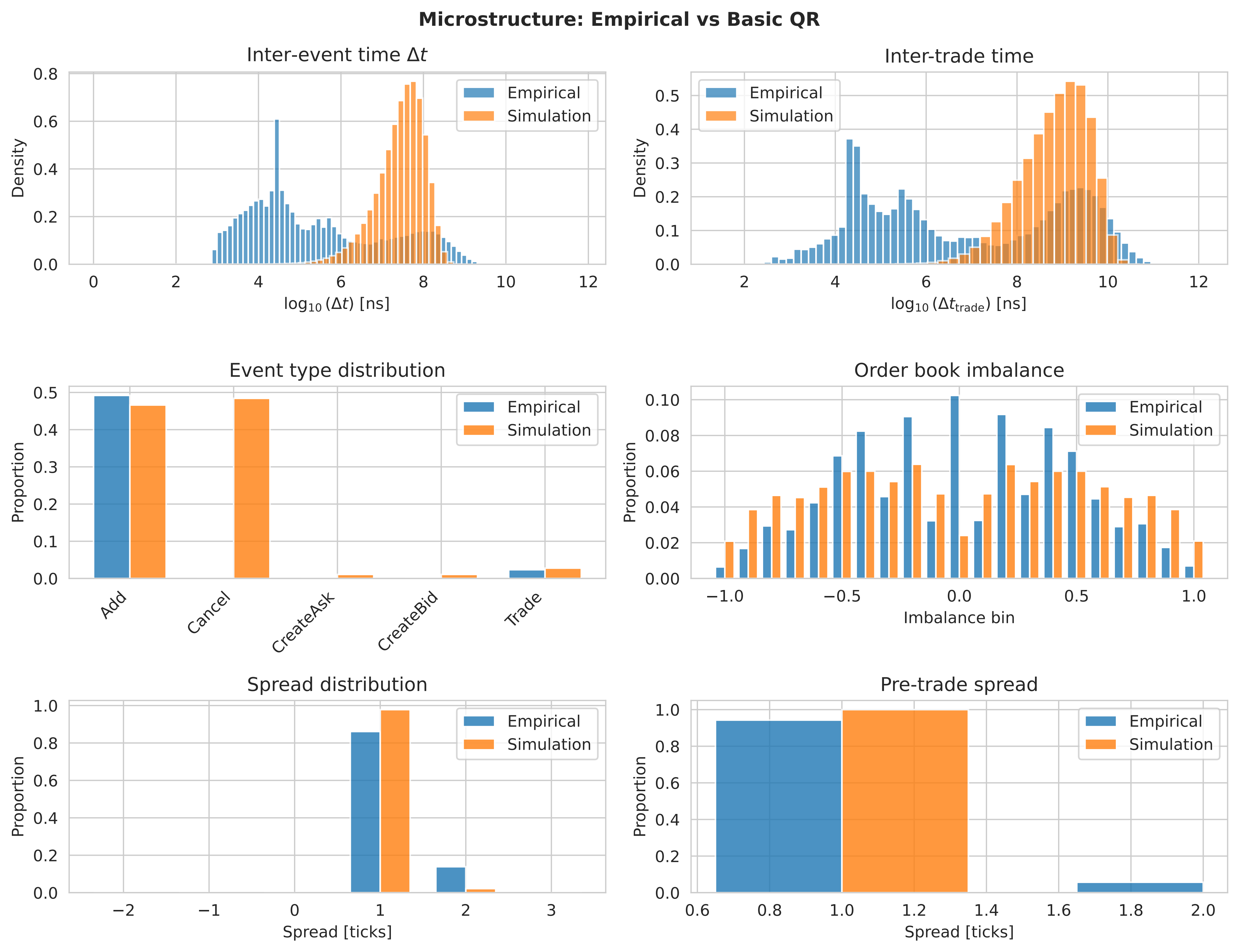
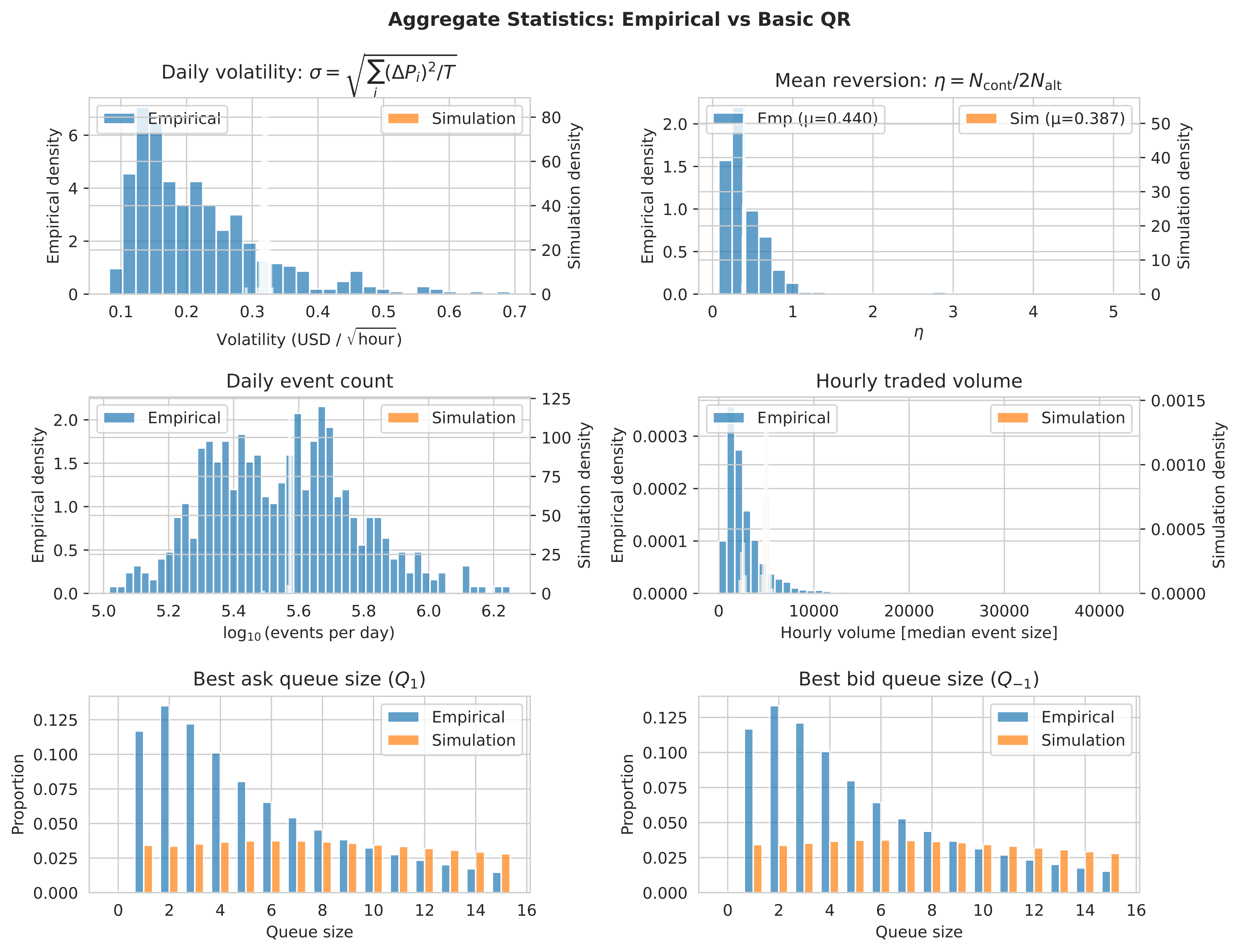
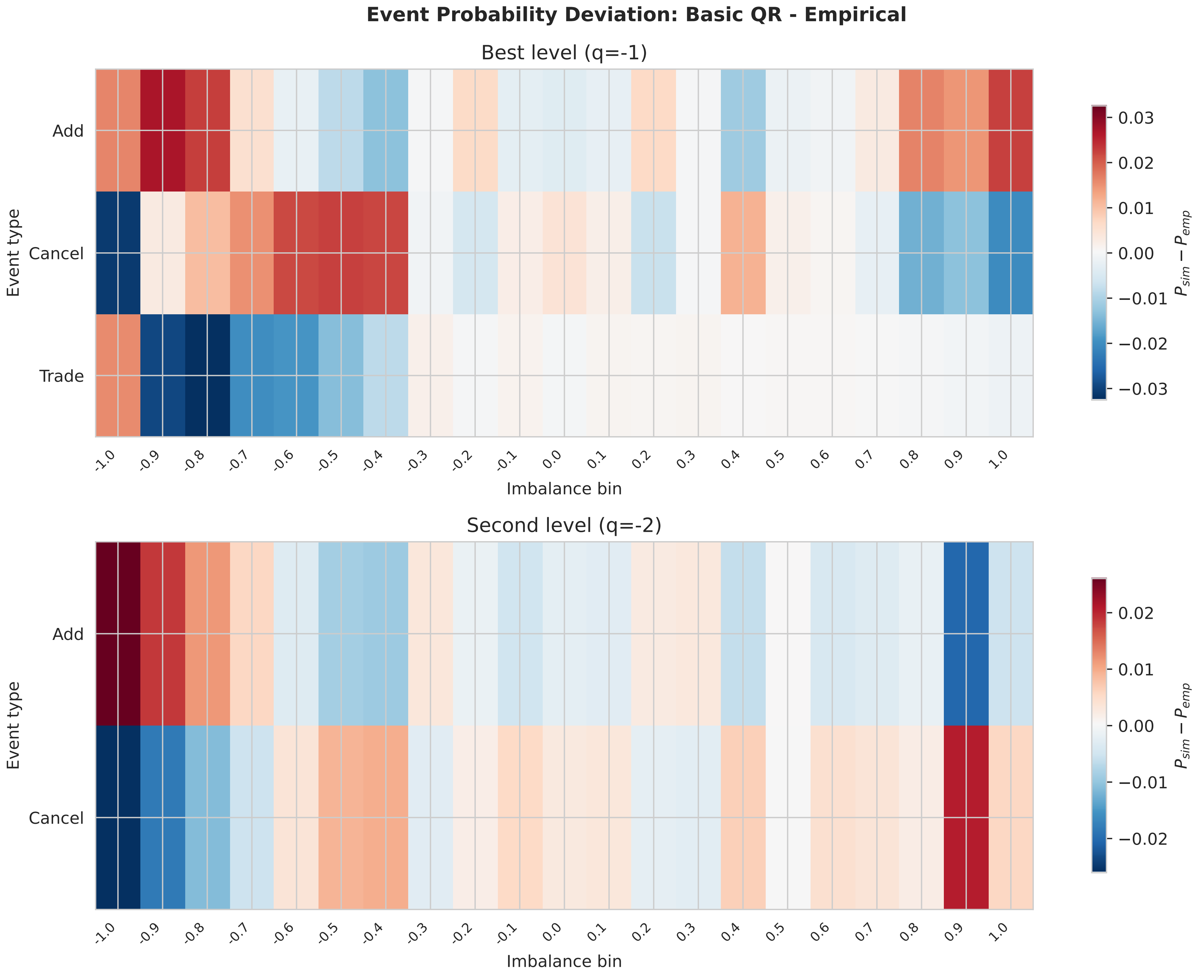


Microstructure: Empirical vs Basic QR
Inter-event time Δt
Density
log10 (Δt) [ns]
Empirical
Simulation
Inter-trade time
log10 (Δt_trade) [ns]
Event type distribution
Proportion
Add
Cancel
CreateAsk
CreateBid
Trade
Order book imbalance
Imbalance bin
Spread distribution
Spread [ticks]
Pre-trade spread



Aggregate Statistics: Empirical vs Basic QR
Daily volatility: $\sigma = \sqrt{\sum_i (\Delta P_i)^2 / T}$
Empirical
Simulation
Empirical density
Simulation density
