The Value of a Millisecond: Harnessing Information in Fast, Fragmented Markets

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WHAT IS A SPEEDBUMP?
WHY WOULD WE NEED ONE?

The language of modern capital markets

Fragmented Liquidity: Problem

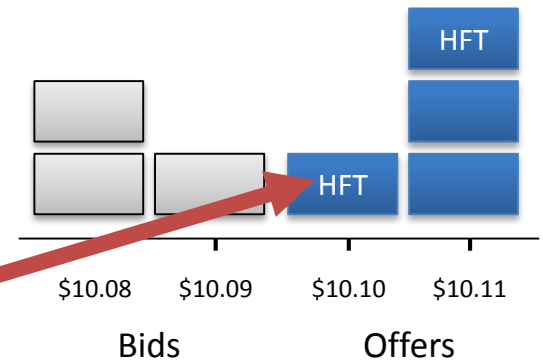- In modern markets liquidity is fragmented across venues
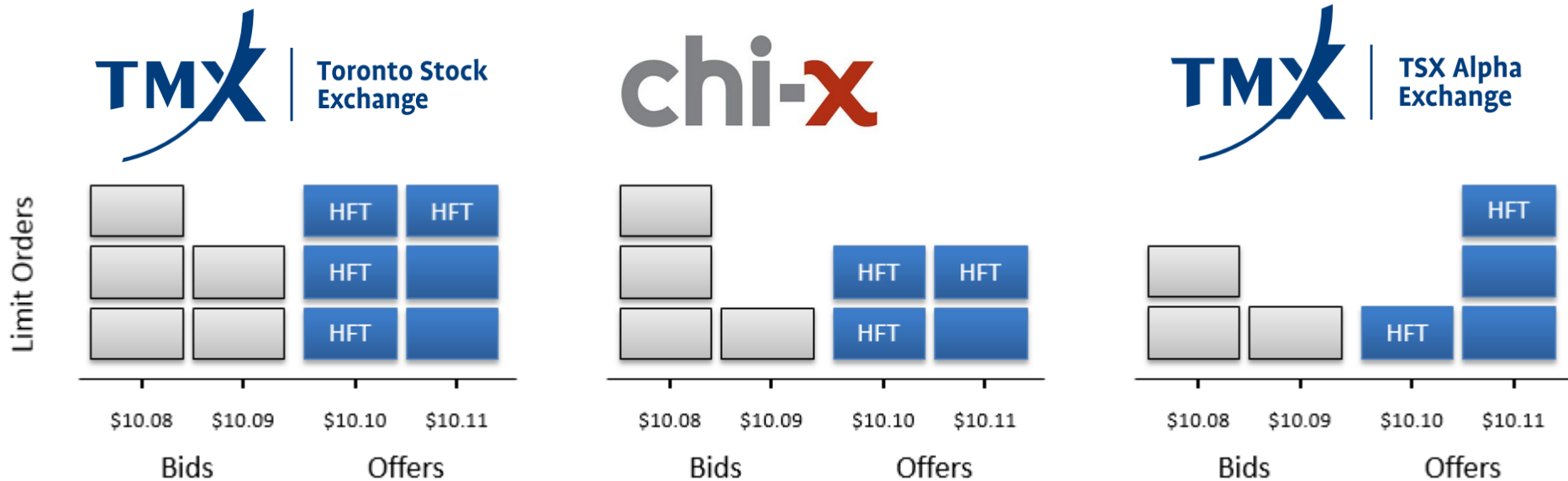
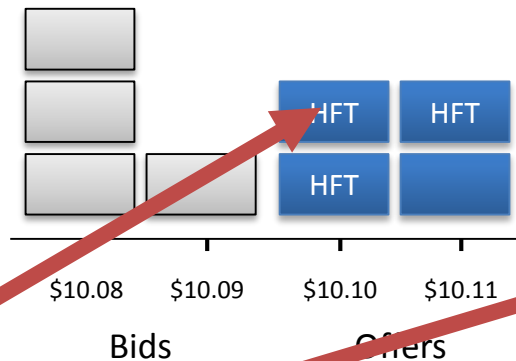# Quote Fade: Problem

- Liquidity supply is fragmented across venues
- Accessing this liquidity requires interacting with all venues
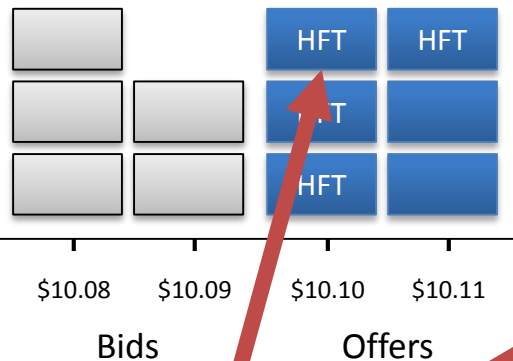
Liquidity "Fades" due to HFT

