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High-frequency trading (HFT) in the CGB bond future

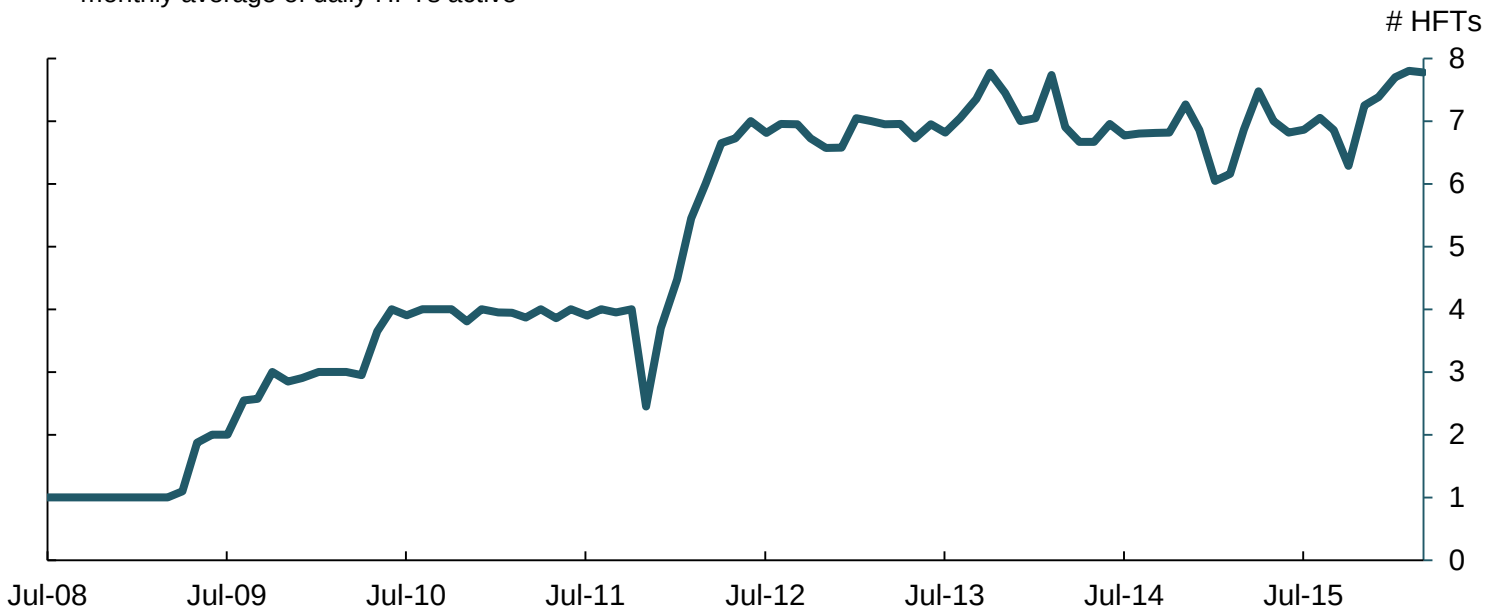
2 February 2017

HFT trading the 10-year GoC bond future (CGB)

- "HFT" firms are identified empirically using characteristics common to the HFT literature,[1] such as high volumes and rare overnight inventory, based on consolidated MX data.

