BANK OF CANADA
BANQUE DU CANADA

2025 CORRA Sunset Review

CORRA Advisory Group

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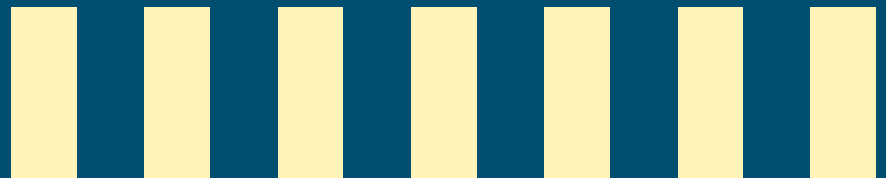
Background

2025 Sunset Review

CORRA remains representative. First sunset review which occurs every 5 years.

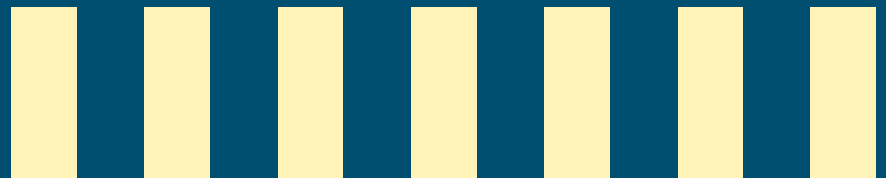
- Scope of 2025 sunset review includes analysis and recommended changes, if applicable, on:
  1. **Bottom 25% trim method**: Is a different method 'better' at removing specials?
  2. **$3bln minimum volume fallback threshold**: Should this be higher now that CORRA volumes are higher?
  3. **BoC transactions**: With the Bank conducting more frequent overnight repo operations (ORs), should these be included?
- Seeking CAG member views on preliminary findings



Considerations

The bar for change should be high.

- Structural change on the horizon
  - CCMS Triparty GC basket will require different treatment and subsequent changes to methodology and/or parameters
  - Can’t ignore but too early to fully integrate into analysis—outside scope of 2025 sunset review
- Changes ought to be durable across market environments / cycles
  - Today’s solution likely won’t solve tomorrow’s concerns
  - Low volatility helps reinforce CORRA’s robustness as a benchmark
- Keep It Simple
  - Trade-off between calibration complexity and simplicity
  - Analysis limited by counterfactual nature



Question #1

Should CORRA's trim methodology be changed?

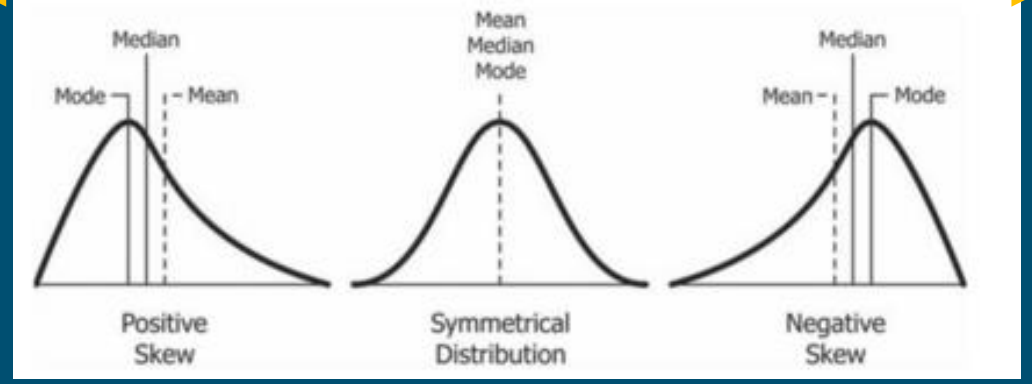
Should the trim methodology be changed?

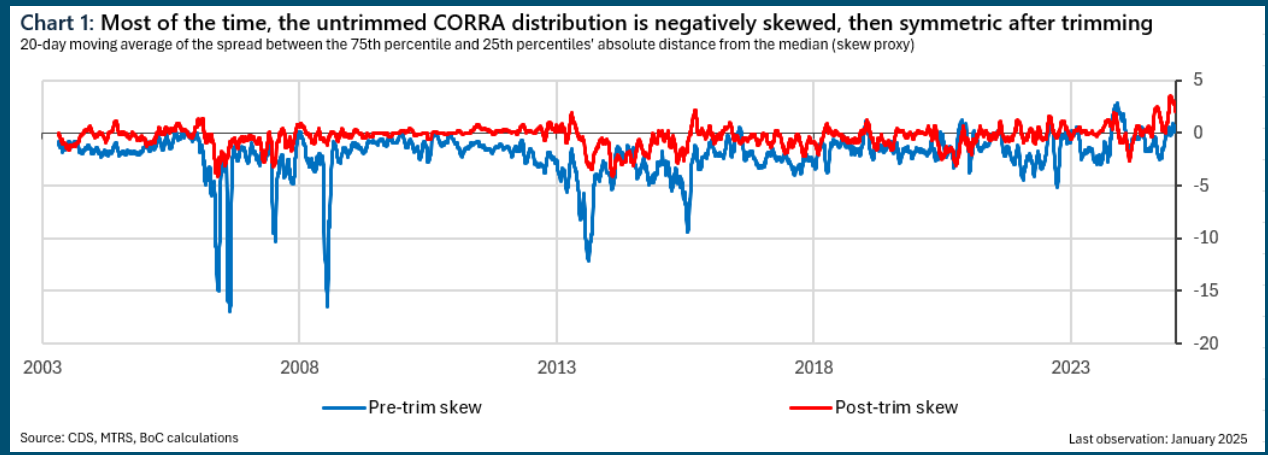
Background

- Use of MTRS data increased CORRA-eligible volume, but no GC flag to exclude specials.
- Estimation technique used to account for specials removes—*trims*—the left tail of the CORRA distribution (bottom 25%).
- However, the weight of the left tail (specials) varies through time while the trimmed volume is constant.
- Concern: current trim method likely trims too much of the higher total volume, and at other times, it could trim not enough.