Volatility (USD / $\sqrt{\text{hour}}$)
0.1 0.2 0.3 0.4 0.5 0.6 0.7
0 2 4 6
0 20 40 60 80
Mean reversion: $\eta = N_{\text{cont}} / 2N_{\text{alt}}$
Emp (μ=0.440)
Sim (μ=0.387)
Empirical density
Simulation density
η
0 1 2 3 4 5
0.0 0.5 1.0 1.5 2.0
0 10 20 30 40 50
Daily event count
Empirical
Simulation
Empirical density
Simulation density
$\log_{10}$(events per day)
5.0 5.2 5.4 5.6 5.8 6.0 6.2
0.0 0.5 1.0 1.5 2.0
0 25 50 75 100 125
Hourly traded volume
Empirical
Simulation
Empirical density
Simulation density
Hourly volume [median event size]
0 10000 20000 30000 40000
0.0000 0.0001 0.0002 0.0003
0.0000 0.0005 0.0010 0.0015
Best ask queue size (Q_1)
Empirical
Simulation
Proportion
Queue size
Best bid queue size (Q_{-1})
Empirical
Simulation
Proportion
Queue size


Event Probability Deviation: Basic QR - Empirical
Best level (q=-1)
Add
Cancel
Trade
Event type
-1.0
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Imbalance bin
0.03
0.02
0.01
0.00
−0.01
−0.02
−0.03
$P_{sim} - P_{emp}$
Second level (q=-2)
Add
Cancel
Event type
-1.0
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Imbalance bin
0.02
0.01
0.00
−0.01
−0.02
$P_{sim} - P_{emp}$