The Value of QE Contingent Promises*

Felix Corell
VU Amsterdam

Fédéric Holm-Hadulla
European Central Bank

Matteo Leombroni
Boston College

Lira Mota
MIT

Melina Papoutsi
European Central Bank

September 15, 2025

Abstract

Quantitative easing provides implicit insurance to bond investors by absorbing excess supply during market distress. Using Euro Area data, we find this contingent promise explains 75% of spread differences between QE-eligible and ineligible corporate bonds. Mutual funds, especially those with high flow volatility, systematically shift toward eligible bonds, revealing through their portfolio choices that they value QE eligibility more than other investors. This differential valuation creates stronger QE price reactions in bonds held by flow-sensitive funds. These findings reveal how investor heterogeneity in valuing contingent central bank support shapes the transmission of monetary policy.

*Corell: Vrije Universiteit Amsterdam, f.c.corell@vu.nl; Holm-Hadulla: European Central Bank, Federic.Holm-Hadulla@ecb.europa.eu; Leombroni: Finance Department, Boston College, leombron@bc.edu; Mota: Finance Department, MIT, liramota@mit.edu; Papoutsi: European Central Bank, melina.papoutsi@ecb.europa.eu. The view expressed here are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem.

Large-scale asset purchases have reshaped the corporate bond market (Haddad et al., 2024). Quantitative easing (QE) policies absorb bond supply during periods of stress, mitigating the price impact of fire sales and providing insurance to bond investors who might need to sell in times of distress. At the time of the announcement, investors revise their expectations about state-contingent policy interventions, which have large implications for asset valuations (Haddad et al. (2023)). In this paper, we use granular data on euro area bond prices and portfolio holdings to quantify the ex ante value of state-contingent corporate bond purchases. We show that heterogeneous investors assign different values to this insurance protection. This difference in valuation translates into variation in bond market responses that stems from investor base heterogeneity across bonds. Our results highlight that insurance provided by central banks might be one of the main ways QE affects asset pricing, and how investors value this insurance is key to explaining the transmission of monetary policy.

We examine two major ECB corporate bond purchase program announcements: the Corporate Sector Purchase Programme (CSPP) and Pandemic Emergency Purchase Programme (PEPP). We explore a key design feature of these programs: at each announcement, the ECB specified that only a subset of corporate bonds would be eligible for purchase. This setting allows us to isolate the effects of policy news on different segments of the market. While prior research documents persistent spread differentials between eligible and ineligible bonds of similar ratings and maturities (Todorov (2020)), we contribute with three novel findings. First, decomposing the announcement impact on corporate bond spreads into a default risk component (captured by CDS spreads) and a non-default component (the CDS-bond basis), we show that movements in the basis account for roughly 75% of the overall decline in spreads at the time of the announcement. Second, we find that mutual funds rebalanced toward eligible bonds rather than selling them to the ECB, with the shift being especially pronounced among funds with more flighty assets under management, measured by the standard deviation of their net inflows. Third, bonds with higher mutual fund ownership experienced larger spread reductions, driven primarily by stronger declines in the CDS–bond basis.

Taken together, these results highlight the central role of *conditional policy promises* in QE transmission. The dominance of basis movements over credit risk changes suggests that investors primarily value the ECB's commitment to provide liquidity support, rather than viewing QE as reducing default risk. Mutual funds—being more vulnerable to outflows during recessions (Coppola, 2021)—derive greater value from the insurance channel and consequently increase their demand for eligible bonds. Finally, the amplified price responses in bonds held by these insurance-sensitive investors show how the heterogeneous valuation of state-contingent promises creates differential transmission effects across the bond universe.

This conditional promise mechanism operates beyond traditional portfolio balance channels. The ECB's announcements induced an outward shift in mutual fund demand for eligible bonds, amplifying rather than offsetting the direct policy transmission to corporate spreads. More broadly, our findings reveal that interpreting QE solely as a supply shock—with effects determined by pre-existing investor demand elasticities (Koijen and Yogo, 2019)—substantially understates its market impact. The evidence demonstrates that the policy systematically altered the perceived characteristics of eligible bonds, generating endogenous shifts in investor demand that magnify transmission effects. This finding suggests that central bank asset purchases derive much of their potency from their capacity to credibly alter the liquidity properties of targeted securities.

Our findings have important implications for monetary policy. First, they show that central banks can substantially influence corporate bond prices by committing to decisive actions in times of distress, even while maintaining a lean balance sheet. Second, the composition of the financial sector shapes the strength of transmission, with a larger presence of mutual funds amplifying policy effectiveness.

Our analysis leverages confidential sector-level portfolio holdings from the ECB's Securities Holdings Statistics (SHSS) combined with granular mutual fund data from Morningstar. We match these holdings with monthly corporate bond prices and bond characteristics from the ECB's Centralised Securities Database (CSDB), complemented by daily data from Markit iBoxx. The empirical analysis is guided throughout by a simple model that informs both the interpretation of the results and the identification strategy.

We develop a standard mean-variance portfolio choice model augmented with an additional component that captures service flows provided by corporate bonds, as in Corell et al. (2023). These services encompass any features that investors value beyond the promised cash flows during the bond's life, such as liquidity, collateral value, or regulatory capital value. Investors differ both in their risk tolerance and in the intensity with which they value these attributes. In equilibrium, all investors hold a combination of the aggregate market portfolio and a tilt toward bonds whose services they value more than the average investor. Equilibrium prices incorporate a convenience yield component that reflects the aggregate value of these service flows.

The model yields three main predictions. First, when a policy increases the service value of eligible bonds, their convenience yield rises, raising prices and potentially lowering expected returns. Second, investors with stronger preferences for these services rebalance toward the affected bonds, while others reduce their exposure. Third, a reduction in the supply of an asset (holding services constant) lowers its expected return, with the magnitude of the effect depending on the elasticity of the relevant investor segment, as more elastic investors sell more aggressively, dampening the impact. When a policy simultaneously alters both supply and service value, the net portfolio adjustment depends on the relative strength of these two channels. Extending the framework to segmented markets, where investors are restricted to particular subsets of assets by mandates or constraints, shows that the composition and elasticity of each segment become central in determining the balance between supply and service effects, and hence the overall transmission of policy.

Guided by the model framework, we design a set of empirical tests to examine the transmission of ECB policy announcements. Our main focus is the initial announcement of the Corporate Sector Purchase Programme (CSPP) in March 2016, which was largely unexpected and generated sizable effects in corporate bond markets. Because this episode did not occur during a crisis, it provides a clean setting to evaluate the model's predictions in a relatively stable environment. We then complement this analysis with evidence from the announcement of the Pandemic Emergency Purchase Programme (PEPP) at the onset of the COVID-19 crisis, which offers a contrasting context and allows us to assess both the robustness of the results and the underlying transmission mechanism.

We use the CDS-bond basis as a proxy for convenience yield. The CDS-bond basis can be understood as the wedge between the credit protection price implied by credit default swaps (CDS) and the credit risk premium embedded in corporate bond yields. A positive basis indicates that investors are willing to accept lower yields on bonds relative to their CDS-implied fair value, reflecting a non-pecuniary benefit or convenience yield from holding the bonds. In this sense, movements in the CDS-bond basis capture shifts in the value investors attach to the services flows provided by corporate bonds beyond their expected cash flows.[1]

First, using daily data we show that the announcement of the CSPP was followed by a decline of about 35 basis points in the credit spreads of eligible bonds in the weeks immediately after the announcement. We then use maturity-matched CDS spreads to compute the CDS-bond basis, and show that nearly all of the impact on credit spreads is explained by an increase of roughly 30 basis points in this non-default risk component. For the PEPP, announced in March 2020 at the onset of the COVID-19 crisis, credit spreads initially widened sharply but reversed after the program was launched, with eligible bonds experiencing a decline of about 40 basis points in the month following the announcement. Similarly, we find that a large chunk of the variation is due to variation in the CDS-bond basis.

While these high-frequency estimates capture the immediate market reaction, they may also reflect other contemporaneous news unrelated to the program. To address this concern, we exploit a key feature of the policy design: at the time of the announcement, the ECB

[1]See, among others, Bai and Collin-Dufresne (2019), Mota (2023), Corell et al. (2023), for the interpretation of the CDS-bond basis.

specified that only euro-denominated investment-grade corporate bonds issued by non-bank corporations in the euro area would be *eligible* for purchase. This restriction allows us to implement a difference-in-differences strategy, comparing changes in yields of eligible (treated) and ineligible (control) bonds.

The difference-in-differences analysis shows a strong impact of both announcements. For the CSPP, credit spreads of eligible bonds fell by about 25–30 basis points relative to ineligible bonds, with roughly three quarters of this decline—around 19–20 basis points—driven by a compression in the CDS-bond basis and only 6–7 basis points explained by changes in CDS spreads. No significant movements are observed in the OIS curve, confirming that risk-free rates did not account for the effect. For the PEPP, eligible bonds experienced a relative decline of about 10–15 basis points, again almost entirely explained by movements in the CDS-bond basis, while CDS spreads remained unchanged. Taken together, the results from both episodes indicate that the transmission of corporate bond purchases operated primarily through an increase in the convenience yield of eligible bonds rather than through changes in default risk.

Moreover, the close alignment between announcement-window estimates and difference-in-differences results reflects that the gap between eligible and ineligible bonds widened sharply at announcement and remained stable thereafter (Haddad et al., 2024), even though actual purchases began several months later. As we show in additional evidence, this persistence is consistent with announcement effects being the key driver of policy transmission rather than the mechanical impact of bond purchases themselves.

Finally, the smaller decline in spreads observed around the PEPP announcement, compared with the initial CSPP launch, is consistent with the idea that investors had already internalized the possibility of central bank intervention. By March 2020, market participants had learned from previous experience that large-scale purchases were a likely policy response to severe stress in corporate bond markets. As a result, the incremental information content of the PEPP announcement was lower, and its effect on credit spreads, though still sizable, was more muted. This pattern underscores that what ultimately drives convenience yields is not the absolute size of central bank purchases, but rather the extent to which actual interventions exceed or fall short of investors' prior expectations.

Second, we study portfolio rebalancing around the CSPP and PEPP announcements to assess how different investor sectors responded, allowing us to identify the mechanism through which QE affects convenience yields. The logic is that by observing which investors rebalance toward now-expensive eligible bonds, we can infer through revealed preferences that these investors particularly value eligibility. We then use knowledge of investor business models to identify the specific service being valued. In particular, when we observe mutual funds—who face significant redemption risk—purchasing more expensive eligible bonds, this allows us to infer that QE primarily operates by providing additional liquidity insurance.

In the quarter following the CSPP announcement, mutual funds purchased about €21 billion of eligible bonds while selling sovereign bonds, raising the eligible share of their overall portfolios by 2.5 percentage points; by the end of 2016 the increase reached 2.62 percentage points. This shows that mutual funds actively reallocated toward the bonds targeted by the ECB. Insurance companies and pension funds also increased their holdings of eligible bonds, but the rise in portfolio shares was modest as they simultaneously accumulated sovereign and ineligible bonds. Banks and foreign investors, in contrast, were the main sellers to the ECB. A similar pattern is observed during the PEPP: mutual funds again emerged as the dominant private-sector buyers, adding roughly €34 billion of eligible bonds while reducing sovereign and ineligible positions, whereas insurance companies and pension funds raised their eligible holdings only marginally.

We formally assess portfolio rebalancing using a difference-in-differences approach that compares changes in holdings of eligible and ineligible corporate bonds around the ECB announcements. For the CSPP, we find that mutual funds increased their average holdings of eligible bonds by about 10% relative to their pre-announcement portfolios, while insurance companies, pension funds, and banks showed no significant adjustment, and other domestic investors and foreign investors reduced their positions. For the PEPP, the results are consistent: mutual funds again increased their holdings of eligible bonds by about 8%, whereas other sectors were net sellers. These findings indicate that mutual funds rebalanced strongly toward the securities targeted by the ECB, even as prices rose. Because mutual fund asset demand curves are typically downward sloping (Bretscher et al., 2021; Koijen et al., 2021), we interpret this as an outward shift in their demand curves rather than movement along existing demand curves. Mutual funds thus play a distinct role in the transmission of corporate bond purchases, amplifying policy effects through endogenous demand responses.

To provide further support for the QE insurance mechanism, we employ detailed fund-level holdings data from Morningstar that allows us to explore heterogeneity across funds (whereas the SHS data are aggregated at the sector-level). We develop a measure of investor base flightiness, intended to capture mutual funds' exposure to redemption risk. The premise is that funds with more volatile fund flows place a higher value on the ability to sell, especially in periods of distress. Therefore, everything else being constant, high-flow volatility funds value eligible bonds more than other funds. Our findings support this hypothesis. A one-standard deviation increase in ex ante flow volatility shifts the fund's portfolio by x% more towards eligible bonds after the announcement of CSPP. Furthermore, we show that funds rebalanced towards eligible bonds by reducing their cash and sovereign bond holdings, which suggests that fund managers view eligible corporate bonds as close substitutes to the most liquid assets in their portfolio.

In summary, our analysis of portfolio rebalancing across different investor types provides strong evidence that (1) QE affects the convenience yield of eligible bonds relative to ineligible ones, and (2) this effect is likely driven by the increased liquidity of eligible bonds, as mutual funds—being the sector that values liquidity the most—rebalance their portfolios toward these higher-priced bonds.

Third, we examine how investor composition shapes the transmission of corporate bond purchases. In line with our model, we find that bonds with higher mutual fund ownership exhibit significantly larger yield declines in the two weeks following the CSPP announcement. The difference is sizable: credit spreads fall by roughly 5 basis points for bonds with about 20% mutual fund ownership, compared to declines of around 70 basis points for bonds with 50% ownership. These effects are large relative to the average decline of 30–40 basis points across all eligible bonds and are driven primarily by movements in the CDS-bond basis. The evidence indicates that mutual funds acted as "helping hands" in the transmission of the policy, consistent with the insurance channel mechanism outlined in our framework.

We confirm this pattern using a difference-in-differences approach that interacts bond eligibility with the pre-announcement investor base. For the CSPP, we estimate that a ten-percentage-point higher mutual fund ownership share is associated with an additional compression of about 3.7 basis points in credit spreads, equivalent to roughly 6.7 basis points for a one-standard-deviation increase in holdings. The effect is concentrated in the CDS–bond basis rather than in CDS spreads, supporting the interpretation that the transmission operated mainly through the convenience yield channel. By contrast, the corresponding coefficients for insurance companies and pension funds are small and statistically insignificant. For the PEPP, the results are qualitatively similar, with bonds more heavily held by mutual funds experiencing stronger relative yield declines, though the estimates are less precise given the heightened market volatility during the COVID-19 crisis.

Our findings inform how central banks should conduct monetary policy. Conditional promises and the option to sell bonds to the central bank have significant effects on corporate bond yields at the time of announcements. This implies that central banks can achieve meaningful reductions in corporate bond yields while maintaining a lean balance sheet. As the ECB revises its strategy and moves toward a smaller balance sheet, our results suggest that it can still effectively mitigate dislocations in the corporate bond market by intervening decisively in times of turmoil.

Our findings also shed light on the role of investor demand (Koijen and Yogo, 2019). We show that the standard interpretation of QE as a supply shock, where the impact depends on market elasticity, must be complemented by considering the effects of policy on asset characteristics. In particular, policy changes the characteristics of QE-eligible bonds and can shift investor demand in addition to reducing supply through central bank purchases, thereby significantly strengthening transmission. Moreover, our results suggest that a larger presence of mutual funds—typically viewed as elastic investors that would dampen policy effects—can instead amplify transmission.

I. Literature Review

Our paper contributes to three strands of literature. First, we contribute to the literature interpreting quantitative easing announcements as state-contingent commitments by the central bank (Haddad et al., 2023, 2024; Hanson et al., 2020). We provide new evidence on the ECB's corporate QE announcements, emphasizing the role of heterogeneous intermediaries, particularly mutual funds vulnerable to outflows during recessions that exacerbate fire-sale dynamics (Coppola, 2021) and heighten corporate bond market fragility (Darmouni and Siani, 2022). Prior work on U.S. corporate bond market disruptions during COVID-19 (Haddad et al., 2021) documented how the Federal Reserve's corporate bond purchase announcements coincided with the disappearance of dislocations and price recovery, likely through alleviating acute liquidity needs among mutual funds. Our analysis advances this literature by examining both the pandemic period and, crucially, the ECB's initial corporate QE announcement in relatively calm conditions. Our contribution is to quantify the value of central bank liquidity insurance. Using granular holdings data, we show that conditional promises embedded in ECB policy had sizable effects amplified by mutual fund rebalancing toward eligible bonds.

Our findings also shed light on the extent to which central banks can influence non-bank financial intermediaries. Breckenfelder and Hoerova (2023) show that during the Covid-19 outbreak, when corporate bond markets were in severe distress, funds holding a higher proportion of assets eligible for purchase in their portfolios before the crisis experienced improved performance and experienced smaller outflows after the announcement of the European Central Bank's large-scale asset purchase program. This aligns with the strategy of mutual funds to strategically maintain eligible bonds, even if they appear relatively expensive compared to other bonds with similar credit and duration risks. This practice serves as a safeguard against fire sale discounts, effectively acting as insurance for funds. The direct impact of monetary policy on services like liquidity or collateral value highlights the important consideration for policy makers on their impact on asset prices and capital allocation.

Second, we contribute to the literature on corporate bond purchases. Todorov (2020) and Zaghini (2020) documented ECB announcement effects on corporate bond yields, with Todorov (2020) showing significant liquidity effects.[2] Haddad et al. (2021); Gilchrist et al. (2024); Darmouni and Siani (2022) examine Fed announcements during the pandemic crisis, discussing how announcements provided liquidity to mutual funds during fire sales. We provide direct evidence that mutual funds played a key role in the ECB's 2016 announcement outside of recession conditions.

