Financial Markets

Paper Discussion: AT & Liquidity

Stefan Arping
University of Amsterdam

Agenda

- Hendershott/Jones/Menkveld (2011). Does Algorithmic Trading Improve Liquidity?, *Journal of Finance*

Algorithmic Trading

"Technological change has revolutionized the way financial assets are traded. Every step of the trading process, from order entry to trading venue to back office, is now highly automated, dramatically reducing the costs incurred by intermediaries. By reducing frictions and costs of trading, technology has the potential to enable more efficient risk sharing, facilitate hedging, improve liquidity, and make prices more efficient. This could ultimately reduce firms' cost of capital."

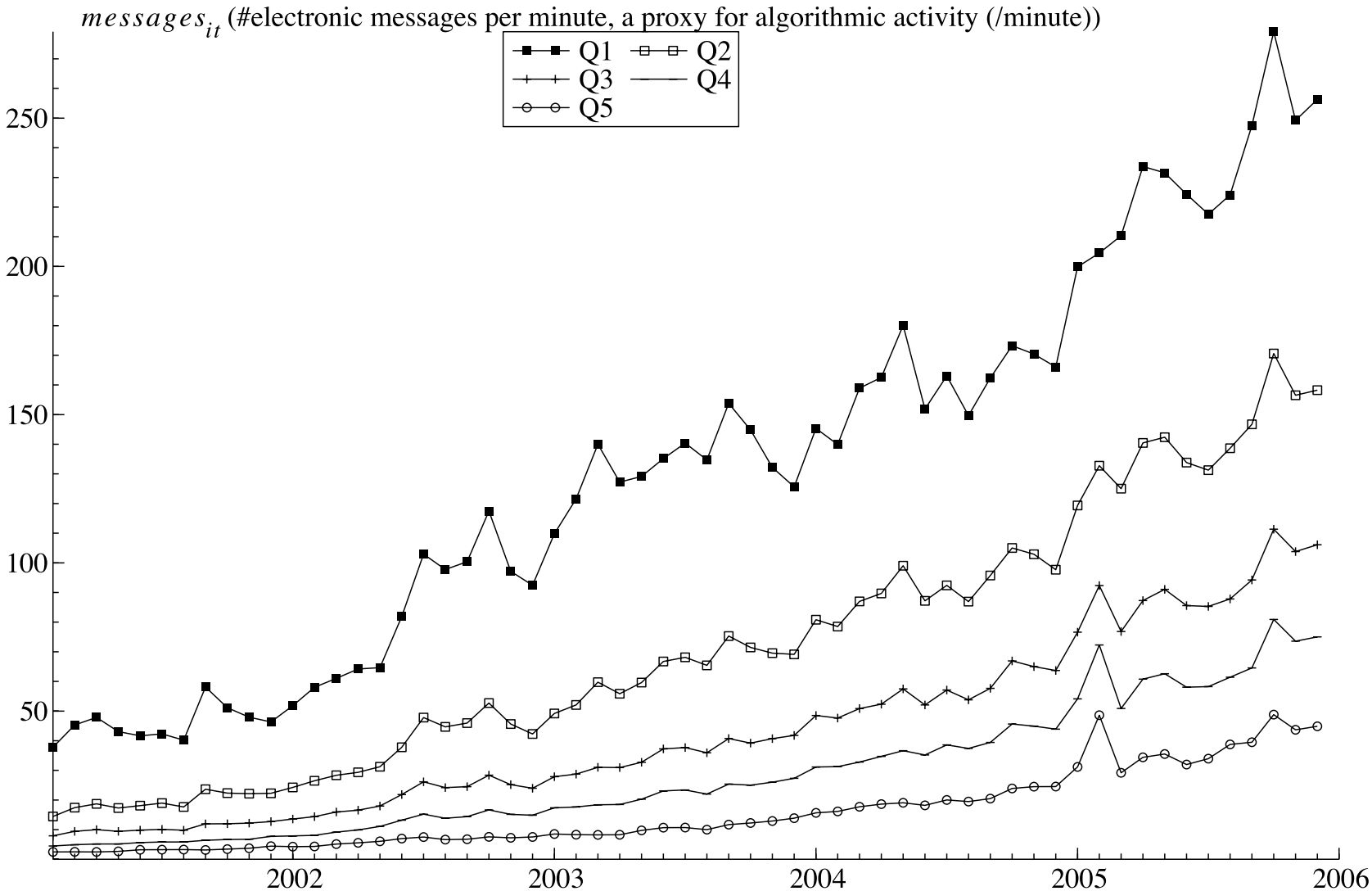
"Algorithmic trading (AT) is a dramatic example of this far-reaching technological change. Many market participants now employ AT, commonly defined as the use of computer algorithms to automatically make certain trading decisions, and manage those orders after submission. From a starting point near zero in the mid 1990s, AT is thought to be responsible for as much as 73 percent of trading volume in the United States in 2009."

