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MACROECONOMIC SURPRISES AND FINANCIAL MARKET REACTIONS: INSIGHTS INTO EURO-AREA INTEREST RATES

by Riccardo Poli* and Giulio Carlo Venturi*

Abstract

This paper examines how euro-area (EA) interest rates react to EA and US macroeconomic surprises. We find that the sensitivity of interest rates to surprises varies across tenors and over time. Short-term OIS rates are significantly less sensitive to macroeconomic surprises than longer-term rates. During the forward guidance period (2013-22), interest rate reactivity was rather muted, especially at the short end of the yield curve. Term premia accounted almost entirely for the sensitivity observed at the long end of the curve. Since the ECB's adoption of a data-dependent and meeting-by-meeting approach, interest rate sensitivity has forcefully surged back to the levels observed during the Great Financial Crisis. In particular, EA OIS rates have become highly sensitive to US surprises, thus pointing to significant spillovers from US economic developments to EA financial conditions. Monetary policy uncertainty amplifies the sensitivity of interest rates to surprises, especially to those related to US economic developments and for the expected short term rate component.

JEL Classification: E43, E44, E52, E58.

Keywords: macroeconomic surprises, monetary policy, interest rates, central bank communication.

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1. Introduction[1]

The ECB's transition to a data-dependent and meeting-by-meeting approach, better suited to calibrate monetary policy in a highly uncertain environment, has coincided with a remarkable increase in the sensitivity of euro area interest rates to macroeconomic news. This development has complicated monetary policy decision-making and the determination of the appropriate stance.

In this paper, we investigate the dynamics of interest rate responsiveness by focusing on the following questions: (I) how has the sensitivity of euro area interest rates to macroeconomic surprises changed under the data-dependent and meeting-by-meeting regime compared to previous periods; (II) how do different forms of ECB communication (e.g., qualitative forward guidance vs. explicit forward guidance) influence the transmission of macroeconomic surprises to interest rates; (III) what role does monetary policy uncertainty play in driving this sensitivity. To answer these questions, we employ a multi-faceted empirical strategy that combines a baseline regression framework, a time-varying analysis, and a nonlinear model that explicitly accounts for the interaction between monetary policy uncertainty and macroeconomic surprises.

Several studies have investigated how interest rates react to macroeconomic surprises, defined as the difference between releases and analysts' forecasts. The seminal papers by Gürkaynak, Sack, and Swanson (2005), and Andersen et al. (2007) document that unexpected macroeconomic surprises have a significant impact on bond yields. Altavilla et al. (2017) further show that such surprises have a persistent impact on bond yields, with their explanatory power for yield variations increasing at lower frequencies. Swanson and Williams (2014) extend this understanding by examining such effects at the zero lower bound and show that monetary policy uncertainty amplifies the market response, a finding later confirmed by Kurov and Stan (2018). Taken together, these contributions provide the basis for our study, which extends the literature by (I) considering the effect of both EA and US macroeconomic surprises on EA yields, (II) decomposing the interest rate response into the expected short-term rates and the term premium, and (III) separately assessing the impact of monetary policy uncertainty on (I) and (II).

Following the approach of Gürkaynak et al. (2005) and Altavilla et al. (2017), we quantify the interest rate sensitivity to EA and US surprises first for the full sample from 2000 to 2024 and second in a time-varying setting. We also slice the sample period based on the different types of ECB communications. Then, based on the approach outlined in Swanson and Williams (2014), we examine how monetary policy uncertainty affects interest rate sensitivity to macroeconomic surprises. Finally,

[1] We thank Fabio Busetti, Martina Cecioni, Stefano Neri and Alessandro Secchi for their valuable comments and insights.

we inspect the contribution to the observed sensitivity from expected short-term rates and term premia, which we derive by decomposing interest rates as in Adrian et al. (2013).

Our prior is that the type of central bank communication regarding the future path of interest rates significantly influences market reactions. Uncertainty about monetary policy may amplify the sensitivity of yields to macroeconomic surprises, especially in a data-dependent and meeting-by-meeting regime.

The analysis shows that EA interest rates responsiveness to domestic and foreign macroeconomic surprises has varied substantially over time, reflecting shifts in financial market perceptions of the importance of macroeconomic data for the central bank's reaction function. During forward guidance (between July 2013 and July 2022), sensitivity was muted due to compressed expected short-term rates and term premia at the short end of the yield curve, while at the long end only the expected short-term rates component was moderated. After the ECB ended forward guidance in July 2022, sensitivity to domestic news reverted to levels last seen in 2010, and sensitivity to US news hit record highs. This supports findings by Ehrmann et al. (2019) that different types of forward guidance vary in impact.

In line with Kurov and Stan (2018) and Swanson and Williams (2014), we find that monetary policy uncertainty amplifies the sensitivity, especially to US surprises, and has driven its sharp rise since 2022. Our decomposition of the sensitivity between expected short-term rates and term premia reveals an interesting dynamic: sensitivity to US surprises comes almost entirely from their effect on expected short-term rates, whereas domestic surprises exert a more balanced influence, affecting both expected short-term rates and term premia. Finally, we find that under high uncertainty, US surprises impacts EA rates more than domestic surprises.

The rest of the paper is organised as follows. Section 2 lists and describes data employed in the analysis; Section 3 presents and discusses the main empirical results; Section 4 delves deeper into the drivers of rate sensitivity; Section 5 provides robustness exercises to corroborate the validity of our results; Section 6 concludes.

2. Data

This analysis exploits a dataset of interest rates, macroeconomic indices, and financial variables retrieved at a daily frequency from January 2000 to December 2024.

Interest Rates. We use daily closing overnight index swap (OIS) rates with a 6-month, 2-, 5- and 10-year tenors retrieved from LSEG.[2]

Macroeconomic Surprises. Daily macroeconomic surprises are retrieved from Bloomberg's EA and US growth and inflation surprise indices. These indices aggregate standardised differences between actual release figures and median survey forecasts for a broad set of growth and inflation indicators with Bloomberg relevance scores.[3]

The daily series of EA and US macroeconomic surprises used in this study result from a two-fold adjustment procedure based on the original Bloomberg indices: (I) the smoothing filter, which Bloomberg applies to surprise time series, is removed to recover daily raw surprises (II) growth and inflation surprise indices for each area are aggregated, in order to obtain a comprehensive summary of the macroeconomic surprises. Detailed descriptions of the indices and the adjustment procedure are provided in Appendix A. Figure 1 shows the resulting EA and US surprise indices, with both panel (a) and (b) highlighting a significant increase in the size of these surprises starting with the pandemic, as economic forecasting had become much more difficult at that time. Notably, panel (a) also shows that the magnitude of macroeconomic surprises increased significantly to the downside after the Ukraine war. Since 2024, surprises retraced back to the pre-pandemic forecasting accuracy.

Similar studies (see Gürkaynak et al. (2005), Swanson and Williams (2014), Altavilla et al. (2017)) typically rely on a small set of macroeconomic indicators which are deemed to be the main market catalysts. Instead, this analysis relies on broad surprise indices, in order to exploit two key advantages. (I) Indices capture much more information than a small set of releases. (II) Indices allow for a more comprehensive and agnostic approach to the estimation, because they do not require an *ad hoc* selection of the indicators to be employed in the analysis. These are particularly desirable features when analysing long samples, as the data on which markets focus might change over time.

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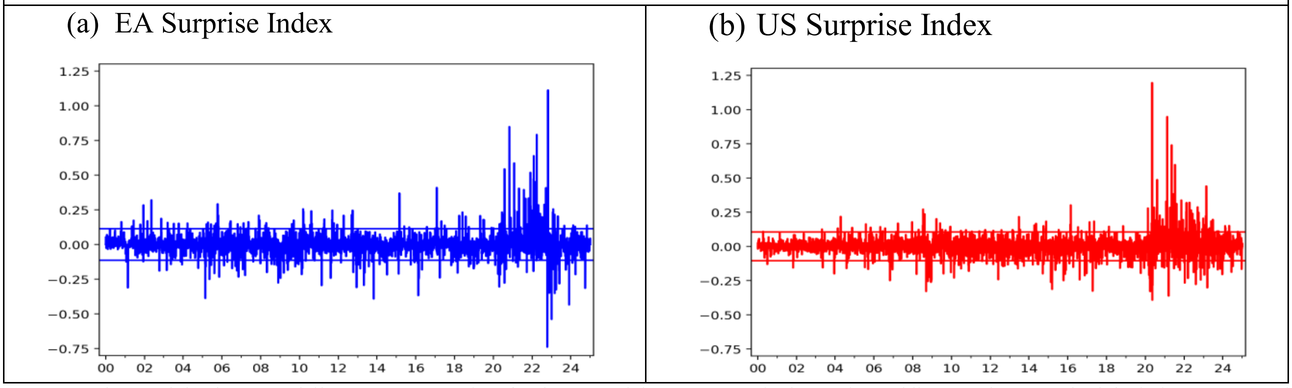
[2] OIS are interest rate swaps in which counterparts exchange a floating overnight rate for a fixed rate at pre-determined reset dates over a specified tenor. In particular, we choose OIS whose floating overnight rate is €STR (formerly EONIA), which is a widely acknowledged proxy of the EA risk-free interest rate.

