**Tick-Level Log Returns ACF (No Aggregation)**

Lag 1 ACF: 0.1342
(Negative = bid-ask bounce effect)

- - - 95% CI

Autocorrelation

Lag (ticks)
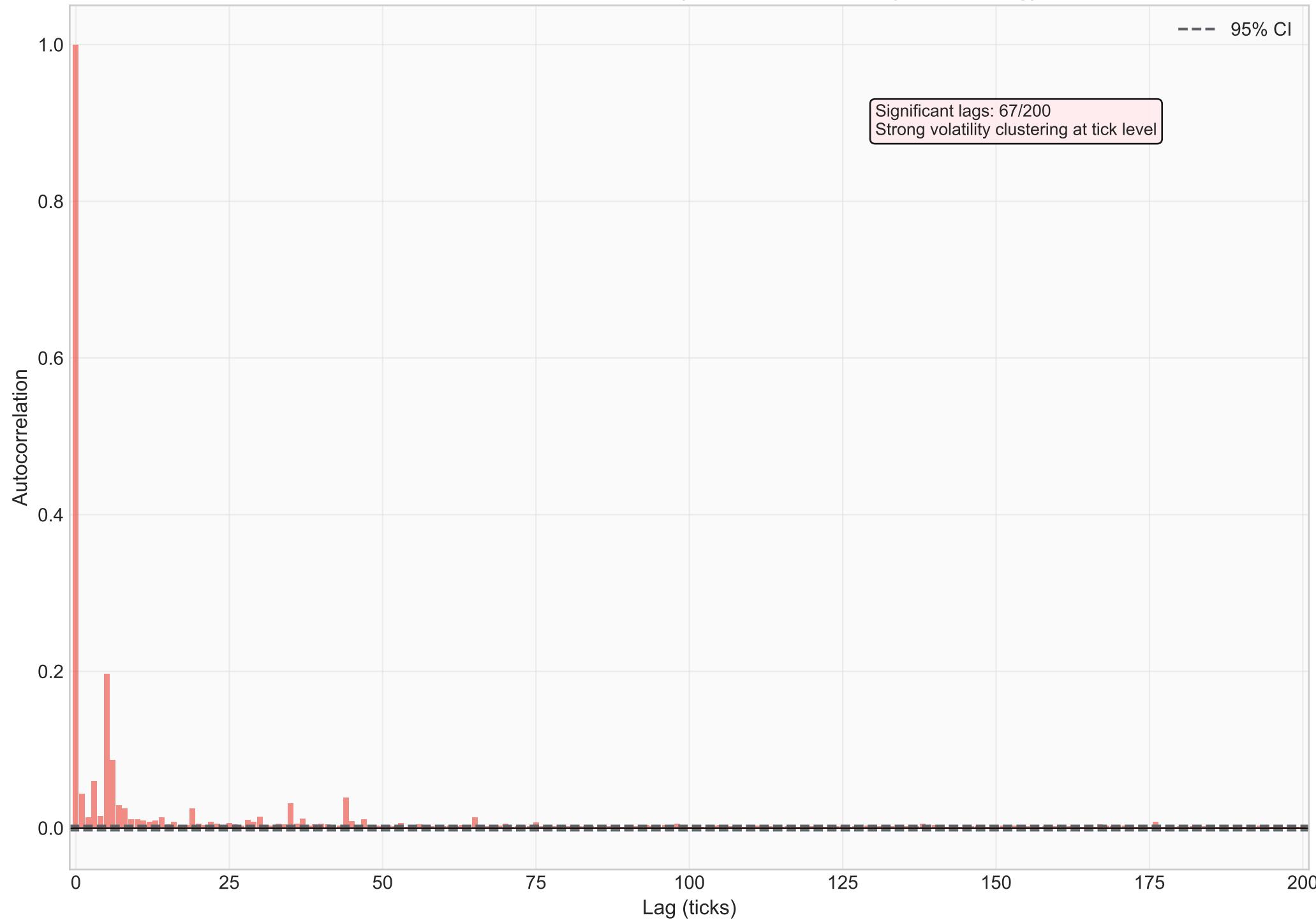
**Tick-Level Log Returns PACF**

