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## Bonds & Bold: Elucidating a Single Chart

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Anders Skytte Aalund

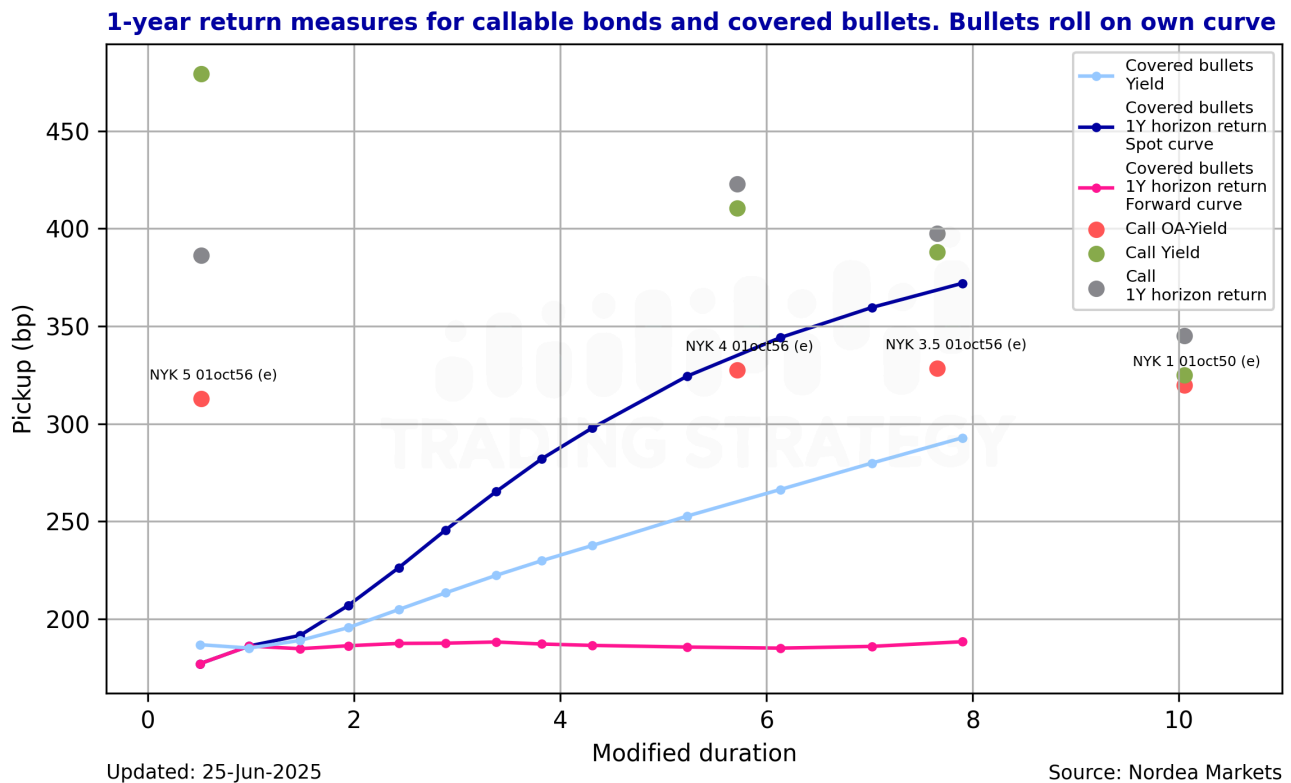
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What should one prefer, yield roll or coupon? Obtain answers to this fundamental inquiry for outright investors.

Certain graphical representations possess timeless validity and precipitate recurring deliberations and assessments when formulating investment decisions. Among these representations is a comparative analysis of carry/roll on linear bonds versus carry on bonds exhibiting negative convexity. The question arises whether one realizes the roll and to what extent one should account for losses attributable to negative convexity. This graphical representation may manifest as illustrated below, wherein the outcome distribution of calculated returns exhibits substantial magnitude.

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In this analytical examination, I investigate the horizon within which one may anticipate realizing the calculated yield roll on the covered bullets curve. Initially, however, I shall quantify the magnitude of losses accumulated through negative convexity in callables.

## Time Change Losses to Theory

Time possesses the characteristic of relativizing even deleterious phenomena. The unfavorable performance years for Danish callable bonds in the recent past are gradually being displaced from collective memory, superseded by the allure of coupon, with losses transforming into theoretical constructs.

We have traversed several anni horribilis for Danish callable mortgage bonds, yet the preceding eighteen months have delivered reasonable returns on high-coupon bonds, partially attributable to stable and mean-reverting interest rates. Consequently, it is my assessment that there currently exists an increasing appetite for carry, further propelled by the steeper curve in the short-term segment.

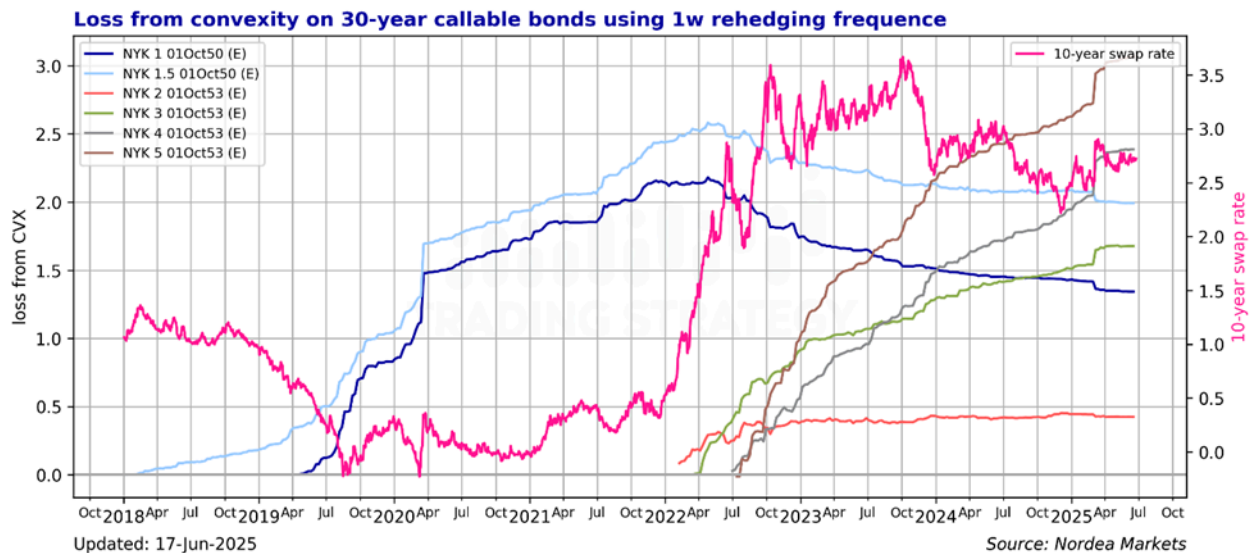
I'll now quantify losses resulting from negative convexity. I must emphasize that this analysis exclusively relates to swap rate fluctuations, not alterations in OAS. Empirically, OAS risk typically exceeds that of covered bullets by a factor of 2-3.

