The Rotation of the Curve: ECB Policy Transmission Before and After Balance Sheet Normalisation

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Abstract

I use intraday asset price changes around 83 ECB Governing Council meetings between January 2015 and October 2025 to ask whether the transmission of monetary policy surprises to the German yield curve changed when the euro area moved from balance sheet expansion to normalisation. Decomposing each meeting into orthogonal target, path and balance-sheet surprises, I find that the transmission did not weaken uniformly. It rotated. The balance-sheet factor transmits with a stable coefficient near unity across both regimes. What changed is the long end of the curve: a hawkish path surprise lowered thirty-year Bund yields by 1.30 basis points per basis point before 2022 and has no detectable effect since, a shift of 1.35 basis points with a wild-bootstrap p value of 0.037. In parallel, target surprises acquired a slope effect they previously lacked, flattening the two-to-ten segment by 1.46 basis points per basis point against essentially zero before. The share of meetings on which yields and equities co-move, the signature of a central bank information shock, fell from 46 to 15 percent. In a four-country panel, target surprises transmit 2.40 basis points more strongly to periphery than to core ten-year yields, but that amplification is confined to the expansion regime and disappears after July 2022. Two caveats discipline the reading. Joint stability tests do not reject coefficient constancy in any single equation, and no individual interaction survives a family-wise correction across the twenty-one tests examined; the evidence for the rotation is a consistent pattern of point estimates across maturities, classifications and robustness variants rather than a decisive rejection. Taken at face value, the estimates imply that curve sensitivities calibrated on the quantitative easing period misstate the current reaction, and that the misstatement is concentrated in the long-duration positions for which it matters most.

Keywords: monetary policy transmission, high-frequency identification, yield curve, quantitative tightening, euro area

JEL: E43, E52, E58, G12

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1 Introduction

Between 2015 and 2021 the European Central Bank operated at the effective lower bound on its policy rate and conducted policy primarily through asset purchases and forward guidance. Since July 2022 it has raised and then lowered policy rates through a full cycle while allowing its balance sheet to contract. The two configurations differ not only in the stance they delivered but in the instruments through which the stance was communicated.

This paper asks whether the mapping from policy surprises to the German sovereign curve changed with that configuration. The question is of interest for two distinct reasons. For the analysis of transmission, the stability of the mapping is informative about whether the channels through which asset purchases and guidance operate are structural or specific to the environment in which they were deployed. For the practice of fixed income risk management, the mapping is the object being estimated whenever a desk asks how far the curve will move on a policy surprise of given size, and a mapping estimated on a regime that has ended is a source of miscalibration rather than information.

The identification follows the high-frequency event-study tradition [Kuttner, 2001, Gürkaynak et al., 2005, Altavilla et al., 2019]. Within a window of minutes around a scheduled announcement, the probability that an unrelated macroeconomic release moves the curve is small, so the observed price change can be attributed to the announcement. The euro area affords an additional advantage exploited by Altavilla et al. [2019]: the rate decision and the elaboration of the outlook and the balance sheet are released at separate times, so the two can be separated by construction rather than by assumption.

I make three contributions. First, I extend the regime comparison to a sample that contains the complete tightening and partial easing cycle through October 2025, which was not available to the literature that established the baseline estimates. Second, I test explicitly whether the response coefficients are constant across the two regimes, using inference calibrated to the small number of post-liftoff meetings rather than relying on asymptotic approximations that are known to over-reject. Third, I show that the change in the mapping is a rotation of the curve response rather than an attenuation, and I trace the rotation to two specific coefficients.

The main results can be stated compactly. The balance-sheet factor moves the Bund curve roughly one for one at every maturity, and this is true in both regimes; the interaction terms are small and never approach significance. The change is concentrated in the path factor at the long end and in the target factor's effect on the slope. Before 2022 a hawkish path surprise lowered ten-year and thirty-year Bund yields, an inversion consistent with guidance that signals a lower expected terminal rate or a weaker growth path. That response is gone. Meanwhile target surprises, which had no discernible effect on the slope during the expansion, now flatten the curve substantially.

The paper also documents two auxiliary findings that bear on interpretation. The fraction of meetings on which the equity market moves with rather than against the interest rate surprise, the sign signature of the central bank information effect of Jarociński and Karadi [2020] and Nakamura and Steinsson [2018], falls by two thirds between the regimes. And the differential transmission of policy surprises to periphery sovereign yields, which was large and precisely estimated during the expansion, is absent afterwards.