**ACF of Tick Direction (Sign of Price Change)**

Positive lag-1: Momentum / Order flow clustering

--- 95% CI
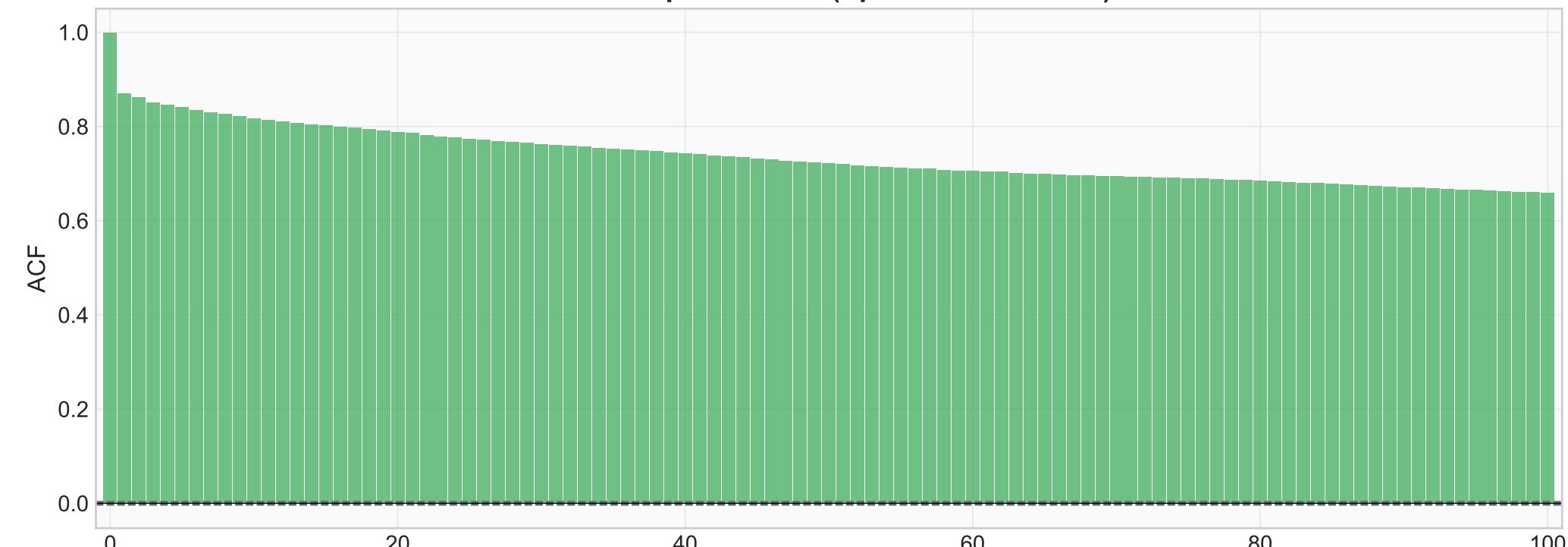
ACF of Squared Tick Returns (Tick-Level Volatility Clustering)

