



Emerging Markets Group

EMG Working Paper Series

WP-EMG-03-2026

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January 2026

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ECBetas in Equity Strategy Returns*

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First Draft: December 2025

Current Draft: January 2026

Abstract

Using high-frequency overnight index swap (OIS) surprises around ECB Governing Council meetings, we uncover a sharp monetary policy risk–return tradeoff in a cross-section of 153 long–short equity factors. Equity strategies more exposed to ECB monetary policy shocks – those with lower OIS betas – earn higher excess returns and Sharpe ratios. Results strengthen using asset pricing methods that account for measurement errors and omitted variables. This risk premium arises primarily in the press release window – i.e. the monetary policy *decision* – and displays a tent-shaped pattern that peaks with OIS surprises between six-month and two-year tenors.

Keywords: Monetary policy; financial markets; asset pricing; European Central Bank; equity factor models; risk premium.

JEL Codes: E32; E44; E52; G12; G15.

*We are grateful for comments and suggestions to Alessandro Secchi and Roberta Zizza. All errors are the authors' responsibility. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy. For the purpose of open access, the authors have applied a Creative Commons Attribution (CC BY) license to any Author Accepted Manuscript version arising from this submission.

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I Introduction

At the core of asset pricing lies the question of what drives risk and expected returns. To answer this question, understanding discount-rate variation and macro-finance linkages is of paramount importance (Cochrane, 2011, 2017). Accordingly, the interaction between monetary policy and asset pricing is at the forefront of this research agenda, given that central bank policy decisions and their associated communications are carefully dissected by investors. This paper asks whether the returns of equity strategy factors employed by a vast asset management industry exhibit a risk-return tradeoff that can be attributed to the factors' exposures to monetary policy surprises. Put simply, do equity portfolios sorted on characteristics earn differential compensation for bearing monetary policy risk? We address this question in the euro-area setting, where the institutional features of the European Central Bank (ECB) and data quality permit sharp identification of monetary policy shocks to address our question compellingly.

Our focus on the cross-section of equity factors is a distinctive feature in this line of research, as previous studies have examined the stock market response to monetary policy shocks (typically in the US) by focusing either on stock market indices (e.g., Bernanke and Kuttner, 2005) or on the cross-section of individual stocks (e.g., Ozdagli and Velikov, 2020). However, monetary policy can have offsetting effects on stock indices: monetary policy easing lowers discount rates (positive for equities) but can signal weaker growth (negative for cash flows). In an index, these forces can offset each other, making results ambiguous. Moreover, indices aggregate away heterogeneity, so that broad benchmarks (e.g., Euro Stoxx 50, S&P 500) provide an average response across stocks but hide which underlying firms or investment styles are driving the effect. At the same time, single-stock returns are strongly driven by firm-specific news, liquidity, and idiosyncratic volatility, which makes it hard to extract systematic monetary policy effects. Increasingly, asset pricing and asset allocation in equity markets are guided by factor models, since factor portfolios — such as value, size, momentum — eliminate much of the idiosyncratic noise in individual stocks, leaving only the systematic component of returns that should be priced. As a result, analyzing how factor returns respond to monetary policy surprises provides a clean mapping from monetary policy to the compensation investors require for bearing risk in

equity markets.¹

Focusing on the euro area offers a distinct laboratory to study the equity market effects of monetary policy, for two main reasons. First, the ECB has a simple, single mandate of price stability. This institutional framework differs from the United States, where the Fed has a dual mandate that involves both employment and price stability. Mandate differences are likely to influence both policy decisions and the content of communication from central bank officials we want to analyze. Under the dual mandate, the price stability effect of monetary policy on asset prices could be diluted by the stabilization effect of monetary policy that is designed to support growth and employment, potentially resulting in offsetting effects and, in extreme cases, negative risk premia (e.g., [Ozdogli and Velikov, 2020](#)). By contrast, ECB policy rate decisions should be entirely driven by its price stability remit.² This makes identification of shocks and interpretation of results more straightforward. Second, the availability of high-quality public datasets suitable for our purposes makes the euro area particularly well-suited. The Euro Area Monetary Policy Event-Study Database, or EAMPD ([Altavilla, Brugnolini, Gürkaynak, Motto and Ragusa, 2019](#)) provides high-frequency asset price changes around and within ECB Governing Council (GC) monetary policy meetings. This is important as the ECB’s communication on GC meeting days, which has been a regular feature at the GC press conferences held since 2001, conveys more information than the mere policy decision, which makes by itself the euro area an instructive case study ([Andrade and Ferroni, 2021](#)), which yet remains understudied ([Altavilla, Bussiere, Galí, Gorodnichenko, Gürkaynak and Rey, 2024](#)). Moreover, the Euro Area Communication Event-Study Database, or EACED ([Istrefi, Odendahl and Sestieri, 2025](#)) allows us to identify and quantify the market impact of policymakers’ statements outside GC meetings. The combination of a single institutional mandate and this granular data infrastructure makes the euro area a natural laboratory for analyzing the transmission of monetary policy to equity markets.³

¹We conduct analyses for 153 equity factors and for their corresponding 13 themes, as detailed later. The argument above applies to both factors, i.e. long-short strategies, and themes, which are equally-weighted combinations of long-short strategies belonging to the same cluster. The clustering of factors follows the allocation of [Jensen, Kelly and Pedersen \(2023\)](#) who propose a factor taxonomy that classifies factors into themes possessing a high degree of within-theme return correlation and economic concept similarity, and low across-theme correlation.

²The ECB also has responsibility with respect to financial stability and fragmentation risks. While these are additional elements of the ECB mandate, they are not pursued typically via interest-rate policies, rather using different policy tools.

³Putting aside the desirable features of the euro area for our purposes, it is also worth noting that by Dec/2024 euro area equity markets within the EMU accounted for 6.90% of global market capitalization, ranking second only behind the US. Moreover, this share is concentrated in the main five markets: Germany, France, Italy, Spain, and the Netherlands, which together make up 6.28% of global market capitalization. These five markets combined still rank second globally, ahead of Japan (5.73%), the UK (2.26%) and China (3.00%), respectively. Yet, euro area markets remain overall unexplored.

In the empirical analysis, we mainly use two sets of data: (i) the excess returns from the equity investment strategies of [Jensen et al. \(2023\)](#), which cover 153 high-minus-low procyclical equity factors that can be conveniently clustered into 13 themes (e.g., value, momentum, investment); and (ii) the high-frequency, intraday changes in euro area asset prices around the ECB GC meetings of [Altavilla et al. \(2019\)](#). The latter data measure the surprises arising in three windows: the full monetary event window (hereafter “mew”); the initial press release window (hereafter “prw”), which corresponds to the release of the policy decision/statement; and the subsequent press conference window (hereafter “pcw”), which captures the subsequent communication phase. Clearly, mew includes both prw and pcw. Therefore, these data enable us to distinguish the effects of the policy decision itself from the additional information conveyed during the ECB President’s remarks and Q&A session. Furthermore, they contain highly granular information for each window, providing the high-frequency changes in various asset prices, including those in overnight index swap (OIS) rates of different tenors. This additional information is useful for shedding light on the type of surprise (e.g., target, path, forward guidance) which matters most to equity investors, without relying on any factor model. The empirical analysis covers the period from 1999 (the first ECB monetary meeting was in July) to December 2024.⁴

The empirical strategy is as follows: first, for a given high-frequency surprise and time window (e.g., the 1-year OIS rate in mew), we estimate the time-varying “ECB betas” by regressing the equity strategy returns on the day of the GC meeting on the surprise, using either a rolling or recursive scheme. These betas provide a direct measure of the strategy’s exposure to the monetary policy surprise, allowing shifts in the strategy sensitivity, without being too concerned about modeling the driver of such shifts. In short, we allow the data to speak for itself, without imposing much structure on the ultimate driver of the exposure. We then sort the strategies into portfolios in real time according to their estimated ECB betas. From these portfolios, we construct spread portfolios, which go long strategies with low OIS betas (high risk) and short those with high OIS betas (low risk). These long-short strategies are of particular interest because they provide information on the compensation that investors require for being exposed to monetary policy shocks of different sources.

⁴To obtain the euro area equity strategy returns, we average over the equity strategy returns of the five largest equity markets. This is because we are not interested in studying how monetary policy surprises affect fragmentation risks, or country heterogeneity, in euro area equity strategy returns, in line with the arguments in [Altavilla et al. \(2024\)](#). This dimension is, of course, an important feature of the euro area setting, which we leave for future research and mainly pertains to unconventional policies (e.g., [Eser and Schwaab, 2016](#); [Koijen, Koulischer, Nguyen and Yogo, 2021](#)). In this study, we are instead mainly concerned with establishing the results at the euro area level.

In empirical asset pricing, it is standard practice to estimate asset risk exposures, or betas, by regressing asset returns on risk factor shocks and subsequently sorting assets based on the estimated exposures (e.g., [Pástor and Stambaugh, 2003](#); [Ang, Chen and Xing, 2006](#)). If a risk factor (the OIS surprises in our case) is a systematic source of risk and is therefore a priced factor, one would expect portfolios sorted by beta exposure to generate significant differences in average returns. This implies that, if monetary policy is a systematic, priced source of risk in equity strategy returns, then strategies hedging against monetary policy tightening shocks (i.e. positive OIS surprises) should be costly and provide lower average returns. Conversely, strategies yielding low returns when OIS surprises are contractionary should yield higher returns in equilibrium. In other words, if buying low OIS beta strategies and selling high OIS beta strategies on average yields a positive return, there is a positive risk-return tradeoff in equity strategy returns due to monetary policy shocks. Forming these spread portfolios separately for each event window and OIS rate enables us to identify the event stages and maturities driving the risk-return tradeoff.

While it is common in much empirical asset pricing research, it is well-known that the beta-sorting procedure is inherently susceptible to measurement error. For instance, beta estimation hinges on arbitrary choices regarding the estimation window and model specification, while the sorting of assets into portfolios requires further choices (e.g. the timing and frequency of portfolio rebalancing). In the case of tradable factors, measurement error may also reflect exposure to unpriced risk (e.g. non-diversifiable errors in the portfolio) or idiosyncratic risk that is not fully diversified ([Daniel, Mota, Rottke and Santos, 2020](#); [Giglio and Xiu, 2021](#); [Giglio, Xiu and Zhang, 2024](#)). Additionally, standard two-pass asset pricing tests on the portfolios are susceptible to omitted variable bias. Therefore, we employ the three-pass estimator of [Giglio and Xiu \(2021\)](#), combined with the RP-PCA method of [Lettau and Pelger \(2020a,b\)](#), to obtain robust estimates of the spread portfolio risk premia that are free from both measurement error and omitted variable bias (“de-noised”). The three-pass estimates of the de-noised spread portfolio excess returns represent the returns that can be expected in equilibrium based on the latent-factor stochastic discount factor (SDF). Therefore, the sample mean of the de-noised factor (or spread portfolio return) is the factor’s risk premium, whereas the sample mean of the raw, noisy factor

is not necessarily equal to its risk premium.⁵

Before turning to the portfolio analysis, we show that OIS surprises generate a significant spread in strategy theme returns, particularly for short-term OIS surprises as measured in the press release window. However, we also show that investment strategy exposures to OIS surprises (or ECB betas) and their dispersion across strategies vary over time. This also means that sometimes a strategy can be classified as highly exposed to monetary policy, while at other times in the sample it is weakly exposed. This evidence lends support to the subsequent beta-sort portfolio analysis, which allows us to account dynamically for the switches in the factor exposures (remaining agnostic about the ultimate cause of the switch). The evidence on the risk premia will then help us shed light on the types of monetary policy shocks that matter to investors, contributing to the risk-return tradeoffs in equity investment strategies.

The empirical analysis reveals several key findings. The main finding is that monetary policy shocks arising from GC meetings contribute to determining a positive and substantial risk–return tradeoff in euro area equity strategy returns. Using the full event window, we observe that portfolio returns decrease monotonically from lower OIS-beta (riskier) portfolios to higher OIS-beta (hedging) portfolios, which is consistent with investors demanding compensation for exposure to policy tightening. The resulting average returns of the spread portfolios are both economically and statistically significant.

However, we also find that not all monetary policy surprises are alike. First, this evidence is stronger for portfolios sorted on short-to-medium term OIS rate surprises. Second, we show that this positive relationship between risk exposures and returns entirely originates in the press release window, with prw shocks captured by high-frequency OIS rates with maturities ranging from 6M to 1Y playing a dominant role – see Figure 1, which reports results for prw (Panel A) and pcw (Panel B). We find evidence of a tent-like shape for the prw spread portfolio excess returns and Sharpe ratios, with the Sharpe ratio reaching values above 0.5 around these maturities (top left panel of Figure 1). By contrast, portfolios formed using surprises from the press conference window (Panel B of Figure 1) display very different properties, resulting generally in insignificant

⁵Specifically, the RP-PCA method enables us to recover the optimal latent-factor SDF from the cross-section of equity strategy returns (i.e., the test assets). In brief, the SDF is optimal in the sense that it fully spans the cross-section of test assets, while maximizing the tangency portfolio’s Sharpe ratio. The three-pass method then delivers estimates of the risk premia of the spread portfolios (i.e. the candidate factors) by projecting the candidate factors onto the latent factors that drive the optimal SDF. Thus, as a by-product of applying this combined procedure, we also shed light on the SDF pricing euro area strategy returns. This augmented three-pass procedure has been used, for example, in currency markets by [Nucera, Sarno and Zinna \(2024\)](#) and [Li, Sarno and Zinna \(2025\)](#).

spread average returns and low (absolute) Sharpe ratios, which is especially clear with de-noised pcw spread returns. This seems to suggest that what ultimately matters for equity strategy investors are both the target and path shocks associated with policy rate announcements.⁶ Overall, this evidence is consistent with the notion that tightening surprises in prw (short-term) OIS rates are associated with bad news from an investor perspective, leading to lower future consumption and higher marginal utility (e.g., [Weber, 2018](#); [Pflueger and Rinaldi, 2022](#)). Strategies that are most exposed to tightening surprises are riskier and provide high average excess returns. By contrast, the portfolios least exposed to monetary policy surprises have statistically insignificant returns. Consequently, these latter portfolios are acyclical with respect to monetary policy surprises and, in this sense, act as hedges against monetary policy shocks.

[Figure 1 about here.]

Applying the three-pass estimator yields evidence that corroborates our earlier findings: (i) a positive risk-return tradeoff emerges during the press release window, and (ii) is captured by OIS surprises with approximately one-year maturities. In fact, the three-pass evidence is stronger due to the removal of measurement error and/or unpriced risk. The Sharpe ratios become twice as large when sorting on OIS surprises in the range between 6M to 2Y (reaching values around 1), accentuating the tent-like shape (bottom left panel of [Figure 1](#)). At the same time, this analysis confirms that spread portfolios sorted on the surprises arising in the press conference tend to have insignificant risk premia. We also show that the returns of the de-noised spread portfolios sorted on mew and prw OIS surprises with maturities of less than two years can be interpreted as compensation for exposure to monetary policy risk. Consistently, these portfolios respond negatively to positive surprises in euro area inflation and inflation uncertainty, which is understandable given the ECB’s price stability mandate.

Another way to conveniently characterize the risk-return tradeoff associated with monetary policy risk is to directly relate the equity theme monetary policy exposures to their average excess returns. To do so we regress the 13 themes excess returns on the de-noised spread portfolio returns, whereby the 153 strategy factors are dynamically sorted on their betas with respect to prw 1Y OIS surprises. Therefore, a higher positive loading on the spread factor reflects greater

⁶Zooming into the portfolio constituents of the portfolios sorted on 1Y OIS rate surprises from the prw, we find that the top two themes in the low OIS-beta quintile (long) portfolio are low risk and momentum. Notably, momentum and value stand out as they appear in the top five constituents of both corner portfolios. That is, these strategy themes sometimes behave as risky assets and sometimes as safe assets with respect to monetary policy surprises.

monetary policy risk exposure. Figure 2, Panel A shows a scatter plot that makes visually clear the sharp risk-return tradeoff and the heterogeneity of monetary policy risk exposures across themes. The vast majority of equity themes displays, as expected, positive exposures of various magnitudes. Highly profitable themes also tend to have higher loadings. However, it is also clear that some themes are largely neutral to monetary policy risk on average across time (profit growth, and short-term reversals), while one theme is negatively exposed to it (low-leverage).

[Figure 2 about here.]

Although this study focuses on monetary policy surprises arising in GC meetings, recent studies have shown that communication between meetings can also affect financial conditions. Therefore, we repeat the beta-sort analysis using surprises measured around ECB President and board members GC inter-meeting communication (say speeches for brevity), as presented by Istrefi et al. (2025), to provide some evidence on the effect of speeches on equity strategy returns. We find that ECB speeches can also be associated with a positive risk-return tradeoff, but only insofar as they influence short-term (one- and three-month) OIS rates. However, the risk premium is lower than that of the policy rate surprises. These initial findings suggest that ECB speeches are less relevant to equity investors than announcements about the policy rate, but they can still be relevant when they provide information about imminent policy actions. This largely supports the conjecture of Bauer and Swanson (2023b) that information revealed via communication mainly matters if it changes the market perception of near-term interest rate policy actions. We conduct extensive robustness checks and additional analyses, none of which invalidate the core results and takeaways of this paper.

The paper proceeds as follows. We first relate the paper to the literature. In Section II, we describe the data. In Section III, we estimate the ECB betas and sort strategies into portfolios, using raw OIS surprises. In Section IV, we apply the three-pass method to de-noise portfolios, and obtain estimates of the ECB monetary policy risk premium. In Section V, we present a number of robustness checks and additional analyses, while more details are provided in a separate Internet Appendix. Section VI concludes.

Related literature. This study relates to several strands of the macro-finance and asset-pricing literatures. First, it connects with the large literature examining the transmission of monetary policy to financial markets, and especially to equity markets. Early contributions, notably Bernanke and Kuttner (2005), document that unexpected monetary policy tightenings lower

aggregate stock prices. An expansionary monetary policy shock is expected to boost the stock market via lower yields, a lower equity premium, and higher expected dividends. Subsequent research shows that this effect operates primarily through the discount-rate channel, either via adjustments in risk-free rates or risk premia (e.g., [Gürkaynak, Sack and Swanson, 2005](#); [Bauer and Swanson, 2023b](#); [Li and Palomino, 2019](#); [Nagel and Xu, 2024](#)).⁷

Consistent with theory, contractionary monetary policy shocks are typically associated with bad news, leading to higher marginal utility. Assets that are more exposed to contractionary surprises must therefore earn higher premia to compensate investors. This mechanism arises both in New Keynesian models with nominal rigidities or habit formation through a consumption channel (e.g., [Weber, 2018](#); [Pflueger and Rinaldi, 2022](#)), and in intermediary asset-pricing and funding-liquidity models operating via a balance-sheet, risk-bearing channel (e.g., [Drechsler, Savov and Schnabl, 2018](#); [Kekre and Lenel, 2022](#); [Kashyap and Stein, 2023](#)).

While most research focuses on aggregate indices, some studies exploit heterogeneity across securities, trying to connect the dispersion in exposures to several characteristics (e.g., see [Ehrmann and Fratzscher, 2004](#); [Maio, 2014](#); [Chava and Hsu, 2020](#); [Gürkaynak, Karasoy-Can and Lee, 2022](#)). Other studies show heterogeneity across sectors; for instance, firms in interest-sensitive industries such as durable goods or construction exhibit amplified policy exposure ([Thorbecke, 1997](#); [Ehrmann and Fratzscher, 2004](#); [Bernanke and Kuttner, 2005](#); [Pflueger and Rinaldi, 2022](#)).⁸ Notably, some recent studies demonstrate that cross-sectional differences in policy exposures of individual stocks are not merely transitory, but can command compensation in expected returns. [Ozdagli and Velikov \(2020\)](#) find that US firms more positively exposed to expansionary monetary policy shocks (in the sense that their stock prices rise more when the Fed eases) earn lower average returns, indicating that in the US monetary policy risk is priced and carries a negative premium. This implies that most exposed firms act as hedges against adverse

⁷[Nagel and Xu \(2024\)](#) revisit the evidence in [Bernanke and Kuttner \(2005\)](#) and find no significant role for the cash-flow effects. That is, the data give no meaningful movement in prices attributable to either revised cash-flow expectations (dividends) or changed risk compensation for equity cash-flow risk, in the short window around FOMC announcements. See also [Knox and Vissing-Jorgensen \(2025\)](#).

⁸[Cieslak and Vissing-Jorgensen \(2020\)](#) show that negative equity returns predict subsequent rate cuts, implying that downside exposure to the business cycle is mitigated by expected monetary accommodation. This dynamics suggests that firms or portfolios with greater sensitivity to downturns (e.g., small or distressed stocks) may benefit disproportionately from a “Fed put”, leading to conditional differences in expected returns. [Knox and Vissing-Jorgensen \(2025\)](#) argue that the reaction function to news has been underappreciated, and may explain many of the equity market responses previously attributed to information effects. This matters because reaction function news can directly affect risk premia (e.g., by strengthening belief in the “Fed put”), whereas information effects mostly alter expectations of future growth. See also, [Odendahl, Pagliari, Penalver, Rossi and Sestieri \(2024\)](#), who show that shifts in the entire yield curve are important to understand the macroeconomy response to OIS surprises, so they conclude that the shape of the yield curve also matters.

macroeconomic conditions, which suggests that the Fed cuts rates in response to deteriorating economic conditions. [Ai, Han, Pan and Xu \(2022\)](#) provide direct evidence that stocks’ exposures to policy news explain variation in returns on FOMC announcement days, consistent with a risk-based interpretation of returns. These findings parallel the broader macro-finance literature showing that exposures to macroeconomic shocks — such as inflation ([Fama and Schwert, 1977](#); [Boudoukh, Richardson and Whitelaw, 1994](#); [Hong, Liu, Pan and Tian, 2024](#)) or global risk ([Fang, Liu and Roussanov, 2025](#)) — are systematically rewarded.⁹

Our first key contribution to the literature is to shift the focus from individual stock returns to equity investment strategies, which are widely used in both academia and by practitioners. The goal is to assess how such strategies respond to monetary policy surprises, and whether investors require a compensation in equilibrium for these exposures. By shifting the focus to systematic factor returns, we eliminate substantial idiosyncratic noise from individual stocks, a key tenet of a large asset pricing literature ([Cochrane, 2011](#)). This allows us to shed light more directly on how monetary policy surprises drive risk premia. To this end, we carry out the analysis in real time with tradable factor returns and observed policy shocks. To our knowledge, no previous study has analyzed the impact of monetary policy surprises on the cross-section of investment strategy returns.¹⁰

Our second contribution to the literature is to shift the equity asset pricing focus from the US to the euro area. We do so for several reasons. The ECB’s single inflation mandate can provide a cleaner setting for isolating discount-rate effects, especially when focusing on the press release window. However, in practice, the ECB also conveys information about the economic outlook, so this ultimately remains an empirical question. Yet, one would expect the output/employment stabilization role to be less relevant under the ECB’s single mandate of price stability, whereas in the US, both effects could be at play ([Ozdagli and Velikov, 2020](#)). Moreover,

⁹A parallel strand connects monetary policy to other asset classes, including corporate bonds ([Guo, Kontonikas and Maio, 2020](#)), exchange rates ([Antolin-Diaz, Cenedese, Han and Sarno, 2025](#)), and currency flows and loans ([Somogyi, Loualiche, Ward and Pecora, 2025](#)).

¹⁰A key debate is also whether stock market responses to announcements reflect “pure” monetary policy shocks or information effects, whereby central bank announcements may reveal private signals about the economic outlook. [Romer and Romer \(2000\)](#), [Campbell, Evans, Fisher and Justiniano \(2012\)](#), and [Nakamura and Steinsson \(2018\)](#) find evidence that policy tightenings sometimes coincide with upward revisions in growth expectations. More recent work, such as [Jarociński and Karadi \(2020\)](#), explicitly decomposes high-frequency policy surprises into monetary and information components. Information effects could mute the response of the equity market to monetary policy shocks, or reverse its sign. [Bauer and Swanson \(2023a\)](#) show that information effects can partly be explained by the Fed’s response to news. The relevance of information effects in equity markets appears modest in short windows around announcements ([Bauer and Swanson, 2023b](#)). Whilst we endeavor to isolate monetary policy shocks from information effects, by controlling for simultaneous changes in stock markets around announcement windows in estimation of exposures, our results are consistent with a discount-rate channel generating a positive risk premium in the cross-section of equity strategy returns.

the structure of the ECB GC monetary policy meetings (mew, prw and pcw) has been held constant essentially since the inception of the ECB, allowing us to analyze asset price changes around the release of interest rate decisions (prw) as well as the release of further information during the press conference (pcw), across the maturity dimension of the term structure of OIS rates. In essence, the comprehensive databases available for studying high-frequency asset price changes to monetary policy announcements in the euro area provide clean identification of monetary policy premia priced in equity strategy returns.¹¹

Beyond policy rate announcements, researchers highlight the role of communication also outside regular monetary policy meeting days (Leombroni, Vedolin, Venter and Whelan, 2021; Bauer and Swanson, 2023a,b; Swanson and Jayawickrema, 2023; Swanson, 2023; Cieslak and McMahon, 2024; Odendahl et al., 2024; Istrefi et al., 2025; Altavilla, Gürkaynak, Kind and Laeven, 2025; Knox and Vissing-Jorgensen, 2025), showing that speeches and testimonies by central bankers can move interest rates at least as much as formal announcements. While our main focus is on monetary policy shocks resulting from GC meetings, we also contribute to this discussion by analyzing the effect of ECB inter-meeting communication on equity strategy returns. To the best of our knowledge, we are unaware of any studies yet to document cross-sectional heterogeneity in exposures to inter-meeting communications.

Finally, our study relates to the strand of the literature that develops asset-pricing methods for estimating risk premia in large panels of returns. Traditional two-pass regressions (e.g., Fama and MacBeth, 1973) suffer from errors-in-variables and omitted-factor biases. For tradable factors, measurement error may reflect exposure to unpriced risk (e.g., non-diversifiable errors in the portfolio), or idiosyncratic risk that is not fully diversified (Daniel et al., 2020; Giglio and Xiu, 2021; Giglio et al., 2024). Recent advances, including the Risk-Premium Principal Component Analysis (RP-PCA) of Lettau and Pelger (2020a,b) and the three-pass estimator of Giglio and Xiu (2021), provide more efficient and robust estimates of the SDF and therefore of the candidate factor risk premia. Put simply, the three-pass estimate of the candidate factor risk premium — that is, the monetary policy premium estimate after controlling for these biases — captures the excess returns that can be expected in equilibrium. These methods have recently been applied by Nucera et al. (2024) and Li et al. (2025), for example, in the context of pricing

¹¹Importantly, to ensure our findings are a general phenomenon — not specific to the euro area — we repeat our main analysis using US investment strategy returns and monetary policy instruments. Although evidence can be, in part, contaminated due to the identification challenges and dual-mandate of the Fed, we find consistent evidence of a priced monetary policy premium in the cross-section of investment returns, in equilibrium.

currency risk. In our setting, these recent advances in asset-pricing methodology allow us to achieve robust estimates of monetary policy premia priced in equity strategy returns.

Taken together, our research helps bridge the macro-finance and asset-pricing literatures offering new insights into the interaction between monetary policy, systematic risk-based drivers of equity market returns, and — more broadly — the SDF.

II Data and Preliminary Evidence

Data. We mainly use two sets of data: (i) equity investment strategy excess returns, and (ii) high-frequency asset price changes around the monetary event window, press release window, and press conference window of the ECB GC monetary policy meetings. We present the data in this order. We then briefly mention additional data used in the empirical analysis. The analysis spans the period from Jan/1999 to Dec/2024.

Equity Investment Strategy Returns. We use the excess returns from the equity investment strategies provided by the Global Factor Data (GFD) repository (Jensen et al., 2023, JKP hereafter). Specifically, we download factor return data for Germany, France, Italy, Spain, and the Netherlands. We then calculate the equally-weighted average of these five countries’ factors and refer to this as the euro area factor data. These five countries account for more than 65% of the FTSE Developed Europe ex UK Index market capitalization, as of Jul/2025. Further excluding weights of those countries whose monetary policy is not under the jurisdiction of the ECB, this share of the euro area’s market capitalization rises to over 93%. Similarly, these five countries account for around 92% of the MSCI EMU index, as of Sep/2025.

There are 153 investment strategy factors for each country. All factors are excess returns (we therefore use factor returns and excess returns interchangeably), arising from zero-net investment portfolios (long-short strategies). For a given sorting variable or signal (e.g., 12-month momentum), stocks are sorted into three portfolios according to their (capped value-weighted) signals — low (P1), medium (P2), and high (P3). The factor is then long the high corner portfolio and short the low corner portfolio.¹² JKP then rotate the factors such that they yield positive average excess returns, ensuring that each factor is long (short) the assets yielding high

¹²Note that the underlying stock returns are denominated in US Dollars. However, because these factors are long-short strategies, they are neutral to the currency of de-nomination of the underlying portfolios. We refer to JKP and the provided documentation, available at <https://jkpfactors.com>, for an in-depth description of the factor data. We also note here that returns are available at both daily and monthly frequencies.

(low) expected returns. As a result, all factors can be interpreted as procyclical factors. We adopt exactly the same rotation as JKP. Importantly, all euro area factors with statistically significant average returns in the 1999-2024 sample tend to have positive average returns. This means that the factors appear to be procyclical also in our sample.

While we mainly work with the 153 factors, it is important to note that JKP conveniently classify these factors into 13 themes: accruals, debt issuance, investment, low leverage, low risk, momentum, profit growth, profitability, quality, seasonality, short term reversals, size, and value. Factors are grouped into themes via cluster analysis such that they have a high degree of within-theme return correlation and low degree of across-theme correlation. We also make use of these clusters, to reduce dimensionality and enhance interpretability. The full list of themes and factors, their rotations, and summary statistics are in the Internet Appendix (Section [IA.1](#)).

It is important to note that, because of this statistical procedure of constructing the JKP themes, the JKP labels for themes do not map perfectly to the typical labels used in some asset pricing research, e.g. Fama-French factors. As an example, while a size factor is typically understood to be simply the excess return from a long-short portfolio that buys small cap stocks and sells large cap stocks, the JKP theme for size includes a variety of other factors. These do, of course, include the conventional small-minus-big factor, but also include factors related to the price per share (*prc*) and to R&D to market (*rdme*). This means that the correlation with a conventional Fama-French size factor is highly imperfect (indeed around 40%) and that some of the underlying factors may well be uncorrelated or even negatively correlated with the conventional size factor. Another issue is that some labels for the JKP themes may be misleading on the basis of recent research. For example, the low-risk theme includes 18 factors that have been proposed by the literature over time but that recent research has shown not to be low risk once higher moments risk is taken into account (e.g., [Schneider, Wagner and Zechner, 2020](#)). These considerations will be important when we interpret the position of the JKP factors in the long-short portfolios constructed sorting on OIS betas later in the paper.

Monetary Policy Surprises. We use high-frequency, intraday changes in euro area asset prices around and within the ECB GC meetings, as provided by the Euro Area Monetary Policy Event-Study Database (EAMPD) ([Altavilla et al., 2019](#)). This dataset provides asset price changes around the full monetary policy event window (*mew*) and separately for the press release window (*prw*), covering the the policy decision announcement, and for the subsequent press conference

window (pcw).¹³ This allows us to assess the different impact of the information provided in the two event windows on strategy returns. Specifically, we focus on the term structure of OIS rate changes around these three windows. When the OIS rate is not available, especially at the beginning of the sample period and for medium- to long-term horizons, we use the German yield for the same maturity. We use the following maturities: one, three, and six months, and one, two, five, seven and ten years.¹⁴ We also use the changes in the *STOXX50* around the three windows, as controls for the stock market in the beta (exposure) estimation.

In addition to the raw high-frequency OIS rate changes used in the baseline analysis, we use the monetary policy factors extracted from the term structure of OIS surprises in subsequent analyses, mainly to help interpreting our main findings based on OIS rates. Specifically, we use the monetary policy surprise factors of [Altavilla et al. \(2019\)](#): the Target factor from the press release, and the Timing, Forward Guidance, and Quantitative Easing factors from the press conference. We also use the surprise factors of [Jarociński and Karadi \(2020\)](#) extracted from the monetary event window, which aims at controlling for information effects. Specifically, we use: (i) the first principal component (PC) across the high-frequency OIS rate changes; (ii) the poor-man monetary policy factor, which sets to zero observations associated with GC days on which there are information effects (e.g., days on which both the short-term OIS one-month surprises and stock price *STOXX50* index surprises rise); and (iii) its complement, i.e., the central bank information factor, which sets to zero observations associated with days on which there are no information effects. These “poor man’s sign restriction” factors yield impulse responses that are very similar to those obtained using surprises extracted from a VAR with sign restrictions ([Jarociński and Karadi, 2020](#)). Therefore, we favor simplicity and employ the “poor man’s” approach, avoiding recourse to VARs to extract factors, despite the identifying assumptions behind these poor-man factors being inherently stronger. We then use the Euro Area Communication Event-Study Database (EACED) of [Istrefi et al. \(2025\)](#) to study the effects of inter-meeting communication. In the empirical analysis, we also use several standard macro-

¹³For a given asset, the pre- and post-press release quotes are given by the median quotes in the 13:25–13:35 and 14:00–14:10 intervals, respectively. Similarly, for the press conference window, pre- and post-press conference quotes are the median quotes in the 14:15–14:25 and 15:40–15:50 intervals, respectively. The monetary event window is the union of these two windows with quotes being the median quotes from 13:25–13:35 (prior to the press release) and 15:40–15:50 (following the press conference). Asset price/yield changes are then computed using these pre- and post-median quotes. Further details can be found in [Altavilla et al. \(2019\)](#).

¹⁴In the empirical analysis, we treat these high-frequency changes in OIS rates as monetary policy surprises or shocks. This is because, while there is evidence that such high-frequency changes are somewhat predictable (e.g., [Miranda-Agrippino and Ricco, 2021](#)), this predictability is not a concern when the focus is on measuring the high-frequency response of asset prices to monetary policy shocks ([Bauer and Swanson, 2023b](#)).

financial variables, which we describe later in the paper.

Given the vast literature studying the impact of US monetary policy shocks on asset prices, it is worth noting how this identification scheme for monetary policy surprises in the euro area compares to the US setting. Importantly, press conferences have been a regular feature of ECB GC meetings since 2001, thus shortly after the council’s inception. This is not the case for the US. Indeed, the Fed’s press conferences following FOMC meetings have evolved significantly over time. Previously, FOMC communication consisted only of a written statement, with no live commentary from the Chair. (Meeting minutes were typically released some days later.) Moreover, these conferences were initially held quarterly, and it was only under the leadership of Chair Powell that they became a regular occurrence following every FOMC meeting. This hinders a systematic assessment of monetary policy meetings and the disentangling of information from the pre- and post-conference periods, as is done for the euro area.¹⁵ Furthermore, US monetary policy surprises are not derived from the OIS term structure, but from a combination of instruments required to cover the entire term structure. In short, the institutional design of the ECB and the granular data that is publicly available for almost 25 years make the euro area a unique testbed for the question addressed in our paper, which could not be examined as clearly even if US data were used.

Preliminary Evidence. Before turning to the main asset pricing analysis, we provide some preliminary evidence on the relation between the returns of the investment strategy factors and the monetary policy surprises from the high-frequency changes in OIS rates. To begin, we construct the equally-weighted euro area strategy factor, computed as the cross-sectional average of the 153 factors. This factor is essentially the level factor in euro area strategy returns; we refer to it as RX.¹⁶ It allows us to study the average exposure of the investment strategy returns to monetary policy surprises. We then turn to assessing the exposures of the theme factors.

[Table 1 about here.]

Table 1 presents the regressions of the monthly returns of investment strategy RX excess returns on the OIS surprises of different maturities in the new (Panel A), prw (Panel B),

¹⁵However, we note that a contemporaneous paper by [Acosta, Ajello, Bauer, Loria and Miranda-Agrippino \(2025\)](#) provides a novel data set for the US that mimics several of the features of the euro area data employed here. These data are likely to spur much further research going forward. However, surprises measured in the press conference are available only since 2011, which provides a span of about 15 years. Such a span is perhaps too short for the specific purpose of pinning down the conference risk premium.

¹⁶Its construction resembles the market factor in the equity literature when using equally weighted stocks or the level factor in the FX literature (e.g., [Lustig, Roussanov and Verdelhan, 2011](#); [Nucera et al., 2024](#)).

and pcw (Panel C) windows.¹⁷ In Panel A1, we find that the estimated exposures of RX to monetary policy surprises is negative, meaning that equity strategy returns decrease (increase), on average, when GC meetings are viewed by the investors as more hawkish (dovish) than expected. Moreover, the (absolute) point estimates tend to decline with maturity. In fact, these beta estimates turn statistically insignificant for maturities greater than two years. Specifically, RX drops by around 2%, annualized, in response to a one standard deviation increase in the 1M OIS surprise. Panels B1 and C1 clearly show that these effects mainly arise in the prw, as the estimates are statistically insignificant when using surprises from the pcw. This is a first piece of evidence on the key role of the information provided by the policy decision.

Turning to the cross-sectional evidence on investment themes in Panel A2, we find that the average beta exposure of themes is also negative and lower (in absolute size) for longer maturities. However, a key finding is that there is significant variation in the themes. Indeed, the cross-sectional standard deviation is large, with some themes (e.g., low leverage) even showing positive average betas. This suggests that not all themes are equally exposed to monetary policy shocks.

We then test whether the spread in the betas of the themes is statistically significant. Specifically, we test the null hypothesis that $\beta_j^m = \beta^m$ for any $j = 1, \dots, 13$, where $m = 1M, \dots, 10Y$ denotes the OIS maturity; see [Burnside \(2011\)](#) for details of the test. We find that such a spread is statistically significant at the 5% level for OIS rates with maturities of less than six months. Furthermore, examining the spread in the beta exposures estimated in the prw (B2) reveals that the spread is strongly statistically significant for maturities up to two years. By contrast, such spread in betas is not statistically significant in the pcw (C2). The results are largely robust if one includes the stock market surprise as control.

Figure 3 shows the time-varying estimates of the betas of the strategy themes. It is evident that there is substantial time-variability in the themes exposures to monetary policy surprises. Thus, unconditional beta estimates likely mask significant variation over time. Some betas even switch sign, implying that some themes can play a dual role – sometimes acting as a hedge against

¹⁷To run the regression at monthly frequency, we allocate monetary policy surprises on the days of the Governing Council to the end of that month. When there is more than one monetary policy GC meeting in a month, we follow previous literature (e.g., [Jarociński and Karadi, 2020](#)), and sum over the OIS surprises of a given maturity in that month. The results are virtually unchanged if the average of the OIS changes is taken instead. Some studies give more prominence to the latest surprises by exponentially weighting them (e.g., [Ottonello and Winberry, 2020](#); [Loualiche, Pecora, Somogyi and Ward, 2024](#)). If there is no GC monetary policy meeting in a given month, we exclude that month from the regressions. The results remain unchanged if the surprises are set to zero in months with no GC meetings. The ECB’s GC held monetary policy meetings on a monthly basis up until December 2014, then it switched to a schedule of eight meetings per year (roughly every six weeks) as of 2015.

(positive OIS betas) monetary policy shocks, and other times behaving as risky assets (negative OIS betas). This could depend on the source of the monetary policy shock, e.g., if it is inflation-driven or growth-driven. However, factor timing is also likely to matter, e.g., momentum can be either in defensive or in cyclical stocks. For brevity, the figure focuses on the average exposure of themes to OIS 1Y surprises across the three windows. However, the heterogeneous and time-varying nature of themes' exposures to monetary policy is a robust finding. That said, the betas can differ substantially with the maturity and event window considered. We dig deeper on the different themes exposures later on, recurring to portfolio sorts.

[Figure 3 about here.]

Overall, this initial evidence shows that, on average, equity strategy returns are negatively exposed to monetary policy shocks. Moreover, it indicates that the most significant shocks are those measured in the prw and from shorter-term OIS. Taken together, this suggests that investment strategies are primarily affected by discount-rate shocks, stemming from target and path surprises. At the same time, these preliminary findings show significant cross-sectional differences across investment themes. A statistically significant spread in the betas across assets is generally a necessary condition to find a spread in expected returns, and hence a risk premium.

Although this preliminary analysis is intentionally simple, it motivates the subsequent cross-sectional portfolio analysis. In what follows, we deepen the analysis in two directions. First, the focus will be on factors rather than themes. So far, we used themes mainly as motivating evidence on the cross-sectional effects of monetary policy shocks on equity investment strategies. However, investors ultimately trade factors, not themes. Factors are also likely to exhibit greater dispersion in monetary policy betas than themes. Figure [IA.1](#) shows factor exposures to short-term OIS surprises from the prw. The factor betas are highly disperse, and some factor betas take even more extreme values than theme betas. Second, subsequent analysis accounts for time variation in betas, as unconditional exposures likely mask significant variation over time. We will estimate the betas in such a way that the trading strategy can be implemented in real time.

III Monetary Policy Exposures and Portfolios

In this section, we first present the econometric methods used to estimate the beta exposures of our 153 factor returns to monetary policy shocks measured in the GC meetings. We then form portfolios sorted on monetary policy exposures estimated around the monetary event window,

as well as around the press release and press conference windows. These portfolio sorts are informative about the (GC) monetary policy risk premia.

III.A ECB Governing Council Betas

In the baseline analysis, we estimate the time-varying beta risk exposures (i.e., the quantity of risk), using simple OLS rolling regressions of the asset excess returns on the shocks to the selected risk factors, as is typically done in the literature (e.g., [Lustig et al., 2011](#); [Menkhoff, Sarno, Schmeling and Schrimpf, 2012](#)).¹⁸ To be specific, we estimate the pre-ranking betas using the following model:

$$R_{id} = \alpha_i + \sum_{l=0}^1 \beta_{il}^{\tau w} \Delta OIS_{d-l}^{\tau w} + \sum_{l=0}^1 \gamma_{il}^w \Delta STOX X_{d-l}^w + \epsilon_{id}, \quad d \in \{\text{GC days}\}, \quad i = 1, \dots, I \quad (1)$$

where R_{id} is the strategy factor return in GC day d , $\Delta OIS_{d-l}^{\tau w}$ is the high-frequency change in the OIS rate of maturity $\tau = 1M, 3M, 6M, 1Y, 2Y, 5Y, 7Y, 10Y$ around the GC event window $w = \text{mew, prw, pcw}$, and $\Delta STOX X_{d-l}^w$ is the high-frequency change in the euro area stock market within the w window, which we add as a control variable; the lag $l = 0, 1$ allows for both current and one-period lagged GC days.

Several observations are in order. First, the use of daily asset price returns to estimate the beta exposures is rather common, since the identification is preserved by measuring OIS changes within a narrow window around the event (see, for example, [Gürkaynak et al., 2022](#); [Pflueger and Rinaldi, 2022](#)). If any effects are indeed present at the intraday frequency, the daily return data would mainly add noise and reduce statistical significance. However, to implement the portfolio sorts, we are interested in the beta point estimates. Second, we estimate the time-varying betas using rolling windows that cover 36 GCs, consistent with much literature on rolling beta estimation (e.g., [Lustig et al., 2011](#); [Menkhoff et al., 2012](#); [Hong et al., 2024](#)).¹⁹ Third, in line with previous asset pricing literature, we control for the aggregate market return. This should also help alleviate the impact of information and/or cash-flow effects priced in the

¹⁸Other studies instead incorporate characteristics and their interactions with the risk factor shocks when estimating beta risk exposures; for example, this is done when estimating the monetary policy risk premium in the cross-sections of stock (e.g., [Ozdagli and Velikov, 2020](#)) and currency (e.g., [Antolin-Diaz et al., 2025](#)) returns. However, while the use of characteristics is viable, if not warranted, for individual assets (e.g., balance-sheet variables for stocks, and macro-financial variables for currencies), this is not the case for investment strategies. In fact, many of our strategies are obtained by sorting on specific characteristics.

¹⁹In our case, using windows of 36 GCs does not map exactly to a 36-month window, mainly because the frequency of the meetings has changed over time. Since the number of monetary policy GC meetings has reduced to eight times per year, our estimation window has extended to roughly four years. We begin the analysis after the first 36 observations and always require a minimum of 18 (half of) observations in any given window.

stock index, enabling the beta estimates to more clearly capture discount-rate effects. Fourth, we standardize all surprises to have zero mean and unit standard deviation. This does not impact any results, and merely allows for comparability of beta estimates across estimations and specifications. Finally, our beta sorting variables are given by $\hat{\beta}_{id}^{\tau w} = \sum_{l=0}^1 \beta_{id-l}^{\tau w}$, thus the sum of the contemporaneous and lagged OIS betas, mainly to obtain more stable estimates of the betas. We perform a number of robustness exercises regarding the beta estimation, which we discuss in more detail later.

Beta Estimates. We find that investment strategies’ exposures to monetary policy vary over time. A strategy factor can sometimes be classified as highly exposed to monetary policy, while at other times it can be weakly or even negatively exposed. We also find that the environment — expected inflation, policy regime, or term spread — can affect strategy theme exposures to monetary policy surprises.

Specifically, sometimes a strategy can be classified as highly exposed to monetary policy, while at other times in the sample it is weakly exposed. The monetary environment (including expected inflation, monetary regimes and term spreads) can explain some of the variability in ECB betas. For instance, the betas of certain themes (e.g., low leverage, low risk, momentum and quality) tend to increase when moving from the lowest to the highest inflation quintile, whereas those of other themes (e.g., debt issuance and seasonality) show a decreasing pattern. For many strategy themes, the betas exhibit contrasting tendencies when conditioned on expected inflation and term spreads. For example, a recurrent finding is that the exposures of momentum and value to monetary policy surprises tend to move in opposite directions regardless of the environment, suggesting that monetary policy contributes to the negative correlation between these two strategies (e.g., [Asness, Moskowitz and Pedersen, 2013](#)). At the same time, the average beta across themes is generally more negative in a monetary expansionary regime, when betas tend to become somewhat more dispersed. Regardless of what drives variation and dispersion in the ECB betas, this evidence lends support to the subsequent beta-sort portfolio analysis, as it allows us to dynamically account for switches in factor exposures.²⁰

Taken together, this evidence lends support to the subsequent beta-sort portfolio analysis, which allows us to account dynamically for the switches in the factor exposures (remaining agnostic about the ultimate cause of the switch). The evidence on the risk premia will then help

²⁰Note that our definition of monetary regimes is based on that of [Buetow, Fabozzi and Henderson \(2009\)](#); a perfectly valid alternative that we also employ is the continuous measure of [Bianchi, Lettau and Ludvigson \(2022\)](#). We present the full detailed analysis of ECB betas in Section [IA.2](#), in the Internet Appendix.

us shed light on the types of monetary policy shocks that matter to investors, contributing to the risk-return tradeoffs in equity investment strategies.

III.B ECB Governing Council Portfolios

Next, we explain how we form the portfolios dynamically using the estimated beta exposures. Specifically, at the end of each GC day, we create five portfolios for a given OIS rate and event window (signal). For a given signal, we assign 20% of all factor strategies with the lowest beta to Portfolio 1 (P1), while the 20% of all factors with the highest beta are assigned to Portfolio 5 (P5). The intervening portfolios have increasing betas when moving from P1 to P5.²¹ We hold these portfolios until the day after the next GC meeting, when they are rebalanced as new beta estimates become available; that is, the day of the GC meeting portfolios still reflect the old sorts. This is important as it enables the strategy to be traded in real time.

We then form spread portfolios from the beta-sorted portfolios. To start with, we construct a low-minus-high (LMH) beta strategy that buys P1 and sells P5. This spread portfolio is long equity strategies that are most exposed to monetary policy shocks (lowest OIS beta) and is short those that are the least exposed (highest OIS beta). We also form a rank (RNK) beta strategy as in [Asness et al. \(2013\)](#), whereby the weights of the factor strategies are proportional to their ranking in terms of beta exposures. Unlike the LMH portfolio, this rank portfolio trades all strategy factors, so its performance does not depend on the specific number of portfolios employed. Finally, we convert all portfolio daily returns to the monthly frequency, by taking the cumulative product of daily discrete returns within a given month.

Portfolio Returns. Below, we present the portfolios sorted on the estimated factor OIS betas, for event windows of $w = \text{mew, prw, pcw}$, and maturities of $\tau = 1\text{M}, 3\text{M}, 6\text{M}, 1\text{Y}, 2\text{Y}, 5\text{Y}, 7\text{Y}$, and 10Y. To begin with, Table 2 shows the portfolios sorted on the mew betas. Regardless of the OIS maturity, we observe that the average return of the portfolios tends to decrease monotonically from P1 (high risk, low beta) to P5 (low risk, high beta). This is consistent with a risk-return tradeoff in equity strategies determined by monetary policy surprises, whereby contractionary policy surprises in (short-term) OIS rates are associated with a bad state of the world (higher marginally utility). Thus, the strategies most exposed to monetary policy tightening surprises are riskier and provide high average excess returns. By contrast, the portfolios least exposed

²¹Each portfolio is self-financed and market neutral as the test assets entering the portfolios are high-minus-low factors.

to monetary policy surprises have statistically insignificant returns, hence being acyclical with respect to monetary policy surprises and acting as hedges against monetary policy shocks.²²

Of particular interest are the spread (long-short) portfolios LMH and RNK. We find that the average returns of the spread portfolios are statistically significant, at least at the 5% level, for all OIS rates. The LMH factors' average annualized returns range from 4.92% for OIS 1M to 5.90% for OIS 2Y. The Sharpe ratios are also of non-trivial magnitude, reaching 0.57 for the OIS 2Y. Thus, the spread returns, or risk premia, are also economically significant. The results are very similar when looking at the RNK portfolios. While the LMH portfolios have slightly higher average returns, they also have higher pre-betas (a measure of ex-ante risk) than the RNK portfolios. As a result, LMH and RNK portfolios have very similar Sharpe ratios. This means that the results are robust to the number of portfolios employed and are not driven solely by the corner portfolios (outliers).

[Table 2 about here.]