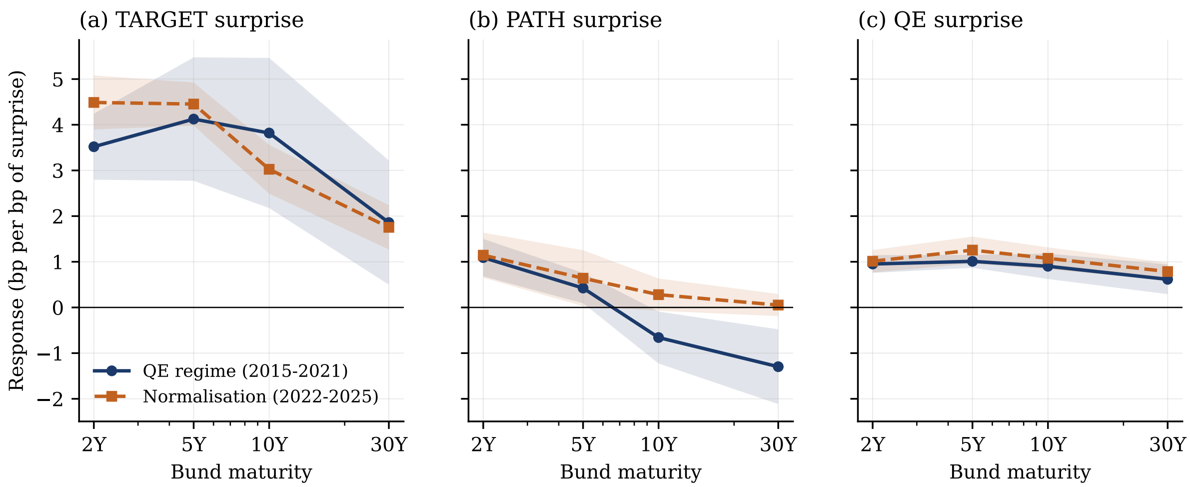

Figure 1: **The result in one picture.** Response of Bund yields to each policy surprise, by regime, with 90 percent confidence bands. The balance-sheet factor (right) is unchanged across regimes. The path factor (middle) lowered long yields before 2022 and does not now. Coefficients are basis points of yield change per basis point of surprise in each factor's anchor instrument.

Section 2 sets out the institutional timeline and states the hypotheses. Section 3 describes the data. Section 4 develops the identification. Section 5 reports results, Section 6 translates them into portfolio arithmetic, Section 7 reports robustness, and Section 8 concludes with the limitations that a reader should weigh against the findings.

2 Institutional background and hypotheses

The sample opens with the announcement of the expanded asset purchase programme on 22 January 2015 and closes on 30 October 2025. Three features of the interval matter for the design.

Until July 2022 the deposit facility rate was at or below zero and unchanged for long stretches. Policy news therefore arrived predominantly as information about the pace and duration of purchases and about the conditions under which rates would eventually rise. On 21 July 2022 the Governing Council raised rates for the first time in eleven years and simultaneously announced the Transmission Protection Instrument. Net purchases under the asset purchase programme had ended the preceding month, and portfolio runoff began in March 2023.

I therefore define an expansion regime through December 2021 and a normalisation regime from July 2022, and treat the first half of 2022 as a transition that the baseline excludes and the robustness section restores. The exclusion is a judgement, not a result, and Section 7 shows the findings do not depend on it.

Five hypotheses were fixed before estimation.

H1, segmentation. Target surprises move the short end most, path surprises the short to intermediate segment, and balance-sheet surprises the long end.

H2, attenuation. The long-end response to balance-sheet surprises is weaker in the normalisation regime, because portfolio runoff is passive, pre-announced and calendar-based, and therefore carries less surprise per meeting than the discretionary purchase announcements whose duration-extraction effects the earlier literature documents [Krishnamurthy and Vissing-Jorgensen, 2011, Rogers et al., 2014].

H3, slope. Restrictive target surprises flatten the curve; restrictive balance-sheet surprises do not.

H4, information. A material share of meetings are information rather than policy shocks, and removing them sharpens the estimated responses.

H5, fragmentation. Balance-sheet surprises transmit more strongly to periphery than to core sovereign yields.

H2 and H5 are rejected in the forms stated. I report them as stated rather than revising them after the fact, because the informational content of a rejected prior differs from that of a hypothesis constructed to fit.

3 Data

The source is the Euro Area Monetary Policy Event-Study Database of Altavilla et al. [2019], maintained by the ECB. It records intraday changes in overnight index swap rates from one month to twenty years, sovereign yields for Germany, France, Italy and Spain, the EURO STOXX 50 and its banking subindex, and major euro exchange rates, separately for the press release window, the press conference window and their union.

Restricting to meetings from January 2015 yields 83 events, 56 in the expansion regime and 27 in the normalisation regime. All series used below are complete over this interval. Yield changes are in basis points and equity changes in percent.

A cleaning step that is not innocuous. The distributed workbook stores the event date as a native date for early observations and as a `dd/mm/yyyy` text string for later ones. A reader applying month-first conventions to the text rows transposes day and month whenever both are below thirteen. In the current vintage this mis-assigns six dates, every one of them in 2024 or 2025, and therefore falls entirely within the regime whose coefficients are the object of the exercise. Each mis-parsed date is placed on a Sunday, Monday or Tuesday, whereas all Governing Council monetary policy meetings in the sample fall on a Wednesday or Thursday, which provides a simple diagnostic. The replication code parses the raw cells by type and verifies the day-of-week distribution. Appendix Table A1 lists the affected dates. I record this not for its intrinsic interest but because it is invisible in any output that does not inspect the calendar, and because the errors concentrate precisely where the paper's identification of a regime change requires them not to.

4 Identification

4.1 The event window

Let Δp_t denote the change in an asset price across the announcement window on meeting date t. The identifying assumption is that, conditional on being in the window, no news other than the announcement moves the price:

$$\Delta p_t = \Gamma' s_t + \varepsilon_t, \qquad E[s_t \varepsilon_t] = 0, \tag{1}$$

where s_t collects the policy surprises. Two threats deserve statement rather than assertion. Macroeconomic releases scheduled inside the window would violate the exclusion; euro area releases are not scheduled during Governing Council windows, though US releases occasionally are, which motivates the control in Section 7. And complex balance-sheet announcements may be priced with a lag exceeding the window, which would attenuate the balance-sheet coefficients toward zero. Attenuation of this kind biases against finding the stable balance-sheet transmission reported below only if it worsened over time, for which there is no evident reason.

