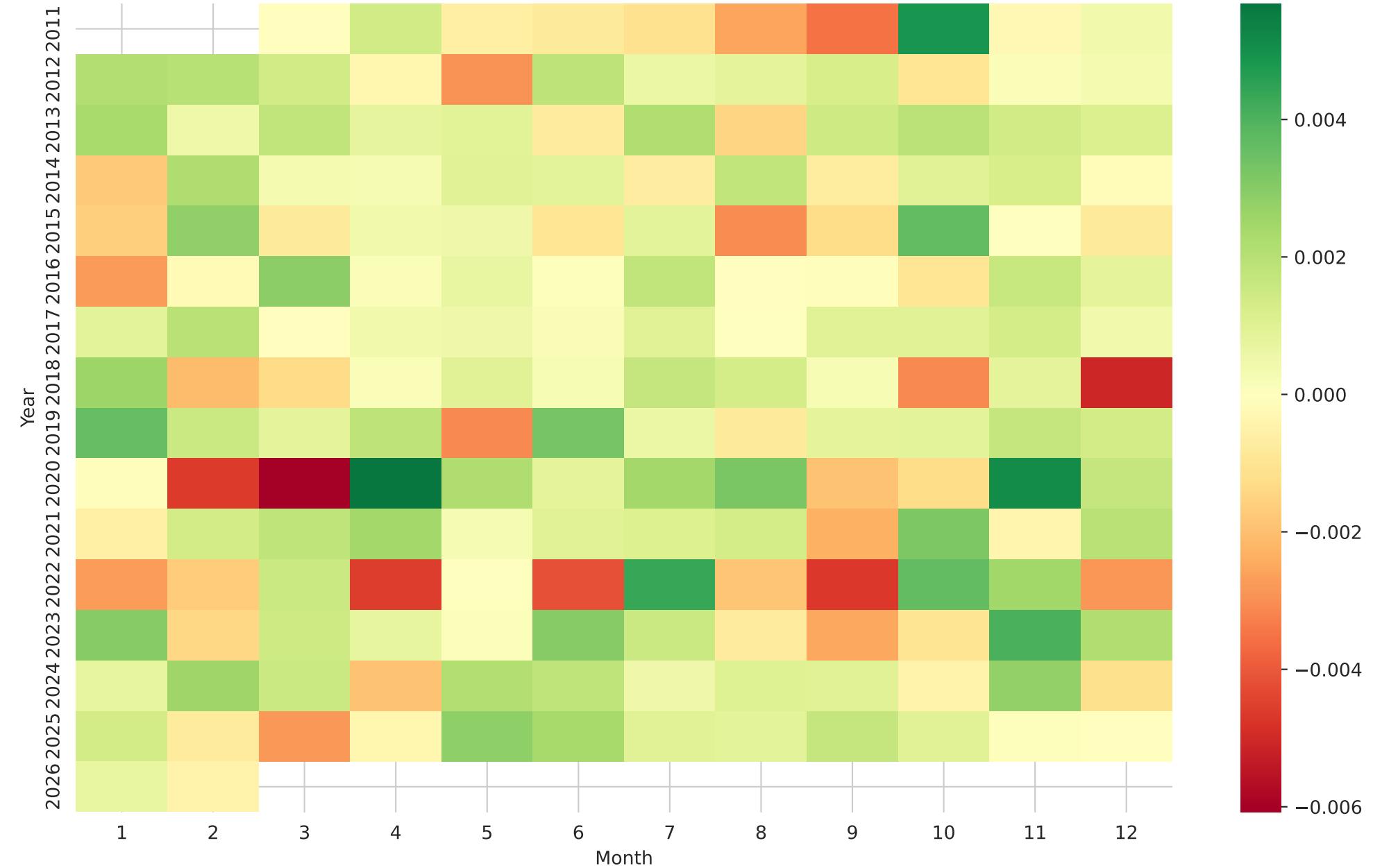
$\wedge$ GSPC • Day-of-Week Returns



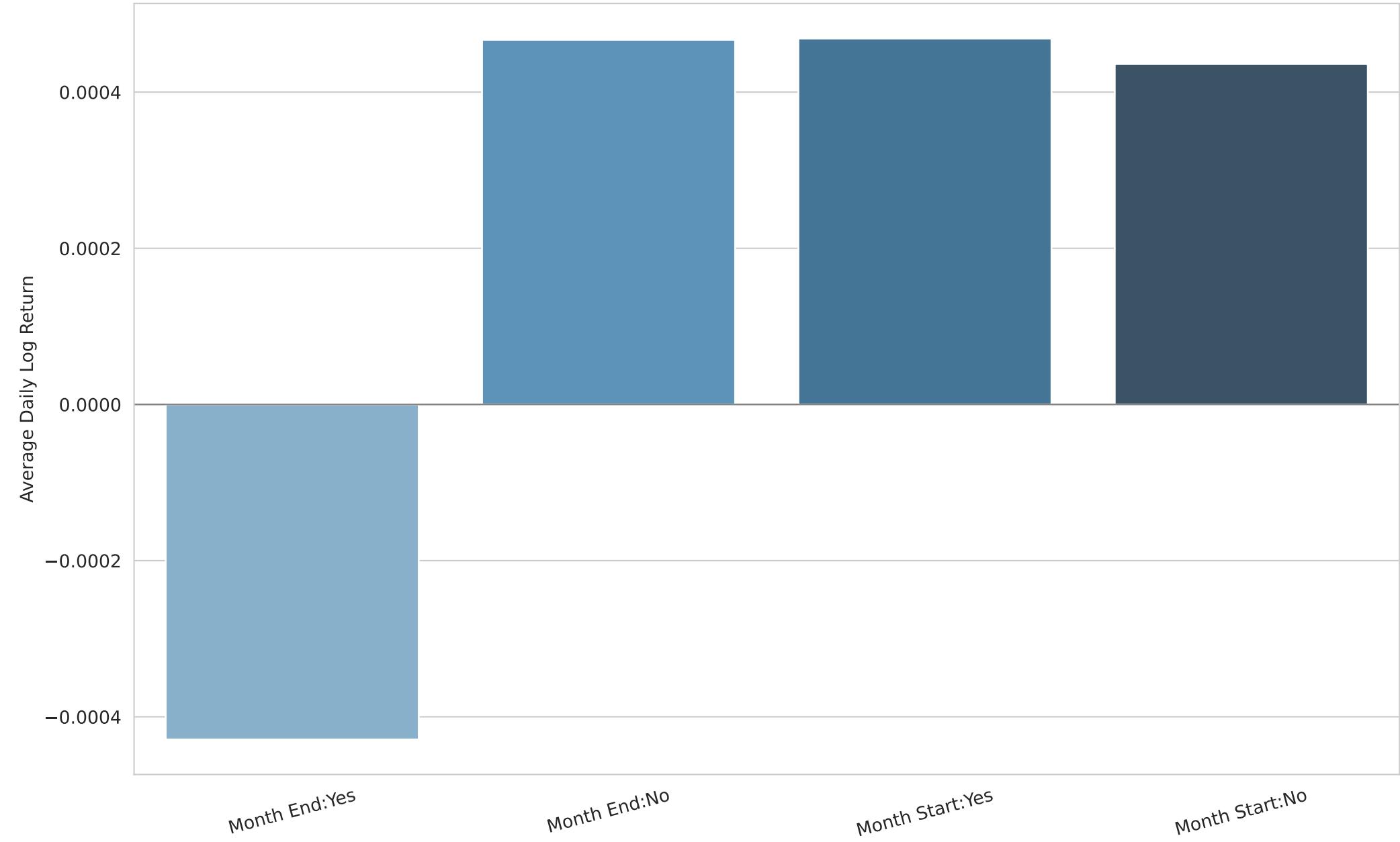
$\wedge$ GSPC • Quarterly Returns



$\wedge$ GSPC • Month×Year Heatmap (Avg Daily Returns)