[3] The Bloomberg's relevance score ranges from 0 to 100. It measures the popularity of an economic release, based on the percentage of users setting alerts for it relative to all alerts for a given country. These alerts are typically linked with decision making of traders, portfolio managers and algorithmic trading. Data releases with a score higher than 10 are included in the indices.

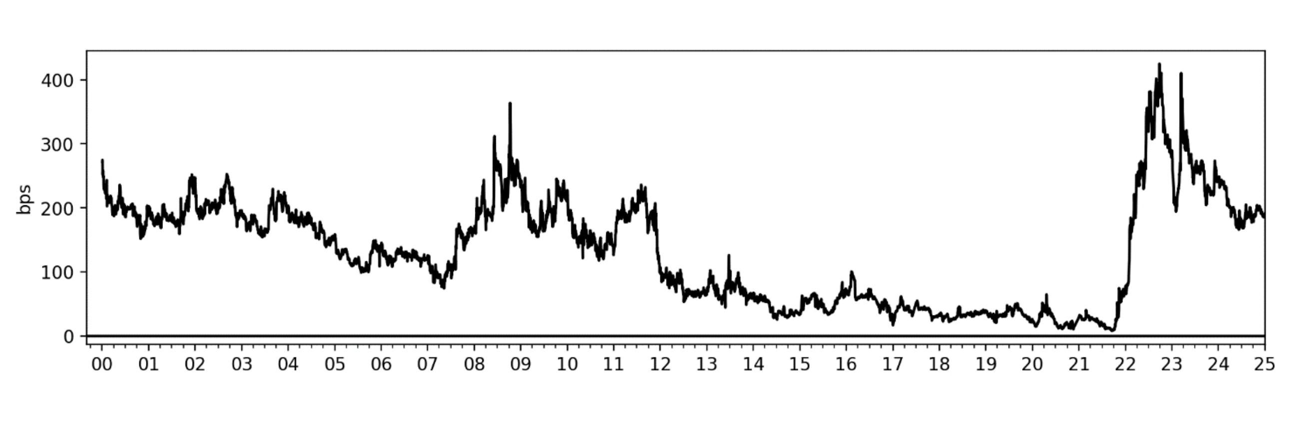
Figure 1: Macroeconomic surprises



Notes: Panel (a) and (b) show raw daily aggregate surprises for the EA and the US, respectively. Horizontal lines mark ±2 standard deviations, computed over the entire sample. *Source*: Bloomberg.

Monetary policy uncertainty. Data on 3-month Euribor futures and options are retrieved from EURONEXT to compute risk-neutral 12-month-ahead option-implied densities for Euribor rates,[4] A daily indicator of monetary policy uncertainty is then built as the difference between the 90th and 10th percentile of the option-implied rate distribution. The computation procedure is detailed in Appendix B. Figure 2 displays the resulting indicator. The Great Financial Crisis and the Sovereign Debt Crisis are clearly reflected in the series. As rates hit the ELB and central banks adopted forward guidance, interest rate uncertainty consistently hovered around historical lows for almost a decade. The indicator surged considerably as inflation rose above the ECB's target, before stabilising around levels consistent with pre-GFC evidence. It is interesting to highlight the second prominent spike in March 2023, caused by the collapse of Silicon Valley Bank.

Figure 2: Monetary policy uncertainty



Notes: Daily indicator of EA monetary policy uncertainty, computed as the width (90th-10th percentile) of the daily probability distributions of 3-month Euribor options with one year to expiration. *Source*: LSEG and authors' calculations.

[4] Our indicator is based on the methodology developed in Vergote and Gutiérrez (2012). Similar indicators are computed for the US in Swanson and Williams (2014), De Pooter et al. (2021), and Bauer et al. (2022).

3. Empirical analysis

a. Baseline

Our empirical analysis is conducted at daily frequency and spans the period from January 2000 to December 2024.[5] Our main specification follows Altavilla et al. (2017):

$$\Delta i_t^m = \alpha^m + \beta^m EA_t + \gamma^m US_t + \delta^m X_t + \epsilon_t^m \qquad (1)$$

where (Δi_t^m) are daily changes in EA overnight interest swap rates (OIS) at tenor m = {6-month, 2-year, 5-year, 10-year}, and EA_t and US_t are the EA and US daily surprise values. X_t denotes the controls: momentum, option-adjusted credit spreads,[6] and realized volatility of the interest rate analysed.[7] The momentum indicator, based on Asness et al. (2013), accounts for persistence in yield changes.[8] Changes in the credit spreads aim to control for shifts in market sentiment. Realized volatility should help account for volatility clustering, among other things. EA and US surprise series are standardised to ensure meaningful comparison between coefficients.

Full-sample estimation of equation (1) is reported in Table 1. The results indicate that OIS rates at 6-month, 2-, 5- and 10-year tenor are sensitive to both EA and US macroeconomic surprises. Point estimates of domestic and foreign surprises are comparable at shorter maturities (6-month and 2-year), while domestic surprises have a larger impact at longer maturities (5- and 10-year). Notably, sensitivity to surprises for the 6-month tenor is generally low in comparison to longer tenors: a one-standard-deviation surprise generates an increase of 0.09 bps and 0.32 bps in the 6-month and 5-year OIS rates, respectively. This is consistent with the empirical finding that central banks respond only gradually to new information (see for instance Sack and Wieland, 2000; Healy and Jia, 2024), and with the fact that, for an extended period, short-term rates were constrained by the effective lower bound. Also, the responses across tenors appear hump-shaped for both EA and the US surprises, aligning with the high-frequency findings for the US reported by Beechey and Wright (2009).

[5] We selected this period based on data availability, using data from LSEG. Daily time series for OIS rate changes were cleaned of outliers, identified as observations with daily changes exceeding 10 standard deviations of the standardised distribution. This resulted in the removal of a handful of extreme observations (11-16 observations).
[6] We relied on ICE BofA Euro Corporate Index.
[7] Realized volatility at day *t* is computed as the standard deviation of the five preceding days *[t-5, t-1]*. For robustness, we also tested reduced models, that do not include control factors, and the results were consistent with the estimates presented above.
[8] Time series momentum is an asset pricing anomaly that has been widely documented in academic literature. Specifically, a security's own past returns are found to be strong predictors of its future returns.

Table 1 – Coefficients estimates from (1)

OIS swap tenor	6-month	2-year	5-year	10-year
β	0.09*** (0.00)	0.27*** (0.00)	0.32*** (0.00)	0.29*** (0.00)
γ	0.06*** (0.01)	0.19*** (0.00)	0.18*** (0.00)	0.15*** (0.00)
R^2	0.19	0.18	0.18	0.16
N. Obs.	6229	6229	6229	6229

Notes: HAC consistent p-values in parentheses. * Indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level. Sample period is January 1st, 2000 to December 31st, 2024.

b. Time-varying analysis

The full-sample analysis estimates the average sensitivity of OIS interest rates to macroeconomic surprises. However, given the variety of economic regimes and salient events occurred over the past 25 years, it is valuable to examine how this sensitivity has evolved over time. To this end, we estimate equation (1) using an 18-month rolling window.

In Figure 3, the black lines represent the time-varying sensitivity coefficients (β_t^m and γ_t^m) for 6-month, 2-, 5- and 10-year OIS rates. The estimates differ by tenor and evolve considerably over time, yet common trends emerge. Sensitivity rose notably after the dot-com bubble, during the Great Financial Crisis (GFC), and in the post-pandemic recovery, while remaining subdued during the period in which the policy rates were at the ELB and the ECB resorted to forward guidance and asset purchases.