Third, we contribute to the demand-based asset pricing literature emphasizing heterogeneous financial intermediaries in shaping asset prices (Koijen et al., 2021; Koijen and Yogo, 2019). Low investor demand elasticity often rationalizes significant QE effects documented using high-frequency identification.[3] Corporate bond investors differ significantly in price elasticities: insurance companies have low elasticity while mutual funds are more elastic (Koijen et al., 2021; Bretscher et al., 2021). Standard theory predicts elastic investors would sell bonds to the central bank, with bonds heavily held by mutual funds experiencing smaller yield declines. Breckenfelder and De Falco (2024) show that this channel is crucial for capturing the effects of QE on government bonds purchased by the ECB during the implementation phase. Our results contrast with this prediction, showing that beyond elasticities, conditional promises matter. Mutual funds place high value on these commitments and rebalanced toward eligible bonds, amplifying effects rather than dampening them.

II. Model

In this section, we present an asset pricing model, similar to that in Corell et al. (2023), in which investors value financial assets not only for their cash flows but also for a vector of service attributes they provide. We generalize their approach to accommodate market segmentation. Our goal is to describe convenience yields and their connections to portfolio allocations.

A. Setup

We study a market with N risky assets indexed by $n \in \{1, \ldots, N\}$ and a continuum of heterogeneous investors i. Investors differ in their risk tolerance and in how strongly they value non-pecuniary benefits from holding assets.

[2]Other CSPP studies include Abidi and Miquel-Flores (2018); De Santis et al. (2018); De Santis and Zaghini (2021). D'Amico and Kaminska (2019) studies UK corporate purchases.

[3]Gagnon et al. (2011); Krishnamurthy and Vissing-Jorgensen (2011) study Fed QE announcements. Altavilla et al. (2015) and Krishnamurthy et al. (2017) focus on ECB government bond purchases.

Let r_t be the vector of excess returns:

$$r_t = \mu_t + \epsilon_t, \qquad \epsilon_t \sim \mathcal{N}(0, \Sigma_t),$$

where μ_t is the $N \times 1$ vector of expected excess returns, and Σ_t is the $N \times N$ positive definite covariance matrix. Each asset has characteristics z_t that give investors utility beyond expected returns. Investors value these characteristics differently, with loadings λ_{it}. We refer to z_t as *services*, and λ_{it} captures investor i's intensity of preference for them.

Investor i chooses portfolio weights $x_{it} \in \mathbb{R}^N$, defined as risky holdings relative to total wealth. The mean–variance problem is

$$\max_{x_{it}} \, (\mu_t + \lambda_{it} z_t)^\top x_{it} - \frac{a_{it}}{2} \, x_{it}^\top \Sigma_t x_{it},$$

where $a_{it} > 0$ is the mean–variance risk aversion.

B. Market clearing and equilibrium

The first–order condition on investor portfolio optimization implies

$$x_{it} = \frac{1}{a_{it}} \Sigma_t^{-1} \big(\mu_t + \lambda_{it} z_t\big). \tag{1}$$

Let w_{it} be investor i's wealth, $w_t = \int_0^1 w_{it} \, di$ total wealth, and $\tilde{w}_{it} = w_{it}/w_t$ the wealth share. Define the wealth-weighted average risk tolerance and the corresponding average service taste

$$\bar{a}^{-1} := \int_0^1 \frac{1}{a_{it}} \tilde{w}_{it} \, di, \qquad \bar{\lambda}_t := \frac{\int_0^1 \frac{1}{a_{it}} \tilde{w}_{it} \lambda_{it} \, di}{\bar{a}^{-1}}. \tag{2}$$

Let x_{mt} be the market portfolio of risky assets. Market cleaning ensures that

$$x_{mt} = \int_0^1 \tilde{w}_{it} x_{it} \, di$$

Aggregating (1) yields

$$x_{mt} = \bar{a}^{-1} \Sigma_t^{-1} \big(\mu_t + \bar{\lambda}_t z_t\big) \tag{3}$$

We can then solve for the equilibrium implied expected return, expressed as a function of current prices:

$$\mu_t = \bar{a} \, \Sigma_t x_{mt} - c y_t, \tag{4}$$

where $cy_t = \bar{\lambda}_t z_t$ is the *convenience yield*. The first term on the right-hand side is the standard equilibrium expected excess return in an economy where investors do not derive utility from services. The second term, the convenience yield, reflects characteristics such as liquidity, hedging value, or collateral use, whose utility may vary across investors.

Substituting (4) into (1), we obtain the holdings of an individual investor i:

$$x_{it} = \frac{\bar{a}}{a_{it}} x_{mt} \; + \; \frac{1}{a_{it}} \Sigma_t^{-1} z_t \, (\lambda_{it} - \bar{\lambda}_t). \tag{5}$$

The first term represents a proportional holding of the market portfolio. In the absence of services, the standard two-fund separation holds, and investors differ only in how much of the market portfolio they hold, with the proportion determined by their risk aversion. The second term is an investor-specific tilt that captures whether an investor values services more or less than the average.

C. Predictions

Based on the setup, we state a set of propositions that guide the empirical analysis. Proofs for all propositions are provided in Appendix A. In the propositions, we use the term *policy* to denote an exogenous change to the system—such as one induced by central bank actions—to draw a direct link to the empirical results. The results, however, apply to any exogenous change.

Proposition 1 (Service shock and equilibrium returns)**.** *If a policy increases the service flow of asset* n *(raising* z_n*), the convenience yield on that asset unambiguously rises. The effect on its expected excess return* μ_n *is ambiguous in equilibrium, since it depends on how the aggregate market portfolio* x_{mt} *adjusts in response.*

Proposition 2 (Rebalancing toward valued services)**.** *Suppose all investors have the same risk-aversion coefficient. If the service of asset* n *increases, then investors with above-average* λ_{it} *tilt their portfolios toward* n*, while those with below-average* λ_{it} *tilt away.*

Proposition 3 (Supply shock and inverse demand)**.** *A reduction in the supply of asset* n *increases its price and lowers its expected return. The effect is stronger when investors are more inelastic. More elastic investors reduce their holdings more strongly in response.*

Proposition 4 (Joint supply and service shock)**.** *If supply falls* ($dx_n < 0$) *while service rises*

($dz_n > 0$), investor i's change in holdings is ambiguous and depends on the relative strength of the two channels.

D. Segmentation with Participation Constraints

We now introduce segmentation whereby investors can only consider a subset of assets. This can be interpreted as an investment mandate in Koijen and Yogo (2019). Suppose each investor i can only hold assets in a subset represented by the selection matrix S_i. Preferences are given by

$$\max_{x \in \text{span}(S_i)} (\mu_t + \lambda_i z_t)^\top x - \frac{a_i}{2} x^\top \Sigma_t x.$$

The optimal portfolio choice is

$$x_{it} = \frac{1}{a_i} (\Sigma_t^i)^{-1} \big(\mu_t + \lambda_i z_t\big), \tag{6}$$

where Σ_t^i is the variance–covariance matrix that incorporates the restriction that allocations are limited to assets within the investment mandate.[4]

The market clearing condition is

$$x_{mt} = \underbrace{\sum_i \tilde{w}_i \frac{1}{a_i} (\Sigma_t^i)^{-1}}_{\Pi_t^x} \mu_t + \underbrace{\sum_i \tilde{w}_i \frac{1}{a_i} \lambda_i (\Sigma_t^i)^{-1}}_{H_t^x} z_t, \tag{7}$$

where $\tilde{w}_i$ denotes investor i's wealth share (as defined above).

Equilibrium expected returns can be expressed in the same form as in equation 4:

$$\mu_t = (\Pi_t^x)^{-1} x_{mt} - (\Pi_t^x)^{-1} H_t^x z_t, \tag{8}$$

where Π_t^x summarizes the aggregate risk-bearing capacity of investors, capturing how wealth shares and risk tolerances interact with investment mandates, and H_t^x represents the aggregate demand for services, weighted by both risk tolerance and portfolio restrictions.

E. Predictions (Segmented Market)

Proposition 5 (Service shock under segmentation)**.** *If the service of asset n rises, the convenience yield on that asset unambiguously increases. The strength of this increase depends*

[4]Formally, $(\Sigma_t^i)^{-1} = S_i \, (S_i^\top \Sigma_t S_i)^{-1} S_i^\top$.

on the composition of the investor segment: the effect is larger when a greater share of the investors who are allowed to hold asset n place higher value on its service.

F. Connection to Empirical Findings

In the following sections, we present empirical results guided by the model and its propositions. At the beginning of each section, we restate the propositions under study and explain how the model informs the interpretation of the findings. We proxy the convenience yield in Equation 5 with the CDS-bond basis, which captures the relative yield investors are willing to forego in order to hold a bond. Several factors contribute to the convenience yield, including collateral value, regulatory constraints, and liquidity. Our focus is on how central bank commitments affect the service value of corporate bonds. As emphasized in the literature, these commitments primarily influence bond safety and liquidity, which are the key non-pecuniary services shaped by policy.

Proposition 1 predicts that if policy announcements raise the services provided by eligible bonds, their convenience yield should increase after the announcement, accompanied by a decline in expected returns once the offsetting effects of prices on the market portfolio are taken into account. We test this prediction in Section 4, where we show that the announcement led to a significant drop in the convenience yield of eligible bonds.

Proposition 2 predicts that investors who value the services affected by the policy should tilt their portfolios toward eligible bonds. In Section 5, we test which types of investors rebalance in this direction. Because investors differ in how they value the policy, we expect heterogeneous portfolio responses. Identifying which investors shift toward eligible bonds, and which do not, provides key evidence on the nature of the policy. We find that mutual funds primarily rebalance toward eligible bonds, rather than selling them to the ECB.

Proposition 5 predicts that in a segmented market, the effects of policy on corporate bonds depend on investor composition. Our objective is to show that the structure of the financial sector (e.g., the relative shares of mutual funds and insurance companies) shapes policy transmission. The ideal experiment would compare identical policy announcements that differ only in investor composition, but such a setting is not available. We therefore exploit the granularity and cross-sectional variation in our data to generate predictions on the role of intermediaries. The portfolio rebalancing effects documented in Section 5 reveal a positive shift in demand by mutual funds, which strengthens policy transmission. Consistent evidence is found in the cross-section, as shown in Section 6.

We acknowledge that the policy also entails standard supply effects. Our results can therefore be interpreted as the net impact of supply changes and conditional promise effects, which implies that the portfolio rebalancing estimates in Section 5 are conservative. If the policy operated purely as a supply shock, the model predicts that investors would sell to the central bank, with the price impact determined by their demand elasticity. More elastic investors would reduce their holdings more sharply, requiring smaller price adjustments. Mutual funds, often regarded as relatively elastic, would thus be expected to act as prominent sellers when the ECB purchases bonds. Moreover, in segmented markets, Proposition 8 implies that bonds with higher mutual fund ownership should display more muted price reactions, as their supply is absorbed more elastically. A formal discussion is provided in Propositions 6–9. The fact that we observe mutual funds buying, rather than selling, underscores the central role of conditional promises in shaping policy transmission.

III. Data

A. Asset Prices

We construct our dataset on asset prices by combining information from several sources. Below, we provide a detailed description of the data. Summary statistics for eligible and non-eligible bonds are reported separately in Table I.

Centralised Securities Database (CSDB) We use monthly bond-level data from the European Central Bank's Centralised Securities Database (CSDB). For each bond, we collect credit ratings from four major agencies—Fitch Ratings, Moody's, Standard & Poor's (S&P), and DBRS—as well as information on the notional amount issued and the issuer's ESA 2010 sector classification. To capture liquidity conditions, we augment the dataset with monthly turnover and average bid-ask spreads from the TraX dataset, sourced from MarketAxess. Finally, we collect each bond's coupon schedule and compute its modified duration.

Markit iBoxx We collect corporate bond data from Markit iBoxx, restricting the sample to bonds denominated in euros. Although the coverage is narrower than that of the CSDB, the iBoxx dataset offers daily frequency, which allows for a more granular analysis of price dynamics. Available variables include bid and ask prices, accrued interest, yield to maturity, option-adjusted spreads (OAS), modified duration, and credit ratings.

CDS We use daily CDS data from Markit and ICE Data Services (formerly CMA). Corporate bonds are matched to CDS contracts on the basis of issuer and seniority. For each issuer–seniority pair, we interpolate the CDS curve to obtain a spread at the exact maturity

Table I. **Summary Statistics** This table reports summary statistics for the sample of corporate bonds used in the analysis. Panel (a) reports the data for eligible bonds while panel (b) reports the data for non eligible bonds. For each variable, we present the mean, standard deviation, 10th percentile, median, and 90th percentile, together with the number of bond–time observations. The variables include the outstanding amount of the bond (in billions of euros), residual maturity (in years), modified duration (percent), yield to maturity (percent), credit spread (percent), the CDS-bond basis (percent), and the bid–ask spread (percent).

(a) Eligible Bonds

	Mean	SD	p10	Median	p90	N
Amount outstanding (bln EUR)	0.68	0.43	0.13	0.62	1.12	101,051
Residual maturity (years)	6.61	4.54	2.04	5.62	12.00	101,051
Modified duration (%)	5.76	3.45	1.94	5.13	10.24	101,051
Yield to maturity (%)	1.83	1.59	0.06	1.41	3.89	101,051
Credit spread (%)	1.19	0.83	0.56	0.98	2.00	101,051
CDS-bond basis (%)	-0.30	0.53	-0.77	-0.32	0.19	101,051
Bid-ask spread (%)	0.53	0.41	0.21	0.43	0.92	89,937

(b) Non Eligible Bonds

	Mean	SD	p10	Median	p90	N
Amount outstanding (bln EUR)	1.76	5.44	0.01	0.05	3.25	562,030
Residual maturity (years)	7.18	6.97	1.72	4.96	15.34	562,080
Modified duration (%)	6.33	5.62	1.68	4.64	13.00	562,080
Yield to maturity (%)	1.78	1.78	-0.04	1.32	4.07	562,080
Credit spread (%)	1.09	1.16	0.20	0.93	2.09	562,080
CDS-bond basis (%)	-0.23	0.92	-1.10	-0.29	0.54	562,080
Bid-ask spread (%)	0.38	0.55	0.03	0.21	0.91	157,523

of the bond, ensuring a precise match. The *CDS-bond basis* is defined as the difference between the maturity-matched CDS spread and the bond's credit spread. We interpret the CDS-bond basis as a proxy for the bond's convenience yield. Intuitively, it represents the wedge between the cost of credit protection implied by CDS contracts and the credit risk premium embedded in corporate bond yields. A positive basis indicates that investors are willing to accept lower yields on bonds relative to their CDS-implied fair value, reflecting a non-pecuniary benefit—or convenience yield—from holding the bond. In this sense, movements in the CDS-bond basis capture changes in the value investors assign to service flows provided by corporate bonds beyond their expected cash flows.

B. Holdings

Securities Holdings Statistics by Sector (SHSS) We use confidential data from the ECB's Securities Holdings Statistics by Sector (SHSS) to calculate the share of each bond held by different types of financial intermediaries. SHSS provides security-level portfolio holdings for all euro area investors, identified by ISIN, at a quarterly frequency beginning in 2013Q4. Holdings are categorized by investor sector and country of domicile. We aggregate across all euro area countries and focus on three main investor sectors: mutual funds, insurance companies and pension funds (ICPF), and monetary financial institutions (henceforth, banks). The dataset also includes information on securities held by the ECB.

Granular Holdings We use granular information on individual mutual funds' holdings from Morningstar.

C. Summary Statistics

We start by examining the holdings of euro area investors. Our analysis focuses on bonds eligible for purchase under the ECB's corporate asset purchase programmes, defined as investment-grade, euro-denominated bonds issued by non-financial corporations domiciled in the euro area (see Section 4 for details on eligibility criteria).

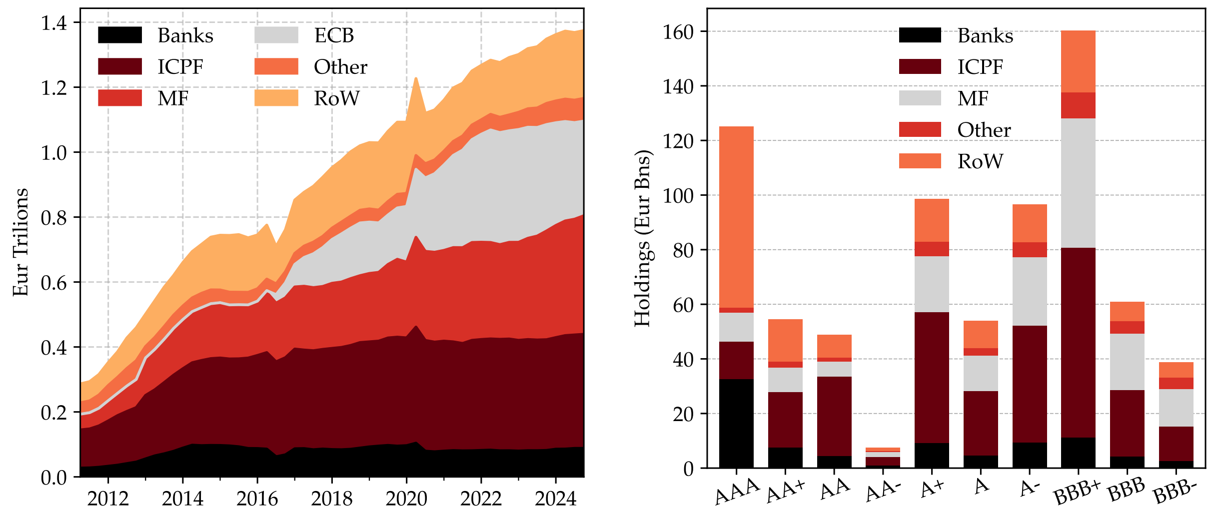
Figure 1a shows the evolution of the allocation of these bonds across investor sectors. The total outstanding amount has grown steadily, with insurers and pension funds increasing their holdings from about €120 billion in 2011 to more than €350 billion in 2024. Mutual funds expanded even more markedly, from less than €50 billion in 2011 to around €360 billion in 2024, making them the largest private-sector holders. Banks remained comparatively small, rising from about €30 billion in 2011 to less than €100 billion by the end of the sample. Foreign investors held €150–200 billion throughout, while the residual "Other" sector remained minor. Foreign holdings are computed as a residual of amounts outstanding minus euro area holdings.

The ECB entered in 2016, rapidly accumulating more than €300 billion at its peak in 2021 before gradually reducing its footprint. By 2019, it already held over 22% of the outstanding stock of eligible investment-grade bonds. Although this share began to decline, it spiked again at the onset of the Covid crisis, reaching 27% in 2023, supported by the launch of the PEPP. By 2023, ECB holdings amounted to about €400 billion.