Chart 1: Number of HFTs active on the CGB

monthly average of daily HFTs active



Source: Montreal Exchange data, Bank of Canada calculations

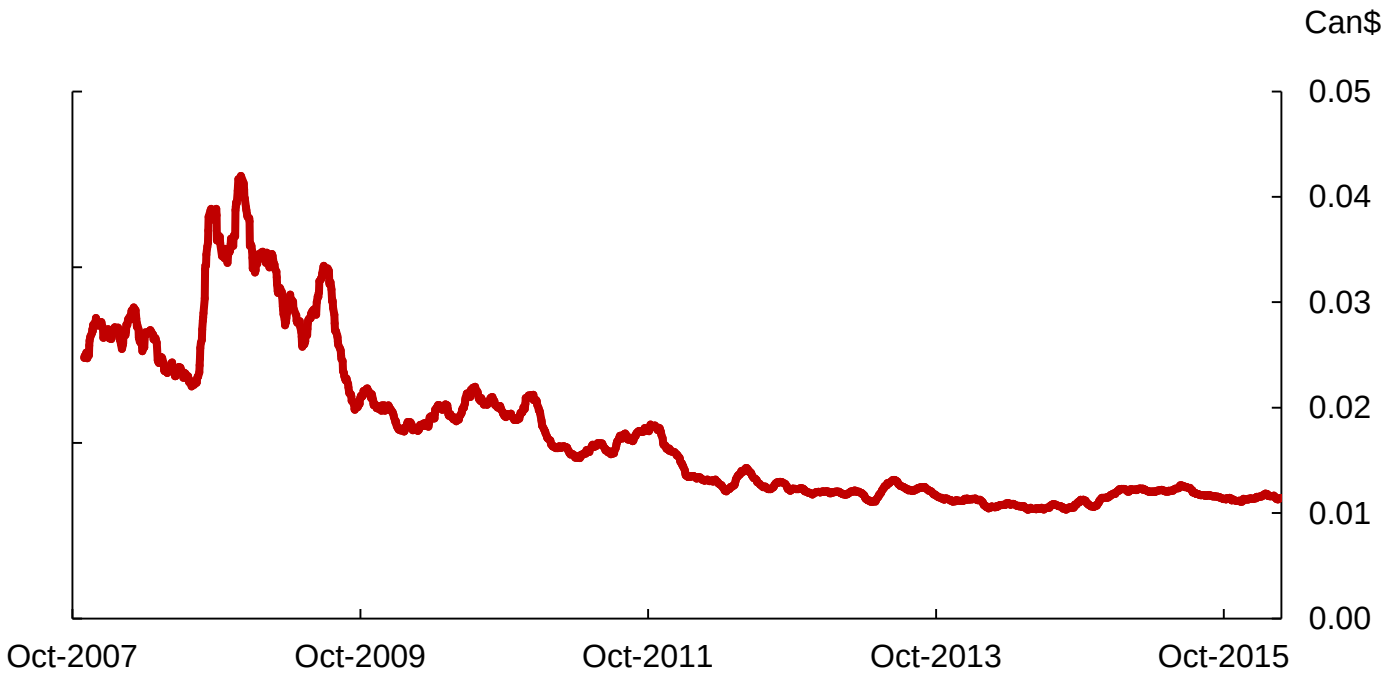
Last observation: 26 March 2016

1: Securities and Exchange Commission (2010); Kirilenko, Kyle, Samadi, and Tuzun (2014); Brogaard and Garriott (2016).

As we know, **spreads improved** over the period

Chart 2: **Daily average CGB futures bid-ask spread**

rolling 20-day moving average



Notes: Using dataset of daily 15s tick data 8:20-16:00

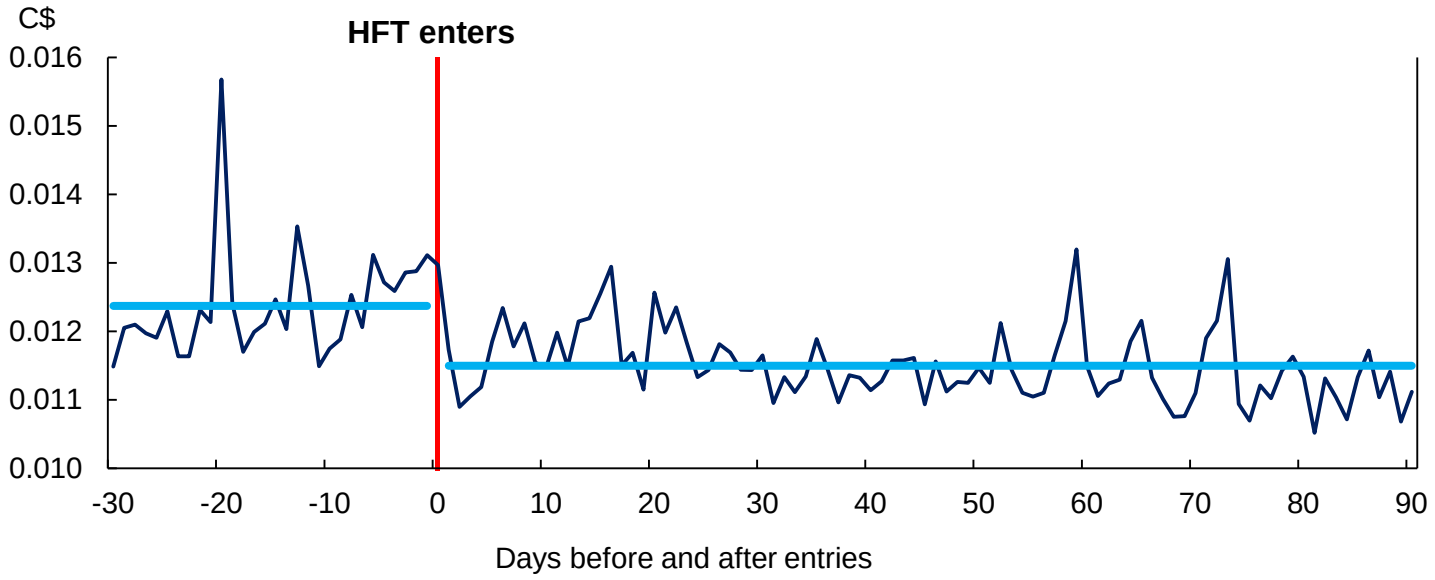
Source: Montreal Exchange data, Bank of Canada calculations

Last observation: 21 March 2016

Is some of the improvement attributable to HFT?