In particular, OIS rates at the 6-month and 2-year horizons were largely insensitive to macro surprises between mid-2013 and mid-2022. This is consistent with policy rates reaching the effective lower bound, and with the ECB adopting FG to steer market expectations of the policy rate path. By contrast, longer maturities continued to respond to macroeconomic surprises, albeit with reduced magnitude. As the ECB abandoned forward guidance in 2022 amid rising inflation, sensitivity to macroeconomic surprises surged back to levels observed during the GFC. Furthermore, although the sensitivity to both EA and US surprises followed similar trends, US surprises seem to have become more important than EA surprises since the post-pandemic recovery, especially at the 2-year tenor.

c. Sub-sample analysis

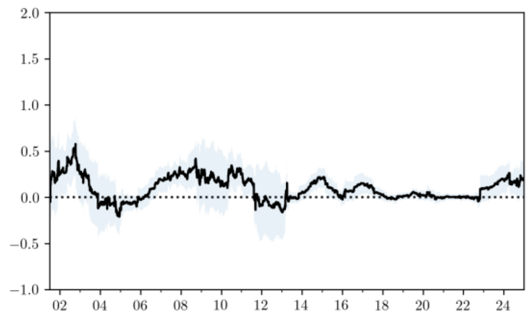
In our sample, the ECB resorted to unconventional measures and forward guidance (FG) for an extended period due to the effective lower bound (ELB) constraint. In addition, ECB FG evolved substantially from statements that tended to be somewhat vague and qualitative in nature to more concrete and quantitative guidance, first by referring to calendar dates and later to economic conditions. To test how the coefficients β^m and γ^m differed in such different phases, we estimated regression (1) across different communication regimes: (I) in the pre-FG period (2000-13); (II) across different ECB FG types (2013-22), using the classification of the Task Force on Rate Forward Guidance and Reinvestment (FORE);[9] (III) in the post-FG period (2022-).

Our results, summarized in Figure 4, show that spillovers from US surprises have reached unprecedented levels during the data-dependent and meeting-by-meeting phase. First, in the period before the FG, euro area interest rates were sensitive to both US and EA macroeconomic news. Second, the introduction of qualitative FG by the ECB in July 2013 had no noticeable effect on the responsiveness of interest rates to EA news (blue dots in the pre-FG and Qualitative-FG periods are not statistically different in Figure 4). Interestingly, it was successful in shielding the euro area interest rates from US macroeconomic news (red dots in the pre-FG and Qualitative-FG periods are statistically different in Figure 4, with the exception of the 10-year tenor). Third, in the ELB period, when more explicit forms of FG were used by the ECB (time-based, dual, state-based, and chain-linked to net asset purchases) interest rates became largely insensitive to both domestic and US macroeconomic surprises. Finally, in the recent data-dependence and meeting-by-meeting period (labeled post-FG), the reactiveness of the EA interest rates to EA surprises increased to pre-forward-guidance levels, while spillovers from US surprises reached unprecedented levels.

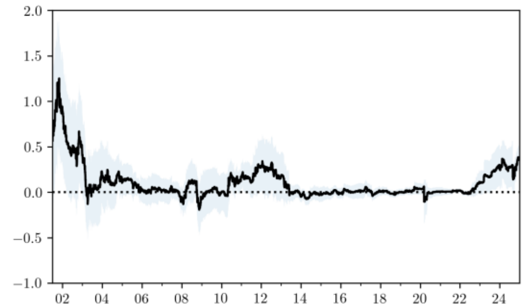
[9] Forward guidance types are classified in accordance to the ECB Occasional paper: "Rate forward guidance in an environment of large central bank balance sheets: a Eurosystem stock-taking assessment", December 2022. Table A1 in Appendix reports such classification.

