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TAIL RISK DYNAMICS OF MARKET-BASED INFLATION EXPECTATIONS IN THE EURO AREA

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Abstract

In this study, we investigate the drivers of tail risk of inflation-linked swap rates across multiple horizons in the euro area. Using high-frequency daily data, we model the tails of the distributions to a Pareto distribution and estimate a tail index regression via OLS. We find evidence that, after the global financial crisis, the probability of sharp revisions in long-term inflation expectations were linked to fluctuations in the short-term outlook on inflation, in both tails of the distribution. Our results suggest that during this period, long-term inflation expectations displayed signs of de-anchoring.

JEL Codes: E31, E39, E58.

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I. Introduction

Inflation plays a central role in the decision-making processes of economic agents. Macroeconomic theory has shown that expectations are fundamental in shaping private agent decisions, as they reflect intertemporal dynamics (Coibion et al. 2024; Tenreyro 2019). Changes in expected inflation affect perceived real interest rates and anticipated real income, which in turn directly influence households' consumption and savings decisions, as well as firms' investment decisions and wage-setting behaviour – potentially reinforcing inflationary pressures if expectations become adrift (Maule and Pugh 2013; Draghi 2014). Perceptions from financial market's participants also play a key role in asset pricing (Kose et al. 2019). The way economic agents perceive inflation (and the real economy and interest rates), is a critical factor for policymakers to monitor, as it plays a central role in the transmission of monetary policy through the expectations channel (Baumann et al. 2021; Georgarakos, Kenny, and Meyer 2023). In particular, the degree of anchoring of inflation expectations is a key indicator of a Central Bank's credibility, and determinant for price stability as transitory shocks end up not having long-lasting effects (ECB 2011; Kose et al. 2019; Neri 2023). Kumar et al. (2015) propose a set of definitions to describe well-anchored expectations of future inflation: long-term expectations should be close to the Central Bank's target and remain stable – not being influenced by transitory shocks, economic agents should be confident about the outlook of future inflation and long-term expectations should not react to fluctuations in short-term expectations. With this in mind, we sought to assess the drivers that influence the probability of observing drastic revisions in market-based inflation expectations, highlighting the responsiveness of long-term expectations to short-term developments.

We use high-frequency daily data on inflation-linked swap rates to examine the determinants influencing the behaviour of the tails of the distribution of market-based inflation expectations across their term structure in the euro area. We conduct this analysis through the estimation of a tail index regression, following a novel methodology developed by Nicolau and Rodrigues (2024). Following a different approach to the related literature, we find evidence that market-based inflation expectations displayed signs of de-anchoring. Short-term inflation expectations influenced the likelihood of observing sharp upward and downward revisions in long-term inflation expectations – and in multiple horizons across the term structure – in the period marked by the aftermath of the sovereign debt crisis and the zero lower bound.

This work project is structured as follows. Section II provides an overview of the related literature, Section III outlines the empirical strategy, Section IV describes the data and presents a brief contextual exploratory analysis, Sections V and VI exhibit the results and corresponding discussion, and, lastly, Section VII concludes.

II. Literature Review

Inflation expectations is a broadly studied field which is very ramified and extensive. The literature evolved in different directions, from the application of inflation expectations in forecasting models of inflation (Baumann et al. 2021) to assessing the formation process of expectations, especially on a micro level using survey data (D'Acunto, Malmendier, and Weber 2023; D'Acunto and Weber 2024) or to analyze the degree of anchoring to the Central Bank's target, which is the focus of this Literature Review. When assessing the strength of the inflation target set by the Central Bank, several approaches have been implemented. Namely, the assessment through high-frequency event-studies, studying the impact of news releases on the outlook on inflation. Additionally, researchers have evaluated the existence of a link between short-term and long-term expectations. Another growing body of literature searches for evidence regarding the Central Bank's credibility by looking at properties of the distribution of expectations.

The responsiveness of long-term market-based inflation expectations to macroeconomic news releases is well documented in the literature, although the findings remain inconclusive. There is evidence of an increasing sensitivity of inflation expectations in the United States following the global financial crisis, on both market-based indicators and survey data. This heightened responsiveness has been interpreted as a sign of de-anchoring of long-term expectations (Galati, Poelhekke, and Zhou 2011; Nautz and Strohsal 2015). Similarly, in the euro area, inflation-linked swaps seemed to become more reactive to news releases since 2013 (Nautz and Strohsal 2015; García and Werner 2021). In contrast, Beechey, Johannsen, and Levin (2011), Lejsgaard Autrup and Grothe (2014) and Speck (2017) report that market-based inflation expectations were not significantly influenced by news releases, suggesting that long-term expectations remained anchored in both the United States and the euro area, particularly in the latter.[1]

In addition to assessing the credibility of central bank targets through news-regression event studies, another strand of the literature focuses on evaluating the pass-through of short-term shocks to long-term inflation expectations. In the United States, early studies around the time of the global financial crisis yielded opposing conclusions. Analyzing market and survey-based indicators, Jochmann, Koop, and Potter (2010) found evidence that long-term expectations were contained, while Clark and Davig (2011) show that they co-moved with fluctuations in short-term expectations.[2]

For the euro area, the evidence appears to be more consistent. Using data from the ECB's Survey of Professional Forecasters (SPF), Lyziak and Paloviita (2017), Buono and Formai (2018) and Neri et al. (2022) find that short-term expectations systematically influence long-term ones, particularly in the aftermath of the global financial crisis. They conclude that, in an environment of elevated economic uncertainty and persistently low inflation, inflation expectations exhibited signs of de-anchoring. Similar results are found using market-based measures. Byrne and Zekaite (2019) and Neri et al. (2022) show that, since 2013, long-term expectations derived from inflation-linked swaps have become increasingly sensitive to revisions in short-term expectations.[3] Moreover, similar studies report that inflation expectations also respond to other economic variables at different horizons, including oil prices and indicators of real economic activity (Byrne and Zekaite 2019; Gomes, Iskrev, and Pires Ribeiro 2021; Neri et al. 2022), as well as the real exchange rate (Kumar et al. 2015; Nasir, Balsalobre-Lorente, and Huynh 2020).

1. Lejsgaard Autrup and Grothe (2014) and Speck (2017) study the sensitivity of news releases on break-even inflation rates (computed as the difference between nominal and real bond yields) adjusted to liquidity premium and inflation-linked swap rates, respectively.

2. Jochmann, Koop, and Potter (2010) use a time-varying parameter model, while Clark and Davig (2011) use a VAR framework, introducing real activity indicators and funds rates as covariates.

3. Speck (2017) alerts that when using market-based indicators, risk premium is a more worrying issue, since it is embedded in both the dependent and independent variables. Further discussion about risk premia in ILS contracts is addressed in section IV.

While most studies focus on changes in the level of inflation expectations, recent developments in the literature have explored the distributional properties in greater depth. By examining the first and second moments of the distribution, Coibion et al. (2024) find evidence that the dynamics of uncertainty and the level of expectations differ meaningfully over time. Using data from the ECB's Survey of Professional Forecasters, several studies have identified signs of de-anchoring in long-term expectations since 2013 based on shifts in the first moment (Dovern and Kenny 2017; Neri et al. 2022).[4] Analyses extending to higher-order moments further support these results: Dovern, Kenny, et al. (2020) and Górnicka and Meyler (2022) find corroborating evidence based on the second and higher moments of the distribution of expectations.[5]

The study of asymmetries and tail dynamics in the distribution of macroeconomic variables has recently gained increasing attention in the field of macroeconomics (Loria, Matthes, and Zhang 2025). Applications have focused on modeling conditional quantiles of key economic indicators, such as real GDP growth and industrial production (Adrian, Boyarchenko, and Giannone 2019; Gächter, Geiger, and Hasler 2023; Loria, Matthes, and Zhang 2025).[6] Using a similar approach, Ghysels, Iania, and Striaukas (2018) and López-Salido and Loria (2020) model inflation dynamics through quantile regressions, estimating the probability that realized inflation exceeds a given threshold, a concept known as Inflation-at-Risk. López-Salido and Loria (2020) find that the sovereign debt crisis significantly increased the likelihood of low inflation outcomes in the euro area. The literature focusing on the tail behaviour of inflation expectations remains relatively limited. Reis (2022) and Grishchenko and Wilcox (2024) assess the probability of extreme future inflation outcomes using market-based and forecast data, respectively. Both studies evaluate the anchoring of inflation expectations by estimating the likelihood that inflation will exceed a specified threshold over multiple horizons. Their findings suggest that expectations became de-anchored in mid-2022[7], but re-anchored in response to monetary policy rate hikes. Furthermore, Grishchenko

4. The authors conduct this analysis using break-point tests.

5. The authors find that the variance of long-term inflation expectations increased, indicating a link between inflation uncertainty and uncertainty surrounding unemployment and economic growth.

6. Loria, Matthes, and Zhang (2025) extend their analysis to examine the impact of different shocks across the distribution, finding substantial discrepancies between the effects on the tails and those to the mean.

7. Grishchenko and Wilcox (2024) observes a significant increase in the likelihood that inflation will exceed 3%

and Wilcox (2024) shows that economic policy uncertainty holds predictive power for tail inflation probabilities in both the United States and the euro area.

Additionally, two studies explore abnormal changes in inflation expectations across different maturities. Antunes (2015) and Natoli and Sigalotti (2017) investigate the anchoring of inflation expectations in the euro area by analyzing the conditional tail dependence between short- and long-term expectations, as well as their dispersion. Using daily data from inflation-linked derivatives, such as swaps and options, they estimate a coefficient of conditional tail dependence through copula functions. By employing copulas, the authors model the joint distribution of inflation expectations at different horizons parametrically[8], allowing them to assess whether extreme movements in short-term horizons are likely to coincide with extreme movements in long-term expectations. The authors from both studies find evidence that short- and long-term maturities displayed co-movement from 2012 (Antunes 2015) and both tails of the distributions started to display higher correlation in mid 2014.[9]

This work contributes to the literature by empirically examining extreme revisions in market-based inflation expectations across different maturities in the euro area, measured by inflation-linked swap rates. Our approach departs from the related literature, since we model the empirical tails of the distribution of inflation-linked swap rates as a Pareto distribution and focus our analysis exclusively on the extreme daily variations across different horizons. Using a novel approach developed by Nicolau and Rodrigues (2024), we model a tail index parameter governing the weight of each tail of the distribution. This framework allows us to investigate the potential drivers behind the likelihood of observing sharp revisions in inflation expectations across multiple horizons.

over a 5- to 10-year horizon.

8. Both select the model specification that best fits the data considering the Akaike and Bayesian information criteria.

9. Natoli and Sigalotti (2017) observe that these results were not robust to different measurements of expectations.

III. Methodology

III.A. Modelling Framework

Our objective is to analyze the behaviour of financial markets' inflation expectations, with a particular focus on the dynamics of extreme changes in market-based inflation expectations. To this end, we follow the tail index regression framework proposed by Nicolau and Rodrigues (2024). This approach allows us to assess how different factors influence the probability of observing extreme changes in the variable under study. More specifically, it allows the identification of drivers behind shifts in the weight of both tails of the distribution of inflation expectations. We assume that the variable y_t, represented by the variation of market-based inflation expectations at different horizons, conditional on a set of covariates x_t, follows a Pareto distribution, i.e.,

$$F(y_t \mid x_t, w_n) = \begin{cases} 1 - \left(\frac{y_t}{w_n}\right)^{-\alpha(x_t,\beta)} & \text{if } y_t \geq w_n \\ 0 & \text{if } y_t < w_n \end{cases}, \quad t = 1, \ldots, n \tag{1}$$

where $\alpha(x_t, \beta) = \exp(x_t'\beta)$ is the tail index and w_n is the tail cut-off point, corresponding to the $((1-k) \times 100)^{\text{th}}$ percentile of y_t. For further notational purposes, we consider the data sub-sample composed of the pairs $\{(y_\tau, x_\tau),\ \tau = 1, \ldots, n_0\}$. As a result, the time series under study becomes irregularly spaced, since only observations above the cut-off point are retained.

The tail index is a key parameter in the Pareto distribution that governs the rate at which the probability of observing values above w_n decreases. This means that high values of $\alpha(x_\tau, \beta)$ correspond to a thinner tail and a lower probability of observing extreme events – due to the negative sign in the cumulative distribution function. On the other hand, a low $\alpha(x_\tau, \beta)$ indicates that the distribution has a heavier tail and the occurrence of extreme events becomes more likely.

To arrive at the tail index regression model, we need to perform some transformations. As per (1), $u_\tau = 1 - \left(\frac{y_\tau}{w_n}\right)^{-\alpha(x_\tau,\beta)}$, where $u_\tau = F(y_\tau \mid x_\tau, w_n)$ is uniformly distributed, $u_\tau \sim U(0, 1)$. By taking the inverse, we have that $y_\tau = F^{-1}(u_\tau \mid x_\tau, w_n)$ which is also Pareto distributed, following:

$$y_\tau = (1 - u_\tau)^{-\alpha(x_\tau,\beta)^{-1}} \cdot w_n. \tag{2.1}$$

Since our goal is to understand the impact of a set of covariates on the tail index $\alpha(x_\tau, \beta)$, we need to isolate the regressors, x_τ, on the right side of (2.1). For that purpose, we start by taking logarithms twice in both sides delivering,

$$-\ln\left(\ln\left(\frac{y_\tau}{w_n}\right)\right) = x_\tau'\beta + a_\tau, \tag{2.2}$$

with $a_\tau = -\ln(-\ln u_\tau)$.

From Nicolau and Rodrigues (2024), we know that a_τ follows a standard Gumbel distribution with expected value $E(a_\tau) = \gamma$, where $\gamma \approx 0.5772$ is Euler–Mascheroni's constant. We are able to define z_τ, by accounting for the value within the error term making it $\xi_\tau = a_\tau - \gamma$. The tail index regression is,

$$z_\tau = x_\tau'\beta + \xi_\tau, \tag{2.3}$$

where ξ_τ is a centered Gumbel error term with zero mean, $E(\xi_\tau) = 0$. Using this specification, we are able to compute the OLS estimates, $\hat{\beta}$, and assess the impact of the covariates in the probability of observing extreme changes in the inflation-linked swap rates' term structure.