CORRA *untrimmed* distribution shape

rarely *sometimes* *most of the time*





Key Considerations of Different Trim Methods

Method	Key Considerations
Percentile	• Trimmed share of total volume stable • Rate at trim will vary • Simple but rate at trim could be too low (not trimming enough) or too high (trimming some GC trades)
Spread to prior CORRA	• More in line with how market views specials • Trimmed share of total volume will vary • No industry consensus on a single basis point spread to represent specialness • Slightly more complex: Using yesterday's CORRA introduces a degree of persistence (autocorrelation) • Specialness (the spread) can vary over time/cycles – might still trim too much or too little
Spread to the Bank's target rate	• Target might not be where GC is trading • Trimmed share of total volume will vary • No industry consensus on a single basis point spread to represent specialness • Specialness (the spread) can vary over time/cycles – might still trim too much or too little
"Bond rate" method	• More complex: Order bonds in decreasing order by volume weighted average repo rates (VWARR) transacted. The trim rate equals the rate of the bottom 10^{th} percentile (P) of the top 30% of bonds (T) ordered by VWARR. • "Model risk": Calibration of P and T • Trimmed share of total volume will vary • Rate at trim and the spread to CORRA/Target will vary

Approaches to evaluating trim methods

- Roughly 20yrs of CDS and MTRS repo data compiled, and different trim methods used to calculate the daily CORRA, trim rate and trimmed volume.
- Assess how stable the calculated CORRA is and how closely it tracks the GC proxy, how well the resulting trim rates tracks each of the proxy rates for specials and how stable the resulting CORRA volumes are.

Approach	Description
GC Proxy	• Create an IDB based trade GC proxy by combining old CORRA (pre-2020) with IDB repo trades with GC flags (post-2020). Note that this represents only the GC rate in the IDB market. The resulting CORRA from each trim method is compared to the GC proxy. The less each method deviates from the GC proxy, the better its 'performance'.
Proxy for specials: Top 10 ISINs	• Using data since 2003, a proxy rate for specials is calculated by taking the daily simple average repo rate for the 10 ISINs trading with the lowest repo rates. The resulting trim rate from each trim method is compared to this 'Top 10 ISIN' proxy rate for specials (less deviation to the proxy rate implies better 'performance').
Proxy for specials: BoC Holdings	• Using data since 2020, a proxy rate for specials is calculated this time by taking the daily simple average repo rate for the 10 ISINs that the BoC owns the most of (as a % of that ISIN's outstanding). The resulting trim rate from each trim methods is compared to this 'BoC Holdings' proxy rate for specials (less deviation to the proxy rate implies better 'performance').
Volume stability	• Using data since 2003, evaluate how much eligible volume is being trimmed away by each method, and how volatile this amount is. The 'true' (unknown) required amount to trim varies through time. Stability in the amount trimmed is related to stability in ultimate CORRA rate.
Rate stability	• Using data since 2003, evaluate the volatility of CORRA under each method. A non-zero but low degree of volatility is generally preferred in a robust benchmark rate.

Qualitative report card of methods

- Overall, the percentile method scores the best and *slightly* better than the spread to prior day's CORRA.
  - The 10th percentile tracks specials slightly closer.
  - Minus 10bps performs the best among the spread to CORRA method.

Caveats:

- Scoring is relative. In most cases, the numerical differences in performance are relatively small given the time horizon.
- The GC proxy does not necessarily reflect the overall GC rate in the market as it only includes the IDB GC trades.
- Trim and assessment methods are all approximations. No method will be perfect, and each has trade-offs (e.g., complexity, flexibility).

Evaluation Criteria:		GC proxy	Specials proxy		Volume stability	Rate stability	Total score
			10 ISINs	BoC holdings			
Methods:	**Percentiles**						
	25th	3	0	0	1	0	4
	20th	2	0	0	0	0	2
	15th	1	0	0	0	0	1
	10th	0	3	3	0	0	6
	Total	**6**	**3**	**3**	**1**	**0**	**13**
	Spread to prior CORRA						
	-15bp	0	0	0	3	0	3
	-10bp	0	1	2	2	0	5
	-5bp	0	0	0	0	3	3
	Total	**0**	**1**	**2**	**5**	**3**	**11**
	Spread to target						
	-15bp	0	2	0	0	0	2
	-10bp	0	0	1	0	0	1
	-5bp	0	0	0	0	1	1
	Total	**0**	**2**	**1**	**0**	**1**	**4**
	'Bond Rate' method						
	Total	0	0	0	0	2	2

Should CORRA's trim methodology be changed?

- Analysis suggests some improvements could be made by changing the trim method.
- However, improvements appear relatively modest considering the high degree of approximation underpinning the analysis—risk of falsely over calibrating.

Evaluation Criteria:	GC proxy (mean)	Specials proxy (mean)		Volume stability (mean, [std. dev.])	Rate stability (std. dev.)
		10 ISINs	BoC holdings		
Method:					
1st: 10th percentile	-0.5bp	+1bp	+0bp	10% [0%]	2.8bp
2nd: CORRA - 10bps	-0.3bp	+2bp	-1bp	9% [8%]	2.7bp
3rd (current): 25th percentile	-0.2bp	+9bp	+5bp	25% [0%]	2.7bp

- Structural change from CCMS forthcoming.
  - Would likely trigger an ad hoc review with subsequent changes to the methodology.
  - Must weigh the cost/risks from changes to methodology on confidence in the benchmark.
- **Do members consider the improvements to changing the trim methodology to be material enough and are worth pursuing further?**

