

Slowing Down Fast Traders: Evidence from the Betfair Speed Bump

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Introduction

- The majority of financial market trade is now automated, and implemented by algorithms
- This means that trading firms increasingly compete on the speed of their trading
- The fastest traders can react to macro and financial news quicker, arbitrage price differences quicker, and extract information from the orders of others quicker
- Baron *et al.* (2014) find that the fastest algorithmic high-frequency traders (HFTs) are consistently the most profitable, and make 45% of their profits from adversely-selecting slightly slower liquidity-providing HFTs
- The returns to being the fastest have led, perhaps predictably (Biais *et al.*, 2014), to an arms-race in speed-enhancing technologies

Example 1 (Wired, 2012)



- The arbitrage of price differences between stock exchanges in New York and futures and options markets in Chicago relies on speed
 - Original cable developed in the 1980s, in red, allows for round-trip communication time of 14.5 milliseconds
 - Spread Networks cable developed in 2010 at a cost of \$300m, in green, brings this down to 13.1 milliseconds
 - Two sets of microwave towers developed in 2012, in orange and blue, reduce the time to 8-9 milliseconds at a cost of \$250,000 a year to each investor

Example 2 (U Michigan Survey, 2012)

- In 2012, Thomson Reuters sold the announcement of the University of Michigan Consumer Sentiment Survey to high-paying customers 2 seconds before general release
 - According to Nanex, 2m shares of a S&P 500 exchange-traded fund changed hands in 10 milliseconds after the advance announcement (*NYT*, July 13th 2013)
 - The next year, when the practice was discontinued under a settlement with the Attorney General, 500 shares were traded
- Although this example was stopped, financial exchanges still routinely sell advance access to market information and co-location (to speed up trading execution)

Algorithmic Trading and Liquidity

- Early work on the introduction of algorithmic trading in financial markets (e.g. Hendershott *et al.*, 2011) found reductions in the cost of trading (bid-ask spreads)
 - Explanation: automated trading reduces the costs of attention, and allows liquidity providers to manage their inventories more effectively
- But, the introduction of algorithmic traders in the forex market increased adverse selection costs for slower traders (Chaboud *et al.*, 2014)
- Speed upgrades - for some traders - on the Nasdaq OMX in Scandinavia led to larger effective bid-ask spreads (Menkveld and Zoican, 2014)
 - The fastest traders use their advantages, in part, to pick off slower traders, and the returns to such strategies create incentives for over-investment in speed-enhancing technologies

Solutions?

- What can be done to reduce/eliminate the advantages to the fastest traders?
- One option is a speed bump, as used by IEX of Flash Boys (Lewis, 2014) fame, and introduced by Toronto Stock Exchange (TSX) Alpha in Autumn 2015
 - A speed bump introduces a delay (5-25 milliseconds) between the time in which an order is submitted and the time that the order is logged on the exchange
 - By the time the order of the fastest trader hits the exchange, the private information they had - e.g. in relation to a macro announcement - will be in the hands of all other traders
- By taking away the ability to profit from fleeting informational advantages, the speed bump could reduce adverse selection, reduce bid-ask spreads (increase liquidity), and, perhaps, reduce expenditure in speed-enhancing technologies

Inplay Betting Markets

- While the speed bump, or order processing delay, is a recent innovation in financial markets, such a design has been used in betting markets for more than a decade
- Inplay betting markets - conducted during a sporting event - are afflicted by an obvious form of adverse selection
- Due to broadcast delays, those present at the event - dubbed 'court-siders' or 'pitch-siders' - may know of a point/goal seconds before others watching at home
 - Analogous to the fastest HFT who knows of a macro/firm announcement milliseconds before others
- Betfair use a speed bump (of 5-9 seconds), so that by the time the pitch-sider's trade hits the exchange, liquidity-providing bettors also know of the goal and can have cancelled their quote (cancellations are not subject to the speed bump)

Betfair

★ C Palace 0-0 Man City

 Live Stream
Multiples

30'

Match Odds

 In-Play i Rules Betfair SP [?]

Matched: GBP 4,089,128 Refresh

3 selections	100.9%		Back all	Lay all	99.8%	
C Palace	6.6 £1033	6.8 £335	7 £833	7.2 £323	7.4 £204	7.6 £790
Man City	1.68 £7510	1.69 £3019	1.7 £2411	1.71 £5769	1.72 £6874	1.73 £6768
The Draw	3.5 £2079	3.55 £1036	3.6 £1475	3.65 £1365	3.7 £163	3.75 £578

A screenshot of the Crystal Palace vs. Manchester City match on the 6th April 2015




Speed Bump in Action

Please wait... 1

Match Odds

In-Play Rules Betfair SP [?]