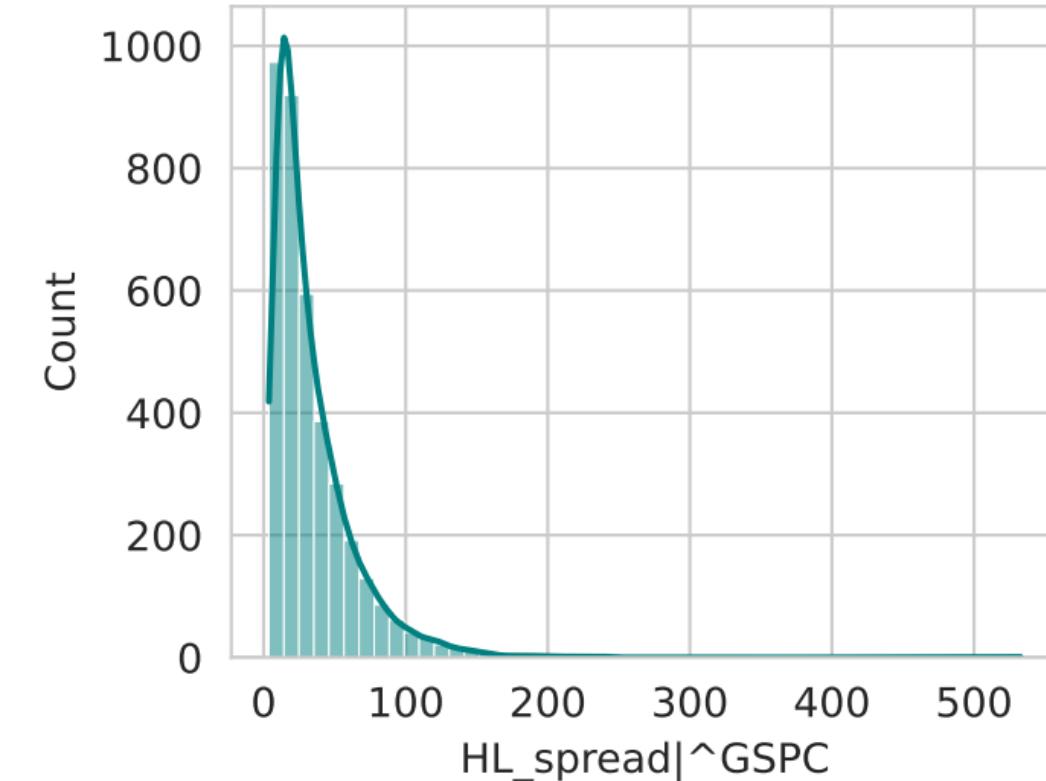


### $\wedge$ GSPC • Avg Returns: Month-End/Start vs Others

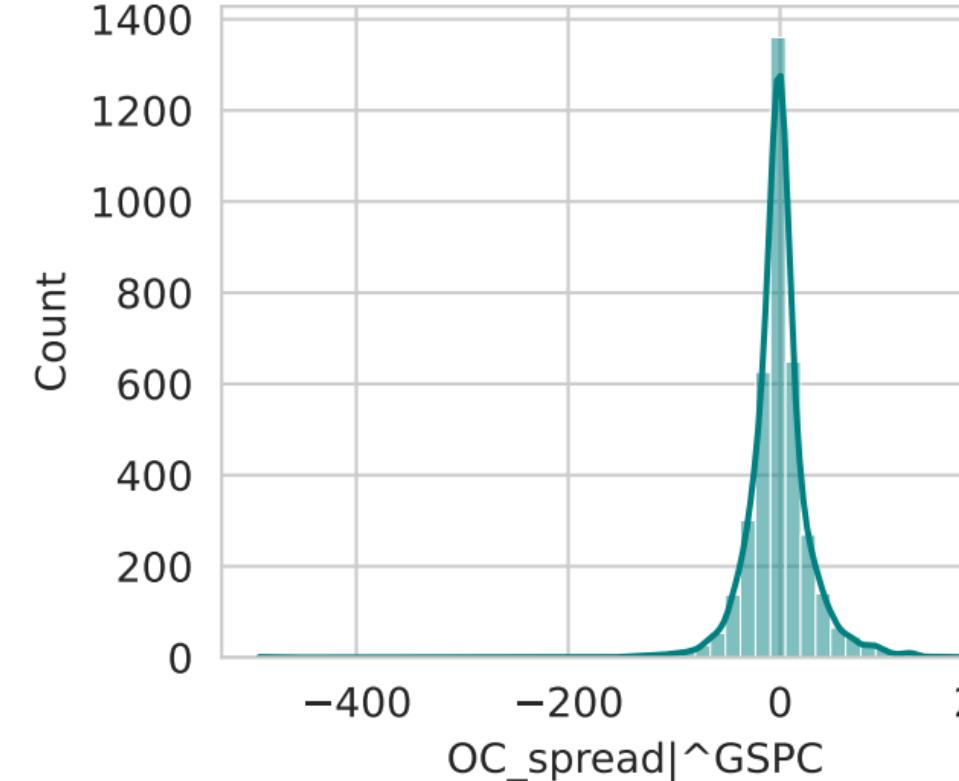


# $\wedge$ GSPC • Spreads

HL\_spread| $\wedge$ GSPC

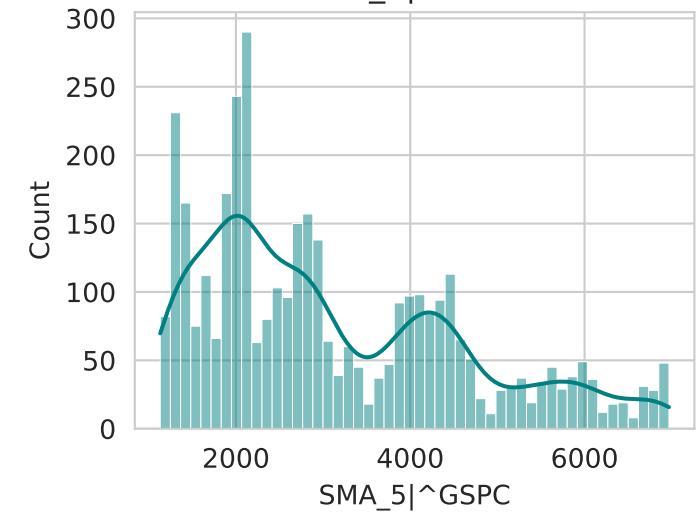


OC\_spread| $\wedge$ GSPC

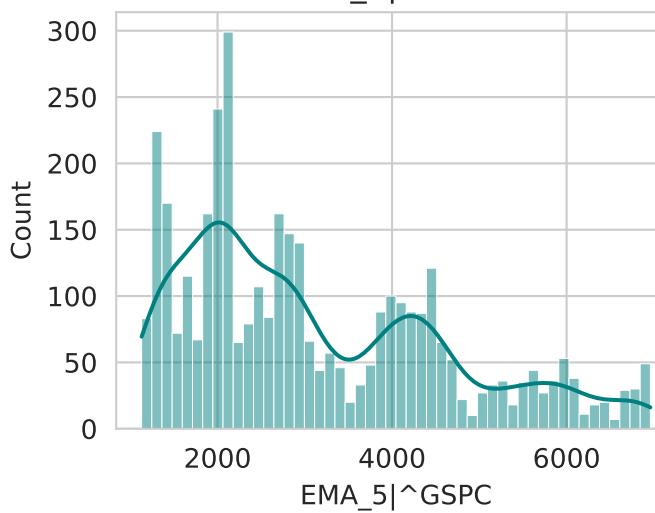


# $\wedge$ GSPC • Moving Averages / EMAs

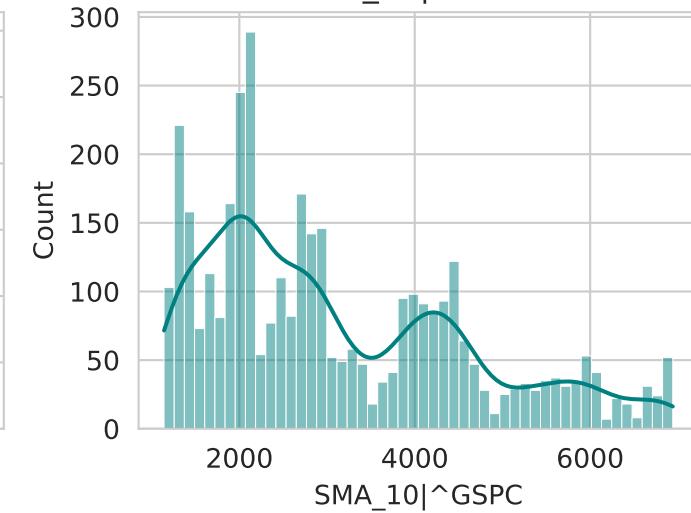
SMA\_5| $\wedge$ GSPC



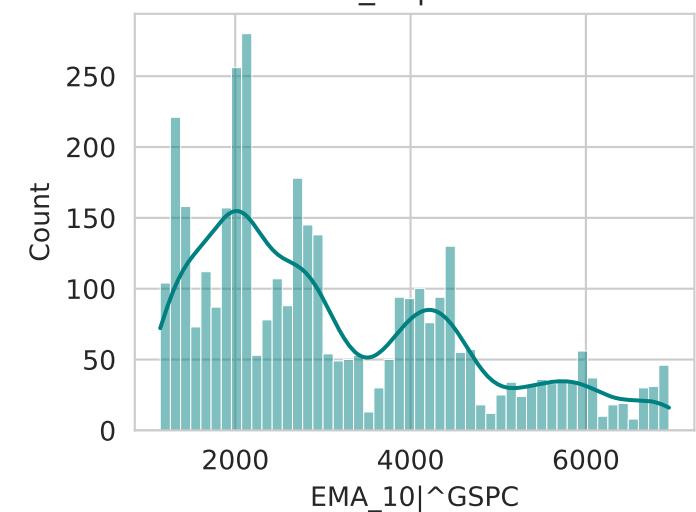
EMA\_5| $\wedge$ GSPC



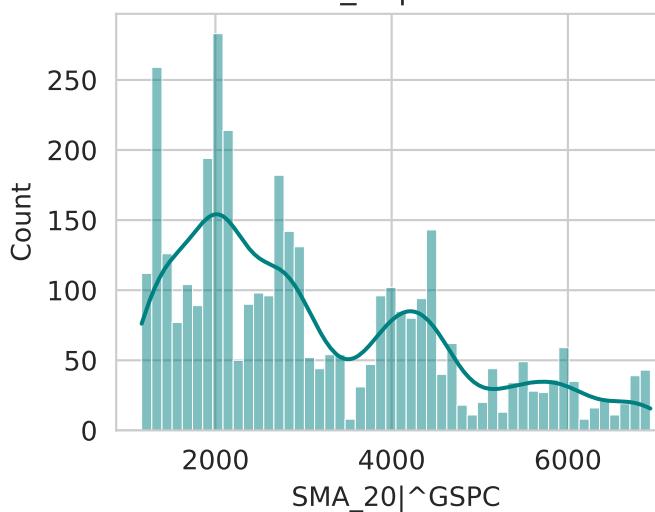
SMA\_10| $\wedge$ GSPC



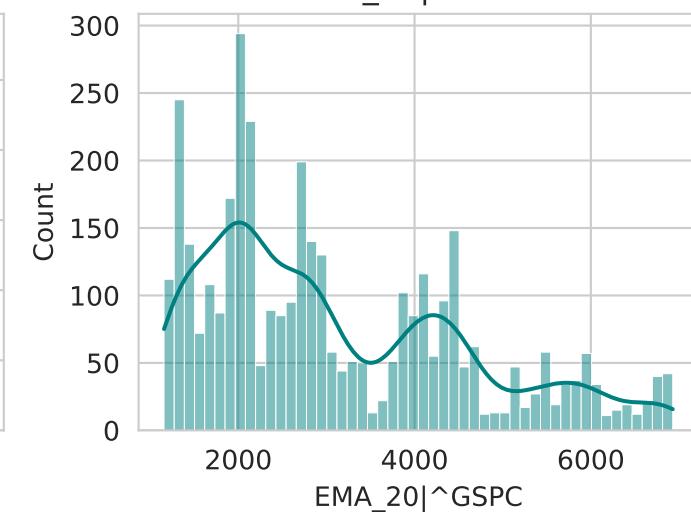
EMA\_10| $\wedge$ GSPC



SMA\_20| $\wedge$ GSPC

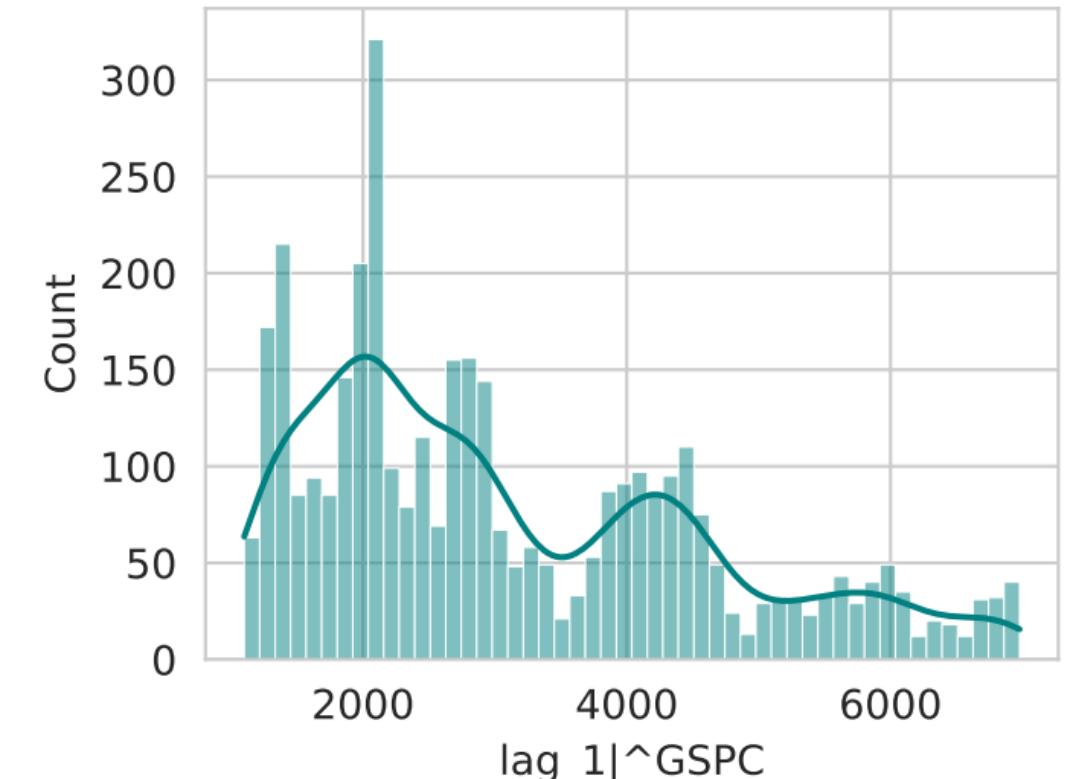


EMA\_20| $\wedge$ GSPC

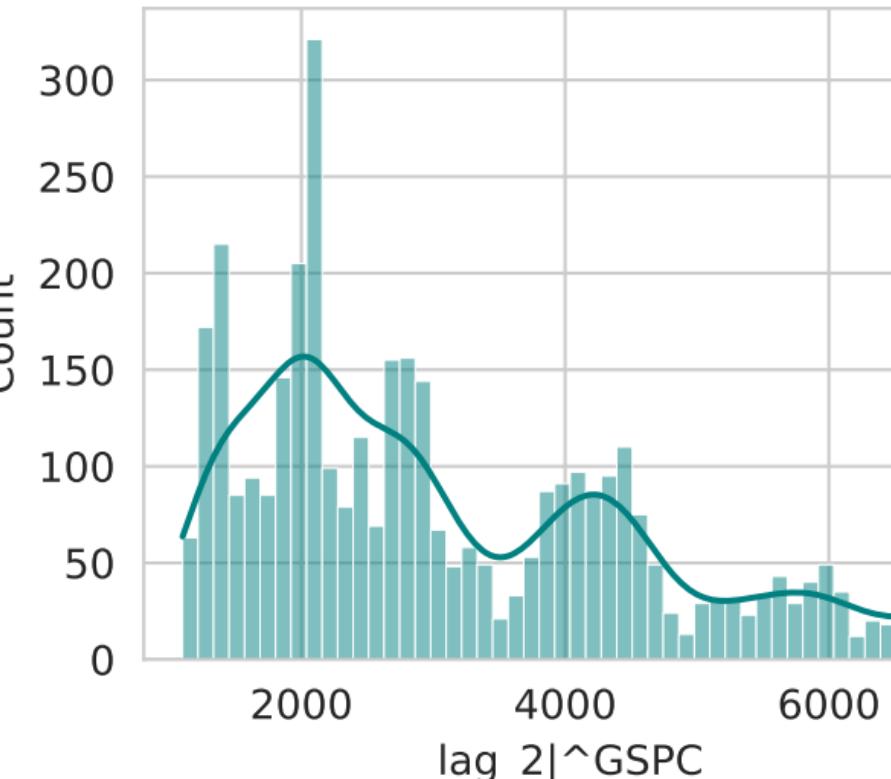


# $\wedge$ GSPC • Lagged Prices

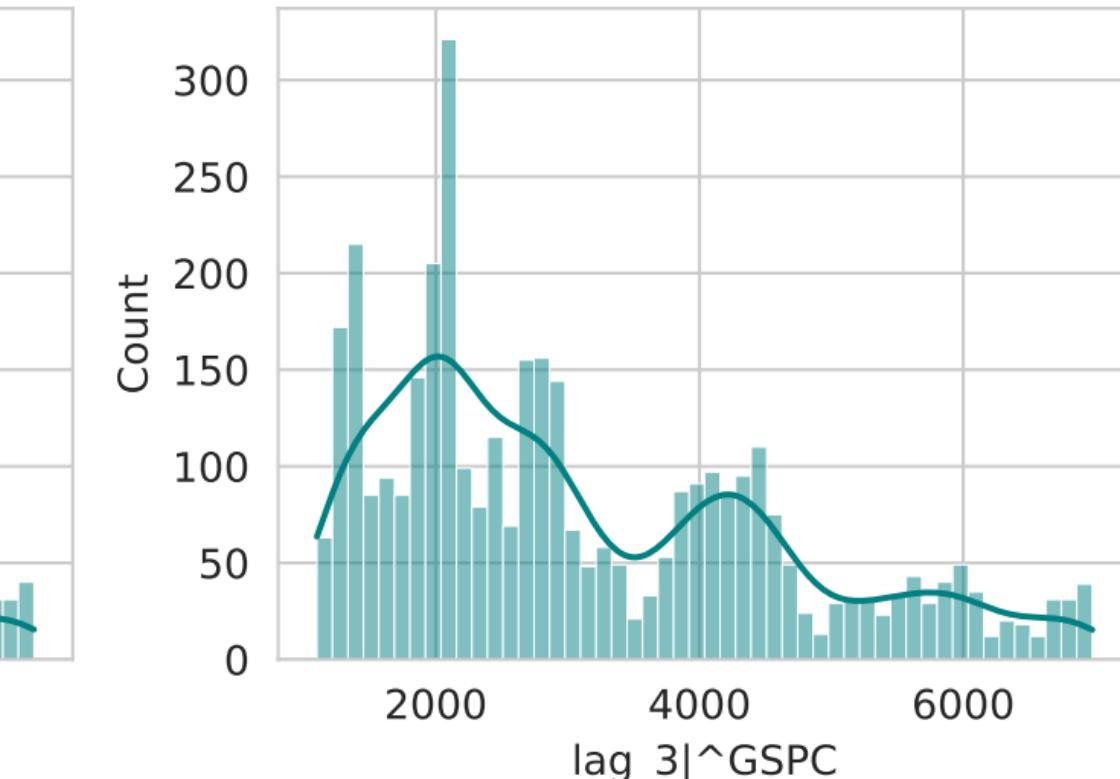
lag\_1| $\wedge$ GSPC



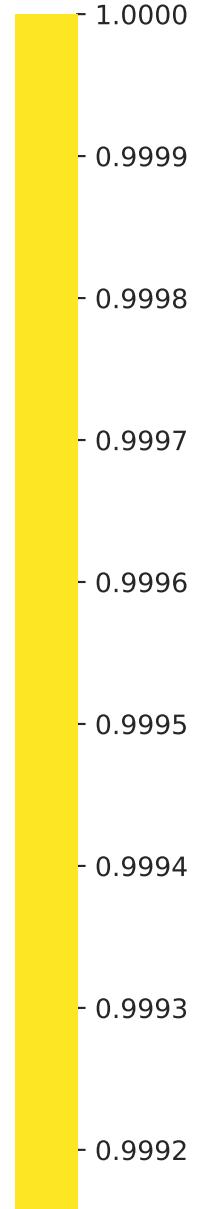
lag\_2| $\wedge$ GSPC



lag\_3| $\wedge$ GSPC



### $\wedge$ GSPC • Correlation • Moving Averages



	SMA_5  $\wedge$ GSPC	EMA_5  $\wedge$ GSPC	SMA_10  $\wedge$ GSPC	EMA_10  $\wedge$ GSPC	SMA_20  $\wedge$ GSPC	EMA_20  $\wedge$ GSPC
SMA_5  $\wedge$ GSPC	1.00	1.00	1.00	1.00	1.00	1.00
EMA_5  $\wedge$ GSPC	1.00	1.00	1.00	1.00	1.00	1.00
SMA_10  $\wedge$ GSPC	1.00	1.00	1.00	1.00	1.00	1.00
EMA_10  $\wedge$ GSPC	1.00	1.00	1.00	1.00	1.00	1.00
SMA_20  $\wedge$ GSPC	1.00	1.00	1.00	1.00	1.00	1.00
EMA_20  $\wedge$ GSPC	1.00	1.00	1.00	1.00	1.00	1.00