We then repeat the portfolio sorting process separately for the prw and pcw beta exposures. This enables us to establish whether the positive risk-return tradeoff observed during the monetary event period emerges during the press release or press conference stage. To begin with, Table 3 shows the prw portfolios. We find that the prw results are broadly consistent with the new evidence, with only minor differences. Notably, the average returns of the LMH and RNK spread portfolios become significant at the 1% level when sorting on OIS 6M and 1Y – and, only for RNK, also with OIS 2Y – while the average return for the OIS 1M and 10Y sorts are no longer significant. Overall, monetary policy surprises arising in the prw seem to be strongly priced into equity strategy factors, determining a clear relation between risk (e.g., pre-formation betas) and return in equity investment strategies.

[Table 3 about here.]

The prw evidence contrasts strongly with the pcw evidence (Table IA.2 in the Internet Appendix). Indeed, the relation between portfolio betas and returns appears to reverse, resulting in negative average returns for spread portfolios. However, it is only at the six-month horizon that the average returns are significant at the 5% level. It is also evident that prw surprises

²²Strictly speaking, a hedge asset should have negative average excess returns. However, for the sake of distinction from the risky portfolios (P1-P4) that have positive and statistically significant returns, we find it convenient to refer to P5 portfolios as hedges.

generate more contained spreads in the betas (for any given OIS maturity, the pre-formation betas of the pcw spread portfolios are lower, in absolute terms, than those of the prw portfolios). Taken together, this evidence suggests that pcw surprises are less relevant for equity strategy investors and convey different information from prw surprises.

Post-formation Betas. Next, we examine the post-formation betas. That is, we regress the monthly portfolio returns on the monetary policy surprises. To do so, we assign the GC surprises falling in a given month to the end of that month. However, in some months there is more than one GC meeting (especially in the earlier part of the sample), while in other months there are no GC meetings (e.g., since 2014). Therefore, we sum the surprises occurring in the same month (see, e.g., [Jarociński and Karadi, 2020](#)) and exclude the months with no GC meetings. Specifically, we run the following regressions:

$$R_{pt}^{\tau w} = \alpha_p + \beta_p^{\tau w} \Delta OIS_t^{\tau w} + \epsilon_{pt}, \quad t \in \{\text{GC months}\}, \quad p = P1, \dots, P5, LMH, RNK \quad (2)$$

where $R_{pt}^{\tau w}$ is the portfolio return in month t obtained by sorting on the selected $OIS^{\tau w}$ surprise. We perform the regressions both with and without the *STOXX* surprise as a control variable.

Tables [IA.3-IA.5](#), in the Internet Appendix, present the results for the mew, prw, and pcw, respectively. For mew and prw, the results are clear cut for sorts with OIS rates of maturities of up to two years. The post-formation betas tend to increase when moving from P1 to P5, resulting in negative and statistically significant post-formation betas for the LMH and RNK spread portfolios. In the very few cases where the betas of spread portfolios are not statistically significant, the high-risk portfolios (P1-P2) have consistent large and negative betas which are often statistically significant. As a result, there is a close (negative) association between post-formation betas and average portfolio returns (see [Figure IA.9](#)). This suggests that the premium earned by mew and prw portfolios sorted on OIS rates of these short maturities is related to the exposure to monetary policy surprise. Conversely, the results are much weaker for the portfolios sorted on the betas from longer-term mew and prw OIS surprises and from pcw surprises, as essentially none of the pcw portfolios yield significant post-formation betas. Thus, not only do the pcw spread portfolios generally have negative and insignificant average returns, but they are also little exposed to the monetary policy surprises arising in the pcw. Therefore, the few significant average returns must be interpreted with caution.

Summing up, we have shown that monetary policy shocks arising from GC meetings contribute to determining a risk-return tradeoff in equity strategy returns. However, we also found that not all surprises are alike. While there is a positive relation between risk and risk premia during the monetary event window, the main source of this tradeoff is attributable to the press release window. Moreover, such evidence becomes weaker when considering surprises in OIS rates of medium-to-long term maturities. Therefore, prw shocks captured by high-frequency OIS rates with maturities ranging from 6M to 2Y play a dominant role. This is consistent with the notion that discount-rate shocks, namely the union of target and path shocks, are the relevant monetary policy shocks for equity investors.²³ These novel findings support and refine previous studies showing that monetary policy shocks, and especially discount-rate ones, affect equity market returns.

Portfolio Constituents. Next, we zoom into the constituents of the corner portfolios in terms of frequency of appearance. In light of the earlier evidence and for brevity, Table 4 presents the results focusing on portfolios sorted on the strategy factor exposures to prw OIS surprises, where we average across the different OIS maturities. Moreover, mainly to reduce the dimensionality and enhance interpretability, we group the 153 factors by assigning them to their respective themes. As a result, we obtain one ranking for the themes in P1 and one ranking for those in P5 by their relative frequency of appearance.

We find that the top-two themes in the low OIS-beta portfolio (P1) are low risk and momentum (40% and 34%, respectively), followed by quality, profitability and value (29%, 23% and 21%, respectively). By comparison, the remaining themes appear less than 20% of the time in P1 (debt issuance only 5%). As mentioned earlier the low risk theme is labeled this way because it includes factors (e.g., those that are long low-beta/low-volatility stocks) that were considered by the literature as low-risk anomalies when proposed. However, recent research has documented that these are not low risk when one accounts for the risk associated with higher moments of returns (Schneider et al., 2020). Hence, the fact that these factors appear in P1 suggests that they are especially exposed to monetary policy risk, potentially establishing a connection between higher moments and monetary policy risk premia.

²³Several studies use changes in one- and two-year rates to proxy for monetary policy shocks, instead of using very short-term rates (Gilchrist, López-Salido and Zakrajšek, 2015; Hanson and Stein, 2015). Unlike the Kuttner’s approach, Bauer and Swanson (2023b) use a one-year monetary policy surprise. This is partly because, for many years, policy rates were at the effective lower bound (ELB), meaning that very short-term rates did not vary. Indeed, one- and two-year rates, when measured in the announcement window, should capture both target and path surprises (e.g., Kearns, Schrimpf and Xia, 2023; Knox and Vissing-Jorgensen, 2025). The latter can also generate variation also at the ELB.

The top-two themes featuring in P5 are value and size (33% and 32%, respectively), followed by low leverage, investment and momentum (29%, 24% and 19%, respectively). While one may be surprised that the size theme features in P5 (low monetary policy risk portfolio), recall that the size theme of JKP includes factors which are not typically related to the small-minus-big factor. Indeed, we notice that the fact that size theme ranks among the top constituents in P5 is mainly driven by these factors (prc and rdme; see Table IA.6 in the Internet Appendix).²⁴

[Table 4 about here.]

We then condition the analysis on the binary indicator of [Buetow et al. \(2009\)](#), thus focusing on the “expansive” and “restrictive” regimes. The procedure, which has been shown to differentiate effectively between periods, classifies monetary policy regimes based on the direction of the immediately preceding policy rate change. The idea is that policy rate changes signal the future course of monetary policy. Monetary policy is restrictive in months after an increase in the policy rate and is expansive in months following a decrease in the rate. For example, if the last policy rate change was an increase, then a sample month is classified as falling in a restrictive monetary policy period.

We find that the top-two themes in P1 are in the top positions in both regimes, with some minor variation in third position (e.g., quality drops to fifth position for P1 in contractionary regimes). However, some themes do behave markedly differently in the two regimes: for example, profitability features more frequently in P1 in the expansionary regime, while size does so in the restrictive regime. Momentum is more often in the low-risk portfolio P5 in the restrictive regime. Interestingly, the JKP market equity factor, which is the most closely related factor to the conventional Fama-French size factor, is the one which features most (less) often in the low OIS-beta (high OIS-beta) portfolio in the contractionary regime among the size theme factors (Table IA.6), suggesting that small-cap stocks are more exposed to contractionary surprises.²⁵

Fama-French Factors. To shed further light on the information content of our portfolios, we examine the relation between the LMH spread portfolios and the five European Fama-French factors: the market ($Mkt-RF$), value (HML), momentum (WML), investment (CMA), and quality

²⁴Notably, momentum and value stand out as they appear in the top-five constituents of both corner portfolios. That is, at times these strategy themes behave as risky and at other times as safe assets with respect to monetary policy surprises. This further corroborates our earlier findings that factors and hence themes can switch from one corner portfolio to another.

²⁵In the Internet Appendix, we slice the evidence along various dimensions: the frequency of appearance of each theme by the OIS maturity (Table IA.7); the constituents for the factors (Table IA.8); and the evidence for new sorts (Table IA.9).

(*RMW*) factors, respectively (Fama and French, 2015). Figure IA.10, in the Internet Appendix, shows the average returns of the prw spread portfolios for maturities up to two years, conditional on the Fama-French factor quintiles. We find a particularly strong positive relation especially between the LMH spread portfolios and the momentum and quality factors. This is consistent with our earlier findings showing that quality and momentum themes very often feature in P1. Interestingly, the LMH portfolio returns are higher when the value factor is in its lowest and highest quintile. This is also consistent with the fact that value factors tend to switch between corner portfolios, albeit they are most often found in P5.²⁶

Taken together, this evidence on mew and prw portfolios shows that low risk, momentum and quality factors feature more often in the high-risk, low OIS beta portfolios (P1). Indeed, we also find that our LMH spread portfolio returns in the prw co-move positively with the quality and momentum Fama-French factors. By contrast, value and low leverage factors most often appear in the low-risk, high OIS beta portfolios (P5). We also show that some strategies (e.g., profitability) can behave differently in expansionary and contractionary monetary regimes. Furthermore, some strategies, like momentum and value, can switch from being low risk or high risk with respect to monetary policy surprises.

IV Three-Pass Analysis: Measuring Monetary Policy Premia

Thus far, we have documented a set of important results by sorting equity strategies on their exposures to OIS surprises within the three event windows. However, these exposures are inherently prone to measurement error as they are estimated, which requires assumptions about the estimation window and model specification. Thus, we cannot rule out the possibility that the risk premium estimates are affected by measurement error. In this section, we employ the three-pass procedure of Giglio and Xiu (2021, GX hereafter) to obtain robust estimates of the risk premia of the spread portfolios, which serve as our candidate factors. Specifically, these risk premia are obtained by projecting the candidate factors onto the latent factors that drive the optimal SDF. This means that the de-noised, projected factors can be interpreted as the excess returns associated with the candidate factor that can be expected in equilibrium on the basis of the latent-factor SDF. Therefore, the sample mean of the de-noised factor is the factor's risk

²⁶We also document a strong negative relation between our LMH factors and the stock market factor. This is not surprising given that the *RMW* and *CMA* Fama-French factors typically have low or negative correlations with the market and value factors, thereby improving portfolio diversification (e.g., Fama and French, 2015; Asness, Frazzini, Israel and Moskowitz, 2015).

premium, whereas the sample mean of the raw, noisy factor is not necessarily equal to its risk premium.

The three-pass estimator assumes that the researcher has already estimated the latent factors and determined the associated SDF in such a way that it accurately spans the space of asset returns. In our case, this would be the cross-section of equity strategy factor returns. The Risk-Premium Principal Component Analysis (RP-PCA) estimator of [Lettau and Pelger \(2020a,b, LP hereafter\)](#) can help achieve this goal. This is because it combines two moment conditions in the latent factor extraction process, selecting factors that explain the time-series comovement, while penalizing factors with low Sharpe ratios (unlike the PCA estimator). This pushes up the factor signal-to-noise ratios, leading to more efficient factor estimation. Consequently, weak latent factors with high Sharpe ratios should be more easily detected, and the relevant pricing information aggregated into a reasonably small set of factors. Hence, the optimal latent-factor SDF recovered using RP-PCA should span all relevant sources of priced risk more effectively.

For these reasons, we combine the three-pass estimator of GX, and the RP-PCA estimator of LP. The augmented three-pass estimator has recently been employed by several studies. For example, see [Nucera et al. \(2024\)](#) and [Li et al. \(2025\)](#) for pricing currency risk in the cross-section of currency strategy returns. We refer to these earlier studies for a detailed description of the method. As a by-product of using RP-PCA, we shed light on the optimal SDF driving equity strategy returns in the euro area. However, our ultimate goal is to obtain robust estimates of the risk premia of the beta-sorted portfolios.

IV.A Econometric Methods

In what follows, we briefly describe the RP-PCA of LP and the three-pass methods of GX, while we present further details in [Section IA.3](#), in the Internet Appendix.

RP-PCA. Assume that K latent factors capture the systematic component of asset returns, with the unexplained idiosyncratic component subsuming the asset-specific risks, such that

$$\underbrace{X}_{T \times N} = \underbrace{F}_{T \times K} \underbrace{\psi^\top}_{K \times N} + \underbrace{\epsilon}_{T \times N}, \quad (3)$$

where X are the excess returns of the test assets (N test assets, each with T observations), F are the latent factors, ψ are the factor loadings, and ϵ are the idiosyncratic components of asset returns. The latent factors are estimated such that they relate to the largest eigenvalues

of $\text{Var}(X)$ — as in standard PCA — but also reflect the pricing information contained in the first moment of test asset returns. Specifically, RP-PCA extracts the latent factors and loadings by jointly minimizing the *unexplained time-series variation* and *cross-sectional pricing errors*, as in

$$\hat{F}, \hat{\psi} = \arg \min_{F, \psi} \left\{ \underbrace{\frac{1}{NT} \sum_{i=1}^N \sum_{t=1}^T (X_{nt} - F_t \psi_n^\top)^2}_{\text{TS: unexplained variation}} + \omega \underbrace{\frac{1}{N} \sum_{i=1}^N (\bar{X}_n - \bar{F} \psi_n^\top)^2}_{\text{CS: pricing error}} \right\}, \quad (4)$$

where $\hat{F}$ and $\hat{\psi}$ are the estimated factors and loadings, $\bar{X}$ denotes the sample mean of excess returns, $\bar{F}$ is the vector of latent factor expected values, and ω is a fixed pricing error penalization term (RP-weight). An $\omega = -1$ is tantamount of using standard PCA, while with $\omega > 0$ one increasingly exploits the information embedded in the first moment of excess returns.

For a given ω , by looking at the eigenvalues extracted from the covariance matrix, $\Sigma_{\text{RP}} = \frac{1}{T} X^\top X + \omega \bar{X}^\top \bar{X}$, in conjunction with several evaluation criteria from pricing statistics, one can infer the number of factors, K , required to span the space of test asset returns. Thus, one can determine the optimal SDF and therefore the tangency portfolio. Indeed, the tangency portfolio of the mean–variance frontier is spanned by a linear combination of the factors driving the SDF, such that $\hat{F} \times \hat{b}_{MV}^\top$, where $\hat{b}_{MV} = \mu_F \Sigma_F^{-1}$ is a $1 \times K$ vector of the factor weights in the SDF, where μ_F and Σ_F are the mean and covariance matrix estimates of the latent factors. The SDF is given by $M_t = 1 - (\hat{F}_t - \mu_F) \hat{b}_{MV}^\top$.

Three-Pass Estimator. Having identified the latent factors and hence the optimal pricing kernel which fully spans our test asset excess returns, we can proceed to implement the three passes of the GX method.

Step One. Obtain the risk exposures (ψ). Use time-series OLS regressions but on transformed data, since latent factors are extracted via RP-PCA, as follows:

$$\tilde{X}_{nt} = \tilde{F}_t \psi_n^\top + \epsilon_{nt}, \quad n = 1, \dots, N, \quad t = 1, \dots, T, \quad (5)$$

where $\tilde{X}_{nt} = X_{nt} + \tilde{\omega} \bar{X}_{nt}$, and $\tilde{F}_{kt} = \hat{F}_{kt} + \tilde{\omega} \bar{F}_{kt}$ for $k = 1, \dots, K$, with $\tilde{\omega} = \sqrt{\omega + 1} - 1$. This retrieves RP-PCA risk exposures for a given ω .

Step Two. Estimate the latent factor prices of risk (γ). Run cross-sectional regressions of

average realized excess returns on the previously estimated exposures (similar to the classic Fama and MacBeth, 1973, procedure), such as:

$$\overline{X}_n = \widehat{\psi}_n \gamma^\top + a_n, \quad n = 1, \dots, N, \quad (6)$$

where γ is the $1 \times K$ vector of the latent factor prices of risk.²⁷

Step Three. Retrieve the candidate factor, g_t , exposures and prices of risk (η, λ_g). First, run time-series spanning regression of the candidate factor innovation, g_t^t , on the de-meaned latent factors, $\widehat{F}_t^t = \widehat{F}_t - \mu_F$:

$$g_t^t = \widehat{F}_t^t \eta^\top + u_t, \quad (7)$$

where η is the $1 \times K$ vector collecting the loadings of the candidate factor on the K latent factors. Then, using the estimated η -exposures, one implements

$$\widehat{\lambda}_g = \widehat{\gamma} \widehat{\eta}^\top, \quad (8a)$$

$$\widehat{g}_t = \widehat{F}_t \widehat{\eta}^\top, \quad (8b)$$

and obtains the *price of risk* of the candidate factor, $\widehat{\lambda}_g$, and the *de-noised* (cleaned) candidate factor, $\widehat{g}_t$, return-based and free of all measurement error and omitted variable biases.

We now proceed as follows. First, we determine the optimal latent-factor SDF using several, standard evaluation criteria. Next, we estimate the risk exposures and risk premia of the spread portfolios. By projecting the spread portfolios onto the latent factors, we also obtain the cleaned, or de-noised, spread portfolios. These are the beta-sorted portfolios that have been purged of measurement error and unpriced risk, thereby providing reliable estimates of the true monetary policy premia.

IV.B Three-Pass Inference

The test assets are the 153 investment strategy portfolios, while the candidate risk factors are the OIS beta-sorted spread portfolios. The cross-section of investment strategy excess returns is therefore the input to the RP-PCA estimation of the latent factors that enter the optimal SDF.

²⁷Given that factors extracted using RP-PCA are return-based with unrestricted means, under no-arbitrage the factor prices of risk simply equal their means (i.e., $\gamma = \mu_F$). However, this second pass is still useful in determining the estimation uncertainty in the asymptotic standard errors, and evaluating the model goodness-of-fit.

We will turn to this next.

Optimal SDF. Table 5 presents the diagnostics and evaluation criteria for the latent factors extracted using a baseline RP-weight of 20, as well as for the SDFs and tangency portfolios of expanding dimension.²⁸ As is usual in the literature, we rotate the latent factors so that they are procyclical factors (i.e., have positive means) and orthogonal to each other.²⁹

[Table 5 about here.]

Panel A1 shows that the latent factors $F_1, F_2, F_3, F_4, F_6, F_7, F_9, F_{10}$ and F_{11} are risk premium or pricing factors, as they have statistically significant mean returns and high Sharpe ratios, which range from a minimum of 0.39 (F_{10}) to a maximum of 1.42 (F_3). These factors therefore receive the largest weights in the optimal SDF and have important implications for pricing the cross-section. The eleventh and third factors have the largest weights (0.58 and 0.51, respectively).

The remaining factors (F_5 and F_8) are time-series factors, as they display statistically insignificant mean returns, low Sharpe ratios, and limited marginal contribution to the maximum Sharpe ratio. Although these time-series factors have insignificant risk premia, they capture substantial time-series variation in the returns of the test assets and should therefore be included in the SDF alongside the risk premium factors (see, e.g., [Lewellen, 2023](#), for a recent exposition on the importance of time-series factors in asset pricing models). For example, excluding such factors in the third-pass can affect the behavior and Sharpe ratios of the de-noised candidate factors, as well as the first- and second-pass evaluation criteria. (While F_{12} is also a time-series factor, it is a much weaker factor and is therefore ordered last.)

Panel A2 shows that the Sharpe ratio of the tangency portfolio spanned by the first eleven factors is 2.28, with the first three factors alone yielding a Sharpe ratio of 1.72. Therefore, the addition of subsequent factors leads to a more contained increase in the efficient frontier, but they cannot be omitted. In particular, F_6, F_7, F_9, F_{10} and F_{11} are risk premium factors with significant weighting in the SDF, resulting in non-negligible increases in the Sharpe ratio.

²⁸Following [Nucera et al. \(2024\)](#) and [Li et al. \(2025\)](#), we set the baseline RP-weight ω to 20. Note that, given that our time series of OIS beta-sorted portfolio returns spans from Jul/2000 to Dec/2024, all three-pass results refer to this same sample period.

²⁹Individual factors are not identified because they are not rotation invariant, whereas the multi-factor SDF and tangency portfolios are. Specifically, we follow LP and normalize the loadings so that the factors are orthogonal to each other. To achieve this, we use the Gram-Schmidt method, as this has the advantage of orthogonalizing the factors sequentially. Models based on the original and orthogonal factors are observationally equivalent. The factors are mainly orthogonalized to facilitate their economic interpretation (i.e., regarding their different contributions to the SDF).

Furthermore, F_{11} is a weak factor with high Sharpe ratio, as its high signal-to-noise ratio mainly stems from its high risk premium.

Panel B reports the results of the first two stages of the three-pass process, as well as the pricing error tests. Panel B1 shows that both the idiosyncratic variance and the average root-mean-squared pricing errors decrease when moving from a one-factor model to an eleven-factor model, thanks to a particularly strong contribution from the first three factors. However, the decrease in both variance and pricing errors stemming from factors four to eleven is also substantial. The second-pass analysis (Panel B2) shows that pricing errors become statistically insignificant when F_{11} is included. We reach a similar conclusion using a bootstrap procedure to test how many test assets have individually significant pricing errors while accounting for multiple hypothesis testing. A less conservative critical value of 1% would suggest that one could achieve full spanning even with a more parsimonious six-factor model.³⁰

Our primary goal is not to identify the most parsimonious optimal SDF, but rather to determine an SDF or pricing model that enables us to achieve full spanning and, consequently, robust estimates of the risk premia of the candidate factors. In this regard, previous literature has shown that it is preferable to include more factors than fewer. This was initially shown by GX and subsequently confirmed by simulations in [Nucera et al. \(2024\)](#). Intuitively, the distortions in the risk premium estimation caused by omitting relevant factors from the SDF are more significant than the issues potentially arising from overfitting the SDF. Therefore, we conclude that an SDF consisting of eleven latent factors is optimal in that it enables us to estimate the risk premium of OIS-sorted portfolios without the influence of omitted variables or measurement errors.³¹ This is a larger model than the one uncovered by recent applications of the three-pass procedure in currency markets, which is not surprising given that the cross section of equity strategy returns is much larger, e.g., than the currency cross sections of [Nucera et al. \(2024\)](#) and [Li et al. \(2025\)](#).

³⁰In short, for a given latent-factor model, we test how many of the 153 test assets have *individually* statistically significant average pricing errors and assess whether this number is consistent with multiple hypothesis testing. We do this by adapting the wild bootstrap procedure of [Giglio, Liao and Xiu \(2021\)](#). We perform 2,000 bootstrap simulations for each latent-factor model, F_{1-k} where $k = 1, 2, \dots, 12$. Returns are bootstrapped by resampling the weighted residuals using a high-dimensional twenty-factor model, to ensure that the moments in the simulated data match those in the observed data. Pricing errors are then estimated for models with an increasing number of latent factors, all under the same data-generating process. Multiple-hypothesis testing biases are accounted for using the [Benjamini and Hochberg \(1995, BH\)](#) false discovery control approach. See Section [IA.3.1](#), in the Internet Appendix, for further details on the wild bootstrap procedure.

³¹In unreported results, we also verified that the main three-pass findings presented below are qualitatively robust when using even much larger models, e.g., including up to twenty latent factors. The role of factors beyond the eleventh appears negligible.

IV.B.1 Candidate Risk Factors

Next, we remove measurement error and/or unpriced risk from the candidate spread portfolios to obtain robust risk premium estimates. We also shed light on the factor structure of these portfolios and their exposure to macro-financial risks after de-noising them.

Risk Exposures. To start with, Table 6 shows that a significant portion of the GC OIS-sorted portfolios is due to measurement error and/or unpriced risks. In fact, using the optimal model consisting of eleven latent factors, the R^2 s range from around 30% to 65%. There is a tendency for the R^2 values to increase with the maturity, but this pattern is not monotonic. These findings hold regardless of the event window considered (i.e, mew, prw, and pcw). Moreover, F_1 appears to account for the majority of the variation in the GC portfolio returns, which is unsurprising given its high signal-to-noise ratio. F_1 plays the role of a market factor for investment strategy returns. Nevertheless, other latent factors are also important in determining sizable increases in the portfolios' explained variations, but their relative importance depends on the specific portfolio considered.

[Table 6 about here.]

Turning to the individual event windows, we again find that the mew and prw evidence is similar, but different from pcw. An important finding is that the prw LMH 3M-2Y exhibit large positive exposures to several of the high Sharpe ratio pricing factors (F_1 , F_2 , and F_6). Exposures to F_3 are positive, but not statistically significant. LMH 1M differs mainly because its exposure to F_2 is not statistically significant and its exposure to F_{11} is negative and highly statistically significant. Conversely, LMH portfolios sorted on longer-term OIS rates (5Y-10Y) display negative exposures to several pricing factors (F_2 , F_9 , and F_{10}), while showing highly statistically significant exposures to F_3 and F_{11} . This explains why they differ from LMH portfolios sorted on shorter-term OIS rate surprises. Aside from F_1 , pcw portfolios have very different exposures to the latent factors from prw and mew. In particular, they are negatively exposed to F_2 .

Overall, the above analysis shows that, despite having different loadings, the mew and prw spread portfolios relate to similar parts of the SDF. Furthermore, there is a clear discrepancy in both cases between the very short- and long-term OIS portfolios, as well as between the mew/prw and pcw portfolios.

[Table 7 about here.]

Risk Premia. Table 7 presents the risk premium and Sharpe ratio estimates for latent factor models of increasing dimension. The main findings are clear-cut and consistent with our earlier evidence, showing that (i) a positive risk-return tradeoff emerges in the prw, and (ii) is captured by OIS surprises with maturities of approximately 1Y. The risk premium estimates for the prw spread portfolios are generally higher but close to the average returns of the noisy portfolios (Panel B). For example, the LMH 1Y risk premium increases from 6.16% to 7.28%. Importantly, removing measurement error and/or unpriced risk from these beta-sorted prw portfolios leads to stronger statistical significance of the risk premium estimates and much higher Sharpe ratios, which in some cases become twice as large. This accentuates the tent-like shape in Sharpe ratios, which peak at the 6M-2Y OIS rates (reaching values around 1.1) and are much lower at the short (1M) and, especially, the long (10Y) end of the OIS term structure.

Specifically, the risk premia of prw portfolios are highly statistically significant, at the 1% level, for OIS rates with maturities ranging from 3M to 2Y; these findings remain largely consistent irrespective of the exact size of the SDF. They show also sizable Sharpe ratios, with a peak of 1.05 at the 6M. In contrast, the risk premia of the LMH portfolios sorted on OIS with 5Y and 7Y maturities are significant at the 5% levels and have much lower Sharpe ratios. The risk premium of the LMH 1M portfolio drops to 10% significance when switching from the ten-factor to the eleven-factor model. This is consistent with the previous evidence indicating that F_{11} is a high risk premium factor and a countercyclical source of risk for the LMH 1M portfolio. The 10Y LMH portfolio has an insignificant risk premium.

The mew evidence (Panel A) is similar to the prw evidence. The Sharpe ratios of the mew portfolios are generally lower for OIS rates with maturities up to 2Y and higher for the longer-term OIS rates. However, recall from the earlier analysis that the returns from these portfolios (5Y, 7Y, and 10Y) showed insignificant post-formation betas for both the mew and prw. Finally, we find that the pcw portfolios (Panel C) have negative risk premia but none of the estimates are statistically significant (the risk premium is only marginally significant at the 10% level for the 6M LMH portfolio). They are positive and statistically significant when using a one-factor model, but become insignificant when using larger models.

IV.B.2 De-noised Spread Portfolios

Next, we explore further the properties of the de-noised LMH portfolios. To begin with, left-hand side panels of Figure 4 present the recursive Sharpe ratio estimates for mew, prw, and pcw portfolios. The Sharpe ratios of the mew and prw portfolios are generally quite stable over time, with a slight downward trend. However, this trend vanishes when the Sharpe ratios are measured relative to the optimal tangency portfolio Sharpe ratio (e.g., prw LMH 6M, 1Y and 2Y account for roughly 50% of the tangency portfolio Sharpe ratio over time). Put simply, the decreasing trend does not stem from investors interpreting differently the GC shocks, but is rather a consequence of the risk-adjusted performance of equity investment strategies reducing over time. Furthermore, the superior performance of portfolios sorted on prw OIS surprises with maturities 6M-2Y is a robust finding, as their Sharpe ratios lie consistently above those of portfolios sorted on OIS rates of other maturities. We see more instability in the Sharpe ratios of the pcw LMH portfolios, with a marked drop in the Sharpe ratios around the global financial crisis, and a downward tendency thereafter.

[Figure 4 about here.]

Macro-Financial Drivers. We also aim to assess how the de-noised spread portfolios co-move with euro area economic conditions. To this end, we focus on prw portfolios given their importance in determining the risk-return tradeoff in equity strategies. In particular, we examine the exposures of the OIS 6M, 1Y and 2Y spread portfolios, as well as the first PC across all prw portfolios.³² Furthermore, we use a long list of macro-financial variables, which we group – for convenience – as interest rates, inflation, and real activity (mainly measured via financial variables). We provide full details of the specific variables employed in Table IA.11, in the Internet Appendix. We note here that we compute the innovations of these variables and de-noise them using the three-pass method. This is important as macro variables are notoriously affected by large measurement errors (see, e.g., Nucera et al., 2024). We then standardize the de-noised variables to enhance the interpretability across the spanning estimates.

[Table 8 about here.]

³²We provide the PC analysis of the LMH portfolios, both raw and de-noised, in the Internet Appendix (Table IA.10). We find that, to a large extent, the PCs have the usual interpretation of level, slope, and curvature. Importantly, the first prw PC yields high returns and Sharpe ratios, consistent with the evidence of a level, target factor.

Table 8 presents the resulting evidence from simple, univariate spanning regressions. One clear finding is that the LMH 6M, 1Y and 2Y, as well as PC(1), move in opposite directions to interest rate changes. For example, in Panel A the one-year real interest rate in the euro area, RR 1Y, has a significant coefficient at the 1% level and an R^2 between 25% (LMH 6M) and 39% (PC(1)). We find similar evidence using the one-year German yield, DE 1Y, and the euro area OIS rate, OIS 1Y. The results are qualitatively similar when using measures of monetary policy surprises from high-frequency changes in OIS rates. This sensitivity of our spread portfolios to interest rate and monetary policy surprises corroborates the earlier finding from the post-formation regressions, showing that returns of portfolios sorted on mew and prw OIS surprises with maturities up to 2Y can be interpreted as compensation for exposure to monetary policy surprises. In the Internet Appendix, Table IA.12 shows similar evidence also for the mew portfolios.

A natural question is whether our portfolios also respond to inflation surprises, given that the primary goal of the ECB is to maintain price stability. We construct measures of inflation surprises (CPI (S)) using the method of Hong et al. (2024).³³ We also consider the euro area one-year inflation-linked swap rate (ILS 1Y), and measures of inflation uncertainty (CPI(D)), which are derived from the cross-sectional dispersion of survey respondents. From Panel B, the findings are clear-cut: portfolio returns are inversely related to inflation and inflation uncertainty/disagreement shocks.

Finally, we consider variables that measure growth in the euro area. In Panel C, we find that the spread portfolios are generally positively exposed to surprises in real activity, albeit to varying degrees depending on the measure employed. As expected, financial variables (e.g., equity indices and credit spreads) show greater significance and explain more variation than macro variables (e.g., IP). One possible explanation for the positive exposure to growth is that, in demand-driven environments, real activity tends to co-move positively with inflation. Thus, positive (negative) growth surprises could be interpreted by investors as a prelude to future increases (decreases) in policy rates (e.g., Savor and Wilson, 2013; Lucca and Moench, 2015; Cieslak and Vissing-Jorgensen, 2020).

³³Inflation surprises are computed as actual minus expected inflation, where expected inflation is assumed to follow an ARMA(1,1) process. We measure inflation surprises not only for the aggregate euro area harmonized index of consumer prices (EA HICP (S)), but also for Germany (DE), Spain (ES), and France (FR). We focus on these countries because the timing of their national CPI releases precedes that of the euro area, and are therefore closely followed by investors.

V Robustness and Additional Analysis

In the Internet Appendix, we carry out a number of robustness exercises, primarily relating to beta estimation (Section [IA.5](#)). We also present additional analysis on the ECB based on (i) surprises from GC monetary policy factors, and (ii) surprises from inter-meeting communication (Section [IA.6](#)). We then shift the focus to US monetary policy surprises, assessing whether a similar risk-return trade-off exists in US equity strategy returns and whether US surprises spillover to the euro area, determining a risk premium (Section [IA.7](#)). The main findings are presented below, with the detailed analysis provided in the Internet Appendix.

V.A Robustness

Overall, we find that the main results remain consistent across the robustness exercises. Most importantly, regardless of the specification used for beta estimation, there is evidence of a positive and substantial risk-return trade-off, mainly arising from OIS rates of relatively short maturities (peaking around six- and one-year maturities), as measured in the press release window. The analysis lends further support to our earlier interpretation that the union of target and path shocks in prw is what ultimately drives the risk-return tradeoff. When the strategy factors are sorted according to 6M and 1Y OIS surprises in prw, which are first orthogonalized with respect to 3M OIS surprises, evidence of a risk-return trade-off weakens, though it does not disappear entirely. Moreover, using a recursive weighted-least-squares (WLS) method, as in [Boons, Duarte, de Roon and Szymanowska \(2020\)](#), whereby the most recent surprises carry more weight in the beta estimation, we find that the average returns and Sharpe ratios of the relevant raw prw spread portfolios (OIS 1M-2Y) tend to increase (e.g., they become 8.23% and 0.71, respectively, for OIS 1Y). Note that the average return of the spread portfolio sorted on the OIS 1M prw becomes significant at the 1% level also before removing measurement error/unpriced risk.

V.B Additional Analysis (ECB)

In what follows, we first sort the strategy factors on their exposures to the monetary policy factors of [Altavilla et al. \(2019\)](#) and [Jarociński and Karadi \(2020\)](#). These factors are extracted from the cross-sections of OIS high-frequency changes in the GC meetings. Thus, they are convolutions of the same surprises we employed so far. We perform this analysis mainly to help interpret our earlier evidence uncovered using the OIS rates of specific maturities. Then, to shed

some light on the effects of inter-meeting communication, we perform a similar portfolio analysis using high-frequency OIS surprises around the speeches of European central bank officials.

Monetary Policy Factors. Using the [Altavilla et al. \(2019\)](#) factors we find that target surprises, or discount-rate shocks, arising in the press release window determine a positive risk-return tradeoff in equity strategy returns, being a systematic source of risk for the investors.³⁴ Specifically, the de-noised TARGET portfolio risk premium is highly statistically significant (9.57%), with a Sharpe ratio of 1.31. The evidence from the pcw factors lends support but also refines our previous findings showing that surprises in the press conference window impact differently on equity strategy returns, being inconsistent with a positive risk-return tradeoff. Indeed, we find that the relevant pcw shocks are those captured by the timing factor and seem to determine a negative risk premium. A possible explanation is that these types of monetary policy surprises play a stabilizing role in the cross-section of equity strategy returns, in the sense of [Ozdagli and Velikov \(2020\)](#). Moreover, using the [Jarociński and Karadi \(2020\)](#) factors we can rule out the possibility that our new findings are driven (or contaminated) by information effects. In fact, we find that the risk premium of the ‘poor man’ factor is highly statistically significant, while there is no significant risk premium associated with the information shock. This further suggests that the positive risk-return found in new surprises is due to ‘pure’ monetary policy shocks.

Inter-meeting Communication. Using the communication surprises of [Istrefi et al. \(2025\)](#) and focusing on the ECB President and board members, we find that inter-meeting communication can generate a positive risk-return tradeoff in equity strategies, and hence represent a source of systematic risk for which investors require compensation, but only to the extent that it affects very short-term OIS rates. Specifically, using OIS 1M and 3M surprises there is again a monotonic, decreasing tendency in returns as we move from P1 to P5. The risk premia of the de-noised LMH OIS 1M and 3M portfolios are 5.41% and 3.78%, being significant at the 5% level, with Sharpe ratios of 0.82 and 0.74, respectively. Essentially none of the spread portfolios for maturities beyond OIS 3M have statistically significant returns. This finding seems consistent with the conjecture of [Bauer and Swanson \(2023b\)](#) that the stock market might be more

³⁴For further details, see [Altavilla et al. \(2019\)](#), pp.167–168). Here, we note that their TARGET factor is not a “pure” target factor as it captures not only variation in very short term OIS rates (typically up to three months) but also in somewhat longer maturities. For example, [Kearns et al. \(2023\)](#) say that three-months rates contain information about target shocks, while the difference between two-year and three-month OIS rates about path shocks. It is a TARGET factor in the sense that is driven mainly by variation in short-term OIS rates, and hence in the level of rates, in the prw.

sensitive to actual policy rate changes than to forward guidance. Nevertheless, this evidence is preliminary and should be treated with caution. For example, our analysis focused solely on speeches delivered by the ECB President and board members, in light of the goal of this study, and without considering the specific type of speech. Furthermore, these findings are from the perspective of equity strategy investors, so they may differ for other types of investors.

V.C US Monetary Policy

Finally, we shift the focus to US monetary policy surprises, given the existence of a large literature on the impact of US monetary policy shocks in various macroeconomic and finance strands of literature. We ask two separate but related questions: First, do US monetary policy surprises generate a risk-return tradeoff in US equity strategies similar to what we document in the euro area for European strategies? This will indicate the extent to which the evidence from the euro area can be applied to the US, notwithstanding the differences in policy mandates, financial structures of these two economics, and data availability. Second, do US monetary policy surprises cause a significant spread in euro area strategy returns? This question relates to the role of US policy in European equity markets, and to the existence of international spillovers emanating from US monetary policy.³⁵

The short answer to the first question above is yes. We document qualitatively similar evidence for the US, with investors requiring compensation for exposure to ‘pure’ monetary policy shocks, consistent with a risk-return tradeoff. However, the risk premia are lower in the US. When we examine the constituents of the corner portfolios more closely, we also observe some differences. One possible explanation is the different sectoral composition of the stock markets in the two areas, which can generate industry tilts in equity strategy factors to some extent. To shed light on this issue, one would need to work with industry-neutral strategies, but we leave further analysis to future research. Here, our focus remains on the euro area, where identification and interpretation are more straightforward given the design of the ECB single-

³⁵For this analysis, we employ both raw surprises from Eurodollar futures prices with maturity up to one year as well as the policy factors of [Jarociński and Karadi \(2020\)](#), which are very common in this literature. As mentioned earlier, a contemporaneous paper by [Acosta et al. \(2025\)](#) provides a novel data set for the US that mimics several of the features of the euro area data employed here, and which we believe will spur much further research going forward. We find that the results are virtually unchanged when using the FOMC monetary event and statement window shocks of [Acosta et al. \(2025\)](#). The sample span for the press conference window is much (over a decade) shorter in the US data, given the different evolution on the use of the press conference in US policy practice. Hence, pinning down a robust estimate of the pcw risk premium remains somewhat challenging, given the desirability of long spans in asset pricing research. Nevertheless, when using their press conference shocks we find that results are qualitatively similar to those of the euro area in the sense that there is no evidence of a positive risk-return tradeoff.

mandate and the richness of the OIS term structure. This section has a more modest objective, which is to establish that the core mechanism detected in this paper – monetary policy shocks generating positive relationship between risks and returns in equity strategies – is likely to be quite general, as it also extends to the US.

The answer to the second question is that US monetary policy surprises, measured by high-frequency changes in futures on short-term rates, do not generate persistent effects on euro area strategy returns. Indeed, we find that sorting the euro area strategy returns on their FOMC beta shows that US monetary policy surprises do not generate any noticeable pattern in euro area excess returns. This finding is consistent with the evidence that US spillovers are usually more substantial at the longer end of the euro area yield curve, and with the findings in [Gourinchas, Ray and Vayanos \(2025\)](#), showing that monetary policy spillovers mainly stem from unconventional policies. Therefore, these types of spillovers are less relevant for the risk-return tradeoff that we document, which mostly works via conventional target/path shocks.

VI Concluding Remarks

This paper uncovers a new dimension of the monetary policy transmission mechanism by shifting the focus to equity strategy returns. The earlier literature has focused either on stock market indices or individual stocks. Yet, long-short strategy factors — such as value, momentum, quality, and low-risk — are widely used by investors and particularly well suited for identifying systematic sources of risk, as they represent diversified portfolios that isolate the systematic components of risk. This is important because only non-diversifiable risk should be compensated in equilibrium. By contrast, individual stocks are highly influenced by idiosyncratic noise, while stock indices mask substantial heterogeneity. Studying strategy returns therefore provides a cleaner signal of how monetary policy shocks affect the risk-return tradeoff in equity markets. Moreover, we focus on the euro area, where institutional features and high-quality data offer an ideal laboratory for such an investigation.

Using high-frequency overnight index swap (OIS) surprises measured around and within ECB GC meetings, we estimate time-varying “ECB betas” that capture each strategy’s exposure to monetary policy shocks, allowing for shifts in their sensitivities over time. Dynamically sorting 153 euro-area equity factors by these betas reveals a sharp monetary policy risk-return tradeoff: strategies more exposed to monetary policy surprises (low OIS betas) earn higher excess returns

and Sharpe ratios, while those less exposed (high OIS betas) exhibit insignificant returns. The results are robust across a range of specifications and become even stronger when applying the three-pass estimation method, which mitigates measurement error and omitted variable bias.

Importantly, we find that not all monetary policy surprises are alike. The risk premium arises primarily from the press release window, when monetary decisions are announced, and exhibits a tent-shaped pattern, peaking for OIS maturities between six months and two years. This suggests that both target and path components of policy surprises are priced in characteristic-sorted equity portfolios. Therefore, contractionary monetary policy surprises in prw short-term OIS rates are associated with a bad news from an investor perspective, leading to higher marginal utility, consistent with standard asset-pricing theory.

We also provide preliminary evidence that inter-meeting communication — speeches by the ECB President and Executive Board members — can generate a similar positive tradeoff, but only when such communication moves short-term OIS rates. Although this premium is smaller than that obtained from policy rate surprises in the press release window, understanding the information content of speeches and their impact on asset prices remains an open and promising area for future research. Another fruitful avenue involves broadening the analysis to other countries, potentially employing industry-neutral strategies to account for sectoral tilts. Finally, it also seems warranted to develop conditional models that shed light on the time variation of the monetary policy premium and its connection to shifts in policy stance and the broader macroeconomic environment.

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TABLE 1

STRATEGY RETURN BETAS AND GOVERNING COUNCIL OIS SHOCKS

The table presents exposures of investment strategy returns to changes in OIS rates around ECB monetary policy announcements. The 153 investment strategy returns are combined to form 13 themes by taking equally-weighted combinations grouped by a cluster analysis of correlation and signal similarity following [Jensen et al. \(2023\)](#). We first regress the average theme return, RX , on the high-frequency OIS shocks around each of the monetary event (Panel A), press release (Panel B) and press conference windows (Panel C), respectively, at a monthly frequency. We sum over all OIS shocks in a given month and allocate to month-end. All shocks are standardized, to have zero mean and unit standard deviation, for interpretability. The outputs are in Panel 1, including the loadings (β), t -statistics (t -stat) using [Newey and West \(1987\)](#) standard errors, and adjusted R^2 s. All regressions include a constant, omitted for brevity. ***, ** and * correspond to a rejection of the null hypothesis of zero at the 1%, 5% and 10% confidence levels, respectively. Below, in Panel 2, we present summary statistics across regressions of the 13 individual theme excess returns on the same high-frequency OIS shocks. We report the average loading ($Mean$), the standard deviation across coefficients (Std), and the 5%, Median (Med) and 95% quantiles of the distribution of loadings. Finally, we report the p -value (p -val) from the joint test of the null that all betas are equal across themes for a given OIS shock: $\beta_j^m = \beta^m$ for any $j = 1, \dots, 13$, where $m = 1M, \dots, 10Y$ OIS maturities ([Burnside, 2011](#)). A rejection of the null indicates significant dispersion in monetary policy exposures across investment styles. The full sample is monthly from Jan/1999 to Dec/2024.