4.2 Factor decomposition

A single meeting conveys several pieces of news at once, so a scalar surprise measure confounds them. Following Gürkaynak et al. [2005], Swanson [2021] and Altavilla et al. [2019], I extract orthogonal factors and rotate them into economically interpretable positions.

Write the matrix of OIS surprises in a given window as $X = F\Lambda' + e$ with $F'F/n = I_k$. In the press release window a single component accounts for 68.4 percent of the covariation; I label it TARGET. In the press conference window the first two components account for 90.7 and 5.9 percent, so I set $k = 2$ and rotate by an orthonormal R obtained as the matrix exponential of a skew-symmetric matrix, which enforces orthonormality at every point of the optimisation. The single restriction

$$[\Lambda R]_{1\mathrm{M},\,\mathrm{QE}} = 0 \tag{2}$$

just identifies the rotation angle: the balance-sheet factor is the linear combination that leaves the one-month OIS unchanged. The residual dimension is labelled PATH.

Because R is orthogonal, the rotation relabels variation without creating or destroying it. The decomposition is a measurement device, not a structural model, and nothing below should be read as identifying deep parameters.

Scaling. Each factor is scaled so that a one-unit realisation moves its anchor instrument by one basis point: the one-month OIS for TARGET, the two-year for PATH, the ten-year for QE. Every coefficient reported below is therefore read as basis points of Bund yield change per basis point of surprise in the anchor. This step is easy to omit and its omission renders the magnitudes uninterpretable.

Figure 3 shows the resulting loading profiles. They have the shapes the labels imply and were not imposed: PATH peaks between one and two years and decays to zero by ten, QE rises monotonically from zero at one month to unity at the long end.

4.3 Regime specification

The estimating equation is

$$\Delta y_t^{(\tau)} = \alpha + \delta\, QT_t + \sum_k (\beta_k + \gamma_k\, QT_t)\, F_{k,t} + \varepsilon_t, \tag{3}$$

where QT_t indicates the normalisation regime. The γ_k are the objects of interest.

Inference. With 27 events in the normalisation regime, asymptotic inference on γ_k is the weakest link in the design. I therefore report, alongside HC1 standard errors, p values from a restricted wild bootstrap in the spirit of Cameron et al. [2008]: residuals are drawn from the model estimated under $H_0 : \gamma_k = 0$, perturbed by Rademacher weights, and the t statistic is recomputed 4,999 times. Where the two disagree I defer to the bootstrap, and I flag the cases where they do.

4.4 Separating policy from information

A restrictive surprise accompanied by rising equity prices is difficult to read as pure tightening. Following the logic of Jarociński and Karadi [2020] and Nakamura and Steinsson [2018], I classify a meeting as a policy shock when the two-year OIS surprise and the EURO STOXX 50 response have opposite signs and as an information shock when they agree. This sign classification is coarser than a sign-restricted vector autoregression and assigns events near the axes on weak evidence, but it requires no auxiliary model and can be verified by inspecting Figure 5.

5 Results

5.1 Baseline responses

Table 2 reports the pooled specification. All three factors move the curve and the pattern is broadly consistent with H1. Target surprises generate the largest movements, peaking between two and five years at roughly 4.2 basis points per basis point of one-month OIS surprise and declining to 1.8 at thirty years. Path surprises move the two-year point by 1.17 and have no average effect beyond ten years. The balance-sheet factor moves every maturity by close to unity.

Level, slope and curvature are the empirical curve summaries of Diebold and Li [2006]; using them avoids fitting a parametric curve to a four-point cross-section. The last observation qualifies H1. The balance-sheet factor is not a long-end factor in its effect on Bunds; it is a level factor. This is not mechanical. The factor is anchored on the ten-year OIS, so unity at ten years is imposed, but unity at two years is not.

5.2 The regime comparison

Table 3 contains the paper's central result and Figure 1 displays it. The table reports the four outcomes the discussion turns on; Appendix Table A3 adds the remaining three.

The balance-sheet factor is stable. Its interaction with the regime dummy is between 0.06 and 0.25 across maturities, never significant at conventional levels under either inference method, and of the opposite sign to that predicted. H2 is rejected. Whatever else changed with normalisation, the pass-through from balance-sheet news to the German curve did not.

Two coefficients did change. The response of long Bunds to path surprises moved from -0.66 (s.e. 0.35) to $+0.28$ (0.22) at ten years, an interaction of 0.94 with bootstrap $p = 0.064$, and from -1.30 (0.50) to $+0.05$ (0.15) at thirty years, an interaction of 1.35 with bootstrap $p = 0.037$. During the expansion, a hawkish path surprise reliably lowered long yields. The response is now indistinguishable from zero.

Second, the slope. Target surprises had no effect on the two-to-ten segment during the expansion (0.30, s.e. 0.81). They now flatten it by 1.46 basis points per basis point, an interaction of -1.76 with bootstrap $p = 0.033$.

How strong is this evidence taken as a whole? Table 4 reports, for each equation, a joint Wald test of the null that all three interaction coefficients are zero, with a bootstrap distribution generated under the stable-coefficient null. The test does not reject anywhere; the smallest p value is 0.165 at thirty years. Likewise, none of the twenty-one individual interactions survives a Holm correction across the full set: the two headline p values of 0.033 and 0.037 rise above 0.68 once the family is accounted for. The honest summary is therefore not that a structural break is established. It is that the point estimates move coherently, in the same direction, across maturities, across the shock classification and across every robustness variant in Section

7, while the sample is too short for any single test to settle the matter. Figure 4 makes the same point without a test: the rolling path coefficient drifts from negative territory to zero across the transition rather than jumping, which is what a gradual change in the information content of guidance would produce and what a 27-meeting subsample cannot sharply date.