### $\wedge$ GSPC • Correlation • Spreads + Lags

HL\_spread| $\wedge$ GSPC

1.00

0.08

0.51

0.51

0.51

OC\_spread| $\wedge$ GSPC

0.08

1.00

0.01

0.01

0.01

lag\_1| $\wedge$ GSPC

0.51

0.01

1.00

1.00

1.00

lag\_2| $\wedge$ GSPC

0.51

0.01

1.00

1.00

1.00

lag\_3| $\wedge$ GSPC

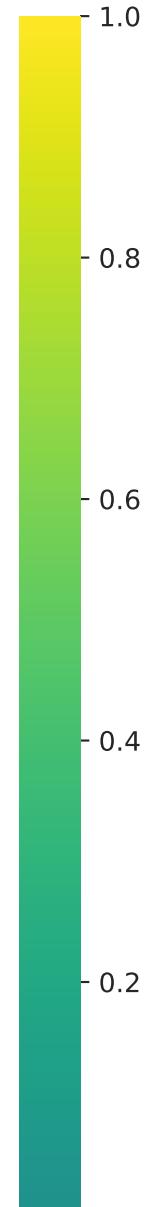
0.51

0.01

1.00

1.00

1.00



HL\_spread| $\wedge$ GSPC

OC\_spread| $\wedge$ GSPC

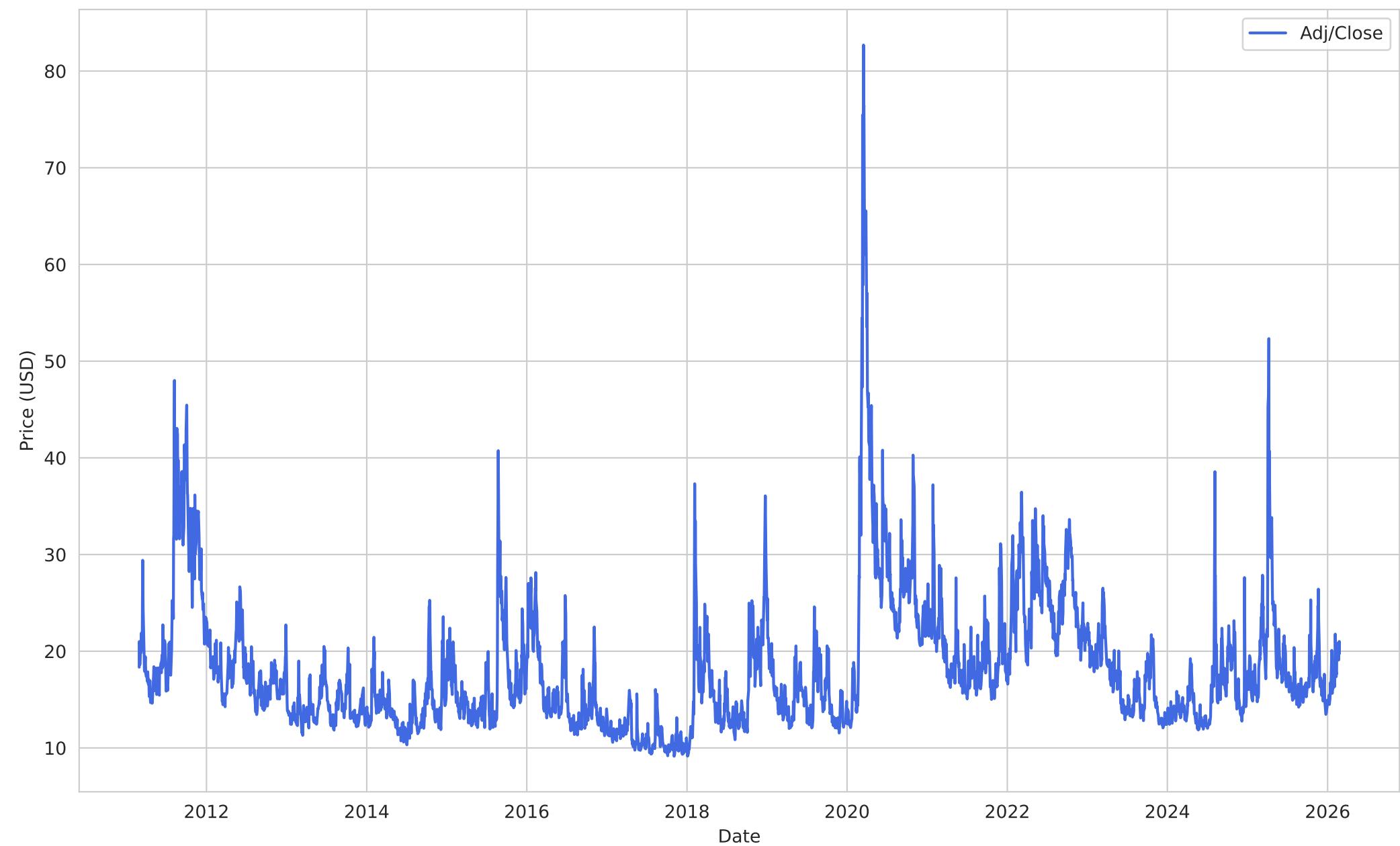
lag\_1| $\wedge$ GSPC

lag\_2| $\wedge$ GSPC

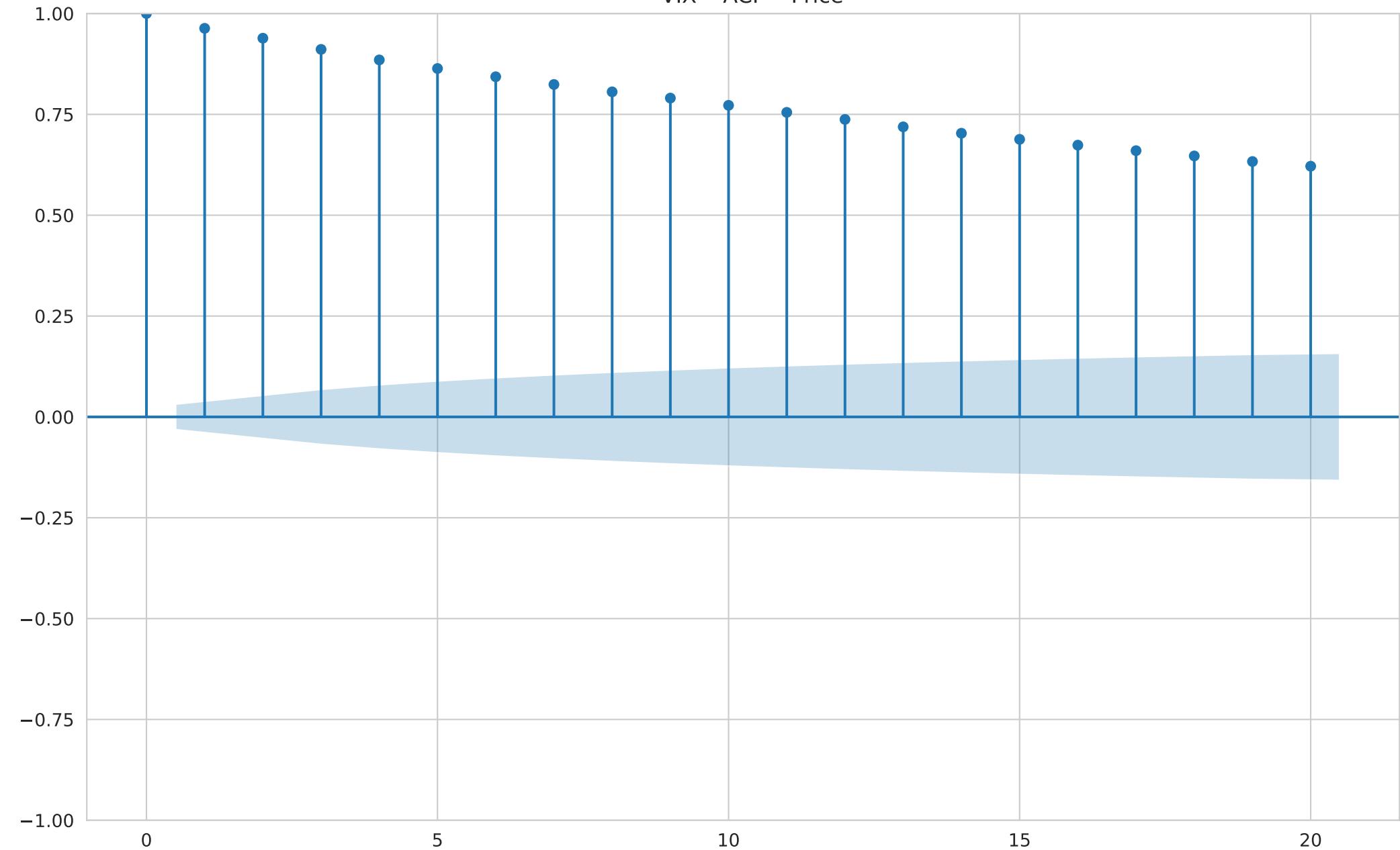