Panel A: Monetary Event Window								
	OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y
A1: RX								
β	-1.99**	-1.87***	-1.64**	-1.69**	-1.17**	-0.78	-0.50	-0.25
t -stat	-2.59	-2.94	-2.42	-2.43	-2.02	-1.32	-0.83	-0.41
R^2	0.03	0.02	0.02	0.02	0.01	0.00	0.00	0.00
A2: Themes								
Mean	-1.68	-1.59	-1.49	-1.51	-1.08	-0.77	-0.57	-0.32
Std	3.22	3.29	2.67	2.20	1.60	1.47	1.78	1.80
5%	-8.17	-8.59	-7.60	-5.74	-4.61	-3.80	-4.56	-3.89
Med	-0.96	-0.76	-0.83	-1.30	-0.61	-0.53	-0.46	-0.07
95%	2.95	2.97	1.99	2.20	1.32	1.02	1.84	2.65
[p -val]	[0.00]	[0.01]	[0.32]	[0.43]	[0.46]	[0.49]	[0.26]	[0.06]
Panel B: Press Release Window								
	OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y
B1: RX								
β	-1.88**	-1.62***	-1.60**	-1.33**	-1.07**	-0.69	-0.33	-0.09
t -stat	-2.55	-2.62	-2.55	-2.39	-2.00	-1.20	-0.55	-0.13
R^2	0.02	0.02	0.02	0.01	0.01	0.00	0.00	0.00
B2: Themes								
Mean	-1.55	-1.39	-1.40	-1.18	-0.92	-0.63	-0.35	-0.16
Std	2.86	2.98	2.95	2.51	1.65	1.19	1.18	1.32
5%	-7.15	-7.68	-7.11	-6.53	-3.43	-3.09	-3.15	-3.13
Med	-1.35	-0.81	-0.64	-0.77	-0.51	-0.27	-0.06	0.09
95%	3.18	3.25	3.27	2.72	2.24	1.26	1.36	1.99
[p -val]	[0.00]	[0.00]	[0.00]	[0.00]	[0.05]	[0.28]	[0.20]	[0.06]
Panel C: Press Conference Window								
	OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y
C1: RX								
β	0.43	-0.89	-0.57	-1.14	-0.87	-0.58	-0.40	-0.24
t -stat	0.63	-1.27	-0.98	-1.59	-1.49	-1.05	-0.74	-0.45
R^2	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
C2: Themes								
Mean	0.22	-0.80	-0.61	-1.01	-0.80	-0.55	-0.43	-0.25
Std	2.08	1.86	1.39	1.33	1.24	1.33	1.51	1.49
5%	-2.59	-4.91	-3.57	-3.90	-3.18	-2.57	-3.05	-2.42
Med	-0.17	-0.20	-0.48	-0.69	-0.37	-0.42	-0.51	-0.35
95%	4.61	1.23	1.48	0.95	0.50	1.30	1.66	2.17
[p -val]	[0.00]	[0.15]	[0.64]	[0.59]	[0.60]	[0.42]	[0.33]	[0.15]

TABLE 2

BETA-SORTED PORTFOLIO STATISTICS: MONETARY EVENT WINDOW

The table presents summary statistics of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the monetary event window. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1\text{M}$ to 10Y , around the monetary event window, $w = \text{mew}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	4.73***	4.31***	3.16***	2.00***	0.23	4.92**	3.99**	Mean	5.47***	4.04***	2.71***	1.58***	0.18	5.26**	4.31**
t-stat	2.64	4.66	4.93	3.72	-0.26	2.05	2.16	t-stat	3.09	4.11	4.00	3.19	0.21	2.23	2.35
Std	8.52	4.32	2.84	2.36	4.69	11.66	9.12	Std	8.36	4.47	3.00	2.27	4.42	11.36	8.87
SR	0.56	1.00	1.11	0.85	0.05	0.42	0.44	SR	0.65	0.90	0.91	0.69	0.04	0.46	0.49
AC(1)	0.14	0.12	0.17	0.20	0.03	0.12	0.10	AC(1)	0.12	0.15	0.21	0.11	0.02	0.09	0.09
Pre- β	-59.19	-22.01	-6.11	9.37	40.94	-100.13	-79.19	Pre- β	-43.33	-17.88	-5.42	6.98	29.75	-73.07	-58.29
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.31***	4.25***	2.54***	1.73***	0.12	5.09**	4.20**	Mean	5.81***	3.93***	2.25***	1.79***	0.16	5.54**	4.42**
t-stat	3.01	4.50	3.76	3.39	0.15	2.21	2.34	t-stat	3.47	3.57	3.31	3.28	0.21	2.56	2.51
Std	8.20	4.27	3.10	2.46	4.19	11.00	8.64	Std	7.84	4.77	3.26	2.37	3.78	10.23	8.27
SR	0.65	1.00	0.82	0.70	0.03	0.46	0.49	SR	0.74	0.82	0.69	0.75	0.04	0.54	0.53
AC(1)	0.13	0.15	0.12	0.09	0.02	0.10	0.09	AC(1)	0.11	0.19	0.09	0.23	0.03	0.10	0.10
Pre- β	-39.62	-16.38	-4.60	7.67	28.48	-68.10	-54.50	Pre- β	-43.25	-19.46	-6.25	5.82	29.12	-72.37	-57.91
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	6.13***	4.09***	2.50***	1.10**	0.10	5.90***	4.98***	Mean	5.36***	3.96***	2.62***	2.06***	0.07	5.27**	4.33**
t-stat	3.56	3.82	4.01	2.04	0.13	2.65	2.79	t-stat	3.22	3.60	4.56	3.85	-0.09	2.46	2.50
Std	7.98	4.66	3.00	2.40	3.78	10.37	8.29	Std	7.88	4.87	2.64	2.37	3.89	10.29	8.14
SR	0.77	0.88	0.83	0.46	0.03	0.57	0.60	SR	0.68	0.81	0.99	0.87	0.02	0.51	0.53
AC(1)	0.12	0.19	0.10	0.17	0.05	0.12	0.12	AC(1)	0.09	0.19	0.12	0.19	0.01	0.08	0.10
Pre- β	-38.53	-16.99	-5.18	5.30	25.60	-64.13	-51.30	Pre- β	-32.61	-14.25	-3.70	5.53	22.64	-55.25	-44.38
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.40***	4.02***	2.66***	1.92***	0.08	5.31**	4.27**	Mean	5.10***	3.97***	2.80***	1.75***	0.29	4.62**	4.00**
t-stat	3.12	4.23	4.11	3.45	-0.10	2.35	2.45	t-stat	3.15	4.28	4.40	2.67	0.34	2.13	2.39
Std	8.02	4.44	2.85	2.50	4.03	10.62	8.25	Std	7.52	4.27	2.95	2.98	4.35	10.32	8.01
SR	0.67	0.91	0.94	0.77	0.02	0.50	0.52	SR	0.68	0.93	0.95	0.59	0.07	0.45	0.50
AC(1)	0.11	0.12	0.17	0.17	0.05	0.10	0.09	AC(1)	0.13	0.12	0.11	0.15	0.04	0.10	0.09
Pre- β	-29.20	-12.70	-3.26	5.47	21.33	-50.53	-40.63	Pre- β	-25.50	-10.75	-2.16	6.19	21.21	-46.71	-37.63

TABLE 3

BETA-SORTED PORTFOLIO STATISTICS: PRESS RELEASE WINDOW

The table presents summary statistics of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press release window. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1\text{M}$ to 10Y , around the press release window, $w = \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	4.52**	4.03***	3.25***	1.84***	0.32	4.13	3.53*	Mean	5.17***	3.99***	2.80***	1.83***	0.18	4.89**	3.91**
t-stat	2.46	4.28	5.42	3.10	0.31	1.62	1.79	t-stat	3.05	4.25	4.44	3.18	0.20	2.19	2.20
Std	8.63	4.54	2.61	2.63	5.17	12.28	9.59	Std	8.16	4.52	2.82	2.55	4.85	11.35	9.06
SR	0.52	0.89	1.25	0.70	0.06	0.34	0.37	SR	0.63	0.88	0.99	0.72	0.04	0.43	0.43
AC(1)	0.15	0.08	0.20	0.21	0.04	0.12	0.11	AC(1)	0.10	0.08	0.16	0.18	-0.02	0.04	0.04
Pre- β	-69.41	-26.05	-6.12	11.58	52.06	-121.47	-95.91	Pre- β	-68.18	-26.41	-6.71	12.07	49.40	-117.58	-93.50
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.80***	4.01***	2.84***	1.73***	-0.40	6.10***	4.84***	Mean	5.83***	3.97***	3.00***	1.61***	-0.45	6.16***	4.90***
t-stat	3.37	4.38	4.14	2.86	-0.43	2.61	2.65	t-stat	3.42	4.14	4.02	2.79	-0.51	2.67	2.67
Std	8.14	4.41	3.13	2.73	4.97	11.60	9.21	Std	8.06	4.53	3.33	2.75	4.92	11.66	9.25
SR	0.71	0.91	0.91	0.63	0.08	0.53	0.53	SR	0.72	0.88	0.90	0.59	0.09	0.53	0.53
AC(1)	0.11	0.06	0.14	0.17	0.00	0.06	0.04	AC(1)	0.11	0.10	0.19	0.09	-0.05	0.04	0.04
Pre- β	-58.75	-22.39	-5.22	11.87	44.44	-103.19	-82.13	Pre- β	-55.61	-22.16	-5.75	10.95	41.39	-97.00	-77.41
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.76***	3.99***	3.21***	1.27**	-0.29	5.91**	4.91***	Mean	5.33***	4.17***	2.85***	1.82***	0.19	5.42**	4.29**
t-stat	3.38	4.10	4.48	2.27	-0.32	2.57	2.67	t-stat	3.09	4.36	3.92	3.33	-0.24	2.39	2.43
Std	8.09	4.39	3.20	2.79	4.86	11.48	9.13	Std	7.95	4.48	3.27	2.59	4.15	10.77	8.41
SR	0.71	0.91	1.00	0.45	0.06	0.51	0.54	SR	0.67	0.93	0.87	0.70	0.05	0.50	0.51
AC(1)	0.11	0.16	0.19	0.01	-0.03	0.05	0.05	AC(1)	0.14	0.11	0.16	0.07	0.04	0.10	0.10
Pre- β	-56.14	-22.38	-5.57	11.11	41.13	-97.27	-77.62	Pre- β	-46.43	-19.45	-5.93	6.94	31.26	-77.69	-61.92
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	4.99***	3.80***	3.10***	2.28***	0.21	5.07**	3.85**	Mean	3.23***	2.81***	3.09***	2.86***	1.92	1.21	0.87
t-stat	2.86	4.14	4.48	3.75	-0.22	2.13	2.09	t-stat	2.93	4.66	4.18	3.10	1.54	0.63	0.57
Std	8.11	4.29	3.06	2.75	4.59	11.19	8.72	Std	5.74	3.08	3.34	4.15	5.99	9.75	7.74
SR	0.62	0.89	1.01	0.83	0.05	0.45	0.44	SR	0.56	0.91	0.93	0.69	0.32	0.12	0.11
AC(1)	0.12	0.10	0.19	0.14	0.08	0.11	0.10	AC(1)	-0.01	-0.02	0.16	0.16	0.12	0.02	0.02
Pre- β	-42.90	-18.23	-5.38	7.20	30.53	-73.43	-58.72	Pre- β	-33.28	-12.68	-1.71	8.84	27.80	-61.08	-49.06

TABLE 4
PORTFOLIO CONSTITUENTS BY THEMES

The table presents constituents of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press release window. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the press release window, $w = prw$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures (see Table 3). Panel A (B) displays, in *Total*, the percentage of times a factor corresponding to one of the 13 respective investment themes appears in P1 (P5), averaged across all OIS maturities, τ , relative to another portfolio. The 153 factors are assigned to their themes by a cluster analysis of correlation and signal similarity following Jensen et al. (2023). Slicing the data into contractionary (*Cont.*) and expansionary (*Exp.*) monetary policy regimes, following Buetow et al. (2009), the table also reports the percentage of times a given theme appears in a corner portfolio within each policy regime. The respective ranking of each theme is also reported across regimes. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: Low OIS-Beta (P1)						
Theme	Rank	Total	Rank	Cont.	Rank	Exp.
low risk	1	39.66	1	32.21	1	42.27
momentum	2	33.83	2	29.97	2	35.18
quality	3	29.32	5	20.17	3	32.52
profitability	4	22.90	11	8.24	4	28.04
value	5	21.06	3	28.12	5	18.59
size	6	17.64	4	25.29	7	14.95
low leverage	7	16.42	6	19.15	6	15.47
short term reversal	8	15.53	9	18.57	8	14.48
seasonality	9	13.86	8	18.64	10	12.32
accruals	10	10.95	13	4.74	9	13.10
profit growth	11	10.26	10	12.54	11	9.48
investment	12	10.07	7	19.05	12	6.92
debt issuance	13	4.61	12	7.36	13	3.65
Panel B: High OIS-Beta (P5)						
Theme	Rank	Total	Rank	Cont.	Rank	Exp.
value	1	33.15	3	27.07	2	35.29
size	2	31.72	9	14.15	1	37.89
low leverage	3	28.87	1	36.30	4	26.27
investment	4	24.02	8	16.35	3	26.72
momentum	5	19.44	2	28.25	7	16.35
seasonality	6	18.56	10	13.86	5	20.06
profit growth	7	17.91	6	19.89	6	17.20
low risk	8	14.77	5	20.80	10	12.67
profitability	9	14.49	7	18.74	9	13.01
quality	10	14.20	4	21.71	12	11.57
debt issuance	11	13.15	12	11.15	8	13.85
accruals	12	12.10	11	12.81	11	12.04
short term reversal	13	9.36	13	4.89	13	10.93

TABLE 5

LATENT FACTOR STATISTICS AND SDF DIAGNOSTICS

The table presents model diagnostics of the first two steps of the three-pass asset pricing procedure of [Giglio and Xiu \(2021\)](#). Specifically, we examine the properties of the latent factors and associated tangency portfolios (Panel A), and the performance of the latent-factor models (Panel B). We do so by examining the first 12 latent factors, i.e., F_k for $k = 1, 2, \dots, 12$, and models including an increasing number of latent factors. We estimate the latent factors applying the RP-PCA method of [Lettau and Pelger \(2020a,b\)](#) with RP-weight of $\omega = 20$ to the 153 test asset (factor) returns. Panel A reports the latent factors and tangency portfolios. Specifically, Panel A1 shows the annualized average return of each latent factor (μ_{F_k}), where ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence levels, respectively, based on [Newey and West \(1987\)](#) standard errors; the k -th factor's Sharpe ratio (SR); and, the k -th factor's weight in the tangency portfolio ($\hat{b}_{MV} = \mu_F \Sigma_F^{-1}$). Panel A2 presents the annualized maximum Sharpe ratio of the tangency portfolios (SR), and the change in the Sharpe ratio owing to the inclusion of the next additional latent factor, k (ΔSR). Panel B provides several statistics and evaluation criteria for the first-pass (Equation (5): $\tilde{X}_{nt} = \tilde{F}_t \psi_n^\top + \epsilon_{nt}$) and second-pass (Equation (6): $\bar{X}_n = \hat{\psi}_n \gamma^\top + a_n$) regressions, where X are the test asset returns, ψ are the asset risk exposures, and γ are the latent factor prices of risk (which, by no arbitrage equal the factor average returns). Panel B1 reports the average idiosyncratic variance ($\bar{\sigma}_\epsilon^2 = 1/N \sum_{n=1}^N [Var(\hat{\epsilon}_n)/Var(X_n)]$), and the average root-mean-square alpha (pricing error) from the time-series regressions ($\overline{RMS}_\alpha = \sqrt{\hat{\alpha} \hat{\alpha}' / N}$). Panel B2 shows the mean absolute pricing error from the cross-sectional regression (MAE), and the percentage of variation explained by the tangency portfolio (R^2). Panel B3 presents the number of individually statistically significant alphas for each factor model. The statistical significance of individual alphas and mean absolute pricing errors are estimated using a wild bootstrap procedure similar to that of [Giglio et al. \(2021\)](#), where multiple-hypothesis testing biases are addressed via the [Benjamini and Hochberg \(1995, BH\)](#) false discovery control approach. Thus, $\alpha_{\xi\%}^{BH}$ represents the number of individually significant pricing errors at the BH-corrected $\xi = \{5\%, 1\%\}$ levels, respectively. See Section [IA.3.1](#), in the Internet Appendix, for details of the wild bootstrap algorithm. The sample is monthly, from Jul/2000 to Dec/2024.

Panel A: Factors & Tangency Portfolios							Panel B: Two-Pass Statistics					
$\omega = 20$	A1: Factors			A2: Tangency Portfolios			B1: First-Pass		B2: Second-Pass		B3: Pricing Errors	
	$\mu_{F,k}$	SR	$\hat{b}_{MV,k}$	SR	ΔSR		$\hat{\sigma}_\epsilon^2$	$\overline{RMS}_\alpha$	MAE	R^2	$\alpha_{5\%}^{BH}$	$\alpha_{1\%}^{BH}$
F_1	41.86***	0.70	0.10	$\pi(F_{1-1})$	0.70	F_{1-1}	66.89	3.39	1.39***	60.40	82	67
F_2	34.35***	0.68	0.11	$\pi(F_{1-2})$	0.97	F_{1-2}	45.51	2.79	0.85***	85.92	87	71
F_3	33.10***	1.42	0.51	$\pi(F_{1-3})$	1.72	F_{1-3}	40.77	1.80	0.23***	98.96	43	22
F_4	9.84*	0.42	0.15	$\pi(F_{1-4})$	1.77	F_{1-4}	36.54	1.70	0.20***	99.17	31	13
F_5	1.97	0.10	0.04	$\pi(F_{1-5})$	1.77	F_{1-5}	33.45	1.69	0.20***	99.19	31	18
F_6	9.62**	0.52	0.23	$\pi(F_{1-6})$	1.85	F_{1-6}	30.80	1.61	0.18***	99.32	25	0
F_7	12.91***	0.81	0.43	$\pi(F_{1-7})$	2.02	F_{1-7}	28.82	1.44	0.13***	99.59	14	0
F_8	3.65	0.23	0.12	$\pi(F_{1-8})$	2.03	F_{1-8}	26.92	1.42	0.13***	99.61	12	0
F_9	6.56**	0.46	0.27	$\pi(F_{1-9})$	2.08	F_{1-9}	25.37	1.38	0.12***	99.66	4	0
F_{10}	5.11*	0.39	0.24	$\pi(F_{1-10})$	2.12	F_{1-10}	24.04	1.36	0.12***	99.69	5	0
F_{11}	10.41***	0.85	0.58	$\pi(F_{1-11})$	2.28	F_{1-11}	22.87	1.22	0.09	99.81	0	0
F_{12}	2.13	0.17	0.11	$\pi(F_{1-12})$	2.29	F_{1-12}	21.69	1.21	0.09	99.81	0	0

TABLE 6

EXPOSURES OF SPREAD PORTFOLIOS TO LATENT FACTORS

The table presents the exposures (Panel 1) and explained variations (Panel 2) of the candidate LMH portfolio returns, LMH τ , for OIS maturities $\tau = 1\text{M}$ to 10Y across windows $w = \text{mew, prw, pcw}$ (Panels A-C) to the optimal euro area pricing kernel. The loadings, η_{F_k} , are obtained from spanning regressions of the candidate factor on the optimal eleven-latent-factor model, and explained variations, $R^2_{F_{1-k}}$ (in percentage), from models of increasing numbers of factors, $k = 1, \dots, 11$. The latent factors are obtained from applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ euro area investment strategy returns. ***, ** and * correspond to a rejection of the null hypothesis of zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated using [Newey and West \(1987\)](#). The sample period is Jul/2000 to Dec/2024.

Panel A: Monetary Event Window																						
A1: Risk Exposure												A2: Explained Variation										
	η_{F_1}	η_{F_2}	η_{F_3}	η_{F_4}	η_{F_5}	η_{F_6}	η_{F_7}	η_{F_8}	η_{F_9}	$\eta_{F_{10}}$	$\eta_{F_{11}}$	$R^2_{F_{1-1}}$	$R^2_{F_{1-2}}$	$R^2_{F_{1-3}}$	$R^2_{F_{1-4}}$	$R^2_{F_{1-5}}$	$R^2_{F_{1-6}}$	$R^2_{F_{1-7}}$	$R^2_{F_{1-8}}$	$R^2_{F_{1-9}}$	$R^2_{F_{1-10}}$	$R^2_{F_{1-11}}$
LMH 1M	11.03***	3.81	-3.26	-1.29	11.72***	9.51**	-1.18	-0.27	-3.66	3.45	-14.45*	32.24	34.78	34.98	34.83	38.77	40.88	40.70	40.49	40.49	40.43	42.59
LMH 3M	11.33***	4.82**	-2.24	-1.84	6.92**	10.05**	-4.19	2.32	-3.34	-2.68	-8.28	35.84	40.28	40.29	40.23	41.55	44.07	44.23	44.14	44.13	44.03	44.65
LMH 6M	10.76***	6.68***	-1.55	-4.00*	5.24*	9.61**	-1.59	3.55	-0.02	0.15	-3.75	34.44	43.77	43.69	44.23	44.97	47.44	47.31	47.40	47.21	47.03	47.02
LMH 1Y	11.64***	2.78	-1.16	-3.61**	4.13	6.38	-1.54	-0.14	-1.21	-3.20	1.29	46.58	48.31	48.21	48.72	49.22	50.40	50.29	50.11	49.97	49.97	49.81
LMH 2Y	11.60***	2.72	2.27	-4.64**	4.17*	6.63	-1.44	-0.14	1.17	-3.27	3.17	45.07	46.67	46.75	47.69	48.18	49.42	49.30	49.12	48.97	48.97	48.93
LMH 5Y	12.90***	-3.02**	6.76***	-5.49***	2.86	3.60	-4.38	-3.82	-3.32	-6.52**	7.70*	56.61	58.69	60.92	62.37	62.56	62.86	63.20	63.42	63.51	64.10	64.84
LMH 7Y	13.03***	-2.96**	8.17***	-6.61***	3.68	4.10*	-6.55**	-5.27	-4.94	-9.62***	11.62***	54.25	56.11	59.20	61.23	61.59	61.97	62.82	63.32	63.64	64.99	66.71
LMH 10Y	10.69***	-3.71***	11.59***	-8.29***	5.67**	4.59*	-8.56***	-7.05*	-6.66*	-9.45***	14.90***	38.64	41.78	48.50	51.93	53.00	53.53	55.14	56.18	56.89	58.24	61.30
Panel B: Press Release Window																						
B1: Risk Exposure												B2: Explained Variation										
	η_{F_1}	η_{F_2}	η_{F_3}	η_{F_4}	η_{F_5}	η_{F_6}	η_{F_7}	η_{F_8}	η_{F_9}	$\eta_{F_{10}}$	$\eta_{F_{11}}$	$R^2_{F_{1-1}}$	$R^2_{F_{1-2}}$	$R^2_{F_{1-3}}$	$R^2_{F_{1-4}}$	$R^2_{F_{1-5}}$	$R^2_{F_{1-6}}$	$R^2_{F_{1-7}}$	$R^2_{F_{1-8}}$	$R^2_{F_{1-9}}$	$R^2_{F_{1-10}}$	$R^2_{F_{1-11}}$
LMH 1M	10.42***	4.05	1.55	-4.28	10.33**	11.89**	-5.21	3.32	-9.62	3.51	-17.32**	25.92	28.50	28.34	28.77	31.44	34.47	34.71	34.66	35.71	35.63	38.47
LMH 3M	9.54***	4.96**	2.04	-5.31**	5.46	8.99*	-3.21	7.95**	-3.17	2.25	-7.80	25.44	30.15	30.08	31.07	31.78	33.73	33.71	34.74	34.67	34.51	35.01
LMH 6M	8.77***	6.40**	3.99	-5.09**	1.52	9.17*	-3.68	9.30**	-1.65	-3.30	2.26	20.58	28.21	28.61	29.44	29.27	31.21	31.22	32.64	32.44	32.35	32.17
LMH 1Y	8.84***	6.98***	3.51	-4.55*	3.60	8.56*	-3.59	5.76	-0.47	-3.30	0.21	20.74	29.78	30.04	30.65	30.80	32.44	32.45	32.84	32.61	32.51	32.28
LMH 2Y	8.53***	5.94**	3.66	-5.30**	4.27	7.73	-2.44	6.22	-0.80	-0.20	-1.11	19.87	26.54	26.84	27.78	28.10	29.43	29.30	29.81	29.57	29.33	29.09
LMH 5Y	12.23***	-0.91	6.35**	-9.18***	-2.17	0.61	-3.15	1.43	-11.41***	-8.48**	8.75	46.43	46.44	48.16	52.04	52.04	51.88	51.94	51.81	53.97	54.92	55.78
LMH 7Y	11.97***	-3.09*	8.42***	10.83***	-0.67	3.34	-7.14	-0.61	-12.80***	15.09***	18.04***	41.20	42.98	45.89	50.94	50.78	50.92	51.80	51.64	54.18	57.29	61.14
LMH 10Y	1.89*	-12.43***	6.94***	-6.76***	-0.34	-3.23	0.92	2.82	0.81	-7.05***	24.01***	1.36	43.23	45.81	48.31	48.13	48.34	48.18	48.21	48.05	48.80	57.97
Panel C: Press Conference Window																						
C1: Risk Exposure												C2: Explained Variation										
	η_{F_1}	η_{F_2}	η_{F_3}	η_{F_4}	η_{F_5}	η_{F_6}	η_{F_7}	η_{F_8}	η_{F_9}	$\eta_{F_{10}}$	$\eta_{F_{11}}$	$R^2_{F_{1-1}}$	$R^2_{F_{1-2}}$	$R^2_{F_{1-3}}$	$R^2_{F_{1-4}}$	$R^2_{F_{1-5}}$	$R^2_{F_{1-6}}$	$R^2_{F_{1-7}}$	$R^2_{F_{1-8}}$	$R^2_{F_{1-9}}$	$R^2_{F_{1-10}}$	$R^2_{F_{1-11}}$
LMH 1M	8.52***	-2.20	-11.95***	4.52**	-4.80	-8.62**	7.16*	-0.08	2.59	-4.64	-6.72	21.33	21.04	29.32	29.33	30.47	32.11	32.32	32.05	32.04	31.85	32.46
LMH 3M	6.64***	-9.76***	-4.92*	6.18**	0.01	-5.50	-4.53	-5.55	1.39	1.61	-12.84**	25.54	37.79	38.77	40.54	40.33	40.87	40.83	41.15	40.98	40.90	43.25
LMH 6M	6.48***	7.95***	-4.58	1.17	-2.37	-4.21	-5.76	0.67	1.18	4.39	-10.92*	20.87	28.34	28.83	28.62	28.36	28.67	28.93	28.65	28.38	28.46	30.06
LMH 1Y	5.87***	10.20***	-2.72	0.51	0.90	-3.63	-5.22	-1.96	1.11	2.81	-5.58	24.77	39.38	39.49	39.28	39.19	39.37	39.43	39.29	39.06	38.95	39.19
LMH 2Y	7.28***	10.39***	-1.78	0.02	1.60	-3.34	-4.03	-1.55	1.48	5.00	-4.75	34.69	49.95	49.88	49.68	49.80	49.95	49.89	49.78	49.60	49.69	49.87
LMH 5Y	8.35***	12.25***	-0.68	0.84	2.59	-1.40	-2.94	1.40	2.42	12.02***	-4.99	42.62	59.37	59.22	59.17	59.75	59.64	59.50	59.34	59.19	60.27	60.48
LMH 7Y	8.45***	12.58***	-0.23	1.52	1.72	-1.71	-3.28	2.79	2.93	11.18**	-5.27	42.16	59.46	59.35	59.39	59.72	59.63	59.55	59.40	59.26	60.17	60.41
LMH 10Y	8.66***	13.63***	-0.07	3.22	3.18	-0.98	-3.16	2.53	4.47	10.61**	-3.52	44.03	63.26	63.18	63.70	64.37	64.24	64.18	64.03	63.98	64.70	64.73

TABLE 7

RISK PREMIA OF SPREAD PORTFOLIOS

The table presents the risk premium and Sharpe ratio estimates of the raw (Panel 1), as well as de-noised (Panel 2-3) LMH portfolio returns, LMH τ , for OIS maturities $\tau = 1\text{M}$ to 10Y across windows $w = \text{mew, prw, pcw}$ (Panels A-C) from the third-pass of the [Giglio and Xiu \(2021\)](#) three-pass procedure. Estimates are reported using models including an increasing number of latent factors, F_{1-k} for $k = 1, 2, \dots, 11$. The latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ $N = 153$ euro area investment strategy returns. ***, ** and * correspond to a rejection of the null hypothesis of zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated as in [Giglio and Xiu \(2021\)](#). The sample period is Jul/2000 to Dec/2024.

Panel A: Monetary Event Window																								
A1: Factor			A2: Risk Premia											A3: Sharpe Ratios										
	Mean	SR	F_{1-1}	F_{1-2}	F_{1-3}	F_{1-4}	F_{1-5}	F_{1-6}	F_{1-7}	F_{1-8}	F_{1-9}	F_{1-10}	F_{1-11}	$SR_{F_{1-1}}$	$SR_{F_{1-2}}$	$SR_{F_{1-3}}$	$SR_{F_{1-4}}$	$SR_{F_{1-5}}$	$SR_{F_{1-6}}$	$SR_{F_{1-7}}$	$SR_{F_{1-8}}$	$SR_{F_{1-9}}$	$SR_{F_{1-10}}$	$SR_{F_{1-11}}$
LMH 1M	4.92**	0.42	4.62**	5.92***	4.85**	4.72**	4.95**	5.87***	5.71***	5.70***	5.46**	5.64**	4.14*	0.70	0.86	0.70	0.68	0.67	0.78	0.76	0.76	0.72	0.74	0.53
LMH 3M	5.26**	0.46	4.74**	6.40***	5.66**	5.48**	5.61***	6.58***	6.04***	6.12***	5.90***	5.77***	4.90**	0.70	0.89	0.78	0.75	0.76	0.86	0.79	0.80	0.77	0.75	0.63
LMH 6M	5.09**	0.46	4.50**	6.80***	6.28***	5.89***	5.99***	6.92***	6.71***	6.84***	6.84***	6.85***	6.46***	0.70	0.93	0.86	0.80	0.81	0.90	0.88	0.89	0.89	0.89	0.84
LMH 1Y	5.54**	0.54	4.87***	5.83***	5.44***	5.09***	5.17***	5.78***	5.58***	5.58***	5.50***	5.34***	5.47***	0.70	0.82	0.76	0.71	0.72	0.79	0.76	0.76	0.75	0.73	0.74
LMH 2Y	5.90***	0.57	4.85***	5.79***	6.54***	6.08***	6.17***	6.80***	6.62***	6.61***	6.69***	6.52***	6.85***	0.70	0.82	0.92	0.85	0.85	0.93	0.90	0.90	0.91	0.89	0.93
LMH 5Y	5.27**	0.51	5.40***	4.36**	6.60***	6.06***	6.12***	6.46***	5.90***	5.76***	5.54***	5.21***	6.01***	0.70	0.55	0.82	0.74	0.75	0.79	0.72	0.70	0.67	0.63	0.72
LMH 7Y	5.31**	0.50	5.46***	4.44**	7.14***	6.49***	6.56***	6.96***	6.11***	5.92***	5.59***	5.10**	6.31***	0.70	0.56	0.87	0.78	0.78	0.83	0.72	0.70	0.66	0.59	0.72
LMH 10Y	4.62**	0.45	4.47***	3.20	7.04***	6.22***	6.33***	6.77***	5.67***	5.41**	4.97**	4.49**	6.04***	0.70	0.48	0.98	0.83	0.84	0.89	0.73	0.69	0.63	0.56	0.74
Panel B: Press Release Window																								
B1: Factor			B2: Risk Premia											B3: Sharpe Ratios										
	Mean	SR	F_{1-1}	F_{1-2}	F_{1-3}	F_{1-4}	F_{1-5}	F_{1-6}	F_{1-7}	F_{1-8}	F_{1-9}	F_{1-10}	F_{1-11}	$SR_{F_{1-1}}$	$SR_{F_{1-2}}$	$SR_{F_{1-3}}$	$SR_{F_{1-4}}$	$SR_{F_{1-5}}$	$SR_{F_{1-6}}$	$SR_{F_{1-7}}$	$SR_{F_{1-8}}$	$SR_{F_{1-9}}$	$SR_{F_{1-10}}$	$SR_{F_{1-11}}$
LMH 1M	4.13	0.34	4.36**	5.75***	6.27***	5.85***	6.05***	7.19***	6.52***	6.64***	6.01***	6.19***	4.39*	0.70	0.87	0.95	0.88	0.87	0.98	0.88	0.90	0.80	0.82	0.56
LMH 3M	4.89**	0.43	3.99**	5.70***	6.37***	5.85***	5.96***	6.82***	6.41***	6.70***	6.49***	6.61***	5.79***	0.70	0.91	1.02	0.91	0.92	1.02	0.95	0.98	0.95	0.96	0.84
LMH 6M	6.10***	0.53	3.67**	5.87***	7.19***	6.69***	6.72***	7.60***	7.13***	7.47***	7.36***	7.19***	7.42***	0.70	0.95	1.15	1.05	1.05	1.15	1.08	1.10	1.08	1.06	1.09
LMH 1Y	6.16***	0.53	3.70**	6.10***	7.26***	6.82***	6.89***	7.71***	7.25***	7.46***	7.43***	7.26***	7.28***	0.70	0.96	1.13	1.04	1.05	1.14	1.07	1.09	1.09	1.06	1.06
LMH 2Y	5.91**	0.51	3.57**	5.61***	6.82***	6.30***	6.38***	7.13***	6.81***	7.04***	6.98***	6.97***	6.86***	0.70	0.94	1.14	1.03	1.03	1.12	1.07	1.09	1.08	1.08	1.06
LMH 5Y	5.42**	0.50	5.12***	4.81**	6.91***	6.01***	5.96***	6.02**	5.62**	5.67***	4.92**	4.49**	5.40***	0.70	0.65	0.92	0.77	0.76	0.77	0.72	0.72	0.61	0.56	0.66
LMH 7Y	5.07**	0.45	5.01**	3.95*	6.73***	5.67**	5.65**	5.98**	5.05**	5.03**	4.19*	3.42	5.30**	0.70	0.54	0.88	0.71	0.70	0.74	0.62	0.62	0.50	0.40	0.60
LMH 10Y	1.21	0.12	0.79	-3.48**	-1.18	-1.85	-1.85	-2.17	-2.05	-1.94	-1.89	-2.25	0.25	0.70	0.54	0.18	0.27	0.27	0.32	0.30	0.28	0.28	0.33	0.03
Panel C: Press Conference Window																								
C1: Factor			C2: Risk Premia											C3: Sharpe Ratios										
	Mean	SR	F_{1-1}	F_{1-2}	F_{1-3}	F_{1-4}	F_{1-5}	F_{1-6}	F_{1-7}	F_{1-8}	F_{1-9}	F_{1-10}	F_{1-11}	$SR_{F_{1-1}}$	$SR_{F_{1-2}}$	$SR_{F_{1-3}}$	$SR_{F_{1-4}}$	$SR_{F_{1-5}}$	$SR_{F_{1-6}}$	$SR_{F_{1-7}}$	$SR_{F_{1-8}}$	$SR_{F_{1-9}}$	$SR_{F_{1-10}}$	$SR_{F_{1-11}}$
LMH 1M	-2.04	0.24	3.96***	4.15***	-0.23	-0.07	0.18	-1.21	-0.95	-0.94	-1.07	-0.90	-1.47	0.70	0.72	0.04	0.01	0.03	0.18	0.15	0.15	0.17	0.14	0.23
LMH 3M	-3.97*	0.41	4.83***	-0.15	-1.99	-1.52	-1.56	-2.55	-2.73	-2.65	-2.72	-2.98	-4.07*	0.70	0.02	0.31	0.23	0.23	0.37	0.40	0.39	0.40	0.42	0.58
LMH 6M	-5.43**	0.57	4.35***	0.44	-1.01	-0.93	-0.90	-1.76	-2.07	-2.06	-2.11	-2.50	-3.42	0.70	0.08	0.18	0.17	0.16	0.31	0.35	0.35	0.36	0.41	0.57
LMH 1Y	-3.93*	0.41	4.73***	-0.67	-1.64	-1.59	-1.68	-2.40	-2.63	-2.60	-2.63	-2.86	-3.34	0.70	0.11	0.26	0.25	0.27	0.38	0.41	0.41	0.41	0.44	0.52
LMH 2Y	-3.20	0.34	5.46***	0.09	-0.48	-0.45	-0.58	-1.22	-1.37	-1.34	-1.37	-1.72	-2.12	0.70	0.01	0.07	0.07	0.09	0.18	0.20	0.20	0.20	0.24	0.30
LMH 5Y	-1.72	0.17	6.42***	0.46	0.58	0.70	0.49	0.24	0.17	0.17	0.15	-0.59	-1.01	0.70	0.06	0.07	0.09	0.06	0.03	0.02	0.02	0.02	0.07	0.12
LMH 7Y	-2.25	0.22	6.45***	0.33	0.72	0.87	0.70	0.38	0.25	0.25	0.20	-0.50	-0.94	0.70	0.04	0.09	0.11	0.09	0.05	0.03	0.03	0.02	0.06	0.11
LMH 10Y	-1.91	0.19	6.79***	0.15	0.61	0.89	0.66	0.53	0.40	0.40	0.30	-0.34	-0.64	0.70	0.02	0.07	0.10	0.08	0.06	0.05	0.05	0.04	0.04	0.07

TABLE 8
SPREAD PORTFOLIO RETURNS AND MACRO VARIABLES

The table presents contemporaneous univariate spanning regressions of the de-noised spread portfolio returns from Table 7 on interest rate (Panel A), inflation (Panel B), and growth-based (Panel C) macroeconomic variables. The returns include the LMH portfolios sorted on OIS 6M, 1Y and 2Y surprises around the press release window, and de-noised using the three-pass estimator, as well as the first principal component across all eight (OIS 1M to 10Y) de-noised LMH portfolios. A description of the macroeconomic variables is provided in Table IA.11, in the Internet Appendix. All macroeconomic variables are also de-noised using the three-pass estimator, with the same euro area pricing kernel. All variables are standardized to have zero mean and unit standard deviation, for interpretability. Reported are the coefficients (β) and goodness-of-fit (R^2), in percent. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are computed using Newey and West (1987). The sample is monthly, from Jul/2000 to Dec/2024.

	LMH 6M		LMH 1Y		LMH 2Y		PC(1) 1M-10Y	
	β	R^2	β	R^2	β	R^2	β	R^2
Panel A: Interest Rates								
RR 1Y	-0.50***	25.15	-0.53***	28.02	-0.54***	29.34	-0.62***	38.90
DE 1Y	-0.45***	19.92	-0.48***	22.81	-0.51***	25.78	-0.54***	29.64
OIS 1Y	-0.30*	8.83	-0.36**	13.26	-0.39**	14.84	-0.41***	17.07
A OIS 1M PRW	-0.22**	4.97	-0.22**	4.91	-0.21**	4.62	-0.22**	4.97
A OIS 1Y PRW	-0.38***	14.73	-0.36***	13.32	-0.34***	11.54	-0.26**	6.84
A TARGET	-0.17*	2.93	-0.15	2.23	-0.16*	2.65	-0.17	2.79
JK PC(1)	-0.34***	11.27	-0.31***	9.63	-0.32***	10.36	-0.30***	9.29
JK PM	-0.38***	14.13	-0.34***	11.76	-0.36***	13.04	-0.29***	8.69
Panel B: Inflation								
DE CPI (S)	-0.21**	4.56	-0.23***	5.14	-0.27***	7.03	-0.26***	6.83
ES CPI (S)	-0.07	0.53	-0.10**	0.93	-0.14***	1.86	-0.21***	4.53
FR CPI (S)	-0.21**	4.54	-0.25***	6.11	-0.28***	7.60	-0.38***	14.20
EA HICP (S)	-0.21***	4.61	-0.22***	5.04	-0.26***	6.86	-0.28***	7.90
DE CPI (D)	-0.66***	44.04	-0.73***	53.12	-0.70***	49.23	-0.57***	32.24
ES CPI (D)	-0.64***	41.05	-0.68***	46.89	-0.67***	44.23	-0.60***	36.35
FR CPI (D)	-0.28***	7.90	-0.32***	10.03	-0.33***	11.03	-0.37***	13.42
EA HICP (D)	-0.27***	7.30	-0.32***	10.44	-0.32***	10.50	-0.22**	5.06
ILS 1Y	-0.39**	15.14	-0.45***	20.07	-0.47***	21.65	-0.49***	24.20
Panel C: Growth								
URATE	0.00	0.00	-0.02	0.04	0.03	0.08	-0.05	0.20
IP	0.37**	14.00	0.38**	14.50	0.34**	11.55	0.24	5.59
TERM	0.07	0.43	0.15**	2.16	0.12*	1.45	-0.06	0.33
STOXX 50	-0.48***	22.58	-0.47***	21.84	-0.50***	24.78	-0.62***	38.41
STOXX 600	-0.50***	25.22	-0.51***	25.60	-0.54***	29.01	-0.64***	40.32
VSTOXX	0.41***	16.52	0.40***	15.99	0.42***	17.84	0.55***	29.78
CREDIT	0.51***	26.36	0.55***	30.16	0.57***	32.73	0.66***	44.16
EA GRO (S)	-0.17	2.92	-0.23*	5.12	-0.29**	8.28	-0.25**	6.42

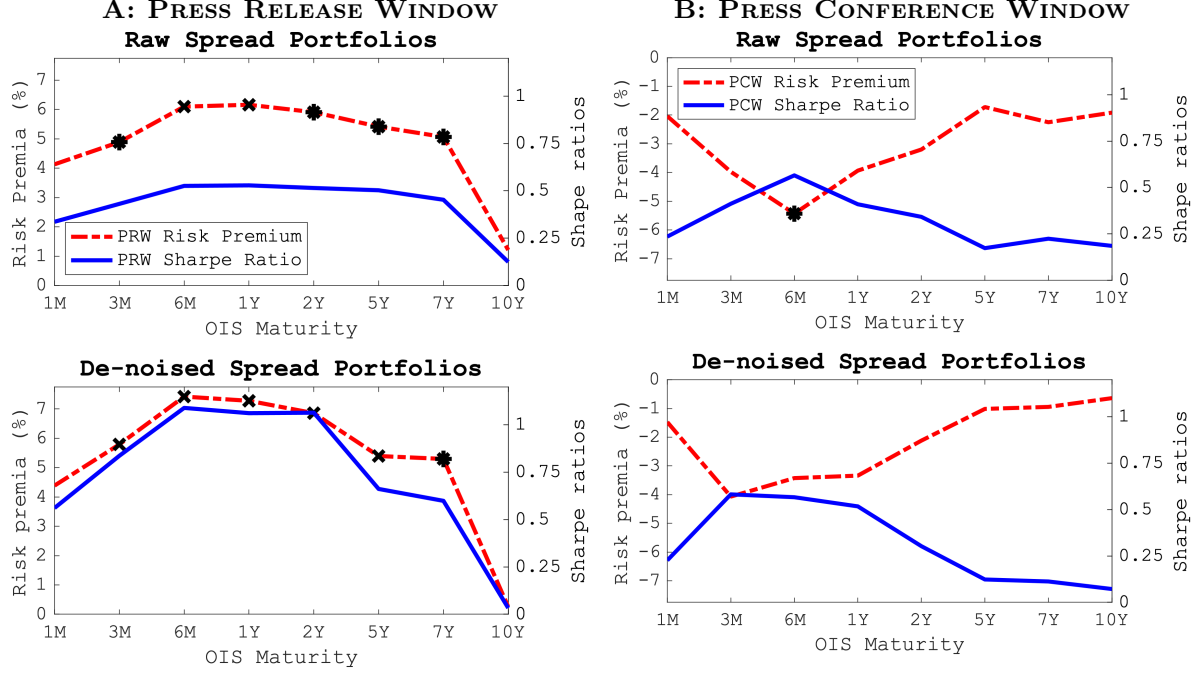


FIGURE 1. MONETARY POLICY RISK PREMIA. The figure presents, in the upper panels, returns (red) and absolute Sharpe ratios (blue) of low-minus-high spread portfolios of 153 investment strategies sorted on their exposures to high-frequency changes in OIS rates of maturities ranging from 1M to 10Y around the ECB press release (left) and press conference (right) windows, respectively. Betas are estimated over rolling-windows of 36 Governing Councils, and control for the contemporaneous high-frequency changes in the European stock market, *STOXX50*, as in equation (1). The lower panels shows the same portfolios, de-noised of all measurement errors and omitted-variable biases using the RP-PCA three-pass estimator, where the eleven-latent-factor model is obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ euro area investment strategy returns. In all instances, an ‘x’ (‘*’) corresponds to a rejection of the null hypothesis that the risk premium is equal to zero at the 1% (5%) level, respectively. The sample period is from Jul/2000 to Dec/2024.

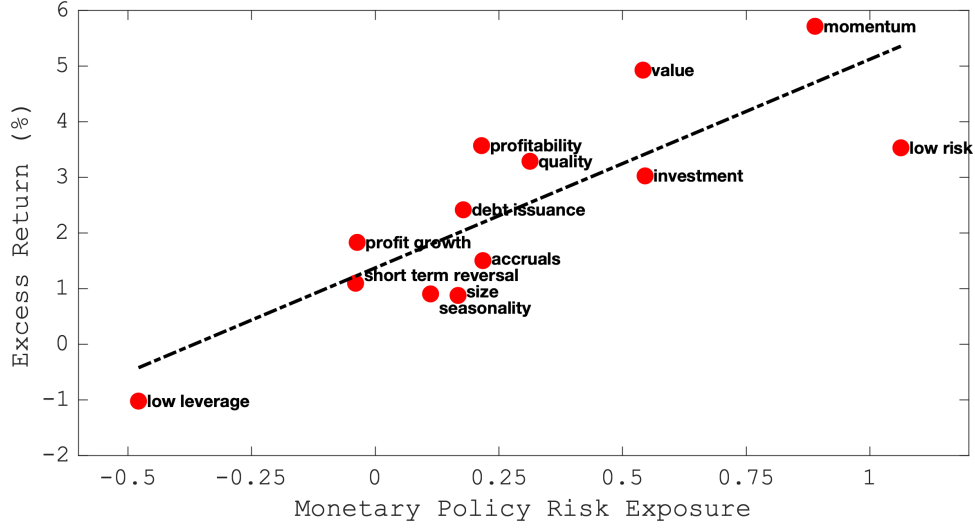


FIGURE 2. THE MONETARY POLICY RISK-RETURN TRADE-OFF. The figure presents the 13 investment theme average excess returns against their quantity of risk (monetary policy risk exposures). Exposures are estimated via simple spanning regressions of each theme return (R_{it}) on the monetary policy spread factor (F_t): $R_{it} = \alpha_i + \beta_i F_t + \epsilon_{it}$, for $i = 1, \dots, 13$ themes. The 13 themes are equally-weighted combinations of 153 investment strategy returns, grouped by a cluster analysis of correlation and signal similarity following [Jensen et al. \(2023\)](#). The monetary policy premium, $\overline{F_t}$, is obtained by sorting each of 153 high-minus-low investment strategies on their exposures to high-frequency changes in the OIS 1Y rate around the ECB Governing Council press release window. These loadings are estimated over rolling-windows of 36 Governing Councils, and control for contemporaneous high-frequency changes in the European stock market, *STOXX50*, as in equation (1). The monetary policy risk premium is de-noised of all measurement errors and omitted-variable biases using the RP-PCA three-pass estimator, where the eleven-latent-factor model is obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ euro area investment strategy returns. The sample is monthly, from Jul/2000 to Dec/2024.

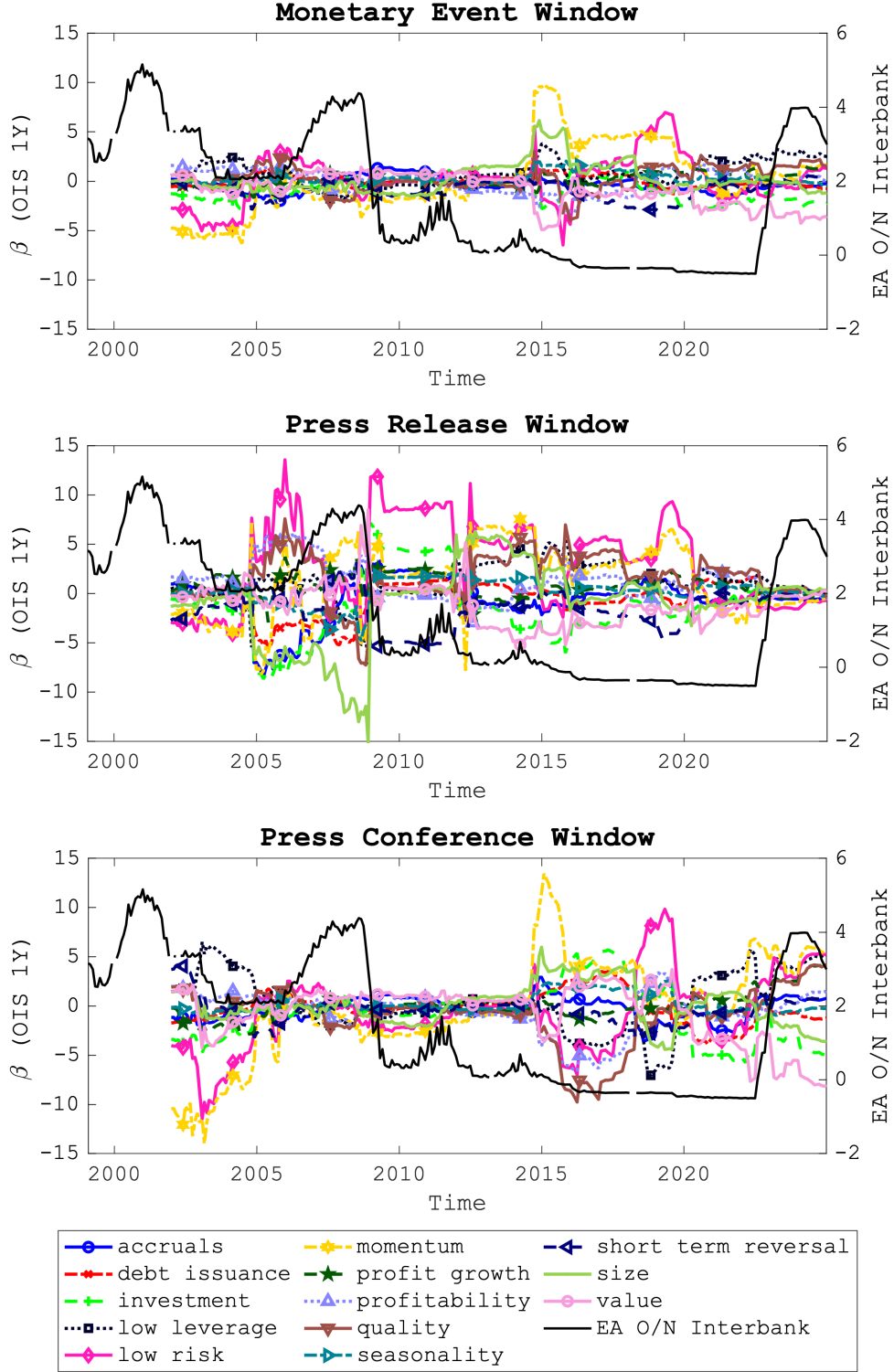


FIGURE 3. THEME TIME-VARYING RISK EXPOSURES. The figure plots the average exposure across the 13 investment strategy themes to the high-frequency change in the OIS 1Y rate around the ECB monetary event (top), press release (middle) and press conference windows (bottom), respectively (β (OIS 1Y), left axis). The 13 themes are equally-weighted combinations of 153 investment strategy returns, grouped by a cluster analysis of correlation and signal similarity following Jensen et al. (2023). These exposures are estimated over rolling-windows of 36 Governing Council months, where we sum over all OIS shocks in a given month and allocate to month-end. All shocks are standardized, to have zero mean and unit standard deviation, for interpretability. Overlaid is the end-of-month euro area overnight interbank rate (EA O/N Interbank, right axis).

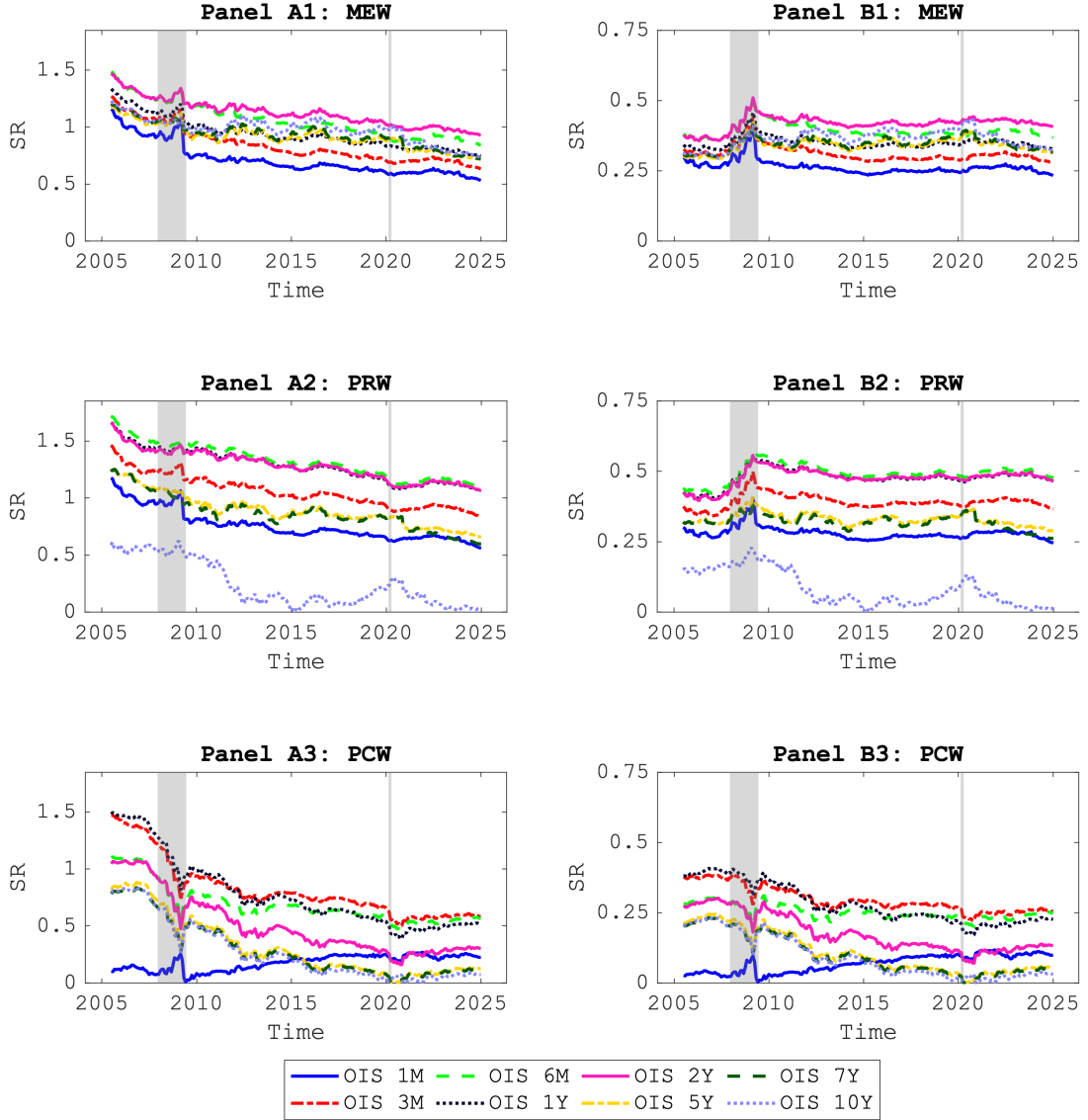


FIGURE 4. RECURSIVE SHARPE RATIOS. The figure plots recursively-estimated Sharpe ratios (SR) of the de-noised spread portfolio returns sorted on ECB monetary policy announcement shocks. For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the three windows, $w = mew, prw, pcw$ (Panels 1-3), as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as a low-minus-high (LMH) spread portfolio (see Tables 2, 3 and IA.2). LMH portfolios are de-noised using the RP-PCA three-pass estimator, where eleven latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the 153 euro area investment strategy returns. Panel A, presents Sharpe ratios where estimation begins after 5 years, whilst Panel B shows the same values scaled by the recursively-estimated Sharpe ratio of the optimal (eleven-latent-factor) tangency portfolio.