The methodological approach entails comparing price change differentials based solely on the delta vector against authentic repricing incorporating comprehensive yield curve adjustments. This precisely captures the non-linear effect. The graph below illustrates the accumulated losses across various 30-year callable mortgage bonds. Two factors influence this representation: firstly, losses increase proportionally with interest rate volatility; secondly, negative convexity characteristics evolve as rates ascend or descend. Note that

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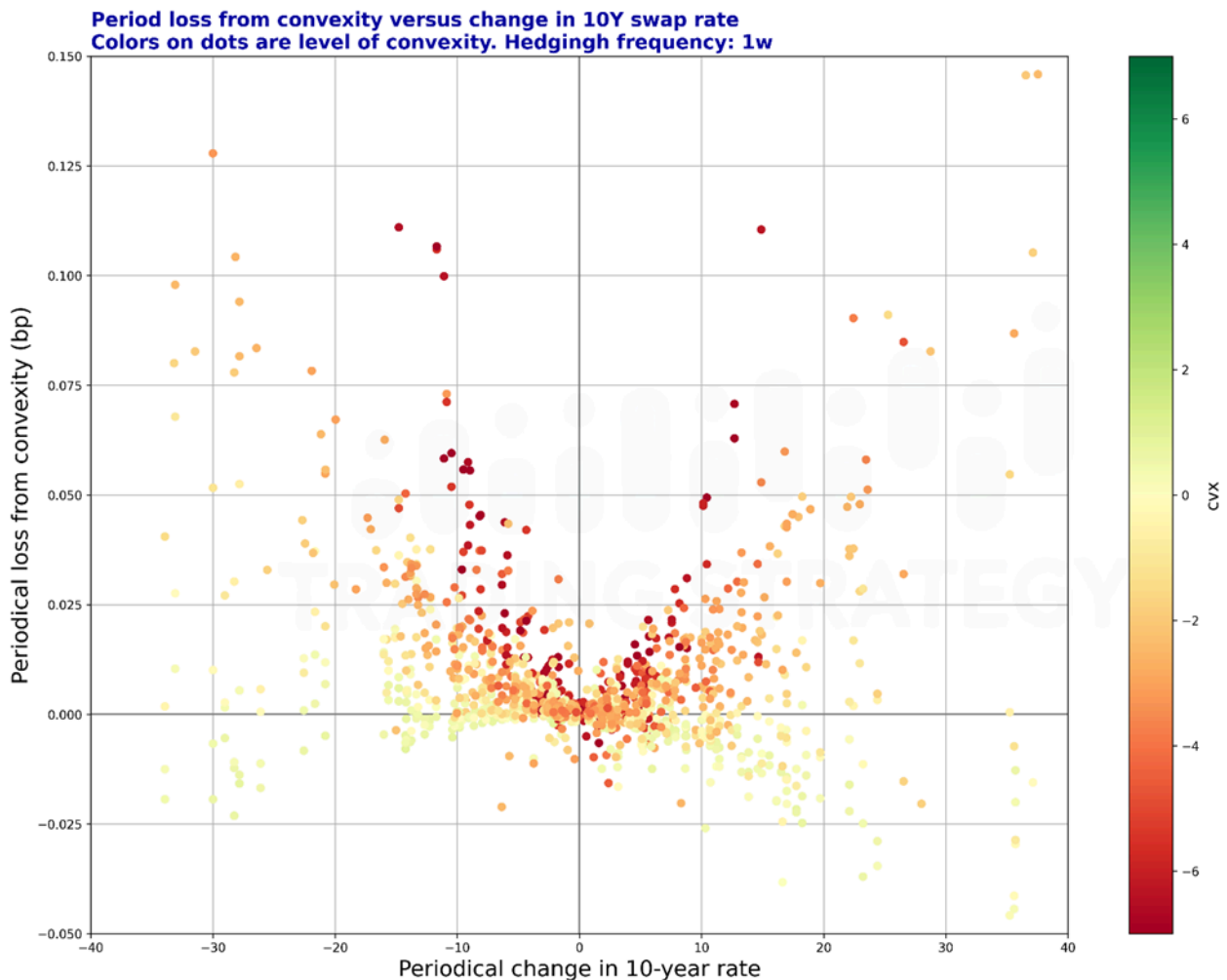
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I consistently employ one-week horizons. The optimal methodology depends on the prevailing regime—whether rates exhibit trending or mean-reverting behavior—though I maintain that a straightforward consistent strategy suffices for this purpose.



One observes that the 1%50 and 1.5%50 graphs do not demonstrate monotonic increases but actually decline from certain points, attributable to transitions from negative to positive convexity, whereby interest rate fluctuations contribute positively to non-linear effects. Additionally, one notes that losses resulting from negative convexity were particularly substantial in 2022, consequent to significant interest rate increases. In 2024 and beyond, the loss curves have moderated somewhat, indicating limited interest rate fluctuations, with the exception of the rate spike observed in March following new European debt outlook.

This can also be represented via a scatter plot, illustrating loss magnitude during interest rate changes relative to the bond's negative convexity at specific points. Here we observe a distinct correlation between these three variables, where the loss from negative convexity forms a parabolic relationship, exhibiting greater convexity proportional to the negative convexity of the observation.