lag\_3| $\wedge$ GSPC

# $\wedge$ VIX • Price

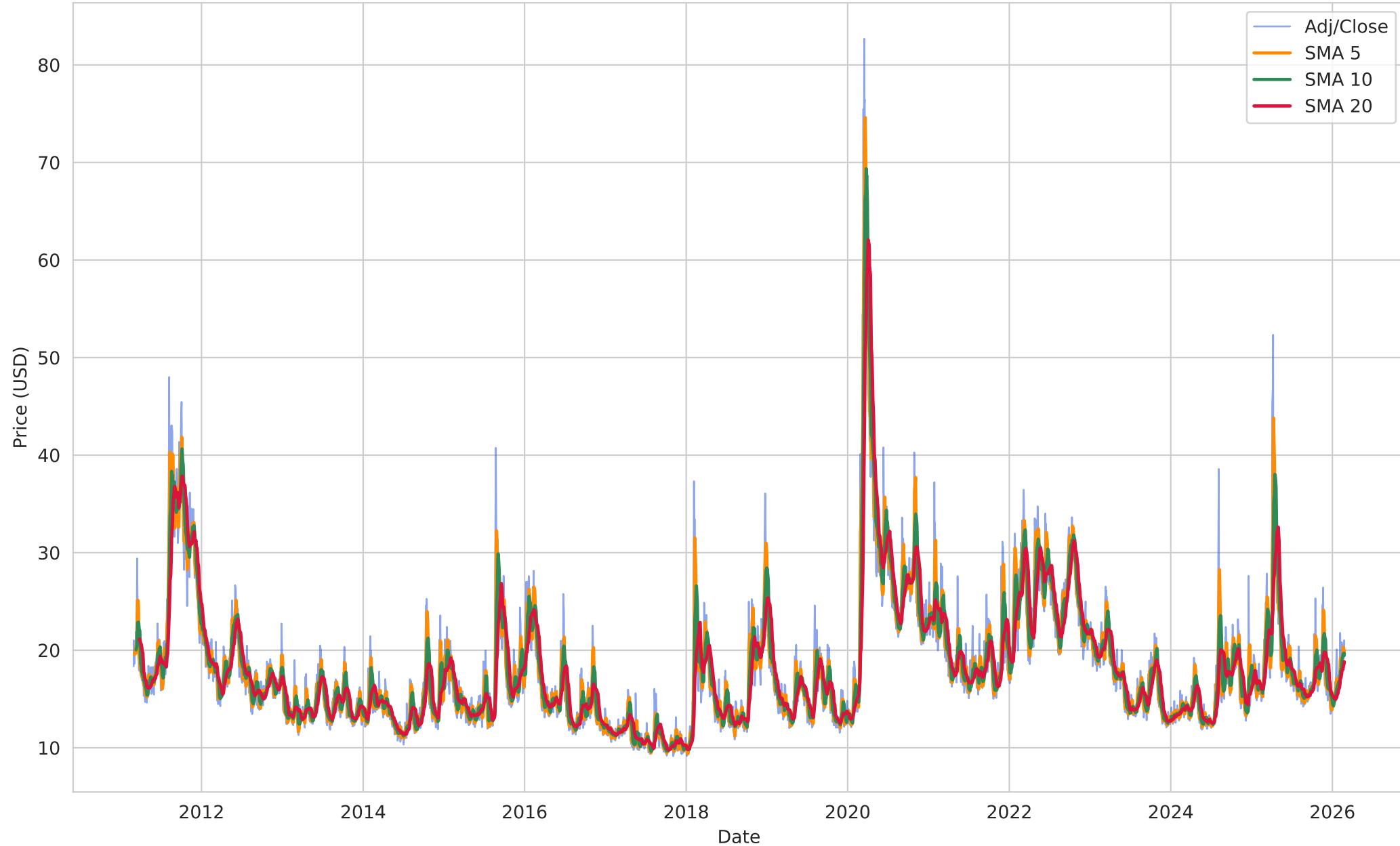
Adj/Close



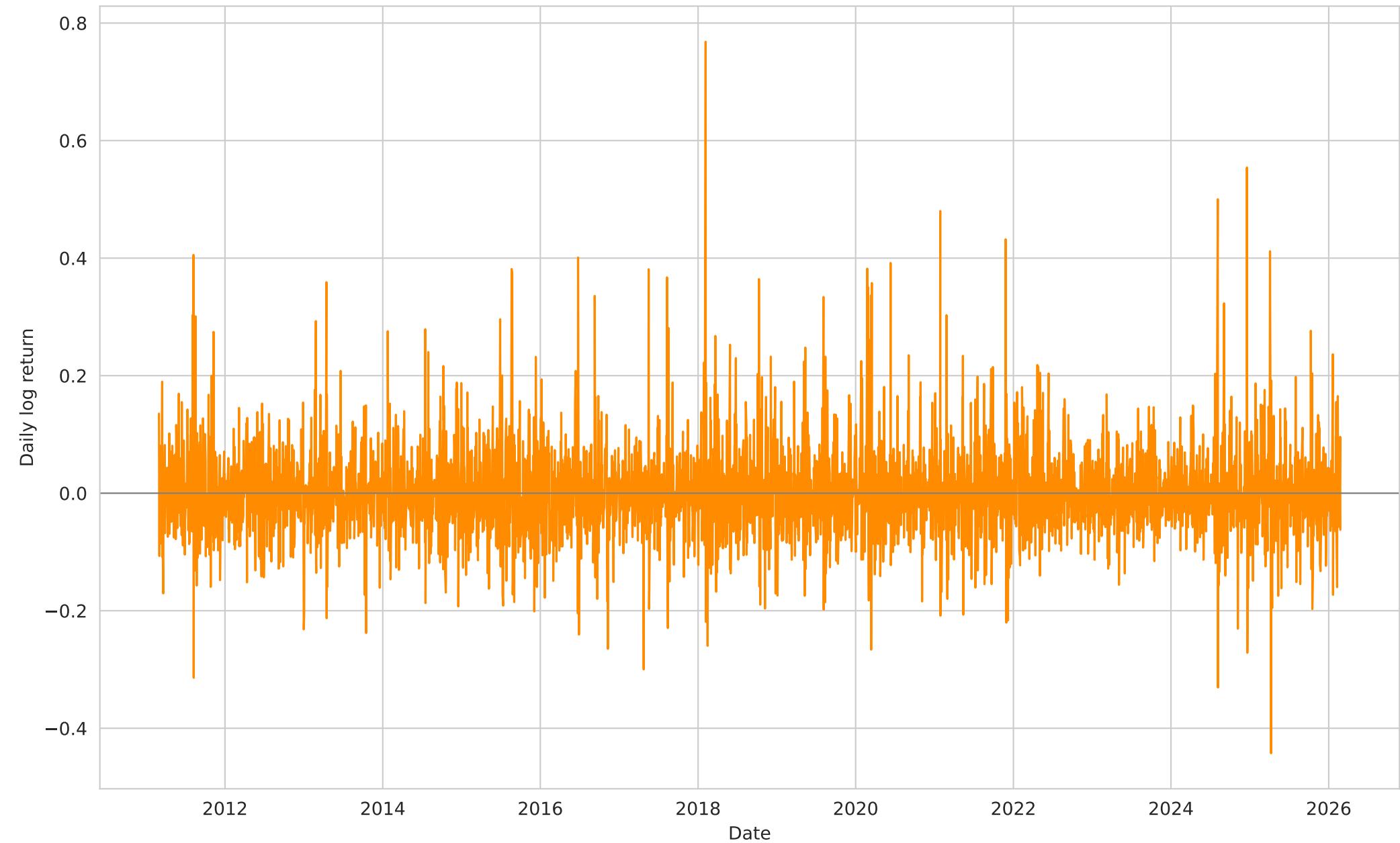
$\wedge$ VIX • ACF • Price



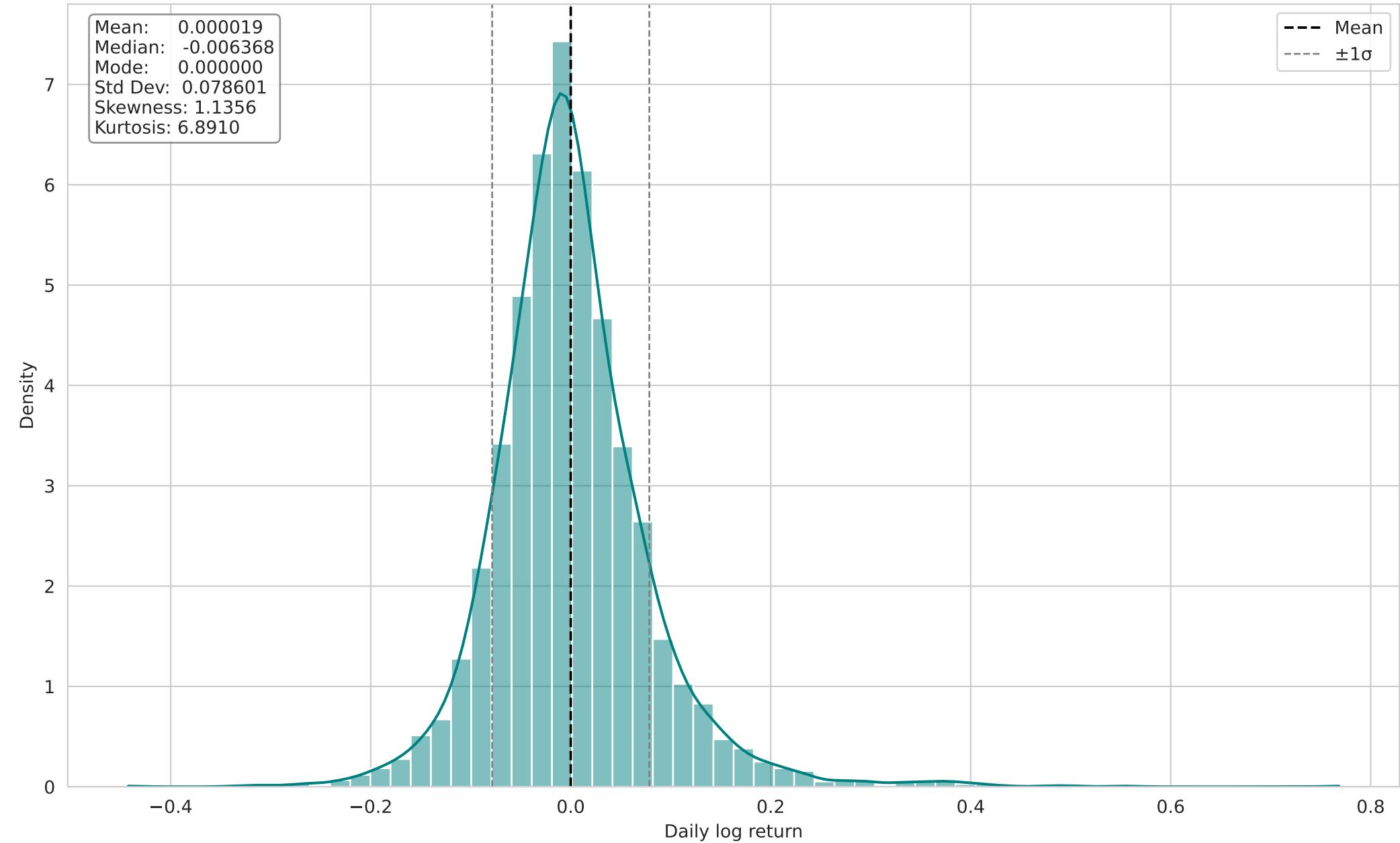
# $\wedge$ VIX • Moving Averages (5/10/20)



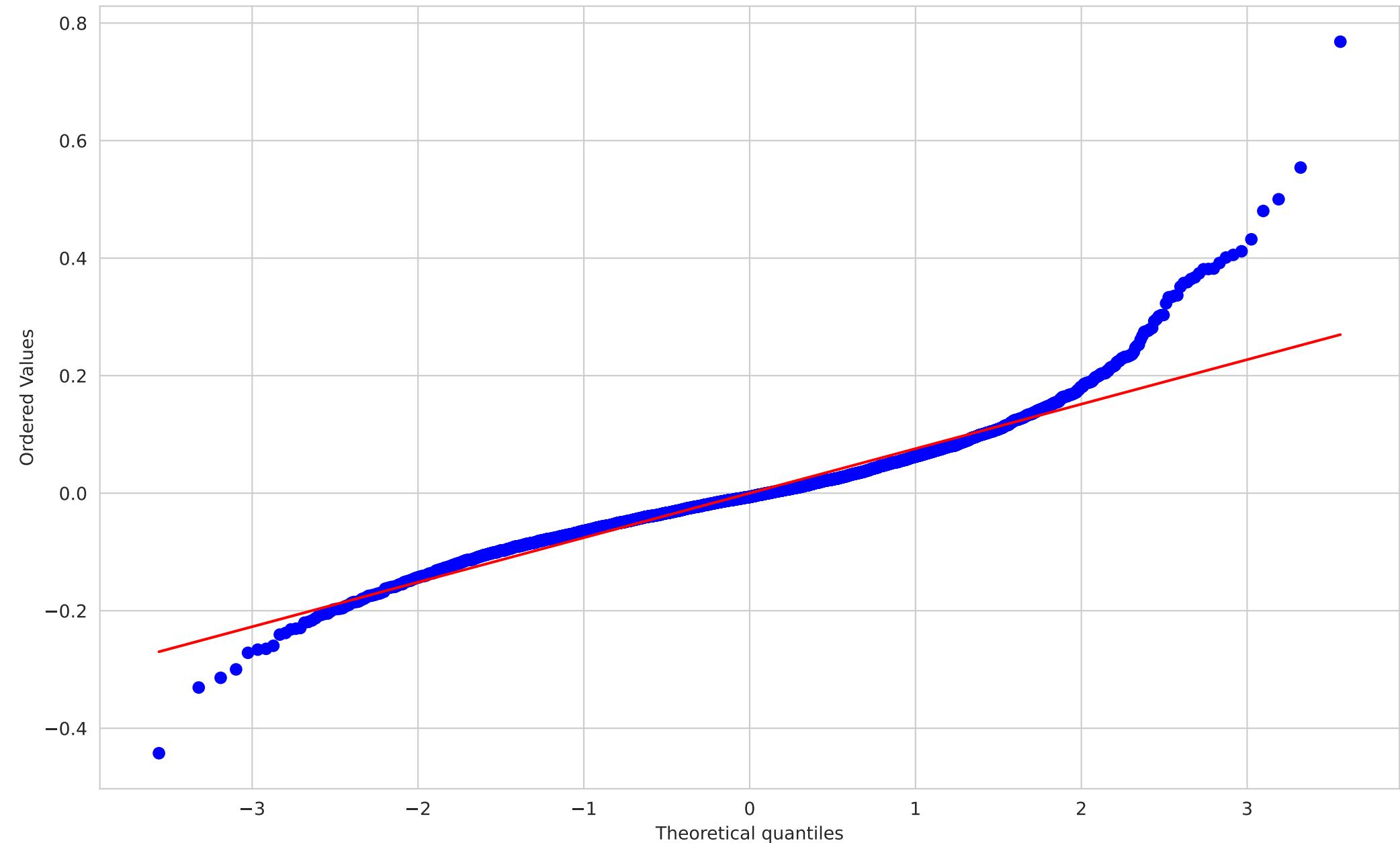
# $\wedge$ VIX • Daily Log Returns



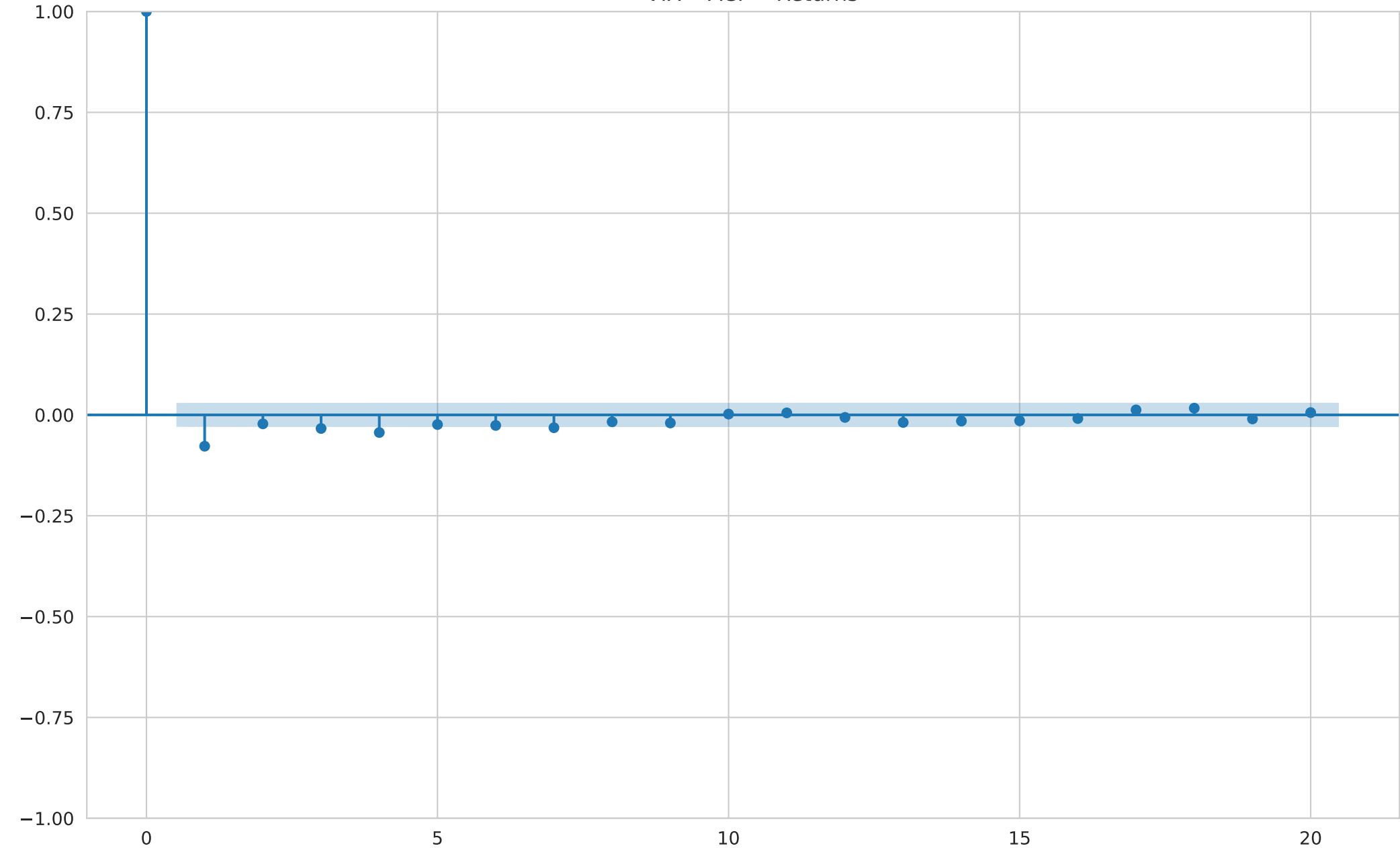
### $^{\wedge}\text{VIX} \bullet \text{Returns} \bullet \text{Distribution}$



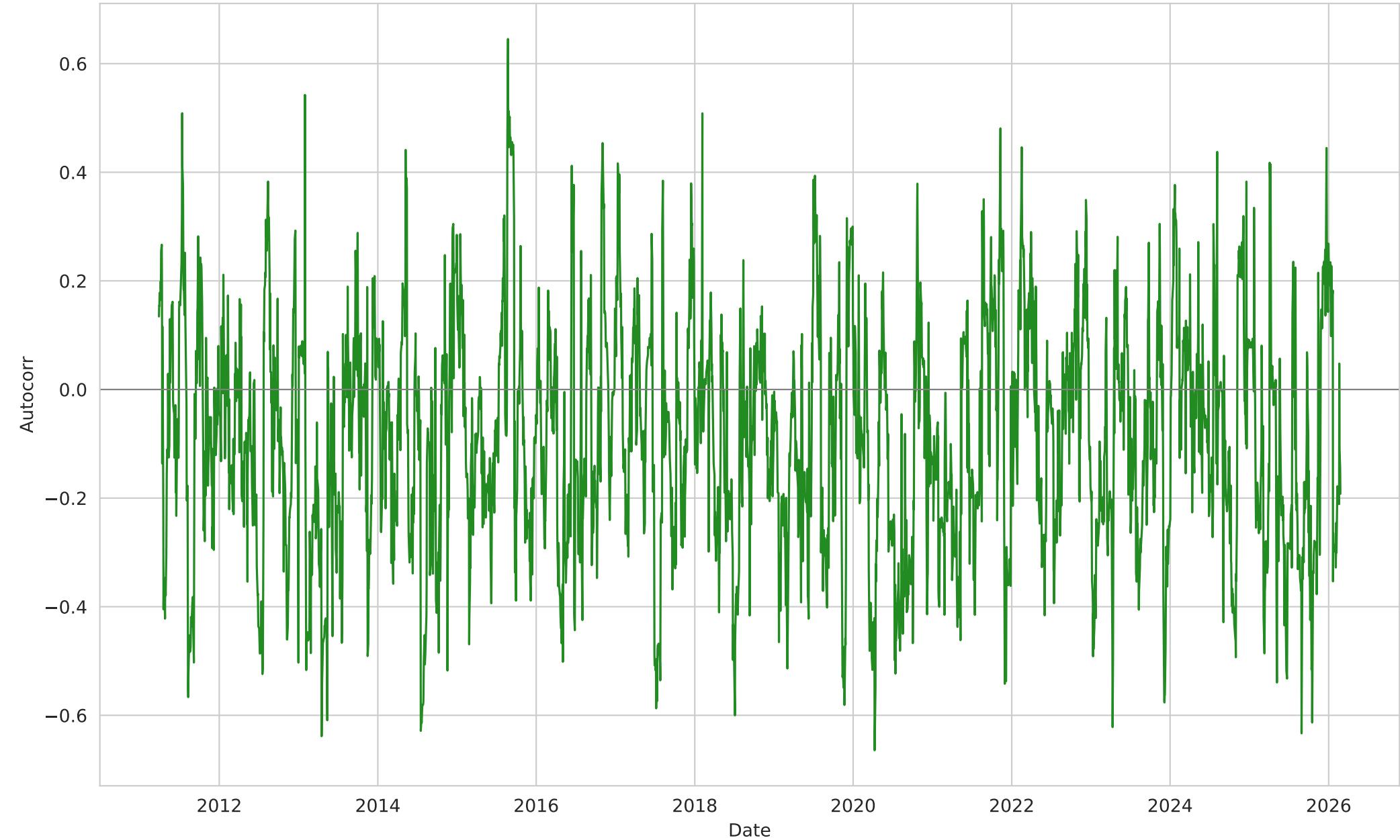
### $\wedge$ VIX • Returns • Q-Q Plot vs Normal