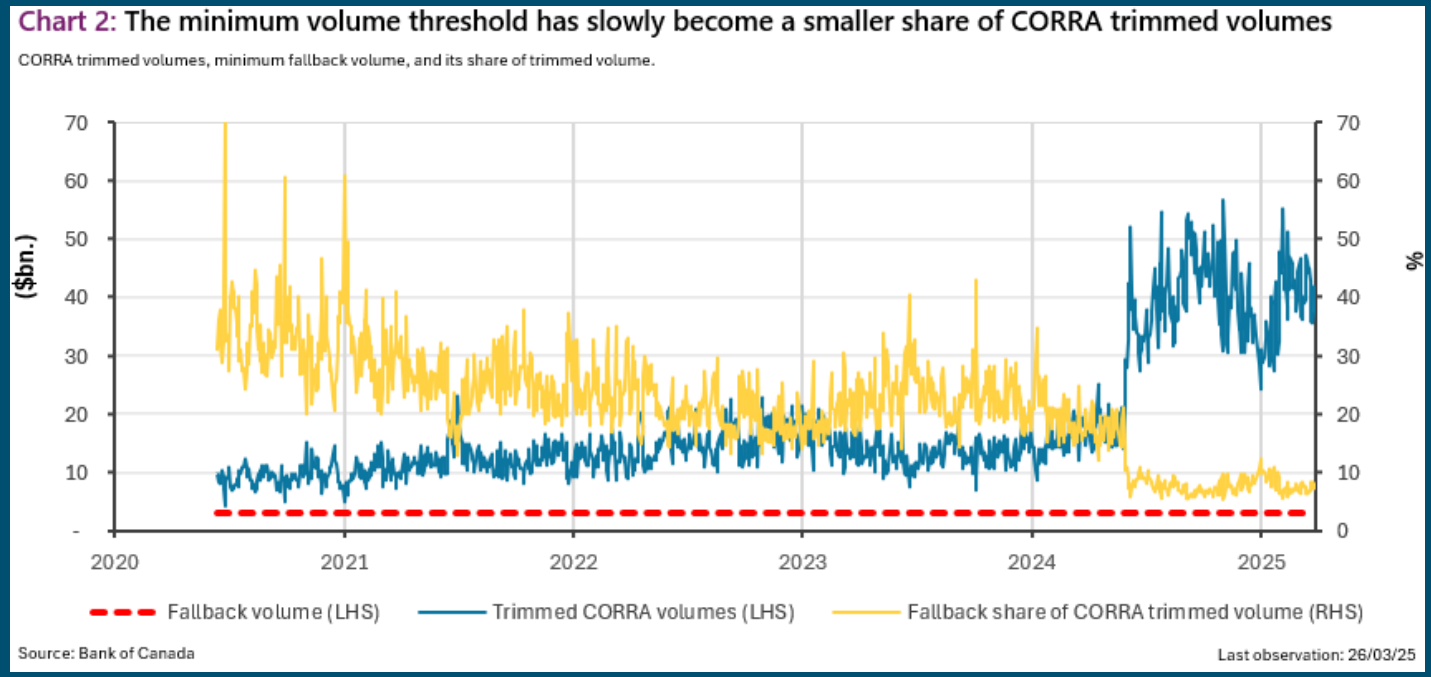
Question #2

Should CORRA's minimum volume threshold ('MVT') methodology be changed?

Should the MVT Methodology be Changed?

A dynamic MVT would likely be more durable over time.

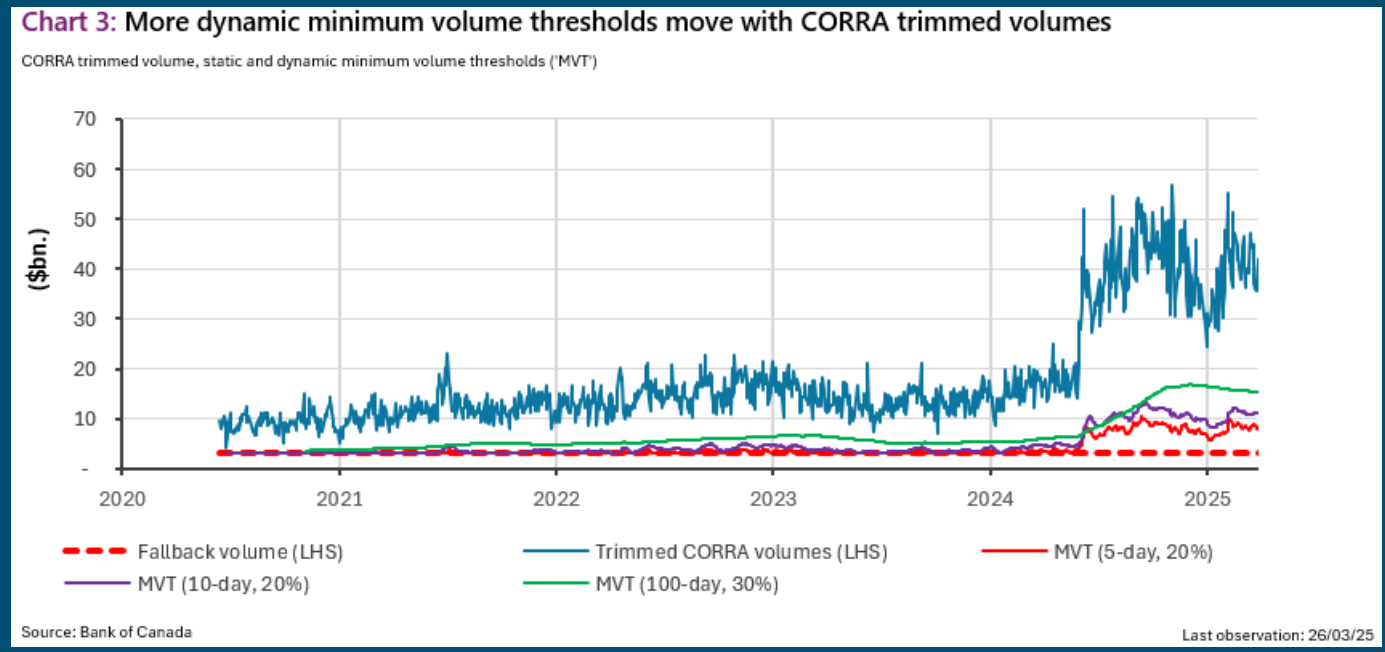
- The MVT ensures that CORRA represents broad conditions in the GC market which at current volumes might not be the case as the MVT is a small proportion of trading volume.
- Status quo MVT with current volumes could result in CORRA being based on trading activity of a few participants.
- Static MVT could be adjusted when volumes change materially; this would be done in a sunset or ad hoc review hence a dynamic MVT could be a better solution.



Simple Yet Dynamic MVT

An MVT based on a moving average would likely require fewer adjustments in the future.

- **Option 1: X% of a Y-day moving average** of volume could be more, or less, responsive to changes in volume depending on the number of days (Y).
- **Option 2:** Instead of calibrating the MVT on volume, set the fallback rate contingent on a **minimum number of submitters**. This, however, needs to account for heterogeneity among submitters over time.



- **Do members see value in changing the minimum volume threshold to a more dynamic moving average method (or to just increasing the level)?**

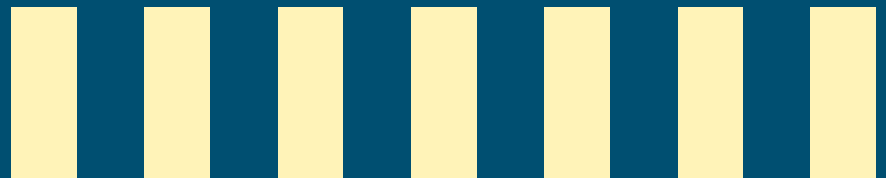
Question #3

Should BoC OR/ORRs and the Govt's AM RG trades be included in CORRA?