Figure 3: EA OIS rate sensitivity to macro surprises

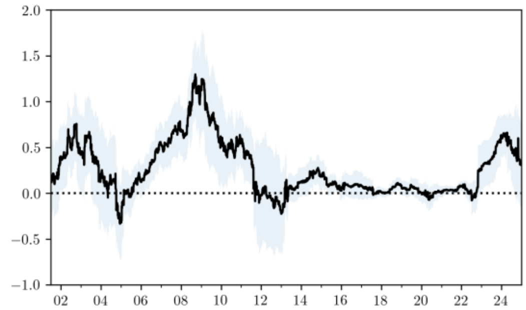
a. 6M OIS rate to EA Surprises



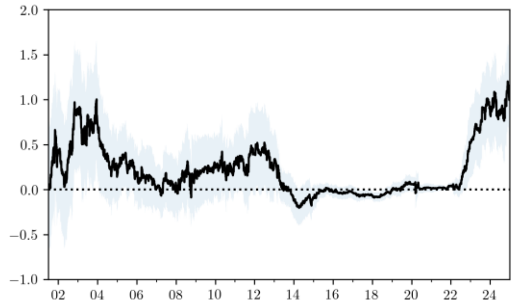
b. 6M OIS rate to US Surprises



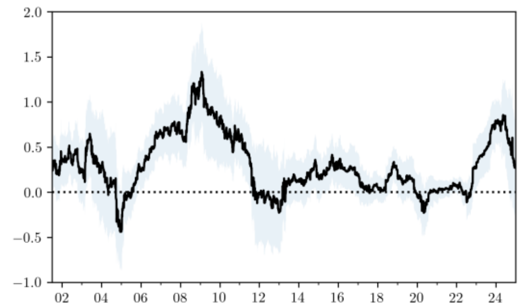
c. 2Y OIS rate to EA Surprises



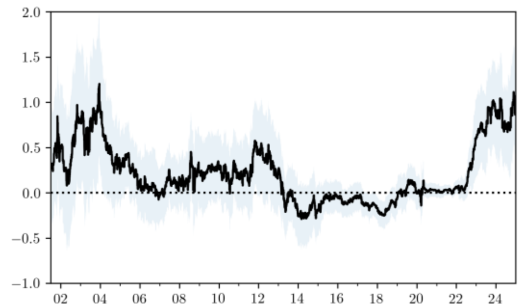
d. 2Y OIS rate to US Surprises



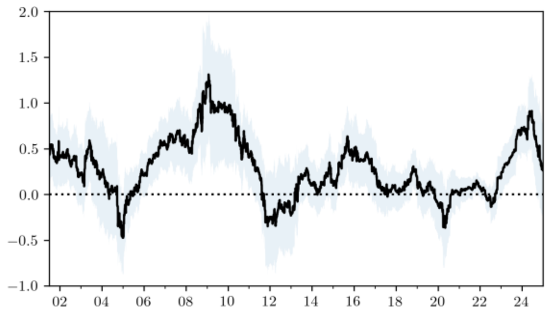
e. 5Y OIS rate to EA Surprises



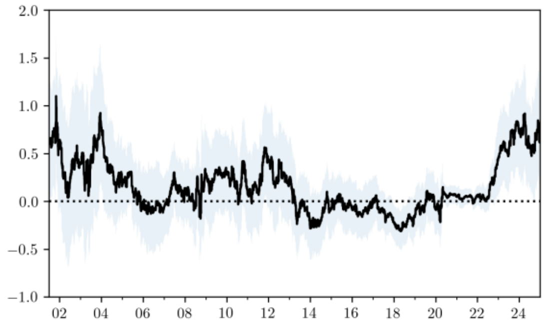
f. 5Y OIS rate to US Surprises



g. 10Y OIS rate to EA Surprises

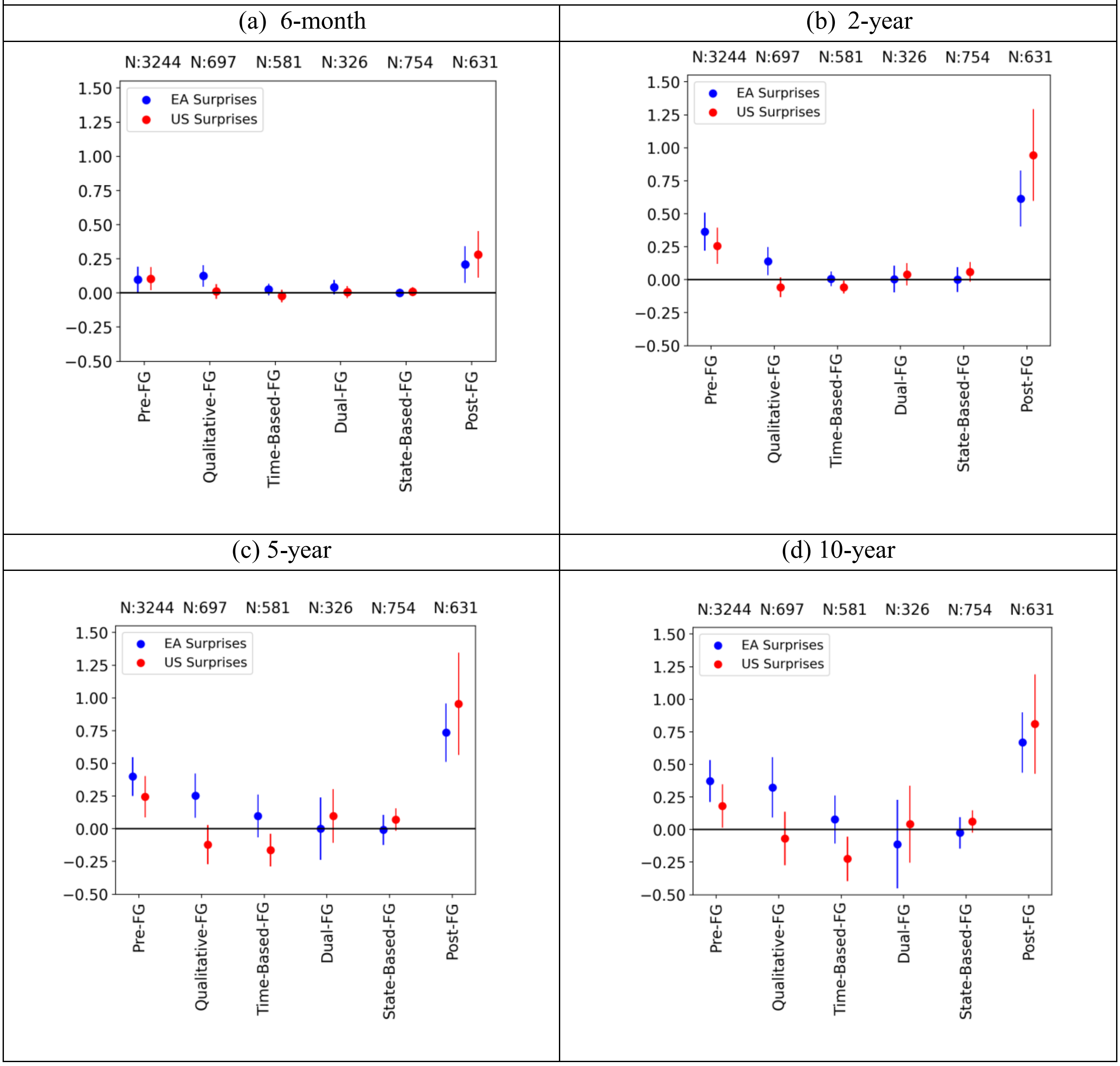


h. 10Y OIS rate to US Surprises



Notes: shaded areas display 90% HAC consistent confidence intervals. Sample period is January 1st, 2000 to December 31st, 2024.

Figure 4: OIS rate sensitivity across ECB communication strategies



Notes: Estimates of coefficient β^m and γ^m for the Full Model in equation (1) over selected samples. Pre-FG: 01/2000-07/2013; Qualitative: 07/2013-03/2016; Time-based: 03/2016-06/2018; Dual: 06/2018-09/2019; State Based: 09/2019-07/2022; Post-FG: 07/2022-12/2024. Number of observations for each sub-period are report above the chart. Dots represent point estimates of the coefficients, vertical bars display 90% HAC standard errors.

4. Drivers of the sensitivity

The data-dependent and meeting-by-meeting phase together with the uncertain macro outlook have led financial markets to rely more heavily on incoming data releases in the formation of policy rate expectations, thereby fuelling uncertainty about the future path of policy rates. Motivated by this, we investigate the role of monetary policy uncertainty in shaping interest rate sensitivity to macroeconomic surprises. Previous literature found monetary policy uncertainty to exert upward pressure on sensitivity (see Kurov and Stan (2018), Swanson and Williams (2014)). We test the existence of these effects on the euro area's risk-free yield curve, but, unlike the existing literature, we consider the effects of monetary policy uncertainty separately for EA and US macroeconomic surprises. This approach allows us to assess the distinct role that monetary policy uncertainty plays in driving interest rate spillovers. Additionally, we decompose sensitivity into two components, the one affecting expected short-term rates and the one that influencing term premia, the yield decomposition used is based on Adrian, Crump, and Moench (2013), ACM hereafter. We then examine how monetary policy uncertainty impacts each component separately.

a. The role of monetary policy uncertainty

Literature employs various proxies to measure monetary policy uncertainty. For example, Kurov and Stan (2018) use realized volatility (following Bekaert et al. (2013)), while others use news-based measures (see Husted (2020)). Yet other research relies on the market-implied distribution for the expected interest rate (see Swanson and Williams (2014), De Pooter et al. (2021), Bauer et al. (2022)). We adopt the latter approach because it provides a forward-looking measure of uncertainty that reflects the future path of policy rates. Specifically, we estimate the market-implied probability distribution for the 3-month Euribor rate at a one-year horizon as implied by Euribor futures options prices (see appendix B for details) and measure monetary policy uncertainty as the difference between the 90th and the 10th percentile of the distribution.

To investigate the impact of monetary policy uncertainty on interest rate sensitivity, we run a nonlinear regression based on the specification of Swanson and Williams (2014):

$$\Delta i_t = \alpha + \mathrm{f}(z_t)\, \beta\, EA_t + \mathrm{g}(z_t)\, \gamma\, US_t + \delta^m X_t + \epsilon_t \qquad (2)$$

where EA_t and US_t denote EA and US macroeconomic surprises, and X_t the same set of control specified in (1). The functions $\mathrm{f}(z_t)$ and $\mathrm{g}(z_t)$ are defined as:

$$\mathrm{f}(z_t) = \theta_{EA} + \varphi_{EA}\, z_t \qquad (3)$$

$$\mathrm{g}(z_t) = \theta_{US} + \varphi_{US}\, z_t \qquad (4)$$

where z_t represents monetary policy uncertainty (see Section 2), and $\theta_{EA}, \theta_{US}, \varphi_{EA}, \varphi_{US}$ are parameters to be estimated together with α, β, γ. The constants θ_{EA}, θ_{US} are normalised such that the averages of $\mathrm{f}(z_t)$ and $\mathrm{g}(z_t)$ equal to unity over the entire sample.[10] Results from this estimation are reported in Table 2.

[10] The nonlinear regression is estimated using OLS. We plug (3) and (4) in (2) and obtain a specification that is linear in the parameters while maintaining the nonlinear interaction effects arising from z_t. Imposing that the averages of $\mathrm{f}(z_t)$ and $\mathrm{g}(z_t)$ are equal to one over the entire sample allows us to: (i) interpret β and γ as the average sensitivity of interest rates to EA and US surprises over the sample period; (ii) identify the parameters; (iii) have a simplified economic interpretation of the effects of monetary policy uncertainty on sensitivity.