Source: Nordea Markets

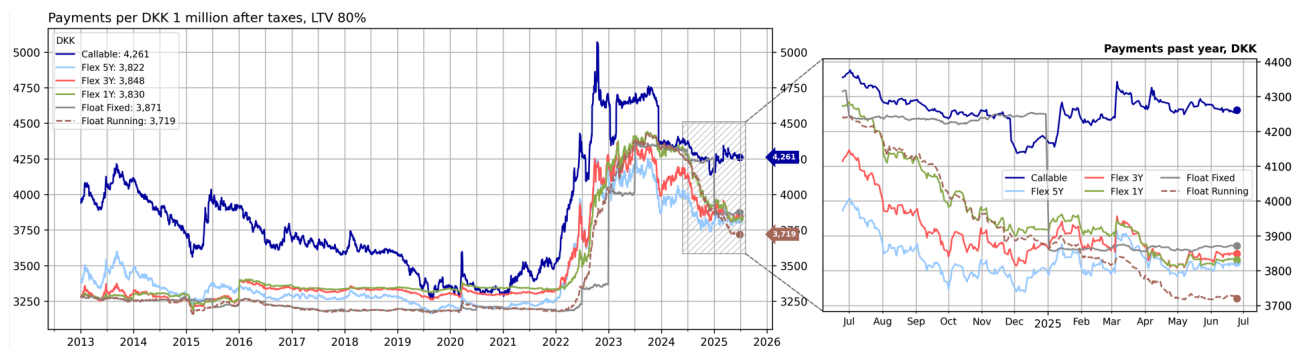
Converting these weekly observations into a tabular format reveals quarterly losses per unit of negative convexity since 2018. We note that 2024 losses approximated those of the favorable period from 2018 through 2021, excluding several quarters characterized by uncertainty, such as March 2020. The stable interest rate environment of the past eighteen months will, I believe, gradually diminish investors' recollection of the distressing period from 2021 onward, relegating these experiences to theoretical outliers.

## Annualized loss from negative convexity per unit of negative convexity based on change in swap rates Hedging frequency: 1w

	NYK 1 01oct50 (E)	NYK 1.5 01oct50 (E)	NYK 2 01oct53 (E)	NYK 3 01oct53 (E)	NYK 4 01oct53 (E)	NYK 5 01oct53 (E)	Average
Q1-2018		0.11					0.11
Q2-2018		0.10					0.10
Q3-2018		0.07					0.07
Q4-2018		0.08					0.08
Q1-2019		0.15					0.15
Q2-2019	0.17	0.11					0.14
Q3-2019	0.41	0.28					0.34
Q4-2019	0.09	0.09					0.09
Q1-2020	0.53	0.48					0.50
Q2-2020	0.07	0.06					0.07
Q3-2020	0.06	0.05					0.06
Q4-2020	0.06	0.06					0.06
Q1-2021	0.08	0.08					0.08
Q2-2021	-0.00	0.01					0.00
Q3-2021	0.17	0.15					0.16
Q4-2021	0.25	0.18					0.22
Q1-2022	-0.04	0.17	0.35	0.07			0.14
Q2-2022			0.57	0.62			0.59
Q3-2022			0.19	0.54	0.50	0.98	0.56
Q4-2022				0.81	0.56	0.95	0.77
Q1-2023				0.43	0.44	0.63	0.50
Q2-2023				-0.21	0.19	0.21	0.06
Q3-2023				0.12	0.48	0.27	0.29
Q4-2023				0.44	0.50	0.56	0.50
Q1-2024				0.19	0.17	0.23	0.19
Q2-2024				0.15	0.12	0.12	0.13
Q3-2024				0.11	0.11	0.11	0.11
Q4-2024				0.13	0.16	0.17	0.15
Q1-2025				0.38	0.46	0.47	0.43
Q2-2025				0.00	0.03	0.05	0.03

Source: Nordea Markets

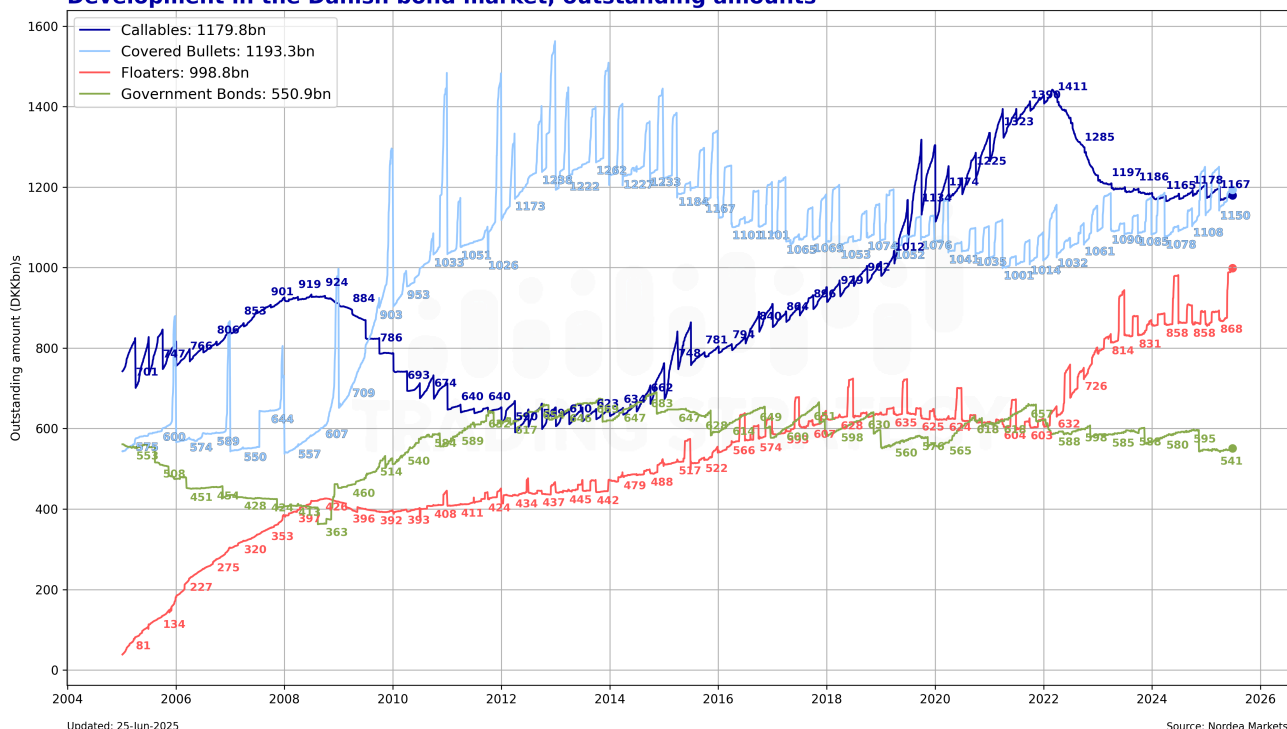
This tendency will be reinforced by supply dynamics, as lower payments on short-term loans progressively contract the callable segment. In summary, the pursuit of carry will emerge as the predominant theme in the latter half of 2025, a trend already manifesting as evidenced by the graphs below.