- HFT may be faster than regular traders
- Trader receives a fill on LSE, but orders are cancelled elsewhere
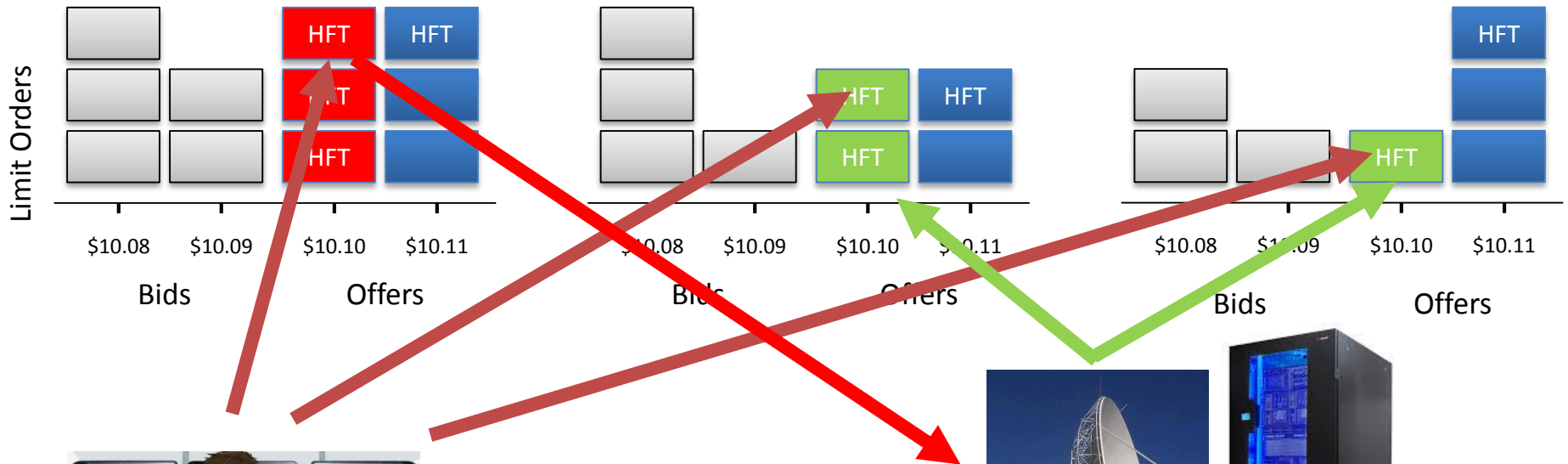
Consequences of Liquidity Fade

- Trader receives low fill rate

Consequences of Liquidity Fade

- Or trader is forced to pay more

- HFT can extract rents
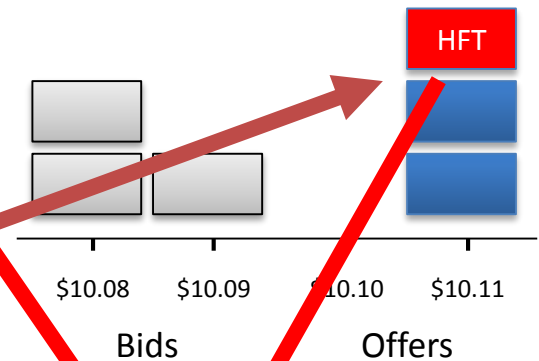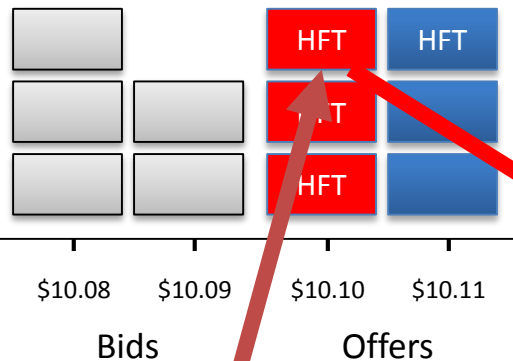
Solution: Speedbump

- Trader can send order to IEX earlier, to ensure that both the LSE and IEX order arrive at the same time.

- This minimises opportunity for HFT to remove liquidity.
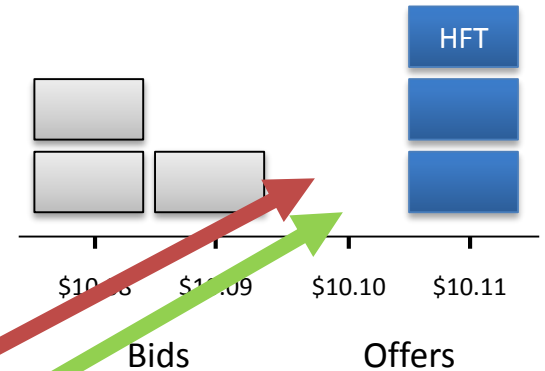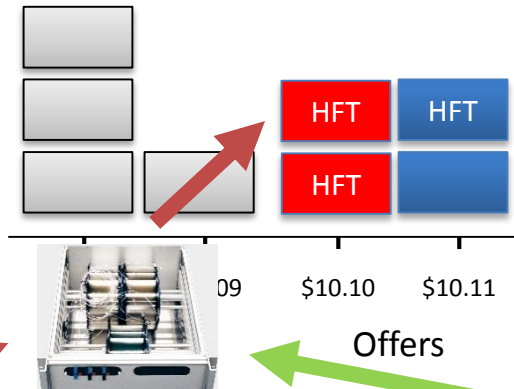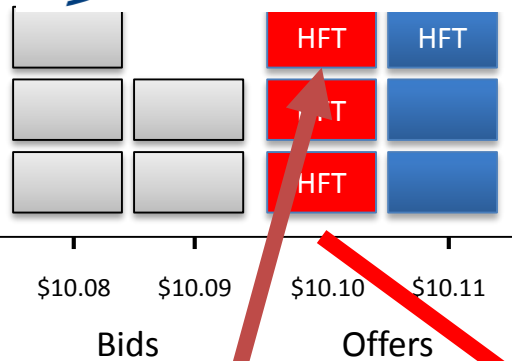
EXPERIMENT:
ALPHA SPEED BUMP IN CANADA