- Event study: Compare liquidity before and after HFT entries
  - 11 entry events: Dates on which an "HFT" **started trading** the CGB
  - Include controls for volume, price, open interest, and 10-day volatility

Chart 3: Effective bid-ask spreads averaged across entry dates



Source: Montreal Exchange data, Bank of Canada calculations

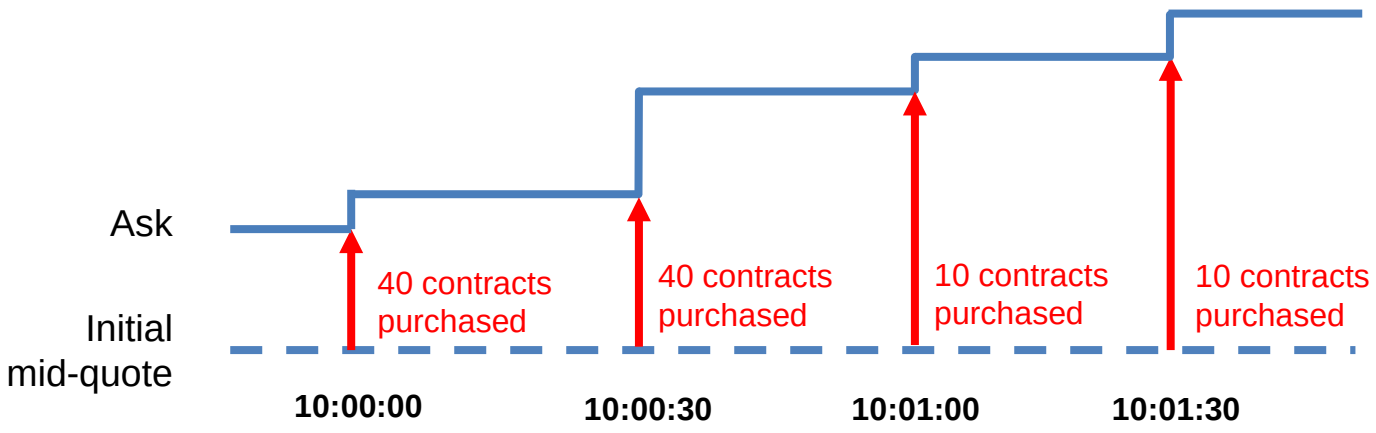
Event-study results—**market quality**

- According to the study, the average impact of one HFT entry is:

Average effective spread	**-8 basis points**
Average bid-ask spread	**-16 basis points**
Average depth (10¢ from mid-quote)	**+74 contracts ($7.4M)**
Average 5-second volatility	**-0.81pp annualized**

A different measure: **implementation shortfall** (IS)

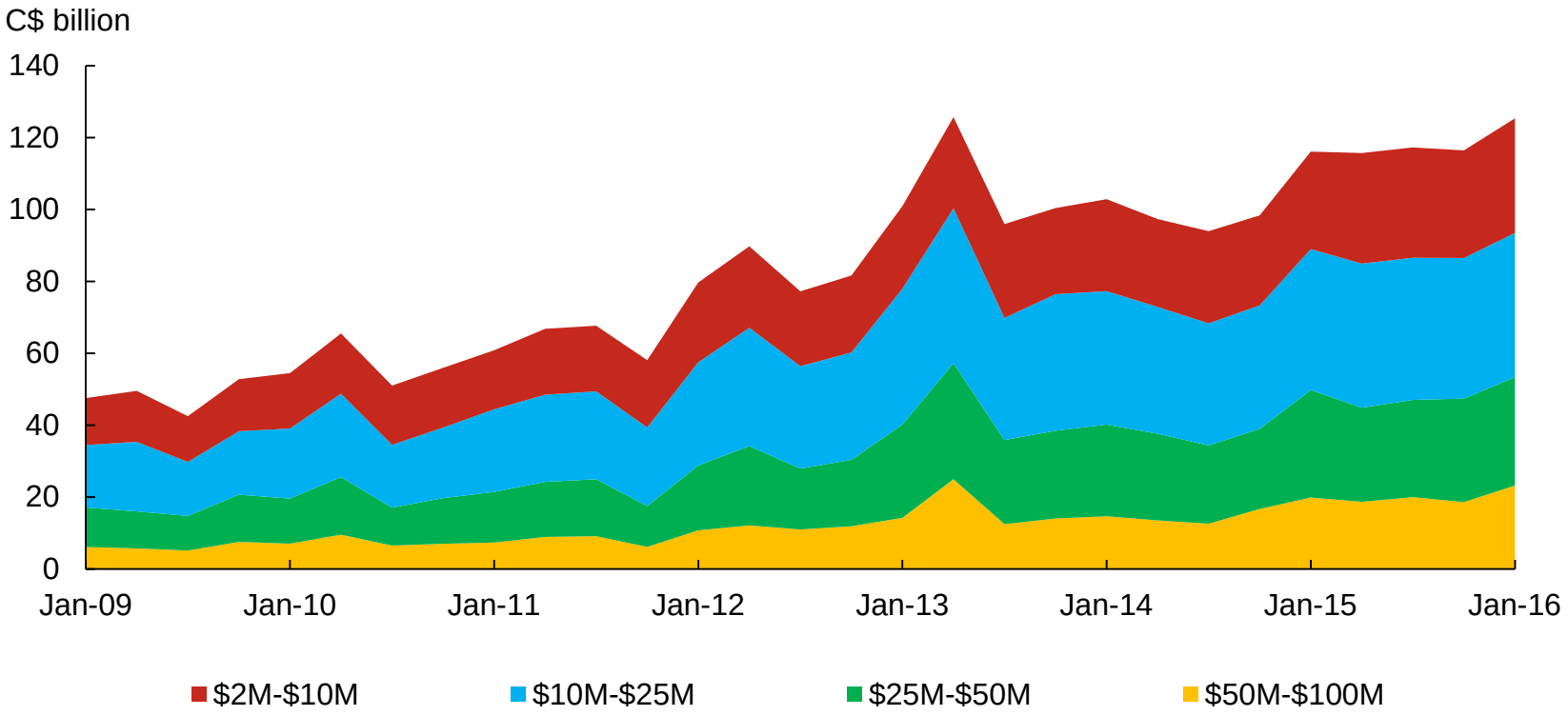
- IS: the difference between the signed (buy or sell), volume-weighted cost of a series of trades less the mid-quote at the time of first trade.