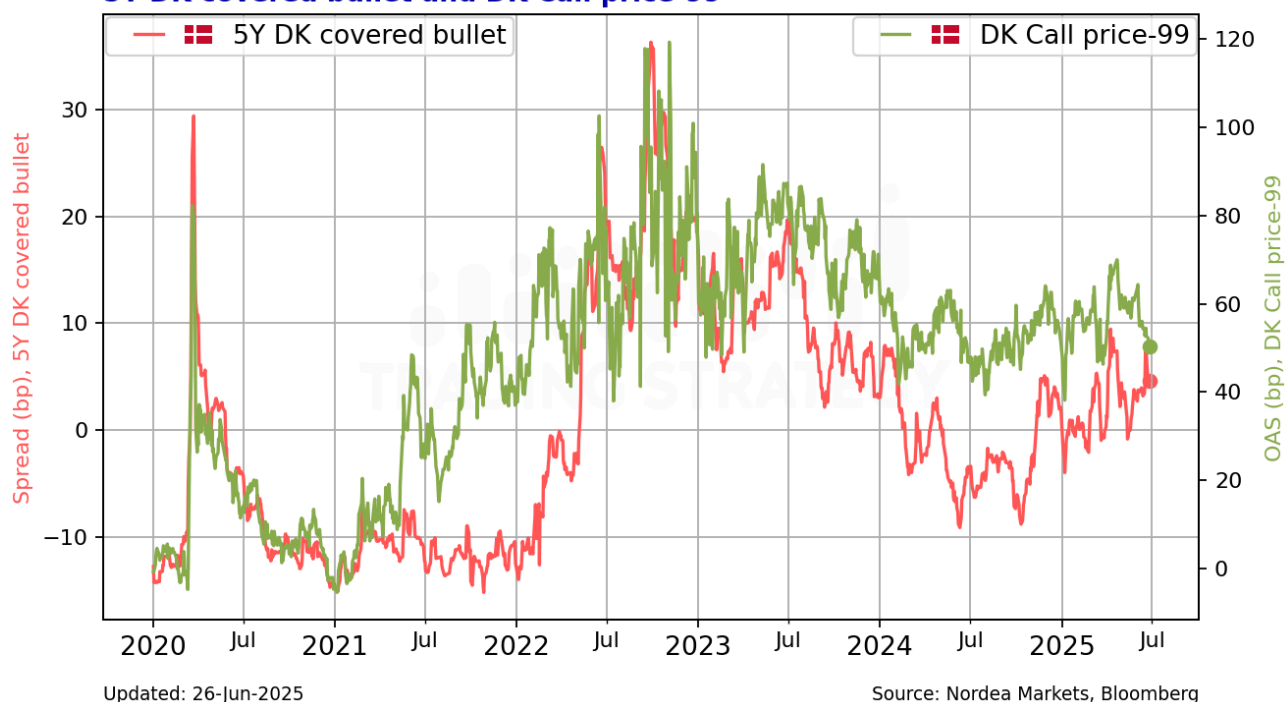
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## Development in the Danish bond market, outstanding amounts



## 5Y DK covered bullet and DK Call price-99



## Quantifying the Negative Convexity Penalty for 4%56 Bonds

Utilizing the average annualized loss per unit of negative convexity (17 cents/cvx) and multiplying by the 4%56 bond's negative convexity value of 4 gives:  $17 \text{ cents/cvx} * 4 \text{ cvx} = 0.68 \text{ cents}$ . This figure is marginally

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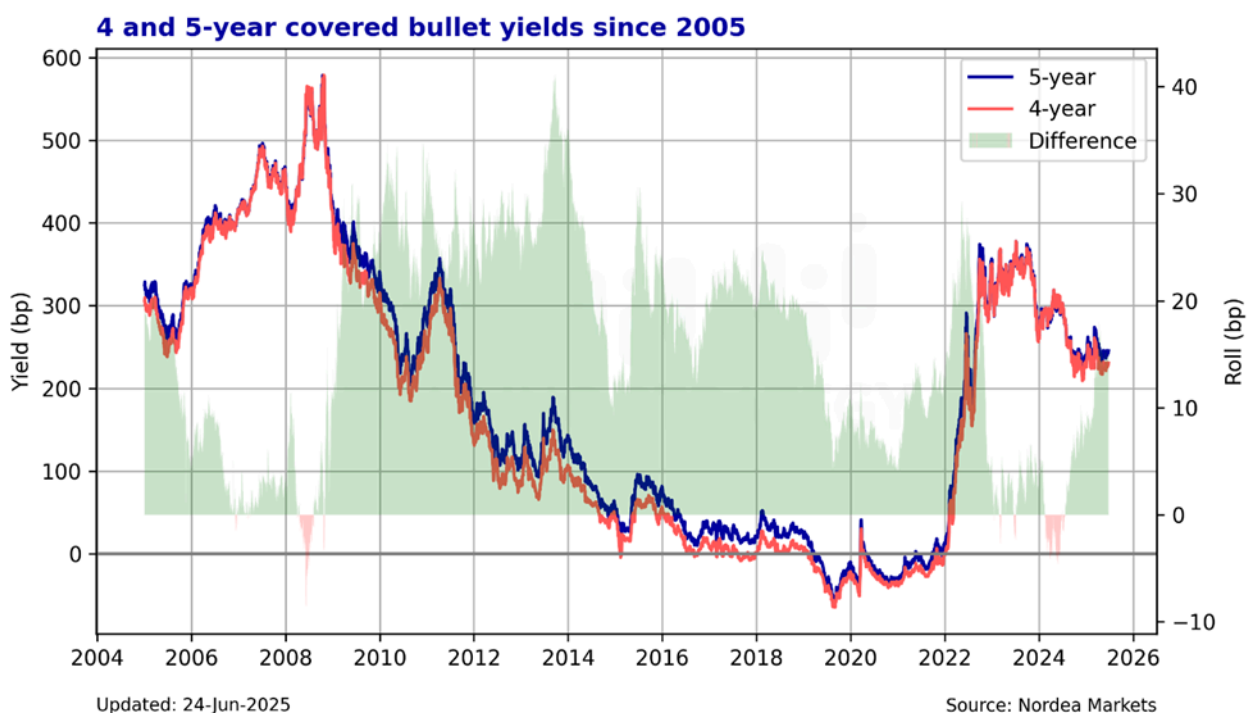
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lower than the differential between deterministic Yield and OAYield (first figure), suggesting that market behavior over the past six quarters has been somewhat more stable than current volatility indicators would suggest.