Matched: **GBP 4,209,274** **Refresh**

3 selections	101.0%		Back all	Lay all	98.9%	
 C Palace £11.70	2.56 £729	2.58 £918	2.6 £32	2.68 £12	2.72 £522	2.76 £73
 Man City -£1.88	3 £2152	3.05 £178	3.1 £1721	3.15 £500	3.2 £985	3.25 £10
 The Draw -£1.88	3.15 £2	3.25 £437	3.3 £10	3.35 £24	3.4 £2075	3.45 £945

Market order is 1 second away from arrival on the exchange (due to the speed bump)

External Validity and Betting Literature

- Some obvious differences between betting and financial markets but similar market structure is used (LOB), manual and algorithmic trading is possible, and size of markets studied (9.3 billion GBP) should ensure bettors price assets efficiently and competitively
- Betting markets often used to study market efficiency, as fundamentals are revealed at the close of proceedings:
 - e.g. Ali (1977), Snyder (1978), Snowberg and Wolfers (2010), Shin (1993), Vaughan Williams and Paton (1997), Croxson and Reade (2014), Brown (2014), and Brown and Yang (2014)
- Adverse selection problem, related to information arrival and cross-market arbitrage, is similar. Less concern in betting markets about prediction of order flows (Lewis, 2014)
- Occasional paper from FCA, 2016, suggests the latter is also less of a concern in U.K. financial markets

Impact Evaluation of Speed Bump

- We need a counterfactual: how liquid would the exchange have been without the speed bump? Unfortunately, the speed bump has been used since the inception of inplay betting
- We compare the liquidity of markets with a long delay (> 5 seconds), with the liquidity of markets with a short delay (≤ 5 seconds)
 - But assignment of delays is not random, even after controlling for pre-match liquidity (no pitch-siders and no speed bump)
- We also exploit steady increases in the average order processing delay over 5 English Premier League football seasons from 2008/9 to 2012/13
 - We compare drift in inplay liquidity over the 5 seasons, to any contemporaneous drift in pre-match liquidity (in DiD framework)
 - We also run placebo tests with Wimbledon tennis betting, where inplay delay was held at 5 seconds

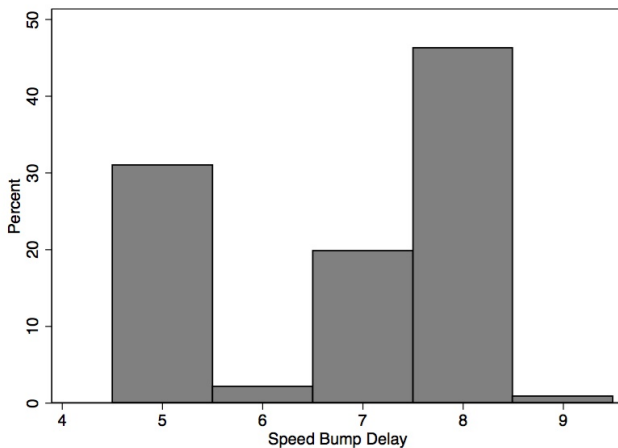
Literature Review

- Part of a nascent literature on market designs to limit the advantages to the fastest traders:
- Budish *et al.* (2013, 2015) propose frequent batch auctions. Orders are aggregated every second, and market clearing prices and quantities determined. Crucially, no preference given to orders submitted earlier in each window
- Gai *et al.* (2013) propose further de-regulation of the minimum tick size, to create HFT competition on price rather than speed
- Speed bump is already at work on an exchange, and appears to be an attractive solution for exchange operators, given its adoption without a known impact evaluation

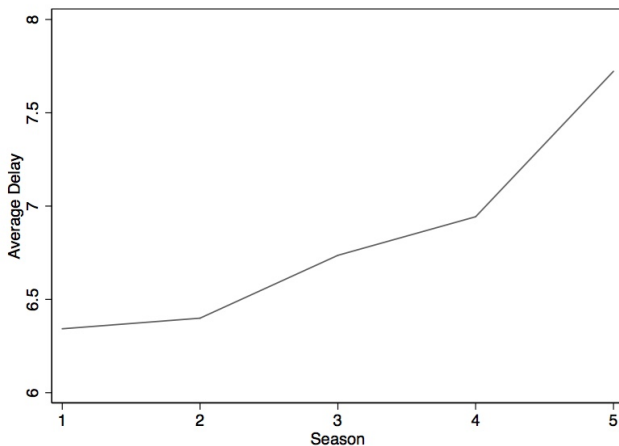
Data

- Data is obtained from Fracsoft. Data comprises snapshots of the Betfair limit order book from morning (pre-match) until the completion of each match
- We observe the best three back and lay quotes (and associated volumes), as well as the last matched price and total matched volume, each second
- EPL football data from 2008/9 to 2012/13 relates to 5,211 separate bets (i.e. approx. 347 out of 380 matches per season). More than 108 million observations
- Placebo Wimbledon tennis data from 2008 to 2013 relates to 641 out of a possible 768 matches over the 6 years. Approx. 35.4 million observations