Not All Speed Bumps Are Created Equal…

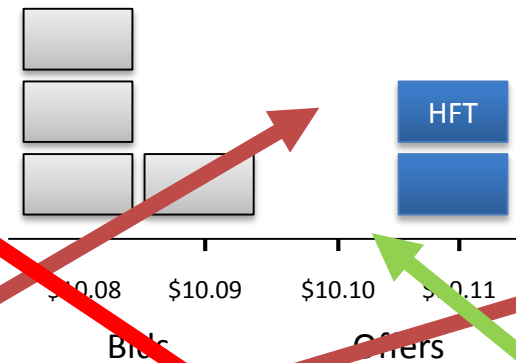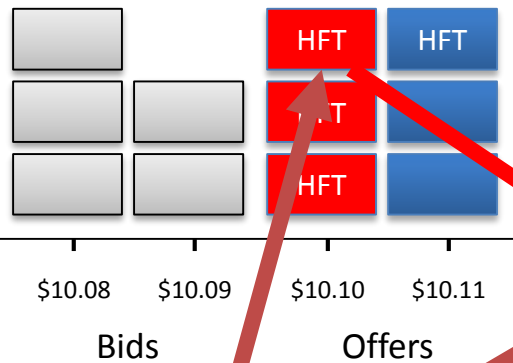- Relaunched on the 21st of September 2015

- Speed bump, randomised between 1 and 3 milliseconds, for all orders **except post only**

- What are **"post only"** orders?
  - Limit orders unable to remove liquidity, i.e. opposite of "fill or kill"
- Inverted maker-taker pricing
  - Means Rebates are paid to those who "take" liquidity with market orders
  - Fees are charged to those who "supply" liquidity with limit orders

Comments from Industry

- **ITG Canada**
  - *The new Alpha design … will allow passive "post only" resting orders … the **ability to fade** should they see trading on another venue.*

- **TD Securities**
  - *The introduction of speed bumps on both Alpha and Aequitas will slow down the operation of smart order routers, making it more difficult to access liquidity at depth and aggravating **quote fade** across all marketplaces.*

- **Scotia Capital**
  - *Often shares will be withdrawn from the market as soon as the order begins to execute (i.e. **liquidity fade**).*

Methodology + Metrics

- Event study around Alpha's market structure changes

$$y_{i,d} = Post_d + Price_{i,d} + Turnover_{i,d} + Volatility_{i,d} + FE_i + e_{i,d}$$

- Standard market quality metrics
  - NBBO quoted spreads and depth
  - Effective spreads, realised spreads and adverse selection

- New market quality metrics
  - Depleted Orderbook: instantaneous adverse selection costs
  - Taking one level of the NBBO: "walking the book"
  - Quote Fade: inaccessibility of displayed quotes