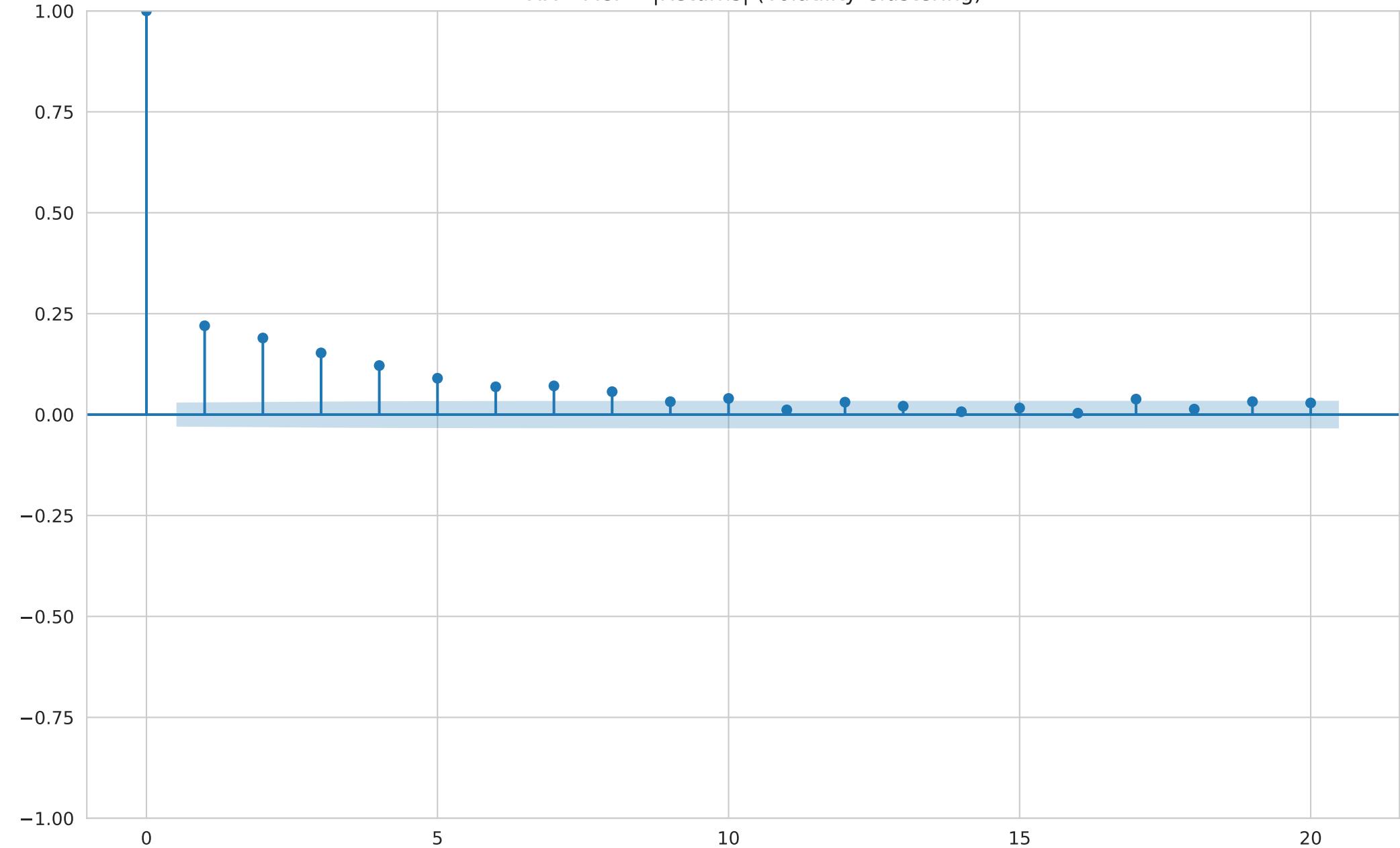
$\wedge$ VIX • ACF • Returns



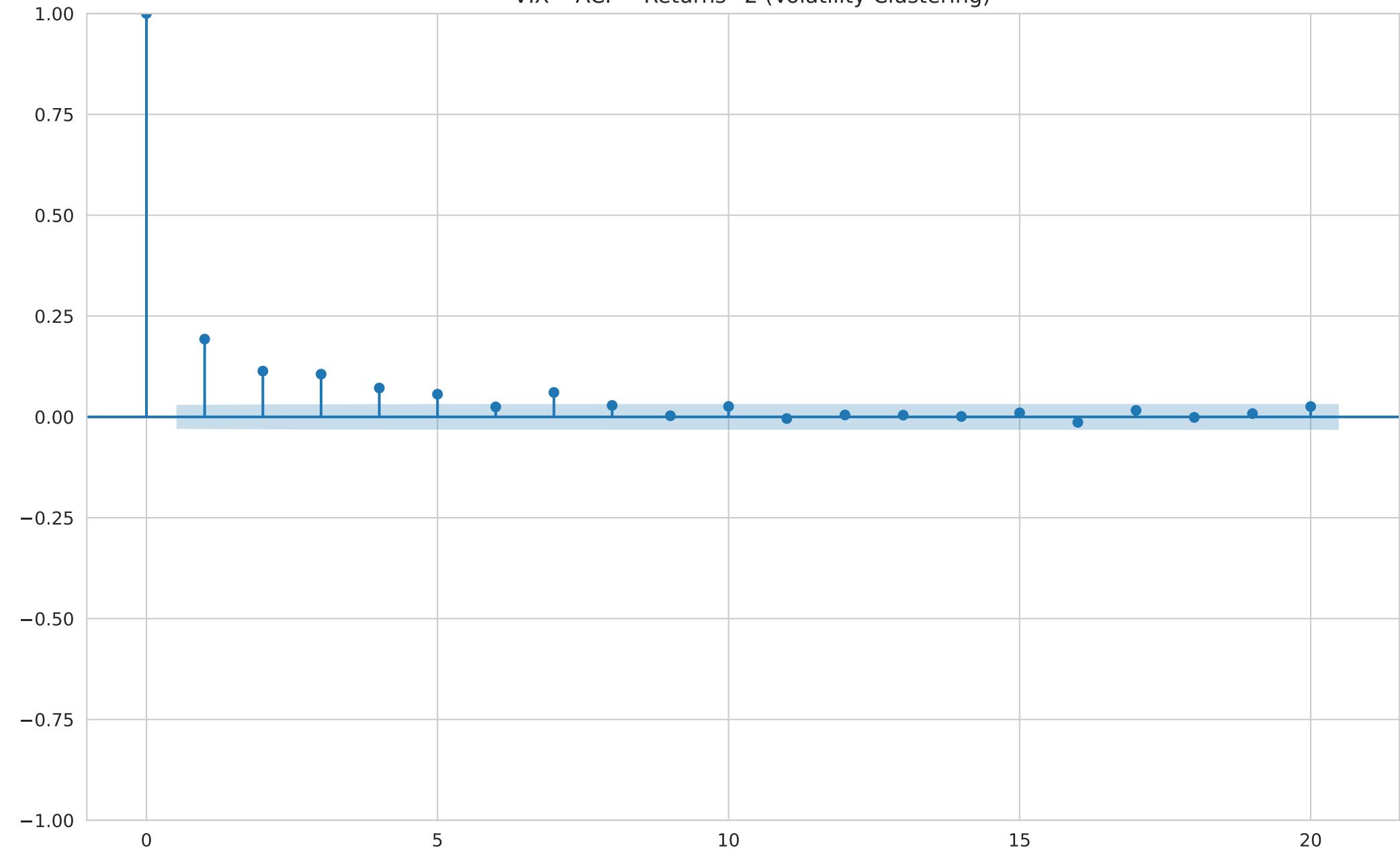
$\wedge$ VIX • Rolling Autocorrelation (lag=1, window=20)



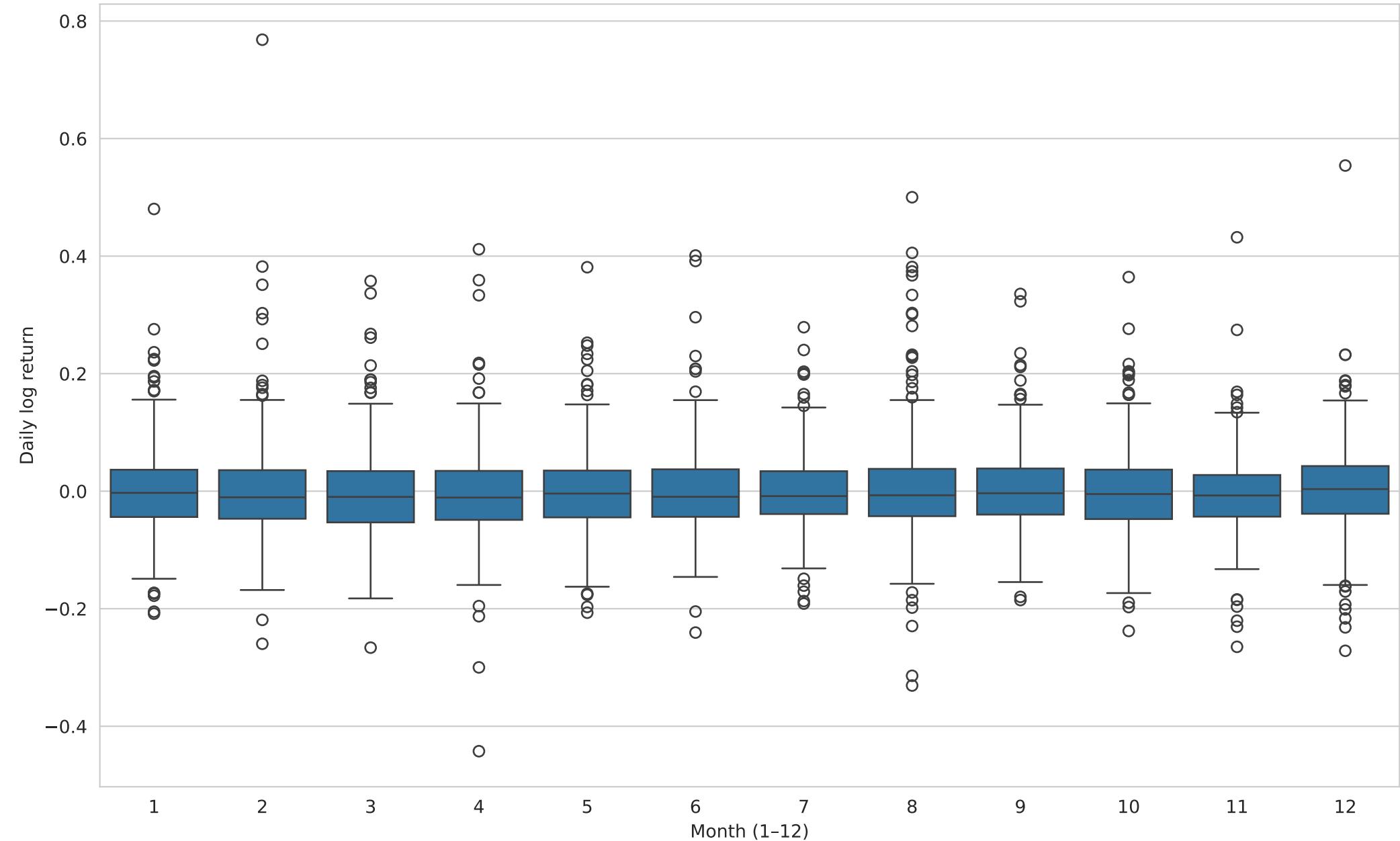
### $\wedge$ VIX • ACF • $|$ Returns $|$ (Volatility Clustering)



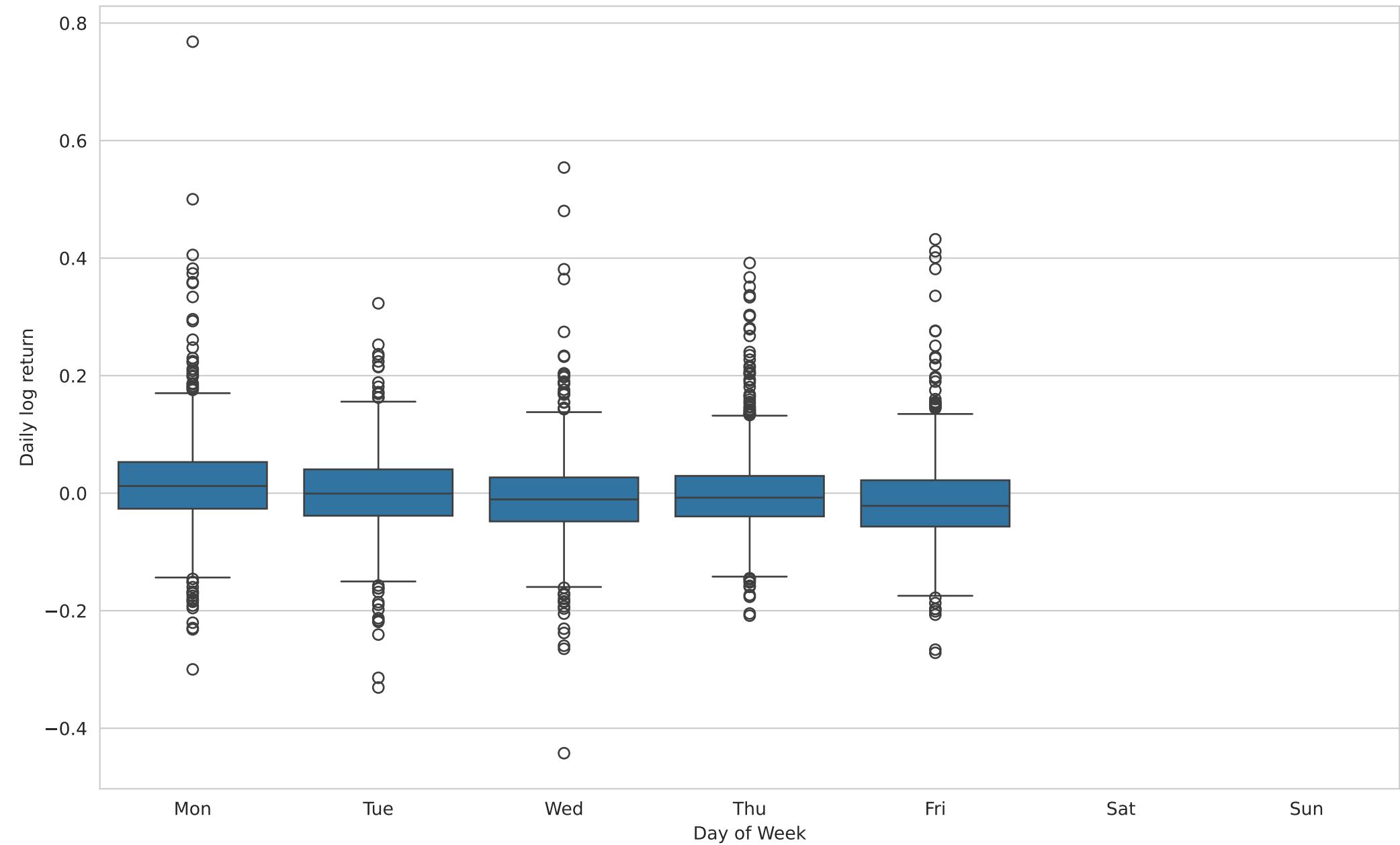
### $\wedge$ VIX • ACF • Returns $\wedge$ 2 (Volatility Clustering)