Order Processing Delay



Speed Bump between 2008/9 and 2012/13



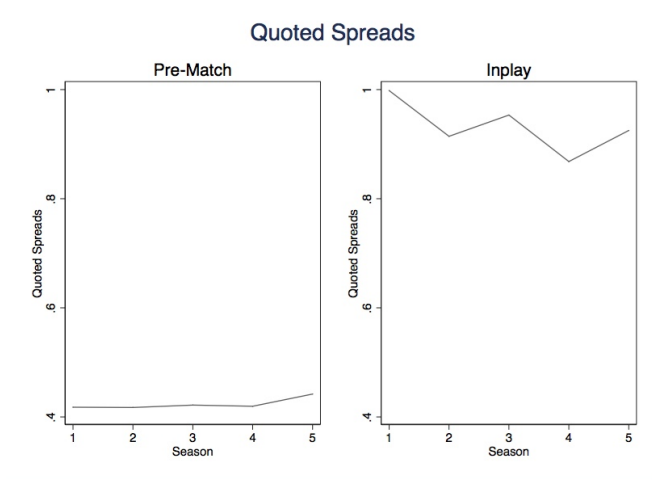
Result 1:

- Adverse selection appears to be reduced with a longer speed bump delay
- Market order traders are less able to predict fundamentals/goals (and pick-off slow limit order traders) when the delay is longer, both within and across seasons

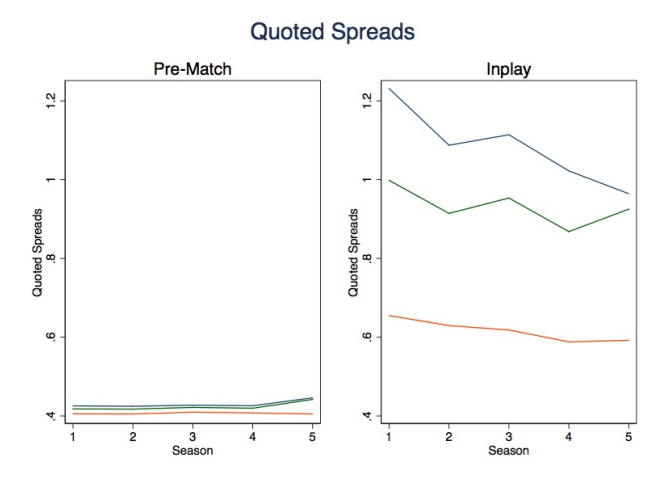
Result 2:

- The 'effect' of a longer order processing delay on market liquidity (spreads/depths etc.) and quality (trading volume and frequency) is less clear
- Opposing effects are detected depending on the use of within/across season variation

Quoted Spreads: Across Seasons

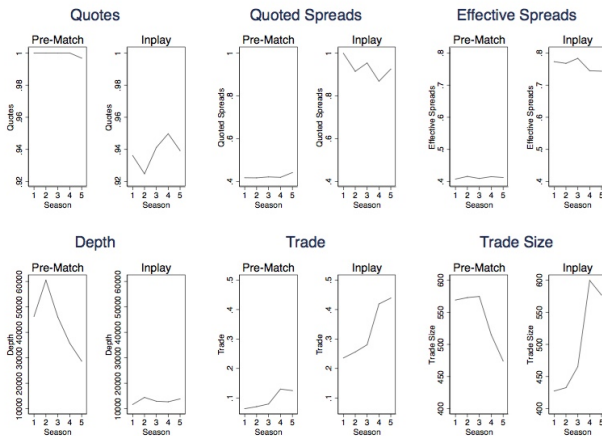


Quoted Spreads: Across & Within Seasons

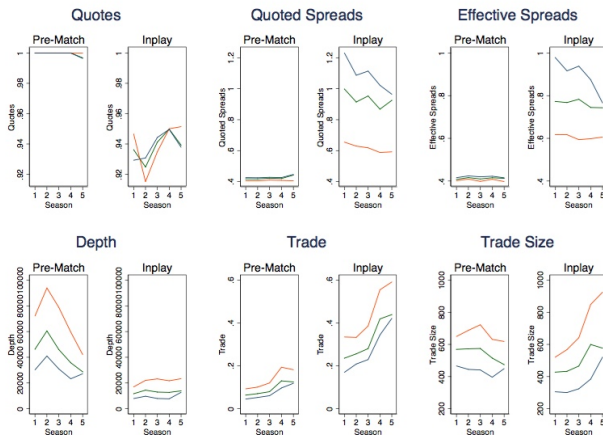


Notes: All, Short Delay, Long Delay

Market Quality: Across Seasons



Market Quality: Across & Within Seasons



Notes: All, Short Delay, Long Delay

Result 3:

- More like a caveat to Result 1.
- Cancellations are not subject to the speed bump. Therefore, pitch-sider can bet (provide quotes) on all teams, then cancel the bet on the team that just conceded a goal
- Cancellations predict/anticipate goals more accurately when the delay is longer, both within and across season
- This subjects slow bettors to a form of the winner's curse (Thaler, 1988)

Conclusion

- Concerns that competition over speed in financial markets is hurting liquidity
 - Some argue that this is nothing new: e.g. Nathan Rothschild and the Battle of Waterloo 1815.
 - But greater automation of information processing and trade may give fastest traders a continual advantage, and continually impair liquidity
- We evaluate the effectiveness of a speed bump:
 - Longer delay did protect slower limit order traders and reduce adverse selection
 - Effect on market liquidity is more difficult to decipher (more research needed)
 - Suggestion that adverse selection risk may simply have been shifted around, and not eliminated