IMPACT OF ALPHA'S SPEEDBUMP
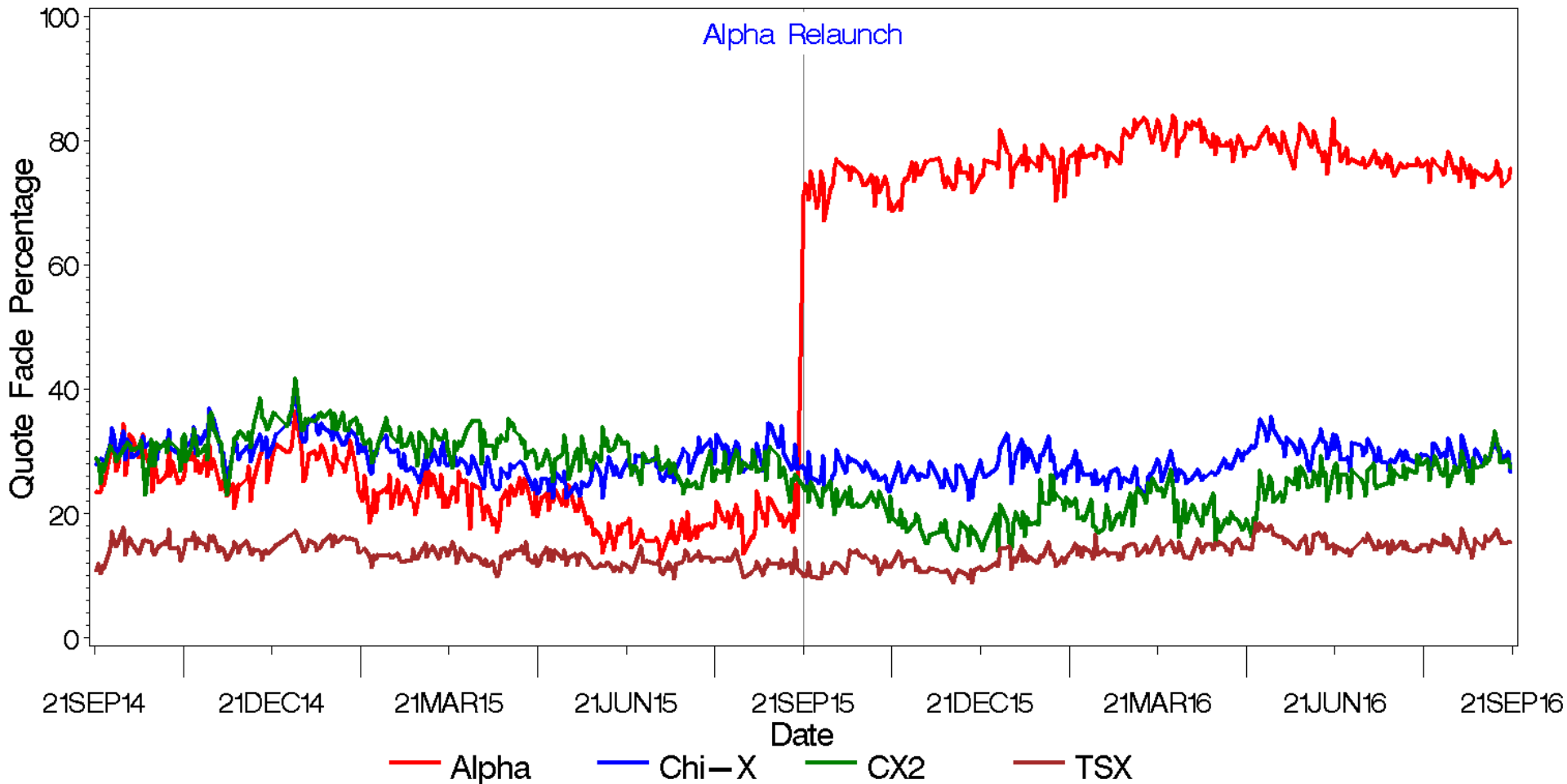
Rebates Attract Retail Liquidity Takers
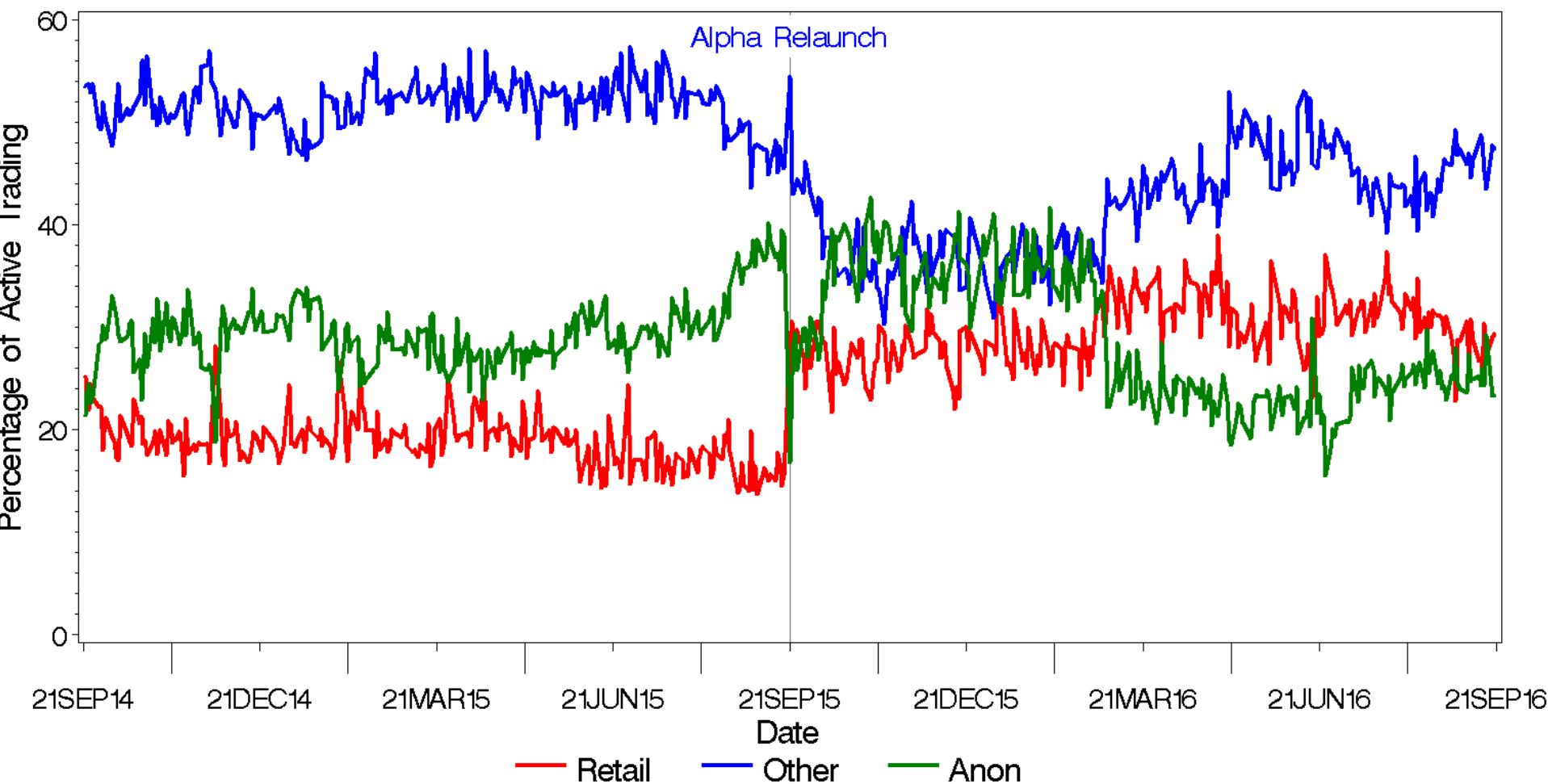
HFT Willing to Pay to Access Retail Flow
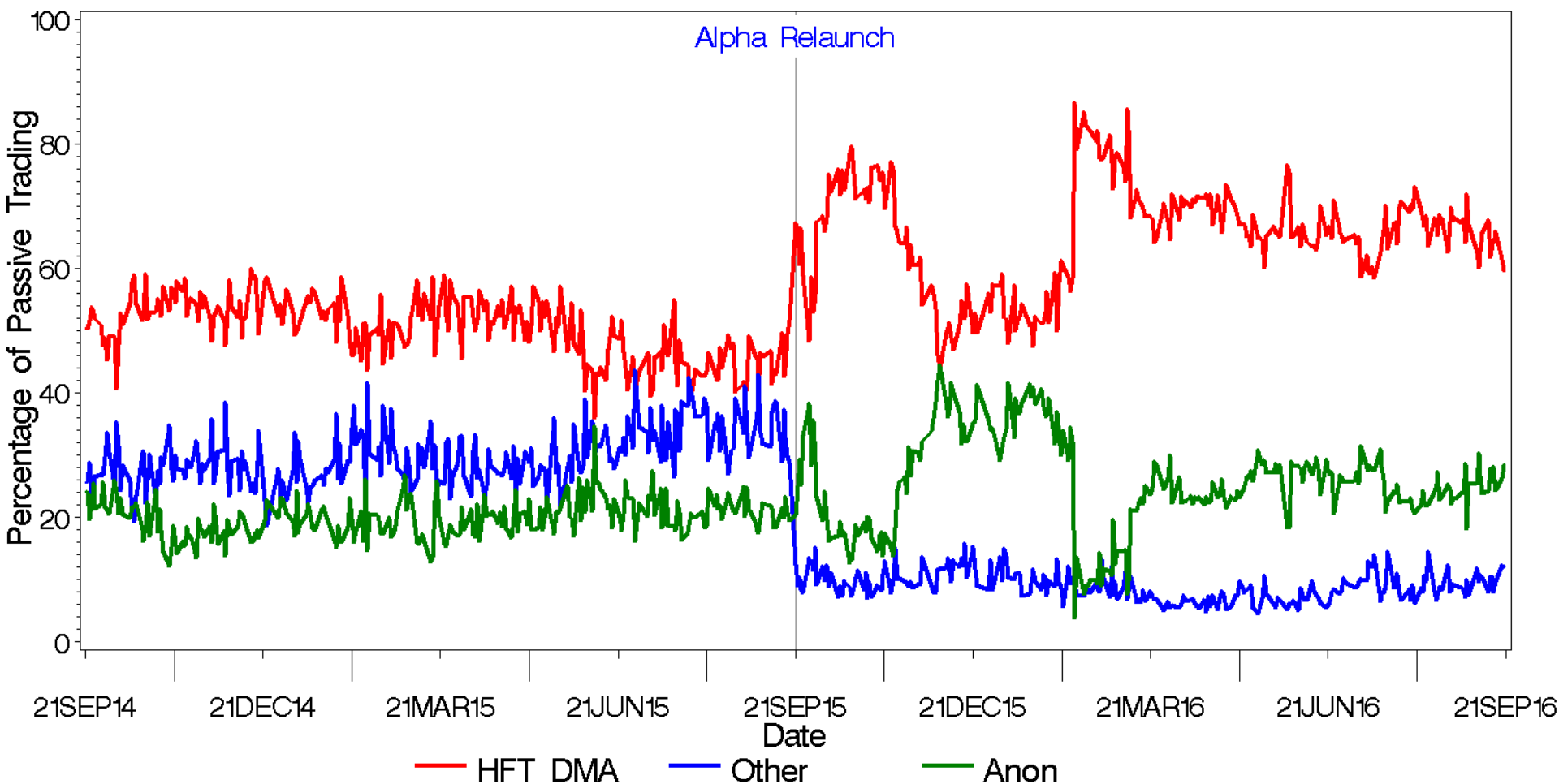
Smart order Routing (Alpha)