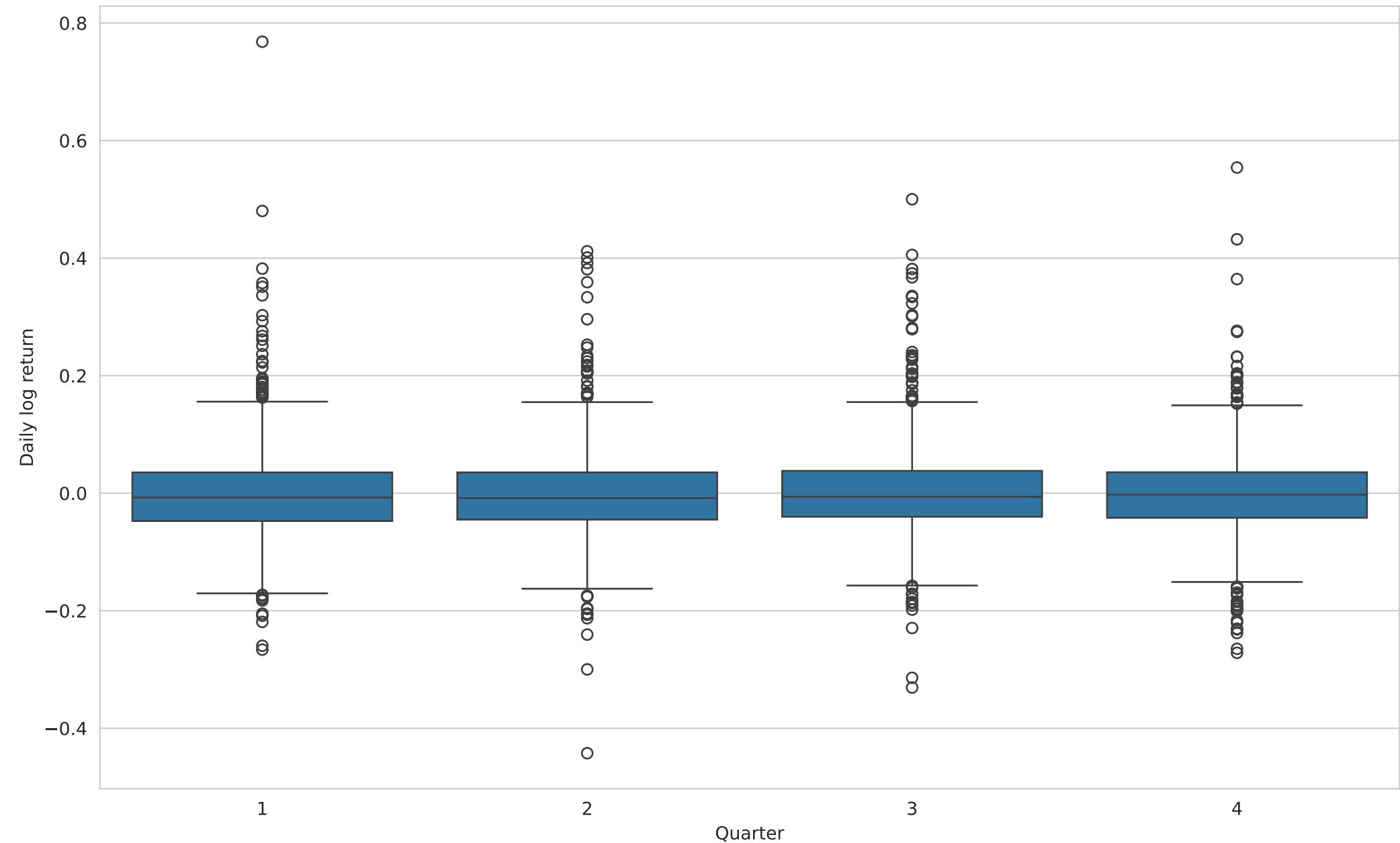
# $\wedge$ VIX • Monthly Returns



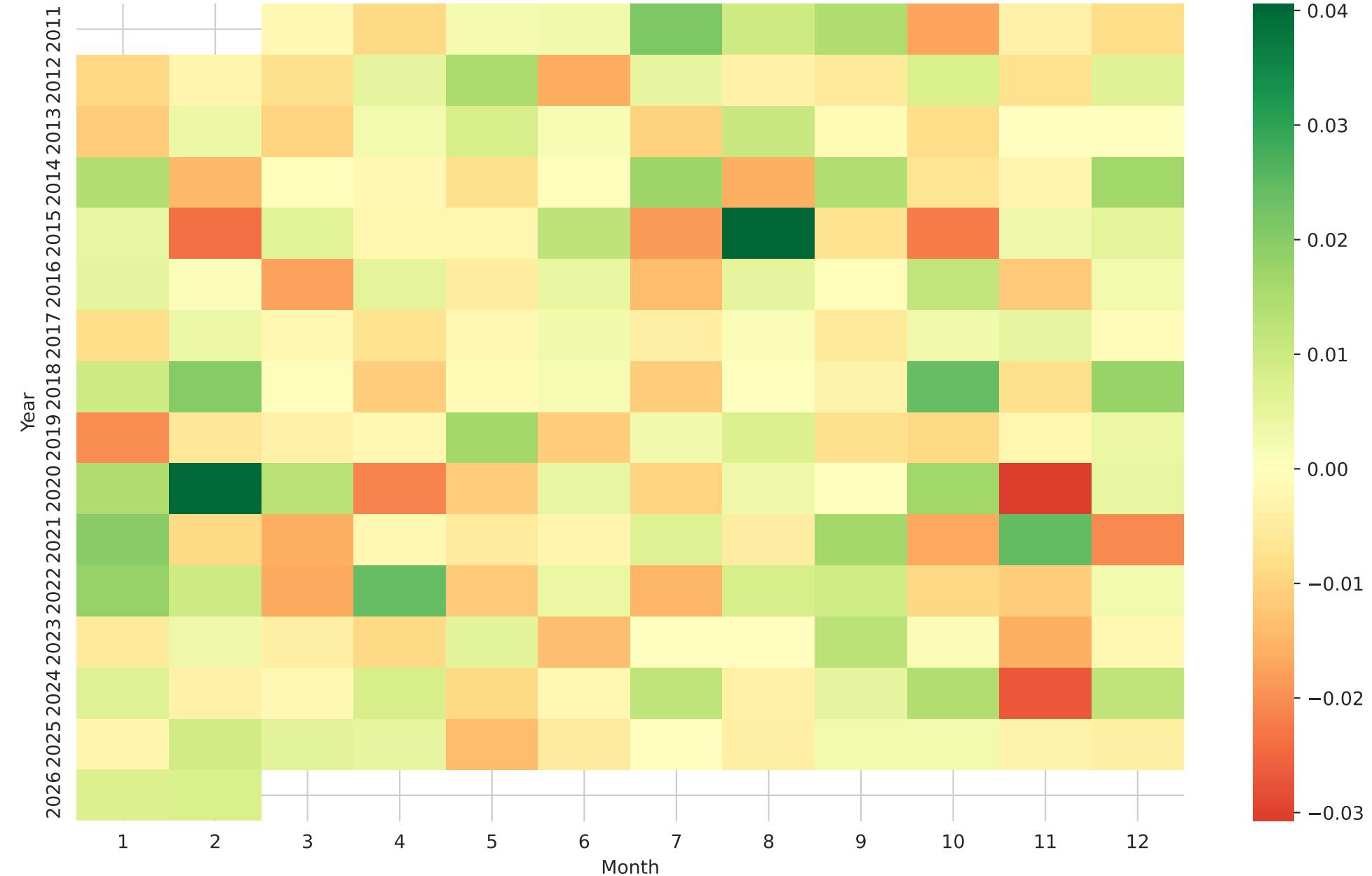
### $\wedge$ VIX • Day-of-Week Returns



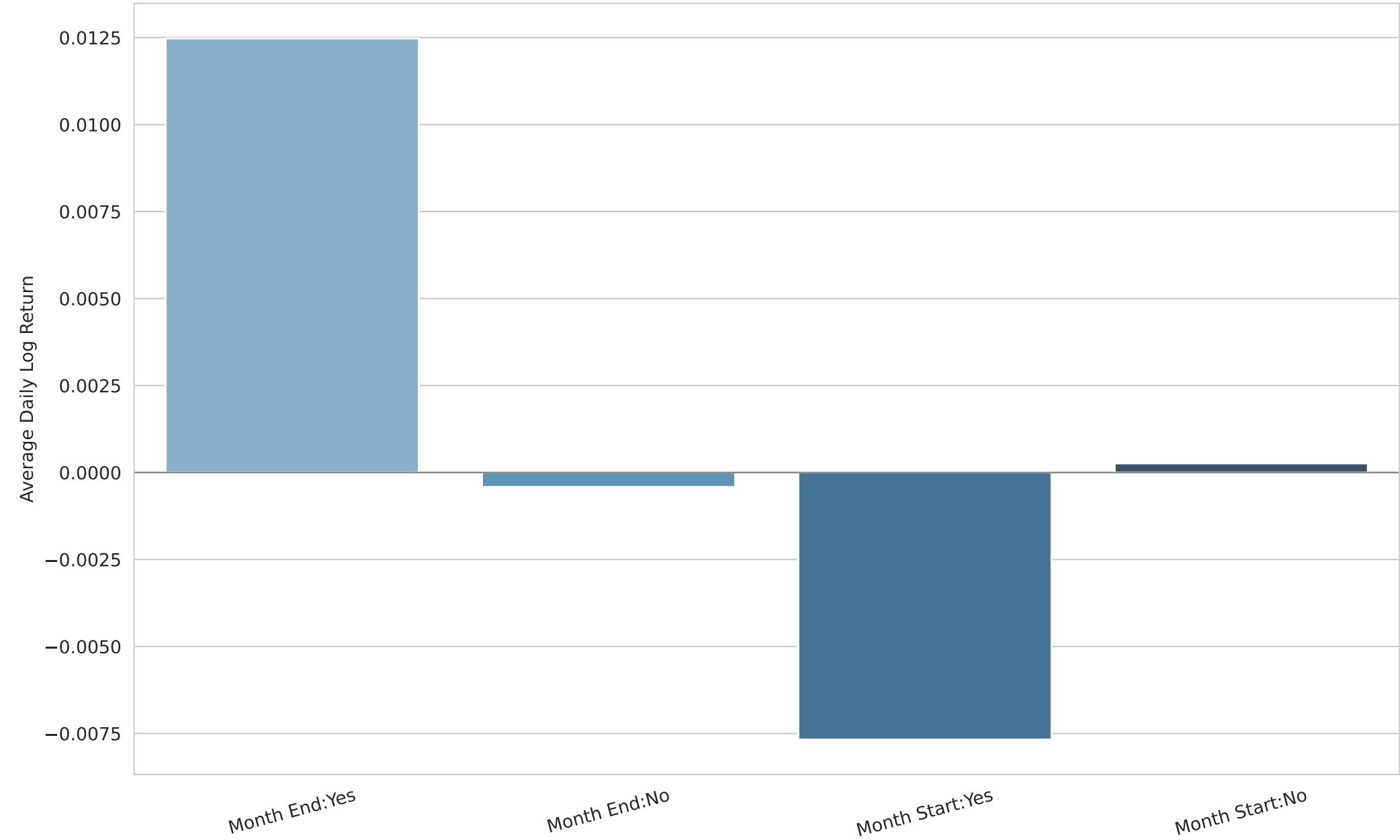
### $\wedge$ VIX • Quarterly Returns



$\wedge$ VIX • Month×Year Heatmap (Avg Daily Returns)