Excluding BoC Repos: Context

The Bank's and the Government's repo footprints can be relatively large at times.

- BoC repos (and the AM RG) are excluded from the CORRA calculation.
  - July 2019 CARR consultation: Decided to exclude BoC trades because they are **only conducted infrequently with a subset of market participants and thus didn't reflect broad funding market conditions.**
- Appropriate to revisit whether the Bank's repos (and the AM RG) should remain excluded.
  - The Bank's OR operations have grown in size and can be frequent—though are single price reverse auctions and remain ad hoc.
  - AM RG has also grown in size but amounts fluctuate based on Government needs.



Arguments for and against inclusion

	BoC O/N Repos	O/N Tranche of AM RG Auction
Arguments to include	• Although ad hoc, have had periods where the frequency and amount of the Bank's ORs increased significantly—potential for similar periods in the future. • Operations have competitive bidding (not a fixed rate).	• Auctions are multi-price (reflect broad market funding conditions). • Amounts offered can be large at times depending on the Government's cash management needs.

Arguments to exclude	• Still only a subset of market participants have access (Primary Dealers).
	• Recent high OR frequency/amounts were a temporary response to structural changes (e.g. T+1 transition).
	• The single price auction does not reflect broad market funding conditions:
	  • Participants' marginal funding costs can be different).
	  • OR/ORR objective is to clear at a rate that helps reinforce the Bank's target.
	• Risk that some view CORRA as being biased towards the Bank's target (see Appendix chart), could undermine the benchmark.
		• Counterparty eligibility is broader than the Bank's operations but still excludes some repo participants.
		• Majority of AM RG volume would not be included in CORRA given:
		  • Eligible collateral is broader, majority is non-GoCs.
		  • *Most* volume in the AM RG is for term.

Overall	**Exclude.** Only a subset of market participants have access and funding rates may not be reflective of the broader market which could undermine CORRA.	**Exclude.** Some large players in the repo market are not eligible, and vast majority of trades do not involve GoCs and/or are for term so would be excluded from CORRA's calculation.

Appendix

Summary of CAG participant feedback

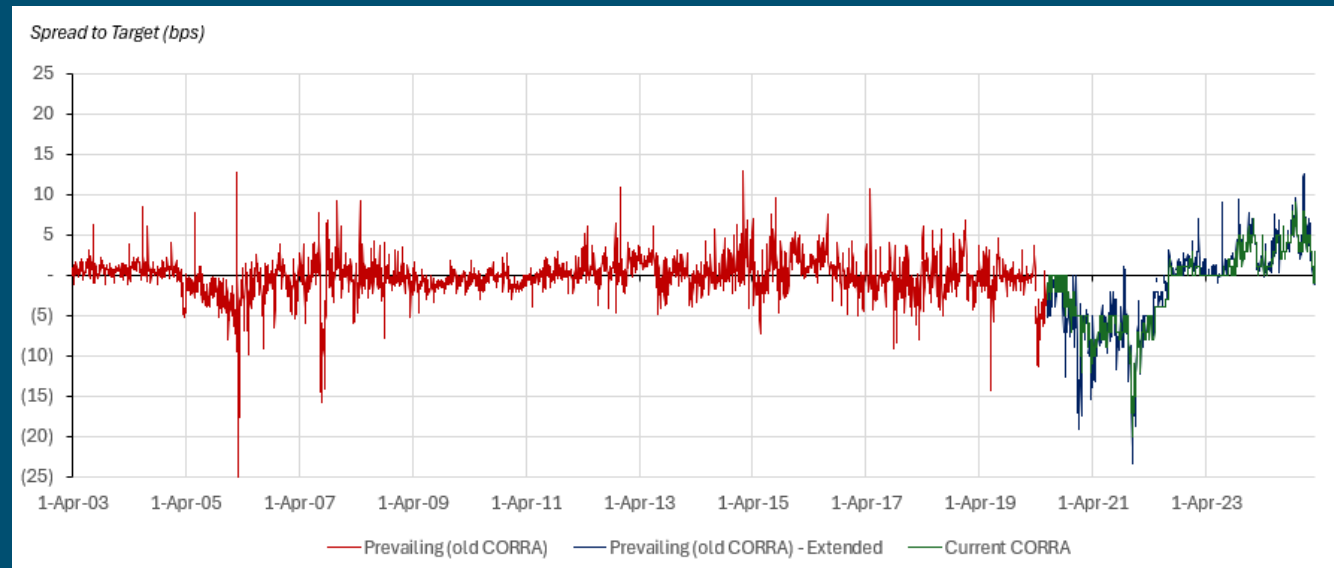
Topic	Arguments for:	Arguments against:
Current percentile trim methodology (2:2)	• less sensitive to market volatility • similar to SOFR • a constant spread is more likely to over-/under-estimate specials volume • if there are concerns with the 25th percentile's precision, we can review other percentiles	• a constant spread measure is favoured • this is closer to how participants 'think' about specials on any given day • spreads suggested range from 5-20bp
BoC OR &/or AM RG inclusion (3:2)	• BoC is viewed as just another client for funding • most (ex-AM RG) collateral meets CORRA eligibility	• not reflective of the *broader* market's funding conditions. • BoC should not have *direct* influence on CORRA
Increasing the minimum volume threshold (2:1:1)	• total volumes appear to be structurally higher post-T+1 • suggestions include $5-10bn or a dynamic moving average	• Don't increase it (*no rationale given*)
	• Increase it only if improves the data quality	

GC Proxy Results

- GC Proxy is constructed by extending Prevailing CORRA (average of GC IDB trades) using IDB data to the BoC
- Best percentile method: 25%
- Best spread to CORRA method: 10bps
- Best spread to target method: 5bps
- **Top 3 methods overall** as measure by cumulative absolute mean difference to GC proxy across all time periods:
  1. 25% percentile method
  2. 20% percentile method
  3. 15% percentile method