- We compute the IS of “trade strings” executed by the unidentified participants.
- “Strings” are **unidirectional** series of buys or sells of total size **greater than 20 contracts** ($2M), and with **no more than 20-minute** gaps between trades.

Smaller-sized “trade strings” are the most common

Chart 4: **Notional volume traded by volume bucket of trade string**
Quarterly sum



Note: Volume buckets categorize trade strings by the size of the position constructed during the string. A string is identified when a series of trades occur over time (non-instantaneous) in the same direction (either buy or sell) at least 95% of the time, with no more than a 20-minute gap.

Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

Implementation shortfall by **volume bucket**

Quarterly median implementation shortfall

Chart 5: $2M-10M

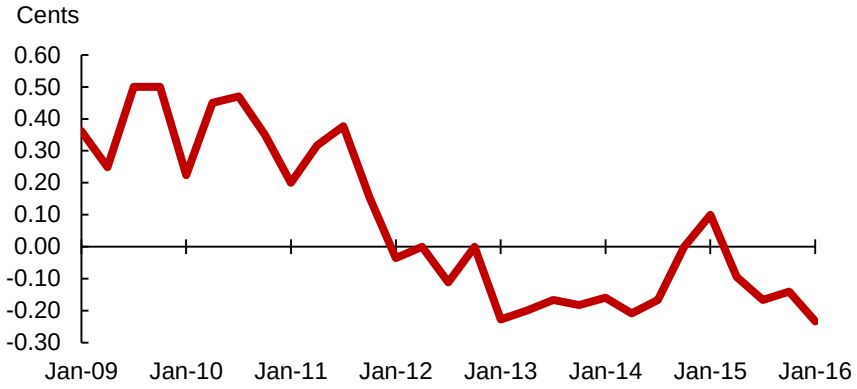


Chart 6: $10M-25M

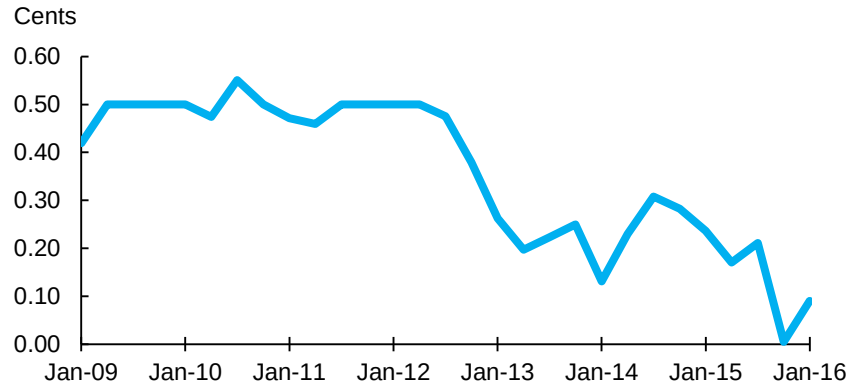