III.B. Tail Threshold Determination

The procedure described in Subsection III.A, implies that an appropriate w_n is selected for the tail cut-off point, both for the left and right tails of the distribution. To choose the optimal threshold w_n empirically, as in Nicolau and Rodrigues (2024), we apply a discrepancy measure developed by Wang and Tsai (2009). This measure aims to minimize the difference between the estimated empirical distribution of the tail observations and a Pareto distribution. The tail observations are transformed using the estimated conditional survival function of the Pareto distribution. This transformation returns the estimated probability of exceeding each observed value in the tail, given the selected covariates and a specified threshold. The discrepancy is then computed as,

$$\hat{D}(w_{in}, x_{i\tau}) = \frac{1}{n_0} \sum_{\tau=1}^{n_0} \left(\hat{U}_{i\tau} - \hat{F}_n(\hat{U}_{i\tau})\right)^2 . \tag{3}$$

This statistic measures the squared deviation between the transformed values and their empirical distribution. A small discrepancy indicates that the threshold w_n produces a tail sample whose transformed values closely resemble a uniform distribution, as expected under the Pareto assumption. To find the optimal threshold, we iterate over a grid of candidates for w_n, estimate a tail index regression (as in equation 2.3) for each candidate, and select the value that minimizes the discrepancy measure.

IV. Data

In this work project, as previously noted, we examine the behaviour of market-based inflation expectations. To this end, we analyze inflation-linked swap rates, across a range of maturities (from one to ten years), as a proxy for the market's perception of inflation developments over time. These financial instruments involve the exchange of payments between two parties over a specified horizon: one party pays a predetermined fixed rate, while the other pays an amount indexed to the Harmonized Index of Consumer Prices, excluding tobacco (ECB 2003).

Although widely analyzed, market-based measures of inflation expectations are not considered *pure* expectations, as they incorporate a risk premium component (Speck 2017; Nautz and Strohsal 2015; Gomes, Iskrev, and Pires Ribeiro 2021). Several authors have sought to decompose ILS rates into expectations and risk premia using affine term structure models (Joslin, Singleton, and Zhu 2011; Camba-Méndez and Werner 2017; Burban et al. 2022), although this approach has some limitations[10]. Despite the presence of a risk component, inflation-linked swaps remain the most

10. Gomes, Iskrev, and Pires Ribeiro (2021) and Reis (2022) alert that this approach leads to an underestimation of the persistence of long-run inflation expectations, quickly converging to a long-run mean, not properly displaying the *real* variations in expectations across time.

actively traded instruments in this market segment. Compared to break-even inflation rates (BEIR) derived from nominal and inflation-linked government bonds, ILS are generally less exposed to liquidity and sovereign risk, indeed, there is evidence suggesting that ILS account for approximately 50% of trading activity in this market segment (Galati, Poelhekke, and Zhou 2011; Byrne and Zekaite 2019; Gomes, Iskrev, and Pires Ribeiro 2021; García and Werner 2021). While ILS rates technically reflect inflation compensation rather than pure expectations, they are widely regarded as the closest available proxy for true inflation expectations in the euro-area, and will be referred to as expectations in this analysis. Notably, Draghi (2014) highlighted the relevance of ILS rates for assessing long-term inflation expectations in the euro-area.

In this study, we aim to identify drivers of extreme revisions in inflation expectations. To this end, we make use of a set of high-frequency economic and financial indicators. Our selection of explanatory variables includes proxies for economic activity, such as daily Eurostoxx50 index returns[11], daily changes in West Texas Intermediate oil prices, and the daily variation in the Euro/US Dollar exchange rate. To account for financial market volatility in the euro area, entering as an indicator of uncertainty in the stock market, we include the VSTOXX index as an explanatory variable (García and Werner 2021). Additionally, to capture market participants' expectations regarding the future path of monetary policy, capturing both conventional and unconventional monetary policy actions[12], and liquidity conditions faced by economic agents (Ferrero and Nobili 2008; Core et al. 2024), we incorporate the daily variation in futures contracts linked to the three months ahead euro short-term rate[13] (€STR) and 1-year ahead Euribor rate[14]. All data series used in this analysis were obtained from Refinitiv.[15]

11. In his seminal work, Fama (1981) states that real stock returns lead real variables like capital expenditures, real rate of return and output. Höynck and Rossi (2023) also report that equity prices should be positively related to demand and supply shocks, and improvements in global sentiment are associated with increasing equity prices.

12. Hubert and Labondance (2018) investigate the impact of monetary announcements on the yield curve, they suggest that forward guidance may lead to a reduction in the perceived risk/uncertainty of private agents.

13. Similarly, Kuttner (2001) uses federal funds rate futures as a gauge of expectations regarding future policy actions, analyzing the impact of anticipated and unanticipated monetary policy shocks.

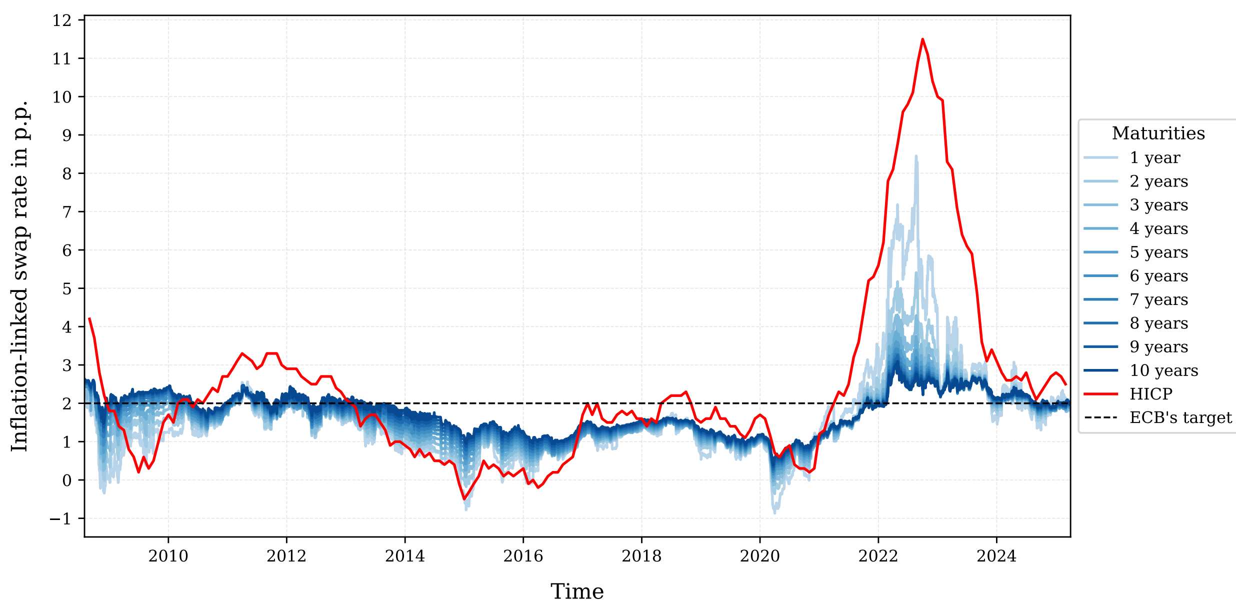
14. Observing that most firm's floating rate loans had Euribor as an underlying reference rate (around 80%), Core et al. (2024) show that facing an interest rate hike, firms may keep prices high to combat raising borrowing costs, hindering the transmission of monetary policy via, as they described, the floating-rate channel.

15. The variables mentioned above are displayed in Appendix.A. The Eurostoxx50 index, WTI oil prices and VSTOXX index were subject to a log-transformation before estimation.

IV.A. Exploratory Analysis

In this study, we analyze market-based inflation expectations from September 2008 to March 2025. Figure 1 displays expected inflation across different maturities alongside realized inflation. It is evident that shorter maturities exhibit considerably more volatile behaviour over time. This aligns with the prevailing view that short-term expectations are more sensitive to transitory shocks compared to long-term expectations. It also suggests that agents operating in shorter maturities may exhibit different risk tolerances and are more directly influenced by current economic developments.

Figure 1: The evolution of market-based inflation expectations in the euro-area



Notes: This figure plots market-based inflation expectations against the European Central Bank's inflation target of 2% over the medium-term and the Harmonized Index of Consumer Prices excluding tobacco.
Source: Inflation-linked swap rates - Refinitiv; Harmonized Index of Consumer Prices excluding tobacco - Eurostat.

The darker lines in the figure, representing the market's long-term inflation outlook, generally display greater stability over short time spans throughout most of the sample period, although they did fluctuate over time. From a policymaker's perspective, long-term inflation expectations are particularly important, if they were fully anchored to the European Central Bank's (ECB) inflation target, they would be systematically close to the 2% benchmark (Kumar et al. 2015). However, this is not consistently observed in the data.

The period under study is characterized by clear heterogeneous dynamics across maturities, over time. The beginning of our sample is marked by the end of the global financial crisis (GFC), a period that created a systemic shock to the financial and banking systems across the globe, a period of high uncertainty, which erupted a banking crisis in Europe and evolved into the sovereign debt crisis (SDC) (Kose and Ohnsorge 2021). This was a period during which several European countries experienced severe liquidity constraints, prompting the European Central Bank to respond by decreasing interest rates to record lows. Around 2014, decreasing energy prices, namely oil, inflation and interest rates, were accompanied by expectations of dis-inflation. As Dovern and Kenny (2017) highlight, the persistence of low long-term inflation expectations during the zero lower bound (ZLB) period suggests that confidence in the ECB's commitment to its inflation objective has not been entirely unquestioned.

With interest rates approaching the ZLB, the ECB launched the Asset Purchase Programme (APP), in early 2015. For the remaining pre-COVID-19 period, expectations seemed to be stable across maturities. The outburst of the pandemic was a period marked by drastic reduction in economic activity and heightened uncertainty. Concomitantly, the Russia-Saudi Arabian oil price war, drove down oil prices in early 2020 (Ma, Xiong, and Bao 2021), which coincides with downward revision in the outlook on future inflation.

The COVID-19 crisis was characterized by high inflation rates. Supply disruptions caused by economic inactivity and demand-supply mismatches (Lane 2024), the substantial economic stimulus introduced through the Pandemic Emergency Purchase Programme (PEPP) in March 2020, and especially the Russian invasion of Ukraine, which significantly affected energy prices, contributed to strong inflationary pressures. The sharp rise in realized inflation during 2022 and 2023 was met with a forceful response from the European Central Bank, which raised interest rates substantially, reaching the 4% level. Short-term inflation expectations proved highly reactive to developments during the COVID-19 crisis, while long-term maturities reflected increased uncertainty in financial markets, with 10-years ahead expectations reaching around 3%. Nevertheless, market-based inflation expectations gradually converged toward the ECB's inflation target across different horizons.

V. Results

According to Section III, among the various possible thresholds for both tails of the distribution, we selected the one that minimized the discrepancy between the empirical distribution and a fitted Pareto distribution, using the tail index estimates as in Nicolau and Rodrigues (2024), following the approach of Wang and Tsai (2009). Once the tail cut-off point is determined, the resulting time series is irregular and, in some cases, quite narrow. To identify the most appropriate model for the following analysis, we selected the specification that achieved the lowest score on the Bayesian Information Criterion (BIC). This criterion was chosen because it measures the model's fit to the data with parsimony, penalizing complexity, thus, preserving degrees of freedom.

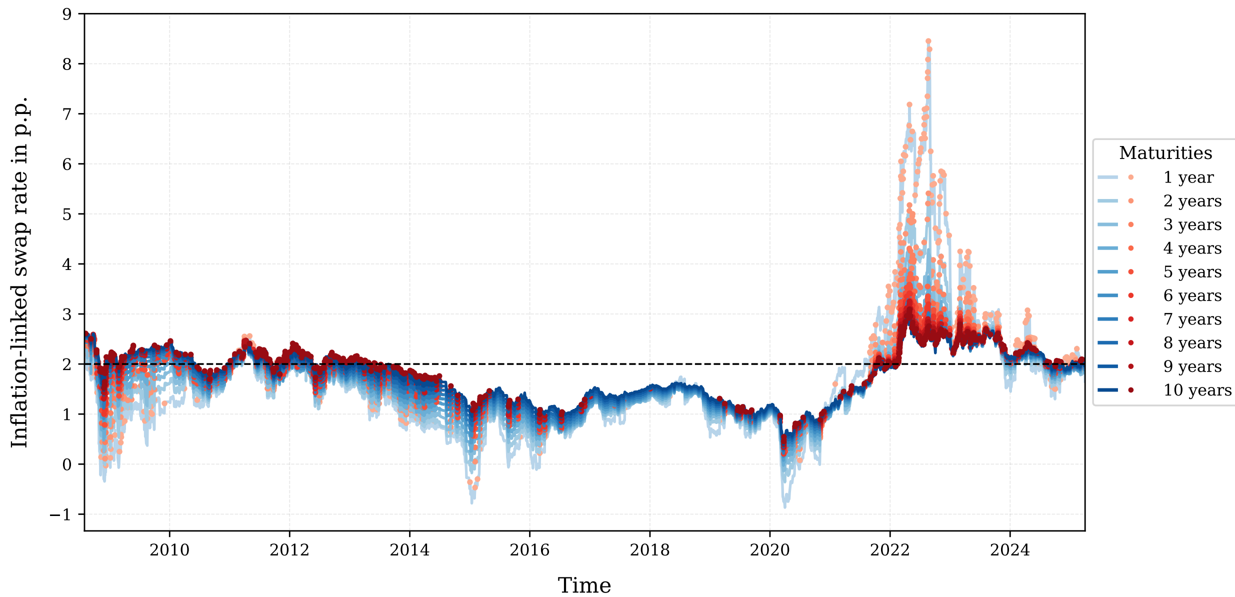
When conducting this experiment, it is important to note that the selected observations are irregularly spaced across time. Figures 2a and 2b display the estimated extreme daily revisions of market-based inflation expectations, as described in III.B. The largest revisions, in both tails, are not regularly distributed across the sample, but instead concentrated in specific intervals. In the right tail, observations are predominantly clustered around the COVID-19 crisis, whereas left tail observations are mainly concentrated between 2011 and mid-2014.[16] Not accounting for this selection would make the comparison between tails uninformative, and hide potential structural heterogeneity in the way the tails behave, as the economic scenario differs significantly across time. To define the sub-samples for analysis, we relied on evidence presented in the existing literature. There is consistent evidence of signs of de-anchoring of inflation expectations around 2013 (Byrne and Zekaite 2019; Dovern and Kenny 2017; Dovern, Kenny, et al. 2020; Neri et al. 2022; Antunes 2015; Natoli and Sigalotti 2017)[17]. Our sample ranges from September 2008 to March 2025 and accordingly, we divided the sample in 2013 and 2020, capturing different crisis episodes, from the aftermath of the global financial crisis and the dawn of the sovereign debt crisis, to the period marked by the ZLB and persistent low inflation and, notably, the COVID-19 crisis.[18]

16. Note that long-term revisions in inflation expectations seemed to appear in both periods mentioned, while shorter term maturities tended to gravitate to the mentioned periods, in both tails.

