# The impact of computer based trading on systemic risk

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# Some general remarks

- I mainly agree with the conclusions of the study.
- I particularly appreciate the interdisciplinary composition of the experts who were consulted.
- I particularly liked the paper by Zigrand and Shin.
  - Catalogs feedback loops and instabilities.
  - Focuses on dynamics!
  - “in specific circumstances CBT can lead to significant instability. In particular, self-reinforcing feedback loops, as well as a variety of informational features inherent in computer- based markets, can amplify internal risks and lead to undesired interactions and outcomes”.

# CBT and rationality

- Computer algorithms have bounded rationality
  - CBT follows stimulus-response reasoning
  - mimics cerebellum, not cerebrum (rules of thumb)
- High frequency CBT is stupider than low frequency CBT: Fast => few lines of code
  - rationality of HFT algos is *strongly* bounded
  - no *de novo* reasoning: More like biology than neoclassical economics: HFT firms are explicitly evolutionary in strategy testing (e.g. GETCO)
- Beware of reliance on game-theoretic equilibria when strategies must be learned
  (Galla and Farmer, PNAS, 2013)

# Is market efficiency only approach to understanding systemic risk?

- How to understand market failures such as instabilities and feedback loops leading to systemic risk or crashes?
- Two paths:
  - neoclassical approach with relaxed assumptions: asymmetric information, institutional constraints, incomplete markets, ...
  - Acknowledge deviations from efficiency at outset, and investigate how they affect markets.

# Friedman paradox

- Market efficiency requires arbitrageurs but arbitrageurs require inefficient markets.
  - see also Grossman and Stiglitz
  - markets necessarily deviate from efficiency
  - It is difficult but not impossible to make consistent profits (e.g. Prediction Company)
  - markets are (informationally) efficient at first order but necessarily inefficient at second order
  - standard approach assumes perfect efficiency
- Do deviations from efficiency drive market instabilities, e.g. systemic risk?

# Market ecology

- Inefficiencies driven by demand for diversification and liquidity. Supports a rich ecology of predators.
- Market impact makes it possible to understand market food web in terms of pairwise interactions.
- Trading moves prices, price movements cause trading, ...
  - on longer timescale profits affect the ecology
- Instabilities in price dynamics depend on ecology.
- Hypothesis: Many market malfunctions driven by disruptions of evolutionary dynamics of ecology.

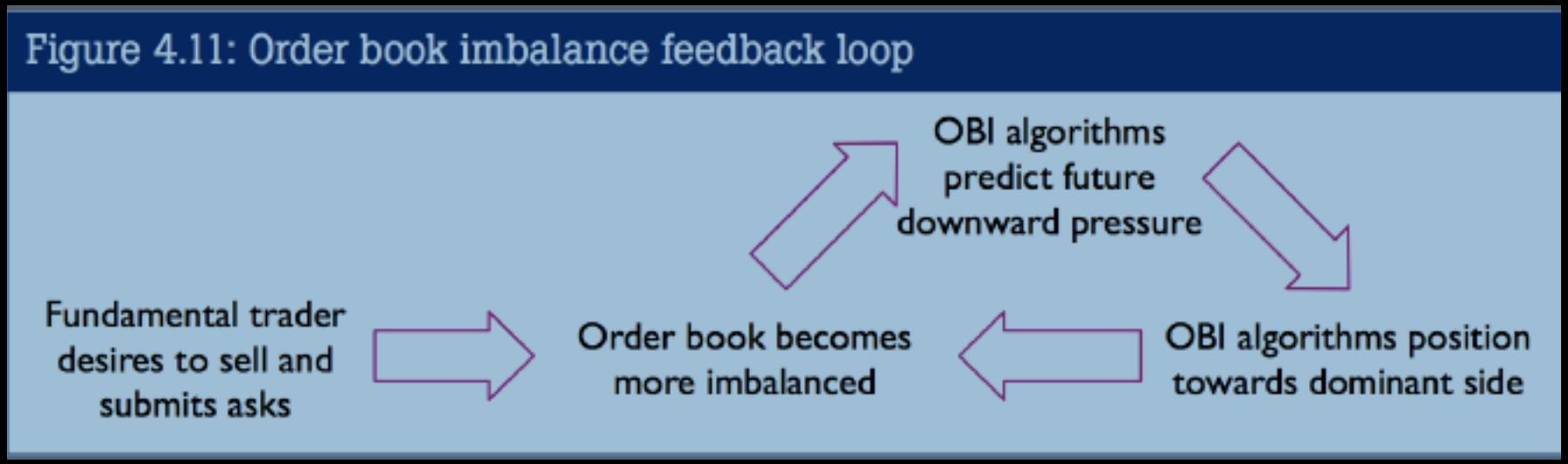
  Market force, ecology and evolution (Farmer, 2002)

  An ecological perspective on the future of computer trading, Farmer and Skouras, (driver review, 2012)

# Market ecology

- Key question is to identify inefficiencies and study their interactions.
- How are inefficiencies removed?
- What price dynamics does this lead to?
- How is trading capital redistributed as a result (i.e. how is ecology reconfigured)?
- Makes it possible to identify instabilities

# Indirect path to efficiency: Order book imbalance




- Exploiting inefficiency does not remove it
- Instead it widens spread
- Makes market making more profitable

  (unpublished research with Jim Gerard and Jim Rutt)

# We need better data!

- Quote from executive summary:
  - "a drive towards making better data available for analysis should be a key objective and the experience of this Project suggests that political impetus could be important in achieving that quickly".
- Ecology requires data with counterparty identifiers
  - some studies already done for HFT on limited scale
  - however, need to map entire ecology to know who feeds whom and how this shifts through time

# Huge advantage to speed

- Quote from study regarding concerns about HFT: "High frequency traders exploit their speed advantage to disadvantage other participants in financial terms"
- With Spyros Skouras, we estimate the average advantage for achieving queue priority is 0.1 - 1 cent per trade. Low estimate => $500B/year.
  - advantage because on average high priority quotes get hit by smaller market orders, which have less impact. Also priority quotes get hit more often.
- Bottom line: Under price-time priority auction there is a huge advantage to speed.

  Are markets too fast? (Skouras and Farmer, 2012)

# Problems with HFT

- HFT algorithms can only execute a few lines of code
  - cannot spend much time thinking
  - any code checking for unusual conditions lowers profits
  - only time for gut reaction
- No intrinsic social welfare value
  - waste of human and computer resources

# How to slow things down?

- Standard proposals:
  - Tobin tax, minimum resting times,
  - All of these create frictions, selectively advantage some players at expense of others
  - band-aid solutions
- Price-time priority is an historical accident

# Alternative proposal

- We propose an alternative:
  - pro rata instead of time priority
  - sequential call auctions at random times, e.g. roughly once a minute
  - provide limited indicative price information
- These measures would completely eliminate HFT
- Usual argument for HFT is liquidity provision
  - liquidity can be provided via other means
- Deserves further study

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