Significant **increase** in small orders which execute at only one venue
Significant **reduction** in large orders which execute across multiple venues
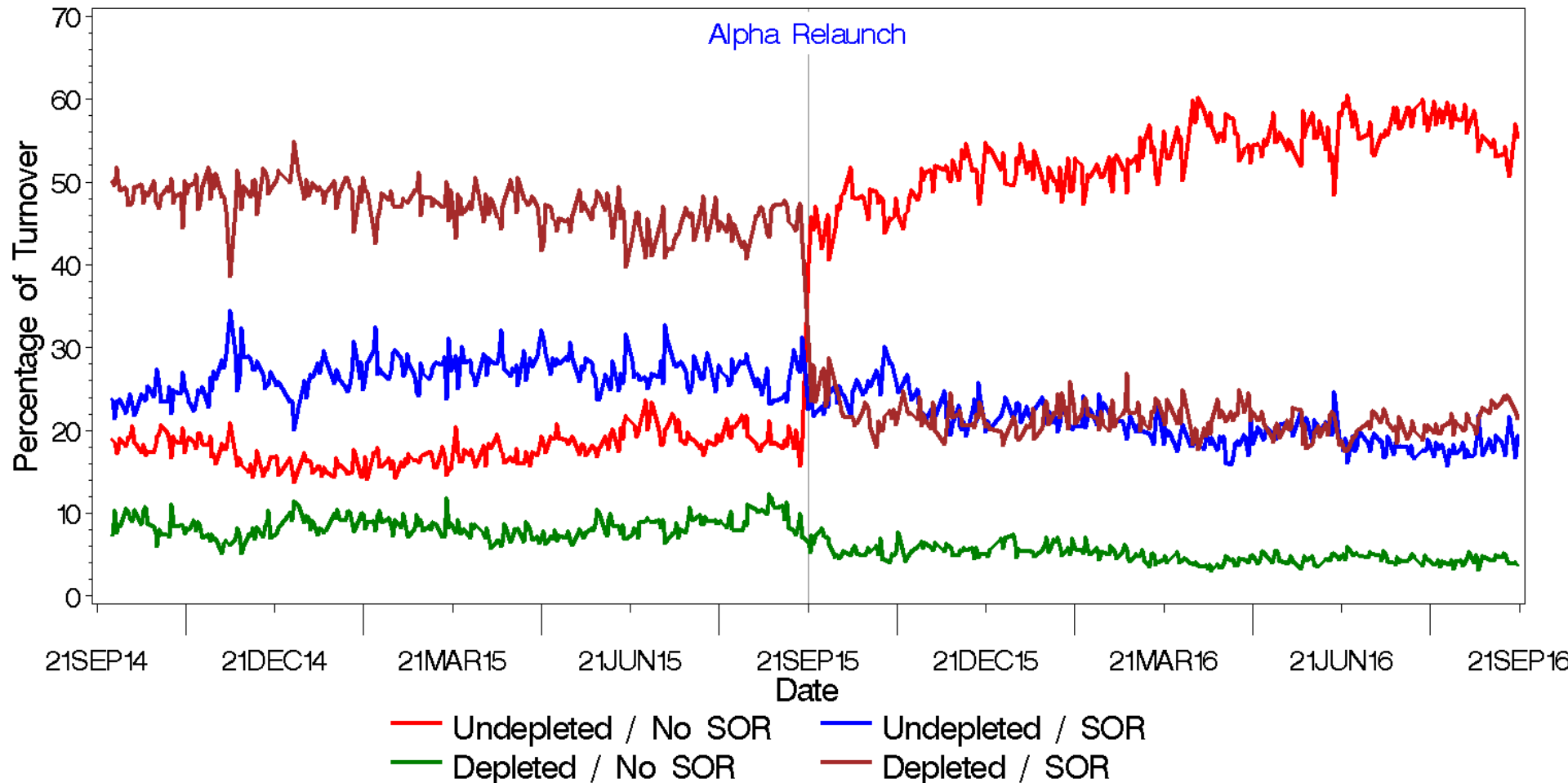
Net-of-Fees Realized Half Spread