Algorithmic Trading

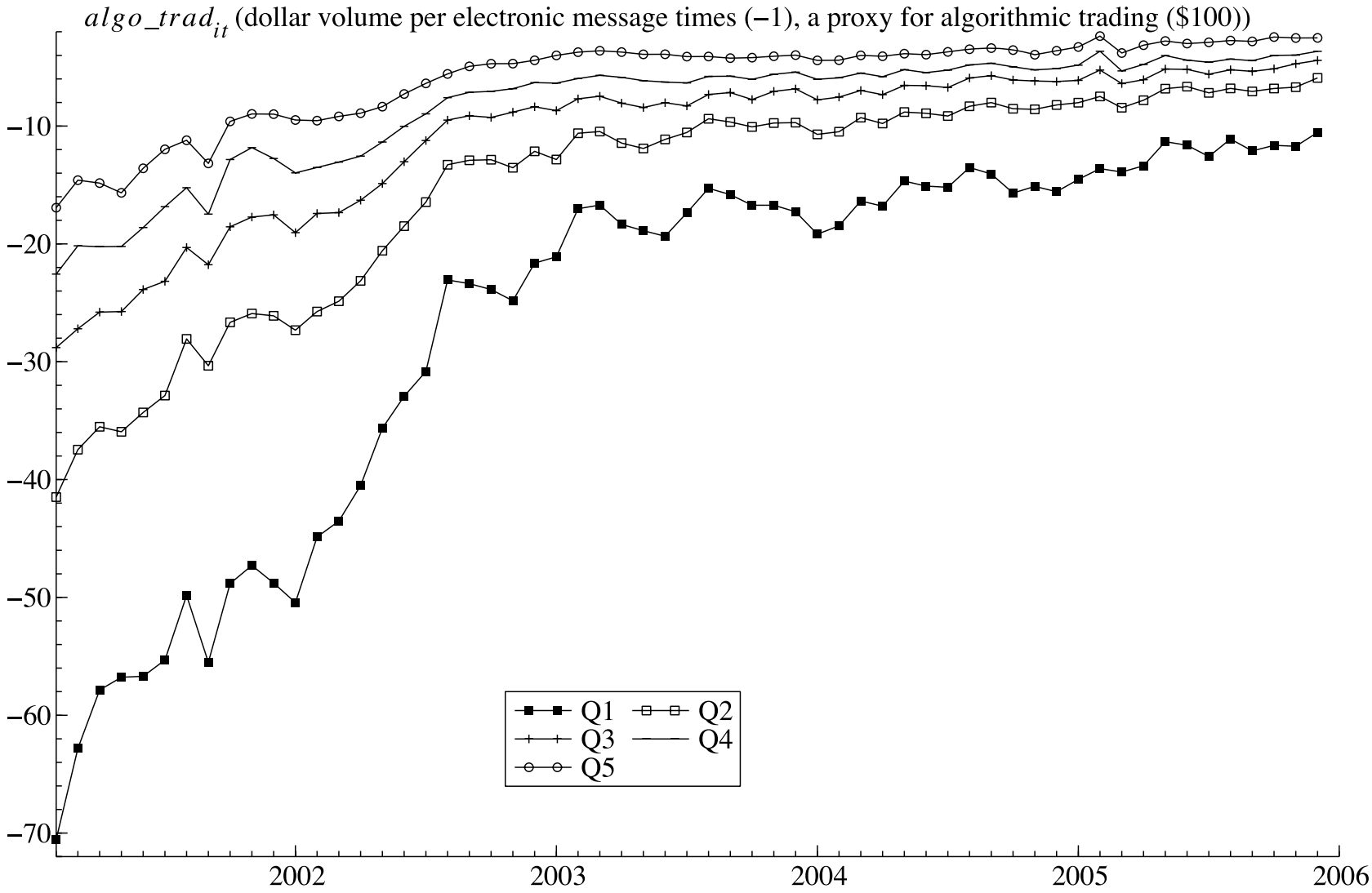
- Algorithms are frequently used to
  - Determine the timing, price, quantity and routing of orders
  - Monitor market conditions across securities and trading venues
  - Reduce price impact by breaking orders into smaller pieces
  - React more quickly to news and order imbalances