Having documented the evolution of holdings across sectors, we next examine the distribution by credit quality. Figure 1b reports the stock of eligible bonds by rating category and investor type. The most common rating is BBB+ (€160 billion), followed by A– (€97 billion) and A+ (€98 billion). In terms of investor composition, mutual funds hold about 25% of BBB+, 26% of A–, and 21% of A+ bonds. Insurers and pension funds account for a large share of A (46%) and A+ (49%) bonds, but a smaller share of BBB bonds (35%), and only 28% of BBB–. Banks are concentrated in the safest assets, holding 26% of AAA bonds, while foreign investors dominate the AAA segment with 53%.

Figure 1. **Holdings of Corporate Bonds** Panel (a) plots the holdings in €billions by different types of intermediaries for eligible bonds, stratified by rating. The numbers reflect the allocation in 2015-Q4. Panel (b) shows the holdings of different intermediaries over time.

(a) Holdings Over Time (b) Holdings by Ratings



IV. The Impact of ECB Corporate QE on Bond Prices

In this section, we provide institutional background on the ECB's corporate bond purchase programs and examine their effects on bond prices, thereby testing Prediction 1. We focus on two key announcements: the initial launch of the Corporate Sector Purchase Programme (CSPP) in 2016 and the announcement of the Pandemic Emergency Purchase Programme (PEPP) during the height of the COVID-19 crisis.

Eligibility Criteria Under both programs, the ECB restricted its purchases to investment-grade corporate bonds issued by non-bank corporations incorporated in the euro area—henceforth referred to as *eligible* bonds. A bond is considered eligible if the following conditions are met: (a) the issuer is not a credit institution and does not have a parent undertaking that qualifies as such; (b) the bond is rated by accepted external credit assessment institutions or third-party rating tools and has a minimum rating of BBB−; (c) the bond has an initial maturity of at least 367 days, with a remaining maturity between six months and 30 years and 364 days; (d) the bond is euro-denominated; (e) it is issued in the euro area; (f) the issuer is established in the euro area and the place of settlement is also located in the euro area and (g) the yield is above the ECB deposit facility rate (DFR).[5] Whether a security is considered eligible is publicly available information, as announced by the ECB.

[5]This requirement was removed in 2017.

Market Neutral Approach The ECB implements its asset purchase programmes using a market-neutral approach, whereby corporate bond purchases are guided by a benchmark that mirrors the outstanding stock of eligible bonds.[6]

Our identification strategy relies on the eligibility criteria and the market-neutral implementation of the purchase program. First, we exploit the definition of eligibility to implement a difference-in-differences approach, comparing similar bonds where only one is eligible for purchase. This allows us to isolate the causal effect of the policy. Second, the market-neutral design of the program ensures that, within the set of eligible bonds, asset purchases followed pre-determined rules. As we interact policy effects with intermediary holdings, this market-neutrality guarantees that purchases are exogenous to intermediary portfolios.

A. Announcement Effects

In this section we study the effects of the announcement on the subset of eligible bonds. We begin by adopting a standard high-frequency approach to examine daily changes in credit spreads and the CDS-bond basis around the announcement dates. Specifically, we compute notional-weighted average credit spreads for bonds eligible under the ECB's purchase programs, along with the corresponding notional-weighted average CDS-bond basis. Both series are constructed from an overlapping sample restricted to bonds with available CDS data and daily pricing via the iBoxx dataset. The use of daily data follows established practice in capturing high-frequency effects of asset purchases (Krishnamurthy and Vissing-Jorgensen, 2011; Krishnamurthy et al., 2017). In Appendix C.1, we extend the analysis using monthly data covering the broader sample.

CSPP The ECB announced the Corporate Sector Purchase Programme (CSPP) on March 10, 2016, as part of its broader efforts to support the eurozone economy and address low inflation. The CSPP operated alongside other programs within the Asset Purchase Programme (APP). On that day, the ECB announced it would extend its APP program from €60 billion per month to €80 billion per month and include corporate bonds. The ECB started purchasing bonds in July 2016.

The March 2016 announcement of the CSPP led to a sharp decline in corporate bond spreads, driven primarily by an increase in the CDS-bond basis. As shown in Figure 2a, credit spreads fell rapidly following the ECB's announcement: within one month, the value-weighted average bond spread declined by about 30 basis points. The figure also reports,

[6] The original market-neutral approach was adjusted in July 2022, when the Eurosystem announced its intention to gradually decarbonize its corporate bond portfolio in line with the objectives of the Paris Agreement. This entails tilting purchases toward issuers with stronger climate performance.

on the right axis, the inverse CDS-bond basis (defined as the bond credit spread minus the CDS spread). It shows an increase of roughly 25 basis points in the CDS-bond basis. This evidence is consistent with Proposition 1, underscoring that the main transmission channel operated through the bond's convenience yield, as ECB purchases enhanced the attractiveness of eligible bonds to investors.

Importantly, there were no significant movements in the default-free interest rate curve (OIS) around the time of the announcement. This confirms that the observed decline in credit spreads was driven by the corporate bond purchase program rather than conventional monetary policy. To test robustness, Section 4.2 applies a difference-in-differences approach.

The CSPP announcement occurred in a relatively calm market environment, rather than during a crisis. Its primary aim was to broaden the range of assets eligible for ECB purchases. This setting strengthens identification by limiting confounding factors and reducing noise in the estimation. We also draw on evidence from the PEPP announcement to show that the results extend across different policy contexts.

PEPP Amid the challenges posed by the COVID-19 pandemic in 2020, the European Central Bank (ECB) responded with a substantial policy package that included corporate bond purchases. The severity of the crisis prompted the ECB to reinforce its interventions by expanding its asset purchase program. At the Governing Council meeting on March 12, 2020, ECB President Christine Lagarde announced a set of measures aimed at supporting the euro area economy. Specifically, the ECB committed to "add a temporary envelope of additional net asset purchases of €120 billion until the end of the year, ensuring a strong contribution from the private sector purchase programmes." Following this announcement, however, bond markets fell sharply, as financial markets perceived the ECB's response as insufficient given the scale of the unfolding shocks.[7]

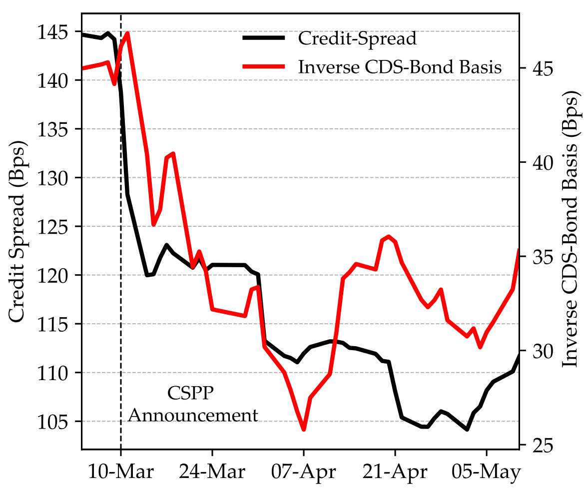
In response, the ECB took further action on March 18, 2020, outside of its regular schedule. In this unscheduled announcement, the ECB unveiled the PEPP programme, committing to a substantial expansion of its asset purchases. The program was launched with an initial envelope of €750 billion, signaling a significant intensification of the ECB's policy response to the escalating crisis.

The two vertical lines in Figure 2b mark the dates of these pivotal events. The figure illustrates the sharp rise in credit spreads observed in March 2020, which intensified following the ECB Governing Council meeting on March 12. However, the announcement of the PEPP one week later reversed this trend, leading to a rapid decline in corporate bond spreads.

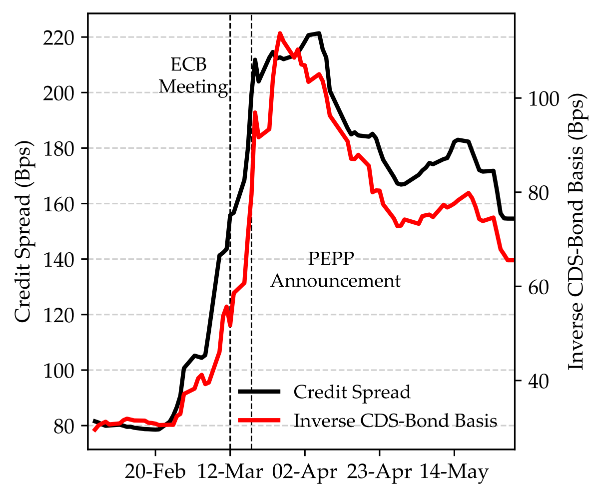
[7] The reaction was also exacerbated by President Lagarde's remark that "we are not here to close spreads," which was widely seen as undermining support for sovereign debt markets.

Figure 2. **Credit Spread and Convenience Yields around ECB Announcements** Figure 2a displays the evolution of credit spreads (left-hand axis) and the inverse CDS–bond basis (right-hand axis). The inverse CDS–bond basis is defined as the difference between the bond credit spread and the maturity-matched CDS spread. We plot its dynamics around the announcement of the Corporate Sector Purchase Programme (CSPP) on March 10, 2016. Similarly, Figure 2b illustrates the behavior of option-adjusted spreads (OAS) and convenience yields around the announcement of the Pandemic Emergency Purchase Programme (PEPP) on March 18, 2020.

(a) CSPP Announcement



(b) PEPP Announcement



As with the CSPP, the surge and subsequent decline in credit spreads closely mirrored the evolution of convenience yields. On average, credit spreads increased by approximately 140 basis points before falling by around 40 basis points in the month following the announcement. Over the same period, convenience yields fell by 100 basis points and then rose by roughly 40 basis points. In this case, CDS spreads also contributed to the initial widening, resulting in a larger overall increase in credit spreads relative to convenience yields. Nonetheless, the PEPP episode further underscores the central role of convenience yields in the transmission of corporate bond purchases.

The evolution of credit spreads and convenience yields during the COVID-19 crisis also confirms a key prediction of our model. Consistent with Haddad et al. (2023, 2024), asset purchases function as state-contingent policies through which the central bank commits to intervening during periods of market stress. This implies that such interventions cannot be viewed merely as a reduction in the supply of bonds. Indeed, prior to the ECB's March 12, 2020 announcement, financial markets had already formed expectations about the scope and scale of the program. The fact that the announcement of a still-large package triggered a surge in yields—rather than a decline—underscores the importance of the policy's state-contingent nature and its impact on market expectations. These findings are consistent with the view that corporate bond purchases operate primarily through liquidity and hedging channels, and are therefore particularly valuable for investors exposed to procyclical outflows during recessions, such as mutual funds (Coppola, 2021).

B. Effects on Yields

As a second step, to further test Proposition 1, we exploit the exogenous timing of monetary policy announcements and the institutional design of the ECB's purchase programs to implement a difference-in-differences (DiD) strategy. This analysis examines the impact of the CSPP and PEPP on bond yields and their decomposition into credit spreads, CDS spreads, and the CDS–bond basis, comparing eligible and ineligible bonds.

Our main empirical specification is:

$$y_t(n) = \theta \ Treat_t(n) \times Post_t + \gamma \ Treat_t(n) + \text{Fixed Effects} + u_t(n) \tag{9}$$

For each bond n and month t, the dependent variable $y_t(n)$ corresponds to one of the following outcomes: corporate bond yield, credit spread, CDS spread, or the CDS-bond basis. The indicator variable $Treat_t(n)$ equals 1 if bond n is eligible for purchase under the CSPP or PEPP, and 0 otherwise. The variable $Post_t$ is a time dummy equal to 1 for periods after the announcement of the respective purchase program, and 0 otherwise. The baseline specification includes rating-by-maturity fixed effects as well as time fixed effects.[8].

The identifying assumption is that, absent ECB purchases, corporate bond yields, credit spreads, CDS spreads, and the CDS-bond basis for the treatment and control groups would have evolved in parallel. In Appendix C.2, we provide evidence supporting the validity of this parallel trends assumption.

Even under parallel trends, one might worry that eligible and ineligible bonds differ systematically, or that ECB announcements coincide with shocks affecting the two groups differently. For instance, since such announcements typically respond to worsening macroeconomic conditions, and eligible bonds are of higher credit quality, they may be less sensitive to macro risks. To address this, we also provide the result in a specification includes rating-by-maturity-by-time and ISIN fixed effects. Moreover, changes in default risk should be captured by CDS spreads, which are directly linked to default probabilities. Non-default factors—such as counterparty risk—would need to differ systematically between treated and control bonds to bias our estimates, which we view as unlikely.

[8] Specifically, we define twelve rating-maturity buckets, combining three rating categories (AAA–A, BBB, and high-yield) with four residual maturity groups (1–3 years, 3–5 years, 5–10 years, and 10–30 years)

In Panel (a) of Table II, we study the impact of the CSPP announcement in March 2016. Columns 1 to 3, which include time and rating-by-maturity fixed effects, show that credit spreads of eligible bonds fell by about 26 basis points relative to ineligible ones. Of this decline, roughly 19 basis points—about 75%—are accounted for by a widening of the CDS–bond basis, while around 6 basis points reflect a decline in CDS spreads. Columns 4 to 6, which add rating-by-maturity-by-time and ISIN fixed effects, confirm these results with estimates of similar magnitude.

Our baseline estimates are consistent with the high-frequency results in Figure 2a, where the measured effect is somewhat larger because the high-frequency design also captures spillovers to non-eligible bonds. This reinforces the interpretation that announcement effects drove the bulk of the transmission of the policy to asset prices. This finding is consistent with Haddad et al. (2023, 2024) and D'Amico and King (2013); De Santis and Holm-Hadulla (2020). We further confirm this in Appendix C.2 by documenting that the wedge between eligible and non-eligible bonds widened at the announcement and remained stable thereafter.

In Panel (b), we turn to the PEPP, announced in March 2020. Columns 1 to 3 indicate that credit spreads of eligible bonds declined by about 12 basis points relative to ineligible ones. This decline is more than fully explained by a widening of the CDS–bond basis of about 14 basis points, while CDS spreads show no significant change. Columns 4 to 6, which include the full set of fixed effects, confirm these findings and demonstrate that the results are robust to more demanding specifications.

All in all, the findings suggest that, consistent with Proposition 1, the policy primarily affected characteristics related to services, which increased the convenience yield of eligible bonds. This mechanism is further confirmed by the evidence from the PEPP.

Table II. **The Effect of Corporate QE on Corporate Bond Yields** This table reports estimates from equation (9) using different measures of bond yields as dependent variables. The first row in each panel presents difference-in-differences estimates capturing the price effect of the respective corporate QE program. Columns 1 to 3 include time and rating-by-maturity fixed effects, while Columns 4 to 6 additionally include rating-by-maturity-by-time fixed effects and ISIN fixed effect. Standard errors are double-clustered at the time and issuer level.

(a) CSPP: September 2015 – September 2016

	(1) Credit Spread	(2) CDS	(3) Basis	(4) Credit Spread	(5) CDS	(6) Basis
Post × Eligible	-0.255***	-0.063***	0.192***	-0.227***	-0.099***	0.127***
	(0.030)	(0.016)	(0.023)	(0.042)	(0.015)	(0.034)
Eligible	0.116	-0.139	-0.255***			
	(0.082)	(0.100)	(0.032)			
Time FE	✓	✓	✓			
Rating x Maturity FE	✓	✓	✓			
Rating x Maturity x Time FE				✓	✓	✓
ISIN FE				✓	✓	✓
R^2	0.39	0.49	0.08	0.94	0.95	0.89
Observations	47,965	47,965	47,965	47,730	47,730	47,730

(b) PEPP: September 2019 – September 2020

	(1) Credit Spread	(2) CDS	(3) Basis	(4) Credit Spread	(5) CDS	(6) Basis
Post × Eligible	-0.118**	0.021	0.139***	-0.105***	0.049***	0.154***
	(0.043)	(0.043)	(0.021)	(0.024)	(0.015)	(0.027)
Eligible	-0.363***	-0.097***	0.266***			
	(0.051)	(0.027)	(0.055)			
Time FE	✓	✓	✓			
Rating x Maturity FE	✓	✓	✓			
Rating x Maturity x Time FE				✓	✓	✓
ISIN FE				✓	✓	✓
R^2	0.45	0.34	0.24	0.90	0.90	0.83
Observations	53,120	53,120	53,120	52,854	52,854	52,854

V. The Impact of ECB Corporate QE on Portfolio Rebalancing

Our next step is to examine *why* ECB eligibility raises the convenience yield of eligible bonds. Proposition 2 states that, after an ECB policy announcement, investors who place higher value on the enhanced non-pecuniary services of eligible assets shift their portfolios more heavily toward them, thereby increasing their portfolio weight. In contrast, Proposition 6 indicates that more elastic investors adjust by reducing their holdings to a greater extent. Finally, Proposition 7 shows that the equilibrium effect depends on the balance between these two opposing forces.

To analyze the mechanism through which the ECB's corporate quantitative easing (QE) programs influence corporate bond prices, we begin by examining aggregate portfolio rebalancing around the Corporate Sector Purchase Programme (CSPP) and the Pandemic Emergency Purchase Programme (PEPP). Panel (a) of Table III reports changes in aggregate holdings from the quarter preceding the CSPP announcement (2015Q4) to one and three quarters afterward (2016Q2 and 2016Q4). The ECB initiated corporate bond purchases in June 2016, acquiring approximately €6 billion in the second quarter and a total of €46 billion by year-end.

During the second quarter of 2016, mutual funds sharply increased their holdings of eligible corporate bonds, purchasing €21 billion. In contrast, they acquired only €3 billion of ineligible corporate bonds while selling €40 billion of sovereign bonds. This reallocation raised the share of eligible bonds in their overall bond portfolios, which include both corporate and sovereign securities, by 2.5 percentage points.

The shift persisted through the end of 2016. Mutual funds maintained elevated holdings of eligible bonds, further reduced their exposure to sovereign bonds, and reallocated part of their portfolios toward ineligible corporate bonds. Overall, the portfolio share of eligible bonds increased by 2.62 percentage points over the year (see Table D1 in Appendix D). These patterns suggest that the policy made eligible bonds particularly attractive to mutual funds. At the same time, their purchases of ineligible corporate bonds point to broader spillover effects that enhanced the relative appeal of the corporate bond market as a whole, especially in comparison to sovereign bonds, which had been consistently absorbed by the ECB since 2015.