Significant **increase** in rewards for liquidity provision on Alpha
Slight **reduction** in rewards for liquidity provision on CX2

IMPACT ON THE CANADIAN EQUITIES TRADING LANDSCAPE

Transaction Cost Metrics
Other Markets

- Increase in market wide order flow toxicity

- Reduction in market wide liquidity provider profits

- Overall increase in Canadian transaction costs

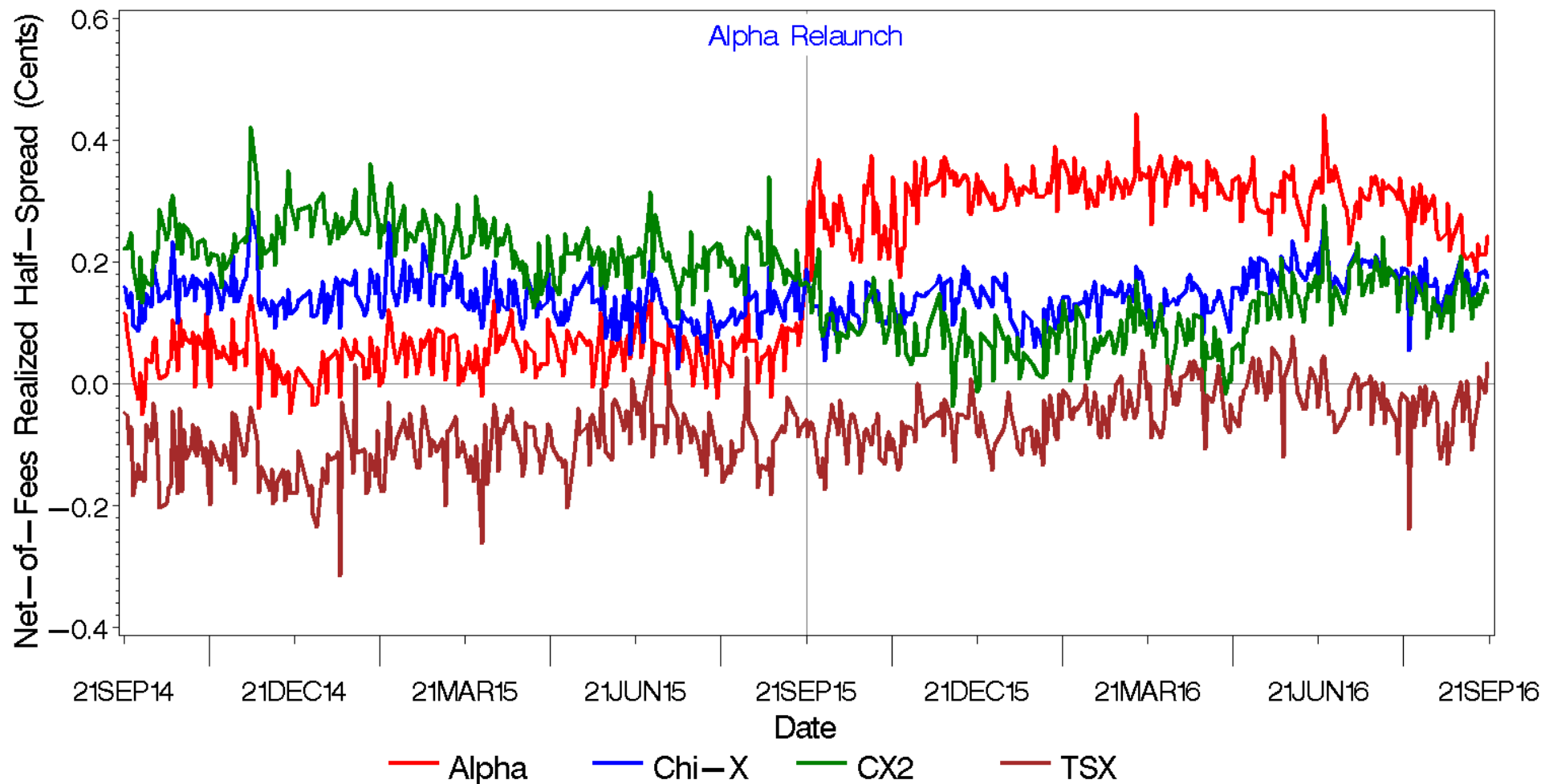|	Effective Spread			Realized Spread			Adverse Selection		
	TSX	Chi-X	CX2	TSX	Chi-X	CX2	TSX	Chi-X	CX2
$Post_d$	0.24	0.29	0.13	-0.07	-0.10	-0.21	0.36	0.36	0.29
	(3.59)***	(3.50)***	(1.64)	(-2.16)**	(-1.96)**	(-3.14)***	(3.80)***	(3.94)***	(4.46)***
$Price_{i,d}$	2.61	2.80	2.94	-1.27	-0.53	0.50	3.79	3.64	2.59
	(3.18)***	(3.26)***	(3.19)***	(-5.90)***	(-1.96)**	(1.24)	(3.41)***	(3.73)***	(5.87)***
$Turnover_{i,d,v}$	-0.52	-0.49	-0.49	0.25	-0.06	-0.28	-0.81	-0.44	-0.20
	(-7.39)***	(-8.54)***	(-7.25)***	(7.26)***	(-1.87)*	(-3.82)***	(-8.40)***	(-6.48)***	(-3.22)***
$Volatility_{i,d}$	0.11	0.11	0.11	-0.11	-0.06	-0.01	0.22	0.17	0.11
	(6.18)***	(6.81)***	(7.49)***	(-12.05)***	(-8.82)***	(-0.77)	(7.19)***	(8.26)***	(9.90)***
Adjusted R^2	8.7%	6.2%	5.1%	7.9%	1.6%	1.6%	11.9%	6.9%	4.9%
# Obs	21948	21939	21818	21948	21939	21818	21948	21939	21818