Internet Appendix

[NOT FOR PUBLICATION]

ECBetas in Equity Strategy Returns

by

Brandon A. McBride, Lucio Sarno, and Gabriele Zinna

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IA.1 Data

Investment Strategy Summary Statistics. Table [IA.1](#) presents descriptions and summary statistics for the 153 euro area investment strategy risk factors, grouped by their 13 respective themes as in [Jensen, Kelly and Pedersen \(2023\)](#).

TABLE IA.1
FACTOR SUMMARY STATISTICS

The table presents summary statistics of the universe of euro area investment strategy returns, grouped by their associated themes, from the Global Factor Database of [Jensen et al. \(2023\)](#), available at <https://jkpfactors.com>. There are 13 themes comprising 153 long-short factors, with monthly observations over the period 01/1999–12/2024. In the main analysis, we primarily work with daily data, which we then aggregated to monthly by taking the cumulative product of daily discrete returns. Euro area factors are taken as averages of individual market-level factors associated with the five main euro area stock markets, of: Germany, France, Italy, Spain, and the Netherlands. Themes are equally-weighted averages of the individual factor-level returns. Reported is a brief description of the factor sorting variable (*Description*), the annualized average return (*Mean*), median return (*Med*), standard deviation (*Std*), skewness (*Skew*), kurtosis (*Kurt*), Sharpe ratio (*SR*), and direction of factor rotation in the original construction of [Jensen et al. \(2023\)](#) (*Dir*). All factors are constructed such that they are procyclical in the full sample of [Jensen et al. \(2023\)](#), to facilitate interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the return is zero at the 1%, 5% and 10% confidence levels, respectively, with [Newey and West \(1987\)](#) standard errors.

Name	Description	Mean	Med	Std	Skew	Kurt	SR	Dir
accruals	Accruals cluster	1.22	1.16	4.17	0.32	4.99	0.29	
cowcgr1a	Change in current operating working capital (Richardson et al., 2005)	1.43	1.04	5.53	−0.17	4.35	0.26	−1
oaccrualsat	Operating accruals (Sloan, 1996)	2.99**	2.06	6.05	0.34	5.04	0.49	−1
oaccrualsni	Percent operating accruals (Hafzalla et al., 2011)	2.04	1.04	6.75	0.12	6.62	0.30	−1
seas1620na	Years 16-20 lagged returns, nonannual (Heston and Sadka, 2008)	1.85	1.22	6.12	0.17	3.75	0.30	−1
taccrualsat	Total accruals (Richardson et al., 2005)	−0.67	−1.03	6.04	0.32	4.80	0.11	−1
taccrualsni	Percent total accruals (Hafzalla et al., 2011)	−0.43	−2.17	6.11	0.56	5.11	0.07	−1
debtissuance	Debt issuance cluster	2.55***	1.54	3.07	0.48	3.37	0.83	
capexabn	Abnormal corporate investment (Titman et al., 2004)	1.44	0.89	5.86	0.17	3.41	0.25	−1
debtgr3	Growth in book debt (3 years) (Lyandres et al., 2008)	3.27***	2.39	6.28	0.09	4.40	0.52	−1
fnlgr1a	Change in financial liabilities (Richardson et al., 2005)	3.91***	2.20	5.06	0.18	3.79	0.77	−1
ncolgr1a	Change in noncurrent operating liabilities (Richardson et al., 2005)	1.05	0.93	5.28	0.29	4.07	0.20	−1
nfnagr1a	Change in net financial assets (Richardson et al., 2005)	3.02***	2.76	4.87	0.28	3.78	0.62	1
niar1	Earnings persistence (Francis et al., 2004)	−0.13	−0.44	4.75	−0.25	5.06	0.03	1
noaat	Net operating assets (Hirshleifer et al., 2004)	5.29***	4.17	6.71	0.69	5.74	0.79	−1
investment	Investment cluster	2.96**	0.29	6.18	1.16	7.98	0.48	
aliquat	Liquidity of book assets (Ortiz-Molina and Phillips, 2014)	2.24	1.11	8.29	0.85	7.91	0.27	−1
atgr1	Asset Growth (Cooper et al., 2008)	3.80**	0.34	8.46	0.93	7.40	0.45	−1
begr1a	Change in common equity (Richardson et al., 2005)	1.42	0.39	8.02	0.05	6.12	0.18	−1
capxgr1	CAPEX growth (1 year) (Xie, 2001)	5.41***	2.23	7.79	0.81	6.94	0.70	−1
capxgr2	CAPEX growth (2 years) (Anderson and Garcia-Feijoo, 2006)	3.96***	0.31	7.60	1.02	5.93	0.52	−1
capxgr3	CAPEX growth (3 years) (Anderson and Garcia-Feijoo, 2006)	2.46	0.26	8.16	0.43	5.40	0.30	−1
coagr1a	Change in current operating assets (Richardson et al., 2005)	1.72	−0.19	7.12	0.78	5.60	0.24	−1
colgr1a	Change in current operating liabilities (Richardson et al., 2005)	0.78	0.12	7.08	1.13	7.58	0.11	−1
empgr1	Hiring rate (Belo et al., 2014)	3.60**	0.23	8.61	0.69	5.84	0.42	−1
invgr1	Inventory growth (Belo and Lin, 2012)	3.41***	1.61	6.73	0.51	5.20	0.51	−1
invgr1a	Inventory change (Thomas and Zhang, 2002)	3.40***	0.82	6.65	0.65	4.70	0.51	−1
lnoagr1a	Change in long-term net operating assets (Fairfield et al., 2003)	4.82***	4.14	7.03	0.39	4.96	0.68	−1
mispricingmgmt	Mispricing factor: Management (Stambaugh and Yuan, 2017)	6.42***	3.89	7.61	0.76	7.23	0.84	1

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ncoagrla	Change in noncurrent operating assets (Richardson et al., 2005)	5.56***	4.38	7.44	0.51	5.45	0.75	-1
nncoagrla	Change in net noncurrent operating assets (Richardson et al., 2005)	4.24***	3.35	6.80	0.29	5.21	0.62	-1
noagrla	Change in net operating assets (Hirshleifer et al., 2004)	5.87***	4.24	7.08	0.49	5.67	0.83	-1
ppainvgria	Change PPE and Inventory (Lyandres et al., 2008)	2.98*	1.06	7.18	0.65	6.23	0.42	-1
ret6012	Long-term reversal (De Bondt and Thaler, 1985)	-1.12	-0.74	10.33	0.38	4.89	0.11	-1
salegr1	Sales Growth (1 year) (Lakonishok et al., 1994)	1.65	-0.09	8.84	0.98	7.41	0.19	-1
salegr3	Sales Growth (3 years) (Lakonishok et al., 1994)	2.18	0.74	7.92	0.28	3.52	0.28	-1
saleqgr1	Sales growth (1 quarter)	1.28	-2.06	12.75	0.58	10.23	0.10	-1
seas25na	Years 2-5 lagged returns, nonannual (Heston and Sadka, 2008)	-1.05	-0.33	9.80	0.19	4.53	0.11	-1
lowleverage	Low leverage cluster	0.09	0.15	6.68	0.49	10.71	0.01	
age	Firm age (Jiang et al., 2005)	-6.08	-7.12	19.11	2.61	21.33	0.32	-1
aliquat	Liquidity of market assets (Ortiz-Molina and Phillips, 2014)	-3.11	-4.90	10.72	-0.15	4.86	0.29	-1
atbe	Book leverage (Fama and French, 1992)	-0.69	-1.01	9.79	-0.13	5.01	0.07	-1
bidaskhl21d	The high-low bid-ask spread (Corwin and Schultz, 2012)	-3.43	-4.56	11.30	0.73	8.07	0.30	1
cashat	Cash-to-assets (Palazzo, 2012)	1.89	2.80	7.32	-0.08	6.20	0.26	1
netdebtme	Net debt-to-price (Penman et al., 2007)	1.21	1.31	9.69	0.22	6.06	0.13	-1
niivol	Earnings volatility (Francis et al., 2004)	-0.45	-0.95	6.87	-0.02	3.21	0.07	1
rd5at	R&D capital-to-book assets (Li, 2011)	7.40***	5.38	12.91	0.62	6.04	0.57	1
rdsale	R&D-to-sales (Chan et al., 2001)	3.17	3.06	14.14	0.44	9.59	0.22	1
tangibility	Asset tangibility (Hahn and Lee, 2009)	2.69*	2.59	7.28	0.02	4.97	0.37	1
zscore	Altman Z-score (Dichev, 1998)	-1.61	-0.49	9.24	-1.00	7.77	0.17	1
lowrisk	Low risk cluster	2.97	2.03	11.31	-0.55	8.93	0.26	
beta60m	Market Beta (Fama and MacBeth, 1973a)	0.36	1.11	16.20	-0.33	6.28	0.02	-1
betadimson21d	Dimson beta (Dimson, 1979)	3.09	1.40	14.38	-0.23	7.11	0.21	-1
betabab1260d	Frazzini-Pedersen market beta (Frazzini and Pedersen, 2014)	2.44	2.75	16.98	-0.43	6.64	0.14	-1
betadown252d	Downside beta (Ang et al., 2006a)	1.38	-1.14	16.70	-0.20	6.13	0.08	-1
earningsvariability	Earnings variability (Francis et al., 2004)	0.36	0.18	5.62	-0.28	4.43	0.06	-1
ivolcapm21d	Idiosyncratic volatility from the CAPM (21 days)	4.90*	6.75	13.53	-1.39	16.96	0.36	-1
ivolcapm252d	Idiosyncratic volatility from the CAPM (252 days) (Ali et al., 2003)	4.25	5.31	13.07	-0.37	10.76	0.33	-1
ivolf321d	Idiosyncratic volatility from the Fama-French 3-factor model (Ang et al., 2006b)	5.28*	7.24	12.72	-1.38	17.62	0.42	-1
ivolphxz421d	Idiosyncratic volatility from the q-factor model	3.17	3.92	9.62	-1.12	8.07	0.33	-1
ocfqsaleqstd	Cash flow volatility (Huang, 2009)	3.20	1.01	10.70	3.85	45.18	0.30	-1
rmax121d	Maximum daily return (Bali et al., 2011)	4.29	5.27	14.49	-1.12	12.81	0.30	-1
rmax521d	Highest 5 days of return (Bali et al., 2017)	4.64	3.06	15.64	-1.08	12.35	0.30	-1
rvol21d	Return volatility (Ang et al., 2006b)	5.10	5.37	16.87	-0.87	10.25	0.30	-1
seas610na	Years 6-10 lagged returns, nonannual (Heston and Sadka, 2008)	3.06**	3.47	8.33	0.11	5.58	0.37	-1
turnover126d	Share turnover (Datar et al., 1998)	1.52	1.43	13.11	-0.43	7.18	0.12	-1
zerotrades126d	Number of zero trades with turnover as tiebreaker (6 months) (Liu, 2006)	1.44	1.66	13.14	-0.43	7.04	0.11	1
zerotrades21d	Number of zero trades with turnover as tiebreaker (1 month) (Liu, 2006)	0.36	0.57	13.27	-0.96	10.61	0.03	1
zerotrades252d	Number of zero trades with turnover as tiebreaker (12 months) (Liu, 2006)	1.62	1.00	13.15	-0.22	6.70	0.12	1
momentum	Momentum cluster	5.91***	7.37	11.92	-0.62	9.28	0.50	
prchighprc252d	Current price to high price over last year (George and Hwang, 2004)	7.55**	9.39	17.57	-0.75	7.99	0.43	1

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resff3121	Residual momentum t-12 to t-1 (Blitz et al., 2011)	5.56***	4.27	8.30	0.50	6.81	0.67	1
resff361	Residual momentum t-6 to t-1 (Blitz et al., 2011)	3.84**	3.56	8.69	0.60	10.83	0.44	1
ret121	Price momentum t-12 to t-1 (Jegadeesh and Titman, 1993)	7.03**	5.76	15.32	-0.83	8.59	0.46	1
ret31	Price momentum t-3 to t-1 (Jegadeesh and Titman, 1993)	4.23*	5.45	13.12	0.01	9.78	0.32	1
ret61	Price momentum t-6 to t-1 (Jegadeesh and Titman, 1993)	6.54**	6.21	14.21	-0.32	8.08	0.46	1
ret91	Price momentum t-9 to t-1 (Jegadeesh and Titman, 1993)	6.56**	8.12	14.95	-0.85	8.52	0.44	1
seas11na	Year 1-lagged return, nonannual (Heston and Sadka, 2008)	5.98**	8.25	15.23	-1.14	9.10	0.39	1
profitgrowth	Profit growth cluster	1.30	2.12	4.23	-0.45	6.78	0.31	
dsaledinv	Change sales minus change Inventory (Abarbanell and Bushee, 1998)	0.53	1.28	5.22	-0.29	3.90	0.10	1
dsaledrec	Change sales minus change receivables (Abarbanell and Bushee, 1998)	1.32	1.19	5.44	0.10	3.92	0.24	-1
dsaledsga	Change sales minus change SG&A (Abarbanell and Bushee, 1998)	0.22	1.11	10.02	-0.14	13.46	0.02	1
niqatchg1	Change in quarterly return on assets	-0.99	2.46	12.43	-1.74	12.57	0.08	1
niqbechg1	Change in quarterly return on equity	1.31	3.80	12.12	0.39	15.65	0.11	1
niqsu	Standardized earnings surprise (Foster et al., 1984)	0.24	1.08	10.29	0.07	14.94	0.02	1
ocfatchg1	Change in operating cash flow to assets (Bouchaud et al., 2019)	2.49***	2.79	4.92	-0.06	4.31	0.51	1
ret127	Price momentum t-12 to t-7 (Novy-Marx, 2012)	5.14*	6.73	12.56	-1.27	9.52	0.41	1
saleempgr1	Labor force efficiency (Abarbanell and Bushee, 1998)	0.14	-0.78	5.31	0.10	4.10	0.03	1
saleqsu	Standardized Revenue surprise (Jegadeesh and Livnat, 2006)	1.80	2.94	12.70	-0.37	9.77	0.14	1
seas11an	Year 1-lagged return, annual (Heston and Sadka, 2008)	2.55	2.25	9.02	0.13	8.12	0.28	1
taxgr1a	Tax expense surprise (Thomas and Zhang, 2011)	1.36	1.76	6.22	0.30	4.75	0.22	1
profitability	Profitability cluster	3.67***	3.13	4.72	0.15	3.50	0.78	
dolvolvar126d	Coefficient of variation for dollar trading volume (Chordia et al., 2001)	0.41	0.93	9.01	-0.04	5.61	0.05	-1
ebitbev	Return on net operating assets (Soliman, 2008)	4.59***	6.44	7.30	-0.05	3.39	0.63	1
ebitsale	Profit margin (Soliman, 2008)	0.45	1.58	6.69	-0.15	3.90	0.07	1
fscore	Pitroski F-score (Piotroski, 2000)	2.93*	3.52	8.91	-0.71	8.54	0.33	1
nibe	Return on equity (Haugen and Baker, 1996)	4.69***	4.42	8.00	-0.09	4.02	0.59	1
niqbe	Quarterly return on equity (Hou et al., 2015)	9.95***	6.57	15.63	2.96	28.84	0.64	1
oscore	Ohlson O-score (Dichev, 1998)	2.95**	2.00	6.42	0.03	4.20	0.46	-1
ocfat	Operating cash flow to assets (Bouchaud et al., 2019)	5.00***	4.18	8.72	-0.04	3.43	0.57	1
opebe	Operating profits-to-book equity (Fama and French, 2015)	5.03***	4.24	7.07	-0.04	3.16	0.71	1
opebell	Operating profits-to-lagged book equity	3.64***	3.28	7.23	-0.10	2.93	0.50	1
turnovervar126d	Coefficient of variation for share turnover (Chordia et al., 2001)	0.77	1.11	9.28	0.31	6.51	0.08	-1
quality	Quality cluster	2.87***	3.18	5.94	-0.29	4.26	0.48	
atturnover	Capital turnover (Haugen and Baker, 1996)	1.46	3.19	7.01	-0.18	2.94	0.21	1
copat	Cash-based operating profits-to-book assets	5.16***	4.94	6.84	0.29	3.56	0.75	1
copatl1	Cash-based operating profits-to-lagged book assets (Ball et al., 2016)	3.83***	3.06	6.80	0.21	2.90	0.56	1
dgpdsale	Change gross margin minus change sales (Abarbanell and Bushee, 1998)	0.82	2.43	6.35	-0.57	6.39	0.13	1
gpat	Gross profits-to-assets (Novy-Marx, 2013)	2.25	2.09	7.63	-0.03	3.47	0.29	1

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gpatl1	Gross profits-to-lagged assets	-0.05	-1.88	7.21	0.17	3.63	0.01	1
mispricingperf	Mispricing factor: Performance (Stambaugh and Yuan, 2017)	7.32***	7.40	12.03	-0.70	7.67	0.61	1
niinc8q	Number of consecutive quarters with earnings increases (Barth et al., 1999)	-1.25	-0.67	10.07	-0.85	9.44	0.12	1
niqat	Quarterly return on assets (Balakrishnan et al., 2010)	6.91**	5.64	14.04	0.39	6.67	0.49	1
opat	Operating profits-to-book assets	4.37***	4.84	8.84	-0.28	3.69	0.49	1
opat11	Operating profits-to-lagged book assets (Ball et al., 2016)	2.49	1.11	9.46	-0.13	3.79	0.26	1
opexat	Operating leverage (Novy-Marx, 2011)	0.90	1.75	6.31	-0.31	4.32	0.14	1
qmj	Quality minus Junk: Composite (Asness et al., 2019)	4.36**	4.93	9.95	-0.37	4.52	0.44	1
qmjgrowth	Quality minus Junk: Growth (Asness et al., 2019)	1.50	2.08	5.64	-0.46	4.16	0.27	1
qmjprof	Quality minus Junk: Profitability (Asness et al., 2019)	4.16**	4.08	9.62	-0.23	3.84	0.43	1
qmjsafety	Quality minus Junk: Safety (Asness et al., 2019)	1.74	1.87	9.01	-0.29	5.42	0.19	1
salebev	Assets turnover (Soliman, 2008)	2.80**	2.71	5.69	-0.03	2.58	0.49	1
seasonality	Seasonality cluster	0.79**	0.89	2.25	-0.61	7.49	0.35	
corr1260d	Market correlation (Asness et al., 2020)	-1.00	-1.12	12.05	-0.41	7.07	0.08	-1
coskew21d	Coskewness (Harvey and Siddique, 2000)	-0.43	-0.67	6.72	-0.02	7.20	0.06	-1
dbnetisat	Net debt issuance (Bradshaw et al., 2006)	2.40***	1.29	4.47	0.22	3.51	0.54	-1
kzindex	Kaplan-Zingales index (Lamont et al., 2001)	0.13	-0.66	7.15	-0.28	5.94	0.02	1
ltigr1a	Change in long-term investments (Richardson et al., 2005)	0.00	0.71	4.82	0.45	4.52	0.00	-1
pinix	Taxable income-to-book income (Lev and Nissim, 2004)	-1.00	0.01	5.01	-0.61	5.88	0.20	1
seas1115an	Years 11-15 lagged returns, annual (Heston and Sadka, 2008)	1.54	1.14	6.40	-0.09	5.17	0.24	1
seas1115na	Years 11-15 lagged returns, nonannual (Heston and Sadka, 2008)	1.16	2.26	7.15	-0.30	5.00	0.16	-1
seas1620an	Years 16-20 lagged returns, annual (Heston and Sadka, 2008)	2.71*	1.92	6.70	-0.05	3.67	0.40	1
seas25an	Years 2-5 lagged returns, annual (Heston and Sadka, 2008)	0.99	0.87	6.99	-0.19	4.57	0.14	1
seas610an	Years 6-10 lagged returns, annual (Heston and Sadka, 2008)	5.68***	4.71	7.29	2.65	23.83	0.78	1
stigr1a	Change in short-term investments (Richardson et al., 2005)	-2.12*	-2.69	5.32	-0.48	5.03	0.40	1
shorttermreversal	Short-term reversal cluster	0.55	0.04	4.85	-1.45	19.36	0.11	
iskewcapm21d	Idiosyncratic skewness from the CAPM	0.12	1.05	5.17	-0.25	5.27	0.02	-1
iskewff321d	Idiosyncratic skewness from the Fama-French 3-factor model (Bali et al., 2016)	0.25	-0.19	4.92	-1.21	12.77	0.05	-1
iskewhxx421d	Idiosyncratic skewness from the q-factor model	1.90**	1.59	4.43	0.23	4.25	0.43	-1
ret10	Short-term reversal (Jegadeesh, 1990)	-0.79	-0.22	11.67	0.06	9.77	0.07	-1
rmax5rvol21d	Highest 5 days of return scaled by volatility (Asness et al., 2020)	1.38	0.44	8.46	-1.44	14.55	0.16	-1
rskew21d	Total skewness (Bali et al., 2016)	1.05	0.02	5.49	-0.30	5.11	0.19	-1
size	Size cluster	0.61	0.57	5.59	-0.72	8.66	0.11	
ami126d	Amihud Measure (Amihud, 2002)	-0.08	-0.05	8.74	-0.34	4.92	0.01	1
dolvol126d	Dollar trading volume (Brennan et al., 1998)	0.84	1.35	9.69	-0.26	5.00	0.09	-1
marketequity	Market Equity (Banz, 1981)	-0.99	-1.21	6.93	0.37	4.11	0.14	-1
prc	Price per share (Miller and Scholes, 1982)	-2.45	-2.58	10.56	0.70	5.98	0.23	-1
rdme	R&D-to-market (Chan et al., 2001)	5.71**	5.29	13.25	-1.18	16.19	0.43	1
value	Value cluster	4.22**	2.94	9.10	-0.20	11.00	0.46	
atme	Assets-to-market (Fama and French, 1992)	1.74	2.14	15.17	-0.31	9.37	0.11	1
beme	Book-to-market equity (Rosenberg et al., 1985)	2.09	2.87	14.18	-0.11	8.55	0.15	1

(continued over page)

bevmev	Book-to-market enterprise value (Penman et al., 2007)	1.79	1.81	13.74	-0.29	8.70	0.13	1
chcsho12m	Net stock issues (Pontiff and Woodgate, 2008)	4.81***	3.71	7.13	-0.03	3.89	0.67	-1
debtme	Debt-to-market (Bhandari, 1988)	0.59	-0.33	12.34	0.01	7.11	0.05	1
div12mme	Dividend yield (Litzenberger and Ramaswamy, 1979)	3.54*	1.70	9.54	0.80	8.46	0.37	1
ebitdamev	Ebitda-to-market enterprise value (Loughran and Wellman, 2011)	6.77***	7.04	11.22	-0.68	14.86	0.60	1
eqdur	Equity duration (Dechow et al., 2004)	3.98	5.11	12.16	0.34	6.89	0.33	-1
eqnetisat	Net equity issuance (Bradshaw et al., 2006)	6.71***	4.40	8.64	0.69	5.84	0.78	-1
eqnpol2m	Equity net payout (Daniel and Titman, 2006)	6.08***	4.81	8.41	0.50	4.43	0.72	1
eqnpome	Net payout yield (Boudoukh et al., 2007)	4.39	1.70	12.17	-0.30	10.06	0.36	1
eqpome	Payout yield (Boudoukh et al., 2007)	2.87	3.36	13.91	-0.82	10.21	0.21	1
fcfme	Free cash flow-to-price (Lakonishok et al., 1994)	4.40***	4.39	7.49	-0.37	5.55	0.59	1
ivalme	Intrinsic value-to-market (Frankel and Lee, 1998)	4.67**	5.29	10.82	0.35	8.57	0.43	1
netisat	Net total issuance (Bradshaw et al., 2006)	5.65***	3.57	8.64	0.32	9.40	0.65	-1
nime	Earnings-to-price (Basu, 1983)	5.38*	5.31	12.23	-0.55	12.08	0.44	1
ocfme	Operating cash flow-to-market (Desai et al., 2004)	6.89***	6.28	11.38	-0.25	14.41	0.61	1
saleme	Sales-to-market (Barbee et al., 1996)	3.57	4.80	14.03	-0.19	9.53	0.25	1

IA.2 Further Betas and Portfolio Sorts

IA.2.1 Beta Estimates.

Figure IA.1 plots the distributions of ECB betas across the 153 factor returns for $\tau = 1M$ to 2Y and $w = \text{prw}$.

In what follows, we present evidence on the ECB beta estimates, to highlight some salient facts. Figure IA.2 (in the left panels) shows the time-varying median beta exposures across the 153 investment strategy returns to high-frequency changes in the 1M to 10Y OIS rates, around each of the monetary event, press release and press conference windows, respectively. It is apparent that the median exposures of the strategy factors to monetary policy surprises arising in the GC vary considerably over time. This clearly demonstrates the advantage of estimating the betas in a time-varying setting. Moreover, on some occasions, the median exposures can switch sign. The right-hand panels show that the median exposures mask substantial heterogeneity in the strategy factors, and that the dispersion to a given OIS shock also varies over time. It is also evident that the beta estimates differ depending on the maturity of the OIS shock and the event window considered. For example, shorter-term maturities (e.g., OIS 1M) generate more dispersion in factor exposures. At the same time, although the dispersion in the press release beta exposures has increased substantially over several time periods, the dispersion in the press conference betas has mainly risen in the post-Covid period.

Before turning to the portfolio beta-sort analysis, we shed some light on what drives time-variation in the median themes beta exposures. In particular, we assess whether the betas vary with the ECB monetary policy stance. For example, Bianchi, Lettau and Ludvigson (2022) show that changes in the stance of monetary policy can generate persistent changes in asset valuations and the equity premium. It seems plausible that the monetary policy stance could also drive time-variation in the themes' exposures to monetary policy shocks. To measure the monetary policy stance of the ECB, we use their monetary spread measure, i.e., the short-term real rate (the nominal rate less expected inflation) minus the natural real rate. We carry out this analysis in a model-free manner. Specifically, we look at the average betas of the themes conditional on the monetary policy spread (quintile). We also inspect if the dispersion in the factor betas changes with the spread.

We find that the betas of some themes vary with the monetary policy spread (e.g., accruals), but the relation is overall weak across themes, not showing a systematic pattern (see Figure IA.3).¹ We then look at components of the monetary policy spread and find a meaningful relation between expected inflation and several investment strategies, showing an almost monotonic relation with expected inflation (Figure IA.4). For example, the beta of some themes (e.g., low leverage, low risk, momentum, and quality) tend to increase moving from the lowest to the highest quintile of inflation, while those of other themes show a decreasing pattern (e.g., debt

¹We compute the monetary policy spread as the ECB policy rate minus expected inflation minus the natural rate. The natural rate is the Holston, Laubach and Williams (2017) estimate, available at <https://www.newyorkfed.org/research/policy/rstar>. We measure expected inflation using forecasts from an ARMA(1,1) model. The main findings are similar if one instead uses the past 12-month moving average of inflation, as in Bianchi et al. (2022), or consensus forecasts.

issuance, seasonality). On average across themes, the betas tend to reduce as expected inflation increases (see Panel *median*). By contrast, the theme betas do not show any clear pattern with respect to the level of the policy rate and natural real rate (Figures IA.5 and IA.6).

We then characterize the monetary policy environment following Buetow, Fabozzi and Henderson (2009), and references therein. The procedure, which has been shown to differentiate effectively between periods, classifies monetary policy regimes based on the direction of the immediately preceding policy rate change. The idea is that policy rate changes signal the future course of monetary policy. Monetary policy is restrictive in months after an increase in the policy rate and is expansive in months following a decrease in the rate. For example, if the last policy rate change was an increase, then a sample month is classified as falling in a restrictive monetary policy period.²

Figure IA.7 shows that for many themes the betas have different magnitudes in the two regimes, with the average betas across themes being generally more negative in the expansionary regime, when betas tend to become somewhat more disperse. However, there are evident differences across themes. For example, the median beta of the low risk strategy factors is roughly three times more negative in the expansionary regime (momentum and quality show a similar behavior). For some themes, the betas even switch sign: debt issuance and investment betas turn positive in the expansionary regime, while those of accruals and low leverage become negative.

Buetow et al. (2009) also show that the slope of the term structure changes in the two regimes, becoming steeper during expansive periods. We therefore condition the betas on the term spread quintiles (Figure IA.8). We find that accruals, low leverage, momentum, and low risk betas tend to decrease with the term spread, while those of debt issuance, investment, and value tend to increase. Interestingly, for many themes, the betas show opposite tendencies when conditioning on expected inflation and term spreads. A recurrent finding is that the exposures of momentum and value to monetary policies tend to move in opposite directions, regardless of whether one conditions on expected inflation, regimes, or term spread. This shows that monetary policy contributes to the well-documented negative correlation between these two strategies (e.g., Asness, Moskowitz and Pedersen, 2013).

IA.2.2 Portfolios.

Table IA.2 presents summary statistics for portfolios sorted on ECB monetary policy announcement shocks around the press conference window.

Tables IA.3, IA.4 and IA.5 present post-formation regressions for the mew, prw, and pcw portfolios.

Figure IA.9 presents a scatterplot of the expected returns of P1 to P5, for portfolios sorted on exposures to high-frequency OIS changes for $\tau = 1M$ to $1Y$ and $w = mew, prw$, against the post-formation regression exposures (estimated with *STOXX50* as control).

²For the beginning of the sample, we classify the regime based on the Bundesbank policy regime, which was expansionary from September 1992 and last revised downward in April 1996. The first policy rate change enacted by the ECB was in April 1999, four months into the sample period.

Table [IA.6](#) presents the frequency and the within theme ranking of the factors entering the size theme; the analysis is performed unconditionally, as well as conditional on the monetary policy regime.

Tables [IA.7](#) and [IA.8](#) present additional portfolio constituents evidence for the prw.

Table [IA.9](#) presents portfolio constituents evidence for the mew.

Figure [IA.10](#) presents portfolios sorted on exposures to OIS 3M to 2Y surprises around the prw conditional on Fama-French factor returns.

TABLE IA.2

BETA-SORTED PORTFOLIO STATISTICS: PRESS CONFERENCE WINDOW

The table presents summary statistics of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press conference window. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1\text{M}$ to 10Y , around the press conference window, $w = \text{pcw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jun/2003 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	-0.07	1.53**	1.67***	2.60***	1.88**	-2.04	-1.75	Mean	-0.54	0.79	1.75***	2.18***	3.42***	-3.97*	-3.11*
t-stat	-0.06	2.37	3.83	4.33	2.15	-1.03	-1.08	t-stat	-0.40	1.35	3.75	3.93	3.12	-1.77	-1.78
Std	5.82	2.73	1.85	2.47	3.83	8.65	6.93	Std	6.04	2.70	2.13	2.43	4.52	9.63	7.62
SR	0.01	0.56	0.90	1.05	0.49	0.24	0.25	SR	0.09	0.29	0.82	0.89	0.76	0.41	0.41
AC(1)	0.10	0.17	0.11	0.21	0.08	0.09	0.12	AC(1)	0.14	0.06	0.10	0.10	0.21	0.17	0.15
Pre- β	-61.79	-25.98	-7.22	11.81	44.67	-106.45	-85.36	Pre- β	-36.82	-14.85	-2.72	8.55	26.97	-63.79	-51.34
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	-1.07	0.86	1.44***	2.00***	4.37***	-5.43**	-4.05**	Mean	-0.37	0.86	1.34***	2.20***	3.57***	-3.93*	-3.11*
t-stat	-0.82	1.35	3.37	3.65	4.08	-2.52	-2.40	t-stat	-0.28	1.43	2.85	4.49	3.33	-1.83	-1.87
Std	5.95	2.83	1.89	2.60	4.76	9.60	7.68	Std	5.93	2.69	1.98	2.33	4.77	9.59	7.54
SR	0.18	0.31	0.76	0.77	0.92	0.57	0.53	SR	0.06	0.32	0.68	0.94	0.75	0.41	0.41
AC(1)	0.12	0.14	0.13	0.01	0.11	0.13	0.11	AC(1)	0.12	0.12	0.16	0.01	0.12	0.13	0.11
Pre- β	-39.23	-16.68	-2.63	11.29	34.95	-74.18	-59.96	Pre- β	-41.53	-17.11	-2.72	11.17	36.28	-77.81	-62.55
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	0.06	1.42**	0.95*	1.93***	3.24***	3.20	-2.38	Mean	1.14	0.90	0.66	2.05***	2.83***	1.72	-1.61
t-stat	0.05	2.25	1.89	4.18	3.29	-1.54	-1.47	t-stat	0.84	1.25	1.47	4.44	2.79	-0.79	-0.93
Std	6.03	2.67	2.05	2.13	4.46	9.35	7.33	Std	6.33	3.04	1.83	2.06	4.58	9.92	7.82
SR	0.01	0.53	0.46	0.90	0.73	0.34	0.33	SR	0.18	0.29	0.36	0.99	0.62	0.17	0.21
AC(1)	0.10	0.17	0.25	0.03	0.09	0.12	0.11	AC(1)	0.10	0.17	0.20	0.09	0.10	0.12	0.12
Pre- β	-35.55	-14.34	-2.70	9.07	29.66	-65.21	-52.44	Pre- β	-28.06	-10.74	-1.30	7.89	23.32	-51.38	-41.34
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	0.76	0.96	0.79*	2.07***	3.00***	-2.25	-1.89	Mean	0.82	1.30**	0.89**	1.88***	2.72***	1.91	-1.53
t-stat	0.55	1.47	1.75	4.42	2.99	-1.02	-1.09	t-stat	0.58	2.08	1.98	3.89	2.70	-0.85	-0.88
Std	6.38	2.84	1.84	2.14	4.60	10.03	7.83	Std	6.55	2.76	1.95	2.17	4.63	10.32	8.02
SR	0.12	0.34	0.43	0.97	0.65	0.22	0.24	SR	0.13	0.47	0.45	0.86	0.59	0.19	0.19
AC(1)	0.11	0.15	0.23	0.05	0.08	0.12	0.12	AC(1)	0.10	0.14	0.08	0.10	0.08	0.10	0.10
Pre- β	-25.61	-9.51	-1.15	7.14	21.12	-46.72	-37.50	Pre- β	-24.44	-8.69	-0.70	7.05	20.61	-45.05	-36.04

TABLE IA.3
POST-FORMATION BETAS: MONETARY EVENT WINDOW

The table presents exposures of portfolios of investment strategies sorted on ECB monetary policy announcement shocks around the monetary event window to the monetary policy shocks. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the monetary event window, $w = mew$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Post-formation regressions estimate the exposure of each of these portfolio returns to the change in the high-frequency OIS rate around the corresponding event window (β^O). Surprises are summed within a month and assigned to month-end, and months with no Governing Council meetings are excluded. Exposures are estimated as in equation (2), where upper sub-panels include no control and lower sub-panels include the contemporaneous high-frequency change in the euro area stock market, Euro Stoxx 50. The t -statistic, computed using Newey and West (1987) standard errors is reported below, as well as the (adjusted) R^2 , in percentage. All OIS shocks are standardized to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample is from Jul/2000 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-53.71***	17.42*	-15.50**	-7.45	12.67	-65.45***	48.58***	β^O	-43.29***	29.81***	16.94**	-6.76	14.39	-56.31**	-45.48***
t-stat	-3.38	-1.75	-2.05	-1.48	1.41	-2.97	-2.79	t-stat	-2.85	-3.31	-2.31	-1.25	1.62	-2.55	-2.74
R^2	4.56	1.79	3.28	1.30	1.08	4.04	3.63	R^2	3.08	4.84	3.53	1.13	1.52	3.13	3.28
β^O	-56.01***	18.82*	-15.73**	-6.91	13.62	-68.67***	51.47***	β^O	-46.61***	31.08***	16.75**	-6.76	16.02**	-61.33***	-49.33***
t-stat	-3.42	-1.87	-2.01	-1.37	1.57	-3.10	-2.96	t-stat	-3.23	-3.50	-2.19	-1.21	2.04	-3.05	-3.25
R^2	4.39	1.82	2.55	0.99	0.71	3.97	3.77	R^2	3.45	4.64	2.78	0.34	1.97	3.92	4.00
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-39.24***	22.06***	-9.56	-9.62	8.65	-47.98**	-36.34**	β^O	-32.56**	-24.29***	12.66*	-3.65	3.68	-36.19*	-31.15**
t-stat	-2.66	-2.69	-1.37	-1.58	1.36	-2.54	-2.48	t-stat	-2.38	-2.96	-1.76	-0.74	0.51	-1.86	-2.05
R^2	2.65	2.91	1.07	1.89	0.72	2.55	2.32	R^2	1.97	2.85	1.73	0.30	0.13	1.55	1.73
β^O	-41.79***	24.36***	10.47	-8.82	9.18	-50.95**	-39.41***	β^O	-37.54***	26.10***	14.45*	-3.00	6.18	-43.62**	-37.37**
t-stat	-2.71	-2.88	-1.42	-1.39	1.42	-2.59	-2.60	t-stat	-2.70	-3.02	-1.89	-0.58	0.89	-2.29	-2.51
R^2	2.21	3.08	0.57	1.50	0.01	2.06	2.04	R^2	2.23	2.42	1.72	-0.28	0.66	2.23	2.50
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-20.22	-20.80**	-7.31	-5.57*	-1.44	-19.30	-17.21	β^O	-23.35*	-11.35	-6.46	-4.50	0.46	-24.28	-18.66
t-stat	-1.58	-2.39	-1.26	-1.65	-0.23	-1.13	-1.25	t-stat	-1.83	-1.36	-1.39	-1.17	0.07	-1.42	-1.35
R^2	0.74	2.19	0.65	0.70	0.02	0.43	0.53	R^2	1.00	0.59	0.68	0.40	0.00	0.64	0.60
β^O	-24.97*	-22.49**	-9.02	-4.57	0.14	-25.44	-22.80	β^O	-28.88**	13.53	-6.62	-4.74	3.90	-33.15*	-25.45*
t-stat	-1.87	-2.39	-1.42	-1.24	0.02	-1.46	-1.62	t-stat	-2.17	-1.50	-1.28	-1.16	0.57	-1.93	-1.82
R^2	0.69	1.67	0.50	0.31	-0.36	0.43	0.75	R^2	1.39	0.25	-0.11	-0.38	1.15	1.64	1.47
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-18.79	-9.23	-9.70**	-5.95	1.08	-20.60	-15.00	β^O	-12.02	-12.95*	-6.72	-5.42	2.06	-14.98	-12.22
t-stat	-1.52	-1.24	-2.05	-1.26	0.15	-1.20	-1.12	t-stat	-1.12	-1.94	-1.46	-0.93	0.26	-0.95	-0.98
R^2	0.64	0.47	1.27	0.63	0.01	0.44	0.38	R^2	0.31	1.00	0.57	0.36	0.03	0.26	0.28
β^O	-24.10*	-11.37	-9.98*	-5.84	4.61	-29.32*	-21.55	β^O	-15.10	-15.34**	-6.96	-4.89	4.48	-20.37	-17.09
t-stat	-1.85	-1.44	-1.93	-1.17	0.60	-1.67	-1.56	t-stat	-1.33	-2.25	-1.42	-0.77	0.55	-1.25	-1.32
R^2	1.04	0.28	0.51	-0.16	1.36	1.52	1.32	R^2	0.26	1.50	-0.20	-0.31	0.67	0.73	1.15

TABLE IA.4
POST-FORMATION BETAS: PRESS RELEASE WINDOW

The table presents exposures of portfolios of investment strategies sorted on ECB monetary policy announcement shocks around the press release window to the monetary policy shocks. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the press release window, $w = prw$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Post-formation regressions estimate the exposure of each of these portfolio returns to the change in the high-frequency OIS rate around the corresponding event window (β^O). Surprises are summed within a month and assigned to month-end, and months with no Governing Council meetings are excluded. Exposures are estimated as in equation (2), where upper sub-panels include no control and lower sub-panels include the contemporaneous high-frequency change in the euro area stock market, Euro Stoxx 50. The t -statistic, computed using Newey and West (1987) standard errors is reported below, as well as the (adjusted) R^2 , in percentage. All OIS shocks are standardized to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample is from Jul/2000 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-48.16***	20.90**	-9.51	-3.66	9.07	-57.75***	45.75***	β^O	-41.20***	23.45***	11.21*	1.53	5.39	-47.05***	41.43***
t-stat	-3.49	-2.53	-1.16	-0.70	1.12	-3.26	-3.38	t-stat	-3.49	-2.70	-1.70	0.26	0.79	-3.18	-3.45
R^2	3.57	2.33	1.47	0.25	0.46	2.84	2.93	R^2	2.96	2.95	1.75	0.05	0.19	2.28	2.78
β^O	-46.34***	19.70**	-9.56	-1.19	12.02	-58.28***	46.91***	β^O	-38.86***	21.61**	-10.71	1.83	7.97	-47.22***	40.90***
t-stat	-3.02	-2.25	-1.07	-0.25	1.37	-2.83	-2.98	t-stat	-3.07	-2.43	-1.55	0.29	1.20	-3.00	-3.16
R^2	2.84	1.60	0.68	0.36	0.06	2.06	2.17	R^2	2.33	2.45	1.01	-0.72	0.05	1.49	2.01
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-32.50**	-26.63***	-4.32	-0.32	-1.48	-32.62	-29.92*	β^O	-36.52***	17.76*	-8.86*	-2.10	4.93	-42.69**	-33.30**
t-stat	-2.44	-2.80	-0.73	-0.06	-0.15	-1.64	-1.88	t-stat	-3.20	-1.72	-1.87	-0.37	0.64	-2.47	-2.32
R^2	1.86	4.06	0.21	0.00	0.01	1.06	1.41	R^2	2.44	1.74	0.78	0.07	0.16	1.82	1.76
β^O	-30.21**	-26.49***	-3.83	1.73	2.49	-33.90*	-31.79**	β^O	-33.76**	-18.40*	-7.69	1.33	7.70	-42.38**	-34.28**
t-stat	-2.14	-2.63	-0.66	0.31	0.26	-1.68	-2.05	t-stat	-2.58	-1.68	-1.32	0.21	1.00	-2.31	-2.29
R^2	1.16	3.29	-0.57	-0.12	0.07	0.28	0.67	R^2	1.77	0.97	0.10	0.99	-0.22	1.03	0.98
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-18.62	-15.02*	-4.15	3.01	-2.97	-16.85	-16.93	β^O	-0.59	-6.64	-9.13	1.73	-13.67	12.27	5.93
t-stat	-1.59	-1.92	-0.82	0.62	-0.33	-0.93	-1.17	t-stat	-0.05	-1.06	-1.32	0.43	-1.52	0.78	0.49
R^2	0.64	1.32	0.19	0.16	0.06	0.30	0.47	R^2	0.00	0.25	0.87	0.05	1.34	0.16	0.06
β^O	-16.50	-12.86	-2.84	7.11	0.44	-17.48	-17.63	β^O	1.99	-3.80	-6.68	4.51	-10.61	12.48	6.06
t-stat	-1.20	-1.37	-0.44	1.34	0.05	-0.92	-1.14	t-stat	0.15	-0.49	-0.77	0.98	-1.04	0.70	0.44
R^2	-0.10	0.73	-0.48	1.48	-0.19	-0.50	-0.32	R^2	-0.70	-0.18	0.58	0.33	1.09	-0.65	-0.74
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	8.11	-0.82	-2.32	-7.49	-17.45	25.31	19.25	β^O	5.84	2.59	-2.22	-10.36	-11.62	16.66	15.55
t-stat	0.92	-0.15	-0.46	-1.17	-1.63	1.55	1.53	t-stat	0.72	0.59	-0.47	-1.30	-0.88	0.96	1.13
R^2	0.12	0.00	0.06	0.86	1.98	0.66	0.64	R^2	0.15	0.09	0.05	0.67	0.47	0.42	0.57
β^O	10.43	0.95	-0.36	-5.79	-12.50	23.19	17.52	β^O	5.06	2.69	-0.89	-8.29	-3.79	8.45	9.12
t-stat	1.02	0.15	-0.06	-0.78	-1.01	1.27	1.24	t-stat	0.58	0.54	-0.16	-0.93	-0.26	0.45	0.62
R^2	-0.57	-0.58	-0.25	0.54	2.93	-0.09	-0.10	R^2	-0.61	-0.71	-0.47	0.32	3.26	1.34	1.40

TABLE IA.5

POST-FORMATION BETAS: PRESS CONFERENCE WINDOW

The table presents exposures of portfolios of investment strategies sorted on ECB monetary policy announcement shocks around the press conference window to the monetary policy shocks. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the press conference window, $w = pcw$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Post-formation regressions estimate the exposure of each of these portfolio returns to the change in the high-frequency OIS rate around the corresponding event window (β^O). Surprises are summed within a month and assigned to month-end, and months with no Governing Council meetings are excluded. Exposures are estimated as in equation (2), where upper sub-panels include no control and lower sub-panels include the contemporaneous high-frequency change in the euro area stock market, Euro Stoxx 50. The t -statistic, computed using Newey and West (1987) standard errors is reported below, as well as the (adjusted) R^2 , in percentage. All OIS shocks are standardized to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample is from Jun/2003 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-6.79	-6.53	-10.74**	-5.07	-1.17	-6.29	-4.81	β^O	-15.03	-9.63*	-2.22	-4.42	0.20	-15.05	-12.50
t-stat	-0.49	-1.22	-2.23	-1.21	-0.19	-0.35	-0.34	t-stat	-1.09	-1.82	-0.44	-1.49	0.02	-0.78	-0.86
R^2	0.18	0.77	4.08	0.56	0.01	0.07	0.07	R^2	0.78	1.83	0.13	0.45	0.00	0.32	0.36
β^O	-6.83	-6.63	-10.81**	-5.16	-1.42	-6.10	-4.72	β^O	-15.26	-9.58*	-2.43	-4.67	-0.13	-14.97	-12.34
t-stat	-0.49	-1.23	-2.21	-1.22	-0.23	-0.34	-0.33	t-stat	-1.10	-1.80	-0.48	-1.58	-0.02	-0.77	-0.84
R^2	-0.75	-0.04	3.29	-0.25	-0.60	-0.83	-0.85	R^2	-0.11	0.93	-0.53	-0.16	-0.78	-0.61	-0.56
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-12.78	-11.07*	-4.73	-2.63	0.48	-13.13	-10.42	β^O	-9.16	-10.33**	-6.84	-3.34	-1.91	-7.43	-7.69
t-stat	-1.17	-1.95	-1.10	-0.85	0.07	-0.89	-0.87	t-stat	-0.91	-2.23	-1.47	-1.26	-0.25	-0.51	-0.67
R^2	0.59	2.18	0.79	0.14	0.00	0.25	0.26	R^2	0.31	1.91	1.62	0.27	0.02	0.08	0.15
β^O	-11.61	-9.79*	-4.52	-4.24	-2.48	-9.03	-6.64	β^O	-8.16	-10.07**	-7.08	-4.64	-3.89	-4.39	-5.15
t-stat	-1.02	-1.70	-1.02	-1.45	-0.36	-0.59	-0.54	t-stat	-0.76	-2.13	-1.49	-1.64	-0.49	-0.29	-0.43
R^2	0.00	3.28	-0.03	2.98	2.91	1.04	1.66	R^2	-0.42	1.06	0.81	1.56	0.43	-0.10	0.07
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-15.29	-6.76	-4.13	-5.22*	0.78	-16.44	-12.27	β^O	-21.64*	-9.82*	-0.16	-2.38	2.15	-23.85	-19.14
t-stat	-1.33	-1.35	-1.18	-1.74	0.11	-1.00	-0.94	t-stat	-1.91	-1.87	-0.05	-0.72	0.26	-1.34	-1.38
R^2	0.80	0.84	0.54	0.90	0.00	0.41	0.38	R^2	1.40	1.33	0.00	0.17	0.03	0.74	0.78
β^O	-15.72	-6.74	-3.65	-6.26**	-0.78	-15.27	-11.07	β^O	-22.75*	-9.39*	0.05	-3.23	0.96	-23.74	-18.71
t-stat	-1.29	-1.26	-1.02	-1.97	-0.10	-0.86	-0.79	t-stat	-1.88	-1.73	0.02	-0.94	0.11	-1.24	-1.26
R^2	-0.10	-0.09	-0.08	1.54	-0.15	-0.43	-0.39	R^2	0.64	0.53	-0.85	0.19	-0.47	-0.19	-0.13
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
β^O	-20.83*	-7.73	-0.20	-1.20	2.21	-23.09	-17.76	β^O	-13.55	-2.96	-3.46	0.58	1.17	-14.66	-10.76
t-stat	-1.80	-1.50	-0.06	-0.31	0.24	-1.21	-1.19	t-stat	-1.14	-0.54	-1.14	0.13	0.11	-0.70	-0.65
R^2	1.28	0.97	0.00	0.04	0.03	0.68	0.66	R^2	0.53	0.14	0.38	0.01	0.01	0.26	0.23
β^O	-21.26*	-7.55	-0.12	-1.82	1.01	-22.29	-16.95	β^O	-13.92	-2.65	-3.60	0.57	0.38	-14.23	-10.37
t-stat	-1.72	-1.41	-0.04	-0.46	0.11	-1.10	-1.06	t-stat	-1.12	-0.48	-1.14	0.13	0.04	-0.66	-0.61
R^2	0.39	0.07	-0.92	-0.23	-0.29	-0.20	-0.18	R^2	-0.33	-0.51	-0.45	-0.92	-0.19	-0.63	-0.64

TABLE IA.6
SIZE THEME PORTFOLIO CONSTITUENTS

The table presents constituents of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks. For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated as in equation (1) for OIS of $\tau = 1M$ to $10Y$, and $w = prw$. Five portfolios are formed (P1-5), the day following each Governing Council, by sorting investment strategies into quintile portfolios given their beta exposures. Panel A (B) displays, in *Total*, the percentage of times a factor corresponding to one of the five size theme factors appear in P1 (P5), averaged across all OIS maturities τ , relative to another portfolio. These five factors are assigned to the size theme following a cluster analysis of the 153 investment strategies, as in Jensen et al. (2023). Slicing the data into contractionary (*Cont.*) and expansionary (*Exp.*) monetary policy regimes, following Buetow et al. (2009), the table also reports the percentage of times a given theme appears in a corner portfolio within each regime. The respective ranking of each theme is also noted within each portfolio and across the given regimes.