- How may AT affect market liquidity?
  - If AT makes it easier or less costly for liquidity providers to provide liquidity, then AT can improve liquidity
  - However, AT may also expose liquidity providers to increased picking-off and adverse selection risk, causing them to increase their spreads

“Algorithmic Activity” (sorted by market cap)



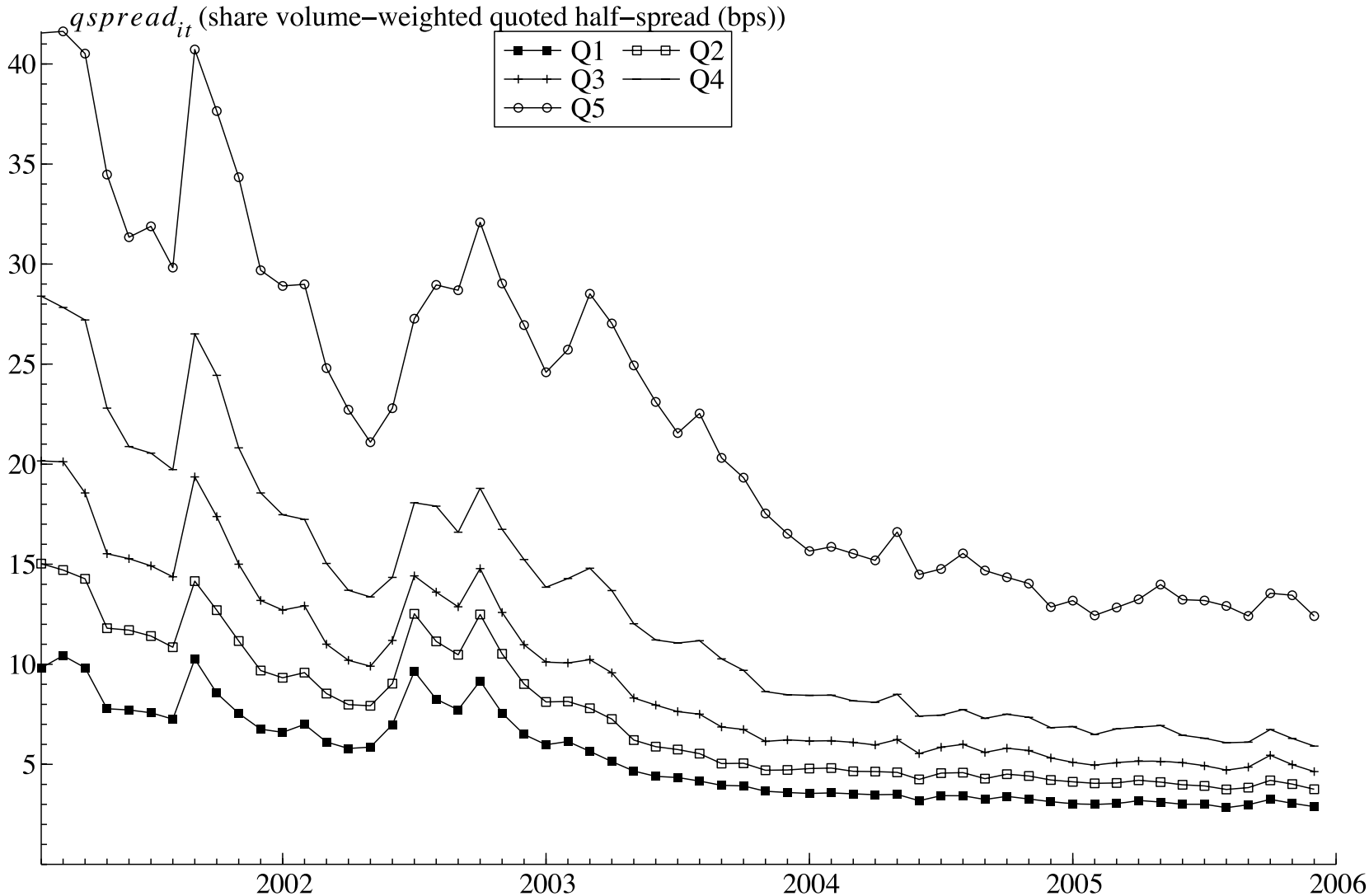
“Algorithmic Trading” (sorted by market cap)