Significant lags: 67/200
Strong volatility clustering at tick level
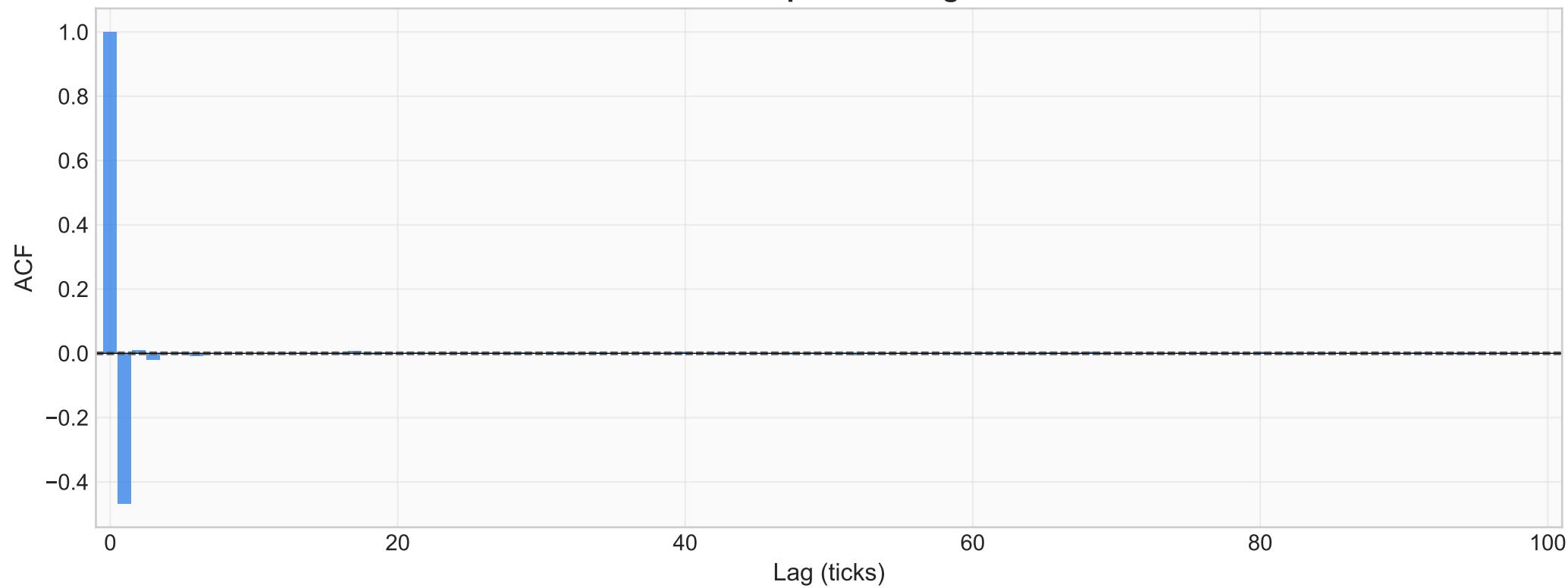
**Bid-Ask Spread Dynamics at Tick Level**
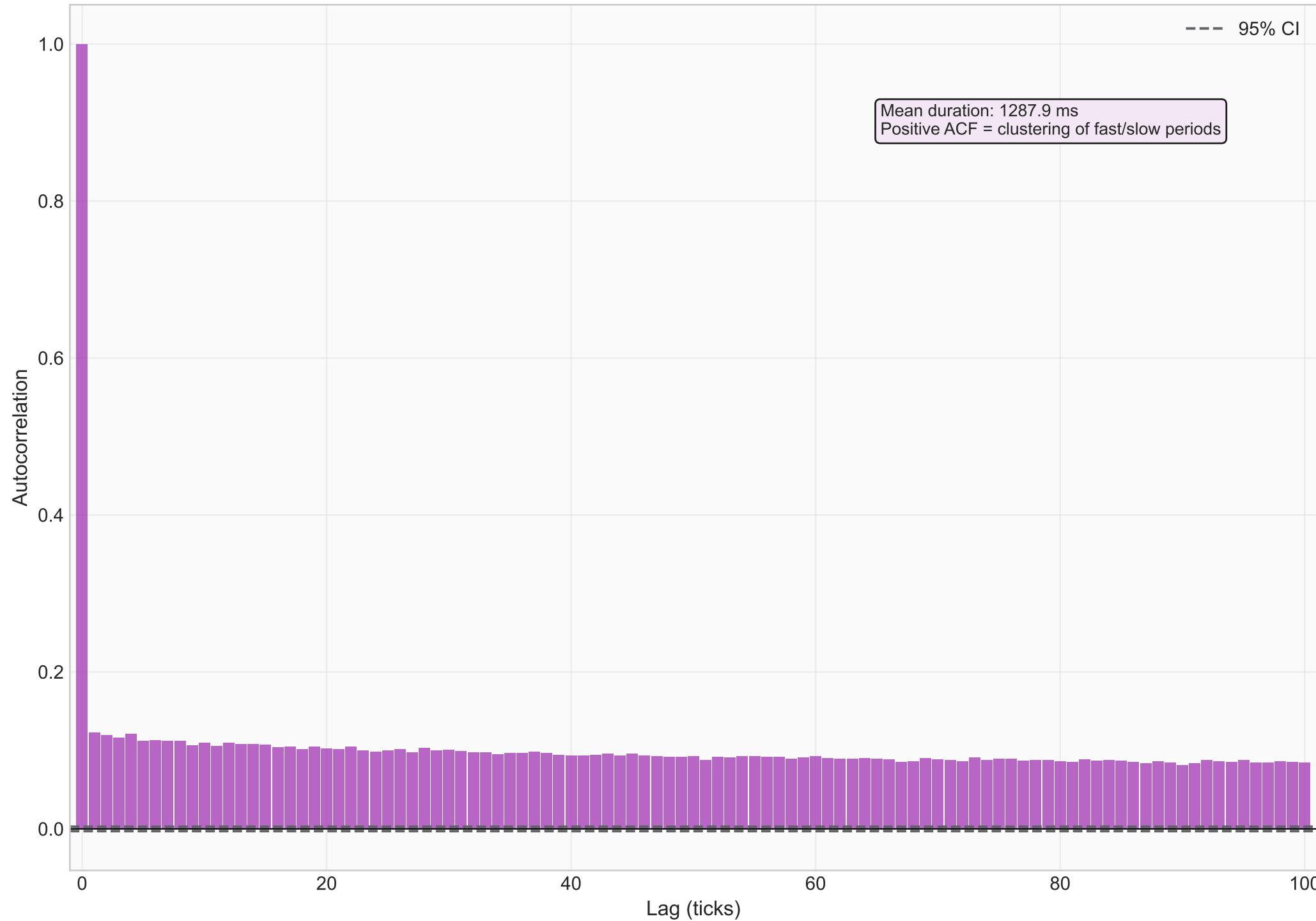
**ACF of Spread Level (Spread Persistence)**