Panel A: Low OIS Beta (P1)						
Theme	Rank	Total	Rank	Cont.	Rank	Exp.
dolvol126d	1	22.27	3	27.10	1	20.57
rdme	2	20.88	4	23.98	2	19.80
ami126d	3	20.36	2	28.34	3	17.56
marketequity	4	13.64	1	31.10	5	7.51
prc	5	11.02	5	15.94	4	9.30
Panel B: High OIS Beta (P5)						
Theme	Rank	Total	Rank	Cont.	Rank	Exp.
prc	1	55.59	2	16.91	1	69.17
rdme	2	36.24	1	28.00	2	39.13
ami126d	3	24.47	3	10.74	3	29.29
dolvol126d	4	23.03	4	9.29	4	27.86
marketequity	5	19.28	5	5.79	5	24.02

TABLE IA.7
PORTFOLIO CONSTITUENT THEMES: PRESS RELEASE WINDOW

The table presents constituents of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press release window (see Table 3). Panel A (B) displays the percentage of times a factor corresponding to one of the 13 respective investment themes appears in Portfolio 1 (Portfolio 5) relative to another portfolio. The 153 factors are assigned to their themes by a cluster analysis of correlation and signal similarity following Jensen et al. (2023). The value for each of the 13 themes represents an average across all factors within a given theme. Results are displayed for the entire term structure of high-frequency OIS rates, $\tau = 1M$ to $10Y$, as well as the average across intermediate ($Mean^{1M-2Y}$ and $Mean^{5Y-10Y}$) and aggregate ($Mean$) horizons, respectively. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: Low OIS-Beta (P1)											
Theme	OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	Mean ^{1M-2Y}	Mean ^{5Y-10Y}	Mean
low risk	41.51	39.67	30.96	32.84	39.20	48.09	48.83	36.19	36.84	44.37	39.66
momentum	30.25	31.05	33.41	33.06	31.63	36.35	37.30	37.57	31.88	37.07	33.83
quality	24.00	31.31	28.23	29.41	28.79	30.75	30.68	31.36	28.35	30.93	29.32
profitability	22.60	25.66	21.35	22.08	19.75	22.77	23.11	25.86	22.29	23.91	22.90
value	29.15	27.08	25.72	26.14	23.95	16.17	12.31	7.98	26.41	12.15	21.06
size	23.26	18.29	20.66	20.46	18.05	15.36	13.26	11.74	20.14	13.45	17.64
low leverage	13.85	11.00	15.09	13.34	15.73	16.26	18.86	27.25	13.80	20.79	16.42
short term reversal	15.92	11.60	17.84	13.87	14.93	13.22	16.63	20.26	14.83	16.70	15.53
seasonality	15.70	14.48	14.27	15.97	14.15	11.10	10.63	14.56	14.92	12.10	13.86
accruals	3.40	6.64	13.12	12.87	14.59	10.33	11.23	15.40	10.12	12.32	10.95
profit growth	7.69	6.59	9.87	8.88	7.30	10.38	12.24	19.16	8.07	13.93	10.26
investment	9.53	9.10	13.56	12.59	12.00	8.79	8.10	6.92	11.36	7.94	10.07
debt issuance	5.40	6.37	5.51	4.36	3.61	2.35	2.67	6.63	5.05	3.89	4.61
Panel B: High OIS-Beta (P5)											
Theme	OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	Mean ^{1M-2Y}	Mean ^{5Y-10Y}	Mean
value	30.09	28.82	32.07	32.80	31.71	32.95	36.36	40.41	31.10	36.58	33.15
size	36.39	35.47	33.20	33.81	31.61	28.97	24.48	29.87	34.09	27.77	31.72
low leverage	24.93	30.93	29.22	31.77	30.49	33.18	31.50	18.96	29.47	27.88	28.87
investment	19.63	24.00	21.87	24.17	24.16	24.28	26.20	27.88	22.77	26.12	24.02
momentum	26.97	20.65	20.87	14.28	19.62	18.52	17.23	17.39	20.48	17.72	19.44
seasonality	19.54	19.31	19.49	17.38	15.76	19.51	18.41	19.07	18.30	19.00	18.56
profit growth	17.33	18.63	19.14	17.02	18.82	20.22	17.49	14.63	18.19	17.45	17.91
low risk	20.64	16.09	17.46	15.15	14.96	9.63	9.44	14.82	16.86	11.29	14.77
profitability	13.17	14.58	14.20	14.39	14.08	14.19	16.06	15.27	14.09	15.17	14.49
quality	13.82	13.15	15.41	16.72	18.05	13.91	13.03	9.52	15.43	12.15	14.20
debt issuance	17.38	15.52	10.90	10.05	9.20	13.55	14.70	13.92	12.61	14.06	13.15
accruals	6.91	6.14	7.29	10.63	11.99	17.65	17.21	18.98	8.59	17.95	12.10
short term reversal	12.90	12.52	9.09	10.34	7.32	9.01	6.89	6.81	10.43	7.57	9.36

TABLE IA.8
PORTFOLIO CONSTITUENT FACTORS: PRESS RELEASE WINDOW

The table presents constituents of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press release window (see Table 3). Panel A (B) displays the percentage of times a given factor appears in Portfolio 1 (Portfolio 5) relative to another portfolio. To reduce dimensionality, only the top 10 factors and their associated investment themes are reported. The 153 factors are assigned to their themes by a cluster analysis of correlation and signal similarity following Jensen et al. (2023). Results are displayed for the entire term structure of high-frequency OIS rates, $\tau = 1M$ to $10Y$, as well as the average across intermediate ($Mean^{1M-2Y}$ and $Mean^{5Y-10Y}$) and aggregate ($Mean$) horizons, respectively. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: Low OIS-Beta (P1)												
Factor	Theme	OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	Mean ^{1M-2Y}	Mean ^{5Y-10Y}	Mean
rmax521d	low risk	67.96	63.83	50.35	54.22	68.09	80.28	78.51	64.19	60.89	74.33	65.93
rmax121d	low risk	70.51	68.27	56.06	53.81	59.48	74.04	68.24	53.89	61.63	65.39	63.04
rvol21d	low risk	69.88	67.30	50.92	50.92	56.37	77.99	74.40	55.85	59.08	69.41	62.95
mispricingperf	quality	54.63	55.11	56.05	63.06	62.90	68.33	69.53	66.62	58.35	68.16	62.03
qmj	quality	39.84	57.93	53.82	53.60	51.23	59.29	60.40	62.67	51.28	60.79	54.85
betadimson21d	low risk	68.67	62.62	56.47	48.66	48.18	59.79	54.56	26.04	56.92	46.80	53.12
beta60m	low risk	48.74	52.85	39.31	42.23	49.71	60.58	64.51	56.79	46.57	60.63	51.84
ret121	momentum	40.25	38.23	48.76	54.03	50.79	51.53	59.32	71.64	46.41	60.83	51.82
opat1l	quality	39.26	56.26	47.19	47.13	49.45	55.47	56.82	57.77	47.86	56.69	51.17
opat	quality	38.08	55.10	48.56	45.11	52.27	54.58	55.05	54.72	47.83	54.78	50.44
Panel B: High OIS-Beta (P5)												
Factor	Theme	OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	Mean ^{1M-2Y}	Mean ^{5Y-10Y}	Mean
ret6012	investment	46.81	52.10	50.21	60.95	64.37	67.49	66.82	71.78	54.89	67.49	60.07
bidaskhl21d	low leverage	62.56	61.61	44.07	43.15	50.06	76.86	74.46	60.98	52.29	76.86	59.22
beme	value	49.76	60.72	55.11	64.04	54.11	51.95	57.30	66.87	56.75	51.95	57.48
prc	size	56.92	63.17	45.05	45.50	50.71	61.06	58.50	63.85	52.27	61.06	55.59
bevmev	value	49.65	50.50	50.85	55.77	55.03	54.79	61.29	57.58	52.36	54.79	54.43
eqdur	value	48.02	44.02	55.30	55.08	53.79	56.43	59.63	61.32	51.24	56.43	54.20
atme	value	44.89	44.84	50.76	56.16	54.93	58.14	62.85	60.22	50.32	58.14	54.10
eqpome	value	52.13	50.97	52.93	53.66	47.45	47.61	46.98	52.24	51.43	47.61	50.50
seas25na	investment	37.91	39.73	35.70	53.61	53.58	52.24	59.67	69.82	44.11	52.24	50.28
debtme	value	44.18	45.55	46.50	52.19	51.61	51.37	55.01	54.50	48.01	51.37	50.11

TABLE IA.9

PORTFOLIO CONSTITUENTS BY THEMES: MONETARY EVENT WINDOW

The table presents constituents of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the monetary event window. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the monetary event window, $w = mew$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures (see Table 2). Panel A (B) displays, in *Total*, the percentage of times a factor corresponding to one of the 13 respective investment themes appears in P1 (P5), averaged across all OIS maturities, τ , relative to another portfolio. The 153 factors are assigned to their themes by a cluster analysis of correlation and signal similarity following Jensen et al. (2023). Slicing the data into contractionary (*Cont.*) and expansionary (*Exp.*) monetary policy regimes, following Buetow et al. (2009), the table also reports the percentage of times a given theme appears in a corner portfolio within each policy regime. The respective ranking of each theme is also reported across regimes. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: Low OIS-Beta (P1)						
Theme	Rank	Total	Rank	Cont.	Rank	Exp.
low risk	1	40.79	1	32.45	1	43.72
momentum	2	39.63	2	29.77	2	43.09
quality	3	26.34	7	15.33	3	30.20
value	4	18.67	3	25.49	5	16.27
profitability	5	17.96	8	15.32	4	18.89
low leverage	6	16.66	4	20.03	7	15.48
size	7	15.20	12	12.79	6	16.05
accruals	8	13.97	13	9.34	8	15.48
seasonality	9	13.84	6	19.19	9	12.15
profit growth	10	12.83	9	14.98	10	12.09
investment	11	12.73	5	19.84	11	10.24
short term reversal	12	11.07	11	13.88	12	10.08
debt issuance	13	5.82	10	13.95	13	2.96
Panel B: High OIS-Beta (P5)						
Theme	Rank	Total	Rank	Cont.	Rank	Exp.
value	1	33.41	5	23.24	1	36.98
size	2	33.20	3	28.09	2	35.00
low leverage	3	32.18	1	35.59	3	30.98
investment	4	21.16	11	12.73	4	24.12
seasonality	5	18.86	8	17.99	5	19.09
profit growth	6	17.93	7	19.69	7	17.31
quality	7	16.56	6	20.25	9	15.27
profitability	8	16.43	12	11.72	6	18.09
momentum	9	15.21	2	29.53	11	10.19
debt issuance	10	15.16	10	12.95	8	15.93
low risk	11	13.19	4	24.73	12	9.14
short term reversal	12	11.28	13	11.38	10	11.24
accruals	13	9.66	9	14.17	13	8.26

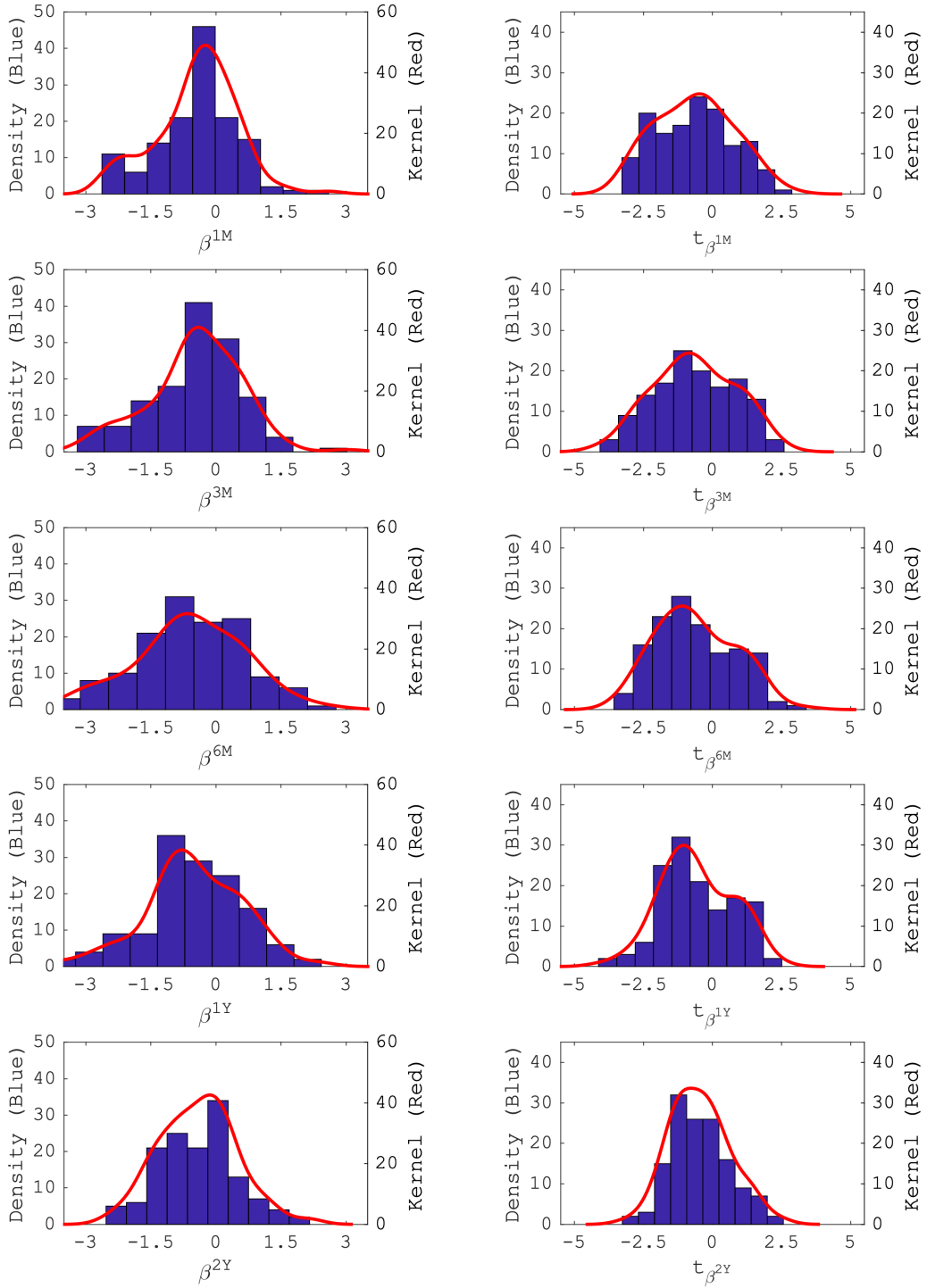


FIGURE IA.1. DISPERSION ON FACTOR ECB BETAS. The figure present the dispersion in exposures of investment strategy returns to changes in OIS rates around ECB monetary policy announcements. We regress each of the 153 investment strategy returns on the high-frequency OIS shocks around the press release window, and a constant, at a monthly frequency. We sum over all OIS shocks in a given month and allocate to month-end. All shocks are standardized, to have zero mean and unit standard deviation, for interpretability. The left (right) panels present the loadings (t -statistics) for OIS rates of varying maturities, $\tau = 1M$ to $2Y$. The sample is from Jan/1999 to Dec/2024.

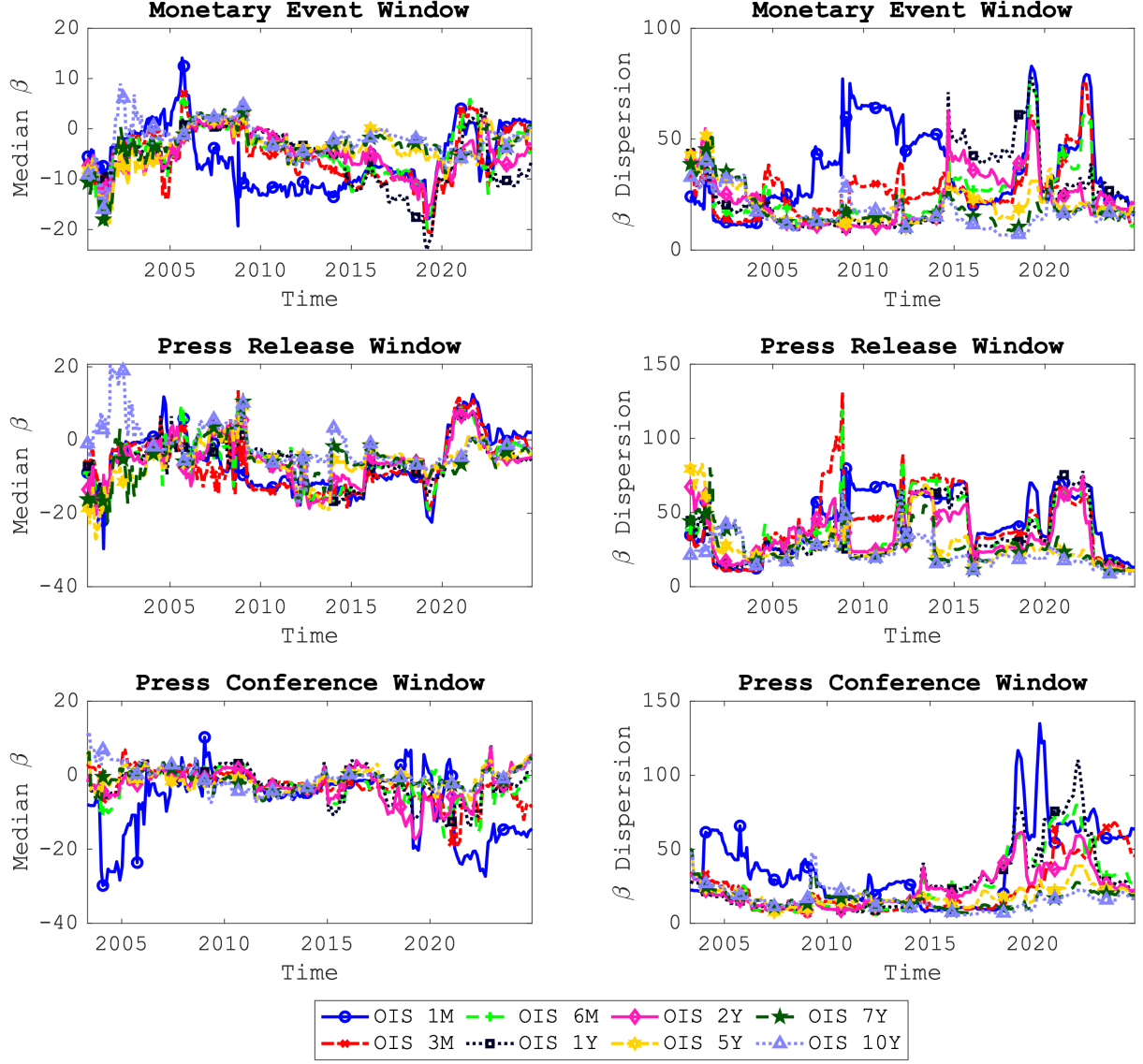


FIGURE IA.2. ECB BETAS BY OIS SURPRISE. The figure plots the median (left) and cross-sectional dispersion (right) of the exposures of 153 investment strategy returns to the change in the high-frequency OIS of varying maturities, $\tau = 1M$ to $10Y$, around the three event windows, $w = \text{mew}, \text{prw}, \text{pcw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. All OIS shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. For each OIS shock, we present the median beta exposure in the left panels, and the cross-sectional standard deviation across factor exposures in the right panel. The sample is from Jul/2000 to Dec/2024 for the mew and prw, and from Jun/2003 for pcw.

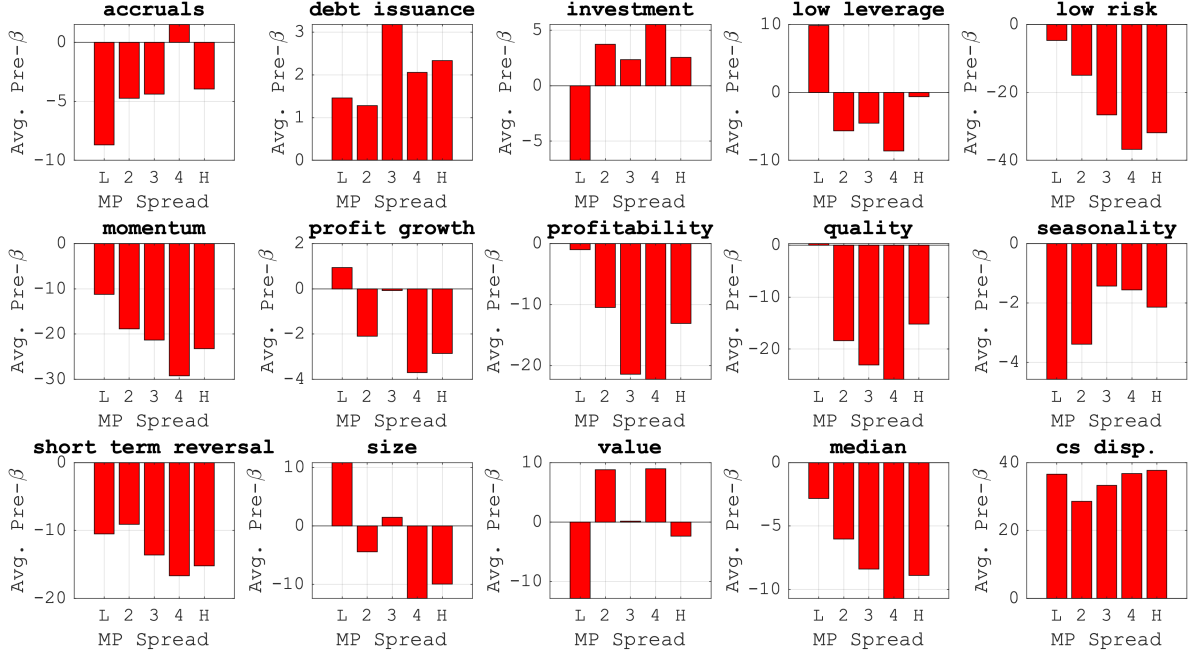


FIGURE IA.3. ECB BETAS VS THE MONETARY POLICY SPREAD. The figure presents the exposures of the 153 investment strategies to ECB monetary policy announcements, conditional on the monetary policy spread (MP Spread). For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS 1Y rate around the press release window, $w = \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. We then cluster these 153 factor exposures into their 13 investment themes, following [Jensen et al. \(2023\)](#), and estimate: the median exposure across all strategies within a given theme, the average across median theme exposures (*median*), and the cross-sectional dispersion across all individual factor exposures (*cs disp.*), respectively. The (3×5) panels show these time-varying exposures conditional on the monetary policy spread being within the lowest (*L*) to highest (*H*) quintile of its sample distribution. The monetary policy spread is constructed as the ECB policy rate (*Pol. Rate*) less an ARMA(1,1) forecast of inflation less the euro area natural rate (*R Star*), from [Holston et al. \(2017\)](#). The sample period is from Jul/2000 to Dec/2024.

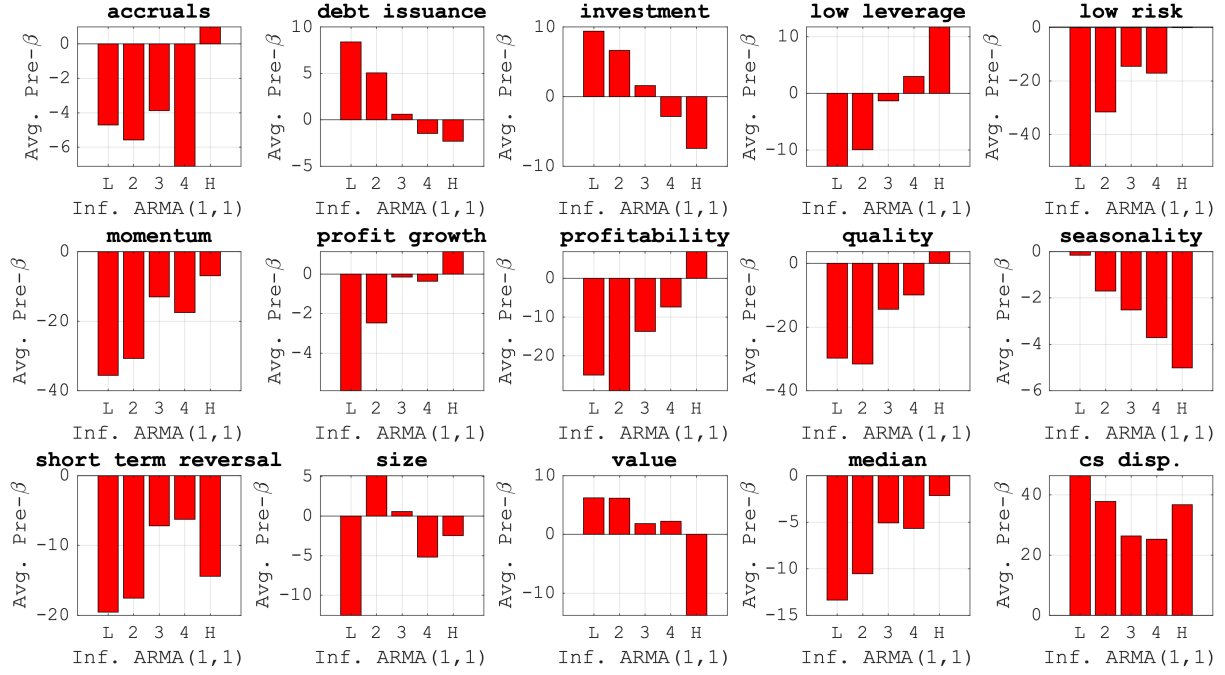


FIGURE IA.4. ECB BETAS VS INFLATION. The figure presents the exposures of the 153 investment strategies to ECB monetary policy announcements, conditional on expected inflation. For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS 1Y rate around the press release window, $w = \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. We then cluster these 153 factor exposures into their 13 investment themes, following Jensen et al. (2023), and estimate: the median exposure across all strategies within a given theme, the average across median theme exposures (*median*), and the cross-sectional dispersion across all individual factor exposures (*cs disp.*), respectively. The (3×5) panels show these time-varying exposures conditional on the 1-month ahead ARMA(1,1) forecast of year-on-year euro area HICP inflation (*Inf. ARMA(1,1)*) being within the lowest (*L*) to highest (*H*) quintile of its sample distribution. The sample period is from Jul/2000 to Dec/2024.

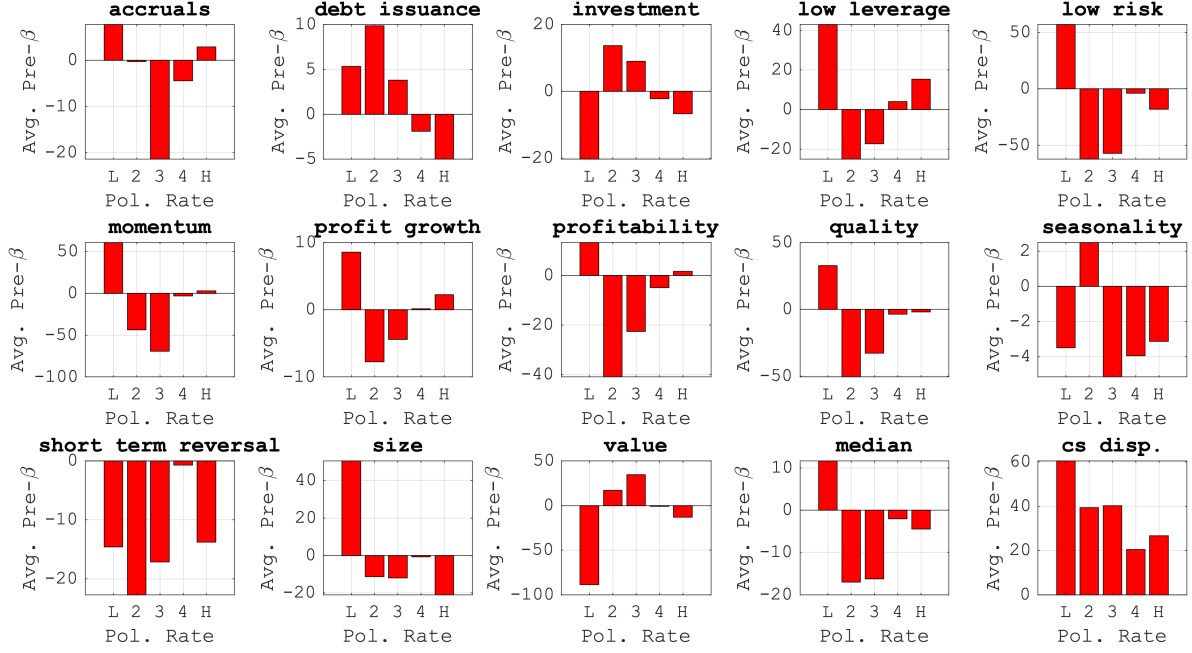


FIGURE IA.5. ECB BETAS VS THE ECB POLICY RATE. The figure presents the exposures of the 153 investment strategies to ECB monetary policy announcements, conditional on the ECB policy rate (Pol Rate). For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS 1Y rate around the press release window, $w = \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. We then cluster these 153 factor exposures into their 13 investment themes, following [Jensen et al. \(2023\)](#), and estimate: the median exposure across all strategies within a given theme, the average across median theme exposures (*median*), and the cross-sectional dispersion across all individual factor exposures (*cs disp.*), respectively. The (3×5) panels show these time-varying exposures conditional on the policy rate being within the lowest (*L*) to highest (*H*) quintile of its sample distribution. The sample period is from Jul/2000 to Dec/2024.

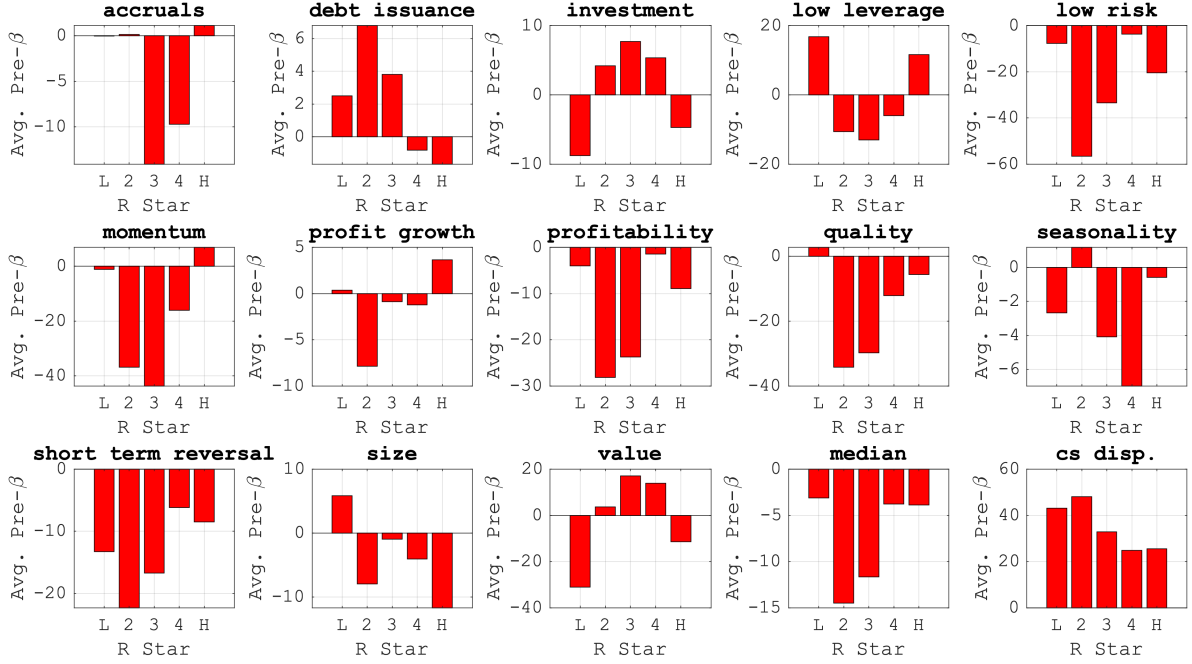


FIGURE IA.6. ECB BETAS vs R STAR. The figure presents the exposures of the 153 investment strategies to ECB monetary policy announcements, conditional on the natural rate (R Star). For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS 1Y rate around the press release window, $w = \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. We then cluster these 153 factor exposures into their 13 investment themes, following [Jensen et al. \(2023\)](#), and estimate: the median exposure across all strategies within a given theme, the average across median theme exposures (*median*), and the cross-sectional dispersion across all individual factor exposures (*cs disp.*), respectively. The (3×5) panels show these time-varying exposures conditional on R Star being within the lowest (*L*) to highest (*H*) quintile of its sample distribution. R Star is the euro area natural rate from [Holston et al. \(2017\)](#). The sample period is from Jul/2000 to Dec/2024.

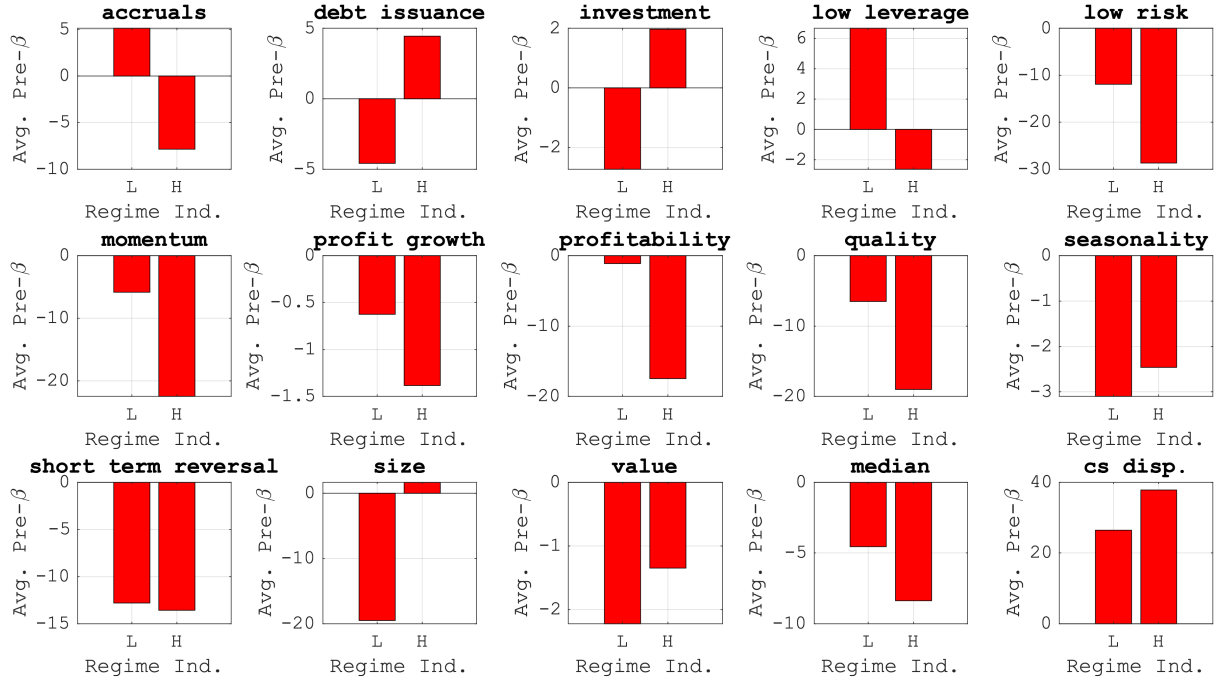


FIGURE IA.7. ECB BETAS VS MONETARY POLICY REGIMES. The figure presents the exposures of the 153 investment strategies to ECB monetary policy announcements, conditional on a binary monetary policy regime indicator. For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS 1Y rate around the press release window, $w = \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. We then cluster these 153 factor exposures into their 13 investment themes, following [Jensen et al. \(2023\)](#), and estimate: the median exposure across all strategies within a given theme, the average across median theme exposures (*median*), and the cross-sectional dispersion across all individual factor exposures (*cs disp.*), respectively. The (3×5) panels show the betas conditional on the binary monetary policy regime indicator of [Buetow et al. \(2009\)](#), which classifies regimes based on the last directional policy rate change (*Regime Ind.*), being contractionary (*C*) or expansionary (*E*), respectively. The sample period is from Jul/2000 to Dec/2024.

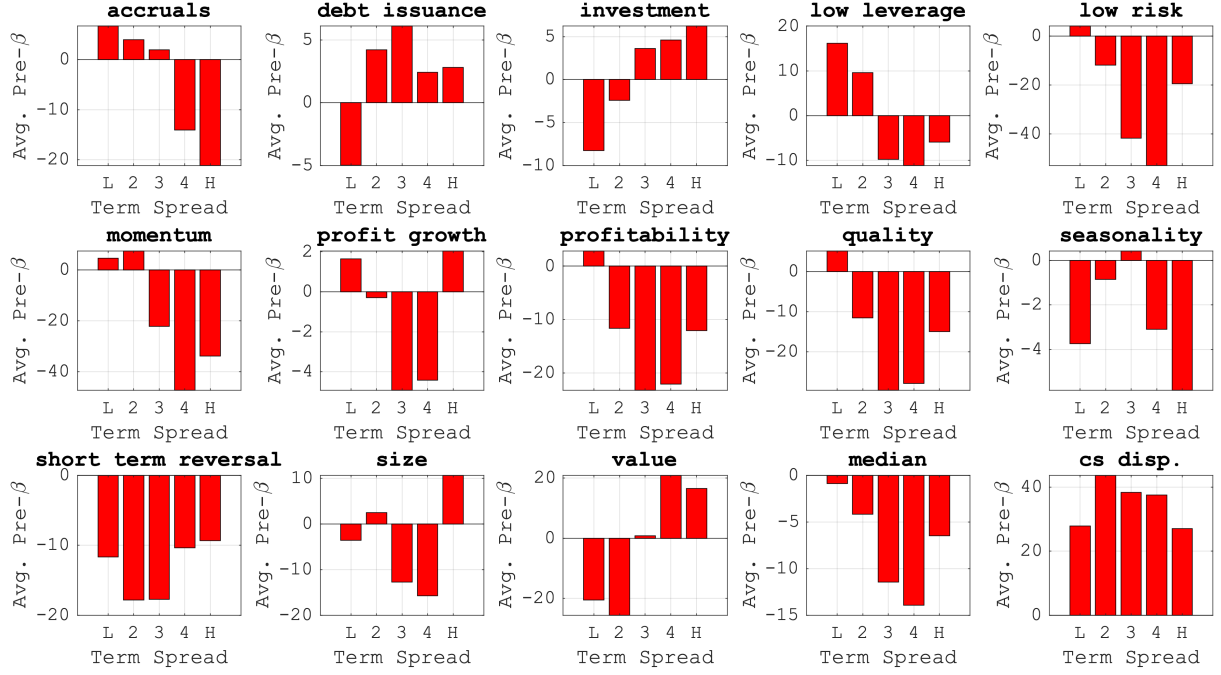


FIGURE IA.8. ECB BETAS VS TERM SPREADS. The figure presents the exposures of the 153 investment strategies to ECB monetary policy announcements, conditional on the German (10Y–1Y) term spread. For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS 1Y rate around the press release window, $w = \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. We then cluster these 153 factor exposures into their 13 investment themes, following Jensen et al. (2023), and estimate: the median exposure across all strategies within a given theme, the average across median theme exposures (*median*), and the cross-sectional dispersion across all individual factor exposures (*cs disp.*), respectively. The (3×5) panels show these time-varying exposures conditional on the Germany (10Y–1Y) term spread being within the lowest (*L*) to highest (*H*) quintile of its sample distribution. The sample period is from Jul/2000 to Dec/2024.

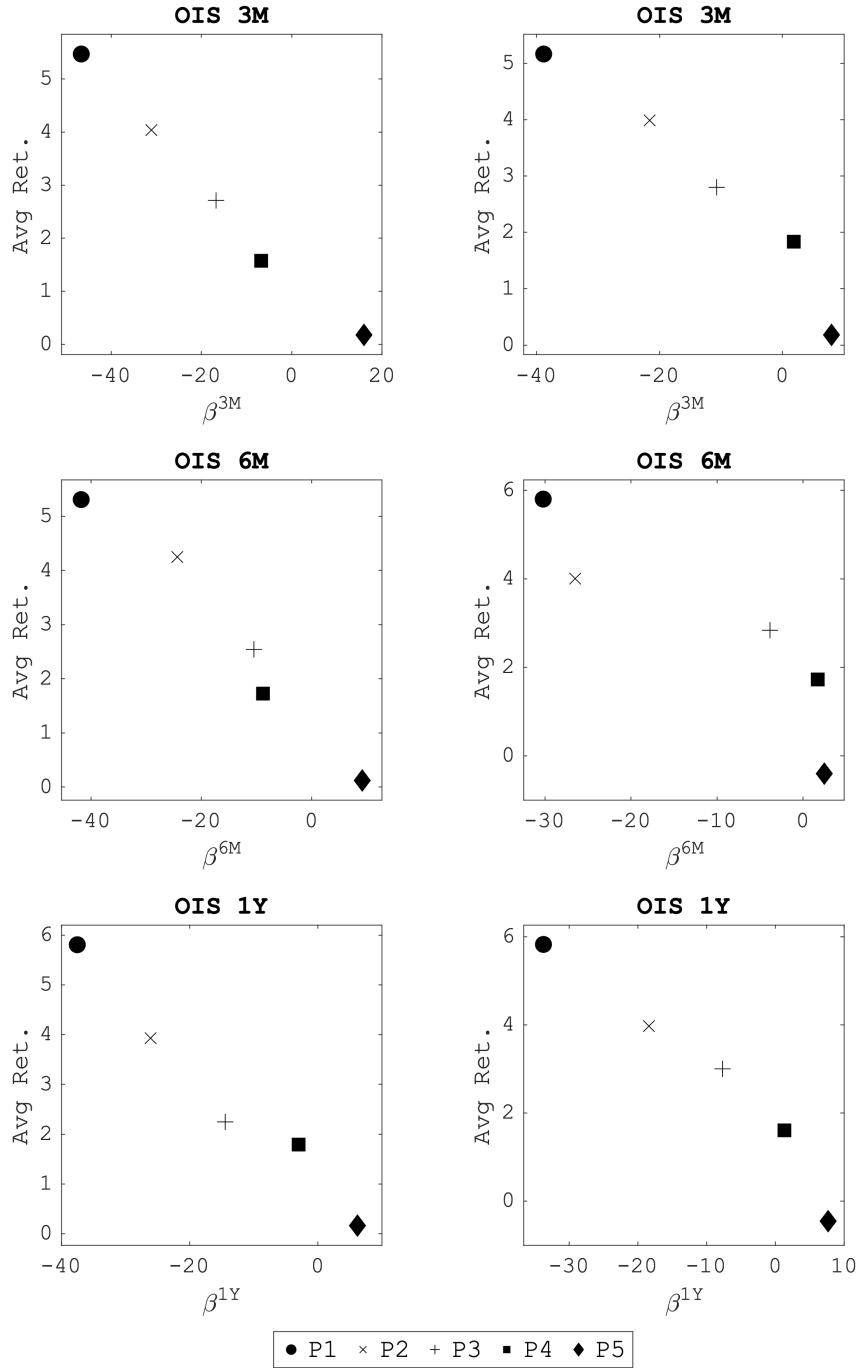


FIGURE IA.9. PORTFOLIO RETURNS VS POST-FORMATION LOADINGS. The figure presents a scatterplot of the average returns of the five quintile portfolio returns (P1–P5), constructed by sorting investment strategy returns on their exposures to ECB monetary policy announcement shocks, against their respective post-formation regression exposures. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 3M$ to $1Y$, around the monetary event and press release windows, $w = \text{mew}, \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1–5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized (see Tables 2 and 3). Post-formation regressions estimate the exposure of each of these five portfolio returns to the change in the high-frequency OIS rate around the corresponding event window. Surprises are summed within a month and assigned to month-end, and months with no Governing Council meetings are excluded. Exposures are estimated as in equation (2), and include the contemporaneous high-frequency change in the euro area stock market, *STOXX50*. All OIS shocks are standardized to have zero mean and unit standard deviation, for interpretability. Left (right) panels present results for mew (prw).

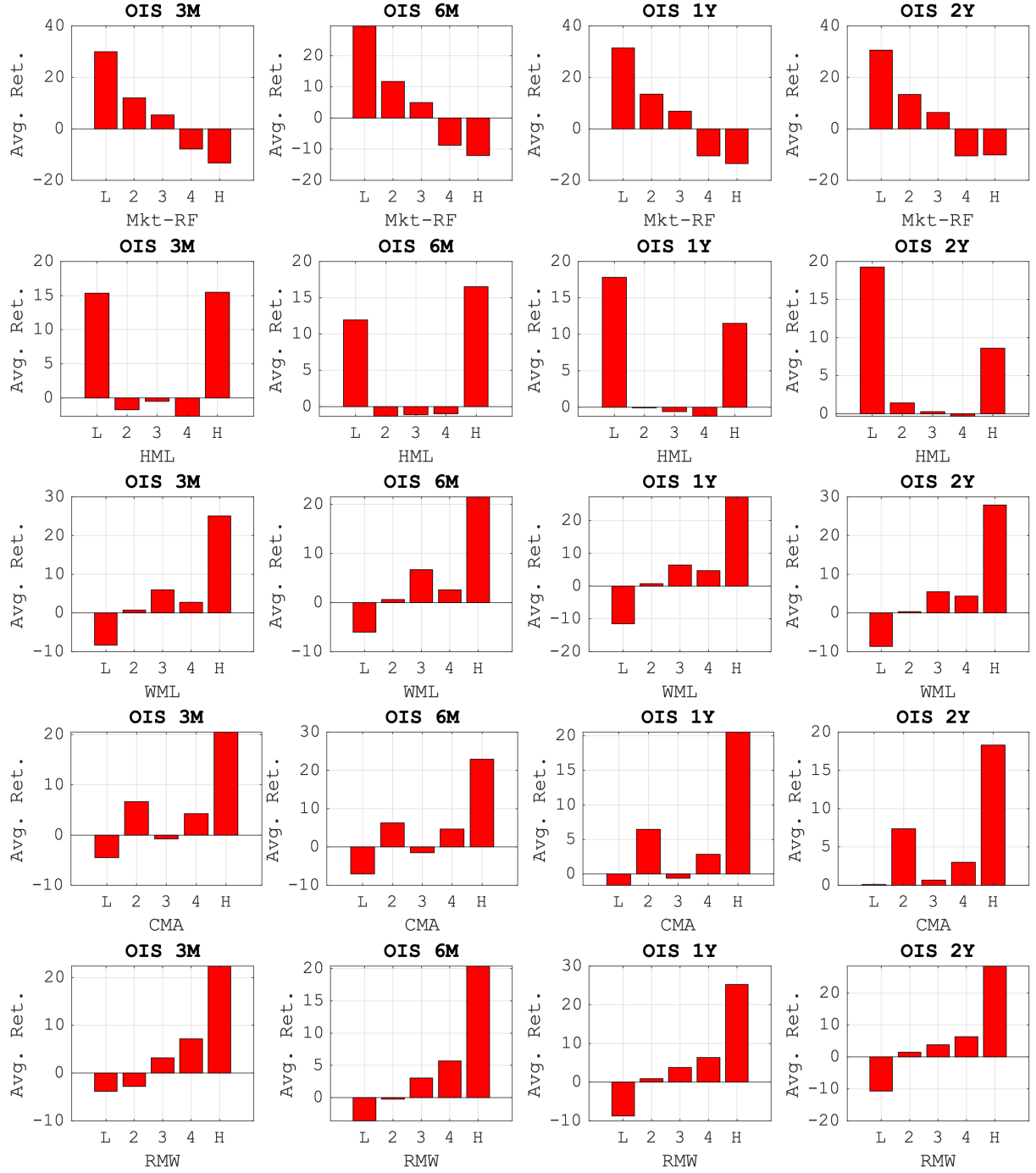


FIGURE IA.10. SPREAD PORTFOLIOS VS FAMA-FRENCH FACTORS. The figure presents spread portfolio returns, sorted on ECB monetary policy announcements, conditional on Fama-French factor returns. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 3M$ to $2Y$, around the press release window, $w = prw$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as a low-minus-high (LMH) portfolio. Each row presents the returns to the LMH portfolios sorted on the varying OIS rate change exposures conditional on the European Fama-French (FF) five factor returns being within the lowest (L) to highest (H) quintile of their respective sample distributions. The FF factors include: the market ($Mkt-RF$), value (HML), momentum (WML), investment (CMA), and quality (RMW), respectively. The sample period is from Jul/2000 to Dec/2024.

IA.3 Asset Pricing Methods

IA.3.1 Optimal SDF

The FMB two-pass procedure has long been the standard empirical asset pricing estimation procedure. Whilst corrections have been proposed for generated risk-exposure covariates or standard error estimation, the more pervasive omitted-variable and measurement-error problems have received less attention.

The *omitted-variable* problem arises when relevant risk factors are omitted from the SDF. This omission biases the estimates of the risk exposures in the first pass, and the estimates of the prices of risk in the second pass, attributes the effect of the missing factors/exposures to the estimated effect of the included factors/exposures. In the first pass, the severity of the bias depends on the time-series correlation between the factors included and those omitted. In the second pass, it varies with the cross-sectional correlation of the estimated exposures and the missing exposures associated with the omitted factors. This is evident in the AMP 3-factor model, given their inability to span the entire cross-section of test assets.