Table 2 – Coefficients estimates from (2), (3) and (4)

OIS swap tenor	6-month	2-year	5-year	10-year
β	0.08*** (0.00)	0.23*** (0.00)	0.27*** (0.00)	0.25*** (0.00)
γ	0.08*** (0.00)	0.26*** (0.00)	0.25*** (0.00)	0.20*** (0.00)
φ_{EA}	0.58** (0.04)	0.62*** (0.00)	0.59*** (0.00)	0.55*** (0.00)
φ_{US}	1.20*** (0.00)	1.19*** (0.00)	1.24*** (0.00)	1.17*** (0.00)
R^2	0.20	0.19	0.19	0.17
N. Obs.	6229	6229	6229	6229

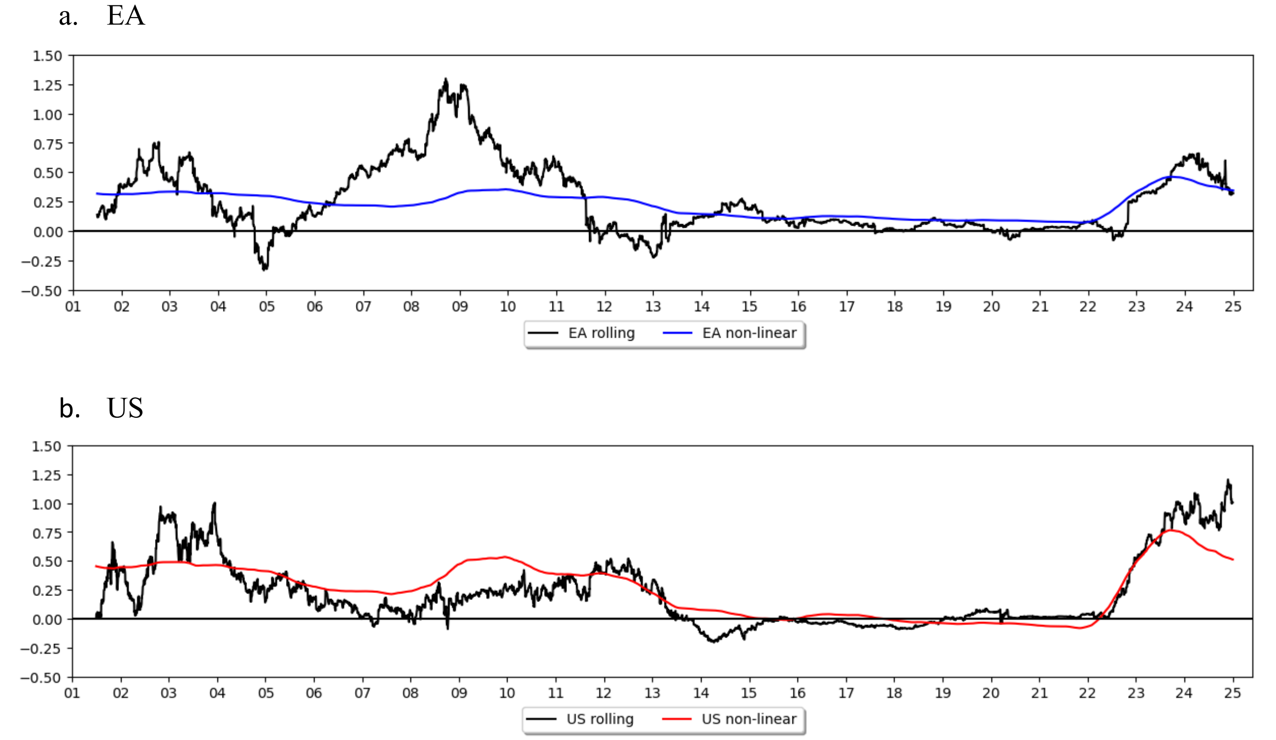
Notes: HAC consistent p-values in parentheses. * Indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level. Sample period is January 1st, 2000 to December 31st, 2024.

Our findings indicate that EA surprises (β) exhibit a slightly higher sensitivity for 5- and 10-year rates, whereas US surprises (γ) have a more pronounced impact on 2- and 5-year rates, coherently with the findings in regression (1) and emphasizing the greater relevance of US surprise for the short tenors. Monetary policy uncertainty (z_t) amplifies these sensitivities, with a stronger effect for US surprises (φ_{US}>φ_{EA}), particularly for short-term rates. These results underscore the critical role of monetary policy uncertainty in shaping market reactions: under high uncertainty, US developments become particularly influential for EA interest rates.

Figures 5 and 6 compare the evolution of time-varying sensitivity coefficients from the baseline regression with the predictions from our nonlinear model for the 2-year and 10-year maturities, respectively, in the spirit of Swanson and Williams (2014). Up to 2021, the spikes observed in the time-varying sensitivity are only partially explained by the nonlinear specification, which moves in response to variations in monetary policy uncertainty, suggesting that factors other than monetary policy uncertainty, such as for example risk aversion, were influencing sensitivities.

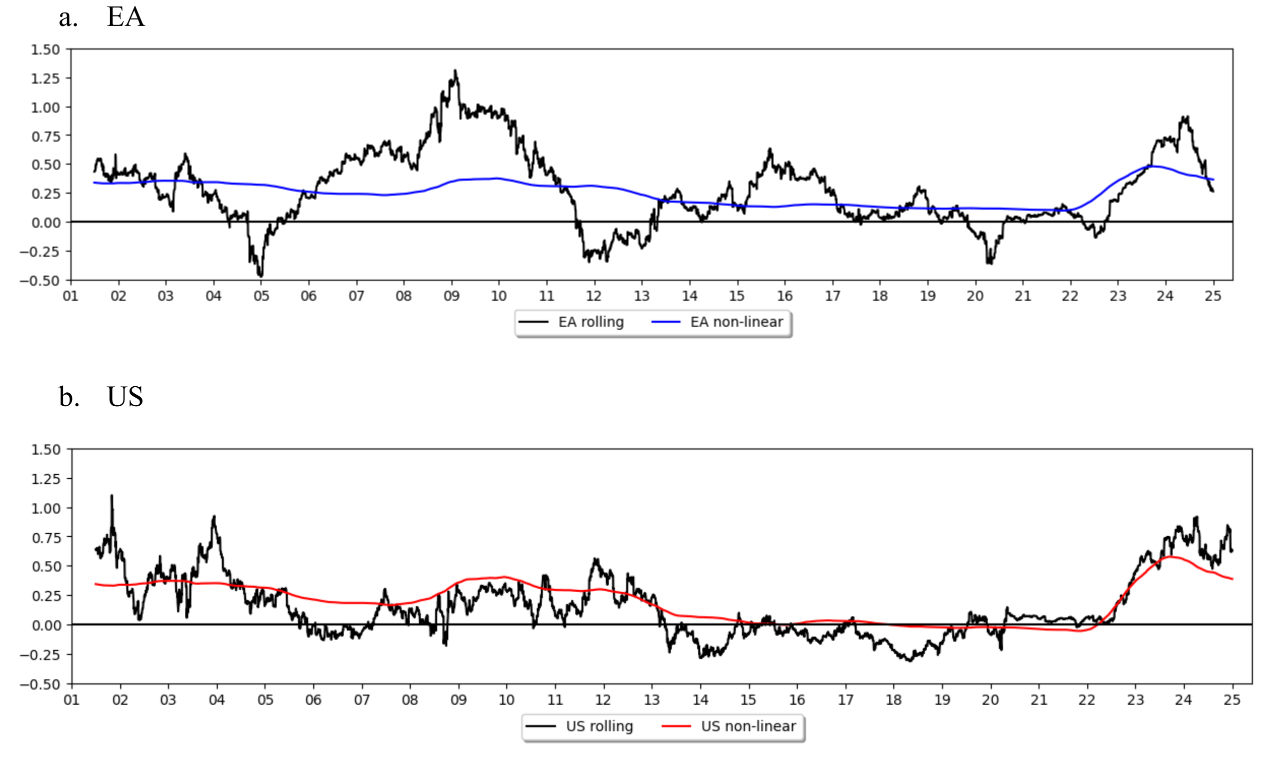
However, since the beginning of 2022, the nonlinear specification has increasingly co-moved with the time-varying sensitivity, indicating that monetary policy uncertainty has become a key driver in steering sensitivity to macroeconomic surprises. This dynamic is observed in both the EA (panel a. of each figure), and the US (panels b). Furthermore, across maturities, the sensitivity attributed to monetary policy uncertainty reached its peak in mid-2022 and has remained historically high until the end of the sample. While it is intuitive that uncertainty about EA monetary policy increases sensitivity to EA surprises, the close relationship between EA monetary policy uncertainty and US surprises further emphasises the leading role of US developments in shaping interest rates during periods of domestic uncertainty.

Figure 5: Time-varying versus nonlinear sensitivities for 2-year rate



Notes: The black lines indicate the estimates of the time-varying coefficients β^m (panel a) and γ^m (panel b) for the model (1) using an 18-month rolling window. The blue and red lines indicate the time-varying coefficients $f(z_t)\ \beta$ and $g(z_t)\ \gamma$ from model (2). To ensure comparability between the two lines, the state variable z_t is averaged over the last 18-months.