Insurance companies and pension funds also increased their holdings of eligible bonds, although to a smaller extent. By the end of the year, they had purchased €19 billion of eligible bonds. The corresponding increase in the share of eligible bonds within their overall bond portfolios was limited to 0.3 percentage points, as they simultaneously accumulated substantial amounts of ineligible corporate bonds and sovereign bonds. This pattern indi-

Figure 3. **Holder composition of ECB-purchased corporate bonds.** These pie charts illustrate which investor sectors held ECB-purchased bonds before the CSPP announcement (i.e., in 2015q4) and after (2016q3) purchases had started. The sample consists only of ISINs that the ECB had purchased under the CSPP by the end of 2016q3, i.e., after one quarter of purchases. Holding shares are obtained by dividing the nominal value held by the total outstanding amount.

cates that these investors expanded their bond portfolios broadly, without a pronounced tilt toward eligible securities.

By contrast, the main sellers to the ECB were banks and foreign investors (Rest of the World). This pattern is consistent with the evidence in Koijen et al. (2021) for sovereign bond purchases. However, as discussed above, the behavior of mutual funds diverged in the case of corporate bond purchases. Whereas Koijen et al. (2021) document that mutual funds sold sovereign bonds to the ECB as prices rose, we observe the opposite here. In the corporate bond market, mutual funds—and, to a lesser extent, insurance companies and pension funds—*purchased* eligible bonds alongside the ECB.

Panel (b) reports portfolio rebalancing around the PEPP. In this case, the role of mutual funds as buyers of eligible bonds is even more pronounced. They purchased €34 billion of eligible bonds while simultaneously reducing their holdings of both ineligible corporate bonds and sovereign bonds. Similar to the CSPP episode, this increase in eligible bond holdings remained stable both in the short run (within one quarter) and in the longer run (within one year). By contrast, insurance companies and pension funds increased their holdings of eligible bonds by only €2 billion during the same period.

The above-described rebalancing pattern can also be confirmed by looking at who held the specific corporate bonds (ISINs) that the ECB would later purchase, before and after purchases started. We plot the investor composition of the corporate bonds that were in the ECB's portfolio at the end of 2016q3 (i.e., after one quarter of purchases), in Figure 3. The pie charts reveal that almost every sector reduced its share held of these bonds, in

Table III. **Portfolio rebalancing around the two corporate QE programs.** The table reports changes in nominal corporate bond holdings (EUR billions) during the ECB's CSPP and PEPP. For each program, portfolio rebalancing is shown over two horizons: a short-run window (from the quarter before the announcement to one quarter after) and a longer-run window (to three quarters after for the CSPP and to four quarters after for the PEPP). Results are reported separately for eligible and ineligible corporate bonds as well as sovereign bonds. We also report net issuance. The final column reports initial holdings in 2015Q4.

(a) CSPP

	2015Q4–2016Q2			2015Q4–2016Q4			2015Q4
	Eligible	Ineligible	Sovereign	Eligible	Ineligible	Sovereign	Holdings
Banks	-2	1	-4	-20	2	-76	1244
ICPF	19	7	63	21	12	56	1563
MF	21	3	-40	20	7	-52	967
Other	-3	-13	-27	-4	-25	-50	583
ECB	6	0	234	46	0	427	692
RoW	-2	16	-90	-39	32	-118	2153
Net issuance	39	13	136	25	28	188	

(b) PEPP

	2019Q4–2020Q2			2019Q4–2020Q4			2019Q4
	Eligible	Ineligible	Sovereign	Eligible	Ineligible	Sovereign	Holdings
Banks	24	34	144	-6	46	61	1202
ICPF	20	5	-21	2	7	-25	1858
MF	34	-4	-10	34	-2	-18	1047
Other	0	-5	104	1	-12	84	499
ECB	65	5	264	117	3	539	1672
RoW	41	-16	99	-35	6	34	2395
Net issuance	184	18	580	114	47	676	

order to accommodate the approx. 6% of amount outstanding purchased by the ECB by the end of 2016q3. The mutual fund sector is the only exception, increasing its share held by one percentage point. This observation alleviates the concern that mutual funds might have attempted to "front-run" the ECB by buying large amounts of eligible bonds before purchases officially started, only to sell them back to the ECB soon afterwards.

A. Effects on Portfolio Rebalancing

The preceding evidence indicates that portfolio rebalancing differed markedly across sectors. In particular, mutual funds shifted substantially toward eligible bonds. To formally assess the causal impact of the ECB's corporate bond purchase programs on investor behavior, we now turn to micro-level holdings data. Proposition 2 predicts that investors who derive greater benefits from the policy should increase the share of eligible bonds in their overall bond portfolios.

We adopt an empirical strategy similar to that in Section 4 to estimate how the ECB's policy announcements affected investor portfolio rebalancing. To study the impact of the CSPP on corporate bond holdings, we use the most granular version of the SHSS data, which classifies investors by both type and country. The unit of observation is therefore the set of corporate bond holdings of investor type j in country c for a given quarter—for example, the holdings of the mutual fund sector in Italy in a specific quarter. For each investor type-country pair, we compute the portfolio share of each bond n within that sector-country's corporate bond portfolio, expressing these shares in basis points since portfolios are large relative to any individual bond.[9] We focus on the intensive margin by excluding cases where the portfolio share is zero, as rebalancing typically occurs by adjusting the size of existing positions.[10]

Before the CSPP, the median portfolio share was 1.57 bps for banks, 4.09 bps for mutual funds, and 3.66 bps for insurance companies and pension funds (ICPF) (see Appendix Table D2). These medians are small, indicating that most single-bond positions represent only a small fraction of the relevant portfolio, and they provide a natural benchmark against which to scale the estimated effects of the program. The overall weight of eligible and ineligible bonds in investor portfolios remains substantial, as discussed in the previous sections.

We then estimate, separately for each investor type, the following difference-in-differences specification:

$$x_{j,c,t}(n) = \theta_j \; Treat_t(n) \times Post_t + \gamma_j \; Treat_t(n) + \text{Fixed Effects} + u_{j,c,t}(n), \tag{10}$$

where $x_{j,c,t}(n)$ is the portfolio share of bond n held by investor type j in country c at time t, $Treat_t(n)$ is an indicator equal to one if the bond is eligible for the CSPP, and $Post_t$ is an indicator equal to one in the quarters following the CSPP announcement. The interaction term captures the differential change in portfolio shares for eligible bonds after the programme announcement. All regressions include holder country-by-time fixed effects and rating-by-maturity fixed effects.

Focusing first on mutual funds, column (2) of Table IV shows that the estimated post-announcement effect is 0.40 bps and is statistically different from zero. Relative to the pre-CSPP median portfolio share of 4.09 bps, this corresponds to an increase of roughly 9.7%

[9]Differently from the discussion in the previous subsection, we now restrict attention to corporate bonds, as this provides the most relevant treatment and control groups.

[10]To limit the influence of extreme values, we also drop the top 97 percentile of portfolio shares across all investors.

in the typical holding of an eligible bond. This is an economically meaningful rebalancing, given the small size of the average position.

For insurance companies and pension funds (ICPF), the estimated effect is -0.030 bps, corresponding to a negligible change of approximately -0.8% relative to their median overall bond portfolio share, and it is not statistically different from zero. By contrast, banks exhibit a decline of -0.23 bps, which is also statistically insignificant. Relative to their median overall bond portfolio share of 1.57 bps, this corresponds to a reduction of about 15%, though the estimate is imprecise. Other domestic investors display a statistically significant decrease of -0.346 bps, or about -23% relative to their median overall bond portfolio share of 1.48 bps. The rest of the world also reduced their holdings of eligible bonds in a statistically significant way, but given their much smaller median share of 0.24 bps, percentage changes are less informative.

Overall, the CSPP appears to have led to a meaningful rebalancing toward eligible bonds among mutual funds, while other domestic sectors and foreign investors reduced their relative exposure, and banks and insurers showed no statistically significant change.[11]

Turning to the PEPP, the results (reported in Panel (b) of Table IV) broadly confirm the patterns observed for the CSPP. Mutual funds again display a statistically significant increase in their holdings of eligible bonds, with an estimated effect of 0.237 bps. Relative to their pre-PEPP median portfolio share of 2.83 bps (Table D2), this corresponds to an increase of about 8.4%. For all other investor types, the coefficients are negative, suggesting that these sectors were net sellers of eligible bonds in the aftermath of the programme announcement.

Consistent with Proposition 7, the evidence from Table III and the difference-in-differences results point to a strong shift in the service characteristics of eligible bonds. For some investors, particularly mutual funds, these effects more than offset the supply-driven channel, which would have predicted that mutual funds act as the main sellers of corporate bonds. Instead, they purchased eligible bonds despite the increase in prices and the associated decline in spreads, as documented in the previous section. These findings highlight that mutual funds derived particular value from the policy.

We interpret the main transmission mechanism as an insurance channel provided by the central bank, which enhances the hedging and liquidity properties of eligible bonds. Mutual funds are prone to sell bonds when they face investor outflows, which typically occur during recessions (Coppola, 2021), precisely when bond prices are falling. If investors expect the ECB to intervene in adverse states of the world, the vulnerability of eligible corporate bonds

[11] We also consider a slightly longer sample, reported in Appendix Table D3. The results remain broadly consistent with the baseline. In this specification, the negative coefficients for banks and for insurance companies and pension funds are of similar magnitude but become statistically different from zero, confirming the presence of a negative rebalancing among these investors.

Table IV. **The effect of corporate QE on portfolio share.** This table displays the results of estimating equation (10) separately for five holdings sectors: Banks, mutual funds, insurance companies & pension funds, others (incl. households and non-financial corporations), and rest of the world (i.e., non-euro area holdings estimated as the residual).

(a) CSPP: 2015q3 – 2016q3

	(1) Banks	(2) MF	(3) ICPF	(4) Other	(5) RoW
Post=1 × CSPP eligible=1	-0.234	0.395***	-0.030	-0.346**	-0.453**
	(0.15)	(0.07)	(0.07)	(0.08)	(0.13)
CSPP eligible=1	-1.735**	-0.806*	0.495	-0.988**	1.843**
	(0.47)	(0.33)	(0.36)	(0.30)	(0.45)
Holder country x Time FE	✓	✓	✓	✓	✓
Rating x Maturity FE	✓	✓	✓	✓	✓
R^2	0.25	0.19	0.22	0.15	0.04
Observations	45,934	71,150	75,106	74,417	20,260

(b) PEPP: 2019q3 – 2020q3

	(1) Banks	(2) MF	(3) ICPF	(4) Other	(5) RoW
Post=1 × PEPP eligible=1	-0.349*	0.225***	-0.204**	0.104**	-0.031
	(0.13)	(0.04)	(0.04)	(0.04)	(0.15)
PEPP eligible=1	-0.158	-1.356***	-0.043	-1.007***	2.275**
	(0.47)	(0.20)	(0.22)	(0.21)	(0.54)
Holder country x Time FE	✓	✓	✓	✓	✓
Rating x Maturity FE	✓	✓	✓	✓	✓
R^2	0.31	0.17	0.20	0.14	0.08
Observations	54,752	106,153	115,454	80,813	20,972

to such fire sales is reduced. The benefits, however, are likely to vary across mutual funds. Funds with a stable investor base and low flow turnover are less exposed to this risk, whereas funds with volatile flows stand to gain more from the insurance channel.

To further corroborate our findings and to more precisely identify the underlying mechanism, we now turn to granular data on mutual fund holdings.

B. Granular Mutual Funds Portfolio Rebalancing

Our results so far indicate that mutual funds tend to rebalance their portfolios toward eligible bonds rather than selling them. We argue that this behavior reflects the value mutual funds place on the ECB's policy: they can sell these bonds to the ECB if they face outflows and need to liquidate assets. Consequently, *within* the mutual fund sector, we expect funds experiencing greater volatility in net flows to be particularly sensitive to ECB announcements. In this section, we test this prediction using granular information on mutual fund holdings from Morningstar.

We start by constructing a fund-level measure of capital flightiness, using the volatility of fund flows as a proxy. We define $CapitalFlightiness_i$ as the volatility of $F_{i,t}$ over the two years leading up to the QE announcements (CSPP and PEPP) for each fund. Our measure is normalized by the average AUM to control for fund size. We retrieve fund net flows $F_{i,t}$ (in Euros) from Morningstar.[12] In summary, in our empirical specification, we measure $CapitalFlightiness_i$ separately for the CSPP and the PEPP:

$$CapitalFlightiness_i = \frac{\sigma(F_{i,t-2yr\to t})_i}{mean(AUM_{i,t-2yr\to t})_i} \tag{11}$$

Building on the difference-in-difference specification (10), we implement a triple difference specification. For each fund i in country c at month t, the dependent variable, the portfolio weight x is defined as the ratio of the market value of fund i's holdings in bond n to the fund's total market value holdings across all corporate bonds. Specifically, we run the regression.

$$\begin{aligned} x_{ict}(n) = \psi_1 Elig(n) \times Post_t \times CapitalFlightiness_i + \psi_2 Elig(n) \times Post_t + \\ \psi_3 CapitalFlightiness_i \times Post_t + \text{Fixed Effects} + \text{Controls} + \varepsilon_{ict}(n) \end{aligned} \tag{12}$$

In our specification we include holder country-time fixed effects to absorb time-varying country-specific demand, fund fixed effects to absorb time-invariant fund fundamentals, and rating × maturity fixed effects to capture time-varying duration and credit risk. The results are reported in Table V.[13]

Columns (1) reports results for regression (10), but at the fund-level. Using more granular data from a different source, we confirm the findings of Table IV. Mutual funds respond to the QE announcement by purchasing more eligible securities. Columns (2)–(3) show that the effect is more substantial for funds with higher capital flightiness. In particular, these results show that a one standard deviation increase in asset flightiness increases mutual funds' portfolio weight in eligible bonds by 4% (= 0.031 × 1.444). We view this as corroborating evidence that the perceived extra liquidity of ECB-eligible bonds is key in explaining why the corporate QE announcement had such a substantial impact on prices.

[12] To maintain consistency across monthly observations, we include only fund/month observations for which $\frac{F_{i,t}}{AUM_{i,t-1}}$ is within the range −0.5 to 0.5. Additionally, we only include funds with valid AUM data for at least 6 months over the two years preceding the QE announcements (CSPP and PEPP). The sample covers, on average, 3567.5 funds for the two events in the quarterly sample and 2,515 funds in the monthly sample.

[13] The sample is monthly. We winsorize portfolio weight, *CapitalFlightiness*, and βs at 1% and 99% to remove outliers.

Table V. **The effect of corporate QE on mutual funds holdings.** This table displays the results of estimating equation (12) for mutual funds in euro area. Panel (a) reports estimations on CSPP (September 2015 – September 2016), and Panel (b) reports estimations on PEPP (September 2019 – September 2020). The dependent variable is the portfolio weight x of fund i in bond n, defined as the share (in %) of the market value of fund i's holdings in that bond to the fund's total market value holdings across all corporate bonds. The key independent variable *CapitalFlightiness* is computed from equation (11). *HighCapF* is a dummy indicator reflecting whether the fund's *CapitalFlightiness* falls within the top 75th percentile. Standard errors are clustered at the fund × time level.

(a) CSPP: September 2015 – September 2016

	Portfolio weights(%)					
	(1)	(2)	(3)	(4)	(5)	(6)
Elig=1 × Post=1 × CapitalFlightiness		1.444***			1.567**	
		(0.537)			(0.747)	
Elig=1 × Post=1 × HighCapF=1			0.122***			0.121**
			(0.037)			(0.053)
Post=1 × CapitalFlightiness		−3.165***			−2.317***	
		(0.452)			(0.680)	
Post=1 × HighCapF=1			−0.198***			−0.128***
			(0.029)			(0.046)
Elig=1 × Post=1	−0.021	−0.093***	−0.059***	0.016	−0.054	−0.015
	(0.019)	(0.032)	(0.022)	(0.026)	(0.041)	(0.028)
Holder Country × Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Rating × Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	692,771	692,771	692,771	291,886	291,886	291,886
R^2	0.788	0.788	0.788	0.809	0.809	0.809

(b) PEPP: September 2019 – September 2020

	Portfolio weights(%)					
	(1)	(2)	(3)	(4)	(5)	(6)
Elig=1 × Post=1 × CapitalFlightiness		0.764***			1.752***	
		(0.214)			(0.412)	
Elig=1 × Post=1 × HighCapF=1			0.032*			0.045
			(0.017)			(0.029)
Post=1 × CapitalFlightiness		−1.445***			−2.465***	
		(0.200)			(0.407)	
Post=1 × HighCapF=1			−0.091***			−0.106***
			(0.015)			(0.028)
Elig=1 × Post=1	0.001	−0.029**	−0.007	0.033**	−0.032	0.022
	(0.008)	(0.012)	(0.009)	(0.015)	(0.022)	(0.017)
Holder Country × Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Rating × Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,281,421	1,281,421	1,281,421	518,250	518,250	518,250
R^2	0.788	0.788	0.788	0.807	0.807	0.807

Where Does the Money Come From? We investigate the ways mutual funds reallocate their resources between ECB-eligible corporate bonds and other asset classes in this section. We begin by constructing the key variable: the portfolio weight $x_{i,m,t}$, defined as the fund i's market value holdings in asset class m, normalized by the fund's total asset under management (AUM) in month t. The change in portfolio weight across the QE announcement for fund i in asset class m is defined as the difference in portfolio weight between the first and last periods of the event window for that asset class.[14] This measure is performed separately for the CSPP and the PEPP.

$$\Delta x_{i,m}^{CSPP} = x_{i,m,pre} - x_{i,m,post}$$

$$\Delta x_{i,m}^{PEPP} = x_{i,m,pre} - x_{i,m,post}$$

We run the following regression on all fund by asset-class observations

$$\begin{aligned}\Delta x_{im} = \alpha + \beta_1 HighCapF_i \times \Delta x_{i,elig} + \beta_2 \Delta x_{i,elig} + \\ \beta_3 HighCapF_i + \gamma_1 log(AUM)_{i,pre} + \gamma_2 x_{i,pre}^{corpbond} + \alpha_c + \epsilon_{im}\end{aligned} \quad (13)$$

We control for the fund's pre-period AUM and corporate bond share to account for differences in fund size and exposure to assets most affected by QE. We include holder country fixed effects to absorb time-invariant country-specific demand. We report results in Table VI.