**ACF of Spread Changes**
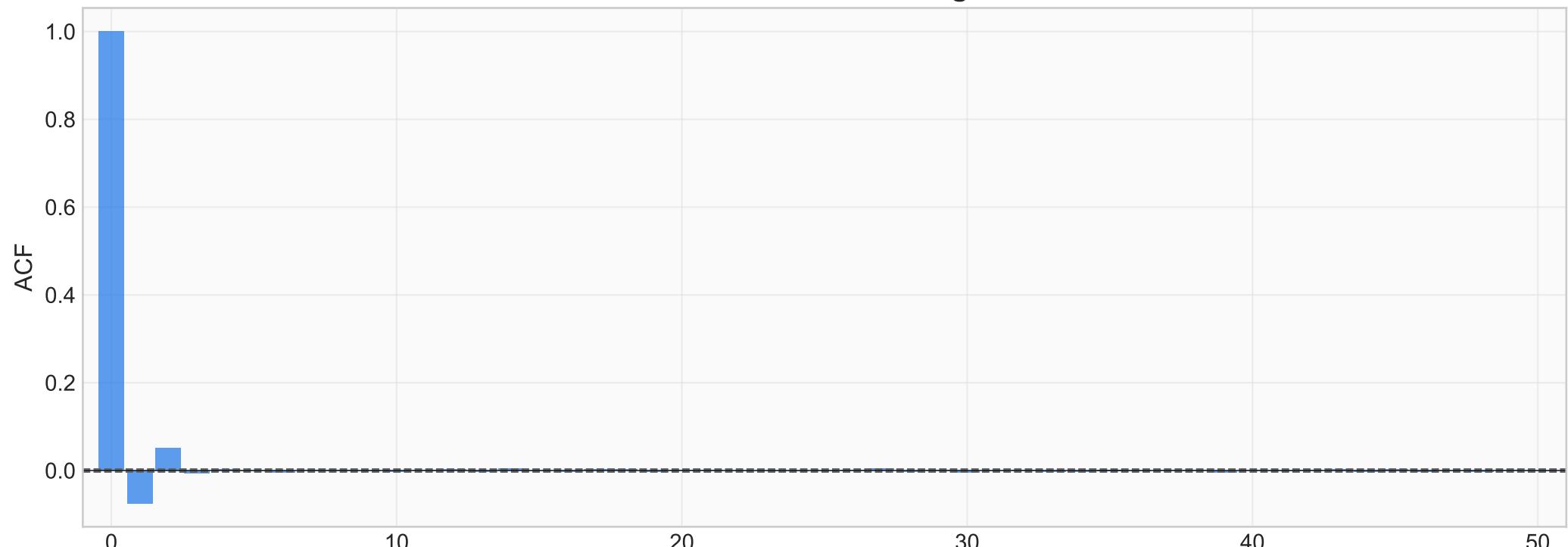
**ACF of Inter-Tick Durations (Trade Intensity Clustering)**