## When Can Curve Roll Be Expected to Materialize?

Rolling on the curve resembles cycling with a tailwind—it facilitates progress despite occasional uphill segments and accelerates significantly during downhill passages.

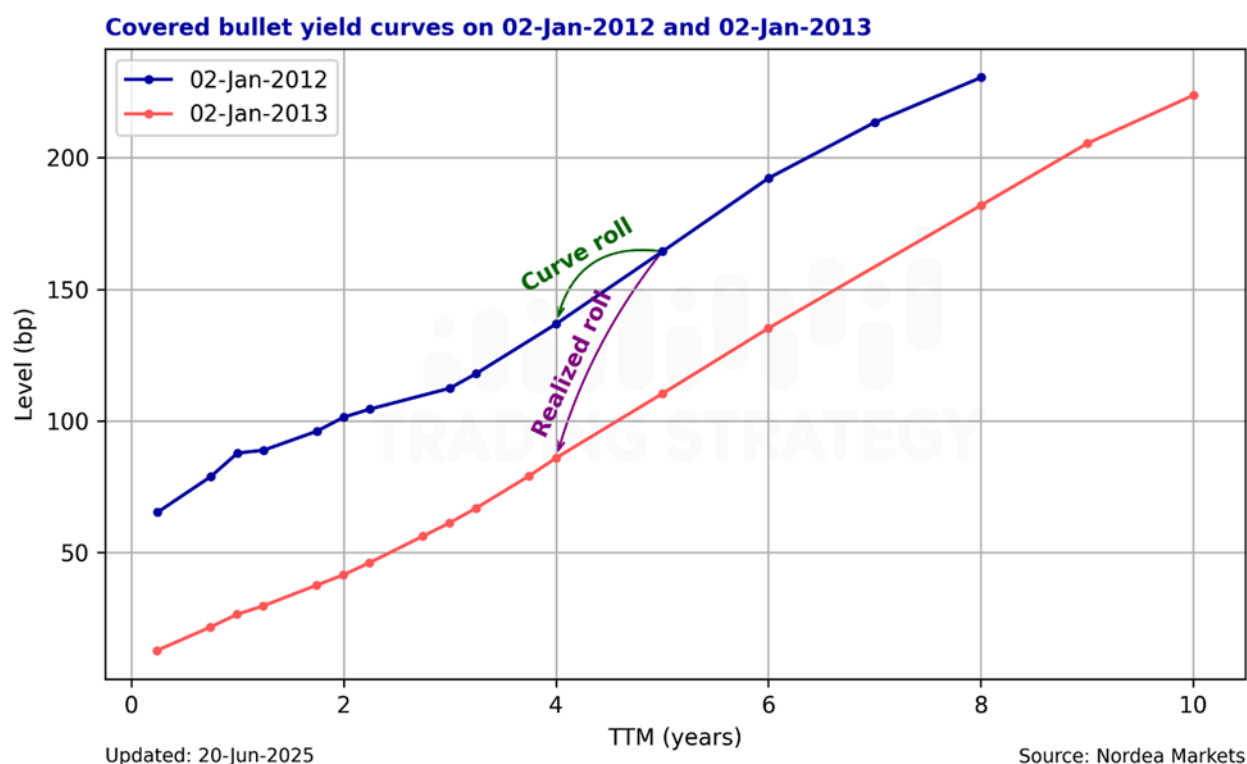
In essence, if interest rates commence and conclude a period at identical levels, one typically realizes the roll on average, though interim variations may be substantial. Below, I have plotted 4-year and 5-year covered bullet rates over the past two decades. Throughout this interval, rates have declined approximately 75 basis points, equating to roughly 4 basis points annually. The average 1-year roll in the 5-year point has been 15.5 basis points.