Chart 7: $25M-50M

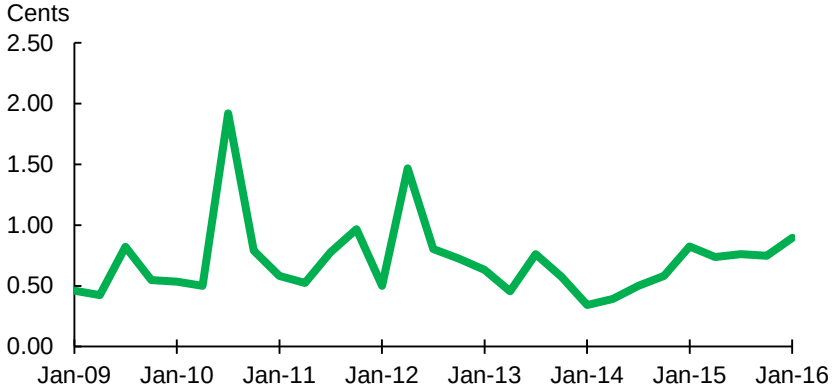
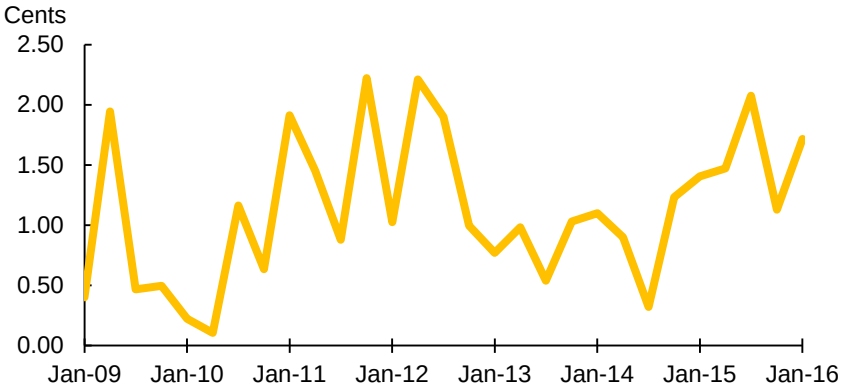


Chart 8: $50M-100M



Source: Montreal Exchange data, Bank of Canada calculations

Last observation: 26 March 2016

Event-study results—IS by **volume bucket**

- According to the study, the average impact on IS of one HFT entry is:

$2M-$10M	**-8 basis points**
$10M-$25M	**No effect**
$25M-$50M	**No effect**
$50M-$100M	**No effect**

Market data provided by Montreal Exchange in accordance with section 5.10 of Regulation 21-101 respecting marketplace operation.

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Appendix

Implementation shortfall by duration
(volume-weighted time to finish)

Appendix: IS by duration

Quarterly median implementation shortfall

Chart A: 0-1 minutes

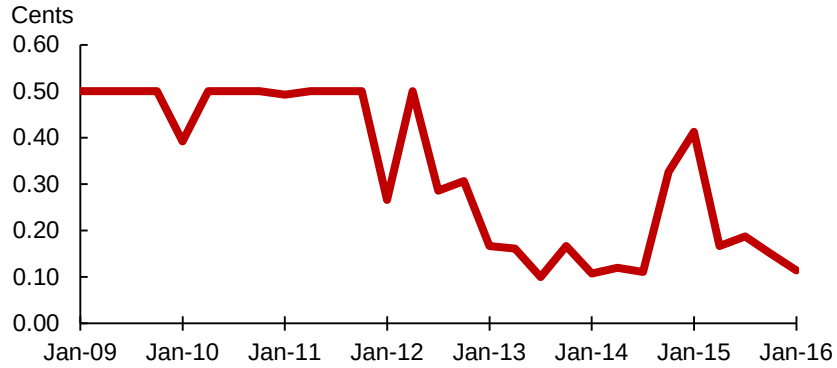


Chart B: 1-5 minutes

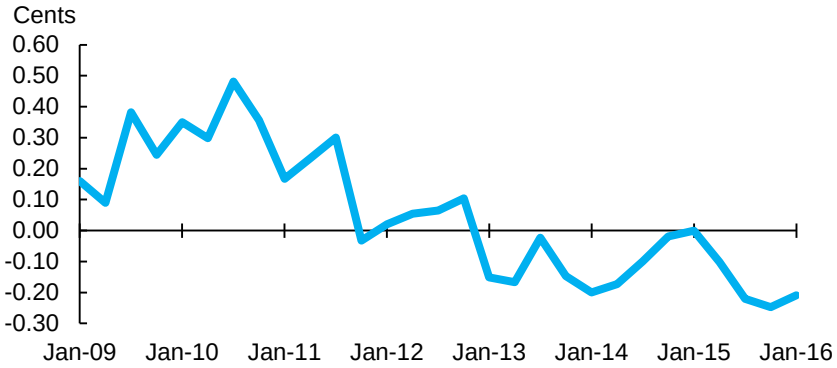
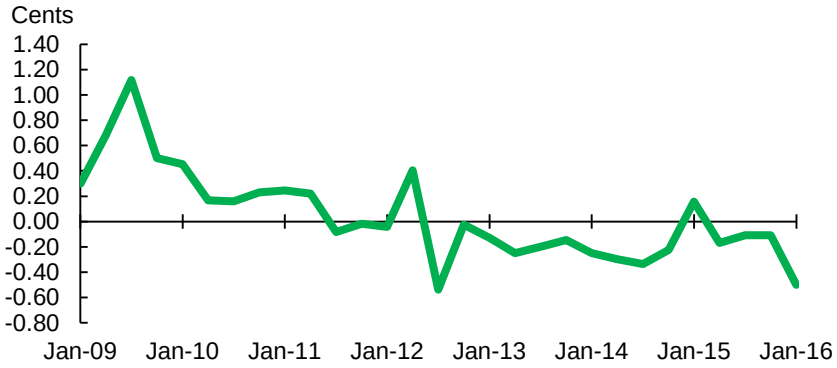