NBBO Liquidity Metrics for Canada

- Increase in overall quoted spreads
- Cost Canada approx $105m in the year since launch
- Decrease in overall order book resiliency

	Quoted Spread		Quoted Depth	Informed Percentage	Multi Take Ratio
	Cents	Basis Points			
Post$_d$	0.35	0.66	0.13	1.93	1.60
	(4.05)***	(3.90)***	(8.98)***	(6.45)***	(10.70)***
Price$_{i,d}$	3.15	85.56	0.33	11.51	5.58
	(2.99)***	(32.01)***	(4.58)***	(8.38)***	(9.85)***
Turnover$_{i,d}$	-0.96	-3.17	0.24	-4.74	-0.38
	(-9.57)***	(-14.13)***	(16.31)***	(-16.32)***	(-2.53)**
Volatility$_{i,d}$	0.13	0.43	-0.03	0.83	0.32
	(6.74)***	(14.29)***	(-17.61)***	(17.04)***	(16.08)***
Adjusted R²	10.6%	47.5%	32.4%	11.6%	8.8%
# Obs	21,948	21,948	21,948	21,948	21,948

CONCLUSION

Implications

- Fairness of liquidity access
  - Randomised speed bumps are able to exclude active institutional flow
  - Is predominantly phantom liquidity on a lit trading venue acceptable?

- Increase in order flow toxicity across other trading venues
  - Higher adverse selection costs and wider effective spreads
  - Lower resiliency of consolidated liquidity at the NBBO

- Synthetic payment for order flow and regulatory arbitrage

- IEX's registration as a National Securities Exchange has just been accepted by the SEC in the United States
  - Impact of discriminatory speed bump
  - Systematic latency advantages in the sub-millisecond environment

Questions?

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Trade Strings and Quote Fade

How much was available before the trades?

How much faded?

NBBO price became inferior to the trade price

$10.11

$10.10
(National Best Offer)