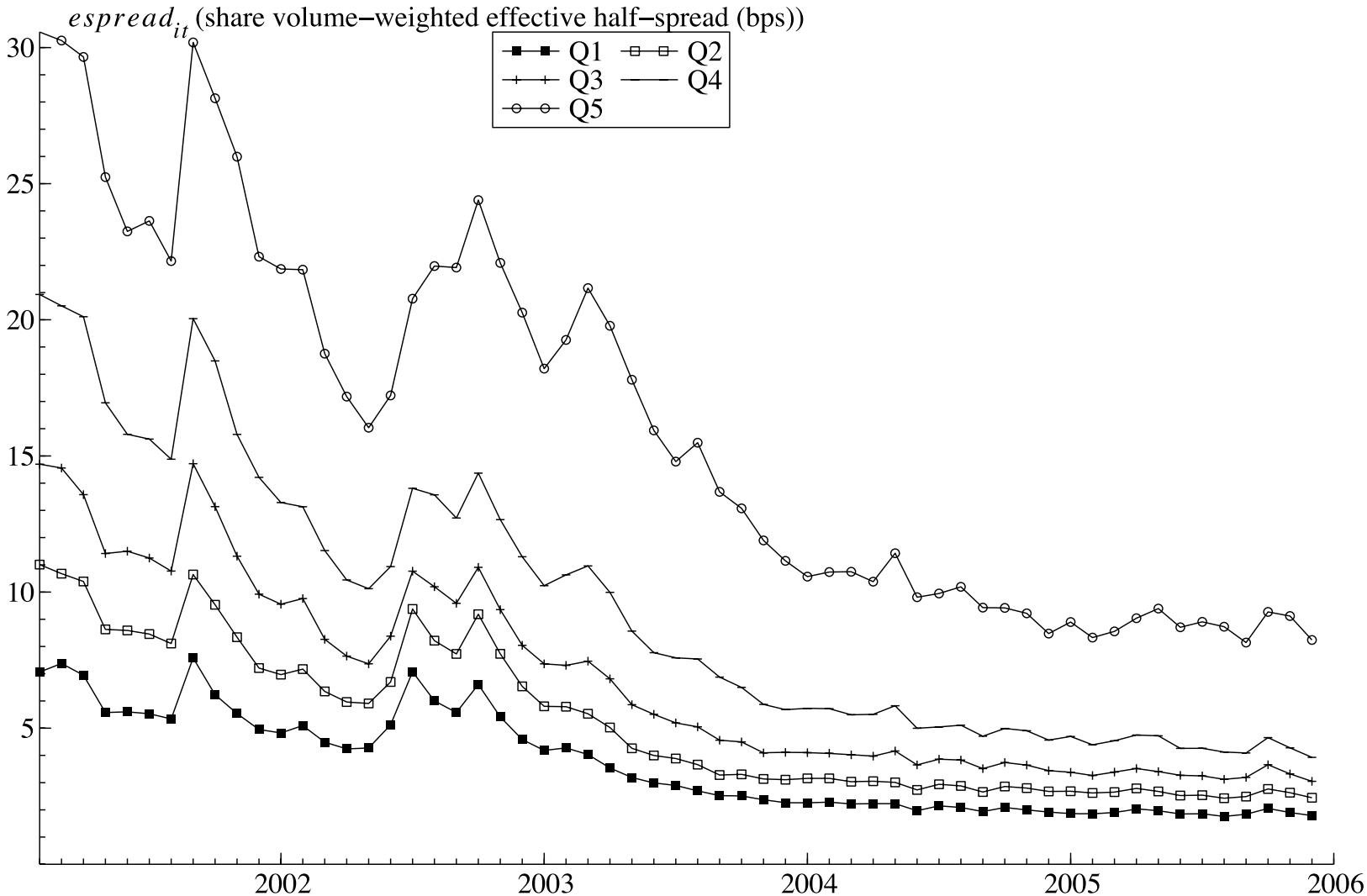
(Il-)Liquidity Measures

- quoted half-spread
- effective half-spread