Chart C: 5-15 minutes



Note: the duration is the volume-weighted average time of trade execution

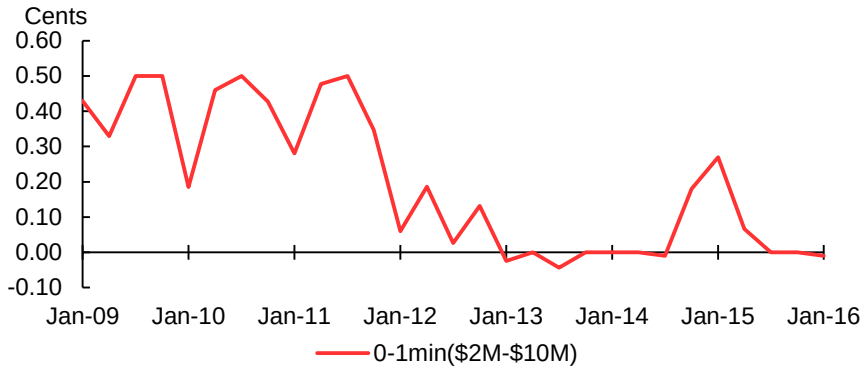
Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

Appendix: Cross-category IS (0-1min)

Quarterly median implementation shortfall

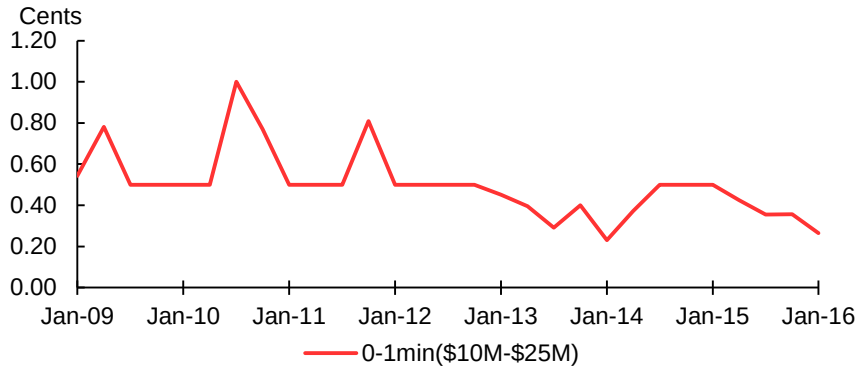
Chart D



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

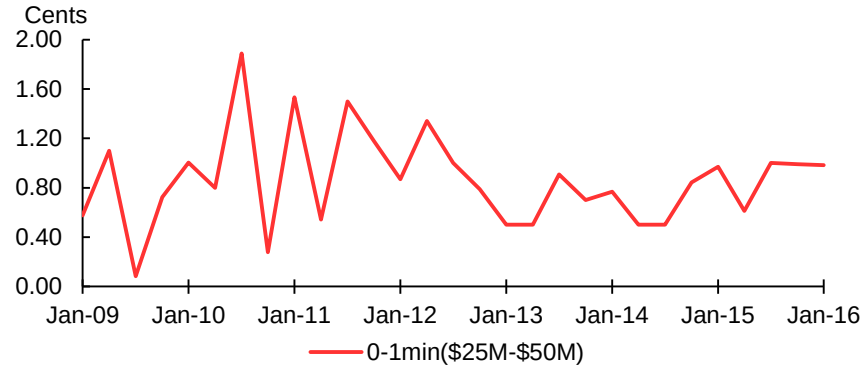
Chart E



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

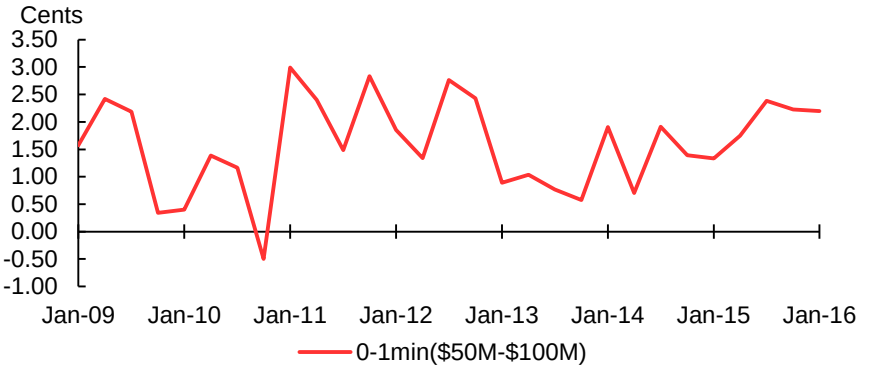
Chart F



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

Chart G



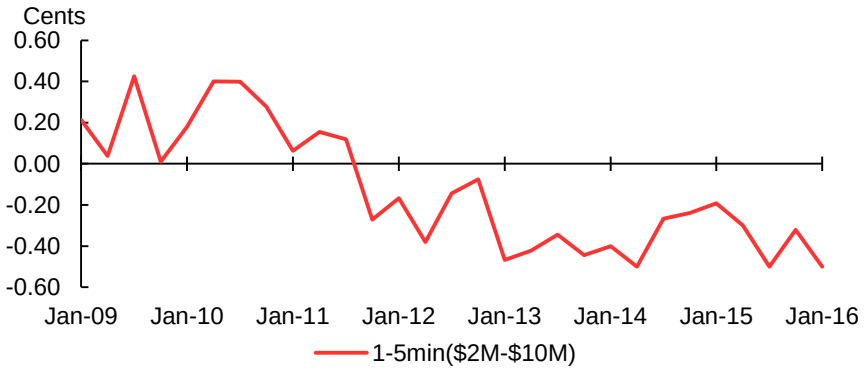
Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

Appendix: Cross-category IS (1-5min)