Taken together the two shifts describe a rotation. Policy news that arrives through rates and guidance is now absorbed at the front end and transmitted into curve shape, whereas during the expansion it propagated to the long end and inverted it. The plain reading is that guidance about the near-term path no longer carries information about the terminal rate or the growth outlook in the way it did when rates were pinned at the lower bound and guidance was the principal instrument.

5.3 Information shocks

Table 5 and Figure 5 report the classification. Information shocks account for 46.4 percent of expansion-regime meetings and 14.8 percent of normalisation meetings. The interpretation is not that the ECB stopped conveying information about the economy, but that its announcements are now read predominantly through the policy channel.

Re-estimating on the 53 policy shocks sharpens one result and weakens the other. The slope result strengthens: the target interaction becomes -1.53 with bootstrap $p = 0.019$. The long-end path result attenuates to 0.66 at ten years with $p = 0.111$ and 1.09 at thirty years with $p = 0.161$. Part of the long-end shift therefore operates through meetings that convey information about the outlook rather than about the stance. H4 is supported in the weak sense that the classification matters; it is not the case that removing information shocks uniformly sharpens the estimates.

5.4 Cross-country transmission

Table 6 reports the four-country panel with unit fixed effects and date-clustered standard errors. At ten years, target surprises transmit 2.40 basis points more strongly to Italian and Spanish yields than to German and French ones ($p = 0.009$). The balance-sheet factor shows no differential (-0.09, $p = 0.548$). H5 is rejected as stated: fragmentation in this sample is a rate-surprise phenomenon, not a balance-sheet phenomenon.

The spread regressions in Table 7 add the regime dimension and are the sharpest result in the paper. During the expansion, a one basis point target surprise widened the Italian ten-year spread over Bunds by 15.7 basis points. The regime interaction is -13.6 with bootstrap $p = 0.033$, leaving a residual effect of about 2.1 that is not distinguishable from zero. The pattern repeats for Spain and, more weakly, for France. The sensitivity of periphery spreads to policy rate surprises has effectively vanished.

The timing invites a conjecture. The Transmission Protection Instrument was announced on 21 July 2022, the same meeting at which rates first rose and the date on which the regime dummy switches. This paper cannot separate the announcement of a contingent backstop from everything else that changed on and after that date, and a design that could would need variation in the backstop that this sample does not contain. I state the coincidence and leave the causal claim unmade.

6 Portfolio arithmetic

Table 8 translates the estimates into position terms. Each scenario is sized at one within-regime standard deviation of the relevant factor rather than at a round number, because a ten basis point target surprise corresponds to roughly nine standard deviations of the expansion-regime distribution and the implied yield move would be an extrapolation far outside the support of the data.

Two entries carry the practical content. A one standard deviation hawkish path surprise moved the thirty-year Bund down by 1.60 basis points during the expansion and moves it by 0.13 today, so a long-duration position that was a hedge against guidance surprises no longer is. And a one standard deviation target surprise flattens the two-to-ten segment by 1.70 basis points today against 0.11 before, so the same surprise that was curve-neutral is now a flattening event.

These are in-sample calibrations of a response function and inherit the confidence intervals of the underlying coefficients, which for the thirty-year path response are wide. They are not return forecasts. I deliberately do not report a back-test: with 83 events, 27 of them in the regime of interest, any Sharpe ratio computed from event-window returns would be dominated by sampling noise and would convey a precision the design cannot support.

7 Robustness

Table 9 summarises. The ten-year path interaction, the paper's headline coefficient of 0.94, is 1.04 when the transition semester is restored, 0.94 when the break is moved to the end of net purchases in March 2022, and 1.02 when crisis meetings are dropped. The alternative rotation that zeroes the path loading at ten years rather than the balance-sheet loading at one month leaves the loading profiles and coefficients almost unchanged.

One specification does move the result and I report it plainly. Extracting three rather than two press conference components and adding a timing factor reduces the ten-year path interaction to 0.34. The third component accounts for 1.3 percent of the covariation, so the additional factor is close to noise and the attenuation is what one expects when a weak regressor is allowed to absorb variation from a correlated strong one. That reading is plausible but not provable from this sample, and a reader who prefers the three-factor specification should regard the ten-year result as unresolved. The thirty-year result and the slope result are not affected in the same way.

8 Conclusion

The transmission of ECB policy surprises to the German curve did not weaken with balance sheet normalisation. It rotated. Balance-sheet surprises pass through to Bund yields with a coefficient near unity at every maturity and in both regimes, and their regime interaction never exceeds 0.25 or approaches significance. Rate and guidance surprises, which during the expansion propagated to the long end and inverted it — lowering thirty-year yields by 1.30 basis points per basis point — are now absorbed at the front and transmitted into curve shape, flattening the two-to-ten segment by 1.46. Alongside this, the incidence of information shocks fell by two thirds and the sensitivity of periphery spreads to rate surprises disappeared.