- realized half-spread
- price impact

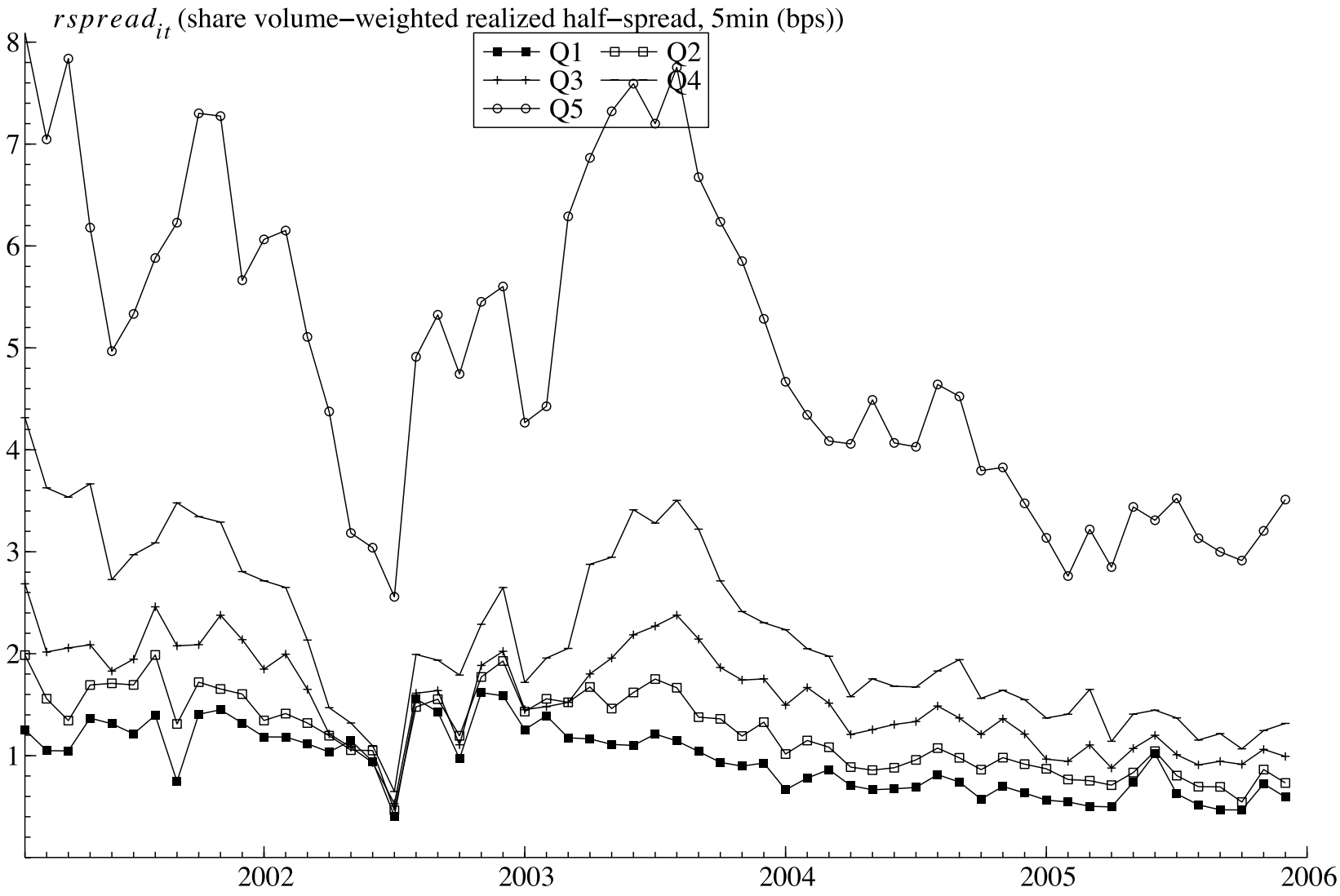
Quoted Half-Spread: $(a_t - b_t)/(2m_t)$