Quarterly median implementation shortfall

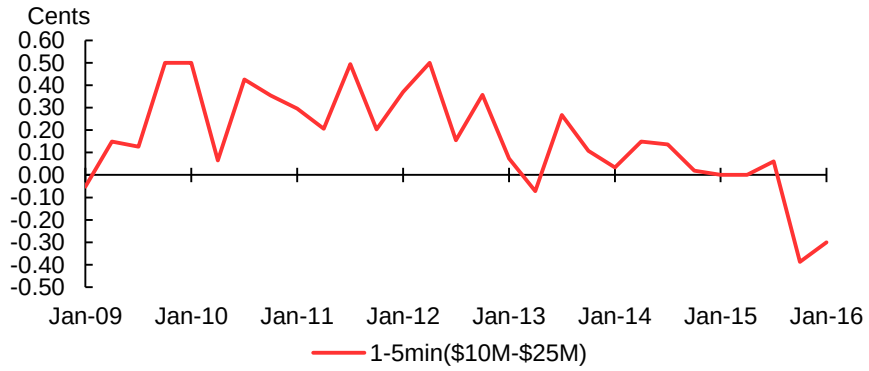
Chart H



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

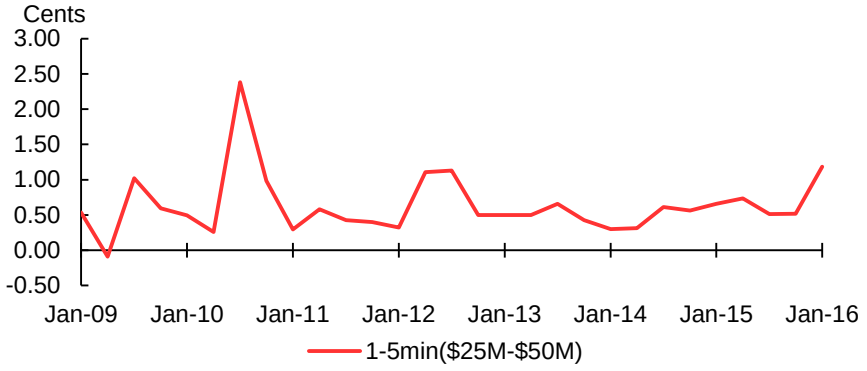
Chart I



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

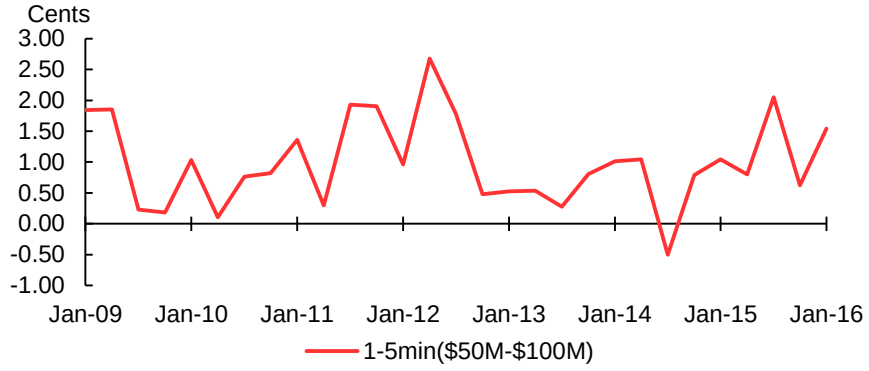
Chart J



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

Chart K



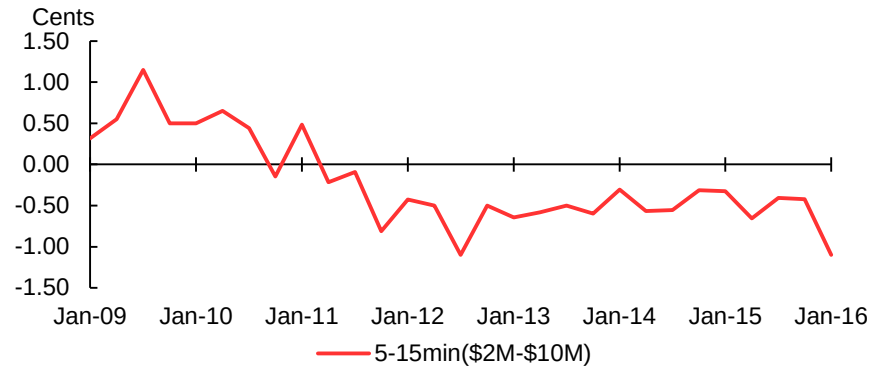
Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