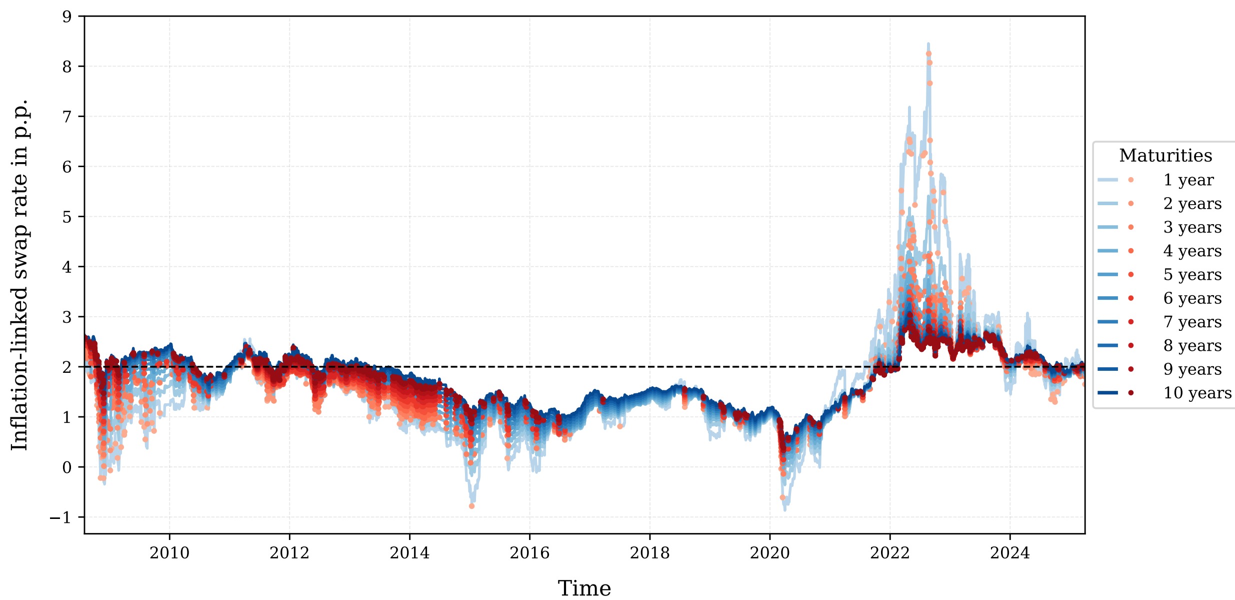
17. As noted in section II, Antunes (2015) and Natoli and Sigalotti (2017) identified signs of de-anchoring as early as 2012 and mid-2014, respectively.

18. We decided to take this approach following the related literature, although the empirical identification, displayed

Figure 2: Estimated Tail Observations — Full Sample



(a) Estimated Right Tail Observations



(b) Estimated Left Tail Observations

Note: This figure shows the right and left tail observations under study against market-based inflation expectations over time. The tail observations are plotted in red.
Source: Inflation-linked swap rates — Refinitiv.

in Figure 2b, might suggest that a possible better fit would be around mid-2011.

V.A. The aftermath of the GFC and the SDC period

From Table 7, Eurostoxx returns, oil price changes, and the volatility index exhibit inconsistent results, with coefficient's signs varying across maturities. This variability makes it difficult to establish a clear relationship between these variables and the right tail risk of inflation expectations' term structure during this period. The EUR/USD exchange rate exhibits a positive and statistically significant effect on the right tail of 1-year ahead inflation expectations. Moreover, as the horizon increases, the risk of extreme upward revisions also rises, with the exchange rate showing negative statistically significant coefficients at medium to long-term horizons. As the domestic currency depreciates, imported goods become more expensive which, in the case of intermediate goods, feed into input costs and, thus prices of final goods (Ortega and Osbat 2020; Neri et al. 2023). Since crude oil is primarily traded in U.S. dollars, a depreciation of the euro relative to the dollar increases the cost of energy in the euro area, thereby exerting upward pressure on inflation (Leiva-Leon, Ortega, and Martínez-Martín 2019; Ricci 2024). Thus, market participants seem to expect a pass-through of the exchange rate to inflation on the medium to long-term during this period.

Short-term interest rate futures also exhibit varying effects across maturities – showing negative coefficients at 2- and 3-years ahead, and positive ones for longer-term maturities. This pattern suggests that expectations regarding the future path of monetary policy influence inflation expectations differently depending on the time horizon. The period under analysis is marked by economic turmoil related to the end of the GFC and the SDC. Ferrero and Nobili (2008) note that risk premia in futures contracts tend to increase during economic downturns. Therefore, for shorter-term maturities, the negative coefficient likely reflects the dynamics of the embedded risk premia in ILS, which in turn raises the likelihood of observing a sharp increase of swap rates. A possible explanation for the positive coefficients associated with 5- and 6-years ahead expectations may stem from reduced uncertainty (and corresponding risk), driven by rising expected policy rates in response to increasing inflation, as observed between 2009 and mid-2011. Increasing rates in Euribor futures contracts 1-year ahead seem to reduce the risk of extreme variations in the right tail of expectations 1-year ahead.

An interesting finding is the statistically significant sensitivity of the right tail of inflation expectations to short-term developments in inflation expectations 2- and 4-years ahead – and at 9-years ahead. Since the coefficient is negative, it means that upward revisions of inflation expectations in the short-term increased the probability of observing a drastic increase of expectations. Therefore, it is indicative of a pass-through of short term expectations for longer horizons – although both lags display statistical significance, we adopt a conservative interpretation, as the change in 1-year ahead ILS rates is absent from every maturity above four years, limiting the evidence for de-anchoring of expectations during this period. Finally, changes in the autoregressive components of the ILS series for the corresponding maturity appear with statistically significant and positive coefficients, suggesting a reduction in the weight of the tail of the distribution. This relationship reflects the fact that the underlying series is stationary – since the tail index indicator is based on the daily variation of inflation-linked swap rates.

Observing the left tail coefficients from Table 9, we find that Eurostoxx50 returns, which we are using as an approximation to economic activity, reduce the risk of a drastic downward revision, in shorter term and longer term maturities. Given that this period is marked by two major crises and elevated uncertainty, the findings may suggest that rising economic activity reduces uncertainty related to dis-inflationary pressures. Counter-intuitively, the exchange rate suggests that, at longer horizons, a depreciation of the domestic currency are associated with heavier left tails of long-term inflation expectations. Oil prices only appear statistically significantly once throughout the term structure, at 7-years ahead.

The Euribor and short term rates futures exhibit positive and statistically significant coefficients, which (following the reasoning described above), might indicate that the expected path of policy action is reducing uncertainty surrounding the inflation outlook. The volatility index still displays the same pattern, increasing volatility decreases the weight of the tails. Unlike the right tail index estimates, variations in inflation expectations 1-year ahead do not yield consistent results, as the coefficients vary in sign. The majority are negative, suggesting that they did not guide the probability of observe strong downward revisions in expectations. Lagged expectations of inflation linked swaps, at the given maturity, were not consistently significant only appearing in specification of expectations 7-years ahead.

V.B. The post-SDC and Zero Lower Bound period

Table 1 displays interesting results, Eurostoxx50 returns appear to increase the probability of upward revisions in the inflation outlook consistently across the term structure. In contrast, the exchange rate is associated with a reduction of the weight of the right tail of the distribution, although the sign of the coefficient changes at the 6-year ahead horizon. Oil prices, on the other hand, were represented in the tail index specifications of 1-, 3- and 4-years ahead, rising energy prices did heightened the probability of extreme upward revisions in inflation expectations – consistent with the findings of (Neri et al. 2022; Gomes, Iskrev, and Pires Ribeiro 2021). At longer maturities, results become less reliable, as the sign shifts between the seventh and eighth horizon. The volatility index appears to influence the probability of upward revisions in inflation expectations across medium- to long-term maturities. However, it displays a change in sign at the 7-year ahead horizon. The sub-sample under analysis is characterized by the ZLB period, where conventional monetary policy actions were restricted. Having said that, interestingly, and perhaps unsurprisingly, futures contracts relative to the short term rate and Euribor were not selected into the final model specifications for any horizon. Strinkingly, reinforcing the findings of the prior sub-sample, there is statistically significant evidence that upward revisions in inflation expectations 1-year ahead led to an increasing likelihood of an extreme upward revision in expectations at long-term horizons. This constitutes another indicator that market-based inflation expectations displayed signs of de-anchoring during this period. It is worth noting that lagged variations of ILS rates at a given maturity exhibited a similar behaviour to the previous sub-sample.

Table 1: Right Tail Index Regression - [2013-2020]

	Z_{1Y}	Z_{2Y}	Z_{3Y}	Z_{4Y}	Z_{5Y}	Z_{6Y}	Z_{7Y}	Z_{8Y}	Z_{9Y}	Z_{10Y}
Constant	0.2329**	0.3502***	0.3457***	0.4871***	0.3759***	0.2999***	0.4310**	0.4728***	0.5926***	0.4157***
	(0.1144)	(0.1194)	(0.1111)	(0.1218)	(0.1264)	(0.1093)	(0.1735)	(0.1454)	(0.1705)	(0.1318)
Δ EUROSTOXX50_L1	-	-31.5274**	-	-	-	-22.1499***	-	-	-	-26.4095***
	-	(13.2510)	-	-	-	(7.1736)	-	-	-	(8.9174)
Δ EUROSTOXX50_L2	-	-	-	-	-27.4075***	-	-	-30.6992***	-	-
	-	-	-	-	(7.0578)	-	-	(9.8808)	-	-
Δ EUR/US$_L1	22.2257	-	-	-	-	-36.9206**	-	-	-	-
	(19.7296)	-	-	-	-	(16.7952)	-	-	-	-
Δ EUR/US$_L2	24.2339**	-	24.8257**	-	-	-	-	-	26.1758*	-
	(11.1543)	-	(10.7488)	-	-	-	-	-	(15.5439)	-
Δ Oil_Price_L1	-	-	-7.6009**	-	-	-	-19.0154***	-	-	-
	-	-	(3.8610)	-	-	-	(5.2590)	-	-	-
Δ Oil_Price_L2	-5.5206***	-	-4.1788***	-4.0851***	-	-	-	9.4557**	-	-
	(1.7090)	-	(1.4660)	(0.9537)	-	-	-	(4.0846)	-	-
Δ VSTOXX_L1	-	-6.1800**	-	-	2.4550	-	-	-	-	-
	-	(2.9681)	-	-	(1.8578)	-	-	-	-	-
Δ VSTOXX_L2	-	-	-	-	-4.3029**	-	9.5971***	-5.4055**	-	-
	-	-	-	-	(1.6724)	-	(3.3537)	(2.5278)	-	-
Δ ILS1Y_L1		-3.0234*		-	-	-	-5.1936***	-	-2.9991**	-
		(1.5775)		-	-	-	(1.8398)	-	(1.2029)	-
Δ ILS1Y_L2	-	-	-	-2.5492**	-	-	-	-	-	-2.7715***
	-	-	-	(1.0391)	-	-	-	-	-	(0.8371)
Δ Y_L1	3.1368**	8.4419***	6.4330***	9.6817***	7.8783***	7.7098***	16.1960***	8.7271***	14.5465***	10.2230***
	(1.3090)	(2.0244)	(1.2619)	(1.1638)	(0.9878)	(1.6839)	(2.9974)	(1.2272)	(2.5351)	(1.3949)
Δ Y_L2	-	-	-	6.1790***	-	4.4577***	7.8673***	-	4.6484***	6.9419***
	-	-	-	(1.7180)	-	(1.5200)	(1.9717)	-	(1.6990)	(1.6363)
N	135	135	161	136	145	153	68	111	111	119
R-squared	0.074	0.112	0.113	0.202	0.136	0.129	0.414	0.192	0.228	0.202

Note: The models displayed in the table were selected using the Bayesian information criterion, as described in Section V. Z is the transformed variable from Equation (2.3). ΔY stands for the first difference of the swap rates' level at the corresponding maturity. Newey–West HAC standard errors in parenthesis. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

From Table 2, Eurostoxx50 shows similar impacts to those observed to the weight of the right tail. On the other hand, although included in only two specifications across the term structure's final models, the exchange rate affected the left tail in a symmetric way to the opposite tail. Likewise, oil prices do not appear to have consistently influenced the weight of the tails of the distribution across the term structure – although there is statistical significant evidence for expectations 9-years ahead. Short term rate's futures display symmetric signs at 3-years and 8-years ahead. The volatility indicator followed the same pattern observed previously, its overall impact is inconclusive.

Reinforcing the results obtained from the opposite tail, the coefficient on 1-year ahead revisions displaying symmetric results to the right tail, which follows the same, but symmetric, narrative. Downward revisions were associated with an increased likelihood of extreme downward revision in expectations across the term structure. Evidence is statistically significant at short and long-term horizons. Therefore, we observe that during this period there is consistent statistical evidence that variations in short-term expectations guide the probability of revisions in the same direction across the term structure of market-based inflation expectations, for both tails. These results align with the conclusions from previously mentioned studies (Lyziak and Paloviita 2017; Byrne and Zekaite 2019; Neri et al. 2022). Finally, the lagged variations of ILS, for each corresponding maturity, displayed the patterns described thus far.