Figure 6: Time-varying versus nonlinear sensitivities for 10-year rate



Notes: The black lines indicate the estimates of the time-varying coefficients β^m (panel a) and γ^m (panel b) for the model (1) using an 18-month rolling window. The blue and red lines indicate the time-varying coefficients $f(z_t)\ \beta$ and $g(z_t)\ \gamma$ from model (2). To ensure comparability between the two lines, the state variable z_t is averaged over the last 18-months.

b. The role of expected future short-term rates and term premium

To further investigate the nature of the sensitivity, we decompose the overall response into two components using the Adrian et al. (2013) model: (I) expected short-term rates component, and (II) term premium, representing the extra yield required for bearing additional risks, mainly interest rate risk, over the life of the bond.

Understanding how monetary policy uncertainty amplifies the transmission of surprises to both expected short-term rates and term premia is relevant for assessing monetary policy implications. As noted by Diercks and Asnani (2024) in the case of an increase in interest rates, upward shifts in expected short-term rates may signal that investors expect monetary policy to be tighter in the future. Thus, if monetary policy does not evolve accordingly, deviations in short-term rates could trigger expansionary impulse on the economy. In contrast, increases in term premium would tighten financial conditions independently of shifts in short rate expectations. Consequently, tighter financial conditions driven by term premium could reduce economic activity and inflation, ultimately pointing to an easing in short rates to maintain price stability.

We run separate regressions to decompose the sensitivity rolling coefficients β and γ from equation (1) into parts attributable to changes in the expected short-term rates and term premia, focusing the analysis to the 2-year and 10-year tenors as proxies for monetary policy driven and the long-term segments of the yield curve, respectively.

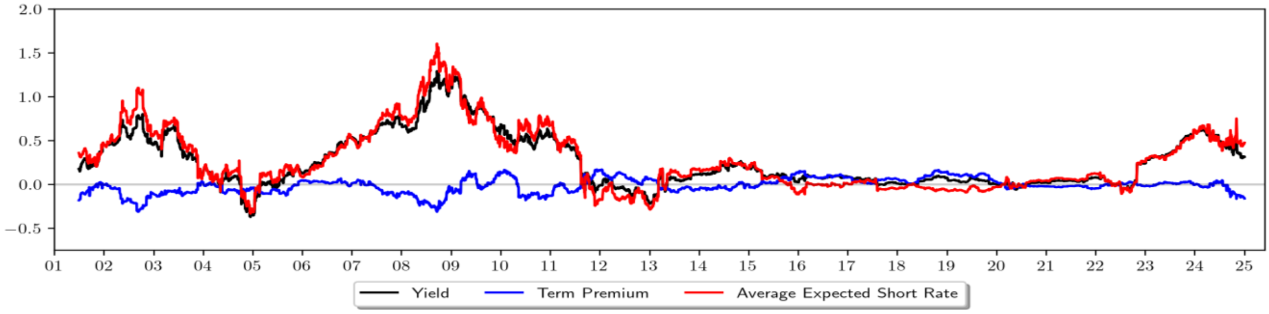
2-Year Maturity (Figure 7) – At the short end, the observed sensitivity of nominal yields to macroeconomic surprises is primarily driven by the expected short-term component. Interestingly, the negative contribution of the term premium component since 2022 for US surprises, suggesting that US macro surprises have been resolving uncertainty, thereby compressing the risk premium.

10-Year Maturity (Figure 8) – At the long end, sensitivity to EA surprises is largely driven by the term premia, consistent with Beechey (2007). This is especially true during the ELB and forward guidance regime, in which virtually the entire sensitivity is explained by the term premia. Therefore, this evidence suggests that central bank's forward guidance does mute the response of expected rates, but does not really insulate from shift in the compensation investors ask for interest rate risk. It should be noted that the impact of US surprises on expected short rate component has become predominant since 2023, thus suggesting that US surprises have been primarily affecting rate expectations rather than risk compensation.[11]

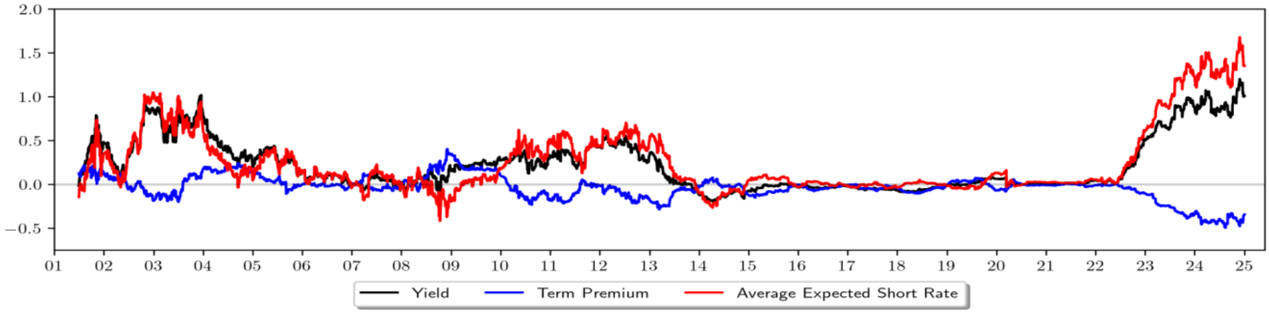
[11] This finding is consistent with the "higher-for-longer" narrative that has emerged in market commentaries since 2023. During this period, upbeat news on US growth and inflation has been interpreted by market participant as indicative of structurally higher short-term yields in the future.

Figure 7: Decomposition of 2-year OIS rate sensitivity in expected short-term rates and term premium

a. EA



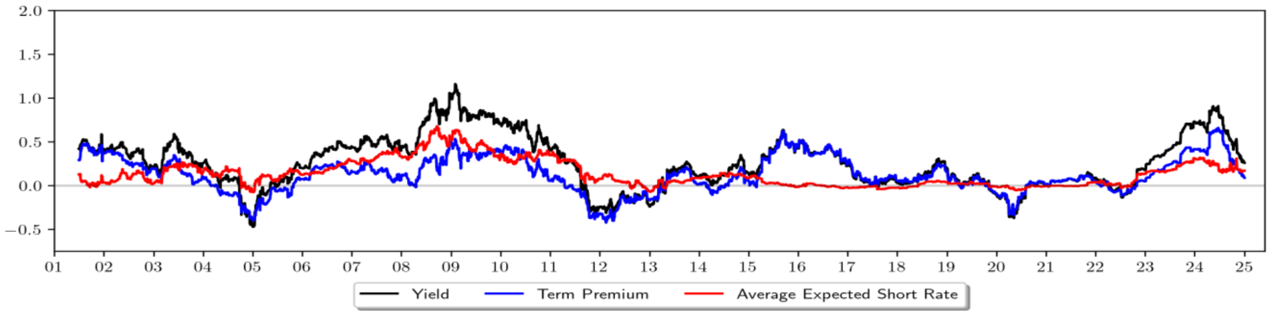
b. US



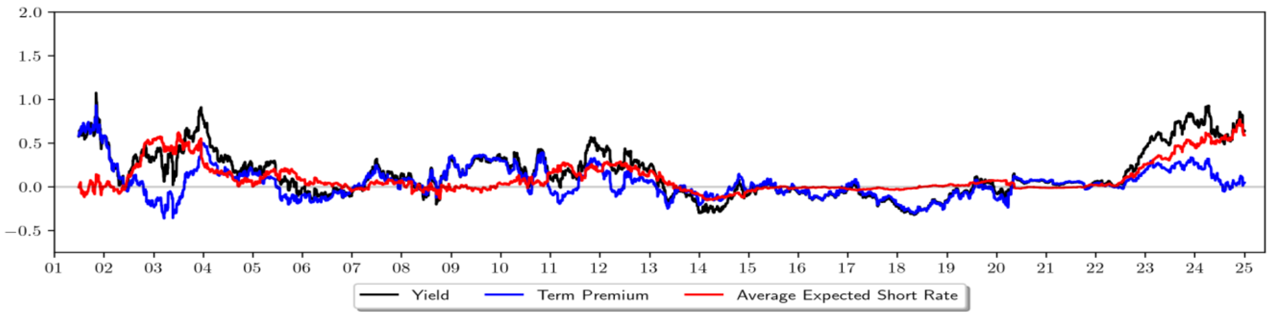
Note: Black lines show the 18-month rolling window estimates of β^m (panel a) and γ^m (panel b) for the full model (equation 1). Red lines show β_{ey} (panel a) and γ_{ey} (panel b) when expected short-term rates are the dependent variable, and blue lines show β_{tp} (panel a) and γ_{tp} (panel b) when term premia are the dependent variable.