The *measurement-error* problem instead emerges even when the researcher includes all the ‘true’ risk factors in the SDF, but the factors are measured with noise. This problem is particularly severe in the case of nontradable factors, especially those based on macroeconomic variables. The use of noisy factors may bias the first-pass estimates of the risk exposures and, as a consequence, the second-pass estimates of the prices of risk. The AMP factors must be estimated with some degree of noise. However, given a desire to understand the drivers of these tradable factors with candidate factors, controlling for de-noising factors is vital to recovering robust estimates.

To resolve both issues, [Nucera, Sarno and Zinna \(2024\)](#) outline an *augmented three-pass procedure*, which combines the risk premium-principal component analysis (RP-PCA) method of [Lettau and Pelger \(2020a,b, LP\)](#) with the three-pass estimation of [Giglio and Xiu \(2021, GX\)](#).

RP-PCA. Assume K latent factors capture the systematic component of asset returns and the unexplained idiosyncratic component subsumes the asset-specific risks, such that

$$\underbrace{X}_{T \times N} = \underbrace{F}_{T \times K} \underbrace{\psi^\top}_{K \times N} + \underbrace{\epsilon}_{T \times N}, \quad (\text{IA.1})$$

where X denotes test asset excess returns, F is the matrix of latent factors, ψ is factor loadings, and ϵ is the asset return idiosyncratic components. If factors and residuals are uncorrelated, the covariance matrix of the returns is given by

$$\text{Var}(X) = \psi \text{Var}(F) \psi^\top + \text{Var}(\epsilon), \quad (\text{IA.2})$$

which consists of a systematic and an idiosyncratic term. Standard principal component analysis (PCA) exploits the fact that the factors relate to the largest eigenvalues of $\text{Var}(X)$, which can

be retrieved from the sample covariance matrix of excess returns

$$\Sigma_{\text{PCA}} = \frac{1}{T} X^\top X + \omega \bar{X}^\top \bar{X}, \quad \omega = -1, \quad (\text{IA.3})$$

where $\bar{X}$ denotes the sample mean of excess returns, and ω is a fixed pricing error penalisation term (RP-weight), expressed in the generalised form of RP-PCA notation. The estimated factor loadings, $\hat{\psi}$, are proportional to the eigenvectors associated with the largest eigenvalues of Σ_{PCA} . The factors $\hat{F}_t$ are then obtained by regressing the asset returns on the factor loadings, minimising the unexplained time-series variation of the returns.

Lettau and Pelger (2020a,b) show that increasing the RP-weight, $\omega > 0$, is tantamount to intensify the information simultaenously extracted from both the first and second moments of excess returns. Applying RP-PCA to the covariance matrix, Σ_{RP} , given a strictly positive ω is therefore equivalent to minimising jointly the *unexplained time-series variation* and the *cross-sectional pricing errors*

$$\min_{F, \psi} \left\{ \underbrace{\frac{1}{NT} \sum_{i=1}^N \sum_{t=1}^T (X_{nt} - F_t \psi_n^\top)^2}_{\text{TS: unexplained variation}} + \omega \underbrace{\frac{1}{N} \sum_{i=1}^N (\bar{X}_n - \bar{F} \psi_n^\top)^2}_{\text{CS: pricing error}} \right\}, \quad (\text{IA.4})$$

where $\bar{F}$ is the vector of latent factor expected values. RP-PCA with $\omega > 0$ combines two moment conditions to increase the *signal-to-noise ratio*, yielding more efficient estimates. It helps to select both factors that explain the time-series, thereby stripping-out weak factors with high Sharpe ratios, as well as the cross-section of asset return, protecting against spurious-factor selection with low Sharpe ratios and vanishing loadings.

The eigenvalues extracted from Σ_{RP} is informative about the required number of factors, K , to form the optimal stochastic discount factor (SDF). This tangency portfolio of the mean-variance frontier is spanned by a linear combination of these factors, $\hat{F} \times \hat{b}_{MV}^\top$, where $\hat{b}_{MV} = \mu_F \Sigma_F^{-1}$ is a $1 \times K$ vector capturing the factor weights in entering the implied SDF, $M_t = 1 - (\hat{F}_t - \mu_F) \hat{b}_{MV}^\top$.

Evaluation Criteria. Three evaluation criteria are employed to inform model selection. The first relates the ability of the model to price the cross-section of excess returns. The standard approach would be to select the most parsimonious model which eliminates all pricing errors, alphas (α), on average. However, tests of this sort — such as that of Gibbons, Ross and Shanken (1989) — are based on the assumption that N is constant and $T \rightarrow \infty$, whilst the RP-PCA estimator is derived under the assumption that both $N, T \rightarrow \infty$. This implies that the covariance matrix no longer converges to the population matrix, and the tests are biased even in large samples (e.g., see Lettau and Pelger, 2020b). To overcome this regulatory condition, a simple multiple-testing approach is employed. $N = 153$ tests of the null hypothesis $\mathcal{H}_0$: $\bar{\epsilon}_n = 0$ for $n = 1, \dots, N$, are conducted to determine how many assets have significant average pricing errors at the 5% and more stringent significance levels, as the dimensionality of the

SDF varies. Provided appropriate adjustment for multiple-hypothesis testing bias (a range of which are presented), this procedure is equivalently informative about the required model to span the entirety of the asset space. Two further diagnostic criteria – the root-mean-square error ($\overline{RMS}_\alpha$) and the magnitude of the idiosyncratic variance ($\overline{\sigma}_\epsilon^2$) – are useful to evaluate the model performance, inform the choice of the penalty value ω , and determine which factors enter the SDF. Moreover, there also exists some degrees-of-freedom with model selection, which allows for considering of other key aspects of fit and performance. The most pertinent here is the significance of risk premia in the cross-section, and the relative contribution such factors make to a candidate SDF. Overall, the optimal SDF is taken to be the model which best satisfies all of these criteria *jointly*.

Wild Bootstrapped Pricing Errors. This section details the application of the wild bootstrap algorithm, originally introduced by [Liu \(1988\)](#) and [Mammen \(1993\)](#), and modified by [Giglio, Liao and Xiu \(2021\)](#), to the case of model estimation via RP-PCA. This is employed to provide p -value estimates for (mean absolute) pricing errors for latent factor models of varying dimensionality.

Step 1. Assume an unconditional factor model with $k = 1, \dots, K$ latent factors, as in equation (IA.1). Estimate latent factors, $\widehat{F}$, and loadings, $\widehat{\psi}$, via RP-PCA

$$\widehat{F}, \widehat{\psi} = \arg \min_{F, \psi} \left\{ \frac{1}{NT} \sum_{n=1}^N \sum_{t=1}^T (X_{nt} - F_t \psi_n^\top)^2 + \omega \frac{1}{N} \sum_{n=1}^N (\overline{X}_n - \overline{F} \psi_n^\top)^2 \right\}.$$

Given that all test assets are tradable excess returns, the risk premium is given by the mean of the factor. Therefore, pricing errors for the k -factor model may be expressed as

$$\widehat{\alpha}_n^k = \overline{X} - \overline{\widehat{F}}^k \widehat{\psi}_n^{k\top},$$

and mean absolute pricing errors as

$$|\widehat{\alpha}|^k = \frac{1}{N} \sum_{n=1}^N |\widehat{\alpha}_n^k|.$$

Step 2. For $n = 1, \dots, N$, and $t = 1, \dots, T$, generate a wild bootstrap sample of excess returns, X_{nt}^b , by re-sampling weighted residuals under the null that the full K -factor model achieves full-spanning

$$X_{nt}^b = \widehat{\psi}_n^{K\top} \overline{\widehat{F}}^K + \widehat{\psi}_n^{K\top} (\widehat{F}^K - \overline{\widehat{F}}^K) + \widehat{\epsilon}_{nt}^*, \quad \widehat{\epsilon}_{nt}^* = \widehat{\epsilon}_{nt} w_{nt},$$

where $\{w_{nt}\}$ is a sequence of i.i.d. random variables, such that $\mathbb{E}(w_{nt}) = 0$ and $\text{Var}(w_{nt}) = 1$. As per [Mammen \(1993\)](#), $w_{nt} = \frac{1}{\sqrt{2}} \eta_{nt} + \frac{1}{2}(\theta_{nt}^2 - 1)$, where η_{nt} and θ_{nt} are independent standard normal.

Step 3. Given X_{nt}^b , retrieve bootstrap loadings, $\widehat{\psi}^b$, and bootstrap risk premia, $\overline{\widehat{F}}^b$, esti-

mates³

$$\begin{aligned}\hat{\psi}_n^b &= (\tilde{F}\mathbb{M}\tilde{F}^\top)^{-1}(\tilde{F}\mathbb{M}\tilde{X}_n^b) \\ \overline{\hat{F}}^b &= (\hat{\psi}^b\hat{\psi}^{b,\top})^{-1}(\hat{\psi}^b\overline{X}_{nt}^b),\end{aligned}$$

where $\tilde{X}_n^b$ and $\tilde{F}$ correspond to the transformed data as described in equation (IA.5) for $\omega > 0$, and $\mathbb{M} = I_T - T^{-1}\iota_T\iota_T^\top$ is the residual maker matrix.

Step 4. For $k = 1, \dots, K$, estimate the bootstrap pricing errors

$$\hat{\alpha}_n^{b,k} = \overline{X}_n^b - \overline{\hat{F}}^{b,k}\hat{\psi}_n^{b,k\top},$$

and the average absolute bootstrap pricing errors

$$|\overline{\hat{\alpha}}|^{b,k} = \frac{1}{N} \sum_{n=1}^N |\hat{\alpha}_n^{b,k}|.$$

Step 5. Repeat steps 2 to 4 for $b = 1, \dots, B$ repetitions. After B repetitions, for the hypothesis tests of the null $\mathbb{H}_0: \alpha_n^{b,k} = 0$ against the alternatives $\mathbb{H}_A: \alpha_n^{b,k} \neq 0$, compute bootstrap two-sided p -values for individual pricing errors for $k = 1, \dots, K$, as⁴

$$\hat{p}_n^k = \frac{1}{B} \sum_{b=1}^B \mathbb{1}\{|\hat{\alpha}_n^{b,k} - \hat{\alpha}_n^k| > |\hat{\alpha}_n^k|\}, \quad n = 1, \dots, N.$$

Likewise, for the hypothesis test of the null $\mathbb{H}_0: |\overline{\hat{\alpha}}|^{b,k} = 0$ against the alternative $\mathbb{H}_A: |\overline{\hat{\alpha}}|^{b,k} \neq 0$, compute bootstrap two-sided p -values for mean absolute pricing errors for $k = 1, \dots, K$, as

$$\hat{p}^k = \frac{1}{B} \sum_{b=1}^B \mathbb{1}\{(|\overline{\hat{\alpha}}|^{b,k} - |\overline{\hat{\alpha}}|^k) > |\overline{\hat{\alpha}}|^k\}.$$

Step 6. The p -values for the *individual* pricing errors, $\hat{p}_n^{b,k}$, must be corrected for multiple-hypothesis testing bias. In line with a vast literature on false discovery control, the [Benjamini and Hochberg \(1995\)](#) procedure is employed. Firstly, p -values for the k -factor model individual test statistics are sorted in ascending order, $\{p_{(1)}^{b,k} \leq \dots \leq p_{(N)}^{b,k}\}$. For $n = 1, \dots, N$, reject $\mathbb{H}_0^n$ if $p_n^{b,k} \leq p_{(\hat{q})}^{b,k}$, where $\hat{q} = \max\{n \leq N : p_{(n)}^{b,k} \leq \tau n/N\}$, and τ is the given significance level (e.g., 5%)⁵.

Note, [Hall and Wilson \(1991\)](#) argue that bootstrap re-sampling should reflect the null hypothesis being tested, in order to preserve the power of the test. However, [Giglio et al. \(2021\)](#),

³[Giglio et al. \(2021, Algorithm 3\)](#) estimate bootstrap loadings from the bootstrap excess returns using the original input factors, and subsequently estimate bootstrap risk premia. To apply this procedure in the context of estimation using RP-PCA, the estimators require a correction given $\omega > 0$, as detailed in equation (IA.5).

⁴See [Hansen \(2022, pp.287\)](#) for details of hypothesis testing for bootstrap estimation, and particularly on the importance of centering bootstrapped estimators with sample estimates.

⁵See [Giglio et al. \(2021\)](#) for further details on the application of this approach to the multiple-hypothesis testing of alphas in the wild bootstrap procedure, including alpha screening for inequality hypotheses, and measures of false discovery rate.

pp.3477) “prove that it is sufficient to impose the joint null hypothesis that all alphas are zero for re-sampling, instead of generating separate bootstrap samples imposing each null hypothesis separately, greatly simplifying the bootstrap procedure.” Therefore, the results presented generate all bootstrapped excess returns under the null that all individual alphas under the K -factor model (α_n^K) are zero. This, however, relies on full spanning. As pricing error outputs are presented for a range of models with varying degrees of ω penalization in RP-PCA extraction, it is not always the case that the same dimension of factor model will sufficiently span the sample excess returns, so as to replicate the moment conditions across bootstrap repetitions. In particular, as $\omega \leq 0$ does not concentrate the RP-PCA estimator on the first moment, thereby not fitting the model to minimize pricing errors, larger dimensions of factor models are required to span test asset returns. As such, for $\omega \leq 0$, $K \geq 20$, whereas for $\omega > 0$, $K \geq 10$ is sufficient. All results are robust to variations around these dimensions.

IA.3.2 Three-Pass

Given identification of the optimal latent tangency portfolio, each of the three passes of the [Giglio and Xiu \(2021\)](#) method produces key characteristics: (i) the exposures of test assets to the latent factors; (ii) the latent factor market prices of risk; and, (iii) spanning of the true SDF for the full cross-section of test assets, which provides loadings, explained variation and robust estimates of candidate factors’ risk premia.

First, time-series OLS regressions of the transformed excess return data (to incorporate information of the pricing errors) are run on the latent factors

$$\tilde{X}_{nt} = \tilde{F}_t \psi_n^\top + \epsilon_{nt}, \quad n = 1, \dots, N, \quad t = 1, \dots, T, \quad (\text{IA.5})$$

where $\tilde{X}_{nt} = X_{nt} + \tilde{\omega} \bar{X}_{nt}$, and the vector $\tilde{F}_t$ contains elements defined as $\tilde{F}_{kt} = \hat{F}_{kt} + \tilde{\omega} \bar{F}_{kt}$ for $k = 1, \dots, K$, with $\tilde{\omega} = \sqrt{\omega + 1} - 1$. This retrieves RP-PCA risk exposures for a given ω . Secondly, estimates of the latent factor prices of risk are obtained from cross-sectional regression of average realized excess returns on the previously estimated exposures (similar to the classic [Fama and MacBeth, 1973b](#), procedure)

$$\bar{X}_n = \hat{\psi}_n \gamma^\top + a_n, \quad n = 1, \dots, N, \quad (\text{IA.6})$$

where γ is the $1 \times K$ vector of the latent factor prices of risk. Given that factors extracted using the RP-PCA method are return-based with unrestricted means, under no-arbitrage the factor prices of risk simply equal their means (i.e., $\gamma = \mu_F$). However, this second pass is still useful in determining the estimate uncertainty in the asymptotic standard errors, and evaluating the model goodness-of-fit. Finally, the candidate factor, g_t , exposures and prices of risk are determined. These are retrieved sequentially, initially by running a time-series spanning regression of the candidate factor innovation, g_t^ι , on the de-meaned latent factors, $\hat{F}_t^\iota = \hat{F}_t - \mu_F$:

$$g_t^\iota = \hat{F}_t^\iota \eta^\top + u_t, \quad (\text{IA.7})$$

where η is the $1 \times K$ vector collecting the loadings of the candidate factor on the K latent factors. Then, using the estimated η -exposures, one implements

$$\hat{\lambda}_g = \hat{\gamma} \hat{\eta}^\top, \quad (\text{IA.8a})$$

$$\hat{g}_t = \hat{F}_t \hat{\eta}^\top, \quad (\text{IA.8b})$$

and obtains the *price of risk* of the candidate factor, $\hat{\lambda}_g$, and the *denoised* candidate factor, $\hat{g}_t$, return-based and free of measurement error.

IA.4 De-noised Spread Portfolios

De-noised LMH Portfolios. We assess the factor structure of the de-noised spread portfolios. Therefore, we extract the first three PCs for each of the three windows. We find that, to a large extent, the PCs have the usual interpretation of level, slope, and curvature, as evident from the PC loadings in Panel B of Table IA.10. PCs are orthogonal by construction and are rotated such they have positive means. In the mew and prw, the first PC (PC(1)) yields high returns and Sharpe ratios, consistent with the evidence of a level, target factor. By contrast, PC(1) in pcw and PC(2) in all windows have insignificant average returns. In all event windows, the third PCs are also high risk premium factors. However, they account for little of the time-series variation, which is almost entirely explained by the first-two PC factors. The PC analysis of the noisy spread portfolios yields similar interpretation of level, slope and curvature (with the exception of prw PC(2) whose loadings flip sign; see Figure IA.11). Moreover, the average return of PC(3) is not significant in the mew and prw, and yields a much lower Sharpe ratio relative to its de-noised counterpart.

Macro-Financial Drivers. Table IA.11 describes the macroeconomic and financial variables, de-noised using the RP-PCA three-pass estimator and employed in the univariate spanning regressions (e.g., see Table 8).

Table IA.12 provides further univariate spanning regression outputs for portfolios sorted on OIS 6M, 1Y and 2Y surprises, and the first principal component across all portfolios (LMH 1M to 10Y) around the mew.

TABLE IA.10

PRINCIPAL COMPONENTS OF SPREAD PORTFOLIO RETURNS

The table presents loadings and returns of the first three principal components (PCs) across the eight noisy (Panel A) and cleaned (Panel B) low-minus-high (LMH) spread portfolio returns, sorted on ECB monetary policy announcement shocks. For each investment strategy, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the three windows, $w = mew, prw, pcw$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the European stock market, *STOXX50*. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. All OIS shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. LMH portfolios are de-noised from the third-pass of the augmented three-pass procedure, where latent factors are obtained from applying RP-PCA with RP-weight $\omega = 20$ to the 153 Euro area investment strategy returns. The loading and cumulative explained variation (*Cum. R²*) of the PCs across the term structure of LMH portfolios are given in Panel 1, whilst Panel 2 presents the return (*Mean*) and Sharpe ratio (*SR*) of the PCs. The sign of the PCs is rotated to be non-negative, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are computed using Newey and West (1987).

Panel A: Noisy Principal Components											
A1: Loadings										A2: Returns	
OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	<i>C.R²</i>		Mean	SR
Monetary Event Window											
PC(1)	0.37	0.39	0.37	0.37	0.37	0.34	0.33	0.28	0.79	14.80***	0.56
PC(2)	-0.41	-0.33	-0.31	-0.11	0.02	0.37	0.45	0.53	0.96	1.03	0.09
PC(3)	-0.62	-0.16	0.24	0.32	0.54	0.06	-0.10	-0.35	0.98	0.41	0.09
OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	<i>C.R²</i>		Mean	SR
Press Release Window											
PC(1)	0.38	0.40	0.41	0.42	0.41	0.32	0.27	0.06	0.72	14.25***	0.54
PC(2)	-0.32	-0.20	-0.09	-0.11	-0.07	0.40	0.56	0.60	0.91	1.72	0.13
PC(3)	-0.73	-0.14	0.34	0.34	0.38	-0.14	-0.21	0.01	0.95	0.90	0.15
OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	<i>C.R²</i>		Mean	SR
Press Conference Window											
PC(1)	-0.19	-0.34	-0.36	-0.37	-0.37	-0.38	-0.39	-0.39	0.83	8.57*	0.38
PC(2)	-0.79	-0.40	-0.11	0.02	0.08	0.24	0.25	0.26	0.93	2.05	0.26
PC(3)	0.32	0.06	-0.58	-0.47	-0.15	0.20	0.26	0.45	0.97	2.80***	0.55
Panel B: Cleaned Principal Components											
B1: Loadings										B2: Returns	
OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	<i>C.R²</i>		Mean	SR
Monetary Event Window											
PC(1)	0.34	0.35	0.33	0.35	0.35	0.38	0.39	0.34	0.87	16.34***	0.78
PC(2)	-0.38	-0.35	-0.40	-0.14	-0.08	0.34	0.40	0.52	0.98	0.47	0.06
PC(3)	-0.76	-0.10	0.46	0.21	0.37	-0.10	0.00	-0.08	0.99	1.94***	0.92
OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	<i>C.R²</i>		Mean	SR
Press Release Window											
PC(1)	0.40	0.37	0.36	0.36	0.34	0.41	0.41	0.01	0.74	15.85***	0.87
PC(2)	0.19	0.17	0.16	0.20	0.17	-0.30	-0.46	-0.73	0.96	1.26	0.13
PC(3)	-0.80	-0.21	0.37	0.30	0.15	0.09	0.16	-0.19	0.98	2.54***	0.81
OIS 1M	OIS 3M	OIS 6M	OIS 1Y	OIS 2Y	OIS 5Y	OIS 7Y	OIS 10Y	<i>C.R²</i>		Mean	SR
Press Conference Window											
PC(1)	-0.22	-0.34	-0.29	-0.32	-0.35	-0.41	-0.44	-0.44	0.92	5.59	0.28
PC(2)	-0.91	-0.16	-0.14	0.08	0.06	0.18	0.18	0.23	0.98	1.55	0.30
PC(3)	0.31	-0.70	-0.25	-0.32	-0.03	0.29	0.28	0.28	0.99	3.67***	1.68

TABLE IA.11
MACROECONOMIC FACTORS

The table reports the names (*Name*) and descriptions (*Description*), including sources, of candidates factors used in the macroeconomic spanning regressions. Factors are sorted into their respective categories, and listed alphabetically. Not all series exist for the full main sample period (Jan/1999 to Dec/2024 for shocks, or since Jul/2000 for portfolio returns). Nevertheless, as all macroeconomic data are de-noised using the three-pass estimator in the main analysis, we can recover nontradable factor loadings and returns at the monthly frequency over the period Jul/2000-Dec/2024.

Name	Description
Panel A: Interest Rate	
A OIS 1M PRW	High-frequency change in the 1M OIS rate around the ECB monetary policy press release window, from Altavilla et al. (2019) .
A OIS 1Y PRW	High-frequency change in the 1Y OIS rate around the ECB monetary policy press release window, from Altavilla et al. (2019) .
A TARGET	Updated TARGET factor of Altavilla et al. (2019) .
DE 1Y	Change in the 1Y nominal German bund yield.
JK PC(1)	First principal component across high-frequency changes in the OIS 1M to 1Y rates around the ECB monetary event window, from Jarociński and Karadi (2020) .
JK PM	The poor man sign restriction monetary policy factor component from Jarociński and Karadi (2020) .
OIS 1Y	Change the 1Y OIS rate.
RR 1Y	Change in the 1Y real rate, taken as the difference between 1Y German bund yield and expected inflation from the Survey of Professional Forecasters.
Panel B: Inflation	
DE CPI (S)	Forecast errors of an ARMA(1,1) process fitted to the German CPI.
DE CPI (D)	Dispersion in analyst forecasts of German CPI.
EA HICP (S)	Forecast errors of an ARMA(1,1) process fitted to the spliced equal-weighted combination of German, French and Spanish CPI with euro area HICP.
EA HICP (D)	Average dispersion of analyst forecasts across all Germany, Spanish and French forecasts.
ES CPI (S)	Forecast errors of an ARMA(1,1) process fitted to the Spanish CPI.
ES CPI (D)	Dispersion in analyst forecasts of Spanish CPI.
FR CPI (S)	Forecast errors of an ARMA(1,1) process fitted to the French CPI.
FR CPI (D)	Dispersion in analyst forecasts of French CPI.
ILS 1Y	Change in the 1Y inflation-linked swap rate.
Panel C: Growth	
CREDIT	Change in the euro area default spread.
EA GRO (S)	The Bloomberg euro area growth surprise index.
IP	change in euro area log industrial production.
STOXX 50	Log return of the STOXX 50 index.
STOXX 600	Log return of the STOXX 600 index.
TERM	Change in the German (10Y – 1Y) term spread.
URATE	Change in the euro area unemployment rate.
VSTOXX	Log change in the volatility of the STOXX index.

TABLE IA.12
SPREAD PORTFOLIO RETURNS AND MACRO VARIABLES: MONETARY EVENT WINDOW

The table presents contemporaneous univariate spannings regressions of the de-noised spread portfolio returns from Table 7 on interest rate (Panel A), inflation (Panel B), and growth-based (Panel C) macroeconomic variables. The returns include the LMH portfolios sorted on OIS 6M, 1Y and 2Y surprises around the monetary event window, and de-noised using the three-pass estimator, as well as the first principal component across all eight (OIS 1M to 10Y) de-noised LMH portfolios. A description of the macroeconomic variables is provided in Table IA.11, in the Internet Appendix. All macroeconomic variables are also de-noised using the three-pass estimator, with the same euro area pricing kernel. All variables are standardized to have zero mean and unit standard deviation, for interpretability. Reported are the coefficients (β) and goodness-of-fit (R^2), in percent. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are computed using Newey and West (1987). The sample is monthly, from Jul/2000 to Dec/2024.

	LMH 6M		LMH 1Y		LMH 2Y		PC(1) 1M-10Y	
	β	R^2	β	R^2	β	R^2	β	R^2
Panel A: Interest Rate								
RR 1Y	-0.61***	37.39	-0.73***	53.46	-0.73***	52.68	-0.74***	54.42
DE 1Y	-0.60***	36.34	-0.69***	47.33	-0.68***	46.55	-0.66***	43.79
OIS 1Y	-0.43***	18.39	-0.47***	22.30	-0.49***	23.81	-0.51***	25.87
A OIS 1M PRW	-0.37***	13.84	-0.38***	14.17	-0.28***	7.65	-0.27**	7.24
A OIS 1Y PRW	-0.42***	17.47	-0.32***	10.35	-0.24**	5.91	-0.20*	4.03
A TARGET	-0.24**	5.75	-0.19*	3.65	-0.10	1.05	-0.12	1.39
JK PC(1)	-0.40***	16.29	-0.35***	12.33	-0.27**	7.07	-0.26**	6.85
JK PM	-0.39***	15.49	-0.30***	9.18	-0.25**	6.12	-0.22*	5.00
Panel B: Inflation								
DE CPI (S)	-0.18**	3.32	-0.21**	4.58	-0.26***	6.61	-0.24***	5.65
ES CPI (S)	-0.25***	6.41	-0.37***	13.83	-0.32***	10.29	-0.35***	11.95
FR CPI (S)	-0.36***	12.65	-0.50***	24.68	-0.47***	22.43	-0.50***	24.90
EA HICP (S)	-0.24***	5.66	-0.29***	8.60	-0.30***	8.81	-0.31***	9.53
DE CPI (D)	-0.66***	44.10	-0.53***	28.51	-0.57***	32.62	-0.52***	27.42
ES CPI (D)	-0.69***	48.28	-0.60***	35.47	-0.56***	31.54	-0.58***	33.17
FR CPI (D)	-0.41***	16.96	-0.50***	24.97	-0.49***	24.23	-0.51***	26.26
EA HICP (D)	-0.37***	13.77	-0.29***	8.58	-0.28***	7.88	-0.28***	8.02
ILS 1Y	-0.49***	23.94	-0.53***	28.25	-0.55***	30.75	-0.57***	32.59
Panel C: Growth								
URATE	0.01	0.02	0.00	0.00	0.03	0.11	-0.02	0.06
IP	0.30*	8.76	0.15	2.25	0.13	1.64	0.08	0.72
TERM	0.26***	6.71	0.12	1.55	0.08	0.66	0.00	0.00
STOXX 50	-0.62***	38.09	-0.76***	58.24	-0.72***	52.08	-0.73***	53.47
STOXX 600	-0.66***	44.04	-0.79***	62.13	-0.74***	55.12	-0.74***	55.26
VSTOXX	0.55***	30.30	0.69***	48.23	0.65***	41.87	0.65***	42.41
CREDIT	0.69***	47.19	0.81***	65.26	0.77***	59.15	0.78***	61.36
EA GRO (S)	-0.30**	9.27	-0.32***	10.18	-0.35***	12.29	-0.33***	10.91

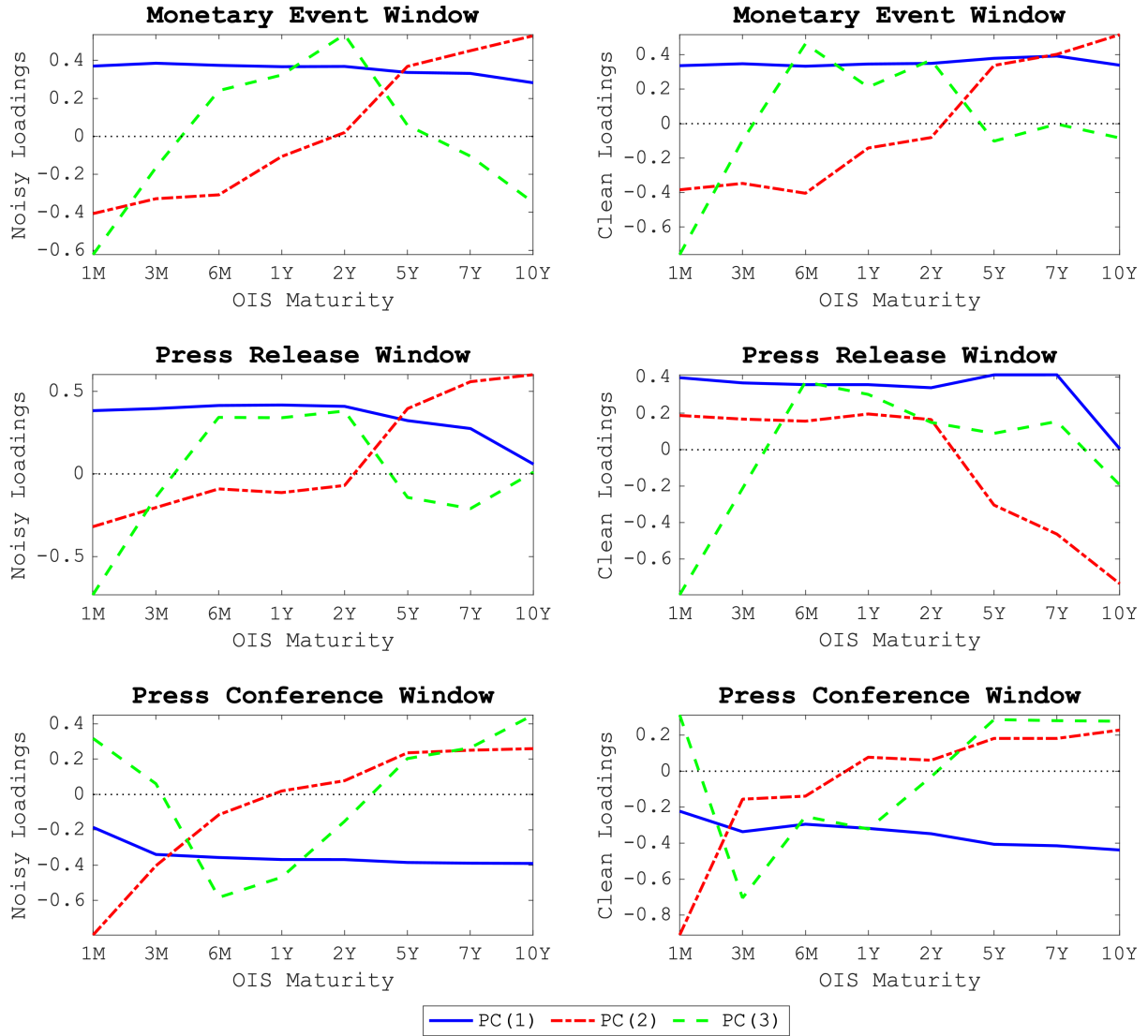


FIGURE IA.11. SPREAD PORTFOLIO PRINCIPAL COMPONENT LOADINGS. The figure presents the loadings (eigenvectors) of the first three principal components (PCs) across the eight noisy (left) and de-noised (right) low-minus-high (LMH) spread portfolio returns, sorted on ECB monetary policy announcement shocks. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the three windows, $w = mew, prw, pcw$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as a low-minus-high (LMH) portfolio. LMH portfolios are de-noised using the three-pass estimator, where latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the 153 euro area investment strategy returns. The loadings correspond to PCs that have been rotated to have non-negative means, for interpretability.

IA.5 Robustness

IA.5.1 Beta Estimation

Weighted Least Squares. As robustness, we first use a recursive weighted-least-squares (WLS) method, as in Boons, Duarte, de Roon and Szymanowska (2020), whereby the most recent surprises carry more weight in the beta estimation. Weights are given by an exponential weighting scheme that has a half-life converging to 36 Governing Councils, as in our baseline analysis. The expanding window ensures as much information as possible is incorporated, whilst the exponential decay ensures that the largest weight is given to the most recent observations. The specification is given by the following model:

$$(\widehat{\alpha}_{i,d}, \widehat{\beta}_{i,d}) = \arg \min_{\alpha_{i,d}, \beta_{i,d}} \sum_{\delta=1}^d \kappa(\delta) \left(R_{i,d} - \alpha_{i,d} - \sum_{l=0}^1 \beta_{il}^{\tau w} \Delta OIS_{d-l}^{\tau w} + \sum_{l=0}^1 \gamma_{il}^w \Delta STOX X_{d-l}^w \right)^2, \\ d \in \{\text{GC days}\}, \quad i = 1, \dots, I \quad (\text{IA.9})$$

with weights

$$\kappa(\delta) = \frac{\exp(-|d - \delta|h)}{\sum_{\delta=1}^{d-1} \exp(-|d - \delta|h)},$$

where R_{id} is the strategy factor return in Governing Council day d , $\Delta OIS_d^{\tau, w}$ is the high-frequency change in the OIS rate of maturity τ around the Governing Council event windows, with $w = \text{mew, prw, pcw}$, and $\Delta STOX X_d^w$ is the high-frequency change in the euro area stock market within the w window, which we add as a control variable; the lag $l = 0, 1$ allows for both current and one-period lagged GC days. Using $h = \log(2)/36$, the half-life of the weights $\kappa(\delta)$ converges to 36 Governing Councils for large d , which is consistent with the standard rolling window using in the main analysis.

Using the WLS method for the beta estimation, both the average returns and Sharpe ratios of the relevant prw spread portfolios (OIS 1M-2Y) tend to increase (Table IA.13). The maximum average return and Sharpe ratio are reached on the OIS 1Y (8.23% and 0.71, respectively), while the lowest significant values are found on the OIS 1M (5.53% and 0.45, respectively). Note that also the average return on the OIS 1M becomes significant at the 5% level.

Contemporaneous Betas. The specification for pre-portfolio formation beta regressions in the main analysis is given by equation (1), which includes contemporaneous and lagged changes in both independent variables: high-frequency OIS and $STOXX50$ changes. To ensure that the portfolio results are primarily driven by the OIS change in the current Governing Council (i.e., that results are robust to variations in this regression specification), Table IA.14 presents portfolios summary statistics of investment strategies sorted on exposures estimated by the following model:

$$R_{id} = \alpha_i + \beta_i^{\tau w} \Delta OIS_d^{\tau w} + \gamma_i^w \Delta STOX X_d^w + \epsilon_{id}, \quad d \in \{\text{GC days}\}, \quad i = 1, \dots, I \quad (\text{IA.10})$$

where variables are defined as above.

STOXX–OIS Double-sort Portfolios. We next control for the stock market effect using an alternative method. That is, we double sort the equity strategies, using 3×5 sorts. Specifically, we first allocate the strategies to three portfolios according to their exposure to STOXX50. Then, we further split each of these three portfolios into five sub-portfolios according to the strategies exposure to the selected OIS rate. To be specific, we estimate the pre-ranking gammas and betas using the following models:

$$R_{id} = \alpha_i + \sum_{l=0}^1 \gamma_{il}^w \Delta STOXX_{d-l}^w + \epsilon_{id}, \quad d \in \{\text{GC days}\}, \quad i = 1, \dots, I, \quad (\text{IA.11a})$$

$$R_{id} = \alpha_i + \sum_{l=0}^1 \beta_{il}^{\tau w} \Delta OIS_{d-l}^{\tau w} + \epsilon_{id}, \quad d \in \{\text{GC days}\}, \quad i = 1, \dots, I \quad (\text{IA.11b})$$

where R_{id} is the strategy factor return in GC day d , $\Delta STOXX_{d-l}^w$ is the high-frequency change in the euro area stock market within the w window, and $\Delta OIS_{d-l}^{\tau w}$ is the high-frequency change in the OIS rate of maturity $\tau = 1\text{M}, 3\text{M}, 6\text{M}, 1\text{Y}, 2\text{Y}, 5\text{Y}, 7\text{Y}, 10\text{Y}$ around the GC event window $w = \text{mew}, \text{prw}, \text{pcw}$; the lag $l = 0, 1$ allows for both current and one-period lagged GC days. We first form three portfolios (P1-3) by sorting on $\hat{\gamma}_{id}^{\tau w} = \sum_{l=0}^1 \gamma_{id-l}^{\tau w}$. Then, within each of P1-3, investment strategies are further sorted on $\hat{\beta}_{id}^{\tau w} = \sum_{l=0}^1 \beta_{id-l}^{\tau w}$, and an LMH spread portfolio is constructed.

From this, we obtain three portfolios: P1LHM, P2LMH, and P3LMH (where the first two letters denote the level of the first sorting variable). The double-sorted LMH portfolios are of particular interest as they contain strategies with similar exposure to the STOXX50, and therefore should better isolate the direct effect of OIS shocks on strategy returns. We repeat the analysis separately for each window. We find that the results are qualitatively and, in many cases, also economically robust. Table [IA.15](#) presents the prw evidence. Focusing on the maturities from 6M to 2Y (the core results presented), the risk premia are positive and statistically significant across all portfolios. Evidence seems stronger for strategies with lower exposures to the STOXX50 (i.e., P1LMH, and P2LMH).⁶ These premia also remain highly significant when estimated via the three-pass method (Table [IA.16](#)). By contrast, pcw double-sorted spread portfolios have insignificant risk premia.

IA.5.2 Other Exercises

Value-weighted Investment Returns. In the main empirical analysis, factor returns are taken as the equally-weighted average of investment strategy returns across the five major euro area stock markets: Germany, France, Italy, the Netherlands and Spain. In unreported results, we sort investment strategies on exposures to OIS-changes around each of the three event windows, where factors are instead value-weighted in proportion to each market's share of total market capitalization. All results are qualitatively consistent with the simple equally-weighted

⁶The results weaken somewhat for portfolios sorted 3M OIS rates, while they seem to strengthen for 5Y and 7Y.

returns presented in the baseline analysis. Results are available upon request.

Orthogonalized Monetary Policy Surprises Next, we first orthogonalize the prw surprises in the 6M, 1Y and 2Y OIS rates with respect to the surprise in 3M OIS rate, and then use these orthogonalized surprises in the beta estimation. In this way, we purge the 6M-2Y surprises from target effects priced in the 3M OIS rate, highlighting the path component. This is essentially an alternative method to using factor models in extracting monetary policy factors (see, e.g., [Kearns, Schrimpf and Xia, 2023](#)). Table [IA.17](#) shows that the evidence of a risk-return trade-off weakens using these orthogonalized surprises, but does not vanish, as risks and returns maintain a positive relationship. This simple exercise further suggests that both target and path surprises matter, and this is why we find that the Sharpe ratio reaches a pick at these maturities. By contrast, when we orthogonalize 5Y, 7Y, and 10Y surprises on the 2Y OIS rate surprise, there is no evidence of a positive risk-return trade-off. Recall that [Altavilla et al. \(2019\)](#) find only one common factor in the prw window, which they label TARGET. This analysis seems to suggest that their TARGET factor may subsume both target and path surprises in the sense of [Gürkaynak, Sack and Swanson \(2005\)](#) and [Kearns et al. \(2023\)](#).

Monthly Portfolio Rebalancing. The main empirical outputs rebalance portfolios the day immediately following each governing council meeting. Table [IA.18](#) presents summary statistics for portfolios sorted on ECB monetary policy announcement shocks around the press release window (the window of the main empirical analysis), where portfolios are rebalanced at the end of each month. End-of-month rebalancing results using monetary event and press conference windows are also consistent with the outputs of their monetary policy announcement counterparts in Tables [2](#) and [IA.2](#). All results are qualitatively the same.

STOXX Portfolios. As an additional analysis, we form portfolios by ranking equity strategies according to their exposures to high-frequency changes in the STOXX50, while controlling for OIS 1Y. We again perform this exercise separately for the three GC event windows. Table [IA.19](#) presents the outputs. We find that none of the spread portfolios yield significant average returns at the 5% level (for pcw they are positive and marginally significant at the 10% level). For mew and prw, we find that, in all cases, portfolio returns tend to decrease when moving from P1 to P5, i.e., from strategies that are least exposed to those that are most exposed to STOXX50. This is remarkably different from the evidence for portfolios sorted on “pure” monetary policy shocks. This may be because these novel betas primarily capture the exposure of strategies to the information or cash flow effects priced in the stock index return. This is also consistent with the negative correlation between the OIS-sorted LMH portfolios and the market factor of [Fama and French \(2015\)](#) shown previously (e.g., see Figure [IA.10](#)). Moreover, we also find that the loadings from the post-formation regressions are significant and negative for the prw spread portfolio, whilst insignificant in the other windows. Taken together, this analysis seems to suggest that the stock index and strategy returns respond differently to monetary policy shocks.

TABLE IA.13

WEIGHTED LEAST SQUARES PORTFOLIO STATISTICS: PRESS RELEASE WINDOW

The table presents summary statistics of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press release window. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the press release window, $w = \text{prw}$, as in equation (IA.9). These regressions are estimated using recursive weighted least squares regressions, where weights are given by an exponential weighting scheme that has a half-life converging to 36 Governing Council observations, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.30***	4.08***	2.80***	1.99***	0.24	5.53**	4.36**	Mean	6.16***	3.49***	3.29***	1.92***	0.93	7.10***	5.30***
t-stat	2.91	4.55	3.92	3.86	-0.25	2.24	2.28	t-stat	3.59	3.73	5.19	3.35	-1.00	3.06	2.94
Std	8.76	4.19	3.11	2.50	4.86	12.23	9.49	Std	8.38	4.42	2.98	2.61	4.78	11.83	9.28
SR	0.60	0.97	0.90	0.80	0.05	0.45	0.46	SR	0.74	0.79	1.10	0.74	0.19	0.60	0.57
AC(1)	0.11	0.13	0.18	0.07	0.03	0.08	0.08	AC(1)	0.07	0.11	0.08	0.14	0.00	0.02	0.02
Pre- β	-42.57	-15.31	-4.89	3.30	23.50	-66.07	-51.86	Pre- β	-36.70	-14.86	-4.72	3.79	23.19	-59.89	-47.57
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	6.66***	3.58***	3.15***	1.86***	-1.32	7.93***	5.98***	Mean	6.80***	3.68***	3.00***	1.94***	-1.49	8.23***	6.15***
t-stat	3.89	3.88	4.38	3.60	-1.42	3.43	3.32	t-stat	3.97	3.72	4.38	3.64	-1.64	3.52	3.37
Std	8.25	4.28	3.16	2.61	4.80	11.64	9.07	Std	8.19	4.53	3.08	2.57	4.73	11.63	9.07
SR	0.81	0.84	0.99	0.71	0.28	0.68	0.66	SR	0.83	0.81	0.98	0.76	0.32	0.71	0.68
AC(1)	0.08	0.12	0.19	-0.02	0.04	0.04	0.03	AC(1)	0.09	0.14	0.15	0.03	0.01	0.04	0.04
Pre- β	-33.02	-15.20	-5.20	3.75	41.07	-74.09	-59.24	Pre- β	-34.68	-15.24	-5.61	3.33	21.67	-56.34	-45.11
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	6.38***	4.28***	2.85***	1.59***	-1.16	7.46***	5.94***	Mean	5.67***	4.31***	2.73***	2.00***	-0.77	6.36**	5.02***
t-stat	3.80	4.29	4.05	3.49	-1.29	3.33	3.34	t-stat	3.16	4.31	4.24	3.81	-0.81	2.58	2.61
Std	7.91	4.52	2.94	2.36	4.51	10.80	8.50	Std	8.33	4.56	2.86	2.57	4.71	11.68	9.15
SR	0.81	0.95	0.97	0.67	0.26	0.69	0.70	SR	0.68	0.94	0.95	0.78	0.16	0.54	0.55
AC(1)	0.10	0.14	0.27	-0.03	0.01	0.07	0.07	AC(1)	0.12	0.13	0.16	0.05	0.06	0.09	0.09
Pre- β	-35.94	-16.64	-6.16	3.46	22.08	-58.02	-46.57	Pre- β	-36.33	-16.70	-6.52	2.36	26.13	-62.46	-49.70
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.61***	4.35***	2.56***	2.23***	0.82	6.33**	4.90**	Mean	3.31***	2.87***	2.64***	2.86***	2.19*	1.04	0.80
t-stat	3.10	4.31	4.12	3.66	-0.84	2.52	2.52	t-stat	3.19	3.92	3.64	3.13	1.80	0.56	0.53
Std	8.40	4.57	2.76	2.88	4.87	11.92	9.22	Std	5.33	3.59	3.28	4.09	5.86	9.43	7.55
SR	0.67	0.95	0.93	0.78	0.17	0.53	0.53	SR	0.62	0.80	0.80	0.70	0.37	0.11	0.11
AC(1)	0.12	0.16	0.18	0.09	0.05	0.10	0.09	AC(1)	0.01	0.06	0.15	0.16	0.11	0.03	0.03
Pre- β	-33.42	-14.75	-5.40	3.22	20.63	-54.05	-43.34	Pre- β	-24.59	-8.88	-1.58	6.13	19.05	-43.64	-35.19

TABLE IA.14
CONTEMPORANEOUS BETAS PORTFOLIO STATISTICS

The table presents summary statistics of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press release and conference windows. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1\text{M}$ to 10Y , around the press release and conference windows, $w = \text{prw}, \text{pcw}$, as in equation (IA.10). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Panel A (B) refers to the press release (conference) window. Reported are the unconditional return (*Mean*), *t*-statistic computed using [Newey and West \(1987\)](#) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024 for prw, and Jun/2003 to Dec/2024 for pcw, respectively.