Table 2: Left Tail Index Regression - [2013-2020]

	Z_{1Y}	Z_{2Y}	Z_{3Y}	Z_{4Y}	Z_{5Y}	Z_{6Y}	Z_{7Y}	Z_{8Y}	Z_{9Y}	Z_{10Y}
Constant	0.1202	0.3281***	0.2282**	0.2271**	0.3291***	0.4037***	0.3798***	0.3461*	0.4741***	0.2742**
	(0.0924)	(0.0955)	(0.0943)	(0.0990)	(0.1147)	(0.1430)	(0.1271)	(0.1917)	(0.0992)	(0.1110)
Δ EUROSTOXX50_L1	-11.4039**	-	-	-	-	-	-	-	-	-
	(5.3910)	-	-	-	-	-	-	-	-	-
Δ EUROSTOXX50_L2	-	-	-	-	-	-	-	-45.8016**	-	-
	-	-	-	-	-	-	-	(19.9432)	-	-
Δ EUR/USD_L1	-	21.7317***	-	12.6511	19.5603**	-	-	-	-	-
	-	(7.3508)	-	(7.8357)	(8.7019)	-	-	-	-	-
Δ Oil_Price_L2	-	-	-	-	-	-	-	-	8.7575***	-
	-	-	-	-	-	-	-	-	(3.2440)	-
Δ Euribor_L1	17.5183	-	-	-	-	-	-	-	-	-
	(10.6593)	-	-	-	-	-	-	-	-	-
Δ €STR_L1	-	-34.6217**	-	-	-	-	-	-	-	-
	-	(13.5899)	-	-	-	-	-	-	-	-
Δ €STR_L2	-	-	-	-	-	-	-	131.1811***	-	-
	-	-	-	-	-	-	-	(49.8038)	-	-
Δ VSTOXX_L1	-	-	-	-	2.1314*	-	2.1777	-	-	-
	-	-	-	-	(1.2471)	-	(1.5162)	-	-	-
Δ VSTOXX_L2	-3.1348**	-	-	-	-	-	-	-7.3403*	-	-
	(1.2988)	-	-	-	-	-	-	(4.0331)	-	-
Δ ILS1Y_L1	-	8.0398***	4.4241**	-	-	3.2332	5.5039***	-	4.4826**	2.1465
	-	(1.4362)	(1.7455)	-	-	(2.2136)	(1.9359)	-	(1.7900)	(1.5376)
Δ ILS1Y_L2	-3.2806**	-	-	-	-	-	-	-	-	-
	(1.5068)	-	-	-	-	-	-	-	-	-
Δ Y_L1	-	-12.0092***	-8.7771***	-7.3278***	-6.6941***	-9.5148***	-9.7277***	-5.6397***	-12.8546***	-11.1813***
	-	(1.6203)	(2.3590)	(1.2749)	(1.1143)	(1.7578)	(1.8564)	(1.7084)	(1.4420)	(1.0915)
Δ Y_L2	-	-5.1170***	-3.7488***	-3.6876**	-	-3.9596*	-2.9882**	-	-5.8025***	-2.6130*
	-	(1.5832)	(1.3903)	(1.6427)	-	(2.1350)	(1.1800)	-	(1.7751)	(1.5553)
N	158	180	178	175	167	115	130	81	179	151
R-squared	0.093	0.142	0.085	0.135	0.127	0.123	0.171	0.153	0.195	0.203

Note: The models displayed in the table were selected using the Bayesian information criterion, as described in Section V. Z is the transformed variable from Equation (2.3). ΔY stands for the first difference of the swap rates' level at the corresponding maturity. Newey–West HAC standard errors in parenthesis. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

V.C. The COVID-19 crisis period

From Table 5, the coefficients suggest that rising Eurostoxx50 returns are associated with a reduced probability of extreme upward revisions in inflation expectations. However, this variable is only displayed in two maturities among the final model specifications. In the context of the COVID-19 crisis, this effect may manifest through risk adjustments, Gieseck and Rujin (2020) suggest that heightened uncertainty regarding the economic outlook is linked to increasing risk premia. Therefore, as the sub-sample under analysis is marked by elevated economic uncertainty (Lane 2024), increasing economic activity might reduce the likelihood of observing an extreme upward revision, by lowering the recquired risk premium. Since the effect is not consistent across maturities, we are conservative in deducing a meaningful relationship.

Oil prices did influence expectations significantly at shorter horizons, as rising energy prices seemed to drive uncertainty regarding the inflation outlook. This, in turn, appears to increase the probability of observing extreme upward revisions in short-term expectations, as higher input prices are likely to feed into inflation. This result is expected, as the time period under study is characterized by rising oil prices, particularly, following the geopolitical conflict triggered by the Russian invasion of Ukraine. Results regarding the nominal exchange rate do not offer conclusive evidence.

Interestingly, the expectations about future monetary policy actions do convey symmetrical effects. On one hand, an increase in the expected Euribor rate 1-year ahead led to a higher likelihood of observing extreme upward revisions in long-term inflation expectations. On the other hand, changes in short term rate futures contracts suggest the opposite effect, being consistent, in short- and long-term horizons, excepting 4-years ahead. As shown by Core et al. (2024), the Euribor rate is the most commonly used reference rate of floating-rate loans to firms in the euro area – accounting for approximately 80% of provided loans. The authors provide evidence that firms, facing rising borrowing costs, tend pass costs on to consumers, thereby contributing to an increasing price level.[19] Thus, a possible explanation for the negative sign of long-term expectations is that market participants might perceive increasing borrowing costs as additional input costs, feeding into long-term inflationary pressures. Having said that, the Euribor rate could also be capturing underlying uncertainty, as high inflation rates were accompanied by successive policy rate adjustments – consequently increasing the weight of the right tail of the distribution of inflation expectations by capturing the endogenous uncertainty characteristic of this period.

19. Hence, reducing the effectiveness of monetary policy through the floating-rate channel.

Conversely, during a period of high inflation and a correspondingly aggressive policy response, short-term rate futures contracts seemed to display a statistically significant effect on the likelihood of an extreme upward revision for multiple horizons. The coefficient is positive for most maturities, with an exception for expectations 4-years ahead. Thus, suggesting that the market's perception of increasing policy rates act by reducing the uncertainty regarding future inflation, and the associated recquired risk premium. Additionally, these future contracts might be capturing the effect of forward guidance from the ECB. As noted by Hubert and Labondance (2018), forward guidance appears to lower uncertainty and recquired risk premium among financial market participants. With respect to changes in 1-year ahead ILS, the statistical evidence of a pass-through from short-term expectations to longer-term ones is positive in two specifications. The volatility index, as well as the lagged ILS of the corresponding maturity, retain the same reading as previously discussed.

From Table 6, the results are very similar in interpretation. The impact of Eurostoxx50 returns was similar to those from the right tail's weight. However, its interpretation should be approached with caution, as this variable does not exhibit consistent effects across the term structure. The exchange rate did appear to have a significant effect, in which depreciation increased the probability of observing extreme downward revisions. Oil prices display positive statistical significance in shorter and longer term maturities, although, in expectations 9-years ahead, the coefficient is negative and statistically significant. At shorter maturities, these results are consistent with the assumption that rising energy prices feed into inflation in the short term, expressing a decrease in the weight of the left tail of the distribution. Short term rates' coefficients' signs change across maturities, complicating the interpretation of their impact. Regarding Euribor rates, they display negative coefficients, thus suggesting that it might be capturing uncertainty, as mentioned above. The volatility indicator appears to have contributed to an increase in the weight of the left tail 9-years ahead, and the autoregressive component's effect remains consistent across sub-samples and tails.

VI. Discussion

From the analysis of the coefficients in the previous section, one result stands out among the rest. There is consistent statistically significant evidence that, during the post-SDC and zero lower bound period, revisions in 1-year ahead inflation-linked swap rates systematically influenced the probability of observing extreme changes in perception on long-term inflation expectations and also on shorter-term maturities. This key finding is observed for both tails of the distribution (evidence from the right tail of the distribution start in the aftermath of the GFC). Following the anchoring definitions proposed by Kumar et al. (2015), we report that long-term inflation expectations displayed signs of de-anchoring during this period. Our findings align with the related literature studying the pass-through of short to long-term inflation expectations.

From this study, we also found intriguing results from other variables. The indicators for perceptions regarding future policy actions namely, future contracts of short-term rates, suggested that, in the aftermath of the GFC, rising policy rates decreased the uncertainty regarding rising inflation in the medium-term. In a period where inflation was increasing from 2009 and, concomitantly, expected policy rates, these indicators seemed to indicate a signal of perceived credibility of the ECB from market participants. Additionally, short-term developments seem to have captured variations in risk premia (Ferrero and Nobili 2008). Interestingly, in a period characterized by restricted conventional monetary ability from monetary authorities, the variables approximating future policy rates were absent from the selected modelling specifications. In the COVID-19 period, long-term expectations displayed statistically significant sensitivity to the perception of future monetary policy actions, the Euribor futures contracts seemed to have captured a significant component of the endogenous uncertainty lived during this period, in both tails, as inflation rates increased rapidly and the ECB reacted aggressively. As described above, financial market's participants might perceive higher future policy rates as rising future input costs for firms, feeding into inflationary pressures (Core et al. 2024).[20] Contrarily, the other gauge of future monetary policy displays mostly the

20. Since the sign of the coefficient is negative in both tails of the distribution during this period, this explanation might be less reliable.

opposite effect, thus hinting for a channel through which, for instance, forward guidance might be influencing the required risk premium in the right tail of the distribution (Hubert and Labondance 2018).[21]

Oil prices' impact on the probability of observing extreme outcomes was only relevant at short-term maturities, from the post-SDC and ZLB period to the present[22]. During the COVID-19 crisis period, the magnitude of the coefficients was higher, on average, which is consistent with the shock in oil prices following the disruption of supply of energy caused by the Russian invasion of Ukraine.

Market participants seemed to perceive that EUR/USD depreciation would pass-through as inflationary pressures during the post-GFC period, especially in the right tail. Although there is no evidence that this mechanism affected expectations for the remaining periods, and tails, consistently. The volatility indicator, counter-intuitively, did not have consistent effects within each tail, across sub-samples and maturities. There is weak evidence that in the post-SDC period, increasing market volatility led to heavier tails of the distribution in some maturities across the sample (as the coefficient changes), and, even less reliable to assess this variable in other sub-samples. Finally, Eurostoxx50 only showed consistent coefficients, and appeared across the ILS's term structure consistently, for the right tail of the post-SDC and ZLB period. In a period of persistently low inflation, rising economic activity was linked to a higher probability of observing sharp upward revisions across the term structure, possibly resulting from an increasing demand and economic activity, which might be perceived as increasing future inflationary pressures (Höynck and Rossi 2023).

To test the strength of the results from the tail index estimates across sub-samples, we constructed *robustness* tables. As outlined in section V, for every cut-off point, we selected the specification that produced the best score using the BIC criterion. Statistically significant results from every other tested combination, for the optimal threshold and corresponding maturity, were stored and are displayed in Appendix.C and accounted for the direction in which they affected each tail.

We will focus on assessing the validity of the pass-through coefficient from short-term fluctu-

21. Note that, in the right tail and in longer maturities, the effects of futures on Euribor and the short-term rate are symmetrical. Thus, they might be canceling each other.

22. Oil prices seemed to have had elevated relevance in this period on the right tail of the distribution, comparatively to the left tail.

ations to the likelihood of sharp revisions of long-term expectations. Tables 7 and 9 show that the share of the pass-through being significant is consistently low for some maturities, for both tails. Additionally, there is evidence, for some maturities of both positive and negative significant coefficients, between lags of the variations in ILS rates 1-year ahead.

Having said that, one should be careful in concluding that the relationships explained above are not informative. The specifications reported above consist of the best model fit to the data, accounting for model simplicity as the sample is short, conditional on minimizing the discrepancy measure from Wang and Tsai (2009), as in (3). Therefore, it is the specification that models the tails of the distribution more closely to a Pareto distribution, meaning that we are analyzing the best linear model under this framework.

There are signs of sensitivity of the coefficients to modelling specifications, as reported in Appendix.C, thus, future research should extend this analysis to a different set of covariates. Building on the tail risk framework, further work could strive to evaluate the way in which the estimated tail index of short-term expectations influences long-term expectations. Lastly, another avenue for future analysis could relate to the application of this approach to market-based inflation expectations decomposed of risk premia.[23]

VII. Conclusion

In this work, resorting to high-frequency daily data, we sought to assess the factors determining shifts in the probability of observing extreme revisions in market-based inflation expectations across its term structure. By modelling the tails of the distribution to a Pareto distribution, we found that there is significant heterogeneity in the way covariates impact the tail index governing the weights of the tails, over time. Following the definition of anchored inflation expectations from Kumar et al. (2015), we conclude that short-term fluctuations guided the likelihood of observing drastic revisions in long-term inflation-linked swap rates, in the post-SDC and zero lower bound period.

23. As noted in Section IV, although there are some limitations to this approach it could allow for a deeper assessment of the impact of the risk component in the analysis provided with this work.

This study is particularly relevant from a policymaker's standpoint, since anchored expectations are a key indicator of a Central Bank's credibility. Through a different approach, we found signs of de-anchoring of inflation expectations by focusing on the examination of extreme revisions within the term structure of market-based inflation expectations, in the euro area.