Four limitations bound these conclusions. First and most importantly, 27 meetings is a small sample and the bootstrap can improve the calibration of a test but cannot manufacture power. The two headline interactions clear conventional thresholds individually, yet no interaction survives a Holm correction across the twenty-one tests examined and the joint stability tests of Table 4 do not reject in any equation. The paper's claim is accordingly one about a coherent pattern of point estimates, not about a statistically established break, and a reader who weights formal tests above patterns should hold the weaker conclusion. Second, the estimates describe the intraday response and are silent about persistence, which would require a design with a longer horizon. Third, the coefficients relating Bund yields to OIS-anchored factors confound changes in transmission with changes in the Bund-OIS basis, which was itself unusually volatile in 2022 and 2023. Fourth, the regime indicator is a date, and every contemporaneous change in the euro area fixed income environment loads on it, including the Transmission Protection Instrument, the inflation episode and the shift in the collateral and liquidity environment.

The natural extension is to separate these by exploiting cross-sectional variation rather than a single time break, for instance by using the announced runoff schedule to construct a continuous measure of balance-sheet news and asking whether the stability documented here survives.

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Tables and Figures

Table 1: Factor loadings. The shapes are not imposed — only one zero restriction is

	TARGET	PATH	QE
OIS 1M	1.000	-0.067	0.000
OIS 3M	2.094	0.170	0.118
OIS 6M	2.750	0.651	0.337
OIS 1Y	3.897	1.025	0.601
OIS 2Y	4.253	1.000	0.793
OIS 3Y	3.959	0.879	0.869
OIS 4Y	3.903	0.555	0.975
OIS 5Y	3.694	0.438	1.049
OIS 7Y	3.147	0.186	1.026
OIS 10Y	2.423	0.044	1.000

Basis points of OIS change per unit of factor. TARGET is the first principal component of the press release window; PATH and QE are the rotated first two components of the press conference window. Each factor is scaled so that a one-unit realisation moves its anchor instrument by one basis point.

Table 2: Baseline responses. All three factors move the curve; the balance-sheet factor moves every maturity by about one

	DE2Y	DE10Y	DE30Y	Slope (10Y–2Y)
TARGET	4.238*** (0.268)	3.157*** (0.331)	1.816*** (0.309)	-1.081*** (0.231)
PATH	1.170*** (0.216)	0.044 (0.223)	-0.333 (0.241)	-1.126*** (0.146)
QE	0.980*** (0.082)	1.128*** (0.107)	0.899*** (0.131)	0.148 (0.095)
R^2	0.910	0.828	0.595	0.558
N	83	83	83	83

HC1 standard errors in parentheses. $N = 83$ meetings. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3: Regime interactions. Only two coefficients change: the path response at the long end, and the target response on the slope

	DE2Y	DE10Y	DE30Y	Slope (10Y–2Y)
TARGET	3.519*** (0.445)	3.819*** (1.013)	1.859** (0.838)	0.301 (0.816)
PATH	1.091*** (0.253)	-0.659* (0.350)	-1.297** (0.504)	-1.750*** (0.560)
QE	0.951*** (0.120)	0.902*** (0.172)	0.616*** (0.201)	-0.049 (0.242)
TARGET × QT	0.969* (0.567)	-0.794 (1.061)	-0.105 (0.886)	-1.763** (0.858)
TARGET × QT [boot p]	[0.232]	[0.558]	[0.909]	[0.033]
PATH × QT	0.053 (0.386)	0.939** (0.408)	1.349** (0.524)	0.886 (0.590)
PATH × QT [boot p]	[0.907]	[0.064]	[0.037]	[0.219]
QE × QT	0.061 (0.188)	0.174 (0.223)	0.170 (0.232)	0.113 (0.263)
QE × QT [boot p]	[0.771]	[0.476]	[0.494]	[0.691]
R^2	0.915	0.848	0.648	0.602
N	83	83	83	83

Estimates of equation (3). HC1 standard errors in parentheses; restricted wild bootstrap p values in square brackets, 4,999 replications with Rademacher weights.

Table 4: Joint stability tests. Coefficient constancy is not rejected in any equation — the evidence is a pattern, not a break

	W	df	p_boot	N
DE2Y	3.349	3	0.570	83
DE5Y	1.986	3	0.805	83
DE10Y	6.203	3	0.292	83
DE30Y	6.674	3	0.165	83
Level	2.262	3	0.740	83
Slope (10Y–2Y)	5.712	3	0.279	83
Curvature	2.532	3	0.641	83

Wald statistic for the null that all three regime interactions are jointly zero, per equation, with HC1 covariance. Bootstrap p values from 999 replications generated under the stable-coefficient null.

Table 5: Shock classification. Information shocks fall from 46 to 15 percent of meetings

	Information	Policy	Info. share
Expansion (2015–21)	26	30	0.464
Normalisation (2022–25)	4	23	0.148

Table 6: Country panel. Target surprises transmit 2.4bp more strongly to periphery yields; balance-sheet surprises do not

maturity	factor	core	(s.e.)	Periphery extra	(s.e.)	p	N
2Y	TARGET	4.181	0.395	1.655	0.426	0.000	332
	PATH	1.116	0.247	-0.417	0.102	0.000	332
	QE	0.902	0.098	-0.091	0.086	0.291	332
5Y	TARGET	4.584	0.321	1.745	0.806	0.030	332
	PATH	0.675	0.292	-0.054	0.124	0.664	332
	QE	1.140	0.115	-0.211	0.133	0.112	332
10Y	TARGET	3.669	0.453	2.400	0.923	0.009	332
	PATH	0.056	0.232	0.113	0.147	0.440	332
	QE	1.159	0.122	-0.089	0.148	0.548	332

Country fixed effects; standard errors clustered by meeting date. "Periphery extra" is the additional response of Italian and Spanish yields relative to German and French.