… Advantage: 25th Percentile

Chart A1: GC Proxy Benchmark



Source: Bank of Canada
Last Observation: February 28, 2025

Table A1: Mean Spreads to GC Proxy Benchmark

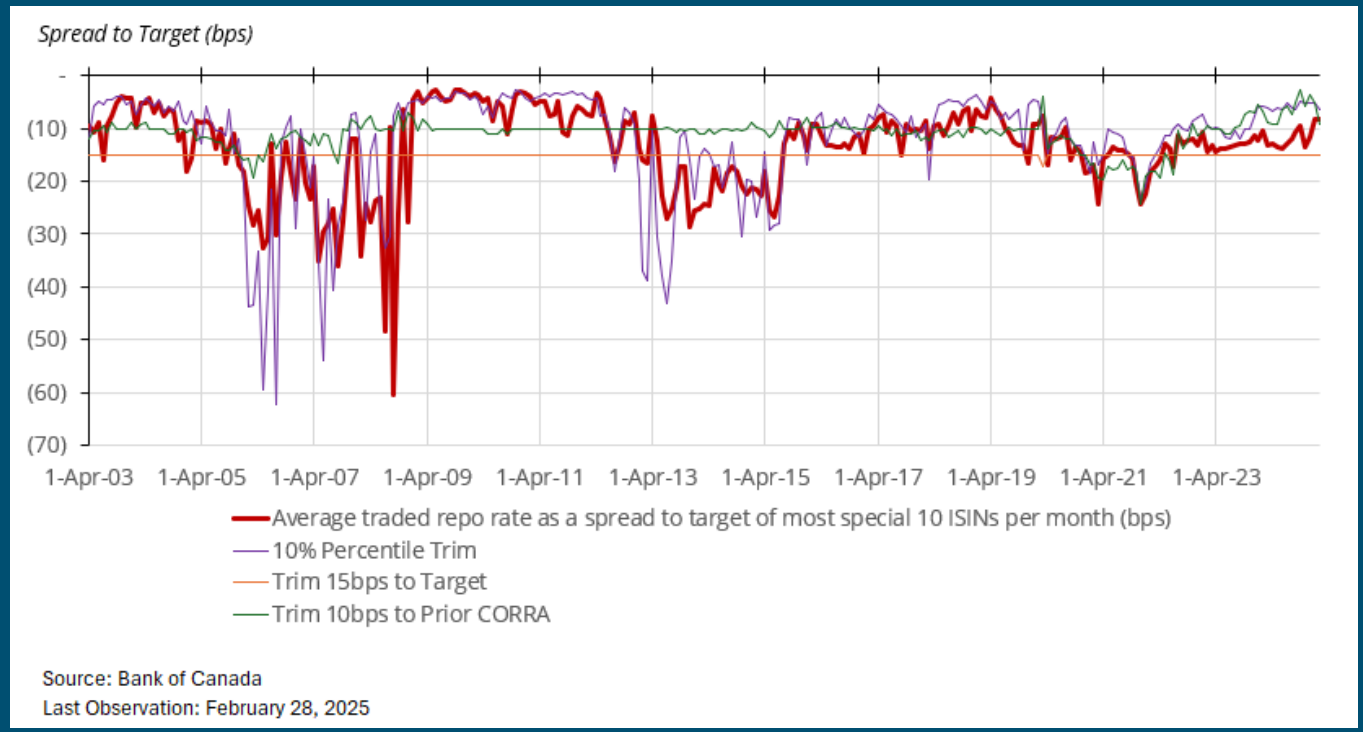
	Observation Period			
	Full Sample	Pre-2020 (Old CORRA)	Post-2020 (new CORRA pre-T+1)	Post-2020 (new CORRA post-T+1)
Start Date	April 3, 2003	April 3, 2003	June 12, 2020	May 28, 2024
End Date	February 28, 2025	June 11, 2020	May 27, 2024	February 28, 2025
	Mean spread to GC Proxy (bps)			
Methodology Description	Mean	Mean	Mean	Mean
CORRA with 25% Trim Rate	-0.18	-0.20	-0.09	-0.15
CORRA with 20% Trim Rate	-0.28	-0.29	-0.23	-0.36
CORRA with 15% Trim Rate	-0.39	-0.39	-0.35	-0.53
CORRA with 10% Trim Rate	-0.51	-0.50	-0.52	-0.66
CORRA 15bps spread to prior CORRA	-0.57	-0.51	-0.76	-0.99
CORRA 10bps spread to prior CORRA	-0.42	-0.41	-0.45	-0.69
CORRA 5bps spread to prior CORRA	0.04	-0.16	0.48	2.13
CORRA 15bps spread to Target	-0.52	-0.48	-0.59	-1.13
CORRA 10bps spread to Target	-0.32	-0.35	-0.04	-1.00
CORRA 5bps spread to Target	0.06	-0.10	0.95	-0.75
Bond Rate Method	-0.45	-0.37	-0.75	-0.97

Specials Proxy Results: Top 10 ISINs

- Best percentile method: 10%
- Best spread to CORRA method: 10bps
- Best spread to target method: 15bps
- **Top 3 methods overall** as measure by lowest absolute mean spread to top 10 ISINs proxy:
  1. 10% percentile method
  2. 15bp spread to Target
  3. 10bp spread to CORRA