VI. Heterogeneous Transmission of QE

In Section 4 we showed that announcements of corporate bond purchases had significant effects on credit spreads and convenience yields. In Section 5 we documented that investors who valued the enhanced liquidity and hedging properties of eligible corporate bonds—most notably mutual funds—rebalanced strongly toward these assets. This additional demand acted as a "helping hand" for monetary policy transmission (Fang and Xiao, 2025), thereby amplifying the effect of the purchases on bond prices. The implication is that a higher share of investors who value the policy strengthens its transmission to asset valuations. Testing this channel would ideally require comparing several announcements that are identical in all respects except for investor composition. In practice, however, this is not feasible.[15]

[14] We trim the distribution of Δx_{im} by keeping observations within the interval [-100, 100], and winsorize at the 1st and 99th percentiles to remove outliers. To avoid data errors or extreme outliers, we restrict the analysis to observations with portfolio weights x_{imt} bounded within the unit interval [0,1].

[15] In our setting, only two major announcements are available—the CSPP and the PEPP—which occurred under substantially different macro-financial conditions and against distinct market expectations.

Table VI. **Mutual Funds Money Rebalancing.** This table displays the results of estimating equation (13) for mutual funds in euro area. Panel A reports estimations excluding the fund asset flightiness metric and panel B reports estimations considering the fund asset flightiness. Portfolio weights are represented in percentage points. $x_{i,other}$ includes fund positions in derivatives, real estats, private equity, commodities, etc. $Log(AUM)_{i,pre}$ and $x_{i,pre}^{corpbond}$ refer to the fund's assets under management and corporate bond share at the onset of the events (September 2015 for CSPP and September 2019 for PEPP). *HighCapF* is a dummy indicator reflecting whether the fund's *CapitalFlightiness* falls within the top 75th percentile. Data is monthly.

(a) CSPP: September 2015 – September 2016

Panel A: Not accounting for capital flightiness metric					
	$\Delta x_{i,inelig}$ (1)	$\Delta x_{i,cash}$ (2)	$\Delta x_{i,sov}$ (3)	$\Delta x_{i,equity}$ (4)	$\Delta x_{i,other}$ (5)
$\Delta x_{i,elig}$	−0.014	−0.150*	−0.427***	−0.048*	−0.347***
	(0.053)	(0.084)	(0.071)	(0.026)	(0.103)
$Log(AUM)_{i,pre}$	−0.052	0.102	0.105	0.001	−0.231
	(0.109)	(0.174)	(0.147)	(0.053)	(0.214)
$x_{i,pre}^{corpbond}$	−9.954***	1.812	5.995***	0.215	2.001
	(0.896)	(1.425)	(1.206)	(0.439)	(1.751)
Holder Country FE	Yes	Yes	Yes	Yes	Yes
Observations	1,174	1,174	1,174	1,174	1,174
R^2	0.168	0.020	0.065	0.020	0.060

(b) PEPP: September 2019 – September 2020

Panel A: Not accounting for capital flightiness metric					
	$\Delta x_{i,inelig}$ (1)	$\Delta x_{i,cash}$ (2)	$\Delta x_{i,sov}$ (3)	$\Delta x_{i,equity}$ (4)	$\Delta x_{i,other}$ (5)
$\Delta x_{i,elig}$	−0.095***	−0.188***	−0.274***	−0.011	−0.409***
	(0.036)	(0.064)	(0.057)	(0.021)	(0.078)
$Log(AUM)_{i,pre}$	0.143	−0.175	0.018	−0.006	−0.003
	(0.089)	(0.156)	(0.141)	(0.051)	(0.192)
$x_{i,pre}^{corpbond}$	0.506	1.328	0.808	0.585	−2.908*
	(0.718)	(1.263)	(1.141)	(0.414)	(1.554)
Holder Country FE	Yes	Yes	Yes	Yes	Yes
Observations	1,434	1,434	1,434	1,434	1,434
R^2	0.030	0.060	0.058	0.018	0.060

To address this challenge, we exploit the granularity of our data and the large cross-section of corporate bonds, together with the segmented structure of the bond market. Following Koijen and Yogo (2019); Bretscher et al. (2021), the model extension in Section 2.4 assumes that investors consider only a subset of available assets. In practice, such segmentation may arise from factors such as home bias, regulatory constraints, or the pattern of net inflows.[16] Moreover, because of frictions such as information and monitoring costs, investors typically adjust their portfolios by scaling positions in assets they already hold rather than by acquiring new securities.[17] Section 5 shows that mutual funds expand their existing holdings of eligible bonds. Under this form of segmentation, Proposition 1 predicts a stronger decline in spreads for bonds held by investors who value the insurance channel, such as mutual funds. These effects, however, may be partly offset because such investors are also relatively elastic, which dampens the strength of transmission (see Propositions 8 and 9).

A. Announcement Effects

We begin with evidence from the raw data, showing that bonds responded heterogeneously in the two weeks following the announcement depending on their mutual fund ownership. Figure 4 plots the reduction in bond yields (y-axis) against the share of bonds held by mutual funds (x-axis). Bonds are grouped into 50 bins based on their announcement yield reactions, and for each group we compute average mutual fund ownership. The figure therefore displays 50 dots, each representing one group. Panel 4a reports the results for the CSPP. Bonds with higher mutual fund ownership experienced larger declines in credit spreads, ranging from about 5 basis points for bonds with 20% ownership to about 70 basis points for bonds with 50% ownership. These magnitudes are substantial, given that the average effect across all bonds was approximately 30 to 40 basis points, depending on the measure. Appendix F, Figure F.1, shows similar results for the CDS-bond basis, where the pattern is nearly identical.

Panel 4b reports the results for the PEPP. As discussed earlier, the announcement effects are considerably noisier, with estimated changes ranging from about -100 to 150 basis points, which makes it more difficult to discern a clear pattern.

One might be concerned that the patterns observed in the raw data reflect (i) differences in the types of bonds held by mutual funds relative to other investors (e.g., insurance com-

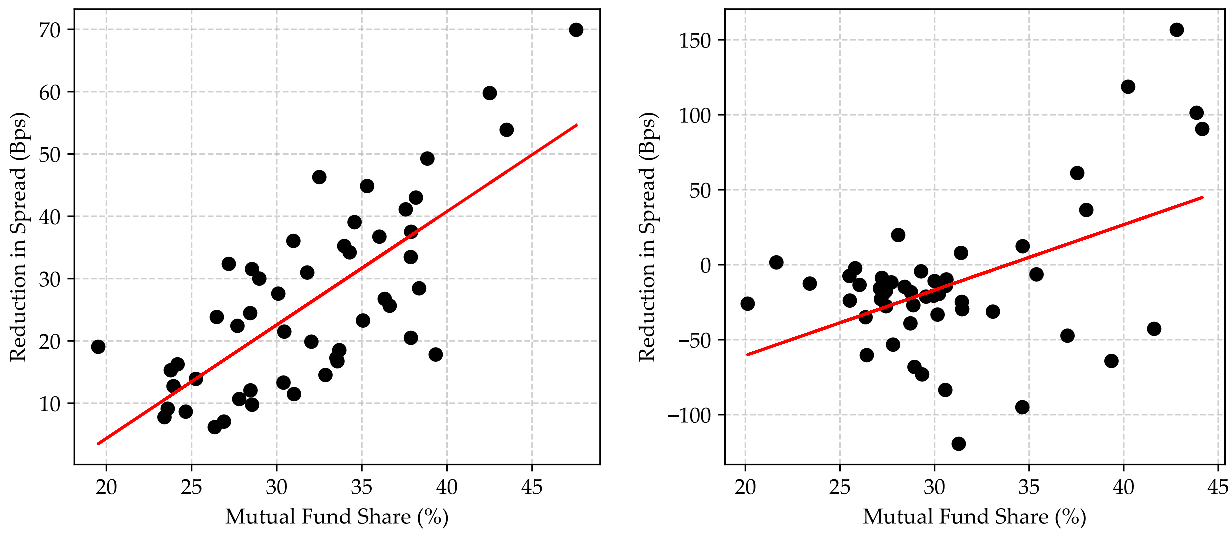
[16] For example, insurance companies often concentrate on the first issuance of bonds and tend to purchase these securities when they receive inflows from policyholders (Coppola, 2021).

[17] Such frictions have been documented in several contexts, including mutual fund flows (Coval and Stafford, 2007), insurance company fire sales (Ellul et al., 2011), and demand-based asset pricing (Koijen and Yogo, 2019; Bretscher et al., 2021).

Figure 4. **Mutual Funds Holdings and Credit Spread Response** The figure depicts the relationship between the reduction in spreads (y-axis) around ECB announcements and the corresponding mutual fund holdings (x-axis). Bonds are ranked according to the magnitude of their spread reactions and sorted into 50 groups with comparable responses. For each group, we compute the average mutual fund share. Panel (a) presents the results for the CSPP announcement, while Panel (b) reports the results for the PEPP announcement.

(a) CSPP

(b) PEPP



panies), or (ii) temporary effects that fade quickly after the announcement. In this section, we address both concerns. We show that the effects remain significant after controlling for bond characteristics and that they persist over longer horizons.

B. Heterogenous Impact on Yields

We extend the baseline difference-in-differences framework in equation (9) by interacting bond eligibility and the post-announcement period with the pre-intervention holdings of mutual funds' (MFs) share of a bond's outstanding amount. Mutual funds have been the primary focus of the paper, but we also extend the analysis to insurance companies and pension funds (ICPF) to compare the two main investor types in corporate bonds. Note that the definition of share in this specification differs from the portfolio shares used in equation (10): here, the share measures the fraction of a bond's outstanding amount held by a given investor type, rather than the share of the investor's portfolio accounted for by a given bond. On average, mutual funds hold about 10% of a bond's outstanding amount, with a standard deviation of about 18 percentage points, indicating substantial cross-sectional variation. Insurance companies and pension funds hold on average about 28% of a bond's outstanding amount. These shares are measured in 2015Q3, just prior to the start of our sample in September 2015.[18]

Formally, we estimate the following specification:

$$y_t(n) = \gamma_j \; Post_t \times Treat_t(n) + \theta_j \; Post_t \times Treat_t(n) \times \tilde{x}_j(n) + \text{Fixed Effects} + u_t(n), \quad (14)$$

where $\tilde{x}_j(n)$ is the share of the bond's outstanding amount held by investor j prior to the intervention. We consider mutual funds ($j = \text{MF}$) and insurance companies and pension funds ($j = \text{ICPF}$). We restrict the sample to bonds in which both mutual funds and insurance companies and pension funds hold a positive share.[19]

Because mutual funds and ICPFs systematically hold different sets of bonds, we include ISIN fixed effects to absorb time-invariant bond-level characteristics—such as credit quality, sector, or issuance characteristics—that may be correlated with both investor composition and price changes.

In line with the extended model in Section 2, the key prediction is that, conditional on similar observable characteristics, the CSPP effect on yields should depend on the ex-ante investor base. The coefficients θ_j on the triple interaction terms capture whether the CSPP effect was amplified or dampened for bonds more heavily held by a given investor type.

Table VII presents the estimates. For mutual funds, the coefficient in column (1) is negative and statistically different from zero, indicating that credit spreads decline more for bonds predominantly held by mutual funds. The magnitude implies that a 10 percentage point increase in mutual fund holdings amplifies the CSPP effect on credit spreads by about 3.7 basis points. Given the standard deviation of mutual fund holdings (18 percentage points), a one-standard-deviation increase in mutual fund share implies an additional compression of roughly $0.37 \times 18 \approx 6.7$ basis points. Column (3) shows that this effect is mirrored in the CDS–bond basis, which increases by about 4.2 basis points for a 10 percentage point increase in mutual fund holdings, or about $0.42 \times 18 \approx 7.6$ basis points for a one-standard-deviation change. This pattern is consistent with the CSPP effect operating primarily through the convenience yield channel—reducing yields without a commensurate change in CDS spreads, as shown in column (2).

In contrast, the interaction terms for ICPF holdings are small and statistically insignificant across all specifications, suggesting that insurance companies and pension funds did

[18] Portfolio holdings are highly persistent, so the precise timing of the measurement has little impact on the results.

[19] We winsorize the holdings at the investor level by trimming the top 1%.

not drive the observed CSPP price effects.

We provide robustness results by extending the event window, as reported in Table F1, and by using a more restrictive set of fixed effects that includes ISIN and maturity–rating–time fixed effects in Table F2.

The effects for the PEPP policy are qualitatively similar but estimated less precisely. In particular, we find a comparable coefficient for the triple interaction term for mutual funds (-0.298), although it is not statistically significant. The corresponding coefficient for the CDS–bond basis is smaller in magnitude. When we extend the sample window, the coefficient on credit spreads remains similar but becomes statistically significant. As shown in Figures 2b and 4b, the PEPP announcement was associated with substantially more market noise, and it took some time before bond yields declined. These results should therefore be interpreted with this caveat in mind.

VII. Conclusion

This paper has examined the transmission of the ECB's corporate bond purchase programs, highlighting the central role of conditional policy promises in shaping investor behavior and bond market outcomes. Using granular data on prices and holdings, combined with a simple model of segmented demand with convenience yields, we provide new evidence that the main channel of transmission operates through changes in the perceived services provided by eligible bonds rather than through default risk.

Our analysis shows that announcement effects were both immediate and persistent. Credit spreads of eligible bonds declined sharply following the CSPP and PEPP announcements, with the bulk of the adjustment explained by movements in the CDS–bond basis. This finding indicates that QE policies enhanced the convenience yield of targeted bonds, reducing the compensation investors required for holding securities exposed to liquidity and fire-sale risk. The results confirm that policy announcements themselves—rather than the gradual implementation of purchases—were the key driver of transmission.

Portfolio rebalancing further underscores the role of heterogeneous investors. Mutual funds, which are especially vulnerable to funding outflows in downturns, valued the insurance component of QE the most. They not only increased their holdings of eligible bonds but did so by reallocating away from sovereign and liquid assets, demonstrating that they viewed targeted corporate bonds as close substitutes for safe assets. Bonds with higher mutual fund ownership experienced disproportionately larger spread declines, confirming that intermediary composition is a critical determinant of policy effectiveness.

Taken together, these results highlight three broad lessons. First, corporate QE should be

Table VII. **Intermediary Effects, Difference-in-Differences Approach** The table reports the estimates of Equation 14. The triple interaction coefficients θ_{MF} and θ_{ICPF} capture the additional effects of the policies for bonds that, ex-ante, had a higher share held by mutual funds or by insurance corporations and pension funds, respectively.

(a) CSPP: September 2015 – September 2016

	MF			ICPF			MF & ICPF		
	(1) Credit Spread	(2) CDS	(3) Basis	(4) Credit Spread	(5) CDS	(6) Basis	(7) Credit Spread	(8) CDS	(9) Basis
Post × Eligible × MF Share	-0.369**	0.047	0.416**				-0.369*	0.037	0.405*
	(0.137)	(0.114)	(0.155)				(0.187)	(0.145)	(0.208)
Post × Eligible × ICPF Share				0.100	-0.003	-0.103	-0.047	-0.021	0.027
				(0.109)	(0.058)	(0.104)	(0.117)	(0.085)	(0.104)
Post × Eligible	-0.062	-0.107**	-0.045	-0.197**	-0.110**	0.087	-0.037	-0.097	-0.060
	(0.047)	(0.044)	(0.057)	(0.071)	(0.050)	(0.071)	(0.086)	(0.080)	(0.090)
Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
ISIN FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
R^2	0.94	0.90	0.92	0.92	0.90	0.90	0.93	0.90	0.90
Observations	12,912	12,912	12,912	15,916	15,916	15,916	18,156	18,156	18,156

(b) PEPP: September 2019 – September 2020

	MF			ICPF			MF & ICPF		
	(1) Credit Spread	(2) CDS	(3) Basis	(4) Credit Spread	(5) CDS	(6) Basis	(7) Credit Spread	(8) CDS	(9) Basis
Post × Eligible × MF Share	-0.298	-0.269	0.030				-0.223	-0.280	-0.057
	(0.190)	(0.178)	(0.156)				(0.187)	(0.188)	(0.167)
Post × Eligible × ICPF Share				0.210	0.216	0.006	0.124	0.047	-0.077
				(0.157)	(0.134)	(0.071)	(0.082)	(0.101)	(0.088)
Post × Eligible	-0.007	0.059	0.066	-0.147	-0.100	0.046	-0.063	0.051	0.115
	(0.052)	(0.047)	(0.062)	(0.142)	(0.090)	(0.068)	(0.052)	(0.050)	(0.079)
Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
ISIN FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
R^2	0.86	0.84	0.79	0.86	0.85	0.78	0.86	0.85	0.79
Observations	16,861	16,861	16,861	19,627	19,627	19,627	22,058	22,058	22,058

understood not merely as a supply shock but as a policy that changes the perceived characteristics of assets by providing state-contingent insurance. Second, heterogeneity in investor bases amplifies these effects, with fragile intermediaries playing a pivotal role. Finally, the effectiveness of future interventions will depend less on the size of announced purchases and more on the extent to which they exceed investor expectations and alter convenience yields.

References

Abidi, Nordine and Ixart Miquel-Flores, "Who benefits from the corporate QE? A regression discontinuity design approach," Working Paper Series 2145, European Central Bank April 2018.

Altavilla, Carlo, Giacomo Carboni, and Roberto Motto, "Asset purchase programmes and financial markets: lessons from the euro area," Working Paper Series 1864, European Central Bank 2015.

Angrist, Joshua D. and Jörn-Steffen Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion* number 8769. In 'Economics Books.', Princeton University Press, November 2009.

Bai, Jennie and Pierre Collin-Dufresne, "The CDS-Bond Basis," *Financial Management*, June 2019, *48* (2), 417–439.

Breckenfelder, Johannes and Marie Hoerova, "Do non-banks need access to the lender of last resort? Evidence from fund runs," Technical Report 2805, European Central Bank April 2023. Available as ECB Working Paper No. 2805, April 2023.