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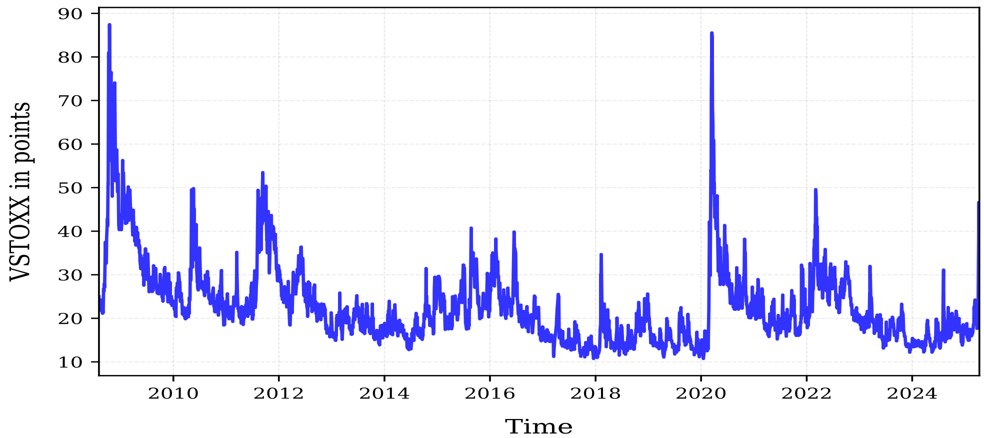
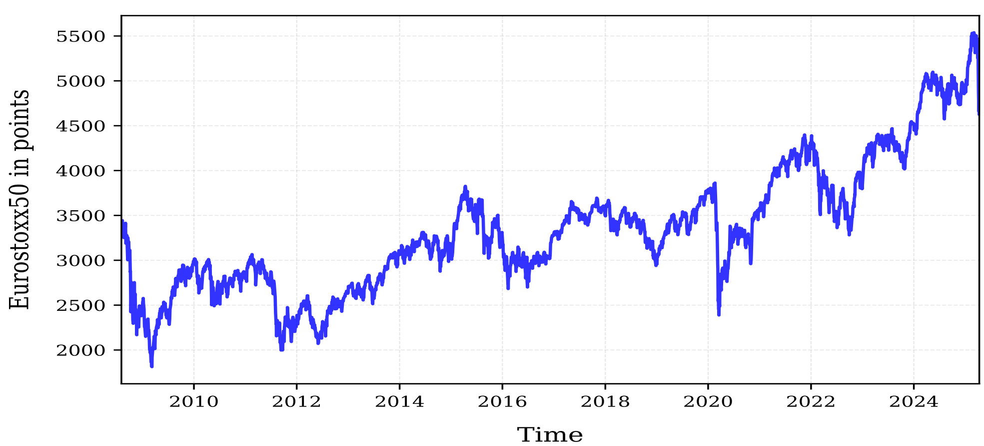
VIII. Appendix

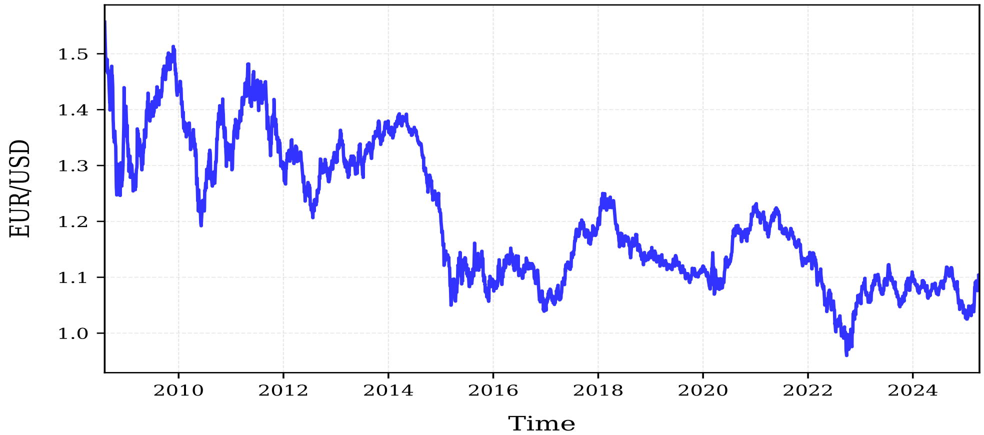
.A. Time-Series Plots



Source: VSTOXX Index - Refinitiv.

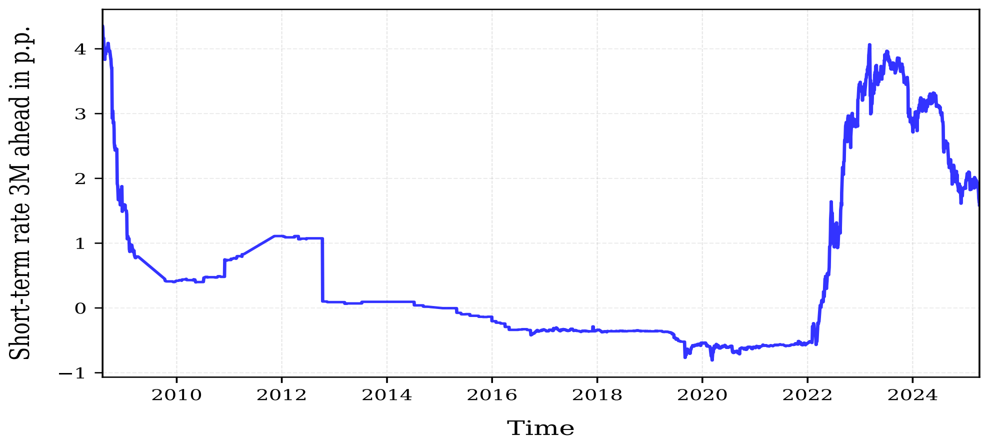


Source: Eurostoxx50 Index - Refinitiv.

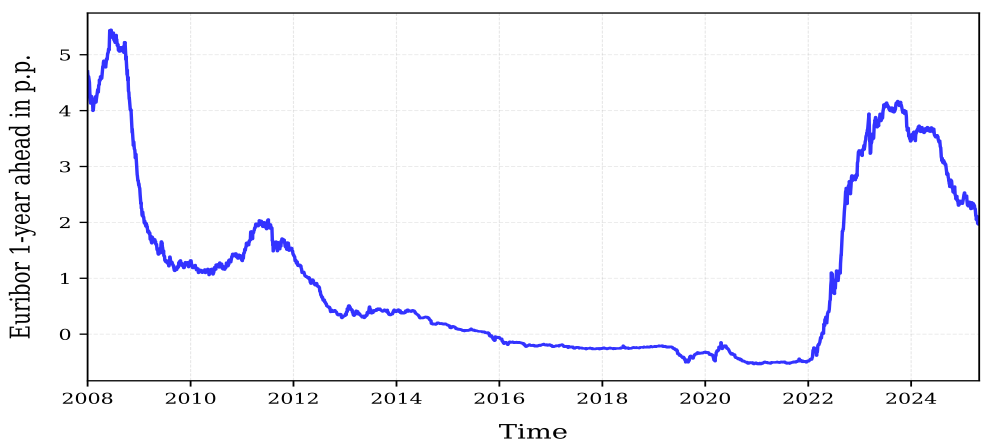


Source: Euro/U.S. Dollar Exchange Rate - Refinitiv.

Source: West Texas Intermediate Oil Prices - Refinitiv.



Source: Short-Term Rate Three Months ahead Futures Contracts - Refinitiv.



Source: Euribor 1-Year ahead Futures Contracts - Refinitiv.

.B. *Tail Index Estimates*

.B.1 The aftermath of the GFC and the SBC period - [2008-2013]

Table 3: Right Tail Index Regression - [2008-2013]

	Z_{1Y}	Z_{2Y}	Z_{3Y}	Z_{4Y}	Z_{5Y}	Z_{6Y}	Z_{7Y}	Z_{8Y}	Z_{9Y}	Z_{10Y}
Constant	0.9815***	1.0637***	1.1154***	1.1157***	1.8337***	1.2020***	3.0323***	0.5916**	1.1436***	1.2486***
	(0.1264)	(0.1248)	(0.1476)	(0.1315)	(0.1743)	(0.0868)	(0.3150)	(0.2591)	(0.1094)	(0.1786)
Δ EUROSTOXX50_L1	-	-	-	-	18.3746**	-	-139.9834***	-	-	7391.0717***
	-	-	-	-	(7.5299)	-	(35.7009)	-	-	(127.9428)
Δ EUROSTOXX50_L2	-	-	26.8000**	-	-32.6697***	-19.6076***	-	-	-	3765.6769***
	-	-	(10.5552)	-	(10.8583)	(5.9798)	-	-	-	(75.1367)
Δ EUR/USD_L1	18.8805**	-	-	-39.4839***	-47.6438***	-29.6422***	-	-	-	-
	(9.4732)	-	-	(8.1871)	(13.9434)	(10.9969)	-	-	-	-
Δ EUR/USD_L2	-	-	-	-	-	-	-292.6659***	-	-	-
	-	-	-	-	-	-	(47.2963)	-	-	-
Δ Oil_Price_L1	-	-	8.0177	-	-	-	-	-84.7621	-	-4547.6890***
	-	-	(5.0586)	-	-	-	-	(52.0669)	-	(68.5144)
Δ Oil_Price_L2	-	-	-	8.0260***	-	-	-	-	-7.9350**	839.7524***
	-	-	-	(2.7808)	-	-	-	-	(3.7183)	(26.6317)
Δ Euribor_L1	4.9849	-	-	-	-	-	-	-	-	-8120.2747***
	(3.2593)	-	-	-	-	-	-	-	-	(121.6569)
Δ Euribor_L2	10.6041***	-	-	-	-	-	-	-79.6564	-	3525.4071***
	(3.0197)	-	-	-	-	-	-	(52.0342)	-	(62.1665)
Δ €STR_L1	-	-12.4655***	-17.9613**	-	21.9867**	17.1993***	-	59.3056	-	18987.5168***
	-	(3.5511)	(7.7745)	-	(8.5845)	(2.3617)	-	(42.4435)	-	(309.1511)
Δ VSTOXX_L1	-	-	-	-	-	-	-	-	5.3544***	-
	-	-	-	-	-	-	-	-	(1.7497)	-
Δ VSTOXX_L2	-	2.7055***	10.4280***	-	-	-4.2340***	17.1987***	-21.0205*	-	-
	-	(1.0117)	(4.0430)	-	-	(1.5245)	(5.9265)	(12.1775)	-	-
Δ ILS1Y_L1	-	-	-	-	-	-	-	-	-1.2495*	-
	-	-	-	-	-	-	-	-	(0.7361)	-
Δ ILS1Y_L2	1.7140	-1.7771**	-	-3.0476**	-	-	-	-	-4.2660***	-
	(1.3026)	(0.8780)	-	(1.2261)	-	-	-	-	(1.1554)	-
Δ Y_L1	-	3.1789***	1.8165**	2.1361*	4.3387***	-	4.1069***	5.5830***	4.6384***	5.2852***
	-	(0.8199)	(0.7429)	(1.1836)	(0.7646)	-	(1.5158)	(1.7005)	(0.7334)	(0.9040)
Δ Y_L2	-	-	-	1.5312	1.4897**	-	-9.9923***	3.0577**	2.6396**	2.8728***
	-	-	-	(0.9682)	(0.6254)	-	(3.2138)	(1.2098)	(1.0552)	(0.7733)
N	135	135	161	136	145	153	68	111	111	119
R-squared	0.074	0.112	0.113	0.202	0.136	0.129	0.414	0.192	0.228	0.202

Note: The models displayed in the table were selected using the Bayesian information criterion, as described in Section V. Z is the transformed variable from Equation (2.3). ΔY stands for the first difference of the swap rates' level at the corresponding maturity. Newey–West HAC standard errors in parenthesis. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 4: Left Tail Index Regression - [2008-2013]

	Z_{1Y}	Z_{2Y}	Z_{3Y}	Z_{4Y}	Z_{5Y}	Z_{6Y}	Z_{7Y}	Z_{8Y}	Z_{9Y}	Z_{10Y}
Constant	0.8840***	0.8827***	1.3356***	1.2908***	1.1958***	0.9853***	2.2254***	1.0306***	1.2452***	1.2313**
	(0.1286)	(0.2688)	(0.1681)	(0.2701)	(0.1181)	(0.0757)	(0.2914)	(0.1056)	(0.1077)	(0.5174)
Δ EUROSTOXX50_L1	-	-	57.1332***	-	-	12.9516*	-	12.6538**	-	-
	-	-	(15.9644)	-	-	(7.6683)	-	(6.3200)	-	-
Δ EUROSTOXX50_L2	-	-	-	-	-15.3472	-	-	-	-	-
	-	-	-	-	(10.3619)	-	-	-	-	-
Δ EUR/USD_L1	-	-	-	-	-	-	-75.9242***	-18.4048*	-	-
	-	-	-	-	-	-	(28.4985)	(11.0178)	-	-
Δ EUR/USD_L2	11.7727	-	-	76.2107	-	-	-	-	-	-
	(9.0688)	-	-	(83.7699)	-	-	-	-	-	-
Δ Oil_Price_L1	-	-	-	-	-	-	-37.5731***	-	-	-
	-	-	-	-	-	-	(10.4504)	-	-	-
Δ Oil_Price_L2	-	-	-	-25.4452	12.5801	-	-	-	-	7.7877
	-	-	-	(29.1323)	(7.7507)	-	-	-	-	(4.8791)
Δ Euribor_L2	-	-	-	-	-	-6.3152	-	10.1791*	-	-
	-	-	-	-	-	(6.4441)	-	(5.9287)	-	-
Δ €STR_L1	6.4079**	58.2550	-	-	-	-	-	-	-	-
	(2.8056)	(41.1806)	-	-	-	-	-	-	-	-
Δ €STR_L2	-	-47.5394	-	-	6.1499***	-	-	-	6.4659***	4.1488
	-	(35.1526)	-	-	(1.8889)	-	-	-	(1.3477)	(3.6052)
Δ VSTOXX_L1 -	-	-	18.9871***	17.6901	-	4.5918**	-	-	-5.8655**	-
	-	-	(6.2038)	(16.8055)	-	(1.8568)	-	-	(2.7024)	-
Δ VSTOXX_L2 -	-	-18.2690	-	-	-	-	-	1.8723	5.8807**	5.7860**
	-	(14.1216)	-	-	-	-	-	(1.7430)	(2.5099)	(2.3230)
Δ ILS1Y_L1	-1.4598**	3.1610	-4.0667	-	-	2.3277***	-	-	-1.8876	-
	(0.6927)	(2.9792)	(3.3927)	-	-	(0.5115)	-	-	(1.1847)	-
Δ ILS1Y_L2	-1.6539**	-	-	-9.8009	-	-	-22.7812***	-	-	-
	(0.7479)	-	-	(9.3313)	-	-	(4.9130)	-	-	-
Δ Y_L1	-	-	3.8974	-	1.4629	-	-	-	-	-2.8429
	-	-	(4.1861)	-	(1.4581)	-	-	-	-	(3.0130)
Δ Y_L2	-	-	-	-	-	-	22.1952***	-	-	-
	-	-	-	-	-	-	(5.3419)	-	-	-
N	135	135	161	136	145	153	68	111	111	119
R-squared	0.074	0.112	0.113	0.202	0.136	0.129	0.414	0.192	0.228	0.202

Note: The models displayed in the table were selected using the Bayesian information criterion, as described in Section V. Z is the transformed variable from Equation (2.3). ΔY stands for the first difference of the swap rates' level at the corresponding maturity. Newey–West HAC standard errors in parenthesis. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