Mean duration: 1287.9 ms
Positive ACF = clustering of fast/slow periods

--- 95% CI
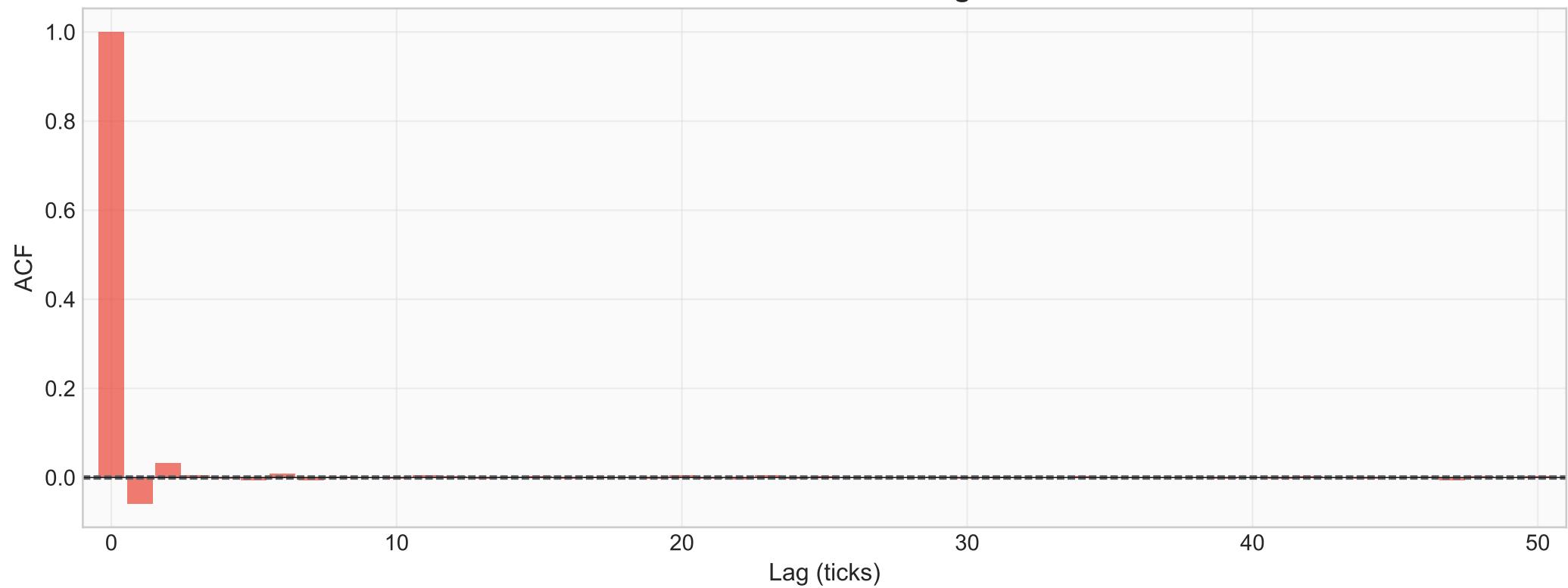
# Bid vs Ask Price Change Autocorrelation