Appendix: Cross-category IS (5-15min)

Quarterly median implementation shortfall

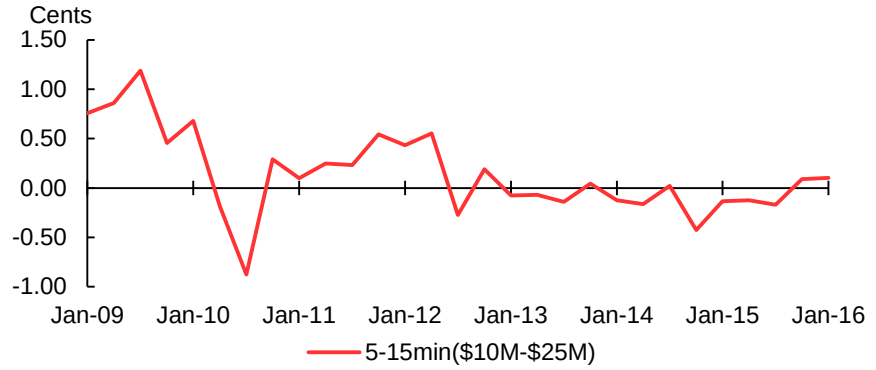
Chart L



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

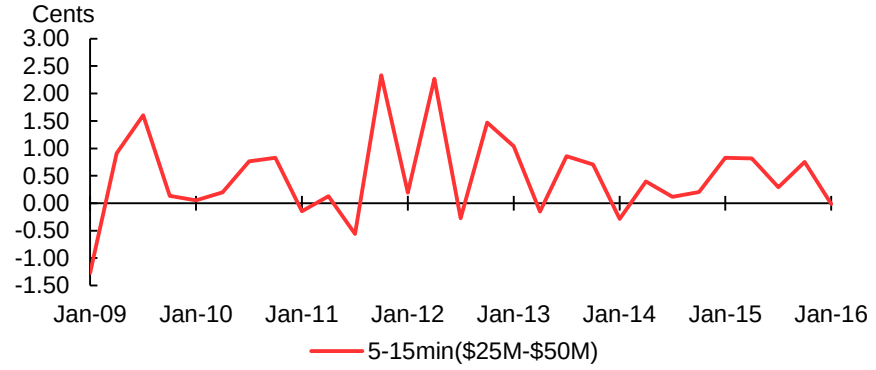
Chart M



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

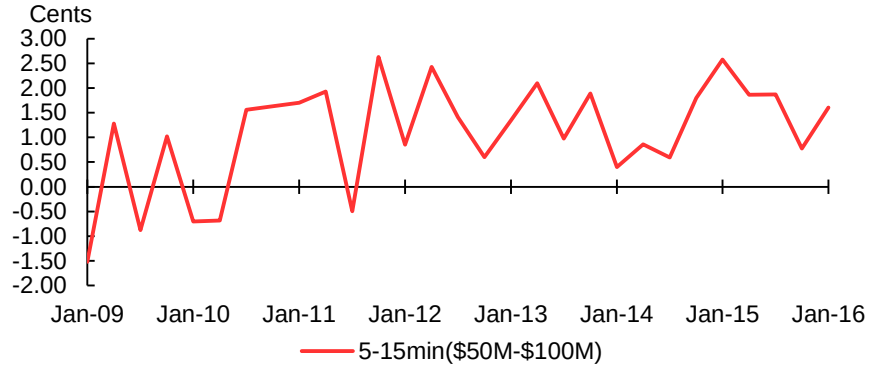
Chart N



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016

Chart O



Source: Montreal Exchange, Bank of Canada calculations

Last observation: 26 March 2016