.B.2 The COVID-19 crisis period - [2020-2025]

Table 5: Right Tail Index Regression - [2020-2025]

	Z_{1Y}	Z_{2Y}	Z_{3Y}	Z_{4Y}	Z_{5Y}	Z_{6Y}	Z_{7Y}	Z_{8Y}	Z_{9Y}	Z_{10Y}
Constant	0.5789***	0.5647***	0.8282***	0.8775***	0.8268***	0.9218***	1.1508***	0.9998***	0.9117***	1.1137***
	(0.1878)	(0.1076)	(0.1477)	(0.1418)	(0.1682)	(0.1582)	(0.1776)	(0.1458)	(0.3174)	(0.1690)
Δ EUROSTOXX50_L1	-	18.8566**	-	-	-	-	16.9832*	-	-	-
	-	(9.3231)	-	-	-	-	(9.2635)	-	-	-
Δ EUR/USD_L1	-	-	-	-	-	-	-	-	96.5073	-
	-	-	-	-	-	-	-	-	(76.2837)	-
Δ EUR/USD_L2	-	-27.5106	-	-	-	-	-	-	-83.2429*	-
	-	(20.1460)	-	-	-	-	-	-	(42.8853)	-
Δ Oil_Price_L1	-10.9121*	-	-	-11.9321***	-7.4069	-10.1243	-	-	-	-
	(6.6814)	-	-	(3.7696)	(5.4937)	(6.4328)	-	-	-	-
Δ Oil_Price_L2	-	-5.9582*	-11.2222***	-	-	-	-	-	-	-
	-	(3.4287)	(3.4073)	-	-	-	-	-	-	-
Δ Euribor_L1	-	-	-	-	-	-	-13.0077**	-8.2707*	-8.8157	-
	-	-	-	-	-	-	(5.7045)	(5.0409)	(9.4906)	-
Δ Euribor_L2	-	-	-	-	-	-	-	-9.8369***	10.7313	-10.3769**
	-	-	-	-	-	-	-	(3.8117)	(10.9952)	(4.4627)
Δ €STR_L1	4.7912*	-	-	-	-	2.9394	10.8280*	10.3303***	-	3.5118*
	(2.5197)	-	-	-	-	(2.2197)	(5.6190)	(3.0688)	-	(1.9730)
Δ €STR_L2	-	-	5.3522***	-7.2008***	2.3279	-	-	-	-	-
	-	-	(2.0318)	(2.0841)	(1.8037)	-	-	-	-	-
Δ VSTOXX_L1	6.6021**	-	-	-	-	-	-	-	-	-
	(2.6194)	-	-	-	-	-	-	-	-	-
Δ VSTOXX_L2	-	-	-	-3.7232**	-	2.9849*	-	-	-	-
	-	-	-	(1.7567)	-	(1.5665)	-	-	-	-
Δ ILS1Y_L1	-	-	-	-	0.8332*	-	-	-	-	0.7745*
	-	-	-	-	(0.4757)	-	-	-	-	(0.4248)
Δ Y_L1	0.9228**	2.2723***	3.9258***	2.8346***	2.2417	3.8288**	4.4932***	-	-	-
	(0.4073)	(0.6056)	(0.9525)	(0.8310)	(1.4542)	(1.5878)	(1.7353)	-	-	-
Δ Y_L2	-	-	1.7395**	-	-	-	-	3.0577**	-	6.0093***
	-	-	(0.8009)	-	-	-	-	(1.2098)	-	(1.5278)
N	76	137	117	62	83	124	76	69	128	62
R-squared	0.144	0.121	0.179	0.258	0.097	0.087	0.174	0.219	0.065	0.151

Note: The models displayed in the table were selected using the Bayesian information criterion, as described in Section V. Z is the transformed variable from Equation (2.3). ΔY stands for the first difference of the swap rates' level at the corresponding maturity. Newey–West HAC standard errors in parenthesis. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6: Left Tail Index Regression - [2020-2025]

	Z_{1Y}	Z_{2Y}	Z_{3Y}	Z_{4Y}	Z_{5Y}	Z_{6Y}	Z_{7Y}	Z_{8Y}	Z_{9Y}	Z_{10Y}
Constant	0.3707***	0.4013***	0.2560**	0.3543***	0.7343***	0.8284***	0.8140***	0.9723***	0.9955***	0.8812***
	(0.1311)	(0.1347)	(0.1230)	(0.1254)	(0.1435)	(0.1728)	(0.1612)	(0.1444)	(0.1291)	(0.1274)
Δ EUROSTOXX50_L1	14.2376**	-	-	-	-	-	-	-	-	-
	(6.7748)	-	-	-	-	-	-	-	-	-
Δ EUROSTOXX50_L2	-	-	14.8352	-	-	-	-	-	-	10.5118**
	-	-	(9.1667)	-	-	-	-	-	-	(5.0876)
Δ EUR/USD_L1	-30.9562	-	-	-	-58.5813***	-37.4760**	-	-	-	-
	(19.7637)	-	-	-	(17.9053)	(17.1090)	-	-	-	-
Δ EUR/USD_L2	-	-36.0489**	-39.0541*	-	-40.1889**	-46.6206**	-	-	-	-42.9702***
	-	(18.2231)	(19.9656)	-	(16.7869)	(19.4308)	-	-	-	(15.3554)
Δ Oil_Price_L1	5.3729*	-	-	-	-	-	-	-	-	-
	(3.1895)	-	-	-	-	-	-	-	-	-
Δ Oil_Price_L2	-	-	-	4.6678	11.1450*	-	-	11.3372**	-10.3094**	-8.1158
	-	-	-	(3.0958)	(6.1551)	-	-	(4.7822)	(4.9986)	(5.2418)
Δ Euribor_L1	-	-	-	-	-	-	-11.3237**	-	-	-
	-	-	-	-	-	-	(4.5512)	-	-	-
Δ Euribor_L2	-	-11.0623**	-	-	-	-	-	-	-	-
	-	(4.3558)	-	-	-	-	-	-	-	-
Δ €STR_L1	-	-	-	-2.5294	-	-4.9514**	-	-3.7253**	-	-
	-	-	-	(1.5920)	-	(2.5233)	-	(1.8991)	-	-
Δ €STR_L2	-	6.8386***	-	-	-	-	1.6344*	-1.7162**	-	-
	-	(2.3442)	-	-	-	-	(0.9539)	(0.7938)	-	-
Δ VSTOXX_L1	-	-	-	2.1297	-	-	-2.4956	-	-3.3360**	-
	-	-	-	(1.6147)	-	-	(1.6354)	-	(1.4102)	-
Δ VSTOXX_L2	-	-	3.8326	-	-	-	-	-	-3.2688**	-
	-	-	(2.8792)	-	-	-	-	-	(1.4248)	-
Δ Y_L1	-	-1.4281**	-1.8094**	-1.4777	-2.0389	-3.0988**	-4.6793***	-3.3406**	-2.5127*	-2.6860
	-	(0.5731)	(0.8275)	(1.1212)	(1.2808)	(1.3421)	(1.4038)	(1.5186)	(1.3654)	(1.6802)
N	122	120	110	121	81	81	86	75	64	78
R-squared	0.054	0.108	0.095	0.059	0.140	0.164	0.201	0.120	0.116	0.092

Note: The models displayed in the table were selected using the Bayesian information criterion, as described in Section V. Z is the transformed variable from Equation (2.3). ΔY stands for the first difference of the swap rates' level at the corresponding maturity. Newey–West HAC standard errors in parenthesis. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

.C. *Robustness to Different Specifications*

.C.1 The aftermath of the GFC and the SBC period - [2008-2013]

Table 7: Right Tail Robustness to Model Specifications - [2008-2013]

	Z_{1Y}			Z_{2Y}			Z_{3Y}			Z_{4Y}			Z_{5Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	350.00	0.00	8.74	1.00	0.00	0.01	0.00	1899.00	19.32	0.00	0.00	0.00	7072.00	0.00	71.96
Δ EUROSTOXX50_L2	0.00	599.00	14.96	0.00	5009.00	50.97	5334.00	0.00	54.27	656.00	0.00	6.67	0.00	2665.00	27.12
Δ EUR/USD_L1	2993.00	0.00	74.75	0.00	5177.00	52.68	0.00	0.00	0.00	0.00	9828.00	100.00	0.00	6660.00	67.77
Δ EUR/USD_L2	2933.00	0.00	73.25	4048.00	0.00	41.19	94.00	3.00	0.99	229.00	5.00	2.38	6792.00	0.00	69.11
Δ Oil_Price_L1	0.00	1691.00	42.23	234.00	0.00	2.38	1764.00	0.00	17.95	0.00	122.00	1.24	85.00	0.00	0.86
Δ Oil_Price_L2	960.00	0.00	23.98	0.00	3301.00	33.59	0.00	3088.00	31.42	9503.00	0.00	96.69	0.00	2480.00	25.23
Δ Euribor_L1	3577.00	0.00	89.34	50.00	0.00	0.51	0.00	0.00	0.00	2383.00	0.00	24.25	1784.00	0.00	18.15
Δ Euribor_L2	3840.00	0.00	95.90	0.00	5108.00	51.97	132.00	728.00	8.75	345.00	38.00	3.90	1897.00	0.00	19.30
Δ €STR_L1	1.00	42.00	1.07	0.00	9828.00	100.00	0.00	3081.00	31.35	0.00	0.00	0.00	3984.00	0.00	40.54
Δ €STR_L2	361.00	0.00	9.02	0.00	2832.00	28.82	0.00	28.00	0.28	690.00	0.00	7.02	18.00	1270.00	13.11
Δ VSTOXX_L1	0.00	1.00	0.02	0.00	278.00	2.83	0.00	3336.00	33.94	0.00	129.00	1.31	714.00	315.00	10.47
Δ VSTOXX_L2	0.00	134.00	3.35	4740.00	0.00	48.23	3458.00	0.00	35.19	0.00	1476.00	15.02	5886.00	0.00	59.89
Δ ILS1Y_L1	0.00	1053.00	26.30	0.00	2002.00	20.37	0.00	2075.00	21.11	2159.00	0.00	21.97	0.00	502.00	5.11
Δ ILS1Y_L2	1034.00	0.00	25.82	0.00	4045.00	41.16	0.00	207.00	2.11	0.00	9828.00	100.00	0.00	182.00	1.85
Δ Y_L1	-	-	-	9828.00	0.00	100.00	4092.00	0.00	41.64	4015.00	0.00	40.85	2716.00	0.00	27.64
Δ Y_L2	-	-	-	0.00	4662.00	47.44	0.00	0.00	0.00	69.00	0.00	0.70	5.00	0.00	0.05

Table 8: Right Tail Robustness to Model Specifications (cont.) - [2008-2013]

	Z_{6Y}			Z_{7Y}			Z_{8Y}			Z_{9Y}			Z_{10Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	6.00	375.00	3.88	832.00	4879.00	58.11	302.00	0.00	3.07	0.00	6370.00	64.81	1851.00	1549.00	34.60
Δ EUROSTOXX50_L2	0.00	2559.00	26.04	1724.00	4247.00	60.75	6.00	369.00	3.82	0.00	1902.00	19.35	16.00	9688.00	98.74
Δ EUR/USD_L1	0.00	8098.00	82.40	3909.00	1603.00	56.08	4.00	0.00	0.04	0.00	7335.00	74.63	924.00	1662.00	26.31
Δ EUR/USD_L2	0.00	0.00	0.00	1110.00	6901.00	81.51	0.00	0.00	0.00	0.00	4362.00	44.38	2496.00	2588.00	51.73
Δ Oil_Price_L1	544.00	0.00	5.54	4445.00	1050.00	55.91	0.00	7777.00	79.13	0.00	1489.00	15.15	3202.00	970.00	42.45
Δ Oil_Price_L2	0.00	2329.00	23.70	593.00	7620.00	83.57	0.00	0.00	0.00	0.00	7750.00	78.86	82.00	6362.00	65.57
Δ Euribor_L1	0.00	979.00	9.96	1712.00	3712.00	55.19	0.00	115.00	1.17	0.00	1208.00	12.29	18.00	6989.00	71.30
Δ Euribor_L2	9187.00	0.00	93.48	5046.00	927.00	60.78	0.00	387.00	3.94	0.00	36.00	0.37	5237.00	432.00	57.68
Δ €STR_L1	9828.00	0.00	100.00	1129.00	6009.00	72.63	174.00	112.00	2.91	4870.00	0.00	49.55	2809.00	1600.00	44.86
Δ €STR_L2	0.00	3641.00	37.05	4039.00	2281.00	64.31	56.00	17.00	0.74	868.00	682.00	15.77	2421.00	1961.00	44.59
Δ VSTOXX_L1	3.00	0.00	0.03	3711.00	1272.00	50.70	0.00	398.00	4.05	8735.00	0.00	88.88	150.00	5080.00	53.22
Δ VSTOXX_L2	0.00	5303.00	53.96	3409.00	1773.00	52.73	0.00	2088.00	21.25	0.00	3912.00	39.80	5527.00	1115.00	67.58
Δ ILS1Y_L1	0.00	0.00	0.00	0.00	3014.00	30.67	373.00	0.00	3.80	0.00	2314.00	23.54	5141.00	607.00	58.49
Δ ILS1Y_L2	0.00	6630.00	67.46	1.00	2.00	0.03	0.00	179.00	1.82	0.00	9828.00	100.00	759.00	1587.00	23.87
Δ Y_L1	0.00	0.00	0.00	5009.00	0.00	50.97	5266.00	0.00	53.58	118.00	0.00	1.20	3217.00	1.00	32.74
Δ Y_L2	0.00	0.00	0.00	0.00	6268.00	63.78	6.00	1520.00	15.53	0.00	0.00	0.00	1061.00	0.00	10.80

Note: For each tail index regression, the positive (+) and negative (–) columns report the number of times a given variable was statistically significant with the respective sign. The percentage (%) column indicates the proportion of times the coefficient was significant at the 10% level. For the first maturity, we tested 4004 and, for the remainder, 9828 specifications.