… Advantage: 10th Percentile

Chart A2: Top 10 Specials ISIN basket vs Trim Rates



Source: Bank of Canada
Last Observation: February 28, 2025

Table A2: Mean Spread of Trim Rate to Specials Basket

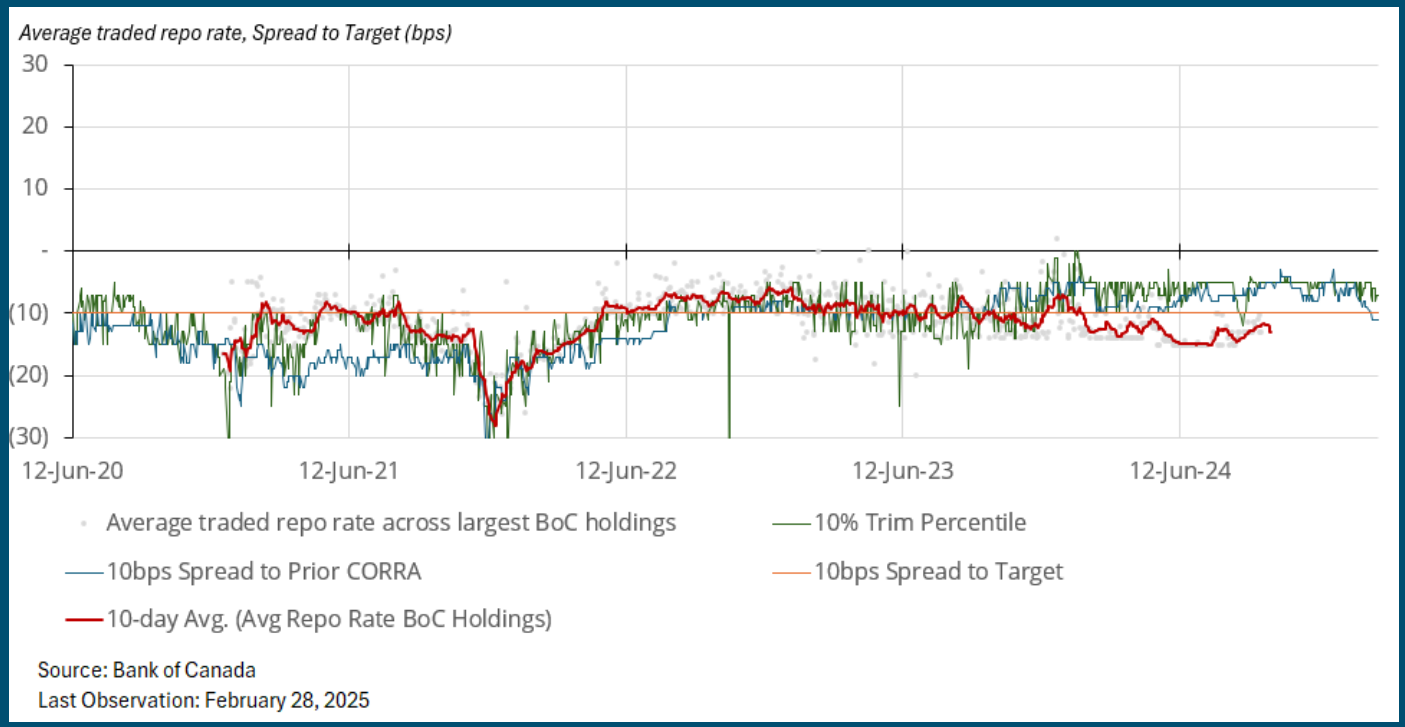
Mean Spread to Specials Basket (Top 10 ISINs)	Methodology
8.82	CORRA 25% Trim Methodology
7.29	CORRA 20% Trim Methodology
5.04	CORRA 15% Trim Methodology
1.49	CORRA 10% Trim Methodology
-2.61	CORRA Trim 15bps spread to prior CORRA
2.53	CORRA Trim 10bps spread to prior CORRA
7.97	CORRA Trim 5bps spread to prior CORRA
-1.57	CORRA Trim 15bps to Target
3.43	CORRA Trim 10bps to Target
8.43	CORRA Trim 5bps to Target
8.84	Bond Rate Method

Specials Proxy Results: BoC Holdings

- Best percentile method: 10%
- Best spread to CORRA method: 10bps
- Best spread to Target method: 10bps
- **Top 3 methods overall** as measure by lowest absolute mean spread to BoC holdings proxy:
  1. 10% percentile method
  2. 10bp spread to CORRA
  3. 10bp spread to Target

… Advantage: 10th Percentile

Chart A3: BoC Holdings basket vs Trim Rates



Source: Bank of Canada
Last Observation: February 28, 2025

Table A3: Mean Spread of Trim Rate to BoC Holdings Basket

Mean Spread to Specials Basket (BoC Holdings)	Methodology
5.13	CORRA 25% Trim Methodology
3.79	CORRA 20% Trim Methodology
2.11	CORRA 15% Trim Methodology
0.25	CORRA 10% Trim Methodology
-6.36	CORRA Trim 15bps spread to prior CORRA
-1.15	CORRA Trim 10bps spread to prior CORRA
4.23	CORRA Trim 5bps spread to prior CORRA
-3.59	CORRA Trim 15bps to Target
1.41	CORRA Trim 10bps to Target
6.41	CORRA Trim 5bps to Target
4.15	Bond Rate Method

Stability: Trimmed Volume

- Percentile method: stable with zero volatility
- Spread methods result in volatile trimmed volume
  - Spread to CORRA: Averages from 5-21% of volume trimmed, std dev. 3-19%
  - Spread to Target: Average 6-23% trimmed, std dev. 9-29%
- Among spread methods, smaller spreads result in more trimmed volume and in several cases/periods can lead to the majority of volume being trimmed.
- *… Overall advantage: Percentile methods*
- *… Among spread methods, advantage: Larger spreads*

Table A4: Average Amount Trimmed (%)

Average Amount Trimmed Volume (%)			
Start Date	April 3, 2003	April 3, 2003	June 12, 2020
End Date	February 28, 2025	June 11, 2020	February 28, 2025
Methodology Description	**Mean**	**Mean**	**Mean**
Current CORRA	25.00%	25.00%	25.00%
CORRA 15bps spread to prior CORRA	5.05%	5.83%	2.22%
CORRA 10bps spread to prior CORRA	9.01%	8.80%	9.78%
CORRA 5bps spread to prior CORRA	20.55%	18.12%	29.44%
CORRA with 25% Trim Rate	25.00%	25.00%	25.00%
CORRA with 20% Trim Rate	20.00%	20.00%	20.00%
CORRA with 15% Trim Rate	15.00%	15.00%	15.00%
CORRA with 10% Trim Rate	10.00%	10.00%	10.00%
CORRA 15bps spread to Target	5.60%	6.07%	3.88%
CORRA 10bps spread to Target	10.20%	9.43%	13.00%
CORRA 5bps spread to Target	22.56%	19.23%	34.70%
Bond Rate Method	20.20%	22.01%	13.44%

Table A5: St. Dev Trimmed Volume (%)

Standard Dev of Amount Trimmed Volume (%)			
Start Date	April 3, 2003	April 3, 2003	June 12, 2020
End Date	February 28, 2025	June 11, 2020	February 28, 2025
Methodology Description	**St. Dev**	**St. Dev**	**St. Dev**
Current CORRA	0.00%	0.00%	0.00%
CORRA 15bps spread to prior CORRA	6.32%	6.74%	3.13%
CORRA 10bps spread to prior CORRA	8.20%	8.38%	7.43%
CORRA 5bps spread to prior CORRA	15.00%	12.70%	18.89%
CORRA with 25% Trim Rate	0.00%	0.00%	0.00%
CORRA with 20% Trim Rate	0.00%	0.00%	0.00%
CORRA with 15% Trim Rate	0.00%	0.00%	0.00%
CORRA with 10% Trim Rate	0.00%	0.00%	0.00%
CORRA 15bps spread to Target	8.23%	7.81%	9.42%
CORRA 10bps spread to Target	11.97%	10.48%	15.99%
CORRA 5bps spread to Target	20.20%	15.49%	28.86%
Bond Rate Method	9.86%	9.77%	6.76%

Stability: Trimmed Volume

- Evaluating the minimum and maximum trimmed from each method can show the extreme cases when a particular methodology will trim the entire distribution (or far too much of the distribution). This is a flaw with the spread methods.