Figure 8: Decomposition of 10-year OIS rate sensitivity in expected short-term rates and term premium

a. EA



b. US



Notes: Black lines show the 18-month rolling window estimates of β^m (panel a) and γ^m (panel b) for the full model (equation 1). Red lines show β_{ey} (panel a) and γ_{ey} (panel b) when expected short-term rates are the dependent variable, and blue lines show β_{tp} (panel a) and γ_{tp} (panel b) when term premia are the dependent variable.

A note of caution is warranted when interpreting the contribution of term premia to sensitivity. While the impact of surprises on expected short rates should be dictated by the state of the economy signalled by the news (e.g. a positive surprise implies higher policy rates), the impact on term premia, instead, depends on how unexpected information affects the compensation investors require to bear interest risk potentially exacerbating or dampening sensitivity. As noted in Swanson and Williams (2014), during crises, high risk aversion may cause positive news to reduce the term premia, offsetting the rise in expected short-term rates and thus muting yield sensitivity. At the same time, bad news may trigger a flight to quality, pushing yields lower than expected and increasing their sensitivity to surprises.

c. Monetary policy uncertainty effects on the sensitivity of expected short-term rates and term premium

Next, we investigate how monetary policy uncertainty amplifies the transmission of surprises to the expected short-term rates and term premium components. We estimate the specification (2) separately for expected short-term rates and term premium of the OIS rates for tenors ranging from 2 to 10 years, the results are reported in Table 3.

Table 3 – Expected short-term rates and term premia coefficients estimates from (2)

	Expected short-term rates			Term premia		
OIS swap tenor	2-year	5-year	10-year	2-year	5-year	10-year
β	0.25*** (0.00)	0.18*** (0.00)	0.11*** (0.00)	-0.02* (0.10)	0.08*** (0.00)	0.13*** (0.00)
γ	0.35*** (0.00)	0.23*** (0.00)	0.13*** (0.00)	-0.09*** (0.00)	0.01 (0.35)	0.06* (0.09)
φ_{EA}	0.59** (0.00)	0.62*** (0.00)	0.62*** (0.00)	0.35 (0.32)	0.56** (0.02)	0.52* (0.03)
φ_{US}	1.16*** (0.00)	1.22*** (0.00)	1.24*** (0.00)	1.08*** (0.00)	1.98 (0.33)	1.11* (0.08)
R^2	0.17	0.16	0.16	0.11	0.11	0.13
N. Obs.	6226	6226	6226	6226	6226	6226

Note: HAC consistent p-values in parentheses. * Indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level. Sample period is January 1st, 2000 to December 31st, 2024.

Our results indicate that monetary policy uncertainty amplifies the responsiveness of the expected short-term rates component to macroeconomic surprises from both the EA and the US, and across tenors, with a stronger impact for US surprises. This finding suggests that under elevated uncertainty, US developments exert a particularly strong influence on market expectations regarding future EA interest rates. For the term premium component, the effects differ by tenor. At the 2-year horizon, EA surprises have only a marginally significant impact, whereas US surprises compress term premia, indicating a resolution of uncertainty about the future evolution of EA yields, with the resolution effect intensifying as monetary policy uncertainty increases. At the 5- and 10-year horizons, EA macro surprises have a positive and significant effect on term premia, that intensifies with rising monetary policy uncertainty, while US surprises have no particular impact.

We interpret these results as pointing to a greater importance of domestic surprises in shaping uncertainty about future short-term rates; however, we recognize that such effects could also arise from the staggered nature of the releases in the EA, that could lead to variations in the term premium component when the same release is published in different countries on subsequent days (e.g. inflation prints).

5. Robustness

To ensure that our findings are not driven by the broad-based construction of our macroeconomic surprise indices or by potential confounding effects of interest rate levels, we implement multiple robustness checks.

First, we construct alternative euro area (EA) and United States (US) surprise indices using a restricted set of key releases rather than the full Bloomberg indices.[12] Specifically, the EA index is based on 11 releases (EA M3 annual growth, German industrial production, German retail sales, IFO business survey, ZEW expectations and current conditions indices, EA CPI, German CPI, French CPI, Italian CPI, and Spanish CPI), while the US index is derived from 12 releases (GDP, durable goods orders, retail sales and retail sales excluding autos, the unemployment rate, nonfarm payrolls, CPI, Core CPI, PPI, Core PPI, Employment Cost Index, and average hourly earnings). Following Balduzzi et al. (2001) we standardize the surprise in announcement i at time t as follows:

$$s_{i,t} = \frac{A_{i,t} - E_{i,t}}{\hat{\sigma}_i} \quad (5)$$

where $A_{i,t}$ is the released value, $E_{i,t}$ is the Bloomberg consensus expectation and $\hat{\sigma}_i$ is the sample standard deviation of $A_{i,t} - E_{i,t}$. Standardised surprises are then aggregated at daily frequency to form the EA and US indices. Tables 4 and 5 report the estimates for specifications (1) – (2) using these restricted indices; the results are similar to those obtained with the full indices, confirming the robustness of our main findings.

[12] We construct the restricted set of releases based on Gürkaynak et al. (2022). In the EA case, individual country CPI releases have been added to account for the staggered nature of the CPI releases in the EA, which tends to weaken the informativeness of the EA CPI release.

Table 4 – Coefficients estimates from (1)

OIS swap tenor	6-month	2-year	5-year	10-year
β	0.09**	0.30***	0.35***	0.34***
	(0.04)	(0.00)	(0.00)	(0.00)
γ	0.08***	0.18***	0.20***	0.17***
	(0.01)	(0.00)	(0.00)	(0.01)
R^2	0.19	0.18	0.18	0.16
N. Obs.	6229	6229	6229	6229

Notes: HAC consistent p-values in parentheses. * Indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level. Sample period is January 1st, 2000 to December 31st, 2024.

Table 5 – Coefficients estimates from (2)

OIS swap tenor	6-month	2-year	5-year	10-year
β	0.08***	0.28***	0.33***	0.32***
	(0.01)	(0.00)	(0.00)	(0.00)
γ	0.11***	0.26***	0.29***	0.23***
	(0.00)	(0.00)	(0.00)	(0.00)
φ_{EA}	0.54	0.47**	0.37**	0.42**
	(0.16)	(0.02)	(0.05)	(0.05)
φ_{US}	1.30***	1.34***	1.30***	1.16***
	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.20	0.18	0.18	0.17
N. Obs.	6229	6229	6229	6229

Notes: HAC consistent p-values in parentheses. * Indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level. Sample period is January 1st, 2000 to December 31st, 2024.

Second, following the approach of De Pooter et al. (2021) and addressing concerns raised by Swanson and Williams (2014), we include the level of the interest rate at the relevant tenor as an additional control in specification (2). The coefficient on this control is statistically insignificant, and its inclusion does not alter the magnitude or significance of the key parameters (full results are available upon request).

Third, acknowledging that there are several ways for measuring monetary policy uncertainty, we test whether our findings remain robust when using an alternative measure. Therefore, we compute monetary policy uncertainty as the 3-month realized volatility based on daily observations of Euribor futures with 24 months to expiration. We re-estimate (2) using this alternative proxy, Tables 6 reports the corresponding results. The estimates remain similar.

Table 6 – Coefficients estimates from (2)

OIS swap tenor	6-month	2-year	5-year	10-year
β	0.08***	0.23***	0.28***	0.27***
	(0.00)	(0.00)	(0.00)	(0.00)
γ	0.07***	0.21***	0.20**	0.16***
	(0.00)	(0.00)	(0.00)	(0.00)
φ_{EA}	0.34	0.27**	0.19*	0.11
	(0.12)	(0.04)	(0.06)	(0.16)
φ_{US}	0.99***	0.92***	0.95***	0.84**
	(0.00)	(0.00)	(0.00)	(0.01)
R^2	0.20	0.18	0.18	0.16
N. Obs.	6185	6185	6185	6185

Notes: HAC consistent p-values in parentheses. * Indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level. Sample period is January 1st, 2000 to December 31st, 2024.