Table 9: Left Tail Robustness to Model Specifications - [2008-2013]

	Z_{1Y}			Z_{2Y}			Z_{3Y}			Z_{4Y}			Z_{5Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	2.00	0.00	0.05	995.00	0.00	10.12	4149.00	0.00	42.22	0.00	0.00	0.00	0.00	0.00	0.00
Δ EUROSTOXX50_L2	0.00	357.00	8.92	58.00	0.00	0.59	10.00	3238.00	33.05	0.00	0.00	0.00	0.00	319.00	3.25
Δ EUR/USD_L1	0.00	0.00	0.00	13.00	0.00	0.13	4834.00	0.00	49.19	0.00	0.00	0.00	0.00	0.00	0.00
Δ EUR/USD_L2	1974.00	0.00	49.30	0.00	0.00	0.00	0.00	588.00	5.98	0.00	0.00	0.00	0.00	0.00	0.00
Δ Oil_Price_L1	0.00	0.00	0.00	0.00	0.00	0.00	1660.00	0.00	16.89	0.00	0.00	0.00	0.00	2.00	0.02
Δ Oil_Price_L2	260.00	0.00	6.49	840.00	0.00	8.55	564.00	0.00	5.74	0.00	0.00	0.00	2365.00	0.00	24.06
Δ Euribor_L1	0.00	0.00	0.00	0.00	0.00	0.00	2293.00	6.00	23.39	0.00	0.00	0.00	2864.00	0.00	29.14
Δ Euribor_L2	0.00	1303.00	32.54	0.00	0.00	0.00	0.00	678.00	6.90	0.00	16.00	0.16	0.00	0.00	0.00
Δ €STR_L1	2882.00	0.00	71.98	0.00	0.00	0.00	71.00	0.00	0.72	0.00	0.00	0.00	0.00	1895.00	19.28
Δ €STR_L2	1126.00	0.00	28.12	0.00	0.00	0.00	5306.00	0.00	53.99	804.00	0.00	8.18	9828.00	0.00	100.00
Δ VSTOXX_L1	0.00	0.00	0.00	687.00	0.00	6.99	5825.00	0.00	59.27	0.00	0.00	0.00	0.00	29.00	0.30
Δ VSTOXX_L2	0.00	0.00	0.00	0.00	0.00	0.00	2026.00	0.00	20.61	0.00	0.00	0.00	152.00	0.00	1.55
Δ ILS1Y_L1	0.00	3267.00	81.59	0.00	0.00	0.00	0.00	828.00	8.42	0.00	0.00	0.00	0.00	0.00	0.00
Δ ILS1Y_L2	0.00	1772.00	44.26	0.00	0.00	0.00	1243.00	0.00	12.65	0.00	0.00	0.00	0.00	1396.00	14.20
Δ Y_L1	-	-	-	0.00	273.00	2.78	1194.00	0.00	12.15	0.00	0.00	0.00	1482.00	0.00	15.08
Δ Y_L2	-	-	-	0.00	50.00	0.51	0.00	274.00	2.79	0.00	0.00	0.00	3438.00	0.00	34.98

Table 10: Left Tail Robustness to Model Specifications (cont.) - [2008-2013]

	Z_{6Y}			Z_{7Y}			Z_{8Y}			Z_{9Y}			Z_{10Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	693.00	0.00	7.05	2125.00	468.00	26.38	8697.00	0.00	88.49	2594.00	0.00	26.39	113.00	0.00	1.15
Δ EUROSTOXX50_L2	312.00	0.00	3.17	3387.00	508.00	39.63	1.00	467.00	4.76	0.00	2426.00	24.68	40.00	1673.00	17.43
Δ EUR/USD_L1	0.00	0.00	0.00	233.00	3746.00	40.49	0.00	2854.00	29.04	0.00	1187.00	12.08	0.00	208.00	2.12
Δ EUR/USD_L2	0.00	0.00	0.00	1559.00	1130.00	27.36	0.00	0.00	0.00	165.00	0.00	1.68	0.00	1616.00	16.44
Δ Oil_Price_L1	0.00	0.00	0.00	752.00	3251.00	40.73	0.00	0.00	0.00	632.00	0.00	6.43	559.00	0.00	5.69
Δ Oil_Price_L2	0.00	0.00	0.00	1235.00	2168.00	34.63	4654.00	0.00	47.35	0.00	353.00	3.59	7424.00	0.00	75.54
Δ Euribor_L1	0.00	1.00	0.01	1380.00	538.00	19.52	0.00	450.00	4.58	0.00	0.00	0.00	0.00	0.00	0.00
Δ Euribor_L2	0.00	4.00	0.04	52.00	4834.00	49.72	7842.00	0.00	79.79	0.00	93.00	0.95	132.00	0.00	1.34
Δ €STR_L1	0.00	964.00	9.81	4645.00	466.00	52.00	173.00	0.00	1.76	172.00	62.00	2.38	0.00	0.00	0.00
Δ €STR_L2	1616.00	0.00	16.44	2662.00	1365.00	40.97	4517.00	0.00	45.96	9828.00	0.00	100.00	4820.00	0.00	49.04
Δ VSTOXX_L1	3372.00	0.00	34.31	1813.00	239.00	20.88	0.00	0.00	0.00	0.00	7505.00	76.36	0.00	0.00	0.00
Δ VSTOXX_L2	89.00	0.00	0.91	2026.00	596.00	26.68	625.00	0.00	6.36	6074.00	0.00	61.80	5618.00	0.00	57.16
Δ ILS1Y_L1	9828.00	0.00	100.00	3041.00	0.00	30.94	0.00	0.00	0.00	0.00	5025.00	51.13	0.00	0.00	0.00
Δ ILS1Y_L2	0.00	241.00	2.45	0.00	3598.00	36.61	0.00	1145.00	11.65	0.00	0.00	0.00	0.00	0.00	0.00
Δ Y_L1	0.00	77.00	0.78	3263.00	0.00	33.20	8.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00
Δ Y_L2	0.00	0.00	0.00	0.00	1175.00	11.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: For each tail index regression, the positive (+) and negative (–) columns report the number of times a given variable was statistically significant with the respective sign. The percentage (%) column indicates the proportion of times the coefficient was significant at the 10% level. For the first maturity, we tested 4004 and, for the remainder, 9828 specifications.

.C.2 The post-SDC and Zero Lower Bound period - [2013-2020]

Table 11: Right Tail Robustness to Model Specifications - [2013-2020]

	Z_{1Y}			Z_{2Y}			Z_{3Y}			Z_{4Y}			Z_{5Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	0.00	0.00	0.00	0.00	3458.00	35.19	180.00	0.00	1.83	0.00	2.00	0.02	0.00	3541.00	36.03
Δ EUROSTOXX50_L2	0.00	0.00	0.00	0.00	458.00	4.66	0.00	599.00	6.09	0.00	0.00	0.00	0.00	5388.00	54.82
Δ EUR/USD_L1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ EUR/USD_L2	1531.00	0.00	38.24	0.00	0.00	0.00	3467.00	0.00	35.28	0.00	0.00	0.00	89.00	0.00	0.91
Δ Oil_Price_L1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7050.00	71.73	0.00	0.00	0.00	0.00	0.00	0.00
Δ Oil_Price_L2	0.00	3031.00	75.70	0.00	3656.00	37.20	0.00	4698.00	47.80	0.00	8659.00	88.11	0.00	2.00	0.02
Δ Euribor_L1	0.00	0.00	0.00	0.00	42.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ Euribor_L2	0.00	0.00	0.00	54.00	0.00	0.55	0.00	54.00	0.55	36.00	0.00	0.37	0.00	0.00	0.00
Δ €STR_L1	0.00	3999.00	99.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1306.00	13.29	0.00	0.00	0.00
Δ €STR_L2	409.00	0.00	10.21	8238.00	0.00	83.82	9828.00	0.00	100.00	7954.00	0.00	80.93	9624.00	0.00	97.92
Δ VSTOXX_L1	0.00	0.00	0.00	0.00	3456.00	35.16	0.00	1229.00	12.51	833.00	0.00	8.48	225.00	0.00	2.29
Δ VSTOXX_L2	0.00	37.00	0.92	0.00	2233.00	22.72	0.00	521.00	5.30	135.00	0.00	1.37	0.00	3433.00	34.93
Δ ILS1Y_L1	4004.00	0.00	100.00	6370.00	2420.00	89.44	5393.00	0.00	54.87	6370.00	0.00	64.81	6370.00	0.00	64.81
Δ ILS1Y_L2	0.00	0.00	0.00	1.00	4.00	0.05	0.00	0.00	0.00	0.00	1092.00	11.11	0.00	2813.00	28.62
Δ Y_L1	-	-	-	9828.00	0.00	100.00	9828.00	0.00	100.00	9828.00	0.00	100.00	9828.00	0.00	100.00
Δ Y_L2	-	-	-	1193.00	0.00	12.14	0.00	0.00	0.00	3569.00	0.00	36.31	945.00	0.00	9.62

Table 12: Right Tail Robustness to Model Specifications (cont.) - [2013-2020]

	Z_{6Y}			Z_{7Y}			Z_{8Y}			Z_{9Y}			Z_{10Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	0.00	4204.00	42.78	0.00	611.00	6.22	0.00	62.00	0.63	0.00	5.00	0.05	0.00	6669.00	67.86
Δ EUROSTOXX50_L2	0.00	1446.00	14.71	2.00	3876.00	39.46	0.00	4591.00	46.71	1391.00	0.00	14.15	0.00	798.00	8.12
Δ EUR/USD_L1	0.00	4060.00	41.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ EUR/USD_L2	6444.00	0.00	65.57	4620.00	0.00	47.01	0.00	0.00	0.00	3018.00	0.00	30.71	0.00	0.00	0.00
Δ Oil_Price_L1	0.00	695.00	7.07	0.00	5460.00	55.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ Oil_Price_L2	0.00	0.00	0.00	0.00	0.00	0.00	7735.00	0.00	78.70	3273.00	0.00	33.30	175.00	0.00	1.78
Δ Euribor_L1	0.00	0.00	0.00	43.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	1745.00	0.00	17.76
Δ Euribor_L2	2646.00	0.00	26.92	33.00	0.00	0.34	0.00	0.00	0.00	5352.00	0.00	54.46	6762.00	0.00	68.80
Δ €STR_L1	0.00	0.00	0.00	0.00	261.00	2.66	0.00	9828.00	100.00	0.00	9828.00	100.00	0.00	9828.00	100.00
Δ €STR_L2	8235.00	0.00	83.79	0.00	2182.00	22.20	4926.00	0.00	50.12	4318.00	0.00	43.94	2836.00	0.00	28.86
Δ VSTOXX_L1	687.00	0.00	6.99	0.00	0.00	0.00	0.00	0.00	0.00	343.00	0.00	3.49	5853.00	0.00	59.55
Δ VSTOXX_L2	0.00	0.00	0.00	9724.00	0.00	98.94	0.00	2075.00	21.11	0.00	229.00	2.33	0.00	352.00	3.58
Δ ILS1Y_L1	6258.00	0.00	63.68	0.00	3458.00	35.19	3974.00	0.00	40.44	804.00	3458.00	43.37	0.00	1186.00	12.07
Δ ILS1Y_L2	0.00	1236.00	12.58	6343.00	0.00	64.54	0.00	565.00	5.75	1226.00	0.00	12.47	0.00	1092.00	11.11
Δ Y_L1	9828.00	0.00	100.00	9828.00	0.00	100.00	9828.00	0.00	100.00	9828.00	0.00	100.00	9828.00	0.00	100.00
Δ Y_L2	9828.00	0.00	100.00	3768.00	0.00	38.34	150.00	0.00	1.53	3458.00	136.00	36.57	3575.00	0.00	36.38

Note: For each tail index regression, the positive (+) and negative (–) columns report the number of times a given variable was statistically significant with the respective sign. The percentage (%) column indicates the proportion of times the coefficient was significant at the 10% level. For the first maturity, we tested 4004 and, for the remainder, 9828 specifications.

Table 13: Left Tail Robustness to Model Specifications - [2013-2020]

	Z_{1Y}			Z_{2Y}			Z_{3Y}			Z_{4Y}			Z_{5Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	0.00	4004.00	100.00	0.00	0.00	0.00	0.00	16.00	0.16	0.00	0.00	0.00	339.00	0.00	3.45
Δ EUROSTOXX50_L2	73.00	441.00	12.84	73.00	0.00	0.74	0.00	3458.00	35.19	0.00	0.00	0.00	0.00	951.00	9.68
Δ EUR/USD_L1	346.00	0.00	8.64	5666.00	0.00	57.65	7828.00	0.00	79.65	8148.00	0.00	82.91	9481.00	0.00	96.47
Δ EUR/USD_L2	0.00	1264.00	31.57	0.00	374.00	3.81	0.00	3947.00	40.16	0.00	9818.00	99.90	0.00	2954.00	30.06
Δ Oil_Price_L1	610.00	0.00	15.23	4521.00	0.00	46.00	661.00	0.00	6.73	0.00	638.00	6.49	0.00	2792.00	28.41
Δ Oil_Price_L2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ Euribor_L1	87.00	0.00	2.17	2769.00	0.00	28.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	200.00	2.04
Δ Euribor_L2	0.00	0.00	0.00	4102.00	0.00	41.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ €STR_L1	0.00	0.00	0.00	0.00	9272.00	94.34	0.00	8197.00	83.40	0.00	2371.00	24.12	0.00	1635.00	16.64
Δ €STR_L2	623.00	0.00	15.56	9828.00	0.00	100.00	1898.00	0.00	19.31	9346.00	0.00	95.10	0.00	0.00	0.00
Δ VSTOXX_L1	0.00	78.00	1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6215.00	0.00	63.24
Δ VSTOXX_L2	0.00	4004.00	100.00	0.00	3736.00	38.01	0.00	3392.00	34.51	0.00	0.00	0.00	0.00	1553.00	15.80
Δ ILS1Y_L1	0.00	0.00	0.00	3458.00	0.00	35.19	2947.00	0.00	29.99	132.00	6370.00	66.16	92.00	4323.00	44.92
Δ ILS1Y_L2	0.00	4004.00	100.00	0.00	8685.00	88.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ Y_L1	-	-	-	0.00	9828.00	100.00	0.00	9828.00	100.00	0.00	9828.00	100.00	0.00	9828.00	100.00
Δ Y_L2	-	-	-	0.00	3071.00	31.25	0.00	2162.00	22.00	0.00	3458.00	35.19	0.00	188.00	1.91