## ACF of Bid Price Changes
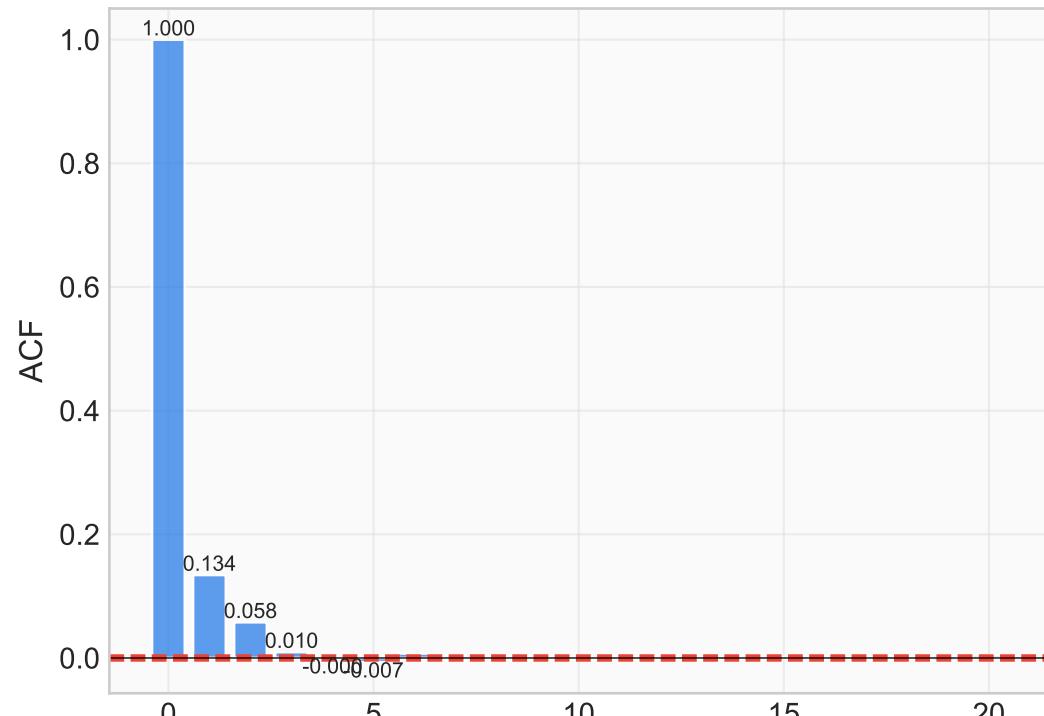


## ACF of Ask Price Changes
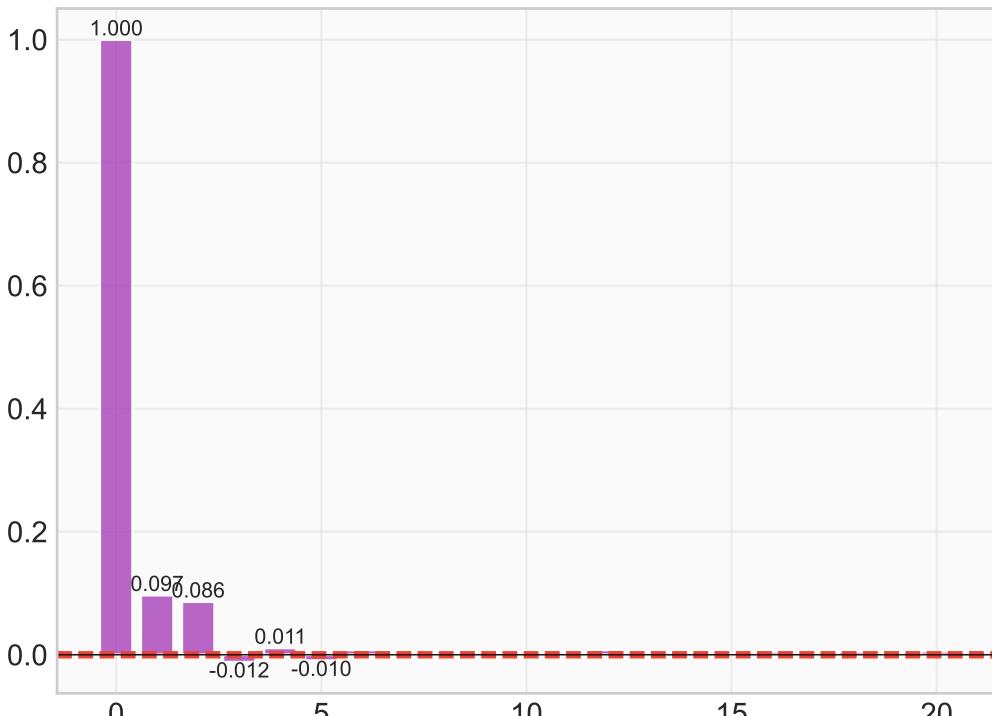
# First 20 Tick Lags - Detailed View