Panel A: Press Release Window															
Panel A1: OIS 1M								Panel A2: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.08***	3.63***	2.26***	2.33***	0.64	4.32**	3.27**	Mean	5.02***	3.62***	3.17***	1.62***	0.48	4.38**	3.63**
t-stat	3.20	4.07	3.29	3.88	0.71	2.05	2.01	t-stat	3.16	3.67	4.62	3.01	0.55	2.09	2.17
Std	7.25	4.25	3.22	2.68	4.79	10.15	7.99	Std	7.40	4.50	2.90	2.66	4.94	10.45	8.34
SR	0.70	0.86	0.70	0.87	0.13	0.43	0.41	SR	0.68	0.80	1.09	0.61	0.10	0.42	0.44
AC(1)	0.18	0.11	0.12	0.16	-0.02	0.12	0.10	AC(1)	0.14	0.15	0.26	0.00	-0.06	0.06	0.06
Pre- β	-31.78	-11.25	-1.01	9.68	33.23	-65.01	-51.61	Pre- β	-36.41	-13.44	-1.49	9.82	35.52	-71.93	-57.23
Panel A3: OIS 6M								Panel A4: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.43***	3.78***	2.79***	1.78***	0.15	5.12**	4.11**	Mean	5.85***	4.03***	2.78***	1.90***	0.62	6.34***	4.91***
t-stat	3.44	3.86	3.80	3.59	0.15	2.32	2.40	t-stat	3.69	4.29	3.97	3.22	-0.59	2.77	2.83
Std	7.18	4.56	3.16	2.49	5.29	10.50	8.24	Std	7.00	4.49	3.03	2.82	5.48	10.69	8.24
SR	0.76	0.83	0.88	0.72	0.03	0.49	0.50	SR	0.84	0.90	0.92	0.67	0.11	0.59	0.60
AC(1)	0.16	0.12	0.22	0.02	0.04	0.13	0.11	AC(1)	0.20	0.10	0.20	0.10	0.04	0.15	0.13
Pre- β	-27.86	-10.04	-0.65	8.60	29.58	-57.45	-45.65	Pre- β	-26.31	-9.25	-0.20	8.65	28.06	-54.36	-43.27
Panel A5: OIS 2Y								Panel A6: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	6.24***	3.75***	2.77***	1.50***	0.34	6.40***	5.04***	Mean	4.38***	3.62***	2.42***	2.28***	1.26*	2.99	2.44
t-stat	4.09	3.92	3.95	2.76	-0.36	3.11	3.10	t-stat	2.77	3.73	3.59	3.75	1.68	1.48	1.52
Std	6.84	4.27	3.07	2.66	4.99	9.65	7.59	Std	7.16	4.52	3.03	3.01	4.19	9.70	7.75
SR	0.91	0.88	0.90	0.56	0.07	0.66	0.66	SR	0.61	0.80	0.80	0.75	0.30	0.31	0.32
AC(1)	0.18	0.16	0.19	0.09	0.00	0.13	0.13	AC(1)	0.17	0.12	0.15	0.04	-0.02	0.11	0.11
Pre- β	-27.48	-10.12	-0.62	8.47	26.51	-53.99	-43.14	Pre- β	-25.28	-10.14	-1.83	6.50	22.66	-47.93	-38.37
Panel A7: OIS 7Y								Panel A8: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	3.03**	4.05***	2.76***	2.44***	1.66*	1.20	1.44	Mean	2.03*	3.05***	2.75***	2.85***	3.21**	-1.33	-0.72
t-stat	2.08	3.98	3.88	3.76	1.88	0.59	0.90	t-stat	1.66	4.03	4.09	3.95	2.47	-0.66	-0.46
Std	7.19	4.47	3.29	2.86	4.54	10.11	8.03	Std	6.09	3.64	3.07	3.33	5.95	9.88	7.74
SR	0.42	0.91	0.84	0.85	0.37	0.12	0.18	SR	0.33	0.84	0.90	0.86	0.54	0.13	0.09
AC(1)	0.04	0.19	0.15	0.16	0.02	0.03	0.02	AC(1)	0.02	0.07	0.16	0.14	0.15	0.04	0.02
Pre- β	-26.55	-10.66	-1.74	6.99	23.93	-50.48	-40.45	Pre- β	-23.39	-8.58	-0.35	7.69	23.50	-46.89	-37.58

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Table IA.14 (Continued)

Panel B: Press Conference Window															
Panel B1: OIS 1M								Panel B2: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	1.43	1.69**	2.39***	2.94***	2.95**	-1.52	-1.49	Mean	1.14	1.91***	2.17***	2.99***	3.20***	-2.11	-1.96
t-stat	1.24	2.26	3.86	3.93	2.50	-0.79	-0.97	t-stat	0.98	3.11	3.75	3.72	3.29	-1.27	-1.48
Std	5.69	3.56	2.80	3.20	5.23	9.02	7.18	Std	5.43	3.06	2.52	3.72	4.90	8.26	6.67
SR	0.25	0.47	0.85	0.92	0.57	0.17	0.21	SR	0.21	0.62	0.86	0.80	0.65	0.25	0.29
AC(1)	-0.03	0.05	0.11	0.18	0.08	0.01	0.02	AC(1)	0.07	0.02	0.14	0.08	-0.01	0.01	-0.01
Pre- β	-47.90	-20.77	-6.30	6.26	28.23	-76.13	-61.05	Pre- β	-26.15	-11.35	-3.05	4.63	18.64	-44.79	-36.00
Panel B3: OIS 6M								Panel B4: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	1.55	1.41*	2.16***	2.85***	3.48***	-1.94	-1.75	Mean	1.52	1.63*	2.56***	2.92***	2.81***	-1.32	-1.31
t-stat	1.11	1.84	3.56	4.23	3.38	-0.94	-1.09	t-stat	1.13	1.95	4.22	4.08	2.78	-0.65	-0.81
Std	6.39	3.24	2.65	3.43	5.50	10.22	7.98	Std	6.23	3.51	2.85	3.64	5.27	10.07	7.98
SR	0.24	0.43	0.82	0.83	0.63	0.19	0.22	SR	0.24	0.46	0.90	0.80	0.53	0.13	0.16
AC(1)	0.09	0.19	0.14	-0.03	-0.05	0.03	0.02	AC(1)	0.09	0.19	0.07	-0.08	-0.01	0.04	0.02
Pre- β	-28.56	-10.26	-0.63	8.65	24.79	-53.35	-42.82	Pre- β	-28.03	-9.91	-0.52	9.01	25.24	-53.26	-42.76
Panel B5: OIS 2Y								Panel B6: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	2.39	2.08***	2.36***	2.77***	1.85*	0.46	-0.06	Mean	2.70**	2.56***	2.16***	2.33***	1.69	0.94	0.76
t-stat	1.63	2.75	4.30	3.74	1.71	0.21	-0.03	t-stat	2.07	3.54	3.30	3.28	1.35	0.42	0.43
Std	6.68	3.26	2.40	3.61	5.56	10.62	8.33	Std	6.15	3.19	2.92	3.63	6.06	10.89	8.57
SR	0.36	0.64	0.99	0.77	0.33	0.04	0.01	SR	0.44	0.80	0.74	0.64	0.28	0.09	0.09
AC(1)	0.10	0.18	0.14	0.04	0.03	0.08	0.07	AC(1)	0.07	0.14	0.11	-0.05	0.10	0.08	0.07
Pre- β	-24.02	-8.59	-0.52	7.71	22.10	-46.12	-37.02	Pre- β	-19.82	-6.91	0.12	6.85	18.77	-38.59	-30.98
Panel B7: OIS 7Y								Panel B8: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	2.94**	2.35***	2.14***	2.22***	1.78	1.08	0.78	Mean	2.84**	2.35***	2.34***	2.43***	1.48	1.32	0.82
t-stat	2.23	3.59	3.56	2.96	1.38	0.49	0.45	t-stat	2.34	3.61	3.70	3.13	1.11	0.59	0.47
Std	6.28	2.97	2.74	3.89	6.15	10.85	8.54	Std	5.72	2.97	2.88	3.70	6.46	10.77	8.50
SR	0.47	0.79	0.78	0.57	0.29	0.10	0.09	SR	0.50	0.79	0.81	0.66	0.23	0.12	0.10
AC(1)	0.04	0.11	0.09	-0.07	0.12	0.08	0.07	AC(1)	0.06	0.11	0.07	0.06	0.09	0.08	0.07
Pre- β	-17.70	-6.20	0.11	6.05	16.84	-34.54	-27.71	Pre- β	-15.97	-5.60	0.34	6.04	16.44	-32.41	-26.02

TABLE IA.15

STOXX-OIS DOUBLE-SORTED PORTFOLIO SUMMARY STATISTICS

The table presents summary statistics of portfolios of investment strategies double-sorted on (i) stock market responses and (ii) high-frequency OIS shocks to ECB monetary policy announcements. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in (i) the high-frequency euro area stock market, Euro Stoxx 50, and (ii) the high-frequency OIS of varying term structures, $\tau = 1\text{M}$ to 10Y , around the press release window, $w = \text{prw}$. These regressions are estimated separately, and with no controls, as in equations (IA.11a) and (IA.11b), and are estimated over rolling windows of 36 Governing Councils. First, three portfolios are formed (P1-3) by sorting investment strategies into quintile portfolios given their gamma ($STOXX50$) exposures. Second, within each P1-3, investment strategies are further sorted on their beta ($OIS \tau$) exposures, and low-minus-high (LMH) spread portfolios are constructed. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: OIS 1M				Panel B: OIS 3M			
	P1LMH	P2LMH	P3LMH		P1LMH	P2LMH	P3LMH
Mean	2.06	1.54	1.96	Mean	2.29	3.36**	2.62
t-stat	1.96	1.89	2.38	t-stat	1.78	1.62	2.09
Std	9.57	9.21	11.57	Std	8.80	8.25	10.66
SR	0.22	0.17	0.17	SR	0.26	0.41	0.25
AC(1)	0.08	0.12	0.12	AC(1)	0.06	0.03	0.01
Panel C: OIS 6M				Panel D: OIS 1Y			
	P1LMH	P2LMH	P3LMH		P1LMH	P2LMH	P3LMH
Mean	3.05*	4.46***	3.43*	Mean	4.53***	4.48***	4.27**
t-stat	1.73	1.65	2.06	t-stat	1.73	1.62	2.07
Std	8.67	8.54	10.25	Std	8.95	8.32	10.25
SR	0.35	0.52	0.33	SR	0.51	0.54	0.42
AC(1)	0.04	0.00	0.05	AC(1)	0.00	0.01	0.06
Panel E: OIS 2Y				Panel F: OIS 5Y			
	P1LMH	P2LMH	P3LMH		P1LMH	P2LMH	P3LMH
Mean	5.08***	5.15***	3.60*	Mean	5.17***	5.58***	4.08**
t-stat	1.81	1.63	1.92	t-stat	1.83	1.70	1.96
Std	9.13	8.57	9.96	Std	9.17	8.55	10.29
SR	0.56	0.60	0.36	SR	0.56	0.65	0.40
AC(1)	0.03	-0.01	0.00	AC(1)	0.04	0.02	-0.02
Panel G: OIS 7Y				Panel H: OIS 10Y			
	P1LMH	P2LMH	P3LMH		P1LMH	P2LMH	P3LMH
Mean	4.55**	5.32***	3.93*	Mean	2.56	3.76**	1.44
t-stat	1.77	1.69	2.03	t-stat	1.65	1.59	1.84
Std	9.00	8.47	10.08	Std	8.37	7.87	9.40
SR	0.51	0.63	0.39	SR	0.31	0.48	0.15
AC(1)	0.03	0.01	0.05	AC(1)	0.00	0.03	0.02

TABLE IA.16
RISK PREMIA OF STOXX-SORTED FACTORS

The table presents the risk premium and Sharpe ratio estimates of the raw (Panel 1), as well as de-noised HML STOXX-sorted portfolio returns, HML STOXX, and double-sorted STOXX-OIS $\tau = 1\text{M}$ to 10Y around the press release window $w = \text{prw}$ from the third-pass of the [Giglio and Xiu \(2021\)](#) three-pass procedure. Estimates are reported using models including an increasing number of latent factors, F_{1-k} for $k = 1, 2, \dots, 11$. The latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ euro area investment strategy returns. ***, ** and * correspond to a rejection of the null hypothesis of zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated as in [Giglio and Xiu \(2021\)](#). The sample period is Jul/2000 to Dec/2024.

	Panel A: Factor		Panel B: Risk Premia											Panel C: Sharpe Ratios										
	Mean	SR	F_{1-1}	F_{1-2}	F_{1-3}	F_{1-4}	F_{1-5}	F_{1-6}	F_{1-7}	F_{1-8}	F_{1-9}	F_{1-10}	F_{1-11}	$\text{SR}_{F_{1-1}}$	$\text{SR}_{F_{1-2}}$	$\text{SR}_{F_{1-3}}$	$\text{SR}_{F_{1-4}}$	$\text{SR}_{F_{1-5}}$	$\text{SR}_{F_{1-6}}$	$\text{SR}_{F_{1-7}}$	$\text{SR}_{F_{1-8}}$	$\text{SR}_{F_{1-9}}$	$\text{SR}_{F_{1-10}}$	$\text{SR}_{F_{1-11}}$
HML STOXX	-2.45	0.23	-5.54***	-5.63***	-4.70**	-4.42**	-4.42**	-5.28**	-4.32**	-4.34**	-4.05*	-3.78*	-2.13	0.70	0.71	0.59	0.55	0.55	0.65	0.52	0.53	0.49	0.46	0.25
P1LMH 1M	2.06	0.22	2.06*	2.03*	5.40***	5.23***	5.45***	6.62***	5.98***	5.94***	5.27***	5.41***	3.92*	0.70	0.69	1.42	1.37	1.23	1.33	1.19	1.18	1.01	1.03	0.71
P1LMH 3M	2.29	0.26	2.18**	2.43**	5.70***	5.34***	5.51***	6.48***	5.78***	6.02***	5.64***	5.56***	4.76***	0.70	0.77	1.46	1.34	1.27	1.37	1.20	1.22	1.13	1.12	0.94
P1LMH 6M	3.05*	0.35	1.63*	2.18**	5.56***	5.05***	5.14***	5.98***	5.57***	5.86***	5.66***	5.54***	5.92***	0.70	0.88	1.62	1.39	1.38	1.47	1.36	1.37	1.31	1.28	1.36
P1LMH 1Y	4.53***	0.51	1.95*	2.32**	4.88***	4.45***	4.57***	5.21***	4.86***	5.13***	4.92***	4.79***	5.20***	0.70	0.81	1.45	1.26	1.22	1.32	1.22	1.24	1.18	1.14	1.23
P1LMH 2Y	5.08***	0.56	2.15*	2.52**	5.40***	4.77***	4.84***	5.46***	5.22***	5.53***	5.29***	5.32***	5.89***	0.70	0.81	1.45	1.18	1.18	1.28	1.22	1.23	1.17	1.18	1.29
P1LMH 5Y	5.17***	0.56	3.29**	3.30**	5.52***	4.83***	4.89***	5.20***	5.04***	5.29***	5.19***	5.09***	5.24***	0.70	0.70	1.11	0.92	0.93	0.98	0.95	0.98	0.96	0.94	0.97
P1LMH 7Y	4.55**	0.51	3.35**	2.92**	5.01***	4.49***	4.45***	4.47***	4.28***	4.59***	4.55***	4.41***	5.63***	0.70	0.60	0.99	0.86	0.85	0.86	0.82	0.85	0.84	0.81	1.00
P1LMH 10Y	2.56	0.31	1.87**	-0.23	1.43	1.25	1.12	0.67	0.89	1.16	1.56	1.43	3.17*	0.70	0.06	0.34	0.29	0.25	0.15	0.19	0.24	0.32	0.30	0.60
P2LMH 1M	1.54	0.17	4.14***	2.90**	3.18*	2.92*	3.02*	3.29**	2.89*	2.87*	2.75	2.86*	1.84	0.70	0.47	0.51	0.47	0.48	0.52	0.45	0.45	0.43	0.45	0.28
P2LMH 3M	3.36**	0.41	3.41***	2.98***	3.77***	3.26***	3.26***	3.58***	3.46***	3.54***	3.78***	3.62***	3.83***	0.70	0.61	0.76	0.64	0.64	0.70	0.67	0.69	0.73	0.70	0.74
P2LMH 6M	4.46***	0.52	2.39**	2.13***	3.67***	3.39***	3.35***	3.54***	3.21***	3.35***	3.71***	3.29***	4.71***	0.70	0.62	1.02	0.92	0.91	0.95	0.86	0.89	0.96	0.82	1.08
P2LMH 1Y	4.48***	0.54	2.67**	2.78***	4.53***	4.24***	4.24***	4.48***	4.27***	4.36***	4.64***	4.15***	5.24***	0.70	0.72	1.12	1.04	1.04	1.09	1.04	1.05	1.11	0.95	1.15
P2LMH 2Y	5.15***	0.60	2.14**	2.02***	3.39***	3.07***	3.03***	3.14***	3.08***	3.17***	3.61***	3.40***	4.56***	0.70	0.66	1.05	0.93	0.91	0.94	0.92	0.94	1.03	0.96	1.20
P2LMH 5Y	5.58***	0.65	2.70**	2.39**	4.16***	3.64***	3.59***	3.65***	3.44***	3.42***	3.68***	3.43***	4.72***	0.70	0.61	1.02	0.85	0.83	0.85	0.80	0.79	0.84	0.78	1.01
P2LMH 7Y	5.32***	0.63	2.78**	1.90*	3.71***	3.24**	3.18**	3.28**	2.90**	2.82**	2.98**	2.73**	4.31***	0.70	0.45	0.85	0.72	0.70	0.72	0.63	0.61	0.64	0.59	0.86
P2LMH 10Y	3.76**	0.48	1.18*	-0.67	1.33	0.82	0.84	1.11	1.00	1.10	1.11	1.08	2.50*	0.70	0.21	0.38	0.22	0.20	0.30	0.27	0.29	0.29	0.28	0.60
P3LMH 1M	1.96	0.17	4.00***	3.35**	2.11	1.76	1.95	2.62	1.92	2.15	1.95	2.47	1.02	0.70	0.58	0.36	0.30	0.31	0.41	0.30	0.33	0.30	0.37	0.15
P3LMH 3M	2.62	0.25	3.75***	3.69***	3.03*	2.54*	2.61*	3.02**	2.87*	3.22**	3.40*	3.61**	2.95	0.70	0.68	0.56	0.46	0.47	0.54	0.51	0.55	0.58	0.61	0.50
P3LMH 6M	3.43*	0.33	1.96*	2.52***	3.28***	2.76**	2.71**	2.73**	2.98**	3.25**	3.90**	3.64**	4.77***	0.70	0.86	1.10	0.86	0.83	0.83	0.91	0.93	1.04	0.95	1.18
P3LMH 1Y	4.27**	0.42	2.27*	3.31***	4.11***	3.55***	3.51***	3.53***	3.67**	3.99**	4.67***	4.31**	5.44***	0.70	0.92	1.13	0.91	0.90	0.90	0.94	0.96	1.06	0.96	1.16
P3LMH 2Y	3.60*	0.36	1.86*	2.14***	2.70**	2.17*	2.10*	2.00*	2.16	2.55*	3.35**	3.39**	4.44***	0.70	0.79	0.99	0.72	0.68	0.65	0.70	0.73	0.86	0.87	1.08
P3LMH 5Y	4.08**	0.40	2.62**	2.25**	2.02	1.46	1.38	0.81	1.33	1.56	2.41	2.50	3.16**	0.70	0.59	0.53	0.36	0.34	0.19	0.31	0.35	0.50	0.52	0.65
P3LMH 7Y	3.93*	0.39	2.81**	1.90*	2.87**	2.19	2.09	1.42	1.98	2.25	2.77*	2.34	4.04**	0.70	0.45	0.67	0.48	0.44	0.29	0.40	0.44	0.53	0.44	0.71
P3LMH 10Y	1.44	0.15	0.91	-2.00	-1.56	-1.97	-2.01	-2.80*	-1.85	-1.48	-0.87	-1.18	0.91	0.70	0.44	0.34	0.43	0.43	0.57	0.37	0.28	0.16	0.21	0.15

TABLE IA.17

ORTHOGONALISED PORTFOLIO STATISTICS: PRESS RELEASE WINDOW

The table presents summary statistics of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press release window. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the press release window, $w = \text{prw}$, as in equation (1). All OIS surprises $3M < \tau \leq 2Y$ are orthogonalized with respect to the OIS $3M$ OIS yield changes, whilst all shocks $\tau > 2Y$ are orthogonalised with respect to the $2Y$ OIS changes. Orthogonalization and exposure regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	4.52**	4.03***	3.25***	1.84***	0.32	4.13	3.53*	Mean	5.17***	3.99***	2.80***	1.83***	0.18	4.89**	3.91**
t-stat	2.46	4.28	5.42	3.10	0.31	1.62	1.79	t-stat	3.05	4.25	4.44	3.18	0.20	2.19	2.20
Std	8.63	4.54	2.61	2.63	5.17	12.28	9.59	Std	8.16	4.52	2.82	2.55	4.85	11.35	9.06
SR	0.52	0.89	1.25	0.70	0.06	0.34	0.37	SR	0.63	0.88	0.99	0.72	0.04	0.43	0.43
AC(1)	0.15	0.08	0.20	0.21	0.04	0.12	0.11	AC(1)	0.10	0.08	0.16	0.18	-0.02	0.04	0.04
Pre- β	-69.41	-26.05	-6.12	11.58	52.06	-121.47	-95.91	Pre- β	-68.18	-26.41	-6.71	12.07	49.40	-117.58	-93.50
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.08***	3.82***	2.51***	2.12***	0.49	4.73**	3.77**	Mean	5.07***	3.88***	2.91***	2.06***	0.10	5.05**	3.94**
t-stat	3.96	4.24	3.76	2.70	0.33	1.99	2.04	t-stat	3.63	3.97	4.42	3.00	0.07	2.16	2.16
Std	6.09	4.01	2.87	3.92	7.45	11.66	9.25	Std	6.17	4.34	2.91	3.29	7.10	11.20	8.81
SR	0.83	0.95	0.88	0.54	0.07	0.41	0.41	SR	0.82	0.89	1.00	0.63	0.01	0.45	0.45
AC(1)	0.11	0.17	0.24	0.03	0.06	0.09	0.06	AC(1)	0.19	0.19	0.17	0.08	-0.01	0.09	0.08
Pre- β	-43.26	-15.11	1.76	18.33	62.34	-105.60	-84.81	Pre- β	-41.82	-16.97	-2.31	11.81	37.22	-79.04	-63.56
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	3.39***	3.66***	2.72***	2.92***	1.28	2.14	1.76	Mean	2.67**	2.94***	3.18***	2.85***	2.30*	0.39	0.34
t-stat	2.80	4.38	4.07	3.51	1.01	1.05	1.10	t-stat	2.25	3.78	4.05	3.21	1.80	0.19	0.21
Std	6.05	3.56	2.87	3.94	6.66	10.54	8.26	Std	5.85	3.59	3.41	4.07	6.38	10.36	8.33
SR	0.56	1.03	0.95	0.74	0.19	0.20	0.21	SR	0.46	0.82	0.93	0.70	0.36	0.04	0.04
AC(1)	0.05	0.21	0.25	0.08	0.00	0.01	0.01	AC(1)	0.06	0.15	0.21	0.14	0.06	0.05	0.05
Pre- β	-49.90	-18.51	-0.95	15.67	47.10	-97.00	-77.97	Pre- β	-52.68	-19.67	-5.34	9.21	34.58	-87.26	-70.07
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	1.38	3.31***	3.54***	3.33***	2.41*	-1.03	-0.59	Mean	2.03*	2.80***	3.81***	2.74***	2.55**	-0.55	-0.22
t-stat	1.17	4.80	4.32	3.23	1.86	-0.48	-0.35	t-stat	1.77	3.98	4.32	3.06	2.02	-0.27	-0.13
Std	5.88	3.38	3.65	4.42	6.15	10.39	8.31	Std	5.88	3.48	3.87	4.03	6.01	10.17	8.14
SR	0.23	0.98	0.97	0.75	0.39	0.10	0.07	SR	0.35	0.80	0.98	0.68	0.42	0.05	0.03
AC(1)	0.04	0.06	0.16	0.24	0.12	0.07	0.08	AC(1)	0.02	0.03	0.19	0.15	0.13	0.06	0.06
Pre- β	110.95	-35.24	-9.64	15.22	58.94	-169.89	-136.17	Pre- β	-52.27	-16.98	-3.92	9.56	33.55	-85.82	-68.68

TABLE IA.18

MONTHLY REBALANCING PORTFOLIO STATISTICS: PRESS RELEASE WINDOW

The table presents summary statistics of portfolios of investment strategies sorted on exposures to ECB monetary policy announcement shocks around the press release window. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1\text{M}$ to 10Y , around the press release window, $w = \text{prw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs at the end of each month in which a Governing Council meeting occurs. In months where more than one Governing Council meeting occurs, we take the last observation to estimate exposures. In months where no Governing Council meeting occurs, we do not rebalance, thereby retaining the same sorting signal until the next Governing Council meeting month. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	4.97***	3.90***	3.21***	1.53***	0.22	4.75*	3.93**	Mean	5.46***	4.02***	2.70***	1.56***	0.09	5.37**	4.42**
t-stat	2.79	4.35	5.37	2.84	0.21	1.89	2.00	t-stat	3.40	4.49	4.56	2.73	0.10	2.46	2.54
Std	8.31	4.23	2.47	2.58	5.40	12.14	9.52	Std	7.64	4.32	2.58	2.66	5.11	11.00	8.80
SR	0.60	0.92	1.30	0.59	0.04	0.39	0.41	SR	0.71	0.93	1.05	0.58	0.02	0.49	0.50
AC(1)	0.16	0.11	0.27	0.12	0.02	0.11	0.11	AC(1)	0.11	0.08	0.22	0.13	-0.08	0.02	0.03
Pre- β	-67.56	-25.42	-6.02	11.08	50.36	-117.93	-93.09	Pre- β	-65.46	-25.32	-6.68	11.37	46.51	-111.98	-89.07
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.98***	4.37***	2.77***	1.34**	-0.62	6.60***	5.46***	Mean	6.20***	4.14***	2.91***	1.32**	-0.74	6.94***	5.64***
t-stat	3.57	5.23	4.24	2.15	-0.57	2.75	2.89	t-stat	3.78	4.66	4.16	2.21	-0.70	2.91	3.00
Std	7.82	4.08	2.96	2.86	5.65	11.88	9.42	Std	7.72	4.25	3.10	2.89	5.62	11.91	9.45
SR	0.76	1.07	0.94	0.47	0.11	0.56	0.58	SR	0.80	0.97	0.94	0.46	0.13	0.58	0.60
AC(1)	0.12	0.05	0.16	0.16	0.02	0.06	0.05	AC(1)	0.12	0.09	0.19	0.06	0.01	0.05	0.05
Pre- β	-56.93	-21.73	-5.22	11.28	42.67	-99.59	-79.24	Pre- β	-54.03	-21.67	-5.80	10.61	39.89	-93.93	-75.01
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	6.08***	4.22***	2.90***	1.26**	-0.63	6.71***	5.47***	Mean	5.71***	3.67***	2.87***	1.71***	0.13	5.84**	4.40**
t-stat	3.66	4.88	4.32	2.11	-0.60	2.81	2.90	t-stat	3.36	4.03	4.32	2.98	-0.13	2.43	2.36
Std	7.85	4.03	3.06	2.94	5.56	11.95	9.43	Std	7.67	4.26	3.04	2.76	4.90	11.23	8.79
SR	0.77	1.05	0.95	0.43	0.11	0.56	0.58	SR	0.74	0.86	0.95	0.62	0.03	0.52	0.50
AC(1)	0.12	0.11	0.17	0.06	0.01	0.06	0.06	AC(1)	0.16	0.12	0.15	0.07	0.08	0.13	0.12
Pre- β	-54.38	-21.71	-5.54	10.58	39.52	-93.90	-74.93	Pre- β	-44.68	-18.80	-5.99	6.57	29.64	-74.32	-59.27
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.07***	3.60***	2.86***	2.53***	0.20	5.28**	3.85**	Mean	3.14***	2.92***	2.67***	3.07***	2.04	1.11	0.77
t-stat	2.97	3.87	4.48	4.18	-0.19	2.13	2.00	t-stat	2.75	4.55	3.88	3.62	1.54	0.53	0.47
Std	7.92	4.35	2.85	2.76	5.23	11.77	9.23	Std	5.98	3.17	3.07	3.88	6.19	10.55	8.24
SR	0.64	0.83	1.00	0.92	0.04	0.45	0.42	SR	0.53	0.92	0.87	0.79	0.33	0.10	0.09
AC(1)	0.13	0.11	0.17	0.13	0.09	0.12	0.10	AC(1)	-0.02	0.05	0.19	0.13	0.15	0.03	0.04
Pre- β	-41.42	-17.74	-5.34	6.69	29.22	-70.64	-56.46	Pre- β	-31.62	-12.20	-1.73	8.24	26.37	-57.99	-46.61

TABLE IA.19
STOXX-SORTED PORTFOLIO STATISTICS

The table presents summary statistics and post-formation exposures of portfolios of investment strategies sorted on exposures to stock market responses to ECB monetary policy announcements. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation gammas are estimated given the exposure of each daily factor return to the change in the high-frequency euro area stock market, Euro Stoxx 50, around the three windows, $w = \text{mew, prw, pcw}$, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the OIS 1Y rate. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their gamma exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. All portfolio summary statistics are presented in Panel A. Post-formation regressions estimate the exposure of each of these portfolio returns to the change in the high-frequency OIS rate around the corresponding event window (β^O). Surprises are summed within a month and assigned to month-end, and months with no Governing Council meetings are excluded. Exposures are estimated as in equation (2), where upper sub-panels include no control and lower sub-panels include the contemporaneous high-frequency change in the OIS 1Y rate. The *t*-statistic, computed using Newey and West (1987) standard errors is reported below, as well as the (adjusted) R^2 , in percentage. All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. All post-formation exposures are presented in Panel B. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024 for mew and prw, and Jun/2003 to Dec/2024 for pcw, respectively.

Panel A: Portfolio Summary Statistics							
A1: Monetary Event Window							
	P1	P2	P3	P4	P5	HML	RNK
Mean	3.91**	3.69***	3.21***	2.21***	1.00	-2.80	-2.29
t-stat	2.00	3.63	4.80	4.69	1.11	-1.09	-1.12
Std	9.36	4.58	2.97	2.19	4.41	12.30	9.77
SR	0.42	0.81	1.08	1.01	0.23	0.23	0.23
AC(1)	0.09	0.15	0.16	0.12	0.06	0.08	0.08
Pre- β	-41.82	-17.99	-6.11	4.55	25.85	67.67	53.78
A2: Press Release Window							
	P1	P2	P3	P4	P5	HML	RNK
Mean	3.98**	3.68***	2.88***	2.03***	1.42	-2.45	-2.21
t-stat	2.22	3.70	4.07	3.56	1.61	-1.02	-1.19
Std	8.16	4.65	3.20	2.56	3.86	10.63	8.37
SR	0.49	0.79	0.90	0.79	0.37	0.23	0.26
AC(1)	0.17	0.13	0.13	0.15	0.20	0.21	0.18
Pre- β	-40.18	-17.50	-5.65	5.34	27.61	67.79	53.87
A3: Press Conference Window							
	P1	P2	P3	P4	P5	HML	RNK
Mean	-0.16	1.16**	1.59***	1.95***	3.04***	3.07*	2.49*
t-stat	-0.14	2.14	4.46	3.20	3.39	1.78	1.78
Std	5.73	2.55	1.70	2.56	4.43	8.84	7.09
SR	0.03	0.46	0.93	0.76	0.69	0.35	0.35
AC(1)	-0.01	0.02	-0.04	0.17	0.01	-0.05	-0.04
Pre- β	-33.11	-11.46	-1.42	7.68	26.03	59.14	46.93

(continued over page)

Table IA.19 (Continued)

Panel B: Post-formation Gammas							
B1: Monetary Event Window							
	P1	P2	P3	P4	P5	LMH	RNK
β^S	-17.79	-3.34	1.89	-1.85	9.68	26.91	18.97
t-stat	-1.12	-0.39	0.56	-0.55	0.77	1.00	0.91
R^2	0.42	0.06	0.04	0.09	0.69	0.60	0.48
β^S	-23.80	-6.53	-1.59	-3.34	8.34	31.34	22.47
t-stat	-1.33	-0.70	-0.42	-0.96	0.65	1.09	1.00
R^2	0.71	0.47	2.60	0.59	0.19	0.17	0.04
B2: Press Release window							
	P1	P2	P3	P4	P5	LMH	RNK
β^S	29.34*	12.58	7.12	7.86*-10.82*	-38.26**	-27.35*	
t-stat	1.96	1.47	1.03	1.92	-1.83	-2.08	-1.89
R^2	1.41	0.78	0.54	1.17	0.89	1.41	1.16
β^S	22.17	6.39	3.92	5.96	-8.64	-29.06	-19.29
t-stat	1.32	0.67	0.52	1.30	-1.36	-1.40	-1.18
R^2	1.36	1.62	0.69	0.98	0.41	1.33	1.24
B3: Press Conference Window							
	P1	P2	P3	P4	P5	LMH	RNK
β^S	-0.71	2.53	-0.33	-2.97	-10.66	-10.21	-8.34
t-stat	-0.05	0.32	-0.08	-0.58	-1.04	-0.41	-0.41
R^2	0.00	0.13	0.00	0.16	0.91	0.23	0.24
β^S	-2.63	1.27	-0.71	-4.37	-10.33	-7.93	-6.90
t-stat	-0.16	0.16	-0.16	-0.85	-0.99	-0.31	-0.33
R^2	-0.06	0.93	-0.61	1.15	0.03	-0.11	-0.32

IA.6 Additional Analysis

IA.6.1 Monetary Policy Factors

In what follows, we form additional portfolios by sorting the strategy factors on their exposures to the monetary policy factors of [Jarociński and Karadi \(2020\)](#) and [Altavilla et al. \(2019\)](#). These factors are extracted from the cross-sections of OIS high-frequency changes in the Governing Council meetings. Thus, they are convolutions of the same surprises we employed so far. We perform this analysis mainly to help interpret our earlier evidence uncovered using the OIS rates of specific maturities.

Specifically, we perform the same steps as in the main analysis. Thus, we first estimate the beta exposures using equation (1), but replacing the specific OIS rate with the selected monetary policy factor, i.e., the factors of [Altavilla et al. \(2019\)](#) and [Jarociński and Karadi \(2020\)](#). For each of these factors, we then group the investment strategies into five portfolios based on the estimated exposures, and obtain the LMH and RNK spread portfolios.⁷

We employ the four factors of [Altavilla et al. \(2019\)](#), which capture information from the press release (the TARGET factor) and press conference (the TIMING, FG, and QE factors) windows.⁸ We find that sorting on the TARGET factor yields evidence consistent with the earlier evidence, uncovered with individual OIS surprises from the prw (Table [IA.20](#), Panel A). That is, average returns increase when moving from P1 to P5, resulting in a positive average return of spread portfolios. Such returns are statistically significant at the 5 percent level. Among the pcw factors (Panels B-D), only sorting on the TIMING factor generates statistically significant negative average returns, with somewhat weaker significance for RNK than LMH. This negative premium confirms the previous analysis on OIS pcw surprises, and yet sheds further light on the component which is most relevant for equity strategy investors, that is timing shocks. Indeed, the TIMING factor heavily loads on the six-month OIS, which was the only OIS surprise resulting in statistically significant returns at the 5% level.

We then turn to assessing the impact of the [Jarociński and Karadi \(2020\)](#) factor surprises. Unlike in [Altavilla et al. \(2019\)](#), these factors are estimated from the entire monetary event window using only OIS rates with maturities from 1M to 1Y. The first factor is the first PC of these OIS surprises (PC1). To recover a true monetary policy, discount-rate shock factor (MPPM), the authors employ a poor's man approach by setting to zero observations that are consistent with information effects, i.e., when OIS 1M and STOXX surprises take the same sign. Similarly, they recover the information factor (INFPM) as the complement, thus by retaining only the surprises in which there are information effects. Consistent with the results from Table [2](#)

⁷The main difference with the OIS analysis is that the monetary policy factors exercise is not tradable in real time, given that the principal components analysis (PCA) used to extract the factors is applied to the full sample period. Nevertheless, we conduct this analysis primarily to provide supplementary evidence to our previous out-of-sample OIS findings.

⁸For further details, see [Altavilla et al. \(2019, pp.167–168\)](#). Here, we note that their TARGET factor is not a “pure” target factor as it captures not only variation in very short term OIS rates (typically up to three months) but also in somewhat longer maturities. For example, [Kearns et al. \(2023\)](#) say that three-months rates contain information about target shocks, while the difference between two-year and three-month OIS rates about path shocks. It is a TARGET factor in the sense that is driven mainly by variation in short-term OIS rates, and hence in the level of rates, in the prw.

for new, we find that sorting on PC1 yields a significant spread in returns (Table [IA.20](#), Panel E), decreasing monotonically from P1 (high risk) to P5 (low risk). The LMH and RNK portfolio average return are both significant at the 5% level. Moreover, comparing Panels F and G, we find that this return is driven by the monetary policy surprise component (MPPM), again with significant LMH and RNK portfolio returns, whereas the information effect component (INFPM) yields a statistically insignificant average return.

We then examine the monetary policy factor and speeches loadings and risk premia estimated using the three-pass method (see Tables [IA.21](#) and [IA.22](#)). The TARGET portfolio risk premium is highly statistically significant, with a Sharpe ratio of 1.31. This increase in its risk-adjusted performance relative to the noisy factor suggests that it is important to account for measurement error/unpriced risks (indeed, its R^2 is around 16%). At the same time, the TIMING portfolio risk premium remains significant at the 5% only upon the addition of the eleventh latent-factor. The FG and QE risk premia remain insignificant. This means that investors in equity strategies are most concerned about target, discount-rate shocks, while there is some evidence about a stabilization effect originating in the pcw from TIMING surprises.

Moreover, through the lens of the three-pass estimator the risk premium of the monetary policy shocks cleaned from information shocks (MPPM) becomes significant at the 5% level, whereas that of the premium of the plain PC1 of [Jarociński and Karadi \(2020\)](#) reduces to 10%. The risk premium of the information shock remains insignificant. This further suggests that the positive risk-return found in new surprises is due to “pure” monetary policy shocks.

These findings, taken together, suggests that target surprises, or discount-rate shocks, arising in the press release window determine a positive risk-return tradeoff in equity strategy returns, being a systematic source of risk for the investors. Moreover, they allow us to rule out the possibility that our findings are driven (or contaminated) by information effects. The evidence from the pcw factors lends support but also refines our previous findings showing that surprises in the press conference window impact differently on equity strategy returns, being inconsistent with a positive risk-return tradeoff. Indeed, we find that the relevant pcw shocks are those captured by the timing factors and seem to determine a negative risk premium. A possible explanation is that these types of monetary policy surprises play a stabilizing role in the cross-section of equity strategy returns, in the sense of [Ozdagli and Velikov \(2020\)](#).

IA.6.2 Inter-meeting Communication

Recent literature (see [Knox and Vissing-Jorgensen, 2025](#), for a review) has shown that communications on days other than GC days can also affect asset prices. In what follows is an initial assessment of the relevance of speeches for strategy returns. To do this, we sort the 153 investment strategy returns according to the high-frequency OIS changes, for $\tau = 1M$ to $10Y$,

measured around the speeches of the ECB President and Executive Board members.⁹ We use again equation (1) to estimate the exposures on the days of the speeches. As there are many more speech days than GC days (2088 vs 308), we use longer estimation windows covering the last 120 speeches.

The resulting evidence is clear: we find that ECB speeches can determine a positive risk-return tradeoff, but only to the extent that they affect very short-term OIS rates (Table IA.23). There is indeed an economically and statistically significant spread in the portfolios sorted by OIS 1M, with an LMH (RNK) spread portfolio return of 5.96% (4.61%), which is significant at the 1% (5%) level. The Sharpe ratio is 0.58 (0.56) for the LMH (RNK) portfolio. There is again a monotonic, decreasing tendency in returns as we move from P1 to P5. By contrast, this tendency is absent when considering OIS rates with longer maturities, except for OIS 3M which demonstrates consistent patterns but insignificant spread portfolio returns. None of the spread portfolios for maturities beyond OIS 3M have statistically significant returns; the average returns of the spread portfolios for longer-maturity OIS rates are negatively signed, which qualitatively mimics the pcw evidence. Therefore, for speeches to affect equity strategy systematically, and generate a positive risk-return tradeoff, they must impact short-term OIS rates.

We test the robustness of these findings by varying the number of speeches used in the beta estimation. Specifically, we also consider windows covering 60 and 240 speeches (Table IA.24). Note that 240 speeches occur on average every three years, thus by employing this number of speeches one covers roughly the same time-window used in the estimation of the GC betas. Focusing on the OIS 1M surprises, we find that the results strengthen using shorter windows, in that the LMH risk premium increases to 6.90%, significant at the 1% level. By contrast, they weaken using a window of 240 speeches. Consistently, the average spread in betas reduces in absolute terms when moving from shorter to longer estimation windows (see pre-betas). Notably, if we use an ensembling method, whereby we sort equity strategies on the average betas estimated over the three windows, the risk premium is significant (at least) at the 5% level. By contrast, regardless of the beta estimation, average returns of LMH portfolios sorted on other OIS maturities (beyond 1M) remain statistically insignificant.

Turning to the three-pass estimation (Table IA.22), the results remain consistent and are slightly strengthened in that the Sharpe ratio of the OIS 1M portfolio increases to 0.82, whilst the OIS 3M portfolio also becomes significant at the 5% level. The risk premium on the OIS 2Y becomes marginally significant, although only at the 10% level after the addition of the eleventh

⁹We use the Euro Area Communication Event-Study Database (EACED) of Istrefi, Odendahl and Sestieri (2025). The database contains intraday changes in euro area OIS and other financial variables around approximately 4,400 ECB inter-meeting communications (speeches) from Jan/1999 to Feb/2024. Specifically, we choose to condition only on those communications by the ECB President or a member of the ECB Executive Board (2088 speeches), which are helpfully indexed by the authors. The EACED combines three independent datasets: *Eurosystem Events*, *Control Events* and *Financial Markets*. Eurosystem Events contains all speech events, and for our purposes all speaking events by the ECB President (including hearings at the European Parliament) and other Executive Board members, including interviews. All non-interview events are taken from Bloomberg's Economic Calendar, retaining only those timestamped. Interview events are taken from Refinitiv Eikon, where again are all timestamped. This method of collecting events is preferred over the ECB's own speech database, which does not allow for intraday identification. We refer to Istrefi et al. (2025) for further details on the types and construction of data included in each database. We thank Klodiana Istrefi and her co-authors for making the EACED available, at <https://sites.google.com/site/istrefiklodiana/ea-ced?authuser=0>.

latent-factor. For portfolios sorted on other OIS maturities, the risk premia remain insignificant. Therefore, speeches can also represent a source of systematic risk for which investors require compensation to the extent that they impact very short-term OIS rates.¹⁰

Overall, this initial analysis shows that speeches can generate a positive risk-return tradeoff in equity strategies to the extent that they affect very short-term OIS rates. This finding is consistent with the conjecture of [Bauer and Swanson \(2023\)](#) that the stock market might be more sensitive to actual policy rate changes than to forward guidance. Nevertheless, this evidence is preliminary and should be treated with caution. For example, our analysis focused solely on speeches delivered by the ECB President and board members, in light of the goal of this study, and without considering the specific type of speech. Furthermore, these findings are from the perspective of equity strategy investors, so they may differ for other types of investors.

¹⁰These results on speeches should be treated with caution for reasons discussed earlier, and future research should further examine the impact of communication outside GC days on asset prices, for example by broadening the set of speeches considered. It should also consider whether this type of communication differs from that on GC days from the investors' perspective. For example, we find that portfolios sorted on OIS 1M surprises around speeches and those sorted on *mew* and *prw* OIS 1M surprises are positively, but imperfectly, correlated (50% and 59%, respectively); these correlations are lower (16% and 20%, respectively) for the noisy portfolios. Moreover, in unreported estimates we use simple univariate spanning regressions for portfolios sorted on OIS 1M and 3M rates (as these are the maturities for which speech portfolios have significant risk premia). We find that the GC cleaned portfolios are positively exposed to the cleaned speech portfolios. The alphas remain highly economically and statistically significant for the OIS 3M *prw* portfolio. This, in turn, suggests that the speech portfolio does not subsume entirely the information in the *prw* portfolio (see, e.g., [Barillas and Shanken \(2017\)](#) for an interpretation of spanning regressions).

TABLE IA.20

MONETARY POLICY FACTOR PORTFOLIO SUMMARY STATISTICS

The table presents summary statistics of portfolios of investment strategies sorted on the monetary policy factors of [Altavilla et al. \(2019\)](#) around the press release (*TARGET*) and press conference windows (*TIMING*, *FG* and *QE*), and the factors of [Jarociński and Karadi \(2020\)](#) around the monetary event window (*PC1*, *MPPM* and *INFPM*) applied to the euro area high-frequency OIS surprises, respectively. For 153 investment strategies, on the day of an ECB Governing Council announcement pre-formation betas are estimated given the exposure of each daily factor return to the given monetary policy factor, as in equation (1). These regressions are estimated over rolling windows of 36 Governing Councils, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using [Newey and West \(1987\)](#) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre-β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jun/2003 to Dec/2024 for prw, Dec/2003 to Dec/2024 for pcw, and Jul/2000 to Dec/2024 for mew factors, respectively.

Panel A: TARGET _{PRW}								Panel B: TIMING _{PCW}							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	3.30***	2.47***	2.22***	0.74	-0.84	4.04**	3.31**	Mean	-1.27	1.38**	1.84***	2.56***	3.35***	4.63**	-3.43*
t-stat	2.67	3.99	5.61	1.57	-0.84	1.98	2.07	t-stat	-0.96	2.16	3.95	3.98	3.20	-2.15	-1.97
Std	6.26	2.90	1.76	2.15	5.03	10.57	8.28	Std	5.91	2.94	1.93	2.72	4.38	9.26	7.56
SR	0.53	0.85	1.26	0.34	0.17	0.38	0.40	SR	0.22	0.47	0.95	0.94	0.76	0.50	0.45
AC(1)	-0.03	0.02	0.11	0.10	-0.02	-0.05	-0.05	AC(1)	0.09	0.09	0.22	0.12	0.18	0.14	0.14
Pre-β	-51.10	-19.15	-4.57	9.23	40.14	-91.25	-72.13	Pre-β	-32.46	-14.89	-4.32	6.64	23.45	-55.91	-45.38
Panel C: FG _{PCW}								Panel D: QE _{PCW}							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	1.05	1.47**	1.60***	1.24**	2.46**	-1.38	-0.72	Mean	1.42	1.62***	1.23***	1.94***	1.61*	-0.32	-0.20
t-stat	0.97	2.35	3.22	2.00	2.43	-0.73	-0.47	t-stat	1.25	2.91	3.07	3.51	1.85	-0.18	-0.14
Std	5.01	2.77	1.99	2.84	4.79	8.80	7.08	Std	5.36	2.57	1.72	2.27	4.36	8.64	6.69
SR	0.21	0.53	0.80	0.44	0.51	0.16	0.10	SR	0.26	0.63	0.71	0.85	0.37	0.04	0.03
AC(1)	0.07	0.10	0.21	0.06	0.02	0.05	0.05	AC(1)	0.04	0.07	0.09	0.19	-0.03	0.00	0.01
Pre-β	-28.20	-10.15	0.88	11.66	29.01	-57.21	-46.26	Pre-β	-25.49	-9.40	-0.30	8.91	25.35	-50.85	-40.79
Panel E: PC1 _{MEW}								Panel F: MPPM _{MEW}							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	5.01***	4.37***	2.89***	1.68***	0.05	4.94**	4.23**	Mean	5.00**	4.27***	2.88***	1.77***	0.13	4.85*	3.95*
t-stat	2.71	4.69	4.11	3.09	0.05	1.97	2.19	t-stat	2.57	4.58	4.27	3.40	0.14	1.84	1.94
Std	8.74	4.26	3.05	2.59	4.36	12.01	9.31	Std	9.26	4.54	2.92	2.25	4.57	12.69	9.92
SR	0.57	1.03	0.95	0.65	0.01	0.41	0.45	SR	0.54	0.94	0.99	0.78	0.03	0.38	0.40
AC(1)	0.13	0.13	0.20	0.12	0.06	0.12	0.11	AC(1)	0.11	0.07	0.19	0.24	0.10	0.11	0.09
Pre-β	-43.30	-17.59	-5.70	6.61	28.56	-71.86	-57.24	Pre-β	-43.83	-17.48	-4.73	7.76	32.99	-76.83	-61.04
Panel G: INFPM _{MEW}															
	P1	P2	P3	P4	P5	LMH	RNK								
Mean	3.56**	3.57***	3.26***	2.15***	1.42*	2.14	1.85								
t-stat	2.36	3.41	4.09	3.31	1.76	1.02	1.12								
Std	7.12	4.58	3.49	3.16	3.97	9.88	7.77								
SR	0.50	0.78	0.93	0.68	0.36	0.22	0.24								
AC(1)	0.14	0.21	0.17	0.08	0.07	0.14	0.14								
Pre-β	-45.37	-18.11	-4.69	8.17	32.79	-78.16	-62.30								

TABLE IA.21

EXPOSURES OF MONETARY POLICY AND INTER-MEETING COMMUNICATION FACTORS TO LATENT FACTORS

The table presents the exposures (Panel 1) and explained variations (Panel 2) of the spread portfolio returns sorted on the monetary policy factors of [Altavilla et al. \(2019\)](#) (Panel A) and [Jarociński and Karadi \(2020\)](#) (Panel B), as well as the spread portfolio returns sorted on the OIS surprises around inter-meeting communications (Panel C), to the optimal euro area pricing kernel. The loadings, η_{F_k} , are obtained from spanning regressions of the candidate factor on the optimal eleven-latent-factor model, and explained variations, $R^2_{F_{1-k}}$ (in percentage), from models of increasing numbers of factors, $k = 1, \dots, 11$. The latent factors are obtained from applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ euro area investment strategy returns. ***, ** and * correspond to a rejection of the null hypothesis of zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated using [Newey and West \(1987\)](#). The sample period is Jul/2000 to Dec/2024.