Table 7: Sovereign spreads. The sensitivity of the Italian spread to rate surprises falls from 15.7bp to about 2 and loses significance

	IT–DE 10Y	ES–DE 10Y	FR–DE 10Y
TARGET	15.653*** (5.006)	6.437*** (1.751)	4.657** (1.849)
PATH	-1.084 (1.047)	-0.408 (0.567)	-0.223 (0.302)
QE	-0.761 (0.572)	-0.329 (0.279)	-0.088 (0.159)
TARGET × QT	-13.604*** (5.035)	-5.805*** (1.759)	-4.390** (1.852)
TARGET × QT [boot p]	[0.033]	[0.034]	[0.027]
PATH × QT	1.256 (1.068)	0.421 (0.585)	0.247 (0.305)
PATH × QT [boot p]	[0.289]	[0.513]	[0.459]
QE × QT	0.967 (0.596)	0.351 (0.295)	0.186 (0.164)
QE × QT [boot p]	[0.200]	[0.299]	[0.352]
R^2	0.509	0.418	0.513
N	83	83	83

Table 8: Scenario calibration. A one-standard-deviation path surprise moved the 30Y Bund by 1.6bp before 2022 and by 0.1 now

	regime	factor	Shock size (bp)	Δy 2Y	Δy 5Y	Δy 10Y	Δy 30Y	Δ 2s10s (bp)	P&L 2Y (EUR)	P&L 5Y (EUR)	P&L 10Y (EUR)	P&L 30Y (EUR)	P&L flattener (EUR)
0	QE	TARGET	0	1	2	1	1	0	-25391	-71705	-124521	-145437	-9801
1	QE	PATH	1	1	1	-1	-2	-2	-26053	-24406	71036	335746	188747
2	QE	QE	3	3	3	3	2	-0	-51144	-130827	-219067	-359253	12009
3	NORMALISATION	TARGET	1	5	5	4	2	-2	-100830	-241042	-307078	-427288	148487
4	NORMALISATION	PATH	2	3	2	1	0	-2	-54376	-73309	-60209	-26948	185469
5	NORMALISATION	QE	4	4	5	4	3	0	-72190	-215889	-346794	-608247	-20628

Shocks sized at one within-regime standard deviation. P&L on EUR 100m notional using a first-order duration approximation. In-sample calibration, not a return forecast.

Table 9: Robustness. The headline coefficient holds at 0.94–1.04 across specifications; the three-factor variant is the exception

	three_pc_path_10y	with_transition_path_10y	alt_break_path_10y	no_crisis_path_10y	n_no_crisis
PATH x QT on 10Y Bund	0.343	1.040	0.939	1.022	82.000

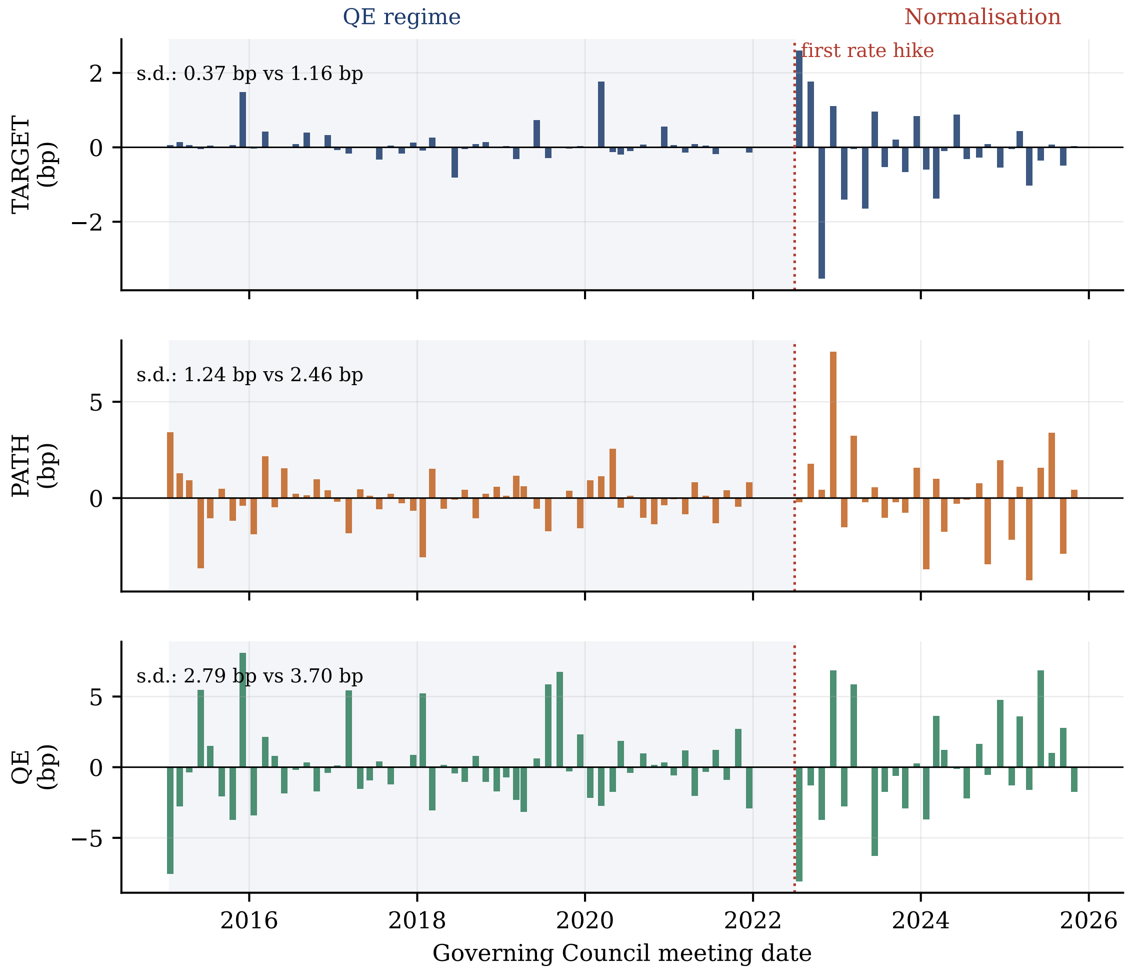

Figure 2: Estimated policy surprise factors by meeting. The dotted line marks the July 2022 liftoff. Factor volatility rises in all three dimensions after 2022.