Table 14: Left Tail Robustness to Model Specifications (cont.) - [2013-2020]

	Z_{6Y}			Z_{7Y}			Z_{8Y}			Z_{9Y}			Z_{10Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	0.00	0.00	0.00	0.00	2228.00	22.67	0.00	0.00	0.00	1668.00	0.00	16.97	891.00	0.00	9.07
Δ EUROSTOXX50_L2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1945.00	19.79	113.00	0.00	1.15	0.00	0.00	0.00
Δ EUR/USD_L1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2033.00	20.69	1050.00	0.00	10.68	110.00	0.00	1.12
Δ EUR/USD_L2	0.00	9825.00	99.97	0.00	9828.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7695.00	78.30
Δ Oil_Price_L1	0.00	0.00	0.00	139.00	0.00	1.41	0.00	626.00	6.37	4520.00	0.00	45.99	2331.00	0.00	23.72
Δ Oil_Price_L2	0.00	0.00	0.00	0.00	9828.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ Euribor_L1	0.00	0.00	0.00	0.00	0.00	0.00	9112.00	0.00	92.71	0.00	0.00	0.00	0.00	0.00	0.00
Δ Euribor_L2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ €STR_L1	24.00	0.00	0.24	0.00	3786.00	38.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ €STR_L2	0.00	0.00	0.00	0.00	1674.00	17.03	9828.00	0.00	100.00	0.00	209.00	2.13	0.00	0.00	0.00
Δ VSTOXX_L1	938.00	0.00	9.54	4350.00	0.00	44.26	0.00	0.00	0.00	0.00	22.00	0.22	537.00	0.00	5.46
Δ VSTOXX_L2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1082.00	11.01	0.00	0.00	0.00	0.00	0.00	0.00
Δ ILS1Y_L1	546.00	0.00	5.56	3458.00	0.00	35.19	333.00	0.00	3.39	3458.00	0.00	35.19	734.00	0.00	7.47
Δ ILS1Y_L2	0.00	1794.00	18.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ Y_L1	0.00	9828.00	100.00	0.00	9828.00	100.00	0.00	9828.00	100.00	0.00	9828.00	100.00	0.00	9828.00	100.00
Δ Y_L2	0.00	1430.00	14.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3458.00	35.19	0.00	2661.00	27.08

Note: For each tail index regression, the positive (+) and negative (–) columns report the number of times a given variable was statistically significant with the respective sign. The percentage (%) column indicates the proportion of times the coefficient was significant at the 10% level. For the first maturity, we tested 4004 and, for the remainder, 9828 specifications.

.C.3 The COVID-19 crisis period - [2020-2025]

Table 15: Right Tail Robustness to Model Specifications - [2020-2025]

	Z_{1Y}			Z_{2Y}			Z_{3Y}			Z_{4Y}			Z_{5Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	0.00	1175.00	29.35	7465.00	0.00	75.96	228.00	0.00	2.32	765.00	110.00	8.90	0.00	0.00	0.00
Δ EUROSTOXX50_L2	1257.00	0.00	31.39	0.00	28.00	0.28	0.00	3.00	0.03	1853.00	0.00	18.85	0.00	0.00	0.00
Δ EUR/USD_L1	0.00	747.00	18.66	96.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ EUR/USD_L2	20.00	0.00	0.50	0.00	6591.00	67.06	563.00	0.00	5.73	0.00	0.00	0.00	0.00	0.00	0.00
Δ Oil_Price_L1	0.00	770.00	19.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6737.00	68.55	0.00	19.00	0.19
Δ Oil_Price_L2	0.00	308.00	7.69	0.00	7096.00	72.20	0.00	9828.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ Euribor_L1	0.00	812.00	20.28	0.00	124.00	1.26	5.00	0.00	0.05	63.00	0.00	0.64	0.00	40.00	0.41
Δ Euribor_L2	36.00	0.00	0.90	0.00	0.00	0.00	5545.00	0.00	56.42	0.00	6370.00	64.81	2374.00	0.00	24.16
Δ €STR_L1	2812.00	0.00	70.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ €STR_L2	17.00	0.00	0.42	0.00	0.00	0.00	9524.00	0.00	96.91	0.00	7038.00	71.61	1374.00	0.00	13.98
Δ VSTOXX_L1	3226.00	0.00	80.57	0.00	1572.00	16.00	0.00	0.00	0.00	1699.00	0.00	17.29	0.00	0.00	0.00
Δ VSTOXX_L2	1325.00	0.00	33.09	0.00	0.00	0.00	1305.00	0.00	13.28	0.00	2111.00	21.48	0.00	0.00	0.00
Δ ILS1Y_L1	3378.00	0.00	84.37	383.00	0.00	3.90	2610.00	0.00	26.56	883.00	0.00	8.98	8910.00	0.00	90.66
Δ ILS1Y_L2	215.00	0.00	5.37	11.00	0.00	0.11	6250.00	0.00	63.59	0.00	0.00	0.00	0.00	91.00	0.93
Δ Y_L1	-	-	-	9828.00	0.00	100.00	9828.00	0.00	100.00	9676.00	0.00	98.45	6789.00	0.00	69.08
Δ Y_L2	-	-	-	0.00	0.00	0.00	775.00	622.00	14.21	1170.00	0.00	11.90	46.00	0.00	0.47

Table 16: Right Tail Robustness to Model Specifications (cont.) - [2020-2025]

	Z_{6Y}			Z_{7Y}			Z_{8Y}			Z_{9Y}			Z_{10Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	0.00	0.00	0.00	6558.00	0.00	66.73	1.00	0.00	0.01	2978.00	0.00	30.30	0.00	0.00	0.00
Δ EUROSTOXX50_L2	0.00	2625.00	26.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	568.00	5.78	0.00	35.00	0.36
Δ EUR/USD_L1	0.00	0.00	0.00	0.00	74.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ EUR/USD_L2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9828.00	100.00	0.00	0.00	0.00	0.00
Δ Oil_Price_L1	0.00	2911.00	29.62	0.00	0.00	0.00	0.00	26.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00
Δ Oil_Price_L2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2988.00	30.40	0.00	0.00	0.00	0.00	0.00	0.00
Δ Euribor_L1	1763.00	0.00	17.94	0.00	3458.00	35.19	0.00	2141.00	21.78	0.00	0.00	0.00	0.00	0.00	0.00
Δ Euribor_L2	0.00	1.00	0.01	0.00	17.00	0.17	0.00	5719.00	58.19	0.00	0.00	0.00	0.00	4292.00	43.67
Δ €STR_L1	4573.00	0.00	46.53	3524.00	0.00	35.86	9828.00	0.00	100.00	66.00	0.00	0.67	744.00	0.00	7.57
Δ €STR_L2	0.00	0.00	0.00	11.00	0.00	0.11	30.00	3672.00	37.67	0.00	0.00	0.00	774.00	0.00	7.88
Δ VSTOXX_L1	14.00	0.00	0.14	0.00	5632.00	57.31	0.00	0.00	0.00	0.00	4545.00	46.25	0.00	0.00	0.00
Δ VSTOXX_L2	5753.00	0.00	58.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Δ ILS1Y_L1	0.00	0.00	0.00	7394.00	0.00	75.23	239.00	0.00	2.43	4807.00	0.00	48.91	2512.00	0.00	25.56
Δ ILS1Y_L2	0.00	0.00	0.00	5125.00	0.00	52.15	3268.00	0.00	33.25	0.00	29.00	0.30	2771.00	0.00	28.19
Δ Y_L1	9801.00	0.00	99.73	9182.00	0.00	93.43	4944.00	0.00	50.31	6300.00	0.00	64.10	147.00	0.00	1.50
Δ Y_L2	0.00	0.00	0.00	0.00	0.00	0.00	7841.00	0.00	79.78	41.00	0.00	0.42	9828.00	0.00	100.00

Note: For each tail index regression, the positive (+) and negative (–) columns report the number of times a given variable was statistically significant with the respective sign. The percentage (%) column indicates the proportion of times the coefficient was significant at the 10% level. For the first maturity, we tested 4004 and, for the remainder, 9828 specifications.

Table 17: Left Tail Robustness to Model Specifications - [2020-2025]

	Z_{1Y}			Z_{2Y}			Z_{3Y}			Z_{4Y}			Z_{5Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	1833.00	0.00	45.78	0.00	0.00	0.00	3221.00	0.00	32.77	1603.00	0.00	16.31	2.00	0.00	0.02
Δ EUROSTOXX50_L2	0.00	1946.00	48.60	0.00	0.00	0.00	1532.00	0.00	15.59	980.00	0.00	9.97	2257.00	0.00	22.96
Δ EUR/USD_L1	0.00	1623.00	40.53	0.00	4471.00	45.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9828.00	100.00
Δ EUR/USD_L2	0.00	0.00	0.00	0.00	6279.00	63.89	0.00	9786.00	99.57	0.00	0.00	0.00	0.00	9420.00	95.85
Δ Oil_Price_L1	995.00	0.00	24.85	0.00	0.00	0.00	0.00	0.00	0.00	323.00	0.00	3.29	0.00	0.00	0.00
Δ Oil_Price_L2	691.00	0.00	17.26	230.00	0.00	2.34	0.00	32.00	0.33	1881.00	0.00	19.14	538.00	0.00	5.47
Δ Euribor_L1	0.00	0.00	0.00	0.00	0.00	0.00	2525.00	0.00	25.69	0.00	0.00	0.00	1730.00	0.00	17.60
Δ Euribor_L2	0.00	1.00	0.02	0.00	3458.00	35.19	0.00	14.00	0.14	0.00	3236.00	32.93	0.00	1030.00	10.48
Δ €STR_L1	0.00	12.00	0.30	0.00	0.00	0.00	0.00	3285.00	33.42	0.00	2493.00	25.37	0.00	523.00	5.32
Δ €STR_L2	7.00	0.00	0.17	6613.00	0.00	67.29	70.00	2.00	0.73	4205.00	0.00	42.79	352.00	275.00	6.38
Δ VSTOXX_L1	0.00	1684.00	42.06	0.00	0.00	0.00	3268.00	0.00	33.25	3594.00	0.00	36.57	0.00	0.00	0.00
Δ VSTOXX_L2	238.00	0.00	5.94	1.00	0.00	0.01	1376.00	0.00	14.00	0.00	0.00	0.00	0.00	1753.00	17.84
Δ ILS1Y_L1	0.00	1247.00	31.14	2.00	4765.00	48.50	298.00	0.00	3.03	0.00	0.00	0.00	0.00	60.00	0.61
Δ ILS1Y_L2	0.00	0.00	0.00	5088.00	0.00	51.77	33.00	0.00	0.34	0.00	0.00	0.00	1650.00	0.00	16.79
Δ Y_L1	-	-	-	0.00	7007.00	71.30	9651.00	98.20	0.00	1702.00	17.32	0.00	2194.00	22.32	0.00
Δ Y_L2	-	-	-	0.00	2450.00	24.93	0.00	281.00	2.86	0.00	0.00	0.00	0.00	0.00	0.00

Table 18: Left Tail Robustness to Model Specifications (cont.) - [2020-2025]

	Z_{6Y}			Z_{7Y}			Z_{8Y}			Z_{9Y}			Z_{10Y}		
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%
Δ EUROSTOXX50_L1	1685.00	0.00	17.14	1257.00	0.00	12.79	0.00	0.00	0.00	5289.00	0.00	53.82	1.00	0.00	0.01
Δ EUROSTOXX50_L2	4187.00	0.00	42.60	5074.00	0.00	51.63	467.00	0.00	4.75	4070.00	0.00	41.41	4772.00	0.00	48.56
Δ EUR/USD_L1	0.00	9784.00	99.55	0.00	1.00	0.01	0.00	0.00	0.00	0.00	128.00	1.30	0.00	1105.00	11.24
Δ EUR/USD_L2	0.00	9828.00	100.00	0.00	213.00	2.17	0.00	222.00	2.26	0.00	229.00	2.33	0.00	9828.00	100.00
Δ Oil_Price_L1	2.00	558.00	5.70	0.00	2709.00	27.56	0.00	0.00	0.00	166.00	0.00	1.69	11.00	0.00	0.11
Δ Oil_Price_L2	1.00	0.00	0.01	5.00	0.00	0.05	8172.00	0.00	83.15	0.00	6206.00	63.15	0.00	2466.00	25.09
Δ Euribor_L1	465.00	209.00	6.86	0.00	9343.00	95.07	0.00	892.00	9.08	2609.00	0.00	26.55	0.00	0.00	0.00
Δ Euribor_L2	0.00	3647.00	37.11	825.00	0.00	8.39	0.00	210.00	2.14	0.00	289.00	2.94	0.00	39.00	0.40
Δ €STR_L1	0.00	8414.00	85.61	0.00	6370.00	64.81	0.00	5844.00	59.46	0.00	1982.00	20.17	0.00	6.00	0.06
Δ €STR_L2	2079.00	286.00	24.06	535.00	519.00	10.72	0.00	556.00	5.66	0.00	1674.00	17.03	0.00	91.00	0.93
Δ VSTOXX_L1	347.00	0.00	3.53	0.00	2817.00	28.66	0.00	73.00	0.74	0.00	6633.00	67.49	0.00	262.00	2.67
Δ VSTOXX_L2	0.00	5048.00	51.36	1686.00	0.00	17.16	0.00	477.00	4.85	0.00	3702.00	37.67	0.00	877.00	8.92
Δ ILS1Y_L1	0.00	7146.00	72.71	0.00	6806.00	69.25	0.00	3099.00	31.53	3.00	0.00	0.03	0.00	0.00	0.00
Δ ILS1Y_L2	0.00	0.00	0.00	0.00	265.00	2.70	0.00	0.00	0.00	280.00	0.00	2.85	0.00	0.00	0.00
Δ Y_L1	0.00	6070.00	61.76	0.00	9828.00	100.00	0.00	6996.00	71.18	0.00	8829.00	89.84	0.00	5873.00	59.76
Δ Y_L2	0.00	0.00	0.00	34.00	0.00	0.35	256.00	0.00	2.60	0.00	48.00	0.49	0.00	0.00	0.00

Note: For each tail index regression, the positive (+) and negative (–) columns report the number of times a given variable was statistically significant with the respective sign. The percentage (%) column indicates the proportion of times the coefficient was significant at the 10% level. For the first maturity, we tested 4004 and, for the remainder, 9828 specifications.