Effective Spread: $d_t \times (p_t - m_t)/m_t$

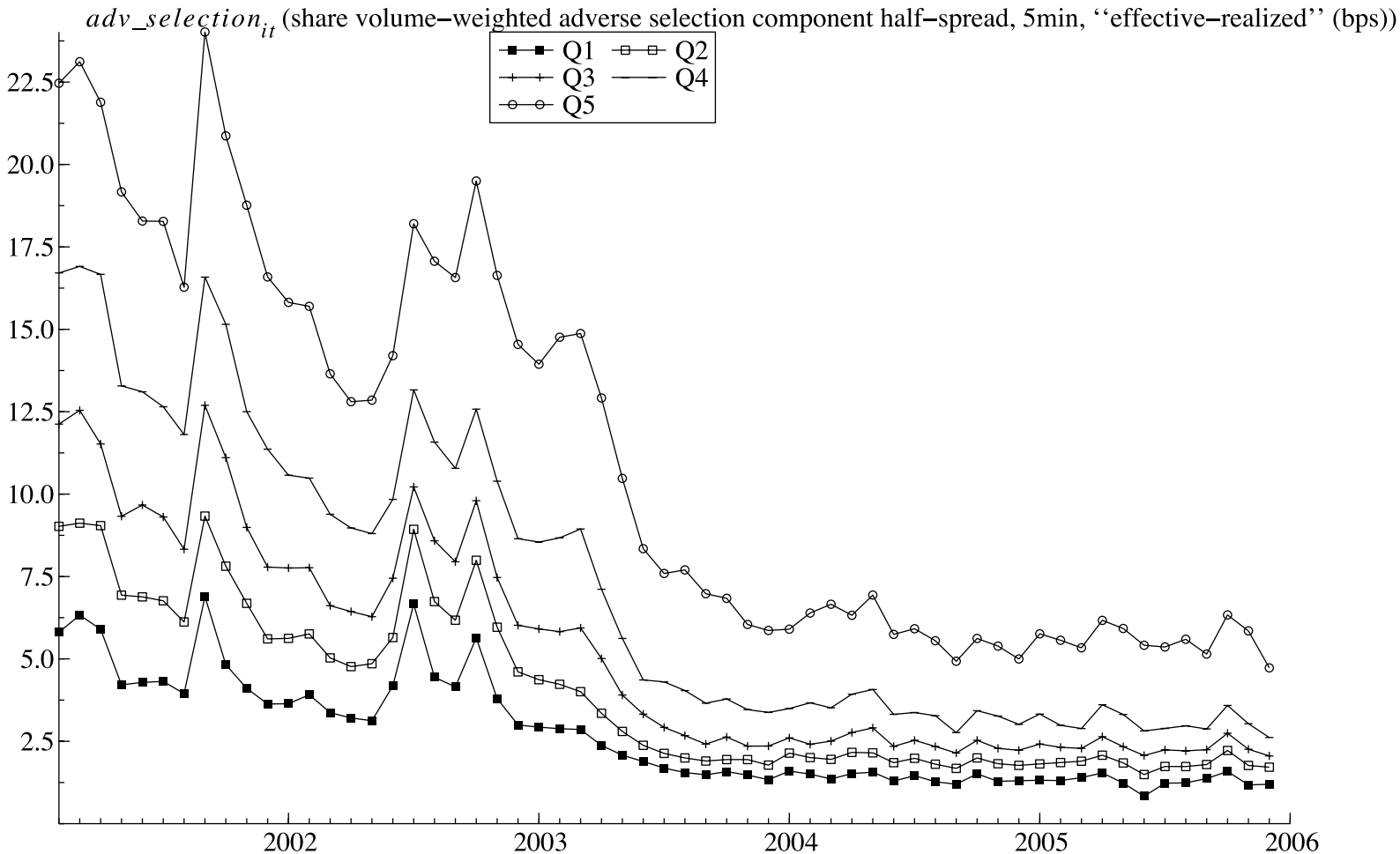


Realized Spread: $d_t \times (p_t - m_{t+5\text{min}})/m_t$



Price Impact: $d_t \times (m_{t+5\text{min}} - m_t)/m_t$

$$\underbrace{d_t \times (m_{t+5\text{min}} - m_t)/m_t}_{\text{price impact}} = \underbrace{d_t \times (p_t - m_t)/m_t}_{\text{effective spread}} - \underbrace{d_t \times (p_t - m_{t+5\text{min}})/m_t}_{\text{realized spread}}$$



Causality? (this is what we are after for!)

- graphical evidence: AT and liquidity are positively related
- however: no proof for **causality**
  - e.g., omitted variables bias, reverse causality, etc.
- need **exogenous** shock to AT . . .
  - . . . which affects some stocks, but not others
    - treatment versus control group
    - "natural" experiment!
  - here: NYSE Autoquote
    - change to market infrastructure, facilitates AT
    - see paper for details
    - key for empirical strategy: **staggered** introduction from 2003
  - Autoquote as **instrument** for AT

2SLS

- first stage:

$$AT_{it} = \alpha_i + \gamma_t + \beta\, Q_{it} + \text{controls} + \epsilon_{it}$$