Table 10: Appendix A1: event dates mis-assigned by a month-first parser

	robust	naive	weekday_robust	weekday_naive
0	2024-03-07	2024-07-03	Thursday	Wednesday
1	2024-04-11	2024-11-04	Thursday	Monday
2	2024-09-12	2024-12-09	Thursday	Monday
3	2025-03-06	2025-06-03	Thursday	Tuesday
4	2025-06-05	2025-05-06	Thursday	Tuesday
5	2025-09-11	2025-11-09	Thursday	Sunday

Table 11: Appendix A2: baseline responses, all seven outcomes

	DE2Y	DE5Y	DE10Y	DE30Y	Level	Slope (10Y–2Y)	Curvature
TARGET	4.238*** (0.268)	4.257*** (0.295)	3.157*** (0.331)	1.816*** (0.309)	3.884*** (0.267)	-1.081*** (0.231)	1.118*** (0.407)
PATH	1.170*** (0.216)	0.706** (0.309)	0.044 (0.223)	-0.333 (0.241)	0.640*** (0.236)	-1.126*** (0.146)	0.197 (0.294)
QE	0.980*** (0.082)	1.152*** (0.122)	1.128*** (0.107)	0.899*** (0.131)	1.087*** (0.091)	0.148 (0.095)	0.195 (0.153)
R^2	0.910	0.868	0.828	0.595	0.905	0.558	0.173
N	83	83	83	83	83	83	83

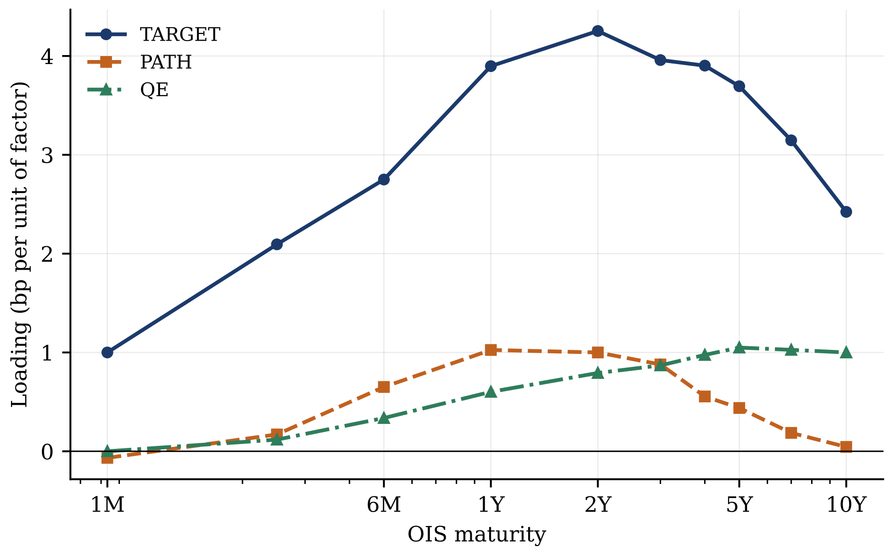

Figure 3: Loading profiles. The shapes are not imposed: only the zero restriction at one month for the balance-sheet factor is.

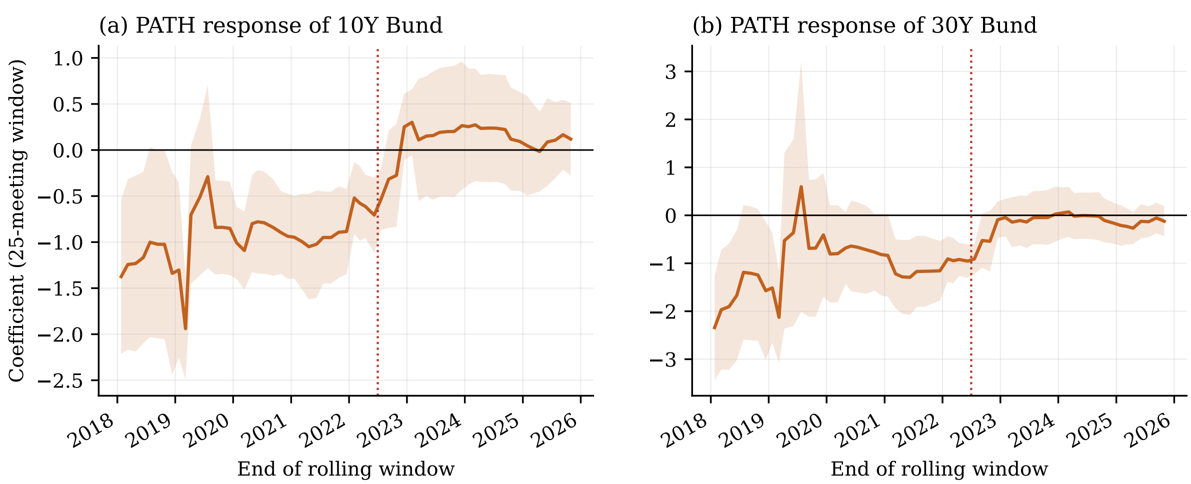

Figure 4: Rolling path coefficients over trailing 25-meeting windows with 90 percent bands, estimated on the sample including the transition semester. Each point is dated by the last meeting in its window, so a change beginning at the July 2022 liftoff (dotted line) enters the series gradually and is fully reflected only once the window has turned over, around early 2023. The coefficient drifts from roughly -1 to zero rather than jumping, which is what a gradual change in the information content of guidance would produce and what the regime dummy of equation (3) approximates coarsely.