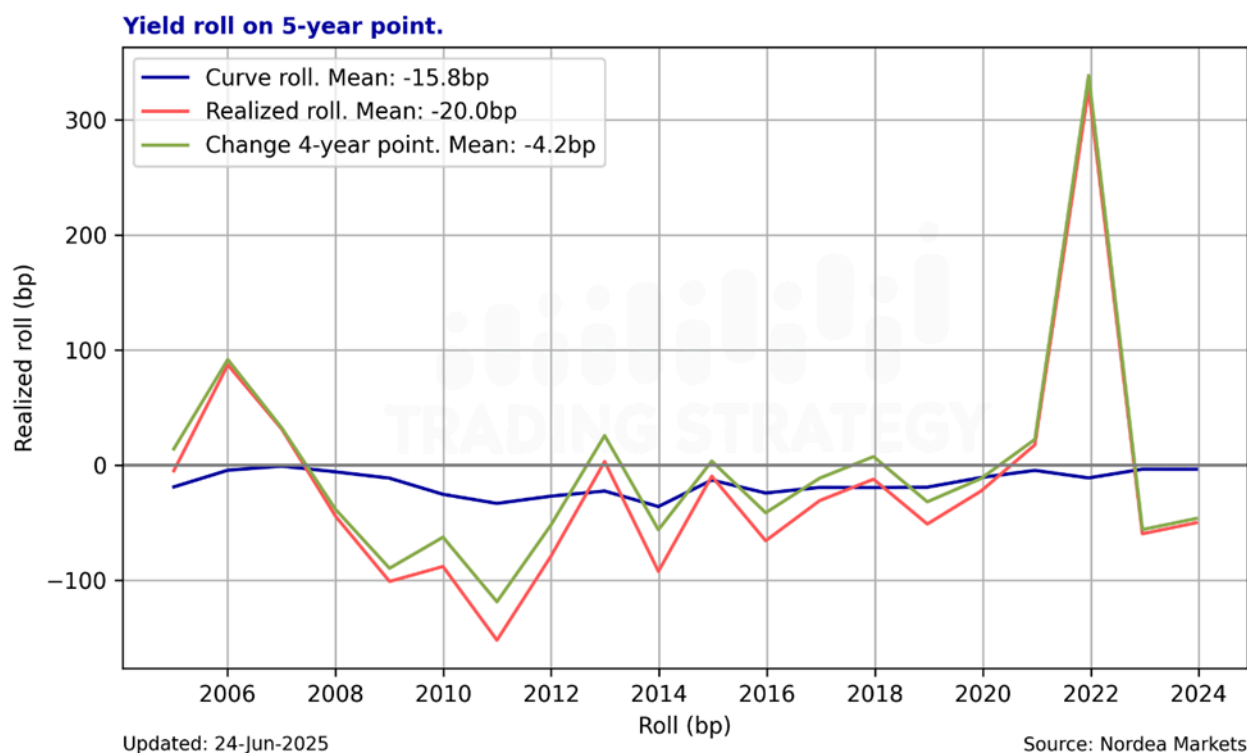
To assess whether the calculated roll on the spot curve materializes, I perform the calculation illustrated in the figure below. This methodology yields, for each day, both a calculated roll on the spot curve and a realized roll.

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To ensure data independence, I exclusively analyze non-overlapping periods while testing data with varied commencement points. As evidenced by the time series below, realized roll has fluctuated considerably, though on average it delivers the expected value plus the drift observed in interest rates.