Panel A: Altavilla et al. (2019)																						
	A1: Risk Exposure											A2: Explained Variation										
	η_{F_1}	η_{F_2}	η_{F_3}	η_{F_4}	η_{F_5}	η_{F_6}	η_{F_7}	η_{F_8}	η_{F_9}	$\eta_{F_{10}}$	$\eta_{F_{11}}$	$R^2_{F_{1-1}}$	$R^2_{F_{1-2}}$	$R^2_{F_{1-3}}$	$R^2_{F_{1-4}}$	$R^2_{F_{1-5}}$	$R^2_{F_{1-6}}$	$R^2_{F_{1-7}}$	$R^2_{F_{1-8}}$	$R^2_{F_{1-9}}$	$R^2_{F_{1-10}}$	$R^2_{F_{1-11}}$
TARGET LMH	8.83***	4.15	4.31	-5.73	-3.02	15.10*	3.61	14.96**	0.75	14.19**	3.94	6.36	8.55	9.77	10.20	9.92	14.70	14.41	16.06	15.77	16.53	16.40
TIMING LMH	6.82***	-6.72***	-9.93***	6.86**	-3.05	-9.45**	-0.84	3.68	1.65	-3.78	-9.36	19.89	23.08	27.47	28.94	29.02	31.40	31.35	31.20	31.04	30.78	31.98
FG LMH	0.64	-2.85	4.98*	-9.11***	7.00	12.44*	-0.50	1.68	2.43	13.45**	-4.53	2.76	4.50	5.58	8.09	9.98	14.81	14.50	14.16	13.81	15.32	15.36
QE LMH	4.08**	-12.04***	3.10	2.67	4.57	-3.99	-4.36	7.52	5.07	3.84	4.40	28.08	49.84	51.03	51.18	52.30	52.77	53.33	53.60	53.68	53.55	53.74
Panel B: Jarocinski & Karadi (2020)																						
	B1: Risk Exposure											B2: Explained Variation										
	η_{F_1}	η_{F_2}	η_{F_3}	η_{F_4}	η_{F_5}	η_{F_6}	η_{F_7}	η_{F_8}	η_{F_9}	$\eta_{F_{10}}$	$\eta_{F_{11}}$	$R^2_{F_{1-1}}$	$R^2_{F_{1-2}}$	$R^2_{F_{1-3}}$	$R^2_{F_{1-4}}$	$R^2_{F_{1-5}}$	$R^2_{F_{1-6}}$	$R^2_{F_{1-7}}$	$R^2_{F_{1-8}}$	$R^2_{F_{1-9}}$	$R^2_{F_{1-10}}$	$R^2_{F_{1-11}}$
PC1 LMH	12.94***	4.48*	-5.15**	0.06	6.99**	9.85**	-2.87	0.59	-3.40	1.98	-11.15	41.82	45.24	46.05	45.87	47.08	49.24	49.21	49.04	49.02	48.89	50.04
MPPM LMH	14.53***	2.79	-2.50	1.38	1.48	10.70**	-4.41	5.17	-2.32	4.60	-15.28**	47.22	48.30	48.34	48.22	48.10	50.40	50.54	50.79	50.69	50.75	52.81
INFPM LMH	9.10***	2.43	-8.90***	2.29	12.37***	1.20	2.97	-1.44	-0.75	-5.32	-6.48	30.54	31.87	36.08	36.17	42.41	42.26	42.29	42.14	41.95	42.27	42.73
Panel C: Speeches																						
	C1: Risk Exposure											C2: Explained Variation										
	η_{F_1}	η_{F_2}	η_{F_3}	η_{F_4}	η_{F_5}	η_{F_6}	η_{F_7}	η_{F_8}	η_{F_9}	$\eta_{F_{10}}$	$\eta_{F_{11}}$	$R^2_{F_{1-1}}$	$R^2_{F_{1-2}}$	$R^2_{F_{1-3}}$	$R^2_{F_{1-4}}$	$R^2_{F_{1-5}}$	$R^2_{F_{1-6}}$	$R^2_{F_{1-7}}$	$R^2_{F_{1-8}}$	$R^2_{F_{1-9}}$	$R^2_{F_{1-10}}$	$R^2_{F_{1-11}}$
LMH 1M	5.74***	6.17***	6.39***	2.29	-12.54***	12.18***	12.56***	5.52	-9.23**	-9.67**	1.31	11.58	20.98	22.62	22.62	28.51	33.28	36.85	37.32	38.78	40.18	39.99
LMH 3M	3.56***	1.36	6.29**	-2.11	-14.65***	9.42***	11.67***	3.45	-3.06	-7.00	12.17**	4.76	4.95	6.69	6.64	15.41	18.37	21.62	21.64	21.56	22.21	24.24
LMH 6M	-4.10***	-6.76***	2.59	-3.63	-10.22**	-3.93	1.25	11.30***	-1.39	9.76**	20.37***	6.00	17.44	17.50	18.02	21.76	21.92	21.69	24.60	24.36	25.71	31.57
LMH 1Y	0.97	-4.24**	4.15	-6.09*	-11.90***	-3.10	3.04	13.13***	-6.35	10.46**	24.58***	0.36	5.17	5.82	7.89	13.58	13.53	13.50	17.91	18.47	20.23	29.80
LMH 2Y	2.03	-4.29**	10.77***	11.88***	-0.61	5.25*	-3.25	5.02	-9.65**	-1.88	32.66***	1.46	5.97	11.98	20.00	19.72	20.59	20.55	20.89	22.53	22.33	38.55
LMH 5Y	-0.73	-10.13***	7.07*	-6.89*	-7.63	-2.48	6.56	11.18***	0.22	7.04	34.48***	0.17	20.43	22.29	24.17	25.65	25.50	26.10	28.29	28.04	28.40	41.87
LMH 7Y	-2.01	-9.85***	6.40**	-7.50**	-2.11	-4.46*	5.74	4.89	-1.72	6.55	30.47***	1.42	24.61	26.50	29.33	29.22	29.50	30.05	30.37	30.17	30.58	43.31
LMH 10Y	-0.89	-11.15***	4.93	-8.04**	-3.78	-3.19	7.07*	4.80	-0.38	3.36	34.53***	0.25	26.40	27.30	30.14	30.34	30.32	31.12	31.36	31.11	31.00	45.36

TABLE IA.22

RISK PREMIA OF MONETARY POLICY AND INTER-MEETING COMMUNICATION FACTORS

The table presents the risk premium and Sharpe ratio estimates of the raw (Panel 1), as well as de-noised spread portfolio returns sorted on the monetary policy factors of [Altavilla et al. \(2019\)](#) (Panel A) and [Jarociński and Karadi \(2020\)](#) (Panel B), as well as the de-noised spread portfolio returns sorted on the OIS surprises around inter-meeting communications (Panel C), all from the third-pass of the [Giglio and Xiu \(2021\)](#) three-pass procedure. Estimates are reported using models including an increasing number of latent factors, F_{1-k} for $k = 1, 2, \dots, 11$. The latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ euro area investment strategy returns. ***, ** and * correspond to a rejection of the null hypothesis of zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated as in [Giglio and Xiu \(2021\)](#). The sample period is Jul/2000 to Dec/2024.

Panel A: Altavilla et al. (2019)																					
	A1: Factor		A2: Risk Premia											B3: Sharpe Ratios							
	Mean	SR	F_{1-1}	F_{1-2}	F_{1-3}	F_{1-4}	F_{1-5}	F_{1-6}	F_{1-7}	F_{1-8}	F_{1-9}	F_{1-10}	F_{1-11}	$SR_{F_{1-1}}$	$SR_{F_{1-2}}$	$SR_{F_{1-3}}$	$SR_{F_{1-4}}$	$SR_{F_{1-5}}$	$SR_{F_{1-6}}$	$SR_{F_{1-7}}$	$SR_{F_{1-8}}$
TARGET LMH	4.04**	0.38	2.66**	5.13***	7.43***	7.12***	7.19***	9.93***	10.04***	9.94***	10.00***	9.24***	9.57***	0.70	0.91	1.21	1.14	1.13	1.23	1.27	1.33
TIMING LMH	-4.63**	0.50	4.13***	1.62	-1.83	-1.41	-1.26	-2.99*	-3.21*	-3.23*	-3.32*	-3.25*	-4.07**	0.70	0.32	0.34	0.25	0.21	0.47	0.50	0.51
FG LMH	-1.38	0.16	1.46*	-0.40	1.43	0.92	0.57	2.87**	2.95**	2.95**	2.94*	2.15	1.75	0.70	0.20	0.65	0.34	0.18	0.69	0.71	0.71
QE LMH	-0.32	0.04	4.57***	-1.30	0.45	0.62	0.36	-0.44	-0.81	-0.85	-0.98	-1.12	-0.74	0.70	0.21	0.07	0.10	0.06	0.07	0.13	0.13
Panel B: Jarocinski & Karadi (2020)																					
	B1: Factor		B2: Risk Premia											A3: Sharpe Ratios							
	Mean	SR	F_{1-1}	F_{1-2}	F_{1-3}	F_{1-4}	F_{1-5}	F_{1-6}	F_{1-7}	F_{1-8}	F_{1-9}	F_{1-10}	F_{1-11}	$SR_{F_{1-1}}$	$SR_{F_{1-2}}$	$SR_{F_{1-3}}$	$SR_{F_{1-4}}$	$SR_{F_{1-5}}$	$SR_{F_{1-6}}$	$SR_{F_{1-7}}$	$SR_{F_{1-8}}$
PC1 LMH	4.94**	0.41	5.42***	6.96***	5.25**	5.26**	5.40**	6.34***	5.97***	6.00***	5.77**	5.87**	4.71*	0.70	0.86	0.64	0.64	0.65	0.75	0.70	0.68
MPPM LMH	4.85*	0.38	6.08***	7.04***	6.21**	6.35***	6.38***	7.41***	6.84***	7.03***	6.88***	7.11***	5.52**	0.70	0.80	0.70	0.72	0.72	0.82	0.75	0.77
INFPM LMH	2.14	0.22	3.81***	4.64***	1.70	1.92	2.17	2.28	2.66	2.61	2.56	2.29	1.62	0.70	0.83	0.28	0.32	0.33	0.35	0.41	0.40
Panel C: Speeches																					
	C1: Factor		C2: Risk Premia											D3: Sharpe Ratios							
	Mean	SR	F_{1-1}	F_{1-2}	F_{1-3}	F_{1-4}	F_{1-5}	F_{1-6}	F_{1-7}	F_{1-8}	F_{1-9}	F_{1-10}	F_{1-11}	$SR_{F_{1-1}}$	$SR_{F_{1-2}}$	$SR_{F_{1-3}}$	$SR_{F_{1-4}}$	$SR_{F_{1-5}}$	$SR_{F_{1-6}}$	$SR_{F_{1-7}}$	$SR_{F_{1-8}}$
LMH 1M	5.92**	0.57	2.41	4.54**	6.55***	6.77***	6.54***	7.75***	6.15***	6.36***	5.75***	5.28**	5.41**	0.70	0.97	1.34	1.38	1.18	1.30	0.98	1.00
LMH 3M	1.94	0.20	1.49	1.97	3.99**	3.78**	3.52**	4.46**	2.96*	3.10*	2.89*	2.55	3.78**	0.70	0.88	1.50	1.39	0.88	1.02	0.62	0.65
LMH 6M	-2.13	0.21	-1.72	-4.05***	-3.19*	-3.55**	-3.73**	-4.08**	-3.91**	-3.45*	-3.54*	-3.07	-1.02	0.70	0.95	0.74	0.81	0.77	0.84	0.80	0.66
LMH 1Y	-0.29	0.03	0.40	-1.07	0.29	-0.30	-0.51	-0.77	-0.36	0.17	-0.24	0.26	2.74	0.70	0.47	0.12	0.10	0.14	0.20	0.09	0.04
LMH 2Y	-0.68	0.07	0.83	-0.63	2.91	1.79	1.78	2.34	1.94	2.14	1.51	1.40	4.70*	0.70	0.25	0.82	0.39	0.39	0.49	0.41	0.44
LMH 5Y	-2.72	0.24	-0.32	-3.81**	-1.43	-2.09	-2.23	-2.43	-1.58	-1.13	-1.11	-0.78	2.71	0.70	0.73	0.26	0.36	0.37	0.41	0.26	0.18
LMH 7Y	-1.99	0.19	-0.86	-4.25***	-2.07	-2.79	-2.83*	-3.23*	-2.48	-2.28	-2.39	-2.08	1.00	0.70	0.82	0.38	0.49	0.49	0.56	0.42	0.39
LMH 10Y	-2.53	0.23	-0.39	-4.23**	-2.53	-3.30*	-3.37*	-3.65**	-2.73	-2.53	-2.55	-2.40	1.08	0.70	0.74	0.43	0.53	0.54	0.58	0.43	0.40

TABLE IA.23

BETA-SORTED PORTFOLIO STATISTICS: ECB INTER-MEETING COMMUNICATION

The table presents summary statistics of portfolios of investment strategies sorted on exposures to yield shocks around ECB President and Executive Board member inter-meeting communications. For 153 investment strategies, on the day of a communication event pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the event window, $w = sp$, as in equation (1). These regressions are estimated over rolling windows of 120 communication events, and include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jun/2002 to Feb/2024.

Panel A: OIS 1M								Panel B: OIS 3M							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	6.16***	3.49***	2.55***	1.92***	0.12	5.96***	4.61**	Mean	3.60***	3.56***	3.33***	2.06***	1.63	1.92	1.77
t-stat	3.84	3.49	3.60	3.02	0.11	2.61	2.52	t-stat	2.85	3.58	4.48	2.62	1.37	0.94	1.08
Std	7.29	4.38	3.07	2.94	5.13	10.29	8.29	Std	6.32	4.49	3.24	3.35	5.65	9.92	7.91
SR	0.85	0.80	0.83	0.65	0.02	0.58	0.56	SR	0.57	0.79	1.03	0.61	0.29	0.19	0.22
AC(1)	0.12	0.17	0.17	0.11	0.07	0.11	0.11	AC(1)	0.01	0.15	0.17	0.23	0.06	0.03	0.04
Pre- β	-17.60	-7.61	-1.57	4.38	15.10	-32.70	-26.34	Pre- β	-13.87	-4.50	0.32	5.21	14.00	-27.86	-22.31
Panel C: OIS 6M								Panel D: OIS 1Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	1.27	3.12***	3.11***	3.28***	3.42**	-2.10	-1.46	Mean	2.62**	2.83***	2.80***	3.04***	2.89**	-0.26	-0.33
t-stat	1.32	3.92	3.95	3.21	2.48	-1.03	-0.89	t-stat	2.25	3.33	3.45	3.84	2.40	-0.13	-0.21
Std	5.03	3.68	3.47	4.47	6.67	10.20	8.13	Std	5.87	3.96	3.56	3.61	5.73	9.71	7.80
SR	0.25	0.85	0.90	0.73	0.51	0.21	0.18	SR	0.45	0.72	0.79	0.84	0.50	0.03	0.04
AC(1)	-0.02	0.11	0.15	0.20	0.08	0.04	0.05	AC(1)	0.02	0.10	0.16	0.14	0.11	0.07	0.06
Pre- β	-14.32	-4.74	0.54	5.82	14.70	-29.01	-23.33	Pre- β	-16.34	-5.59	0.20	6.19	15.69	-32.04	-25.82
Panel E: OIS 2Y								Panel F: OIS 5Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	2.48*	3.07***	3.04***	2.49***	3.12**	-0.63	-0.39	Mean	0.92	2.68***	3.07***	3.76***	3.81***	-2.76	-2.14
t-stat	1.85	3.18	4.08	3.39	2.56	-0.29	-0.22	t-stat	0.74	3.23	4.05	3.84	2.67	-1.16	-1.14
Std	6.16	4.18	3.31	3.34	5.79	9.97	8.03	Std	6.28	4.03	3.28	4.14	6.71	11.54	9.14
SR	0.40	0.73	0.92	0.75	0.54	0.06	0.05	SR	0.15	0.67	0.94	0.91	0.57	0.24	0.23
AC(1)	0.13	0.19	0.12	0.17	0.14	0.16	0.16	AC(1)	0.02	0.04	0.18	0.25	0.15	0.11	0.10
Pre- β	-17.11	-6.69	-0.64	5.25	14.53	-31.65	-25.58	Pre- β	-17.60	-6.90	-0.68	5.17	15.20	-32.80	-26.44
Panel G: OIS 7Y								Panel H: OIS 10Y							
	P1	P2	P3	P4	P5	LMH	RNK		P1	P2	P3	P4	P5	LMH	RNK
Mean	1.18	2.73***	3.16***	3.83***	3.31**	-2.08	-1.70	Mean	0.88	2.05**	3.72***	3.98***	3.59**	-2.59	-2.30
t-stat	1.04	3.35	4.15	3.87	2.38	-0.94	-0.98	t-stat	0.76	2.54	4.47	4.18	2.57	-1.14	-1.28
Std	5.68	3.81	3.38	4.26	6.40	10.49	8.39	Std	6.07	3.93	3.48	4.20	6.54	11.21	8.82
SR	0.21	0.72	0.94	0.90	0.52	0.20	0.20	SR	0.15	0.52	1.07	0.95	0.55	0.23	0.26
AC(1)	0.01	0.06	0.15	0.25	0.16	0.11	0.09	AC(1)	-0.01	0.03	0.22	0.22	0.14	0.07	0.08
Pre- β	-15.91	-5.88	-0.21	5.21	14.36	-30.27	-24.37	Pre- β	-14.80	-5.17	-0.02	4.87	13.03	-27.83	-22.40

TABLE IA.24
BETA-SORTED SPREAD PORTFOLIO STATISTICS: ECB INTER-MEETING
COMMUNICATION

The table presents summary statistics of portfolios of investment strategies sorted on exposures to yield shocks around ECB President and Executive Board member inter-meeting communications, constructed using from OLS and weight-least squares (WLS) regressions over varying rolling-window and half-lives. For 153 investment strategies, on the day of a communication event pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency OIS of varying term structures, $\tau = 1M$ to $10Y$, around the event window, $w = sp$. The OLS exposures are estimated as in equation (1) over rolling windows of 60, 120, and 240 speeches, as well as the average (*Mean*) beta over these three estimates, respectively. The WLS exposures are estimated as in equation (IA.9) where weights are given by an exponential weighting scheme that has a half-life converging to 60, 120, and 240 speeches, as well as the average (*Mean*) beta over these three estimates, respectively. All regressions include as control the simultaneous high-frequency change in the euro area stock market, Euro Stoxx 50. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each Governing Council. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return (*Mean*), *t*-statistic computed using Newey and West (1987) standard errors (*t-stat*), standard deviation (*Std*), Sharpe ratio (*SR*), first-order autocorrelation coefficient (*AC(1)*), and the average portfolio-level monetary policy shock exposure (*Pre- β*). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Oct/1999 (60), Jun/2000 (120), and Feb/2002 (240), respectively, to Feb/2024.

OLS					WLS				
Panel A: OIS 1M									
	60	120	240	Mean		60	120	240	Mean
Mean	6.90***	5.96***	2.25	6.21**	Mean	7.39***	5.04**	1.88	6.72***
t-stat	2.62	2.61	1.65	2.44	t-stat	2.99	2.40	1.44	2.88
Std	12.34	10.29	6.14	11.83	Std	10.94	9.03	6.04	10.09
SR	0.56	0.58	0.37	0.53	SR	0.68	0.56	0.31	0.67
AC(1)	0.08	0.11	0.08	0.09	AC(1)	0.14	0.18	0.06	0.18
Pre- β	-51.86	-32.70	-16.12	-31.57	Pre- β	-21.06	-16.39	-10.95	-17.78
Panel B: OIS 3M									
	60	120	240	Mean		60	120	240	Mean
Mean	2.89	1.92	-2.10	2.60	Mean	1.24	1.27	0.02	1.32
t-stat	1.22	0.94	-1.18	1.13	t-stat	0.52	0.62	0.01	0.57
Std	11.31	9.92	8.46	11.20	Std	11.15	9.90	8.56	10.71
SR	0.26	0.19	0.25	0.23	SR	0.11	0.13	0.00	0.12
AC(1)	0.06	0.03	0.05	0.05	AC(1)	0.09	0.05	0.03	0.11
Pre- β	-43.30	-27.86	-19.83	-26.60	Pre- β	-22.35	-16.60	-11.36	-17.03
Panel C: OIS 6M									
	60	120	240	Mean		60	120	240	Mean
Mean	1.99	-2.10	-2.88	-0.34	Mean	-2.29	-4.23**	-2.82*	-3.24
t-stat	0.84	-1.03	-1.61	-0.15	t-stat	-1.00	-2.24	-1.81	-1.45
Std	12.07	10.20	8.42	11.90	Std	11.63	9.58	7.46	11.33
SR	0.17	0.21	0.34	0.03	SR	0.20	0.44	0.38	0.29
AC(1)	0.00	0.04	0.07	0.01	AC(1)	0.02	0.02	0.07	0.03
Pre- β	-43.28	-29.01	-20.40	-26.54	Pre- β	-21.74	-15.37	-11.23	-16.06
Panel D: OIS 1Y									
	60	120	240	Mean		60	120	240	Mean
Mean	0.95	-0.26	-2.18	-0.42	Mean	-2.05	-2.90	-2.22	-2.71
t-stat	0.40	-0.13	-1.13	-0.19	t-stat	-0.90	-1.48	-1.27	-1.25
Std	11.85	9.71	9.03	11.25	Std	11.49	9.88	8.39	11.11
SR	0.08	0.03	0.24	0.04	SR	0.18	0.29	0.26	0.24
AC(1)	0.03	0.07	0.08	0.04	AC(1)	0.03	0.04	0.06	0.03
Pre- β	-48.85	-32.04	-22.74	-29.84	Pre- β	-23.92	-15.18	-10.26	-16.47

(continued over page)

Table IA.24 (Continued)

OLS					WLS				
Panel E: OIS 2Y									
	60	120	240	Mean		60	120	240	Mean
Mean	1.26	-0.63	-0.55	0.86	Mean	-0.05	-0.19	-1.10	0.40
t-stat	0.51	-0.29	-0.24	0.35	t-stat	-0.02	-0.08	-0.51	0.16
Std	11.85	9.97	10.11	11.54	Std	11.83	10.81	10.19	11.63
SR	0.11	0.06	0.05	0.07	SR	0.00	0.02	0.11	0.03
AC(1)	0.13	0.16	0.15	0.15	AC(1)	0.12	0.11	0.06	0.12
Pre- β	-46.22	-31.65	-24.28	-29.98	Pre- β	-25.35	-17.47	-11.12	-18.26
Panel F: OIS 5Y									
	60	120	240	Mean		60	120	240	Mean
Mean	1.84	-2.76	-0.63	0.18	Mean	-0.31	-2.13	-0.79	-0.99
t-stat	0.62	-1.16	-0.28	0.06	t-stat	-0.10	-0.85	-0.34	-0.34
Std	13.92	11.54	10.82	13.53	Std	13.86	12.31	11.21	13.68
SR	0.13	0.24	0.06	0.01	SR	0.02	0.17	0.07	0.07
AC(1)	0.13	0.11	0.05	0.13	AC(1)	0.14	0.06	0.05	0.13
Pre- β	-42.72	-32.80	-26.44	-30.92	Pre- β	-27.90	-21.34	-15.32	-21.52
Panel E: OIS 7Y									
	60	120	240	Mean		60	120	240	Mean
Mean	2.15	-2.08	-0.41	0.69	Mean	0.10	-2.18	-0.49	-0.81
t-stat	0.81	-0.94	-0.19	0.26	t-stat	0.04	-0.94	-0.23	-0.30
Std	12.65	10.49	9.95	12.43	Std	12.88	11.34	10.50	12.60
SR	0.17	0.20	0.04	0.06	SR	0.01	0.19	0.05	0.06
AC(1)	0.10	0.11	0.06	0.12	AC(1)	0.12	0.06	0.04	0.12
Pre- β	-40.39	-30.27	-24.18	-29.00	Pre- β	-26.28	-19.75	-14.00	-20.34
Panel F: OIS 10Y									
	60	120	240	Mean		60	120	240	Mean
Mean	0.96	-2.59	-1.27	-0.58	Mean	-1.16	-3.07	-1.21	-1.50
t-stat	0.35	-1.14	-0.58	-0.22	t-stat	-0.41	-1.30	-0.54	-0.54
Std	13.15	11.21	10.39	12.96	Std	13.35	11.78	10.78	13.10
SR	0.07	0.23	0.12	0.04	SR	0.09	0.26	0.11	0.11
AC(1)	0.10	0.07	0.06	0.09	AC(1)	0.11	0.05	0.04	0.12
Pre- β	-37.36	-27.83	-22.57	-27.10	Pre- β	-25.25	-20.55	-15.89	-20.95

IA.7 US Monetary Policy

US Equity Strategies. While equity strategy returns are more comparable across countries than stock indices (e.g., larger tech firms account for a large and increasing portion of the US market), they may also reflect differences in economic structures, financial markets and industry composition. Moreover, differences in the monetary settings (e.g., dual vs single mandates), in the format of monetary policy meetings, and in communication, among other things, are all relevant aspects that could affect the risk-return trade-off. For example, the dual mandate gives the Fed more flexibility in responding to downturns with aggressive easing, which could support more long-duration growth stocks. There is also evidence of a Fed put, which could affect the exposure and compensation required by investors (Cieslak and Vissing-Jorgensen, 2020).¹¹ All of this implies that it is ultimately an empirical question whether results in the euro area extend to the US.

To address this question, we repeat the beta-sorting approach for the US. We use the US equity strategy factors, which are also sourced from the GFD repository of Jensen et al. (2023). By contrast, the measurement of monetary policy surprises differs somewhat given the different way in which the Federal Open Market Committee (FOMC) operates. To begin with, the Fed’s press conferences following FOMC meetings have evolved significantly over time. They were first introduced by Chair Bernanke to enhance transparency and explain monetary policy decisions. Previously, FOMC communication consisted only of a written statement and meeting minutes, with no immediate live commentary by the Chair. Moreover, these conferences were initially held quarterly, and it was only under the leadership of Chair Powell that they became a regular occurrence following every FOMC meeting. Consequently, US studies tend to rely on monetary policy surprises measured in a tighter window, excluding the conference window (e.g., see Jarociński and Karadi, 2020). Put simply, this impedes a systematic assessment of monetary policy meetings and the disentangling of information from the pre- and post-conference periods, as is done for the euro area. Furthermore, US monetary policy surprises are not derived from the OIS term structure, but rather from a combination of instruments, which is required to cover the entire term structure Boehm and Kroner (Fed funds, Eurodollar/SOFR and Treasury futures; e.g., see 2024, and references therein).

What follows uses the surprises in one- to four-quarter Eurodollar futures prices (ED 1–4). We use these surprises in their raw form and as a simple average (ED(Mean)), which can be considered a model-free level factor. We also employ the monetary policy factors of Jarociński and Karadi (2020), using both the plain first principal component (PC(1)) and the corresponding ‘poor man’ monetary policy factor (MP(PM)), which should remove information effects from PC(1). These factors are extracted from Fed fund and Eurodollar futures covering maturities ranging from one month to one year. We use the high-frequency change in S&P 500 returns to

¹¹Given its broader remit, the Fed tends to frame policy in terms of macroeconomic outcomes (employment, wages, and inflation expectations) and risk management around its forecasts. The ECB communication is instead more rule-based and less discretionary, emphasizing inflation projections and medium-term price stability.

control for the market factor.¹²

Table IA.25 presents the portfolio sorts. Regardless of the surprise used for the analysis, the resulting evidence is qualitatively similar to that for the euro area. Indeed, we observe a monotonic decrease in average return point estimates when moving from P1 (high risk, low beta) to P5 (low risk, high beta). Consequently, the LMH and RNK spread portfolios also exhibit positive average returns similar in magnitude to those of the euro area new portfolios. However, these are not statistically significant amid the high volatility of the underlying returns, leading to much lower Sharpe ratios compared to the euro area (in the 0.2–0.3 range). For example, the standard deviation of P1 is considerably higher than that of the other portfolios.

Notably, these spread portfolios become statistically significant at the 5% level when de-noised using the three-pass method, with Sharpe ratios close to 0.5 (columns LMH^{3P} and RNK^{3P}). The maximum Sharpe ratio of 0.57 is achieved using the poor man factor. This suggests that the raw portfolios are severely affected by measurement error or unpriced risk.¹³

Thus, we document qualitatively similar evidence for the US, with investors requiring compensation for exposure to ‘pure’ monetary policy shocks, consistent with a risk-return trade-off. However, the risk premia are lower in the US. When we examine the constituents of the corner portfolios more closely, we also observe some differences. One possible explanation is the different sectoral composition of the stock markets in the two areas, which can generate industry tilts in equity strategy factors to some extent. To shed light on this issue, one would need to work with industry-neutral strategies, but we leave further analysis to future research. Here, our focus remains on the euro area, where identification and interpretation are more straightforward given the design of the ECB single-mandate and the richness of the OIS term structure. This section has a more modest objective, which is to establish that the core mechanism detected in this paper – monetary policy discount-rate shocks generating positive relationship between risks and returns in equity strategies – is quite likely to be quite general, as it also extends to the US.

We find that the results are virtually unchanged when using the FOMC monetary event and statement window shocks of Acosta, Ajello, Bauer, Loria and Miranda-Agrippino (2025) (see Table IA.26). We then repeat the analysis using their press conference shocks, and the resulting evidence is qualitatively similar to that of the euro area; in fact, there is no evidence of a positive risk-return tradeoff (see Table IA.27). Of course, this additional analysis needs to be interpreted with caution, as the sample period is arguably too short to pin down a robust estimate of the pcw risk premium, given the desirability of long spans in asset pricing research.

Euro Area Equity Strategies. The international spillovers of US monetary policy have been extensively documented in both academic and policy debates. US monetary policy surprises

¹²We conduct this analysis using portfolio returns beginning in 1999 to maximize the power of our analysis while maintaining consistency with the euro area period. In the euro area analysis, returns begin in July 2000 as the initial period is required for the rolling-window estimate. As the US sample has a longer time series, we start using FOMC announcements in September 1996, enabling us to estimate portfolio returns beginning in January 1999 and thus obtain more observations for inference.

¹³To de-noise the factors, we followed the same steps as before: first, we extracted the latent factors from the cross-section of equity strategy returns via RP-PCA. We find that the optimal SDF for US strategy returns is larger than that for the euro area and consists of 14 latent factors. The two maximal Sharpe ratios of the respective tangency portfolios are very similar.

propagate globally through real (Obstfeld and Rogoff, 2004, 2007) and financial (Bernanke and Kuttner, 2005; Bruno and Shin, 2015; Miranda-Agrippino and Rey, 2020; Miranda-Agrippino and Nenova, 2022) channels. Moreover, these spillovers are typically pronounced for the euro area (Georgiadis, 2016; Dedola, Rivolta and Stracca, 2017; Karnizova, Sims and Xiao, 2023), for example due to strong transatlantic financial linkages (Kearns et al., 2023).

We therefore sort the euro area strategy returns on their FOMC beta using the same US surprises as before. Table IA.28 shows that US monetary policy surprises do not generate any noticeable pattern in euro area excess returns. Spread portfolio returns remain statistically insignificant also using the three-pass.¹⁴ Thus, we conclude that US monetary policy surprises, measured by high-frequency changes in futures on short-term rates, do not generate persistent effects on euro area strategy returns. This finding is consistent with the evidence that US spillovers are usually more substantial at the longer end of the euro area yield curve (Miranda-Agrippino and Nenova, 2022; Karnizova et al., 2023). Therefore, they are less relevant for the risk-return trade-off that we document, which mostly works via target/path shocks.

¹⁴We conduct this analysis over the period Jul/2000 to Dec/2024, for direct comparability with our ECB GC euro area return sorts. Also note that this analysis requires to estimate the FOMC betas using two days euro area strategy returns, as the FOMC meeting typically happens when euro area market are closed. This also implies that portfolios are rebalanced two days after the FOMC meeting. Thus, exposures are likely to be less precisely estimated. We also tried to estimate the FOMC exposures using monthly euro area strategy returns, sorting portfolio at the end of the month. However, the results are similar.

TABLE IA.25
BETA-SORTED PORTFOLIO STATISTICS: FOMC

The table presents summary statistics of portfolios of investment strategies sorted on exposures to FOMC monetary policy announcement shocks. For 153 investment strategies, on the day of an FOMC announcement pre-formation betas are estimated given the exposure of each daily factor return to the the change in the high-frequency change in the one- to four-quarter Euro-Dollar futures price ($ED\ 1-4$), the average across these surprises ($ED\ (Mean)$), as well as both the first principal component across Federal Funds and Euro-Dollar futures ($PC(1)$), and the ‘poor-man’ sign-restricted shock $MP\ (PM)$ of Jarociński and Karadi (2020). These regressions are estimated over rolling windows of 36 FOMC announcements, and include as control the simultaneous high-frequency change in the US stock market, S&P 500. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each FOMC announcement. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return ($Mean$), t -statistic computed using Newey and West (1987) standard errors ($t-stat$), standard deviation (Std), Sharpe ratio (SR), first-order autocorrelation coefficient ($AC(1)$), and the average portfolio-level monetary policy shock exposure ($Pre-\beta$). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jan/1999 to Dec/2024. The last two columns of each panel present the LMH and RNK portfolio returns de-noised using the three-pass estimator (LMH^{3P} and RNK^{3P}). Latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ US investment strategy returns. Portfolios are de-noised using the optimal US SDF, which comprises 14 latent factors. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated as in Giglio and Xiu (2021). The sample of returns is from Jan/1999 to Dec/2024.

Panel A: PC (1)										Panel B: MP (PM)									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	4.05	2.92*	2.35***	1.81***	0.35	4.02	3.07	9.14**	7.30**	Mean	3.92	2.77*	2.36***	1.61**	0.80	3.40	2.74	9.63**	7.52**
t-stat	1.55	1.85	2.81	2.64	0.21	1.03	0.99	2.09	2.12	t-stat	1.50	1.82	2.61	2.42	0.55	0.91	0.91	2.32	2.26
Std	13.42	7.93	4.14	3.39	8.35	20.25	16.23	17.44	14.06	Std	13.42	7.76	4.56	3.23	7.81	19.70	15.91	16.80	13.61
SR	0.30	0.37	0.57	0.53	0.04	0.20	0.19	0.52	0.52	SR	0.29	0.36	0.52	0.50	0.10	0.17	0.17	0.57	0.55
AC(1)	0.03	0.07	0.08	0.10	0.01	0.01	0.01	0.11	0.11	AC(1)	0.03	0.04	0.08	0.10	-0.01	0.00	0.00	0.11	0.10
Pre- β	-63.64	-20.37	4.54	30.02	79.04	-142.68	-114.76			Pre- β	-42.26	-12.76	3.04	20.03	51.63	-93.89	-75.46		
Panel C: ED 1										Panel D: ED 2									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	4.71*	3.35**	2.66***	1.11	-0.40	5.34	4.27	9.01**	7.25**	Mean	4.42	3.55**	2.33***	1.24**	-0.05	4.77	4.07	8.96**	7.13**
t-stat	1.88	2.15	3.21	1.54	-0.26	1.46	1.45	2.10	2.12	t-stat	1.64	2.19	2.69	1.99	-0.03	1.20	1.26	2.00	1.99
Std	13.18	7.99	4.24	3.43	8.08	19.69	15.92	17.48	14.19	Std	13.83	8.22	4.23	3.16	8.21	20.61	16.76	18.43	15.07
SR	0.36	0.42	0.63	0.32	0.05	0.27	0.27	0.52	0.51	SR	0.32	0.43	0.55	0.39	0.01	0.23	0.24	0.49	0.47
AC(1)	0.00	0.05	0.08	0.16	0.00	-0.03	-0.02	0.09	0.09	AC(1)	0.03	0.06	0.10	0.03	0.01	0.01	0.01	0.10	0.10
Pre- β	-39.35	-13.40	1.52	16.79	43.94	-83.29	-67.19			Pre- β	-37.57	-12.15	2.28	16.96	42.69	-80.26	-64.77		

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Table IA.25 (Continued)

	Panel E: ED 3										Panel F: ED 4								
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	4.33	3.75**	2.32***	1.42**	-0.32	4.94	4.15	9.45**	7.58**	Mean	4.86*	3.37**	2.14**	1.46**	-0.35	5.50	4.34	9.39**	7.42**
t-stat	1.59	2.30	2.62	2.18	-0.20	1.23	1.27	2.11	2.10	t-stat	1.75	2.39	2.39	2.06	-0.22	1.38	1.39	2.11	2.16
Std	13.90	8.34	4.26	3.26	8.27	20.78	16.95	18.15	14.92	Std	13.89	7.26	4.55	3.57	8.03	20.44	16.16	17.98	14.18
SR	0.31	0.45	0.54	0.43	0.04	0.24	0.25	0.52	0.51	SR	0.35	0.46	0.47	0.41	0.04	0.27	0.27	0.52	0.52
AC(1)	0.04	0.05	0.13	0.05	0.00	0.01	0.01	0.11	0.11	AC(1)	0.07	0.04	0.07	0.04	0.00	0.03	0.03	0.11	0.11
Pre- β	-37.41	-12.17	0.01	12.94	37.18	-74.60	-59.72			Pre- β	-38.80	-14.57	-1.67	10.98	34.89	-73.69	-59.14		
	Panel G: ED (Mean)																		
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}										
Mean	4.46*	3.73**	2.33***	1.29*	-0.33	5.08	4.28	9.33**	7.50**										
t-stat	1.65	2.27	2.80	1.96	-0.21	1.28	1.32	2.10	2.09										
Std	13.83	8.37	4.14	3.30	8.22	20.63	16.85	18.37	15.06										
SR	0.32	0.45	0.56	0.39	0.04	0.25	0.25	0.51	0.50										
AC(1)	0.03	0.05	0.09	0.06	0.00	0.01	0.01	0.10	0.10										
Pre- β	-37.14	-15.76	-2.95	9.85	31.08	-68.22	-55.31												

TABLE IA.26
BETA-SORTED PORTFOLIO STATISTICS: FOMC STATEMENT WINDOW

The table presents summary statistics of portfolios of investment strategies sorted on exposures to FOMC statement window announcement shocks. For 153 investment strategies, on the day of an FOMC announcement pre-formation betas are estimated given the exposure of each daily factor return to the the change in the high-frequency change in the one- to four-quarter Euro-Dollar futures price ($ED\ 1-4$), and the average across these surprises ($ED\ (Mean)$) of Acosta et al. (2025). These regressions are estimated over rolling windows of 36 FOMC announcements, and include as control the simultaneous high-frequency change in the US stock market, S&P 500. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each FOMC announcement. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return ($Mean$), t -statistic computed using Newey and West (1987) standard errors ($t-stat$), standard deviation (Std), Sharpe ratio (SR), first-order autocorrelation coefficient ($AC(1)$), and the average portfolio-level monetary policy shock exposure ($Pre-\beta$). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jan/1999 to Dec/2024. The last two columns of each panel present the LMH and RNK portfolio returns de-noised using the three-pass estimator (LMH^{3P} and RNK^{3P}). Latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ US investment strategy returns. Portfolios are de-noised using the optimal US SDF, which comprises 14 latent factors. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated as in Giglio and Xiu (2021). The sample of returns is from Jan/1999 to Dec/2024.

Panel A: ED 1										Panel B: ED 2									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	3.96*	3.25**	2.39***	1.87***	0.02	4.23	3.20	9.72**	7.53**	Mean	3.60	3.79**	2.31***	1.48**	0.34	3.60	3.31	8.98**	7.25**
t-stat	1.65	2.21	2.65	2.72	-0.01	1.12	1.08	2.24	2.23	t-stat	1.37	2.43	2.77	2.28	0.19	0.90	1.04	2.02	2.06
Std	12.87	7.57	4.37	3.34	9.12	20.21	15.92	17.22	13.63	Std	13.71	7.79	4.01	3.40	9.03	20.92	16.64	17.99	14.35
SR	0.31	0.43	0.55	0.56	0.00	0.21	0.20	0.56	0.55	SR	0.26	0.49	0.58	0.43	0.04	0.17	0.20	0.50	0.50
AC(1)	-0.02	0.06	0.10	0.08	0.03	-0.02	-0.02	0.09	0.09	AC(1)	0.01	0.09	0.14	-0.04	0.02	0.00	0.00	0.08	0.09
Pre- β	-44.83	-14.88	0.79	16.89	46.31	-91.15	-73.26			Pre- β	-38.58	-11.89	2.52	16.93	43.18	-81.76	-65.68		
Panel C: ED 3										Panel D: ED 4									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	3.51	3.89**	2.45***	1.51**	0.18	3.68	3.46	9.23**	7.27**	Mean	4.47	4.01**	2.25***	1.20*	-0.39	5.20	4.44	10.38**	8.54**
t-stat	1.29	2.49	2.82	2.43	0.10	0.91	1.06	2.07	2.04	t-stat	1.64	2.55	2.76	1.84	-0.24	1.30	1.38	2.35	2.41
Std	14.03	7.90	4.09	3.32	8.93	21.22	17.03	18.26	14.72	Std	14.18	7.99	4.04	3.34	8.66	21.23	17.07	18.12	14.62
SR	0.25	0.49	0.60	0.45	0.02	0.17	0.20	0.51	0.49	SR	0.32	0.50	0.56	0.36	0.05	0.25	0.26	0.57	0.58
AC(1)	0.02	0.07	0.17	-0.06	0.00	-0.01	0.00	0.08	0.09	AC(1)	0.02	0.06	0.10	-0.02	-0.01	-0.01	-0.01	0.09	0.09
Pre- β	-41.00	-13.39	1.01	15.91	43.28	-84.28	-67.61			Pre- β	-38.92	-12.92	0.59	14.15	39.32	-78.25	-62.73		
Panel E: ED (Mean)																			
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}										
Mean	3.80	4.03***	2.33***	1.33**	0.03	4.12	3.71	9.69**	7.76**										
t-stat	1.42	2.65	2.77	2.14	0.02	1.03	1.16	2.17	2.20										
Std	13.91	7.72	4.03	3.31	9.00	21.13	16.83	18.17	14.48										
SR	0.27	0.52	0.58	0.40	0.00	0.19	0.22	0.53	0.54										
AC(1)	0.01	0.07	0.14	-0.06	0.01	-0.01	-0.01	0.08	0.09										
Pre- β	-36.56	-12.90	-0.20	12.30	34.64	-71.20	-57.24												

TABLE IA.27
BETA-SORTED PORTFOLIO STATISTICS: FOMC PRESS CONFERENCE WINDOW

The table presents summary statistics of portfolios of investment strategies sorted on exposures to FOMC press conference window announcement shocks. For 153 investment strategies, on the day of an FOMC announcement pre-formation betas are estimated given the exposure of each daily factor return to the change in the high-frequency change in the one- to four-quarter Euro-Dollar futures price ($ED\ 1-4$), and the average across these surprises ($ED\ (Mean)$) of Acosta et al. (2025). These regressions are estimated over rolling windows of 36 FOMC announcements, and include as control the simultaneous high-frequency change in the US stock market, S&P 500. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs the day following each FOMC announcement. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return ($Mean$), t -statistic computed using Newey and West (1987) standard errors ($t-stat$), standard deviation (Std), Sharpe ratio (SR), first-order autocorrelation coefficient ($AC(1)$), and the average portfolio-level monetary policy shock exposure ($Pre-\beta$). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2019 to Dec/2024. The last two columns of each panel present the LMH and RNK portfolio returns de-noised using the three-pass estimator (LMH^{3P} and RNK^{3P}). Latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ US investment strategy returns. Portfolios are de-noised using the optimal US SDF, which comprises 14 latent factors. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated as in Giglio and Xiu (2021). The sample of returns is from Jan/1999 to Dec/2024.

Panel A: ED 1										Panel B: ED 2									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	-0.14	2.28	2.21	0.98	1.43	-1.66	-0.78	-2.24	-0.38	Mean	0.96	2.81	1.83	1.73	-0.50	1.32	1.18	-3.65	-2.59
t-stat	-0.07	1.08	1.39	0.46	0.37	-0.32	-0.20	-0.49	-0.11	t-stat	0.49	1.38	1.15	0.81	-0.13	0.25	0.30	-0.73	-0.73
Std	4.77	4.50	3.37	4.79	9.21	12.63	9.58	8.42	6.01	Std	4.84	4.42	3.49	4.72	9.25	12.81	9.36	11.50	8.91
SR	0.03	0.51	0.66	0.21	0.16	0.13	0.08	0.27	0.06	SR	0.20	0.64	0.52	0.37	0.05	0.10	0.13	0.32	0.29
AC(1)	-0.05	0.23	0.25	0.12	-0.03	-0.07	-0.08	0.00	0.01	AC(1)	-0.09	0.19	0.17	0.16	0.05	-0.02	-0.01	0.04	0.03
Pre- β	-17.47	-4.99	1.54	8.06	23.48	-40.96	-32.76			Pre- β	-25.48	-4.94	4.63	15.08	41.15	-66.63	-52.77		
Panel C: ED 3										Panel D: ED 4									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	-0.92	2.46*	2.62	1.41	1.08	-2.50	-1.19	-8.24*	-5.71	Mean	-0.74	0.98	2.16	1.14	2.95	-4.19	-2.99	-10.07*	-7.81*
t-stat	-0.47	1.81	1.67	0.52	0.25	-0.46	-0.27	-1.71	-1.44	t-stat	-0.32	0.83	1.38	0.44	0.64	-0.69	-0.61	-1.91	-1.80
Std	4.62	2.91	3.38	5.79	9.70	12.83	10.05	16.76	13.10	Std	5.33	2.51	3.48	5.48	10.34	13.89	11.05	19.60	16.16
SR	0.20	0.85	0.78	0.24	0.11	0.19	0.12	0.49	0.44	SR	0.14	0.39	0.62	0.21	0.29	0.30	0.27	0.51	0.48
AC(1)	-0.02	0.22	0.21	0.21	0.07	0.01	0.07	0.02	0.02	AC(1)	0.07	0.24	0.13	0.27	0.11	0.07	0.09	0.03	0.03
Pre- β	-22.40	-5.45	2.68	12.16	33.95	-56.34	-44.80			Pre- β	-25.18	-5.95	2.91	13.08	37.98	-63.16	-50.14		
Panel E: ED (Mean)																			
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}										
Mean	-1.20	2.57*	2.63	1.36	1.33	-2.95	-1.33	-7.21	-5.02										
t-stat	-0.62	1.88	1.63	0.53	0.31	-0.54	-0.30	-1.50	-1.27										
Std	4.62	2.89	3.59	5.56	9.88	12.86	10.10	15.95	12.15										
SR	0.26	0.89	0.73	0.24	0.13	0.23	0.13	0.45	0.41										
AC(1)	-0.03	0.25	0.12	0.19	0.08	0.00	0.05	0.02	0.02										
Pre- β	-23.62	-6.01	2.97	12.10	34.25	-57.87	-46.08												

TABLE IA.28
BETA-SORTED PORTFOLIO STATISTICS: FOMC & EURO AREA RETURNS

The table presents summary statistics of portfolios of euro area investment strategies sorted on exposures to FOMC monetary policy announcement shocks. For 153 investment strategies, on the day of an FOMC announcement pre-formation betas are estimated given the exposure of each two-day factor return (sum of FOMC dates d and $d + 1$) to the change in the high-frequency change in the one- to four-quarter Euro-Dollar futures price ($ED\ 1-4$), the average across these surprises ($ED\ (Mean)$), as well as both the first principal component across Federal Funds and Euro-Dollar futures ($PC(1)$), and the ‘poor-man’ sign-restricted shock $MP\ (PM)$ of [Jarociński and Karadi \(2020\)](#). These regressions are estimated over rolling windows of 36 FOMC announcements, and include as control the simultaneous high-frequency change in the US stock market, S&P 500. Five portfolios are formed (P1-5) by sorting investment strategies into quintile portfolios given their beta exposures, as well as low-minus-high (LMH) and rank (RNK) portfolios. Rebalancing occurs two days following each FOMC announcement. Portfolio returns are scaled to the monthly level by taking the cumulative product of daily discrete returns, and then annualized. Reported are the unconditional return ($Mean$), t -statistic computed using [Newey and West \(1987\)](#) standard errors ($t-stat$), standard deviation (Std), Sharpe ratio (SR), first-order autocorrelation coefficient ($AC(1)$), and the average portfolio-level monetary policy shock exposure ($Pre-\beta$). All shocks are standardized over the full sample to have zero mean and unit standard deviation, for interpretability. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively. The sample of returns is from Jul/2000 to Dec/2024. The last two columns of each panel present the LMH and RNK portfolio returns de-noised using the three-pass estimator (LMH^{3P} and RNK^{3P}). Latent factors are obtained by applying RP-PCA with RP-weight $\omega = 20$ to the $N = 153$ euro area investment strategy returns. Portfolios are de-noised using the optimal euro area SDF, which comprises 11 latent factors. ***, ** and * correspond to a rejection of the null hypothesis that the coefficient is zero at the 1%, 5% and 10% confidence levels, respectively, where standard errors are calculated as in [Giglio and Xiu \(2021\)](#). The sample of returns is from Jul/2000 to Dec/2024.

Panel A: PC (1)										Panel B: MP (PM)									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	2.47**	3.10***	3.20***	3.39***	1.94	0.44	0.24	2.78	2.25	Mean	2.29**	3.30***	3.62***	2.72***	2.13*	0.06	0.27	2.81	2.26
t-stat	2.18	3.89	3.90	4.39	1.59	0.23	0.16	1.26	1.26	t-stat	2.44	4.25	4.52	3.18	1.80	0.03	0.19	1.41	1.42
Std	5.05	3.80	3.85	3.56	5.91	9.11	7.33	5.07	4.11	Std	4.46	3.64	3.80	3.86	5.64	8.36	6.72	4.80	3.93
SR	0.49	0.82	0.83	0.95	0.33	0.05	0.03	0.55	0.55	SR	0.51	0.91	0.95	0.70	0.38	0.01	0.04	0.58	0.58
AC(1)	0.20	0.09	0.09	0.13	0.13	0.12	0.14	0.20	0.22	AC(1)	0.13	0.10	0.07	0.15	0.16	0.12	0.12	0.20	0.20
Pre- β	-76.47	-29.00	-1.18	26.51	81.09	-157.56	-126.56			Pre- β	-60.82	-24.41	-1.89	19.45	59.63	-120.45	-97.06		
Panel C: ED 1										Panel D: ED 2									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	2.36**	3.11***	3.14***	3.54***	1.94	0.35	0.08	1.14	0.88	Mean	2.99**	3.49***	3.20***	3.12***	1.30	1.61	1.27	3.59	2.77
t-stat	2.35	3.98	3.84	4.34	1.43	0.18	0.05	0.57	0.57	t-stat	2.43	4.35	3.74	3.85	1.11	0.81	0.80	1.64	1.59
Std	4.66	3.62	3.74	3.94	6.38	9.25	7.46	5.55	4.52	Std	5.36	3.80	3.85	3.74	5.66	9.30	7.40	5.45	4.39
SR	0.51	0.86	0.84	0.90	0.30	0.04	0.01	0.21	0.20	SR	0.56	0.92	0.83	0.84	0.23	0.17	0.17	0.66	0.63
AC(1)	0.13	0.15	0.12	0.07	0.15	0.10	0.09	0.12	0.12	AC(1)	0.22	0.10	0.16	0.12	0.15	0.16	0.17	0.23	0.24
Pre- β	-53.84	-20.02	1.24	20.75	57.51	-111.35	-89.80			Pre- β	-57.98	-21.20	1.79	23.37	62.41	-120.39	-97.29		

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Table IA.28 (Continued)

Panel E: ED 3										Panel F: ED 4									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}		P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	2.85**	3.10***	3.69***	3.25***	1.22	1.56	1.14	3.89*	2.87	Mean	1.99**	3.17***	3.58***	3.91***	1.46	0.47	0.14	3.27	2.52
t-stat	2.40	3.93	3.99	4.04	1.07	0.80	0.73	1.74	1.57	t-stat	2.29	3.90	4.18	4.77	1.25	0.28	0.11	1.60	1.56
Std	5.10	3.75	4.10	3.70	5.52	8.89	7.15	5.16	4.30	Std	4.11	3.87	4.08	3.50	5.67	8.19	6.33	4.57	3.44
SR	0.56	0.82	0.90	0.88	0.22	0.18	0.16	0.75	0.67	SR	0.48	0.82	0.88	1.12	0.26	0.06	0.02	0.71	0.73
AC(1)	0.25	0.08	0.19	0.10	0.16	0.21	0.20	0.32	0.33	AC(1)	0.13	0.07	0.08	0.21	0.14	0.13	0.14	0.22	0.25
Pre- β	-50.28	-19.70	-0.06	18.76	50.78	-101.07	-81.86			Pre- β	-50.54	-20.47	-1.52	16.86	48.10	-98.64	-79.90		

Panel G: ED (Mean)									
	P1	P2	P3	P4	P5	LMH	RNK	LMH ^{3P}	RNK ^{3P}
Mean	2.59**	3.22***	3.45***	3.47***	1.38	1.12	0.73	3.41	2.61
t-stat	2.27	3.98	3.79	4.41	1.20	0.59	0.47	1.58	1.48
Std	5.04	3.74	4.08	3.66	5.53	8.86	7.20	5.10	4.26
SR	0.51	0.86	0.84	0.95	0.25	0.13	0.10	0.67	0.61
AC(1)	0.21	0.13	0.16	0.09	0.16	0.18	0.18	0.25	0.26
Pre- β	-45.36	-18.34	-1.60	14.41	42.65	-88.00	-71.17		

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