Finally, we re-estimated specifications (1) and (2), also separately for the expected short-term rates and term premia component, after excluding the control variables from the baseline model, and it confirms that the findings are robust.

6. Conclusions

This study examines the sensitivity of EA interest rates to both domestic and US macroeconomic surprises from 2000 to 2024. Our analysis reveals that during the ECB's forward guidance period (2013–22) market reactions were subdued. However, the shift by the ECB to a data-dependent and meeting-by-meeting policy has been accompanied by heightened sensitivity, particularly to US surprises for which estimates had been hovering around historical highs since 2022. Uncertainty regarding future monetary policy amplifies the impact of surprises, with a more pronounced effect on the expected short-term rates component.

Heightened sensitivity of interest rates to macroeconomic surprises may hamper the ECB's ability to steer financial conditions and, by extension, shape its policy stance, especially when this is combined with increased magnitude of surprises. Our findings suggest that providing some information regarding the future path of policy rates - aimed at reducing market uncertainty about future rates - could help to reduce market sensitivity and, where macroeconomic conditions warrant, decouple EA financial conditions from those of the US. However, such communication should strike a balance between the ECB's desire to steer financial conditions and the need to avoid binding commitments that might endanger its credibility.

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Appendix

A. Bloomberg's Surprise Index Methodology

In what follows we report the methodology outlined by Bloomberg, keeping its notation. Bloomberg's growth and inflation surprise indices account for 67 (69) growth releases and 32 (43) inflation releases for the US (EA), respectively. Surprises generated by the publication of the indicator x_i at day t are defined as:[13]

$$s_{i,t} = \frac{x_{i,t} - E(x_{i,t})}{sd(x_{i,t} - E(x_{i,t}))} \quad (1)$$

where $E(x_{it})$ is the Bloomberg consensus forecast and the denominator is the standard deviation of the surprise computed from 1997 (data availability varies across data releases). Consequently, $s_{i,t} = 1$ is interpreted as a one standard deviation positive economic data surprise. The indices consider surprises for weekly, monthly, and quarterly observed data.

In a given day, the growth and inflation surprises are:

$$g_t^s = 1/N_g \sum_{i=1}^{d_{g,t}} (s_{it}) \quad (2)$$

$$\pi_t^s = 1/N_\pi \sum_{i=1}^{d_{\pi,t}} (s_{it}) \quad (3)$$

where d_{gt} is the number of growth data releases at t, and $d_{\pi t}$ is the number of inflation releases. N_g is the total number of growth releases, and N_π is the equivalent for inflation releases considered by the indices (respectively 67 and 32 for the US and 69 and 43 for the euro area).

Daily surprises are finally smoothed as follows to produce daily time series:

$$g_{s,t} = g_t^s + \alpha g_{s,t-1} \quad (4)$$

$$\pi_{s,t} = \pi_t^s + \alpha \pi_{s,t-1} \quad (5)$$

The smoother assumes that daily data surprises are economic shocks with a half-life of about six months. We recovered original surprises from smoothed daily series, backing out a smoothing parameter $\alpha \approx 0.995$. Finally, we merged de-smoothed growth and inflation daily surprises, in order to obtain a unique clean surprise index.

[13] The indices have been developed by Ana Beatriz Galvao, Bhargavi Sakthivel and Bjorn van Roye. Reference document available upon request.

B. Monetary policy uncertainty indicator

The computation of risk-neutral probability distributions implied in option prices relies on the Breeden-Litzenberger (1978) result, which states that the second derivative of the call option price $C(K,\tau)$, with respect to the strike price K, yields the risk-neutral probability density function $f_Q(K)$:

$$\frac{\partial^2 C(K,\tau)}{\partial K^2} = e^{-r\tau} f_Q(K) \qquad \text{(B.1)}$$

in the above relation τ stands for the time to maturity of the option, and r for the interest rate used to discount the expected future payoff.[14] Thus, a finite difference method can be used to approximate B.1.

In what follows we describe the practical steps followed to estimate the risk-neutral probability density function, our methodology builds on Vergote and Gutiérrez (2012). Once we obtain the daily call and put option prices on 3-month Euribor across strikes and time to maturity since, along with 3-month Euribor Futures prices (all from 3rd January 2000 onward), we perform:

1. **Cleaning**. Remove options with null prices and that do not satisfy monotonicity and convexity.[15] Convert put options to call options using the put-call parity relationship.
2. **Greeks**. Compute implied volatility (σ) of each option, that is find the positive value of sigma such that the observed price is equal to the price implied by the Black-Scholes formula given the option market data (strike price, underlying price, option price, time to maturity). Compute the delta ($\delta = \frac{\partial C}{\partial S}$, where S is the price of the underlying asset) of each option, based on the computed implied volatility and option market data. Compute the vega ($vega = \frac{\partial C}{\partial \sigma}$) of each option, based on the computed implied volatility and option market data.
3. **Interpolation**. Use points in the delta-sigma space to generate an interpolation over a fine grid of 1000 deltas. Interpolate the points with a cubic smoothing spline with weight equal to vegas.
4. **Constant Maturity**. Options with a maturity of exact *n* months might not be available at day *t*, because options typically expiry in March, June, September, and December. In order to ensure that the interpolated smile is generated by options with a constant maturity of *n* months, rely on two option sets. The first has a maturity of $n_1 < n$ months, the second has a maturity of $n_2 > n$

[14] Recall that, when using futures data, there is no need to discount payoffs in option pricing, because the future is already providing current discounted forward prices. As a result, set the discounting rate to zero (r=0) in all standard formulas.

[15] The results derived by Breeden and Litzenberger (1978), which yield B.1, assume the absence of arbitrage opportunities. This, in turn, implies that option prices must exhibit monotonicity and convexity with respect to K: call option prices must decrease as exercise price increases, and prices of option triplets should be convex in their exercise prices.

months. We then linearly interpolate the two smiles across time, in order to generate a smile for maturity of exactly *n* months.

5. **Price Function**. Back out from the constant-maturity interpolated delta-sigma smile the implied call option strike price. Use the strike price grid and the implied volatility to compute with the Black-Scholes formula the call option price implied in each point of the interpolated smile.
6. **Implied Distribution**. Exploit the Breeden-Litzenberger (1978) result and compute the second derivative of the interpolated pricing function, in order to back out implied probability distributions. To this aim, fit a cubic polynomial over each triple of points in the *K*-price space. Differentiate the cubic polynomial twice to obtain its second derivative numerically.

C. Table A1

Table A1 – Evolution of the ECB's communication

(based on FORE Taskforce; ECB Occasional paper no. 290, 2022)

Period	Type	Wording
July 2013 – Mar 2016	Qualitative forward guidance	*"The Governing Council expects the key ECB interest rates to remain at present or lower levels* ***for an extended period of time****"*
Mar 2016 – Jun 2018	Time-based and chain-linked to net asset purchases	*"… for an extended period of time, and* ***well past the horizon of our net asset purchases****"*
Jun 2018 – Sept 2019	Dual (time and state-based)	*"…* ***at least through the summer [end] of 2019*** *and in any case for as long as necessary to ensure that the evolution of inflation remains aligned with our current expectations of a sustained adjustment path"*
Sep 2019 – Jun 2021	State-based; APP guidance chain-linked to key policy rates	*"[…]* ***until we have seen the inflation outlook robustly converge to a level sufficiently close to, but below, 2%*** *within our projection horizon, and such convergence has been consistently reflected in underlying inflation dynamics"*
July 2021 – Jun 2022	State-based	*"[…]* ***until it sees inflation reaching two per cent well ahead of the end of its projection horizon and durably for the rest of the projection horizon****, and it judges that realised progress in* ***underlying inflation*** *is sufficiently advanced to be consistent with inflation stabilising at two per cent over the medium term."*
July 2022 – October 2024	Meeting-by-meeting & data dependency	*"… At the Governing Council's upcoming meetings, further normalisation of interest rates will be appropriate. The frontloading today of the exit from negative interest rates allows the Governing Council to* ***make a transition to a meeting-by-meeting approach to interest rate decisions****. The Governing Council's* ***future policy rate path will continue to be data-dependent*** *and will help to deliver on its 2% inflation target over the medium term."*