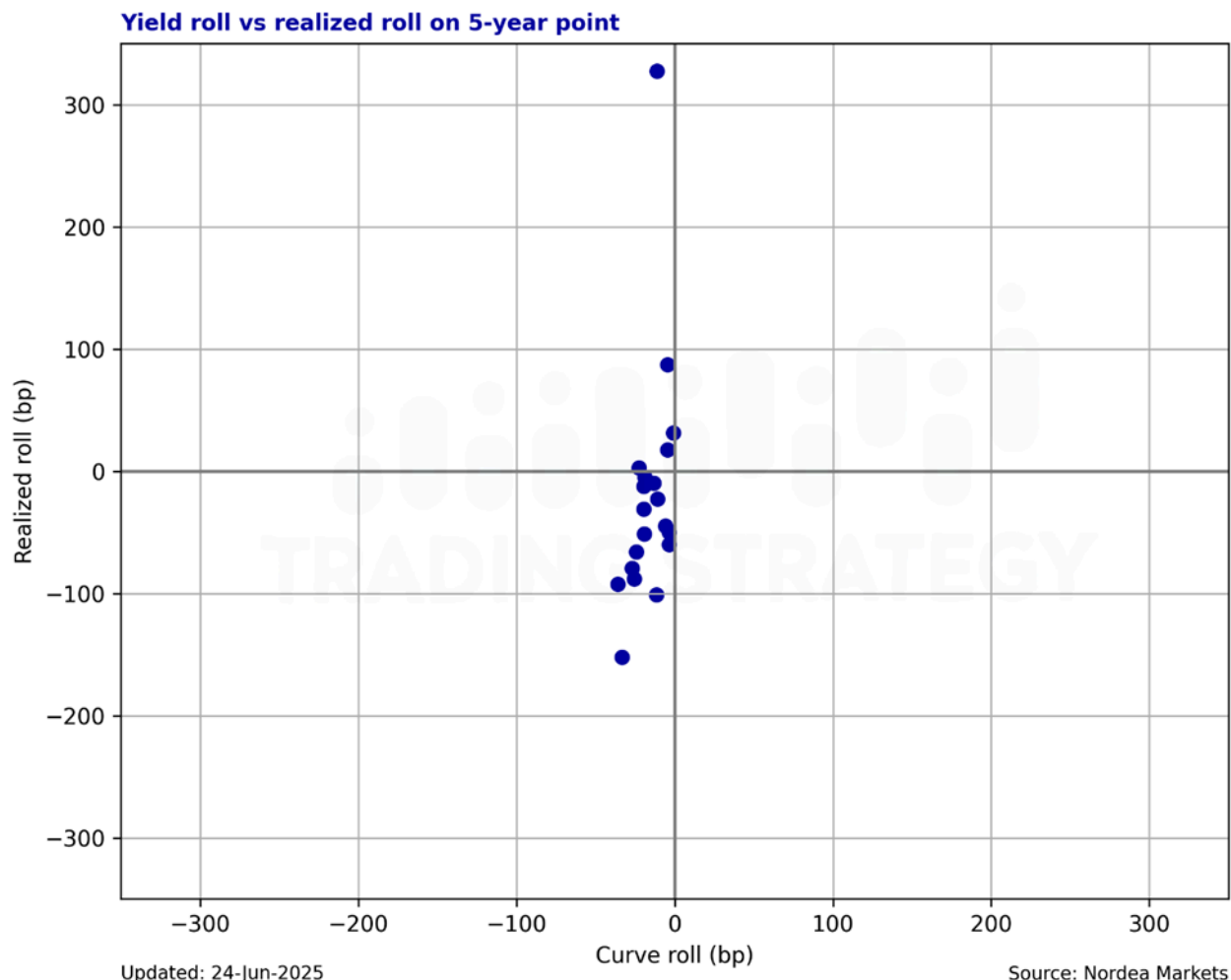


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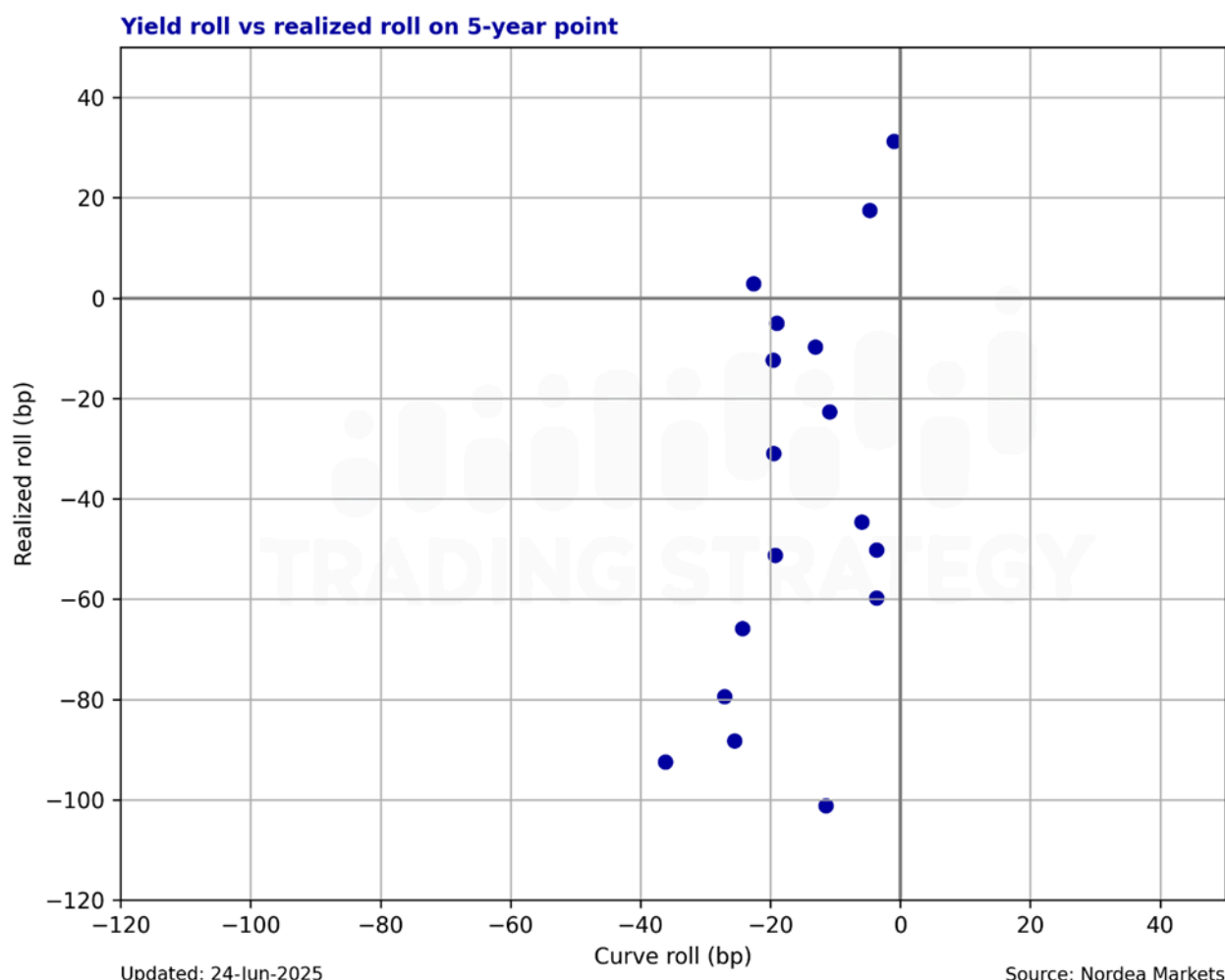
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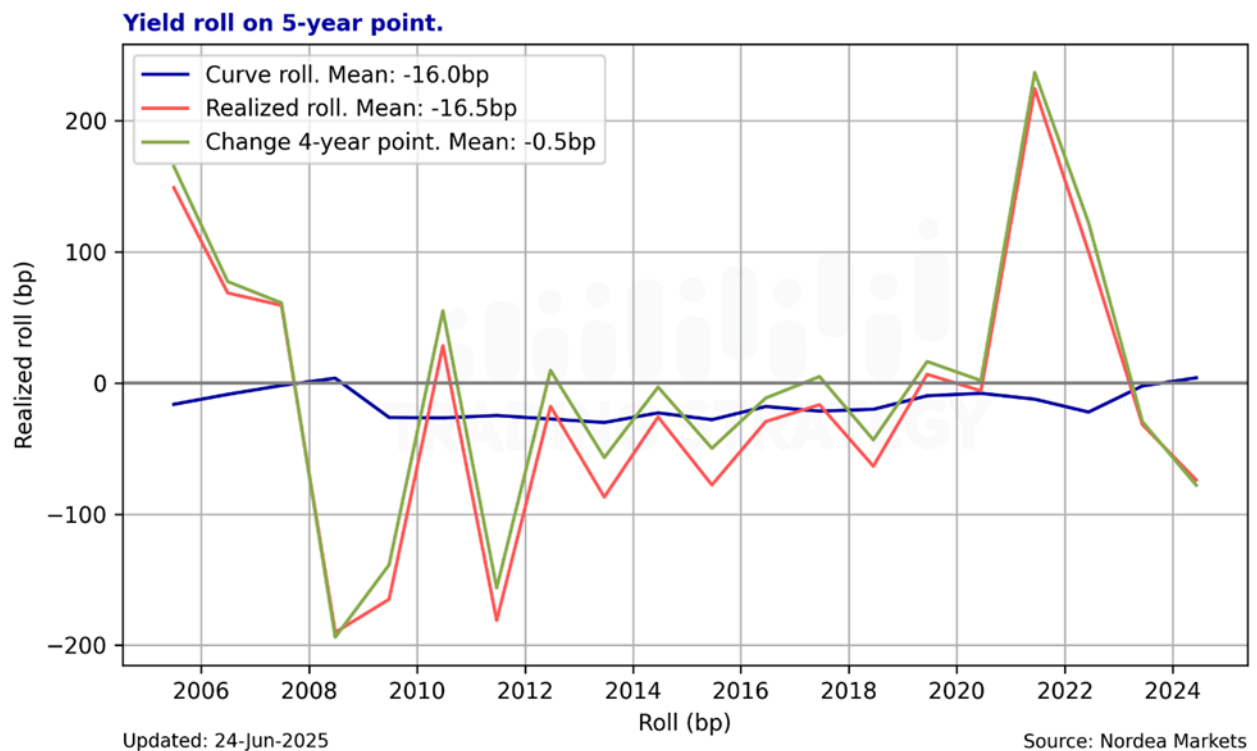
To examine potential correlations between high curve roll and realized roll, I have plotted these variables against each other in the graph below. We observe a single point representing a clear outlier, which unsurprisingly corresponds to the substantial interest rate increase of 2022.