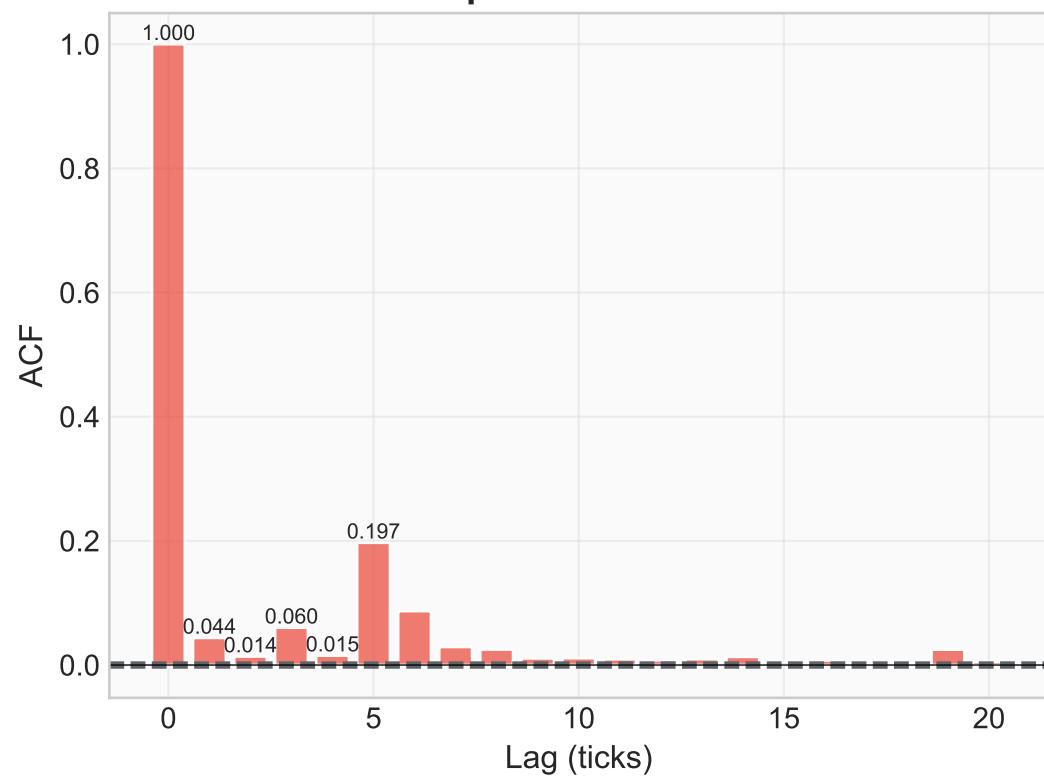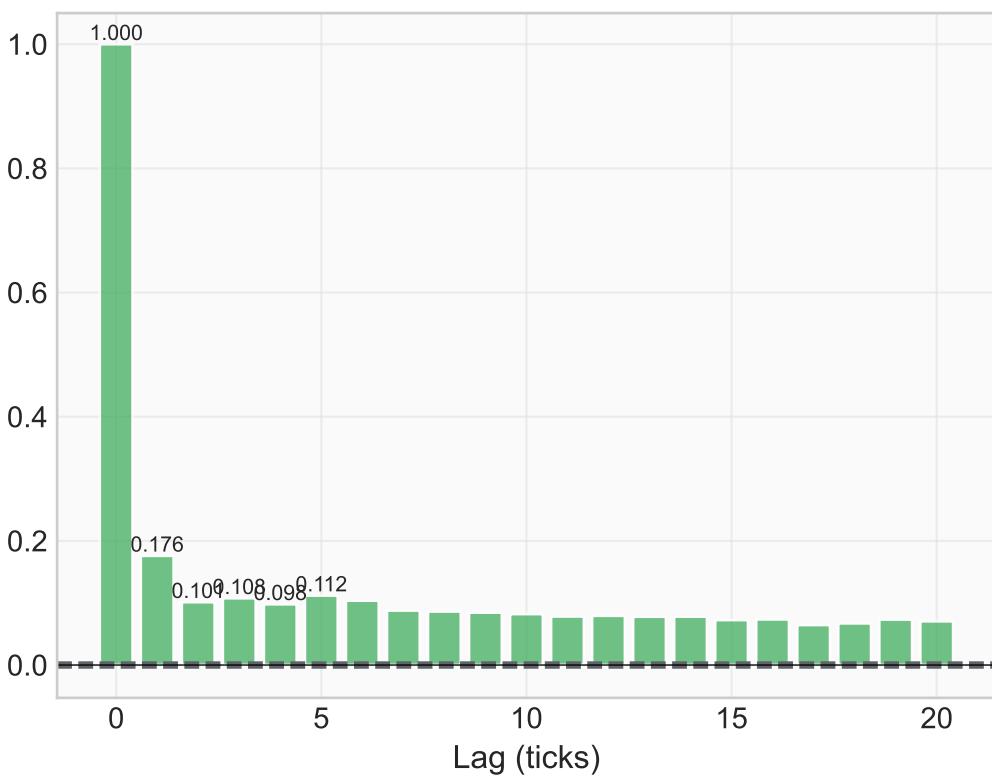
```
TICK-LEVEL MICROSTRUCTURE ANALYSIS SUMMARY
        EUR/USD High-Frequency Data - January 2026
```