- Charts A4 & A5 depict total trimmed volume of CORRA-eligible trades when trimming as a spread to target and prior CORRA respectively

Table A6: Min / Max of Amount Trimmed (%)

Min/Max			
Start Date	April 3, 2003	April 3, 2003	June 12, 2020
End Date	February 28, 2025	June 11, 2020	February 28, 2025
Methodology Description	**Min / Max**	**Min / Max**	**Min / Max**
Current CORRA	25% / 25%	25% / 25%	25% / 25%
CORRA 15bps spread to prior CORRA	0% / 59%	0% / 59%	0% / 35%
CORRA 10bps spread to prior CORRA	0% / 61%	0% / 61%	0% / 48%
CORRA 5bps spread to prior CORRA	0% / 99%	0% / 99%	1% / 95%
CORRA with 25% Trim Rate	25% / 25%	25% / 25%	25% / 25%
CORRA with 20% Trim Rate	20% / 20%	20% / 20%	20% / 20%
CORRA with 15% Trim Rate	15% / 15%	15% / 15%	15% / 15%
CORRA with 10% Trim Rate	10% / 10%	10% / 10%	10% / 10%
CORRA 15bps spread to Target	0% / 93%	0% / 93%	0% / 88%
CORRA 10bps spread to Target	0% / 100%	0% / 100%	0% / 90%
CORRA 5bps spread to Target	0% / 100%	0% / 100%	3% / 98%
Bond Rate Method	0% / 72%	0% / 72%	0% / 46%

Chart A4: Trimmed Volume Spread to Target (%)

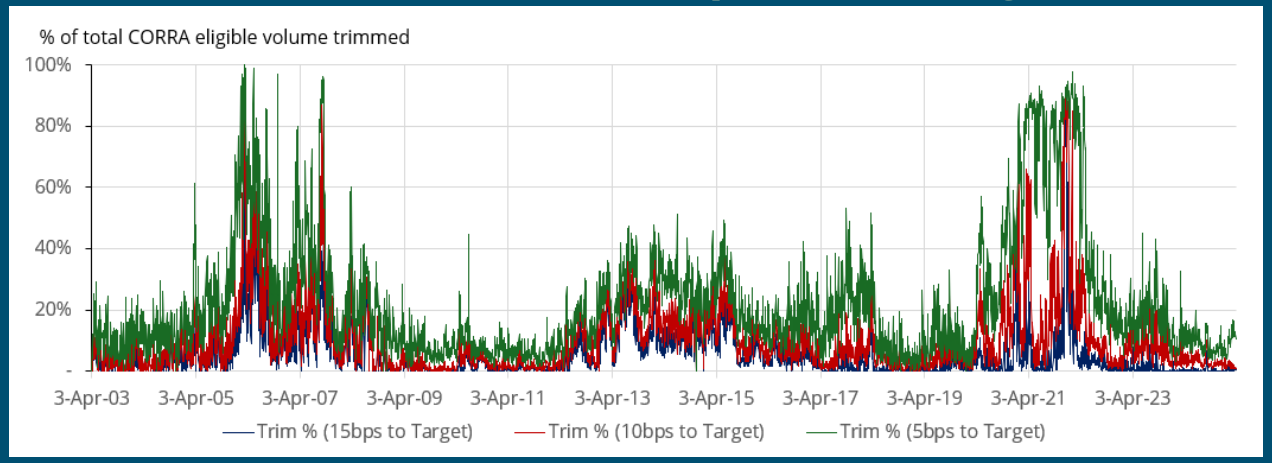
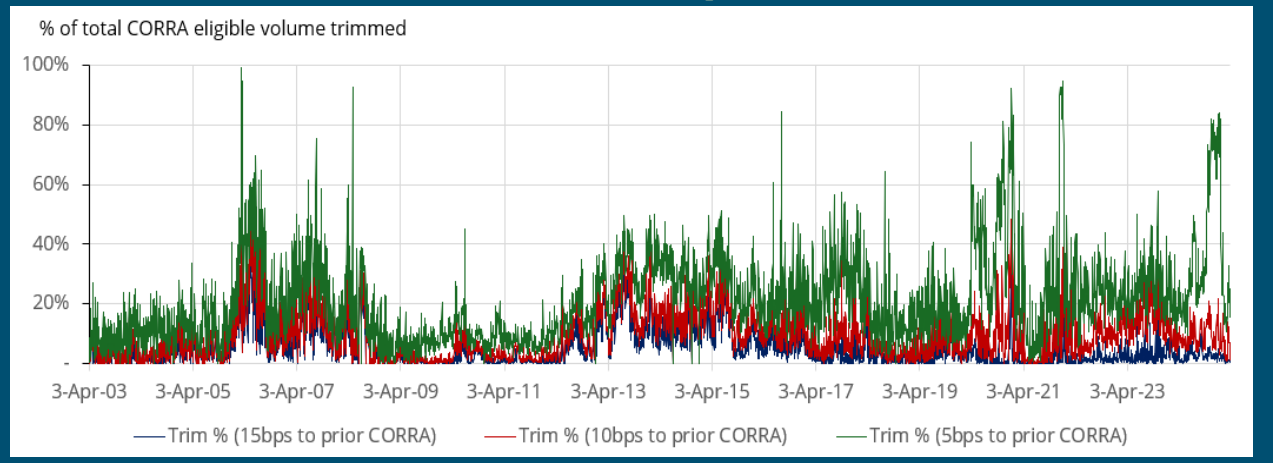


Chart A5: Trimmed Volume Spread to CORRA (%)