Upon magnifying the cluster of observations in the lower left quadrant, I determine that no distinct correlation exists there either. Thus, based on the historical data from the past two years, one may conclude that while the roll is realized on average, one must accommodate considerable noise relative to the "anticipated" return.

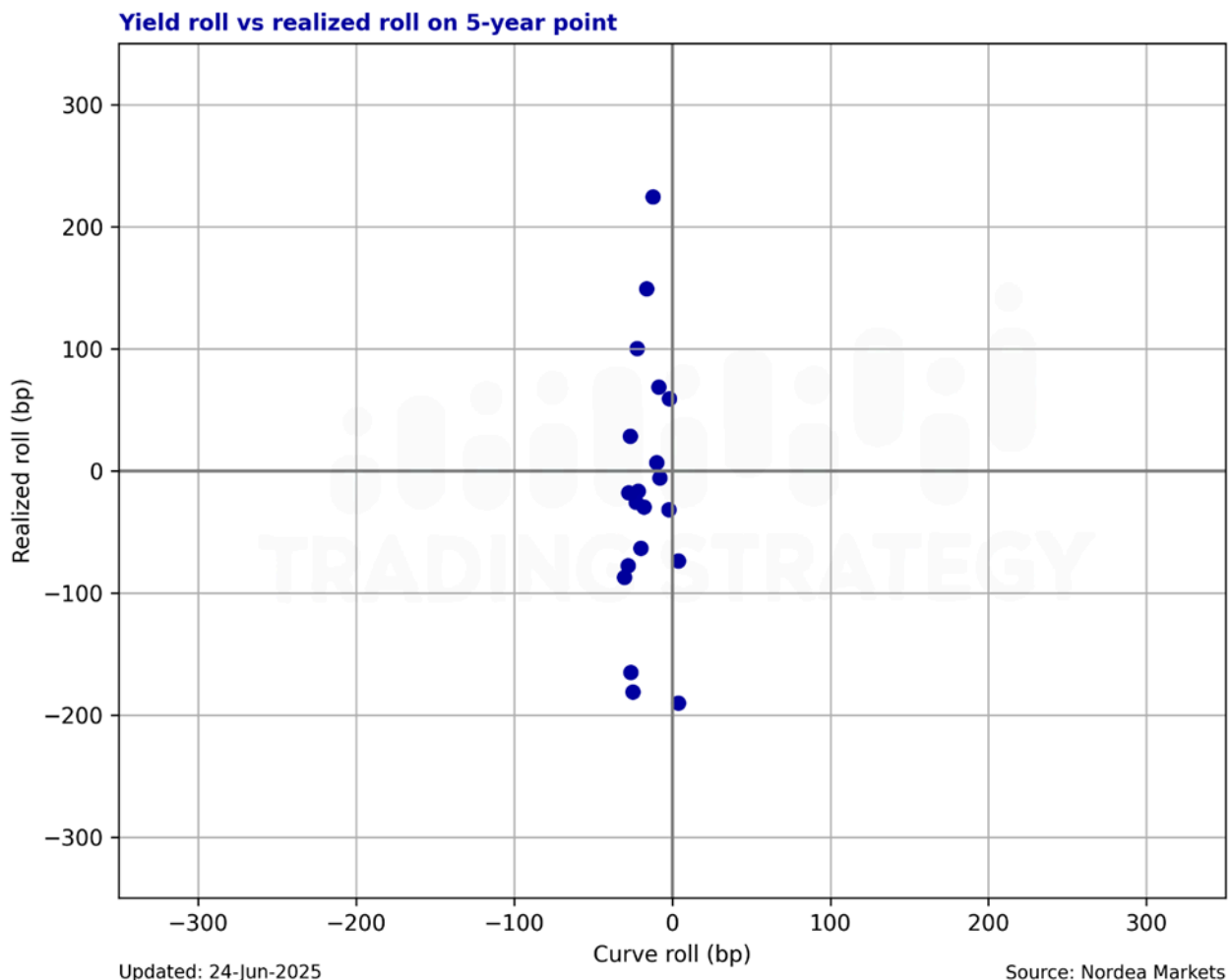


This noise intensifies significantly when the commencement point is shifted by six months, merely emphasizing that one must accept substantial noise in curve roll, even when interest rates follow a stationary process. Consequently, this investment strategy likely best suits investors with extended time horizons and moderate leverage. Spread roll represents an entirely different phenomenon, which we have analyzed previously. The conclusion therein indicated that spread roll was consistently delivered and empirically leveraged, yielding returns exceeding calculations when high and underperforming when low.



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At Nordea Analytics API/Web, horizon returns have been calculable for decades using both unchanged spot curve assumptions (as demonstrated above) and the presumption that forward rates materialize. As the initial figure illustrated, this produces substantial return differentials. The academic debate regarding the superior methodology has persisted throughout my professional tenure, and I shall refrain from engaging in it here. I will note, however, that all our risk models are naturally Q-measure models wherein forward rates materialize.

## Conclusion

I anticipate that time favors callables and that spreads will compress further. The extent of this compression depends on interest rate stability duration, though I can envision levels 10 basis points lower by early autumn. While I generally avoid interest rate strategy speculation, I have observed markets' remarkable capacity to absorb significant events with stoic composure, suggesting a favorable environment for callable bonds. Conversely, the analysis demonstrated that realizing yield roll on the curve necessitates somewhat extended time horizons. Overall, I project that callables will outperform covered bullets in the forthcoming quarters.

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