## DATA SUMMARY

```
   Total ticks analyzed: 499,999
    Average inter-tick time: 2238.5 ms
   Average spread: 0.372 pips
   Tick return std: 0.1122 bps
```

## KEY AUTOCORRELATION FINDINGS (First 5 lags)

```
   Tick Returns:     [+0.1342, +0.0578, +0.0096, -0.0001, -0.0067]
   Direction:        [+0.0969, +0.0863, -0.0120, +0.0111, -0.0095]
   Squared Returns:  [+0.0437, +0.0137, +0.0601, +0.0151, +0.1969]
   Inter-tick Time:  [+0.0000, -0.0000, -0.0000, +0.0001, +0.0000]
95% CI threshold: +/- 0.0028
```

## MICROSTRUCTURE EFFECTS DETECTED

```
   [ ] Bid-Ask Bounce: Negative lag-1 return autocorrelation
   [X] Volatility Clustering: Positive squared return ACF
   [ ] Trade Intensity Clustering: Positive duration ACF
   [ ] Mean Reversion: Negative direction autocorrelation
```

## IMPLICATIONS FOR MODELING

- Bid-ask bounce invalidates naive trend-following at tick level
- GARCH/ACD models appropriate for volatility & duration dynamics
- Roll model or similar needed to separate noise from true price moves
- Hawkes processes may capture trade clustering