_ **and Veronica De Falco**, "Investor heterogeneity and large-scale asset purchases," Working Paper Series 2938, European Central Bank May 2024.

Bretscher, Lorenzo, Lukas Schmid, Ishita Sen, and Varun Sharma, "Institutional Corporate Bond Pricing," *Swiss Finance Institute Research Paper*, 2021.

Coppola, Antonio, "In Safe Hands: The Financial and Real Impact of Investor Composition Over the Credit Cycle," *Working Paper*, 2021.

Corell, Felix, Lira Mota, and Melina Papoutsi, "Service Flows in Euro Area Corporate Bonds," Working Papers, ECB 2023.

Coval, Joshua and Erik Stafford, "Asset Fire Sales (and Purchases) in Equity Markets," *Journal of Financial Economics*, 2007, *86* (2), 479–512.

Darmouni, Olivier and Kerry Siani, "Bond Market Stimulus: Firm-Level Evidence from 2020-21," 2022.

De Santis, Roberto A. and Andrea Zaghini, "Unconventional monetary policy and corporate bond issuance," *European Economic Review*, 2021, *135*, 103727.

D'Amico, Stefania and Iryna Kaminska, "Credit easing versus quantitative easing: evidence from corporate and government bond purchase programs," Bank of England working papers 825, Bank of England September 2019.

— **and Thomas B King**, "Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply," *Journal of financial economics*, 2013, *108* (2), 425–448.

Ellul, A., C. Jotikasthira, and C. T. Lundblad, "Regulatory pressure and fire sales in the corporate bond market," *Journal of Financial Economics*, 2011, *101*, 596–620.

Fang, Chuck and Kairong Xiao, "What Do $40 Trillion of Portfolio Holdings Say about Monetary Policy Transmission?," *SSRN Electronic Journal*, June 2025. Available at SSRN: https://ssrn.com/abstract=5025417 or http://dx.doi.org/10.2139/ssrn.5025417.

Gagnon, Joseph, Matthew Raskin, Julie Remache, and Brian Sack, "The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases," *International Journal of Central Banking*, March 2011, *7* (1), 3–43.

Gilchrist, Simon, Bin Wei, Vivian Z Yue, and Egon Zakrajšek, "The Fed takes on corporate credit risk: An analysis of the efficacy of the SMCCF," *Journal of Monetary Economics*, 2024, p. 103573.

Haddad, Valentin, Alan Moreira, and Tyler Muir, "When Selling Becomes Viral: Disruptions in Debt Markets in the COVID-19 Crisis and the Fed's Response," *The Review of Financial Studies*, 01 2021, *34* (11), 5309–5351.

— **,** — **, and** — , "Whatever it takes? The impact of conditional policy promises," Technical Report, National Bureau of Economic Research 2023.

— **,** — **, and** — , "Asset purchase rules: How QE transformed the bond market," Technical Report, Working paper, UCLA, Rochester, and USC 2024.

Hanson, Samuel G, Jeremy C Stein, Adi Sunderam, and Eric Zwick, "Business credit programs in the pandemic era," *Brookings papers on economic activity*, 2020, *2020* (3), 3–60.

Koijen, Ralph S. J. and Motohiro Yogo, "A Demand System Approach to Asset Pricing," *Journal of Political Economy*, 2019, *127* (4), 1475–1515.

Koijen, Ralph S.J., François Koulischer, Benoît Nguyen, and Motohiro Yogo, "Inspecting the mechanism of quantitative easing in the euro area," *Journal of Financial Economics*, 2021, *140* (1), 1–20.

Krishnamurthy, Arvind and Annette Vissing-Jorgensen, "The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy," Working Paper 17555, National Bureau of Economic Research October 2011.

— **, Stefan Nagel, and Annette Vissing-Jorgensen**, "ECB Policies Involving Government Bond Purchases: Impact and Channels*," *Review of Finance*, 11 2017, *22* (1), 1–44.

Mota, Lira, "The Corporate Supply of (Quasi) Safe Assets," Working Papers, MIT Sloan 2023.

Santis, Roberto A De and Fédéric Holm-Hadulla, "Flow effects of central bank asset purchases on sovereign bond prices: Evidence from a natural experiment," *Journal of Money, Credit and Banking*, 2020, *52* (6), 1467–1491.

Santis, Roberto A. De, André Geis, Aiste Juskaite, and Lia Vaz Cruz, "The impact of the corporate sector purchase programme on corporate bond markets and the financing of euro area non-financial corporations," *Economic Bulletin Articles*, 2018, *3.*

Todorov, Karamfil, "Quantify the quantitative easing: Impact on bonds and corporate debt issuance," *Journal of Financial Economics*, 2020, *135* (2), 340–358.

Zaghini, Andrea, "How ECB purchases of corporate bonds helped reduce firms' borrowing costs," *Research Bulletin*, 2020, *66.*

I. Appendix: Proofs

A. Additional Propositions, Baseline Model

Proposition 6 (Supply shock and inverse demand)**.** *A reduction in the supply of asset n increases its price and lowers its expected return. The effect is stronger when investors are more inelastic. More elastic investors reduce their holdings more strongly in response.*

Proposition 7 (Joint supply and service shock)**.** *If supply falls ($dx_n < 0$) while service rises ($dz_n > 0$), investor i's change in holdings is ambiguous and depends on the relative strength of the two channels.*

B. Additional Propositions, Segmentation with Participation Constraints

Proposition 8 (Supply shock under segmentation)**.** *If the supply of asset n increases while services remain fixed, the expected return on n rises. The magnitude of this effect depends on how elastic the group of investors who can hold asset n is. If only a few or very risk-averse (inelastic) investors are allowed to hold it, the price impact is large.*

Proposition 9 (Joint supply and service policy under segmentation)**.** *If a policy simultaneously changes both the supply of asset n and the value of its service, the net effect on holdings and expected returns is ambiguous. The outcome depends on the balance between the direct supply adjustment and the additional demand from investors who particularly value the services provided by asset n. In segmented markets, composition is central: a higher concentration of service-oriented investors within the relevant segment amplifies the service channel relative to the supply channel.*

Proof of Proposition 1. From (4),

$$\mu_t = \bar{a}\,\Sigma_t x_{mt} - \bar{\lambda}_t z_t.$$

An increase in z_n directly raises the convenience yield term $\bar{\lambda}_t z_t$, reducing μ_n if x_{mt} is held fixed. However, since investors with higher λ_{it} tilt into asset n, the aggregate market weight $x_{mt}(n)$ also rises, which increases μ_n through the first term. Hence the convenience yield always rises, but the effect on μ_n is ambiguous and depends on the adjustment of x_{mt}. $\square$

Proof of Proposition 2. Differentiating (5) with $dx_{mt} = 0$ yields

$$dx_{it} = \tfrac{1}{a_{it}}\Sigma_t^{-1} dz_t\,(\lambda_{it} - \bar{\lambda}_t),$$

so for a service shock to asset n,

$$dx_{it}(n) = \frac{1}{a_{it}}[\Sigma_t^{-1}]_{nn}(\lambda_{it} - \bar{\lambda}_t)\,dz_n,$$

which is positive for above-average λ_{it} and negative for below-average. □

Proof of Proposition 6. From (4),

$$d\mu_t = \bar{a}\,\Sigma_t\,dx_{mt}.$$

A negative supply shock $dx_n < 0$ raises the price of asset n and lowers its expected return. Investors with lower a_{it} (more elastic) absorb less of the shock and sell more. □

Proof of Proposition 7. Combining the service and supply channels, investor i's change in holdings is

$$dx_{it} = \frac{\bar{a}}{a_{it}}\,dx_{mt} + \frac{1}{a_{it}}\Sigma_t^{-1} dz_t\,(\lambda_{it} - \bar{\lambda}_t).$$

With $dx_n < 0$ and $dz_n > 0$, the two effects work in opposite directions, so the net outcome depends on their relative magnitudes. □

Proof of Proposition 5. Recall the segmented equilibrium,

$$\mu_t \;=\; (\Pi_t^x)^{-1}x_{mt} \;-\; (\Pi_t^x)^{-1}H_t^x z_t, \qquad \Pi_t^x = \sum_i \tilde{w}_i\,\frac{1}{a_i}(\Sigma_t^i)^{-1}, \quad H_t^x = \sum_i \tilde{w}_i\,\frac{1}{a_i}\lambda_i(\Sigma_t^i)^{-1}.$$

Define the *effective convenience-yield matrix* $C_t := (\Pi_t^x)^{-1}H_t^x$. Holding x_{mt} fixed (the pure service channel), a shock dz_t changes expected returns by

$$d\mu_t \;=\; -\,C_t\,dz_t.$$

For a unit shock to asset n only, $dz_t = e_n\,dz_n$, so the direct effect on μ_n is

$$d\mu_n \;=\; -\,\kappa_n\,dz_n, \qquad \text{where} \quad \kappa_n := e_n^\top C_t\,e_n \;=\; e_n^\top(\Pi_t^x)^{-1}H_t^x e_n.$$

Hence the convenience-yield component for n rises (and μ_n falls) unambiguously when z_n increases; the magnitude is governed by κ_n.

It remains to show that κ_n increases with the concentration (or intensity) of investors who value the service of asset n. Since H_t^x is linear in the λ_i,

$$\frac{\partial C_t}{\partial \lambda_i} = (\Pi_t^x)^{-1}\frac{\partial H_t^x}{\partial \lambda_i} = (\Pi_t^x)^{-1}\Big(\tilde{w}_i\,\frac{1}{a_i}(\Sigma_t^i)^{-1}\Big),$$

and thus

$$\frac{\partial \kappa_n}{\partial \lambda_i} = e_n^\top (\Pi_t^x)^{-1}\Big(\tilde{w}_i\,\frac{1}{a_i}(\Sigma_t^i)^{-1}\Big)e_n.$$

Because $(\Pi_t^x)^{-1}$ is symmetric positive definite and $(\Sigma_t^i)^{-1}$ is positive semidefinite on $\text{span}(S_i)$, the scalar above is nonnegative; it is strictly positive whenever investor i can hold asset n (i.e., $n \in \text{span}(S_i)$, which implies $(\Sigma_t^i)^{-1}e_n \neq 0$). Equivalently,

$$e_n^\top(\Pi_t^x)^{-1}(\Sigma_t^i)^{-1}e_n = \big\|(\Pi_t^x)^{-1/2}(\Sigma_t^i)^{-1/2}e_n\big\|^2 \geq 0,$$

with strict inequality under the same condition. Therefore κ_n is (strictly) increasing in each λ_i for investors who can hold n.

Consequently, any shift in investor composition that places more weight (higher $\tilde{w}_i/a_i$ or more investors) on those with higher λ_i *within the segment that can hold* n increases κ_n and strengthens the service-channel effect on μ_n. This establishes that the convenience-yield increase from a rise in z_n is stronger when the relevant segment has a higher concentration (or intensity) of service-valuing investors. □

Proof of Proposition 8. Differentiating the equilibrium condition with respect to the supply of asset n,

$$d\mu_t = (\Pi_t^x)^{-1}dx_{mt}.$$

Thus the effect on $\mu_t(n)$ is proportional to the inverse demand slope for investors who can hold n. Cross-asset effects $d\mu_t(m)$ arise when segmented investors jointly hold n and m. □

Proof of Proposition 9. Investor i's demand is

$$x_{it} = \frac{1}{a_i}(\Sigma_t^i)^{-1}\big(\mu_t + \lambda_i z_t\big).$$

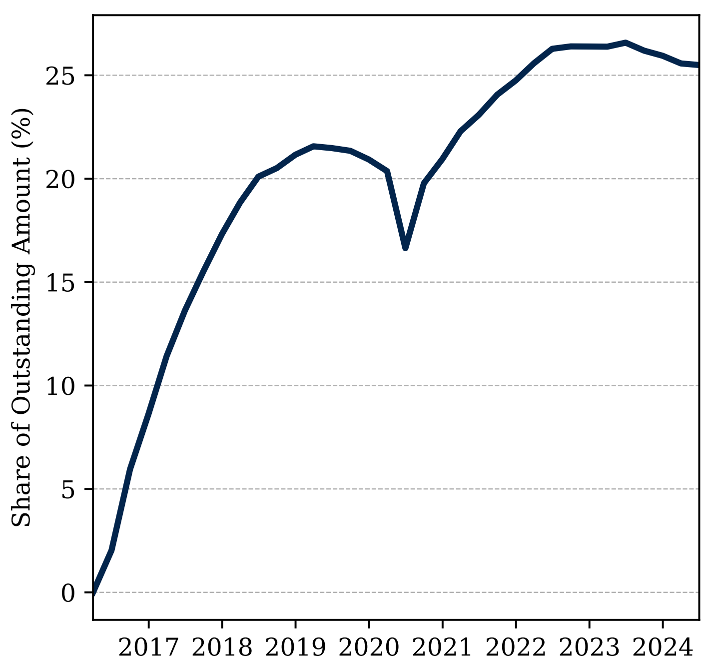
Substituting the segmented equilibrium expression for μ_t and differentiating gives

$$dx_{it} = \frac{1}{a_i}(\Sigma_t^i)^{-1}(\Pi_t^x)^{-1}dx_{mt} + \frac{1}{a_i}(\Sigma_t^i)^{-1}\big(\lambda_i I - (\Pi_t^x)^{-1}H_t^x\big)\,dz_t.$$

The first term reflects proportional reallocation to meet the new supply, while the second captures the heterogeneous tilts from service revaluation. Because these two forces push in different directions, the overall effect is ambiguous. □

II. Appendix: Additional Data

Figure B.1. **ECB Share of Outstanding Amount** igure B.1 plots the shares of the outstanding amount of eligible bonds held by the ECB. The share was 0% at the beginning of 2016, prior to the start of the CSPP and peaked to 27% in 2023.



III. Appendix: Effects on Prices

A. High-Frequency Identification, CSDB Sample

Figure C.1 shows the evolution of average credit spreads around the announcement of the CSPP and PEPP, separately for eligible and ineligible corporate bonds.

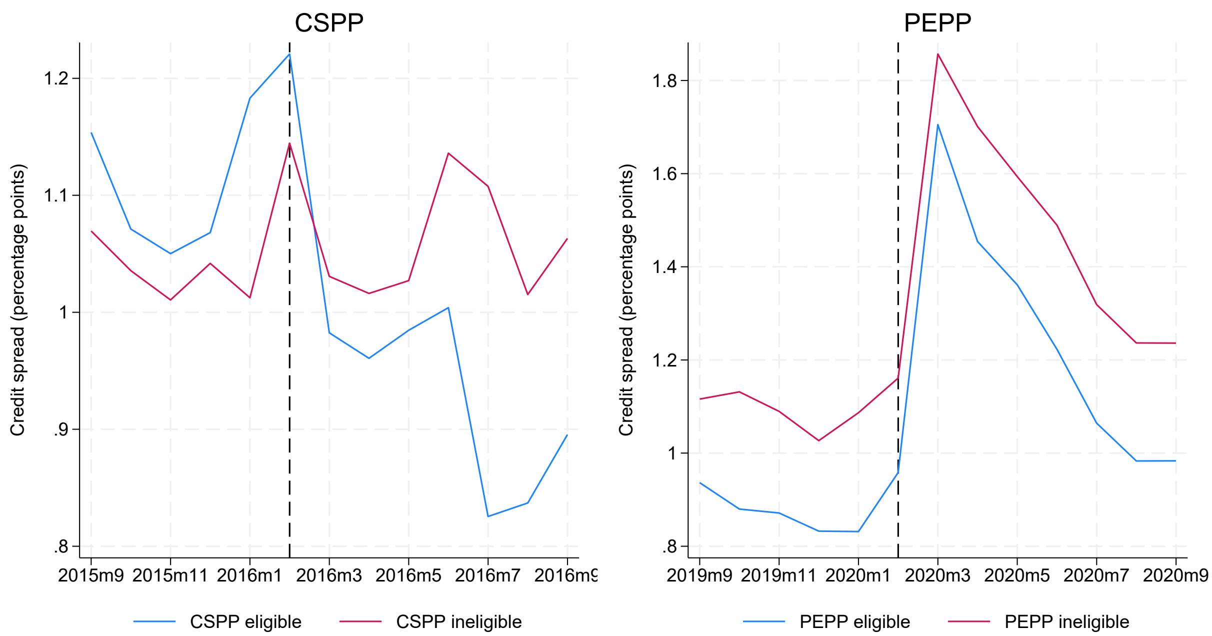
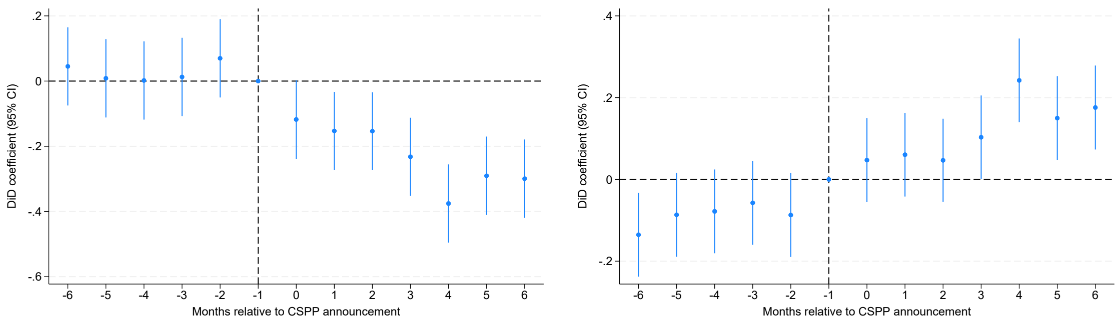


Figure C.1. **Average credit spreads around CSPP and PEPP announcement dates.** This plot illustrates the average credit spreads of QE-eligible (blue) and QE-ineligible (pink) corporate bonds around the announcement dates of the CSPP (March 2016) and PEPP (March 2020).

The time period included in this plot is the same as in the baseline specification — six months before and six months after the announcement of the purchase program. From the time series plots, it becomes obvious that after the announcement of the CSPP the decrease in spreads was significantly larger for eligible bonds relative to ineligible bonds. Similarly, around the announcement of the PEPP the spike in spreads was larger for ineligible bonds relative to the eligible ones. In the results that follow, we identify the impact of the two programs in a more robust way, as we control for bond and firm characteristics.