Order Book Snapshot at Start

Time

< 30 ms

< 30 ms

TSX
500 shares
buyer initiated

Alpha
200 shares
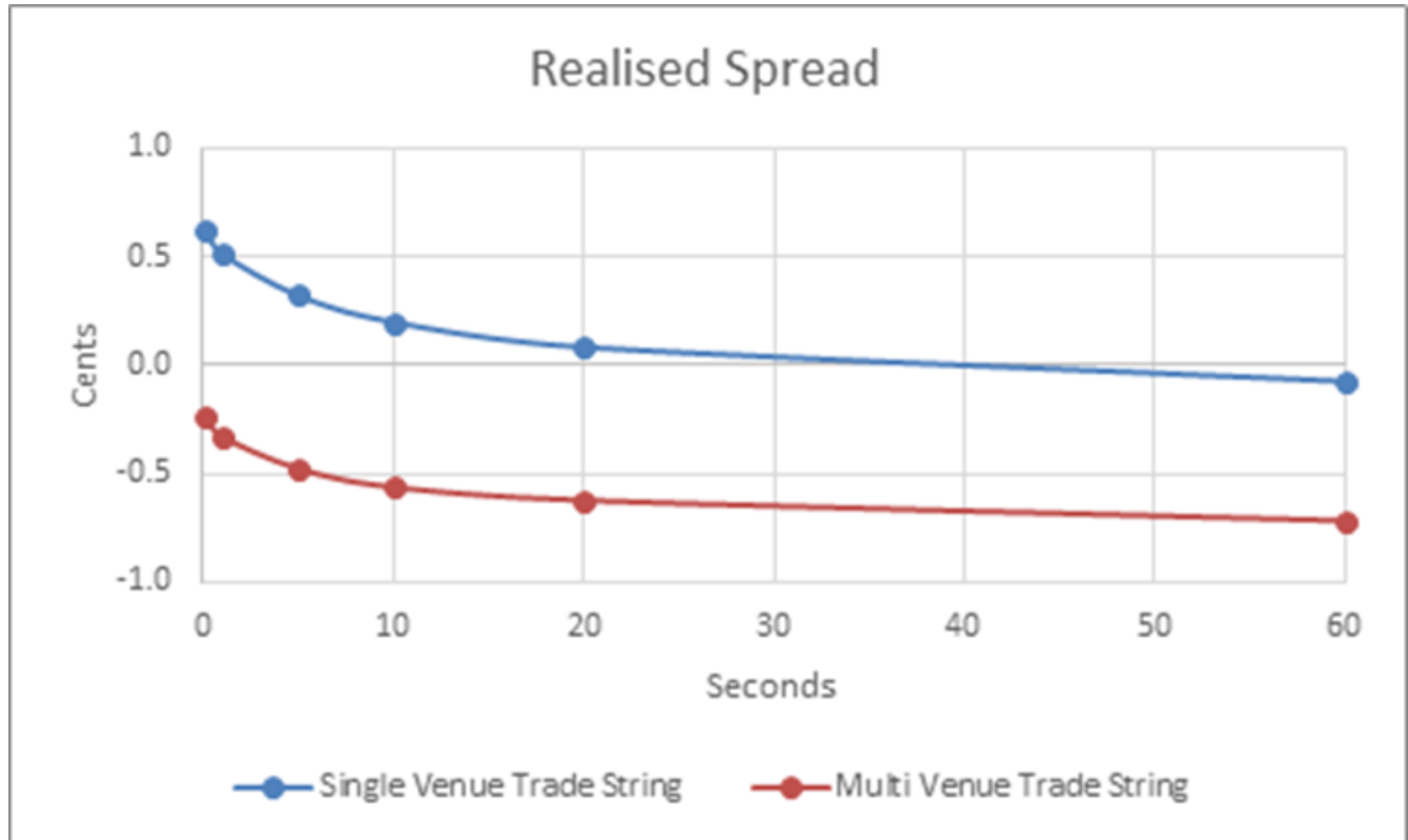buyer initiated

Chi-X
300 shares
buyer initiated
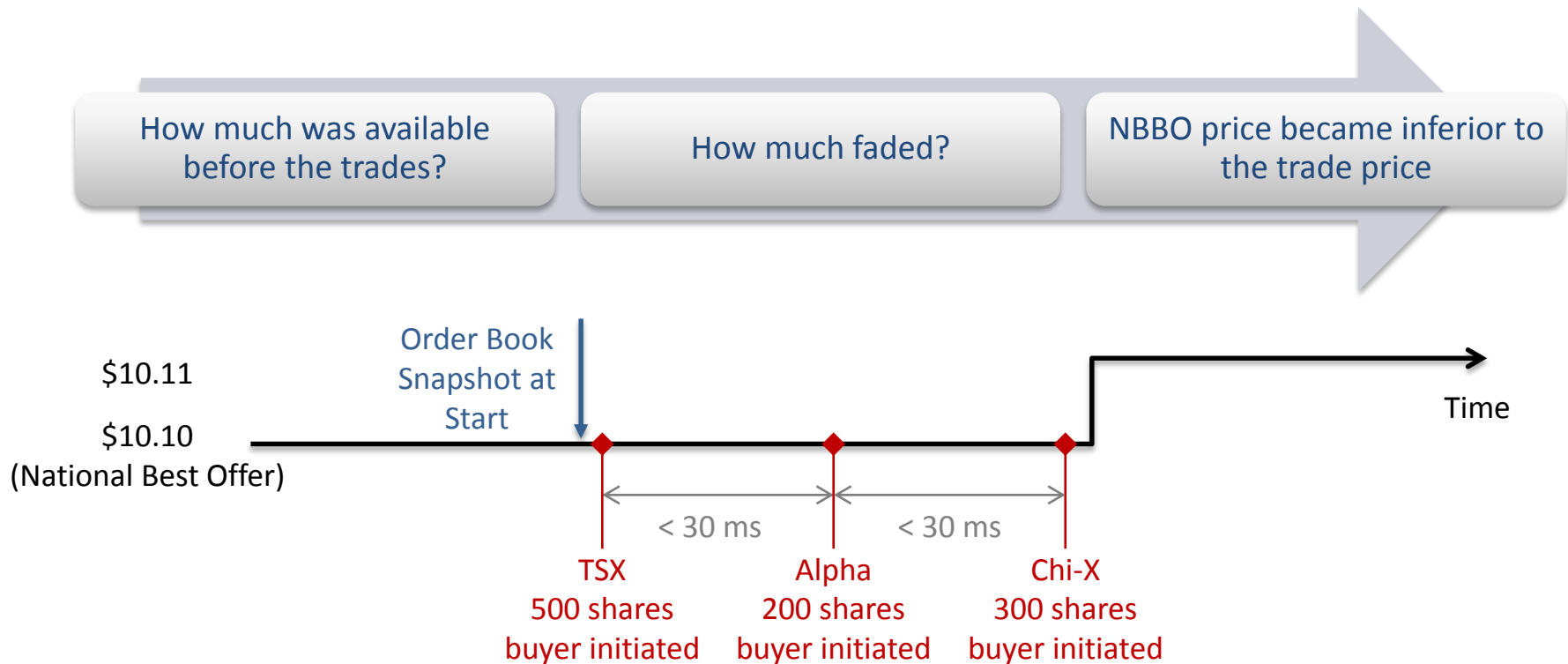
- For trade strings that displace entire NBB / NBO:

$$Quote\ Fade = 1 - \frac{Traded\ Volume}{Starting\ Liquidity}$$

- How much liquidity did I see which I couldn't hit?

Consolidated Realised Spreads

Avoid Multi-Venue Trade Strings if You Can!!!

Inverted Markets Comparison

- HFT are able to reduce adverse selection on Alpha – vs Chi-X 2
- Non-HFT suffer a detriment

	Adverse Selection			Realized Spread		
	HFT DMA	Anonymous	Other	HFT DMA	Anonymous	Other
$Alpha_v$	-0.16	-0.50	-0.04	0.27	0.45	-0.23
	(-5.62)***	(-8.90)***	(-0.85)	(7.09)***	(3.42)***	(-4.73)***
$Price_{i,d,v}$	0.93	1.17	1.09	0.55	0.11	0.20
	(6.15)***	(9.86)***	(9.67)***	(3.15)***	(0.47)	(1.29)
$Turnover_{i,d,v}$	0.07	-0.12	-0.05	-0.12	0.20	0.09
	(3.79)***	(-8.49)***	(-2.31)**	(-4.83)***	(7.24)***	(4.97)***
$Volatility_{i,d,v}$	0.04	0.05	0.05	0.02	0.00	0.01
	(9.25)***	(13.36)***	(10.82)***	(4.74)***	(0.00)	(1.13)
Adjusted R^2	46.2%	43.1%	49.5%	15.7%	5.9%	4.9%
# Obs	21,235	18,124	21,284	21,235	18,124	21,284