Evaluating Stability

- Trimming CORRA via a fixed spread adds stability to CORRA evident by the lower standard deviation as a spread to target
- Methods that trim more, gap fewer times since more of the left tail is excluded.
  - Methods that trim more result in a trim rate that sets at CORRA fewer times.
- **Top 3 methods overall** as measure of rate volatility:
  1. 5bp spread to prior CORRA
  2. Bond Rate method
  3. 5bp spread to target

… Advantage: 5bp spread to CORRA

Table A7: Mean and standard deviation spread to target

Spread to: Target			
Start Date	April 3, 2003	April 3, 2003	June 12, 2020
End Date	February 28, 2025	June 11, 2020	February 28, 2025
Methodology Description	**Standard Deviation**	**Standard Deviation**	**Standard Deviation**
CORRA (BoC)	3.10	2.41	4.71
CORRA 15bps spread to prior CORRA	2.78	1.75	4.79
CORRA 10bps spread to prior CORRA	2.69	1.65	4.73
CORRA 5bps spread to prior CORRA	2.61	1.40	4.94
CORRA with 25% Trim Rate[1]	2.65	1.62	4.71
CORRA with 20% Trim Rate	2.69	1.68	4.72
CORRA with 15% Trim Rate	2.73	1.76	4.72
CORRA with 10% Trim Rate	2.80	1.87	4.73
CORRA 15bps spread to Target	2.55	1.60	4.39
CORRA 10bps spread to Target	2.27	1.42	3.97
CORRA 5bps spread to Target	2.18	1.75	3.27
Bond Rate Method	2.60	1.52	4.59

[1] *This will not be equal to current CORRA when the date range is earlier than June 12, 2020, as this marked the shift to "new-CORRA" (i.e., when CORRA swithed to a median calculation vs. an average).*

Table A8: CORRA gapping tabular (%)

Observation Period: January 2003 - February 2025

Day over day gap size	CORRA (15bps Spread to Prior CORRA)	CORRA (10bps Spread to Prior CORRA)	CORRA (5bps Spread to Prior CORRA)	CORRA (15bps spread to Target)	CORRA (10bps spread to Target)	CORRA (5bps spread to Target)	CORRA (25% trim)	CORRA (20% trim)	CORRA (15% trim)	CORRA (10% trim)	Bond Rate Method
3bps	2.9%	2.6%	1.2%	2.8%	2.4%	1.0%	1.9%	2.7%	2.8%	3.4%	2.3%
4bps	0.9%	0.5%	0.5%	0.9%	0.6%	0.4%	0.7%	0.7%	0.9%	0.9%	0.7%
5bps	0.5%	0.4%	0.2%	0.4%	0.4%	0.3%	0.6%	0.6%	0.5%	0.5%	0.3%
6bps+	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.4%	0.4%	0.4%	0.4%	0.3%

Table A9: Trim rate setting at CORRA tabular (%)

Observation Period: January 2003 - February 2025

	Trim Rate (15bps Spread to Prior CORRA)	Trim Rate (10bps Spread to Prior CORRA)	Trim Rate (5bps Spread to Prior CORRA)	Trim Rate (15bps spread to Target)	Trim Rate (10bps spread to Target)	Trim Rate (5bps spread to Target)	Trim Rate (25% trim)	Trim Rate (20% trim)	Trim Rate (15% trim)	Trim Rate (10% trim)	Bond Rate Trim Rate (Bps) Spread to Target
Trim Rate set at CORRA (%)	-	-	0.05%	0.02%	0.31%	6.01%	4.49%	1.13%	0.24%	0.13%	0.11%

CORRA with BoC ORs included

- From July 17th, 2024, to January 31st, 2025, the impact on CORRA would have been on average slightly less than a 1bp decrease towards target.
- The **maximum impact would have been a decrease of 6bps** on December 19th, 2025.
- There were a few instances where ORs would have had an *upward* impact on CORRA, pushing it away from target.

Chart A6

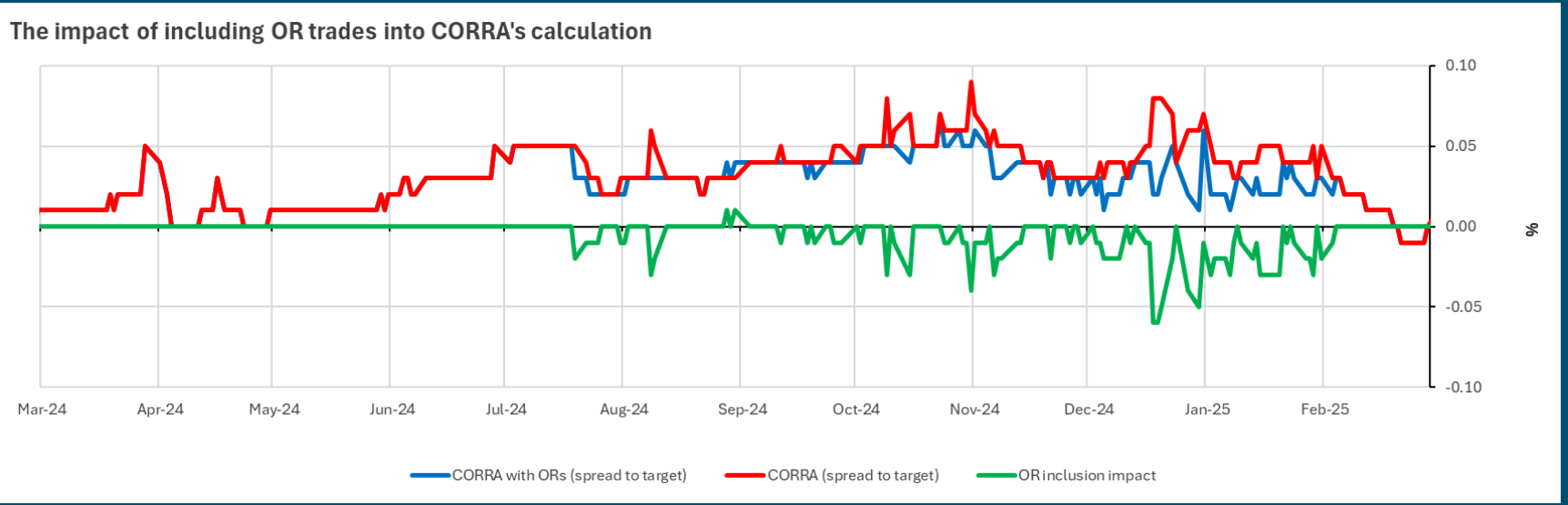


Chart A7