(a) CSPP: September 2015 – September 2016



(b) PEPP: September 2019 – September 2020

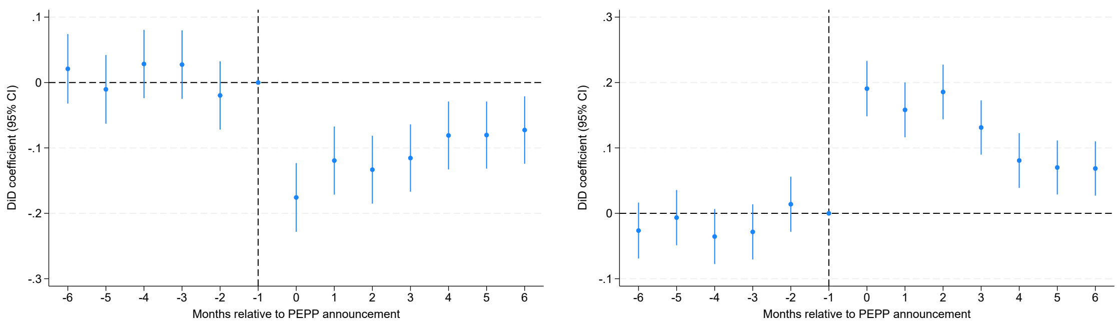


Figure C.2. **DiD coefficients around the CSPP announcement.** This figure contains the monthly point estimates in equation (15) where the dependent variables are credit spreads (left-hand panel) and the CDS-bond basis (right-hand panel).

B. Parallel Trend

Next, to assess the validity of the parallel trends assumption and provide evidence of the dynamic impact of both ECB packages for different time periods, we set up a Granger causality test, as suggested in Angrist and Pischke (2009). The goal is to check whether causes happen before consequences and not the opposite. To do this, we split the *Post* dummy into monthly dummies and run the following specification:

$$y_t(n) = \sum_{\tau} \theta_{0,\tau} \times \mathbb{1}_{\tau=t} \times Eligible_t(n) + \alpha_{R\times M} + \alpha_t + \epsilon_t(n) \qquad (15)$$

We chose the month before the program announcement as reference date. Figure C.2 shows the dynamic DiD coefficient estimates with 95% confidence intervals for the two events (CSPP and PEPP) for the credit spread (left-hand side) and for the CDS-Bond basis (right-hand side).

The impact of the two programs on the credit spread is clear. We observe that all coefficients are not statistically significant and close to zero until the month before the

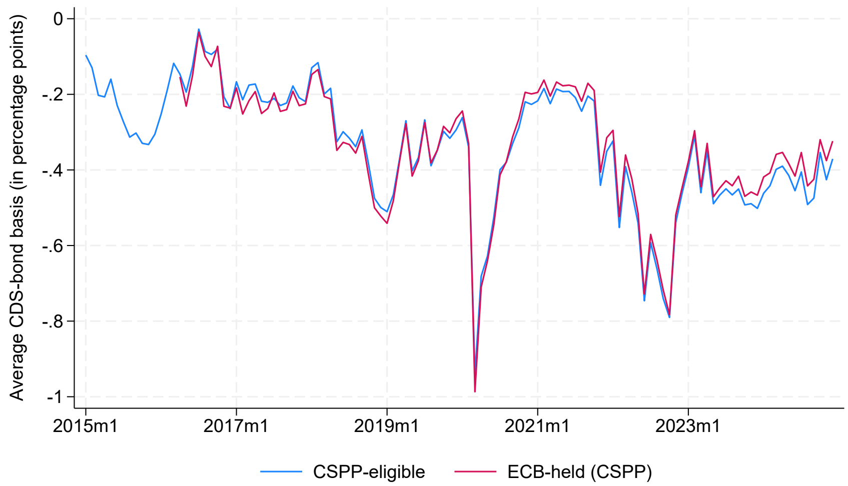


Figure C.3. **Average CDS-bond basis for ECB-held bonds compared to the universe of CSPP-eligible bonds.** This figure plots the average CDS-bond basis separately for CSPP-eligible bonds (blue) and the bonds *actually purchased* by the ECB (pink).

program announcement, whereas they become negative and statistically significant in the months that follow. The fact that we do not observe significant differences in the pre-period is strong evidence that the parallel trends assumption holds.

Finally, note that the mechanism we propose works through a change in the service flows that a bond provides, not through a change in the relative supply of different assets. Therefore, an important question that naturally arises is whether the actual purchases of the ECB have an effect on top of the eligibility effect. In Figure C.3, we present the average CDS-bond basis of CSPP-eligible bonds (blue) and that of bonds *actually* purchased by the ECB (pink). The two lines are almost identical for the entire period of interest, which confirms that there is no additional effect caused by the actual ECB purchase.

IV. Appendix: Rebalancing

Table D1. **Portfolio shares rebalancing around the two corporate QE programs.** This table displays the change in portfolio corporate bond holdings (in EUR billion) between the beginning and end of each event period (2015q1 – 2016q4 for CSPP; 2019q1 – 2020q4 for PEPP), separately for QE-eligible and -ineligible bonds, for the following investor sectors: Banks, mutual funds, insurance companies & pension funds, others (incl. households and non-financial corporations), and rest of the world (i.e., non-euro area holdings estimated as the residual). Net issuance is calculated as the sum of all sectors' rebalancing. The third column contains each sector's total holdings (ineligible and eligible) at the beginning of the event period. The final column shows the total change in holdings (ineligible and eligible) over the event period as a share of initial holdings.

(a) CSPP

	2015q4 – 2016q2			2015q4 – 2016q4			2015q4
	Eligible	Ineligible	Sovereign	Eligible	Ineligible	Sovereign	Holdings
Banks	-0.13	0.17	-0.04	-1.13	1.61	-0.48	1244
ICPF	0.18	-0.30	0.12	0.30	0.03	-0.33	1563
MF	2.54	0.59	-3.13	2.62	1.24	-3.86	967
Other	-0.02	-0.48	0.51	0.18	-1.13	0.95	583
ECB	0.60	0.00	-0.60	3.98	0.00	-3.98	692
RoW	0.20	1.27	-1.47	-1.44	2.44	-1.00	2153

(b) PEPP

	2019q4 – 2020q2			2019q4 – 2020q2			2019q4
	Eligible	Ineligible	Sovereign	Eligible	Ineligible	Sovereign	Holdings
Banks	-0.35	0.27	0.08	-1.53	2.32	-0.80	1202
ICPF	1.03	0.22	-1.25	0.30	0.47	-0.77	1858
MF	2.68	-0.82	-1.87	2.84	-0.48	-2.36	1047
Other	-1.78	-3.48	5.25	-1.17	-4.11	5.29	499
ECB	1.66	0.22	-1.87	2.36	0.08	-2.44	1672
RoW	0.76	-1.06	0.31	-1.48	0.22	1.26	2395

Table D2. **Summary Statistics of portfolio shares** This table displays the median and average portfolio shares pre-CSPP announcement and pre-PEPP for each type sector.

	Banks	MF	ICPF	Other	RoW
Pre-CSPP Median	1.57	4.09	3.66	1.48	0.24
Pre-CSPP Mean	5.52	7.18	7.48	4.88	1.89
Pre-PEPP Median	1.75	2.83	2.82	1.61	0.72
Pre-PEPP Mean	6.03	5.31	5.78	4.81	2.12

Table D3. **The effect of corporate QE on log-portfolio shares. Longer Sample** This table displays the results of estimating equation (10) separately for five holdings sectors: Banks, mutual funds, insurance companies & pension funds, others (incl. households and non-financial corporations), and rest of the world (i.e., non-euro area holdings estimated as the residual).

(b) CSPP: Portfolio Shares: 2015q2 – 2016q4

	(1) Banks	(2) MF	(3) ICPF	(4) Other	(5) RoW
Post=1 × CSPP eligible=1	-0.267*	0.283***	-0.115**	-0.550***	-0.536***
	(0.12)	(0.05)	(0.04)	(0.05)	(0.11)
CSPP eligible=1	-1.713**	-0.820*	0.555	-0.942**	1.901***
	(0.46)	(0.34)	(0.37)	(0.30)	(0.46)
Holder country x Time FE	✓	✓	✓	✓	✓
Rating x Maturity FE	✓	✓	✓	✓	✓
R^2	0.25	0.19	0.22	0.16	0.04
Observations	64,275	98,853	103,481	103,145	28,261

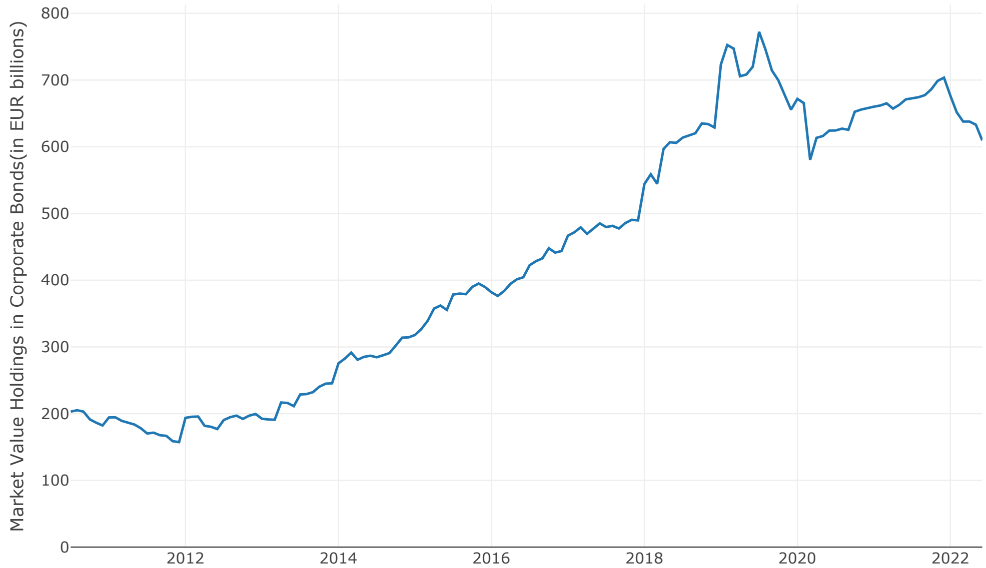
(c) PEPP, Portfolio Shares: 2019q2 – 2020q4

	(1) Banks	(2) MF	(3) ICPF	(4) Other	(5) RoW
Post=1 × PEPP eligible=1	-0.523***	0.191***	-0.304***	0.117***	-0.084
	(0.06)	(0.02)	(0.03)	(0.03)	(0.06)
PEPP eligible=1	-0.085	-1.340***	-0.006	-0.953***	2.309***
	(0.50)	(0.21)	(0.23)	(0.22)	(0.57)
Holder country x Time FE	✓	✓	✓	✓	✓
Rating x Maturity FE	✓	✓	✓	✓	✓
R^2	0.31	0.18	0.20	0.14	0.08
Observations	76,133	147,489	160,739	112,949	29,781

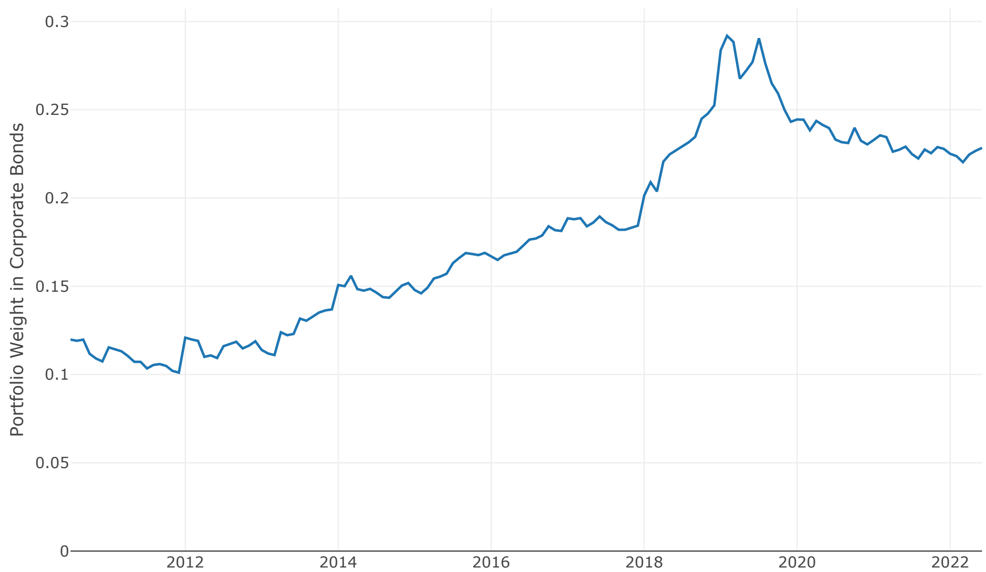
V. Fund-Level Analysis

A. Data

We retrieve monthly euro area mutual fund holdings, asset under management (AUM), and flows from Morningstar. We include only open-end funds and exclude closed-end, variable annuity funds, and index funds from our analysis. To ensure data quality, we exclude holdings for which the amount held by the fund exceeds their total outstanding amount and truncate the share of total outstanding at the 99th percentile. We merge the holdings table with ECB corporate bond table (CSDB) and exclude observations for which the market value is zero or the ratio of the market value of holdings to the total market value amount exceeds one. The sample is further refined based on fund characteristics. Funds must have at least 1 million market value holdings in corporate bonds each month. We also drop funds where the portfolio weight in corporate bond positions is greater than one. To ensure consistent reporting behavior, for monthly holdings data, we only keep funds that report in all 3 months of each quarter and include only those with holdings data available for at least 6 months across the event window. For the quarterly table, we only include funds that report holdings for at least 2 quarters within the event window.

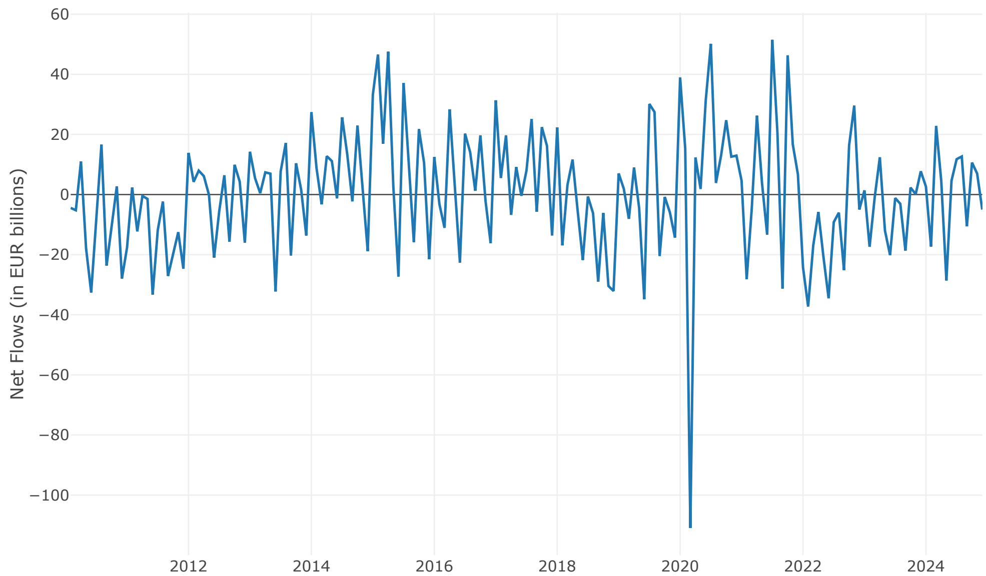


(a) Market Value Holdings in Corporate Bonds

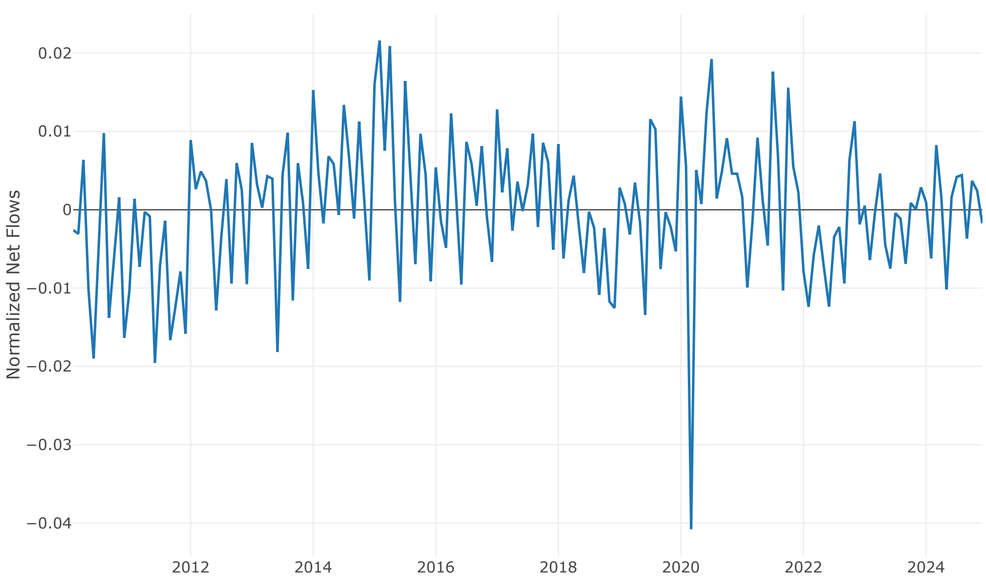


(b) portfolio Weight in Corporate Bonds

Figure E.1. **Time Series of Mutual Fund Portfolio Weight in Corporate Bonds.** Panel (a) plots the mutual funds' total market value holdings in corporate bonds overtime. Panel (b) plots the time series of the ratio of mutual funds' total market value holdings in corporate bonds to total AUM. The sample is monthly from July 2010 to June 2022.



(a) Net Flows



(b) Normalized Net Flows

Figure E.2. **Time Series of Mutual Fund Flows.** Panel (a) shows the sum of euro mutual fund net flows over time. Panel (b) shows the time series of total fund net flows normalized by the total fund AUM in the previous period. The sample is monthly from February 2010 to December 2024.

