

# Zooming In on Equity Factor Crowding

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Capital Fund Management

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Preprint available: <https://arxiv.org/abs/2001.04185>

## Crowding

- ▶ Different investors following the same (or very similar) signals
- ▶ Expect it for well known strategies (“alternative  $\beta$ ”)

## Possible effects

- ▶ Erosion of performance due to competition for the same excess returns
- ▶ Increased transaction costs due to similar trade flows
  - Co-impact (market reacts to total net flow)!
- ▶ Systemic risk due to overlapping portfolios: liquidation can trigger further ones; cascades
  - Quant Crunch 2007

- ▶ If there is a crowd, it should be visible in the order flow: can we identify it?
- ▶ If yes, how does it behave in time?
- ▶ We will look at correlations between expected order flow (signal) and actual order flow

- ▶ Standard Fama-French factors + Momentum
  - SMB: Small [market capitalization] Minus Big
  - HML: High [book-to-market ratio] Minus Low
  - Momentum: Long term trends in asset prices
- ▶ Scope: Russell3000 1995-2018
- ▶ Signal: ranked, normalised
- ▶ Trading is costly: need to slow down the signal
- ▶ Quadratic trading costs lead to exponential slowing down
- ▶ Expected position:

$$\pi_{i,t} = A \sum_{t' \leq t} s_{i,t'} \exp\left(-\frac{t-t'}{D}\right)$$

- ▶ Expected order flow

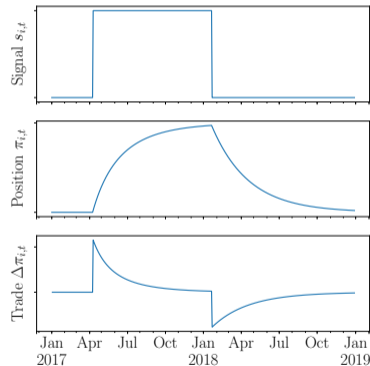
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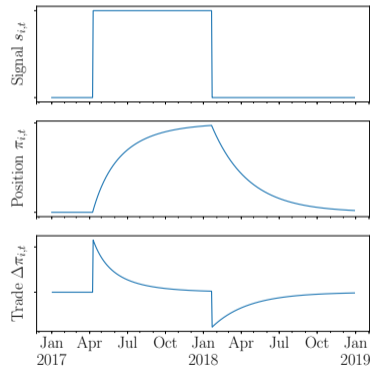


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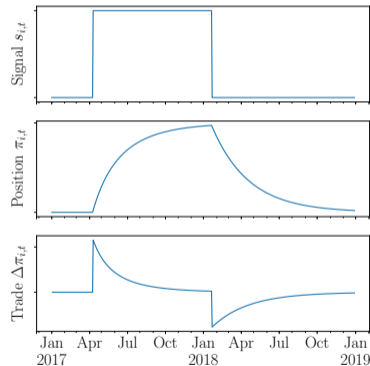


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### Microstructure data

- ▶ All trades and order book updates
- ▶ 1600 US stocks, 2011-2018
- ▶ This is **anonymous** flow
- ▶ Daily trade imbalance

$$I_{i,t}^{\text{volume}} = \frac{\sum_{n \in \mathcal{E}_t} \overbrace{\epsilon_{i,n}}^{\text{sign}} \cdot \overbrace{V_{i,n}}^{\text{volume}}}{\sum_{n \in \mathcal{E}_t} V_{i,n}}$$

- ▶ Daily order book imbalance

$$I_{i,t}^{\text{book}} = \frac{V_{i,t}^{\text{bid}} - V_{i,t}^{\text{ask}}}{V_{i,t}^{\text{bid}} + \underbrace{V_{i,t}^{\text{ask}}}_{\text{avg quote}}}$$

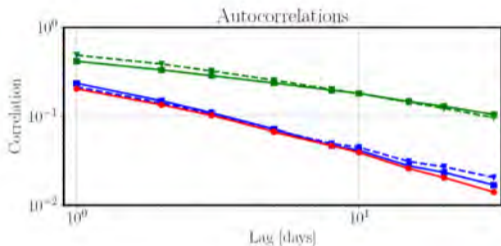
### Metaorder data

- ▶ Ancerno dataset: institutional investors
- ▶ 1999 - 2014
- ▶ Covers  $\approx 10\%$  of volume
- ▶ Data contains client identification
- ▶ Possible to **group trades to metaorder**
  - same client
  - same start/end date
  - same direction
  - same product

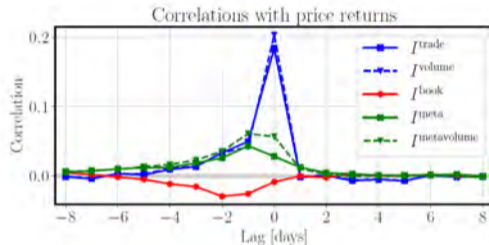
$$I_{i,t}^{\text{meta}} = \frac{\sum_{m \in \mathcal{E}_t} \epsilon_{i,m}^{\text{meta}}}{\sum_{m \in \mathcal{E}_t} |\epsilon_{i,m}^{\text{meta}}|}$$

- ▶ Executed via limit or market orders

## Imbalance autocorrelation



- ▶ Positive autocorrelation
- ▶ Decays very slowly
- ▶ Power-lawish:  $C(\ell) \sim \ell^{-\gamma}$ ;  $\gamma \approx 0.5 - 0.8$