  where:

  - AT_{it}: AT proxy
  - Q_{it}: Autoquote dummy
  - α_i: stock fixed effect
  - γ_t: time fixed effect

- second stage:

$$Illiquidity_{it} = \alpha_i + \gamma_t + \varphi\, \widehat{AT_{it}} + \text{controls} + \epsilon_{it}$$

  where $\widehat{AT}_{it}$ is predicted AT from first stage regression.

  Coefficient of interest: φ

Results

	Coefficient on $algo\_trad_{it}$				
	Q1	Q2	Q3	Q4	Q5
					Panel A: Quoted Spread, Quoted De
$qspread_{it}$	-0.53^{**}	-0.42^{**}	-0.43	-0.21	9.92
	(-3.23)	(-2.21)	(-1.44)	(-0.06)	(1.22)
$espread_{it}$	-0.18^{**}	-0.32^{**}	-0.35	-1.67	4.65
	(-2.67)	(-2.23)	(-1.56)	(-0.42)	(1.16)
$rspread_{it}$	0.35^{**}	0.76^{**}	1.03^{**}	14.25	15.88
	(3.52)	(3.97)	(2.06)	(0.46)	(1.36)
$adv\_selection_{it}$	-0.53^{**}	-1.07^{**}	-1.39^{**}	-15.51	-11.21
	(-3.56)	(-4.08)	(-2.06)	(-0.47)	(-1.33)

Bottom Line

- AT appears to have reduced quoted spreads, effective spreads and price impact for large-cap stocks
- no statistically significant effects for small-cap stocks
- however, AT also seems to have resulted in higher realized spreads, suggesting that early users of AT had market power