Table E1. **Descriptive statistics for mutual funds holdings.** This tables shows the descriptive statistics for key variables in regression(12). x is the portfolio weight of fund i in bond n, defined as the ratio of the market value of fund i's holdings in that bond to the fund's total market value holdings across all corporate bonds. The key independent variable *CapitalFlightiness* is computed from equation (11). *HighCapF* is a dummy indicator reflecting whether the fund's *CapitalFlightiness* falls within the top 75th percentile. βs are the loadings on the first two principal components obtained from a principal component analysis (PCA) of bond returns at the bond category level. The sample is monthly. We winsorize x, *CapitalFlightiness*, and βs at 1% and 99% to remove outliers.

(a) CSPP: September 2015 – September 2016

	N	Pctl(25)	Median	Pctl(75)	Mean	St. Dev.
Portfolio weight (%)	694,376	0.575	1.446	3.490	3.443	5.855
CapitalFlightiness	694,376	0.022	0.039	0.060	0.045	0.031
HighCapF	694,376	0	0	1	0.256	0.436
Elig	694,376	0	0	1	0.481	0.500
Post	694,376	0	1	1	0.556	0.497
β_1	291,886	−0.070	−0.052	−0.026	−0.040	0.048
β_2	291,886	−0.024	0.009	0.033	−0.004	0.068

(b) PEPP: September 2019 – September 2020

	N	Pctl(25)	Median	Pctl(75)	Mean	St. Dev.
Portfolio weight (%)	1,281,421	0.353	0.983	2.354	2.240	3.767
CapitalFlightiness	1,281,421	0.014	0.031	0.054	0.040	0.036
HighCapF	1,281,421	0	0	1	0.276	0.447
Elig	1,281,421	0	1	1	0.541	0.498
Post	1,281,421	0	1	1	0.571	0.495
β_1	518,250	−0.066	−0.036	0.051	−0.012	0.060
β_2	518,250	−0.023	0.002	0.021	−0.001	0.069

Table E2. **Descriptive statistics for mutual funds portfolio weights.** This table displays the descriptive statistics for key variables in regression (13). The fund AUM is the average fund AUM over the two years preceding the QE announcements (CSPP and PEPP) and is presented in millions. Portfolio weights are represented in percentage points. $x_{i,other}$ includes fund positions in derivatives, real estats, private equity, commodities, etc. $Log(AUM)_{i,pre}$ and $x_{i,pre}^{corpbond}$ refer to the fund's assets under management and corporate bond share at the onset of the events (September 2015 for CSPP and September 2019 for PEPP). *HighCapF* is a dummy indicator reflecting whether the fund's *CapitalFlightiness* falls within the top 75th percentile. Data is monthly. We trim the distribution of Δx_{im} by keeping observations within the interval [-100, 100], and winsorize at the 1st and 99th percentiles to remove outliers.

(a) CSPP: September 2015 – September 2016

	Key variables in regression (13)				
	Pctl(25)	Median	Pctl(75)	Mean	St. Dev.
$\Delta x_{i,elig}$	−0.784	0.000	1.184	0.154	2.982
$\Delta x_{i,inelig}$	−3.811	−0.613	1.919	−1.165	5.785
$\Delta x_{i,cash}$	−4.126	−0.391	2.166	−1.043	8.476
$\Delta x_{i,sov}$	−4.341	−0.187	1.732	−1.469	7.341
$\Delta x_{i,equity}$	0.000	0.000	0.000	0.040	2.610
$\Delta x_{i,other}$	−1.809	2.470	7.676	3.490	10.637
CapitalFlightiness	0.017	0.035	0.059	0.043	0.035
HighCapF	0	0	0	0.244	0.430
AUM	37.290	118.008	352.025	365.920	796.744
	$x_{i,m}$ **in pre-period CSPP (September 2015)**				
$x_{i,elig}$	0.406	2.887	7.348	5.451	7.015
$x_{i,inelig}$	8.017	16.490	29.872	20.722	16.458
$x_{i,cash}$	2.575	6.896	16.049	13.151	17.287
$x_{i,sov}$	4.908	16.925	41.948	25.851	25.144
$x_{i,equity}$	0.000	0.000	7.153	6.147	12.476
$x_{i,other}$	12.590	27.422	44.699	28.678	25.439
	$x_{i,m}$ **in post-period CSPP (September 2016)**				
$x_{i,elig}$	0.568	3.180	7.617	5.615	7.028
$x_{i,inelig}$	7.784	15.443	27.663	19.583	15.492
$x_{i,cash}$	2.191	5.439	15.197	12.192	16.924
$x_{i,sov}$	4.075	15.240	38.845	24.340	24.784
$x_{i,equity}$	0.000	0.000	7.417	6.170	12.486
$x_{i,other}$	12.590	27.422	44.699	28.678	25.439

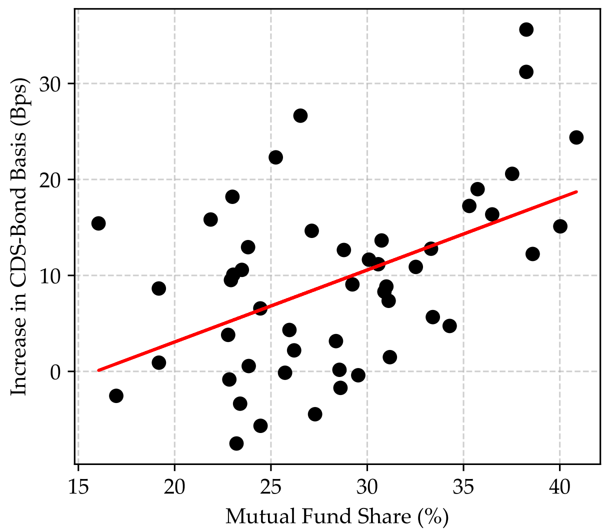
(b) PEPP: September 2019 – September 2020

	Key variables in regression (13)				
	Pctl(25)	Median	Pctl(75)	Mean	St. Dev.
$\Delta x_{i,elig}$	−0.274	0.663	2.814	1.312	3.423
$\Delta x_{i,inelig}$	−1.529	0.302	2.677	0.577	4.682
$\Delta x_{i,cash}$	−2.716	−0.065	2.213	−0.838	8.366
$\Delta x_{i,sov}$	−3.154	−0.001	1.832	−0.550	7.548
$\Delta x_{i,equity}$	−0.104	0.000	0.000	−0.318	2.685
$\Delta x_{i,other}$	−4.680	−0.439	3.655	−0.092	10.296
CapitalFlightiness	0.011	0.026	0.049	0.035	0.031
HighCapF	0	0	0	0.237	0.425
AUM	49.762	136.010	387.869	436.510	1,161.619
	$x_{i,m}$ **in pre-period PEPP (September 2019)**				
$x_{i,elig}$	1.493	4.448	10.474	7.146	7.817
$x_{i,inelig}$	6.231	14.079	26.306	17.883	15.172
$x_{i,cash}$	2.081	5.026	11.338	9.413	12.336
$x_{i,sov}$	3.247	13.809	34.818	22.397	23.719
x_{equity}	0.000	0.000	9.479	7.144	12.680
$x_{i,other}$	18.699	34.396	54.516	36.016	25.094
	$x_{i,m}$ **in post-period PEPP (September 2020)**				
$x_{i,elig}$	2.307	5.828	12.609	8.431	8.279
$x_{i,inelig}$	7.006	14.158	26.868	18.460	15.733
$x_{i,cash}$	2.303	5.017	10.446	8.593	11.286
$x_{i,sov}$	2.917	13.775	33.730	21.825	23.628
x_{equity}	0.000	0.000	8.779	6.841	12.695
$x_{i,other}$	19.032	34.684	53.773	35.849	24.991

VI. Appendix: Intermediary Effects

Figure F.1. **Mutual Funds Holdings and Basis Response** The figure depicts the relationship between the increase in CDS-Bond basis (y-axis) around ECB announcements and the corresponding mutual fund holdings (x-axis). Bonds are ranked according to the magnitude of their spread reactions and sorted into 50 groups with comparable responses. For each group, we compute the average mutual fund share. Panel (a) presents the results for the CSPP announcement, while Panel (b) reports the results for the PEPP announcement.

(a) CSPP



(b) PEPP

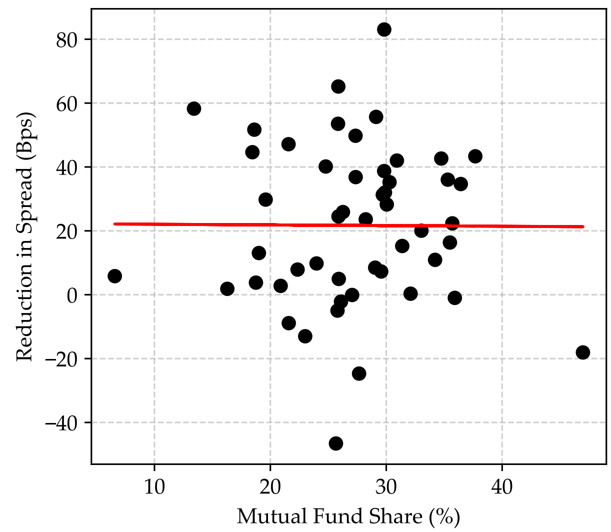


Table F1. **Intermediary Effects, Difference-in-Differences Approach** The table reports the estimates of Equation 14. The triple interaction coefficients θ_{MF} and θ_{ICPF} capture the additional effects of the policies for bonds that, ex-ante, had a higher share held by mutual funds or by insurance corporations and pension funds, respectively.

(a) CSPP: June 2015 – December 2016

	MF			ICPF		
	(1) Credit Spread	(2) CDS	(3) Basis	(4) Credit Spread	(5) CDS	(6) Basis
Post × Eligible × MF Share	-0.414***	0.044	0.458***			
	(0.125)	(0.094)	(0.142)			
Post × Eligible × ICPF Share				0.067	-0.007	-0.074
				(0.097)	(0.050)	(0.106)
Post × Eligible	-0.028	-0.087*	-0.059	-0.174**	-0.088*	0.085
	(0.050)	(0.045)	(0.062)	(0.066)	(0.046)	(0.077)
Time FE	✓	✓	✓	✓	✓	✓
ISIN FE	✓	✓	✓	✓	✓	✓
R^2	0.91	0.84	0.90	0.89	0.85	0.89
Observations	18,672	18,672	18,672	22,975	22,975	22,975

(b) PEPP: June 2019 – December 2020

	MF			ICPF		
	(1) Credit Spread	(2) CDS	(3) Basis	(4) Credit Spread	(5) CDS	(6) Basis
Post × Eligible × MF Share	-0.349*	-0.259	0.090			
	(0.190)	(0.171)	(0.152)			
Post × Eligible × ICPF Share				0.177	0.186	0.009
				(0.140)	(0.117)	(0.076)
Post × Eligible	0.013	0.064	0.051	-0.122	-0.080	0.041
	(0.048)	(0.047)	(0.059)	(0.122)	(0.079)	(0.063)
Time FE	✓	✓	✓	✓	✓	✓
ISIN FE	✓	✓	✓	✓	✓	✓
R^2	0.86	0.83	0.79	0.85	0.84	0.78
Observations	24,095	24,095	24,095	28,157	28,157	28,157

Table F2. **Intermediary Effects, Difference-in-Differences Approach** The table reports the estimates of Equation 14. The triple interaction coefficients θ_{MF} and θ_{ICPF} capture the additional effects of the policies for bonds that, ex-ante, had a higher share held by mutual funds or by insurance corporations and pension funds, respectively.

(a) CSPP: September 2015 – September 2016

	MF			ICPF		
	(1) Credit Spread	(2) CDS	(3) Basis	(4) Credit Spread	(5) CDS	(6) Basis
Post × Eligible × MF Share	-0.254*	0.110	0.364**			
	(0.124)	(0.099)	(0.138)			
Post × Eligible × ICPF Share				0.078	0.000	-0.077
				(0.101)	(0.050)	(0.101)
Post × Eligible	-0.054	-0.122**	-0.068	-0.150**	-0.099**	0.051
	(0.044)	(0.044)	(0.055)	(0.068)	(0.044)	(0.072)
ISIN FE	✓	✓	✓	✓	✓	✓
Rating x Maturity x Time FE	✓	✓	✓	✓	✓	✓
R^2	0.94	0.91	0.92	0.93	0.91	0.91
Observations	12,912	12,912	12,912	15,913	15,913	15,913

(b) PEPP: September 2019 – September 2020

	MF			ICPF		
	(1) Credit Spread	(2) CDS	(3) Basis	(4) Credit Spread	(5) CDS	(6) Basis
Post × Eligible × MF Share	-0.078	-0.097	-0.019			
	(0.133)	(0.083)	(0.135)			
Post × Eligible × ICPF Share				0.147	0.157	0.011
				(0.105)	(0.089)	(0.072)
Post × Eligible	-0.028	0.043	0.071	-0.071	-0.043	0.029
	(0.052)	(0.044)	(0.062)	(0.088)	(0.043)	(0.078)
ISIN FE	✓	✓	✓	✓	✓	✓
Rating x Maturity x Time FE	✓	✓	✓	✓	✓	✓
R^2	0.90	0.88	0.82	0.90	0.88	0.81
Observations	16,856	16,856	16,856	19,623	19,623	19,623

A. Announcement Effects

After establishing the effects using the difference-in-differences approach, we now turn to a higher-frequency analysis and focus on the announcement effects of the policy. Following standard practice in the literature, we study market reactions around the announcement date and then include intermediary holdings to assess heterogeneity. For this part of the analysis, we restrict the sample to the iBoxx dataset, which provides daily data. Specifically, we compute the change in $y(n)$ from the three-day average before the announcement to d

days after the event. When using iBoxx data, we also include euro-denominated investment-grade bonds issued by firms outside the euro area. This broader sample gives us a larger set of non-eligible bonds and improves identification. We estimate:

$$\begin{aligned}\Delta y(n) = {} & \theta_1 \; Treat_t(n) + \theta_{MF} \; Treat_t(n) \times MF(n) + \gamma_{MF} \; MF(n) \\ & + \theta_{ICPF} \; Treat_t(n) \times ICPF(n) + \gamma_{ICPF} \; ICPF(n) + \text{Fixed Effects} + u_d(n)\end{aligned} \tag{16}$$

We can estimate a θ for each time lag. We use a 2-weeks period to make sure our results are not driven by difference in liquidity across bonds and at the same time use a window tight enough. The main coefficients of interest are θ_{MF} and θ_{ICPF}.

Panel (a) of Table F3 reports the results for the CSPP announcement. The estimates support the difference-in-differences approach. In columns (1) and (2), we find that the interaction with mutual fund ownership yields coefficients of -0.21 and -0.17 for bond yields and credit spreads, respectively. This implies that a 10 percentage point increase in mutual fund share results in an additional 1.7 basis point reduction in bond yields following the announcement.

Consistent with earlier findings, most of the effect is driven by the convenience yield. The coefficient on the CDS-bond basis in column (3) is 0.18, indicating that the decline in yields is primarily attributable to an increase in convenience yield rather than a change in default risk. The results align closely with those in the previous section, despite relying on a different identification strategy and dataset, further reinforcing the robustness of our findings.

We extend the analysis to the PEPP announcement in Panel (b) of Table F3. The outcome variable is measured as the change between the average over the three days before March 24—one week after the announcement—and the two weeks that follow. The PEPP was announced outside a scheduled Governing Council meeting, and the timing was unexpected by markets. As shown in Figure 2b, market reactions unfolded within a few days.

This setting allows us to examine how the effects of the policy vary with investor composition. We find a sizable response. The coefficient on mutual fund holdings, θ_{MF}, is approximately -1.1, implying a 10 basis point decline in yields for a 10 percentage point increase in mutual fund ownership. As in the CSPP case, the effect is entirely driven by the convenience yield: the coefficient in column (4) is also 1.1, confirming that the yield compression reflects changes in liquidity or safety premia rather than credit risk.

The PEPP results confirm the pattern observed under the CSPP. However, the interpretation may differ due to the nature of the shock. As noted by Coppola (2021), mutual funds are prone to fire sales during recessions, which can amplify the rise in bond yields. It is therefore expected that the ECB's intervention had a stronger effect on bonds held by mutual funds, as these bonds experienced more severe dislocations prior to the announcement.

At the same time, the evidence is consistent with the prediction of our model, which emphasizes that such policies are particularly beneficial to mutual funds. In a counterfactual scenario without the intervention, mutual funds would have likely faced steeper losses. The ECB effectively acted as a countercyclical buyer, supplying liquidity precisely when mutual funds needed it most.

Table F3. **The effect of corporate QE on sectoral corporate bond holdings.** This table displays the results of estimating equation (10) separately for five holdings sectors: Banks, mutual funds, insurance companies & pension funds, others (incl. households and non-financial corporations), and rest of the world (i.e., non-euro area holdings estimated as the residual).

(a) CSPP

	(1) Credit Spread	(2) CDS	(3) Basis
Eligible × MF Share	-23.98**	-3.190	20.79***
	(10.06)	(9.418)	(4.537)
Eligible × ICPF Share	-11.33	-6.040	5.287
	(12.74)	(12.32)	(4.089)
Eligible	4.801	-0.558	-5.359*
	(7.108)	(6.345)	(2.548)
MF Share	-16.85*	8.293	25.15***
	(8.397)	(10.29)	(5.086)
ICPF Share	-4.336	3.907	8.243**
	(6.269)	(6.604)	(2.944)
Rating x Maturity FE	✓	✓	✓
R^2	0.34	0.29	0.16
Observations	818	818	818

(b) PEPP

	(1) Credit Spread	(2) CDS	(3) Basis
Eligible × MF Share	-1.079**	0.063	1.142**
	(0.416)	(0.188)	(0.344)
Eligible × ICPF Share	-0.337	0.443***	0.781**
	(0.301)	(0.046)	(0.297)
Eligible	0.724***	-0.101*	-0.825***
	(0.191)	(0.051)	(0.170)
MF Share	0.769*	-0.139	-0.909**
	(0.362)	(0.168)	(0.264)
ICPF Share	0.498**	-0.278**	-0.776***
	(0.195)	(0.087)	(0.159)
Rating x Maturity FE	✓	✓	✓
R^2	0.17	0.05	0.12
Observations	1,216	1,216	1,216