Imbalance<sub>t</sub>-return<sub>t+l</sub> correlation

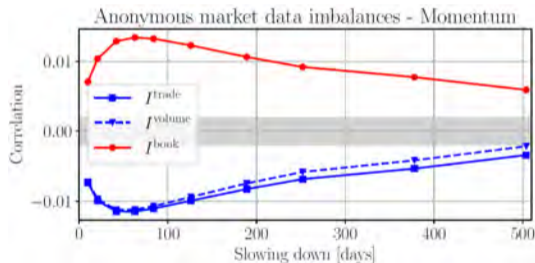
- ▶ Positive at zero lag
- ▶ Zero for  $\ell > 0$ : past public info does not predict future returns
- ▶ Positive for  $\ell < 0$ : compatible with autocorr

## Results

- ▶ We find a significant correlation
- ▶ Peak at 3-4 months (in line with autocorr time of signal)
- ▶ Positive correlation to OB imbalance
- ▶ Negative correlation to trade imbalance

## Possible interpretations

1. Aggressive flow following mean-reversion
  - Unlikely: MR profitable on much shorter times
2. Momentum followed by passive orders
  - Quite possible (AQR paper: 80% of volume executed via limit orders)

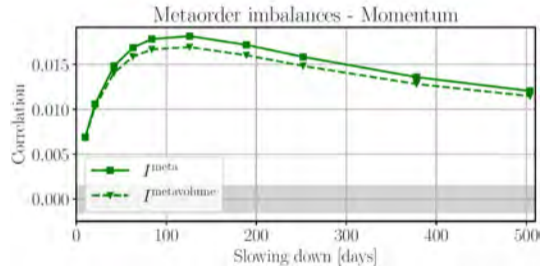


## Results

- ▶ We find a significant correlation
- ▶ Peak at 4-6 months
- ▶ Correlation is positive
- ▶ Note: very similar shape as anonymous data

## Interpretation

- ▶ Institutionals follow Momentum strategies
- ▶ Execution via limit orders

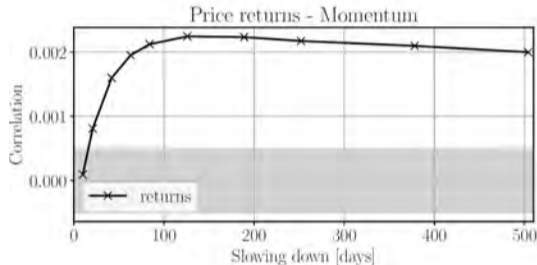


## Results

- ▶ Significant correlation
- ▶ But much weaker than with imbalances

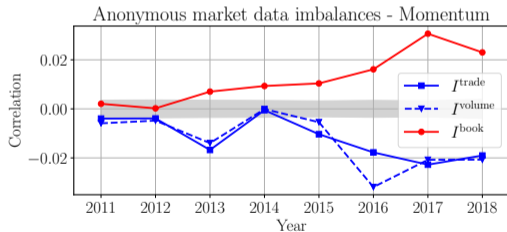
## Interpretation

- ▶ It is very hard to see things on prices!
- ▶ This correlation can help estimate costs ( $C(Q) = \int_0^Q p(q) dq$ )
- ▶ Need to compare to correlation of **position** and returns ( $\approx 0.1\%$ )
- ▶ In a quadratic cost model: price paid is half of instantaneous impact
- ▶ Suggests: **costs**  $\approx$  **gains!**
- ▶ Note: other implementations still work



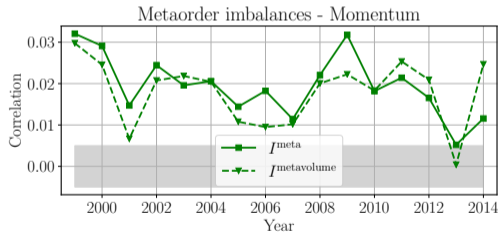
## Anonymous flow

- ▶ Consistently significant correlation
- ▶ Clear upward drift since 2012
- ▶ Increased crowding



## Metaorder flow

- ▶ Consistently significant correlation
- ▶ No clear trend can be found
- ▶ Note: periods only partially overlap



## Anonymous flow

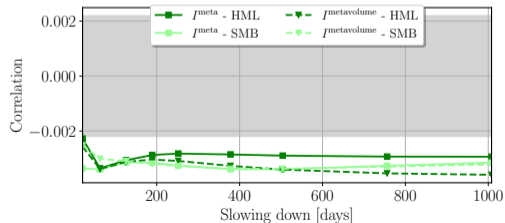
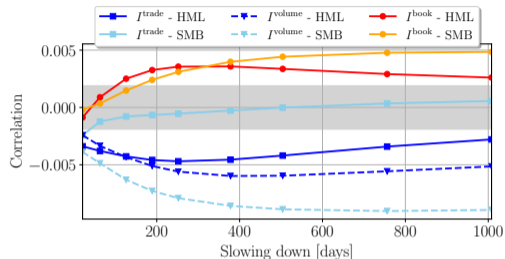
- ▶ Significant correlations
- ▶ Positive for OB, negative for trade imbalance
- ▶ Weaker than for Momentum
- ▶ Expected, since longer holding period (less rebalancing)

## Metaorder flow

- ▶ Correlations are barely significant

## Time evolution

- ▶ Too noisy to say anything



## Conclusions

- ▶ Crowding can be quantified through correlations between imbalances and expected flow from equity factors
- ▶ Signals are particularly significant for Momentum: it is crowded
  - In line with recent low profitability
- ▶ Crowding appears to have increased in the past years
- ▶ Results are robust
  - Across stocks (liquidity, tick size, ...)
  - Changing the mechanism for slowing down
  - Looking at only long/short leg
- ▶ HML and SMB: clear signs of crowding in anonymous flow data

## Open questions

- ▶ How to relate weakening performance to crowding
  - Front-running until signal disappears?
  - And if crowd leaves, signal returns?
- ▶ Quantify risk of de-leveraging spirals → policy implications