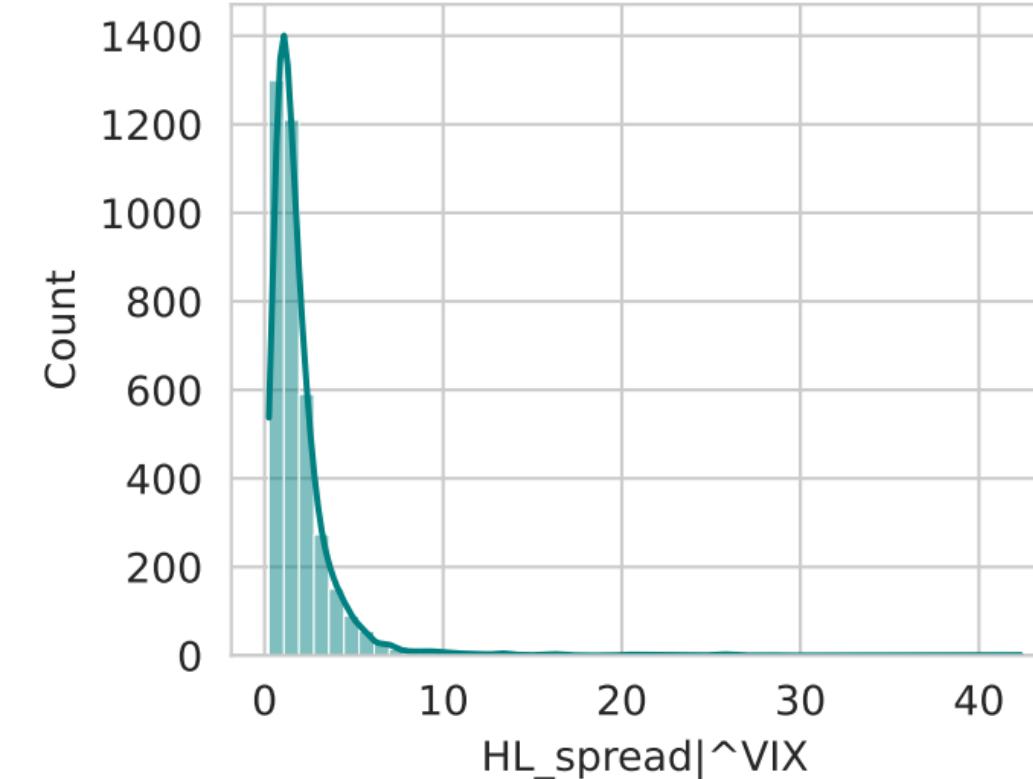


### $\wedge$ VIX • Avg Returns: Month-End/Start vs Others

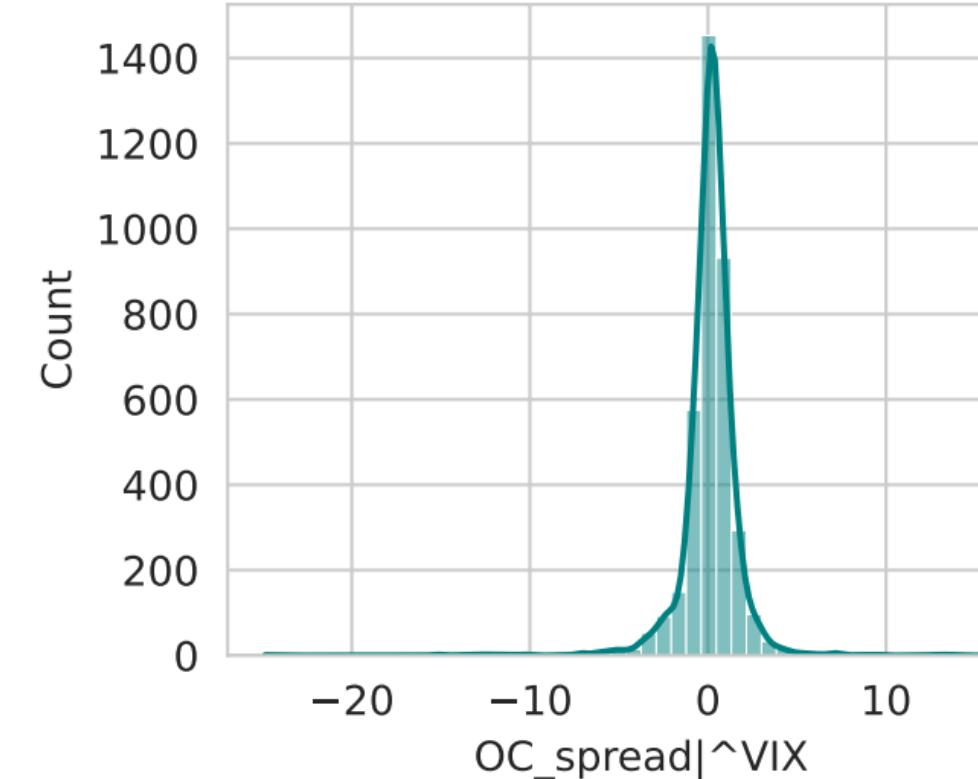


# $\wedge$ VIX • Spreads

HL\_spread| $\wedge$ VIX

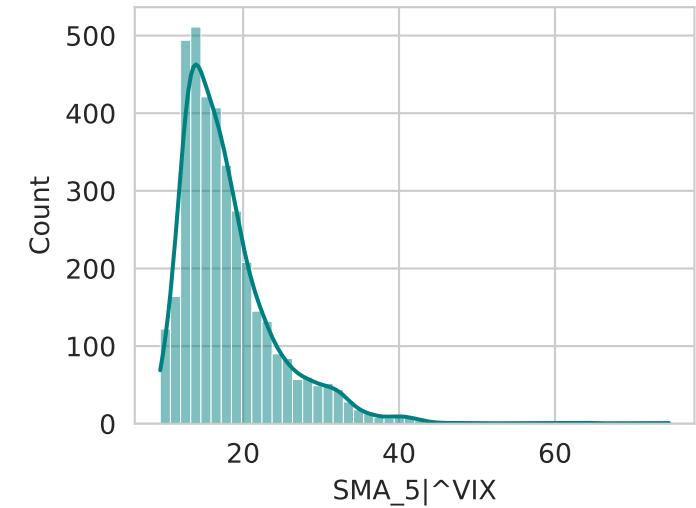


OC\_spread| $\wedge$ VIX

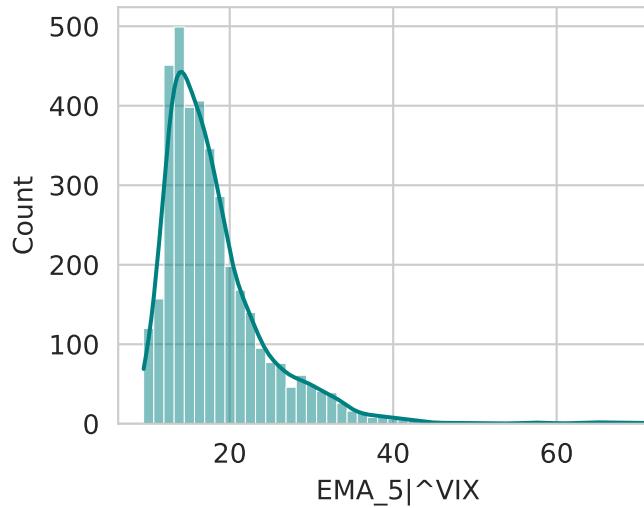


# $\wedge$ VIX • Moving Averages / EMAs

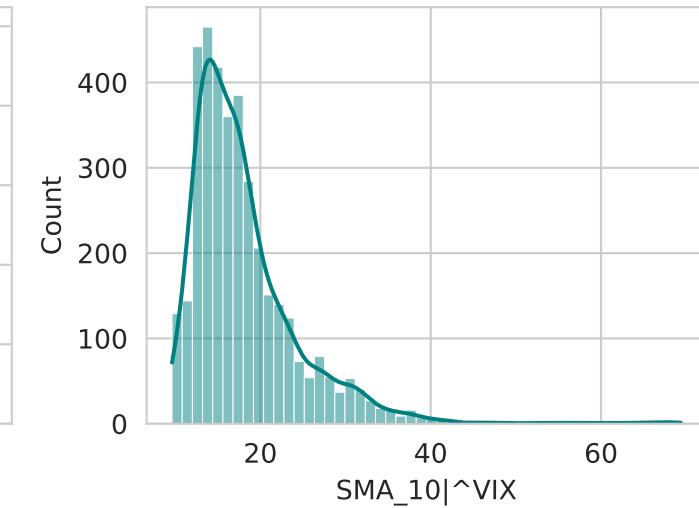
SMA\_5| $\wedge$ VIX



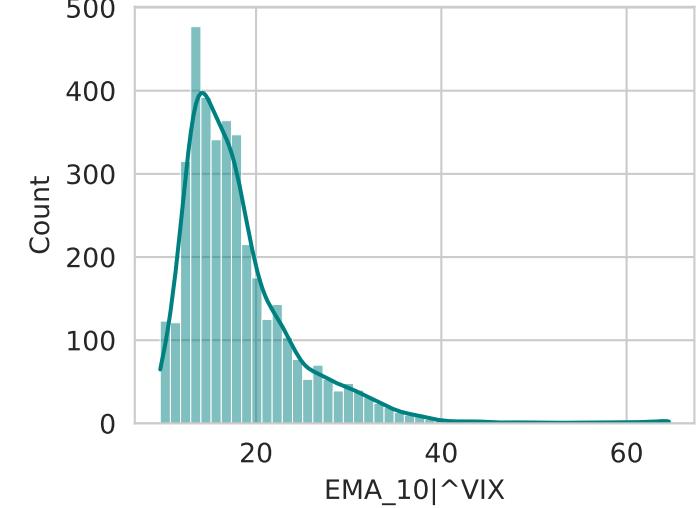
EMA\_5| $\wedge$ VIX



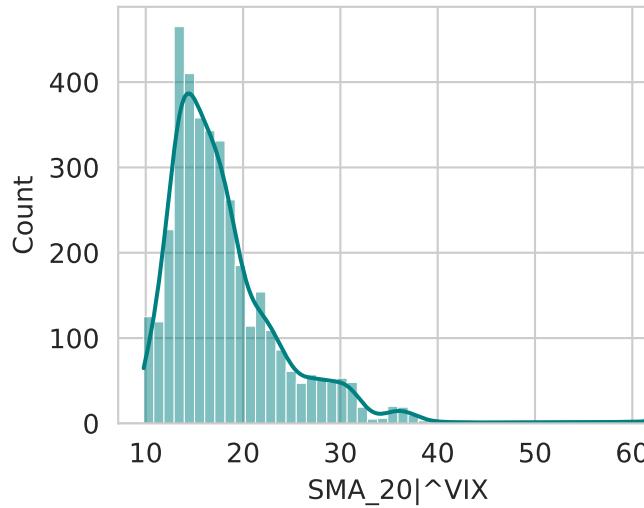
SMA\_10| $\wedge$ VIX



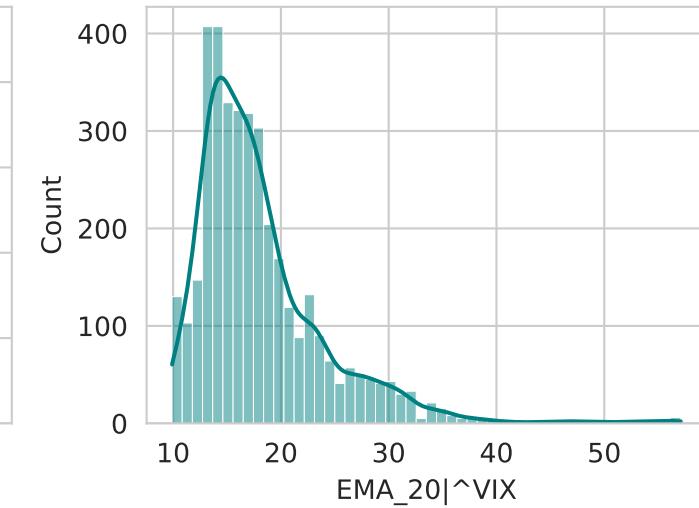
EMA\_10| $\wedge$ VIX



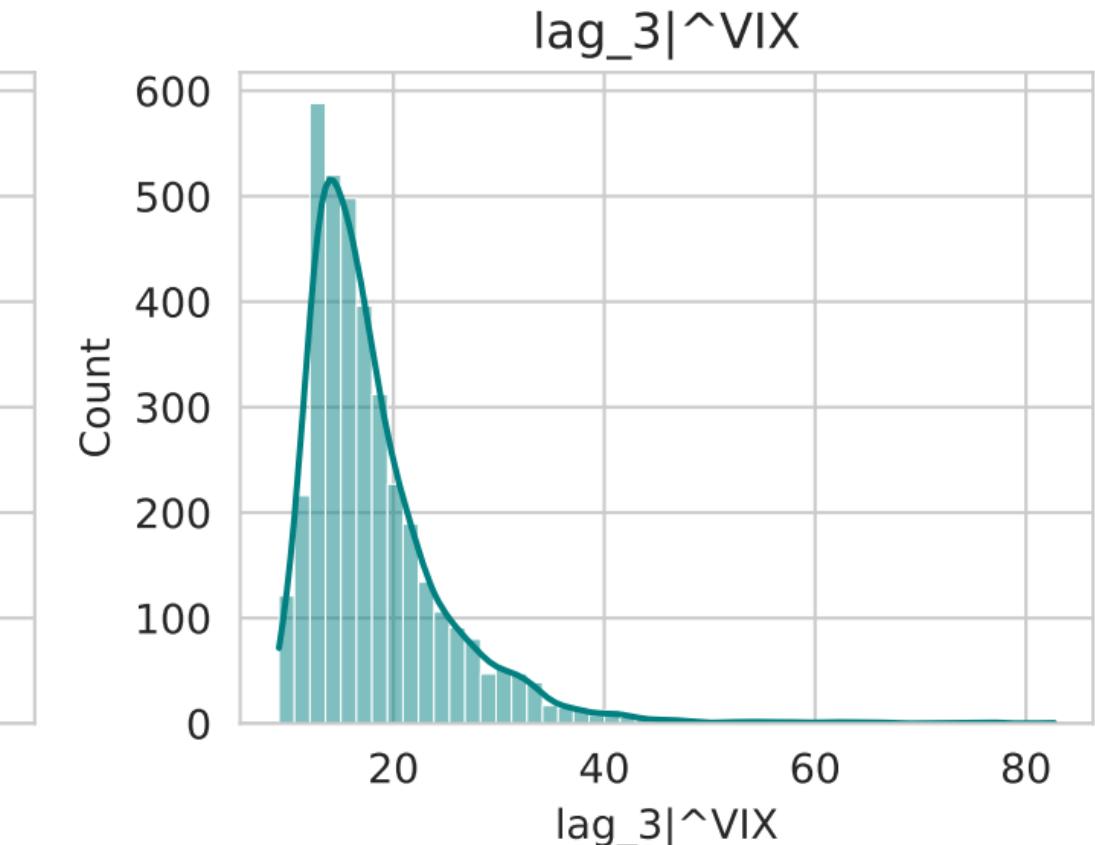
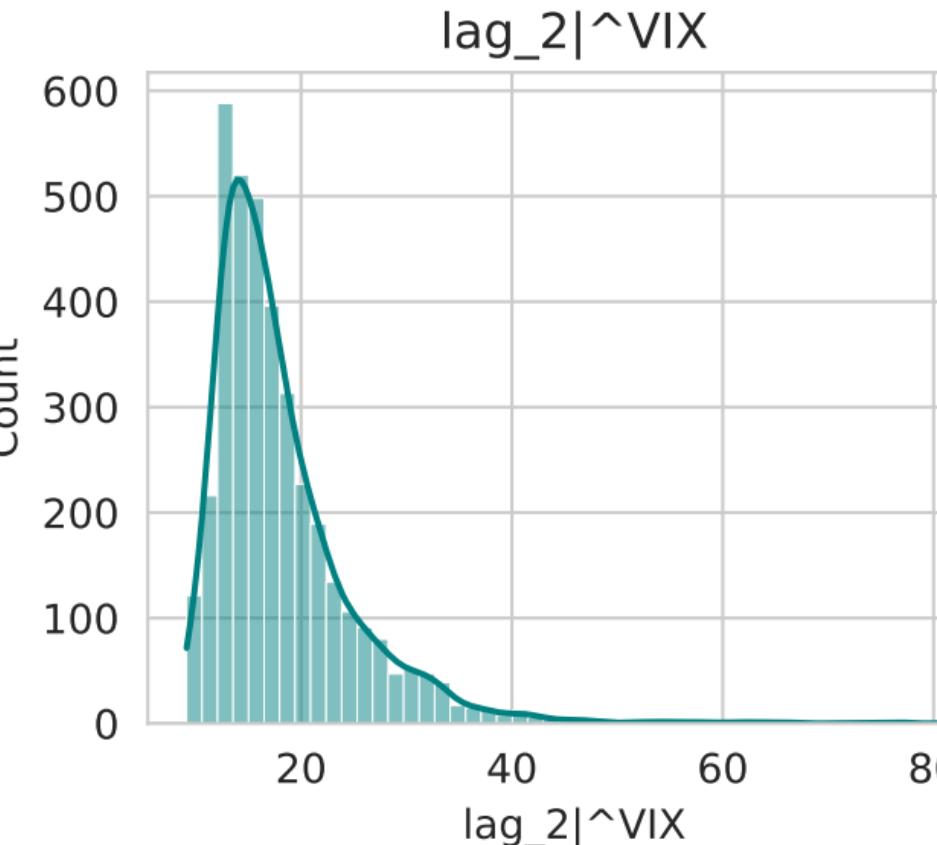
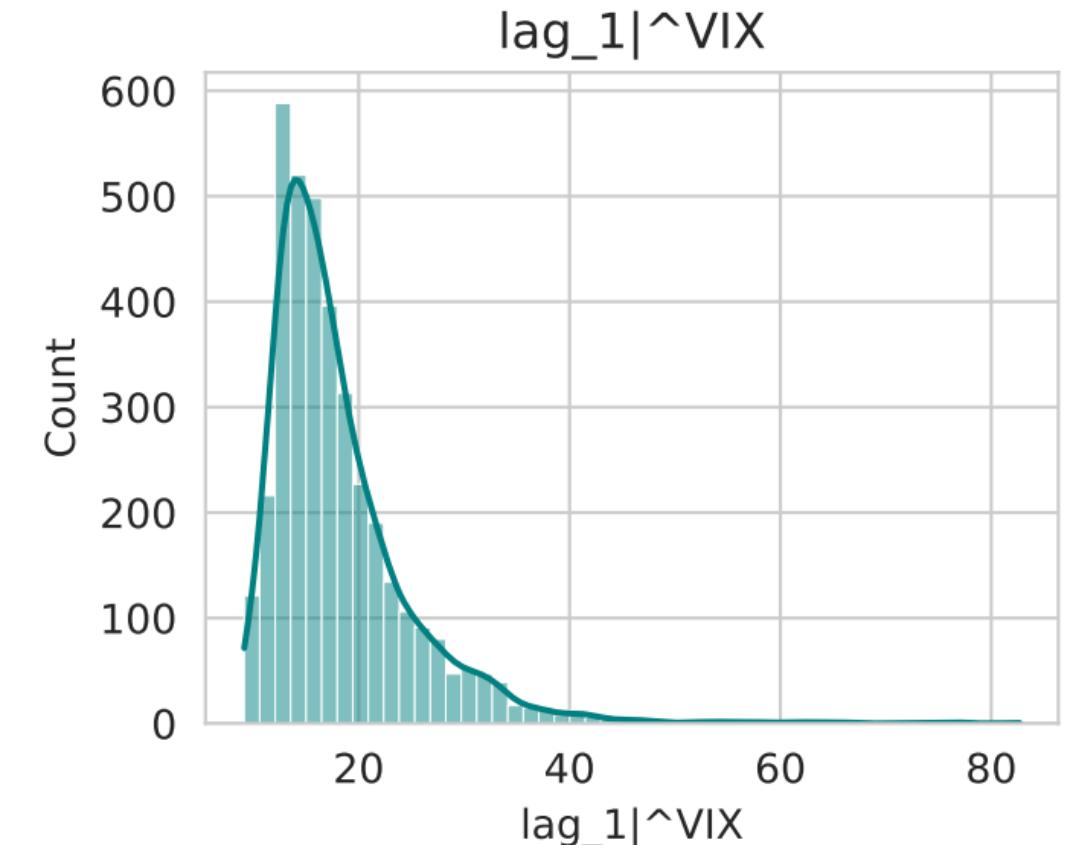
SMA\_20| $\wedge$ VIX