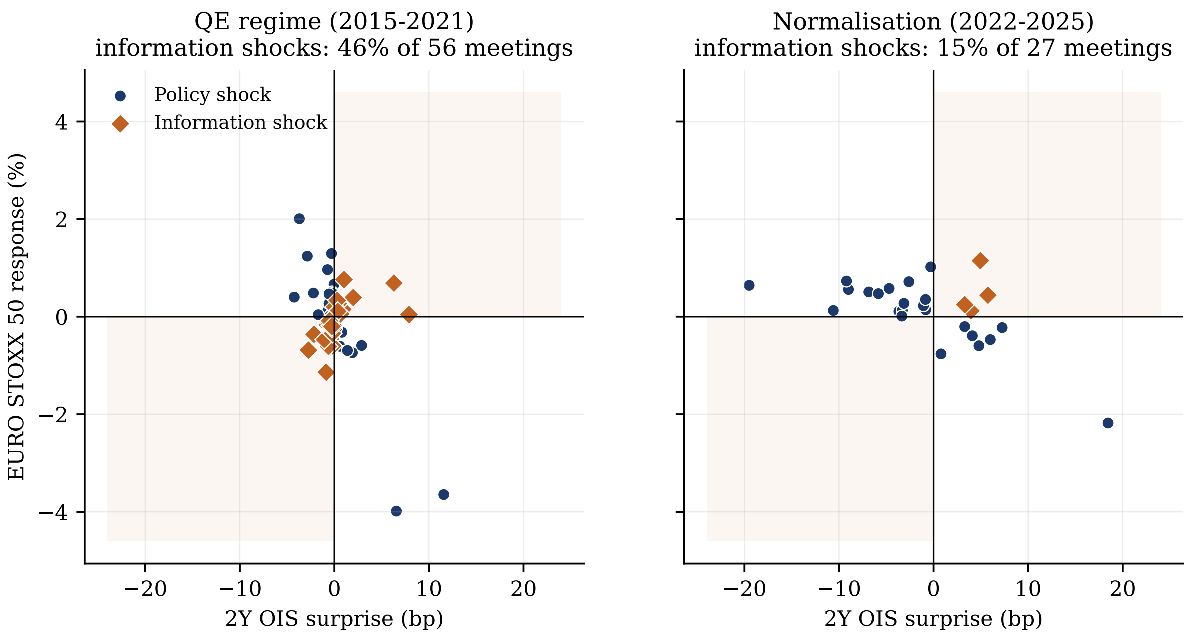

Figure 5: Interest rate surprise against equity response, by regime, on a common scale. Points in the shaded co-movement quadrants, where yields and equities move together, are classified as information shocks. Two features are visible directly: surprises are several times larger after 2022, and the co-movement quadrants empty out.

Table 12: Appendix A3: regime interactions, all seven outcomes

	DE2Y	DE5Y	DE10Y	DE30Y	Level	Slope (10Y–2Y)	Curvature
TARGET	3.519*** (0.445)	4.124*** (0.833)	3.819*** (1.013)	1.859** (0.838)	3.821*** (0.704)	0.301 (0.816)	0.911 (0.780)
PATH	1.091*** (0.253)	0.424** (0.205)	-0.659* (0.350)	-1.297** (0.504)	0.286*** (0.108)	-1.750*** (0.560)	0.416 (0.472)
QE	0.951*** (0.120)	1.010*** (0.087)	0.902*** (0.172)	0.616*** (0.201)	0.954*** (0.077)	-0.049 (0.242)	0.167 (0.163)
TARGET × QT	0.969* (0.567)	0.329 (0.879)	-0.794 (1.061)	-0.105 (0.886)	0.168 (0.761)	-1.763** (0.858)	0.482 (0.833)
TARGET × QT [boot p]	[0.232]	[0.855]	[0.558]	[0.909]	[0.877]	[0.033]	[0.599]
PATH × QT	0.053 (0.386)	0.216 (0.416)	0.939** (0.408)	1.349** (0.524)	0.403 (0.295)	0.886 (0.590)	-0.560 (0.560)
PATH × QT [boot p]	[0.907]	[0.708]	[0.064]	[0.037]	[0.350]	[0.219]	[0.388]
QE × QT	0.061 (0.188)	0.246 (0.195)	0.174 (0.223)	0.170 (0.232)	0.160 (0.165)	0.113 (0.263)	0.257 (0.204)
QE × QT [boot p]	[0.771]	[0.254]	[0.476]	[0.494]	[0.388]	[0.691]	[0.249]
R^2	0.915	0.874	0.848	0.648	0.912	0.602	0.210
N	83	83	83	83	83	83	83

The four columns discussed in the text appear in Table 3; this table adds the five-year point, the level factor and curvature.