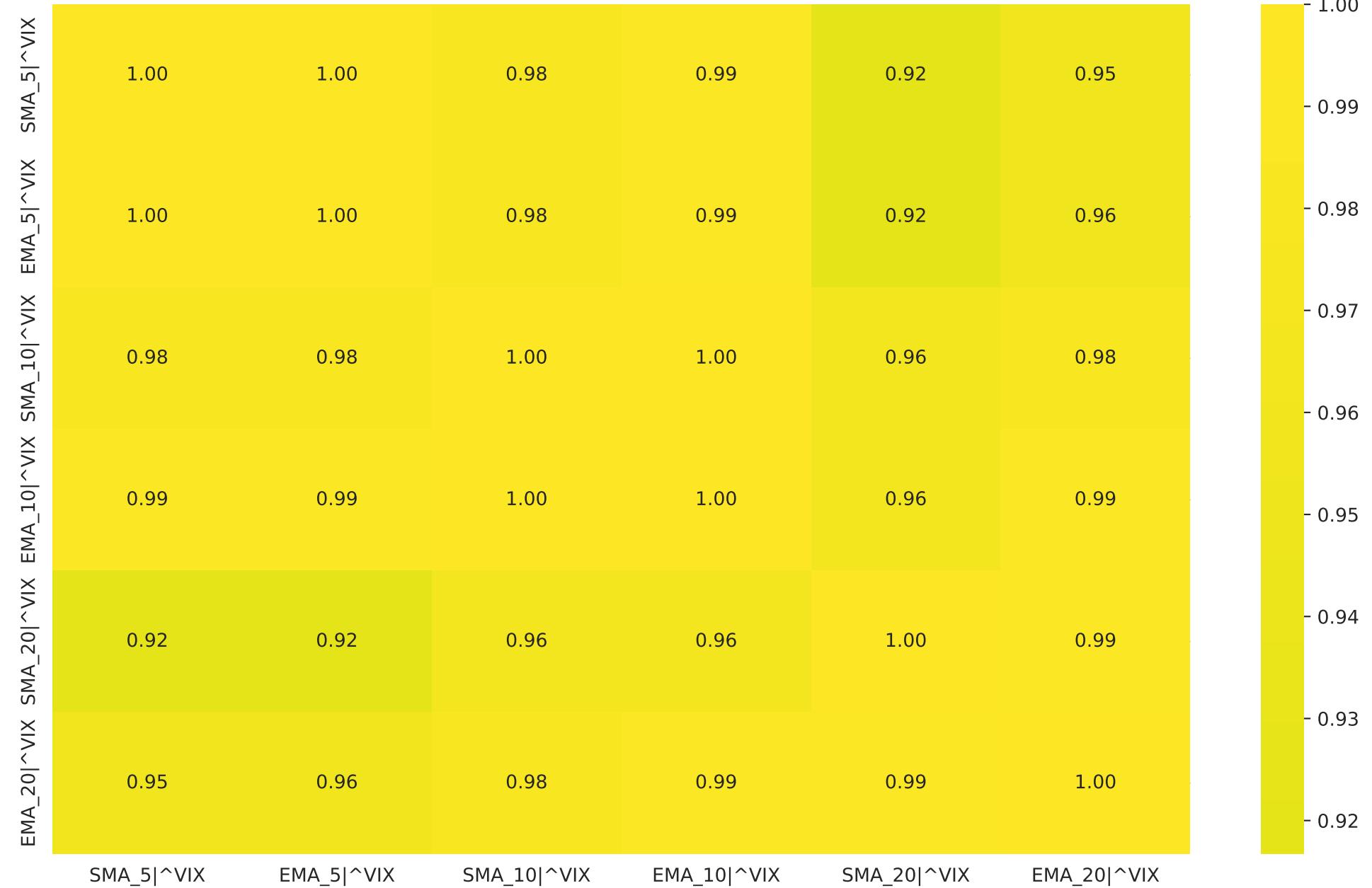
EMA\_20| $\wedge$ VIX

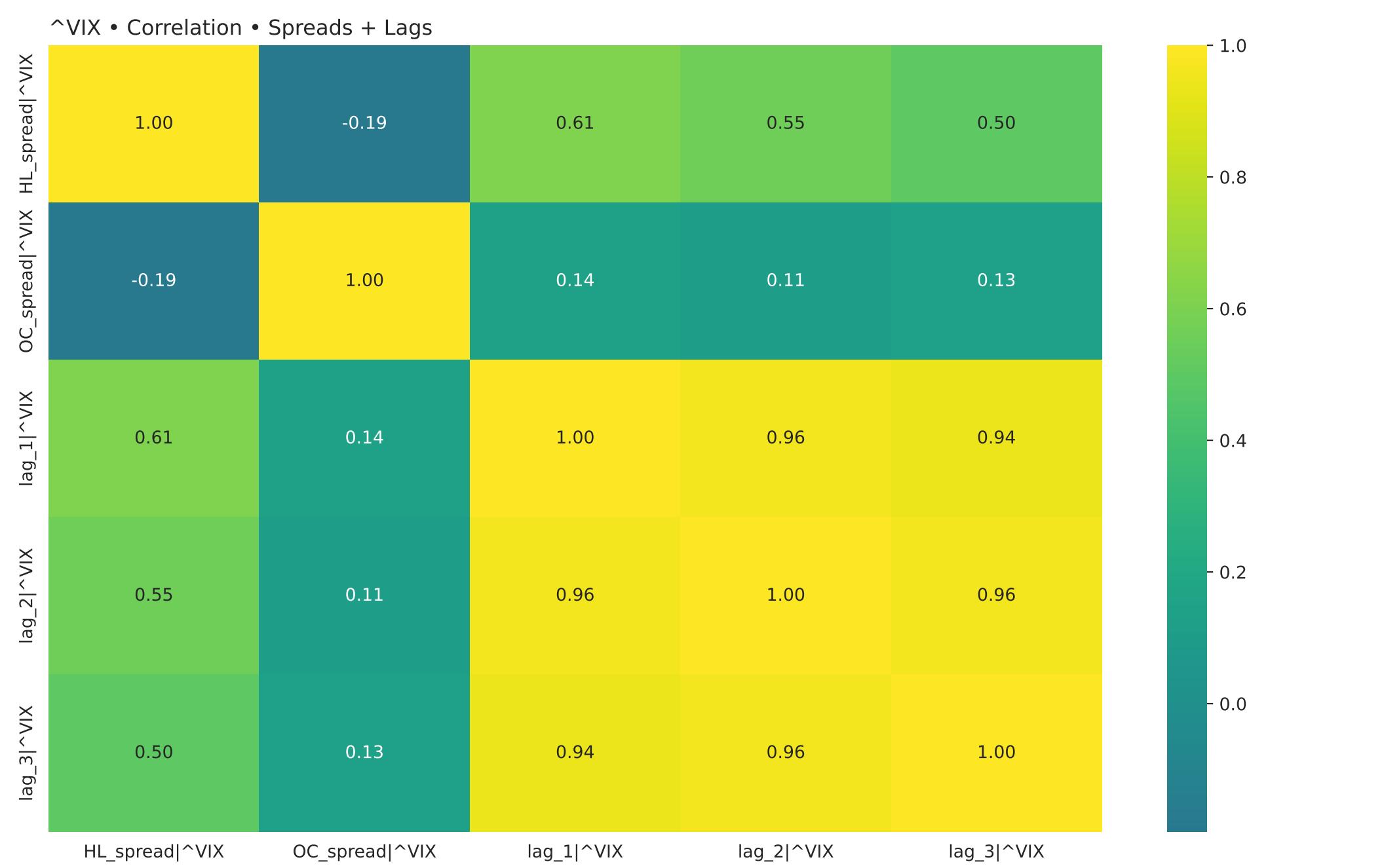


# $\wedge$ VIX • Lagged Prices

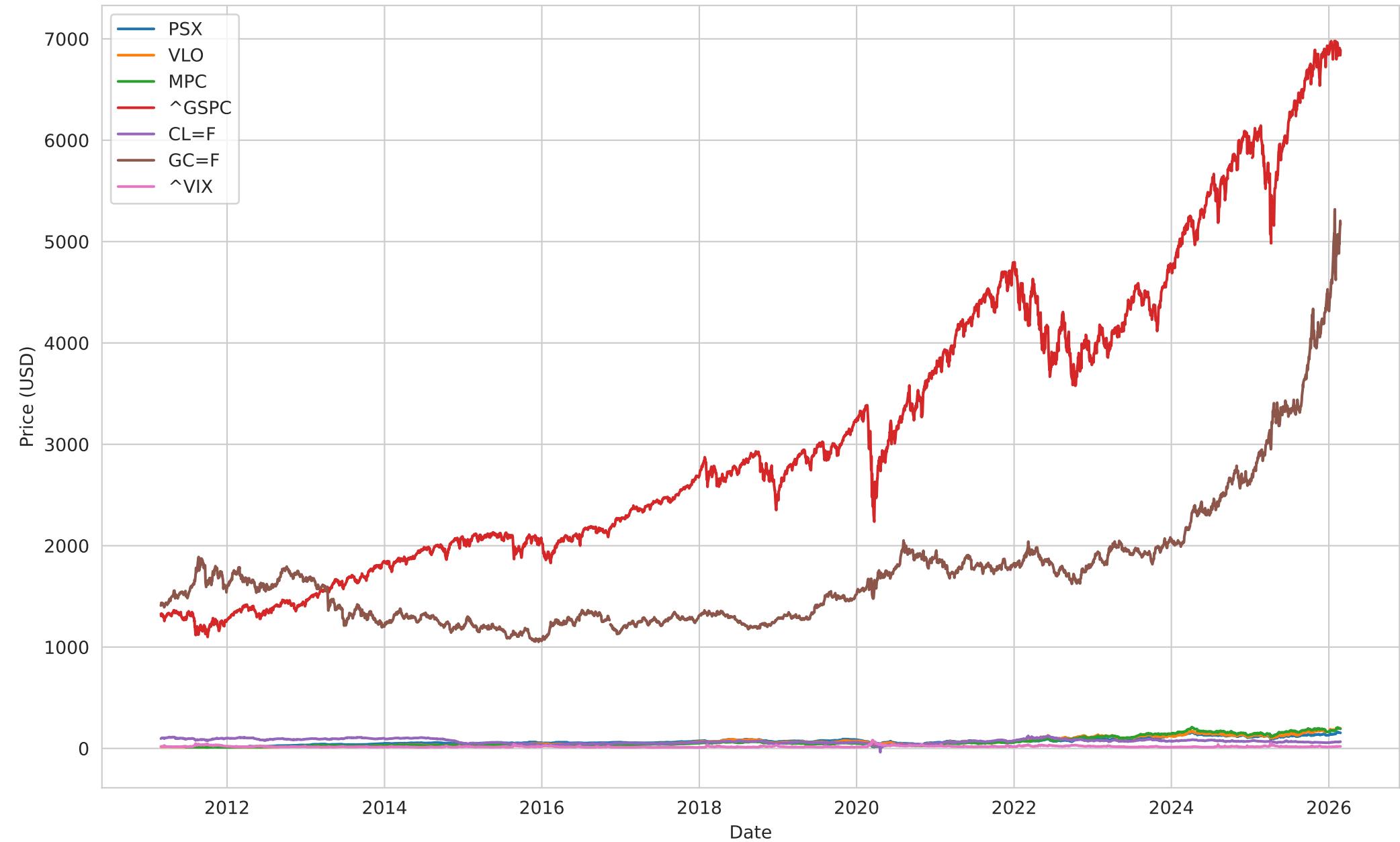


# $\wedge$ VIX • Correlation • Moving Averages





# Cross-Ticker • Adjusted/Close Prices



Cross-Ticker • Log Return Correlation

