DEMAND-DRIVEN BOND FINANCING IN THE EURO AREA

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ABSTRACT

We show non-financial corporations changed the quantity and composition of their bond issues in response to the European Central Bank's corporate quantitative easing program. Eligible issuers shifted toward bonds meeting the program's eligibility requirements. Moreover, demand for credit risk increased, and risk premia in the bond market dropped after the announcement. Eligible and ineligible firms increased total issuance and shifted toward bonds with riskier characteristics, namely unsecured and non-guaranteed bonds. Total issuance increased the most among those firms that were most exposed to the decline in risk premia. Firms also shifted away from short-maturity instruments and issued more fixed-coupon bonds.

Keywords: Bond financing, market timing, capital structure, quantitative easing, CSPP.

JEL Classification: G32, G38, E58.

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I. INTRODUCTION

Starting with the financial crisis of 2008, and continuing through the pandemic of 2020, central banks around the world implemented a series of quantitative easing (QE) programs to improve capital market conditions and facilitate the pass-through of monetary policy to markets and the real economy. As central banks expanded their QE programs to include corporate bonds, non-financial corporations began playing an important role in the transmission of monetary policy.

Because corporations time capital markets in response to market conditions (Baker and Wurgler (2002); Baker, Stein, and Wurgler (2003b); Covas and Den Haan (2011); Ma (2019)), their issuance choices reflect the effects of QE on financial markets. Therefore, by studying the quantity and composition of corporate bond issuance, regulators and policy makers can gather valuable evidence about which channels are responsible for the transmission of QE to credit markets.

In this paper, we use the announcement of the European Central Bank's (ECB's) corporate quantitative easing program (the Corporate Sector Purchase Program, or CSPP) as a shock to the demand for corporate bonds and we show how it was transmitted to bond issuance. Although the CSPP was endogenous to the aggregate economic and financial conditions of the euro area, bonds were classified as eligible for purchase by the ECB based only on rules governing the conduct of monetary policy.[1]

To evaluate the impact of the ECB's QE program on corporate bond issuance, we analyze a comprehensive sample of euro-denominated bonds issued by non-financial corporations

[1]Based on the initial announcement of the CSPP, to be eligible for purchase, a bond needs to be euro-denominated, issued by a non-bank corporation established in the euro area, and eligible to be used as a collateral at the ECB. This last requirement implies a bond must satisfy the collateral-eligibility criteria we report in Internet Appendix A.8. Among other criteria, the list specifies the bond must be investment-grade rated. Importantly, eligibility is based on bond characteristics and not on the issuer's credit rating. Thus, some firms may issue both eligible and ineligible bonds.

domiciled in the euro area. In our main specifications, we include firm-time fixed effects to control for variation in each firm's demand for total financing and each firm's time-varying characteristics. We then study how firms changed the composition of their bond issues across multiple bond characteristics. Our findings indicate that firms choose the features of their bond issues in response to market demand, and not only in response to firms' characteristics, which were the focus of previous literature on debt composition (Rauh and Sufi (2010); Colla, Ippolito, and Li (2013); Barclay and Smith (1995)).

We show firms increased issuance of eligible bonds to meet the ECB demand for such bonds. In particular, firms persistently increased issuance of eligible bonds relative to ineligible ones. We estimate that issuers of eligible bonds (eligible issuers) increased eligible net issuance over ineligible net issuance by about €4.1 billion per month following the CSPP announcement. This quantity represents 55% of the €7.5 billion monthly purchases that the ECB conducted in the initial phase of the program.[2] We find the largest short-term increase in eligible issuance among those firms that experienced the largest decline in the spread of their eligible bonds. The relation between spread changes and eligible issuance disappears over the longer horizon, consistent with the notion that, over time, the increased supply of eligible bonds offset the initial price impact of the ECB demand.

Consistent with the shift toward eligible issuance, we also show that eligible firms changed the features of their bond issues to meet the ECB's demand for certain bond characteristics. Because the ECB requires eligible bonds to be listed on a regulated exchange, not

[2]The shift from ineligible to eligible issuance that we document after the announcement of the CSPP is analogous to the move from jumbo to conforming loans that Di Maggio, Kermani, and Palmer (2020) find during the first round of mortgage-backed securities purchases by the Federal Reserve.

subordinated, and to be investment-grade rated, firms increased issuance of bonds satisfying these three requirements.

After the CSPP announcement, we also observe a decline in risk premia in the corporate bond market and an increase in total bond issuance. Empirically, we find that the increase in total issuance reflects primarily firms' exposure to the decline in risk premia, rather than firms' ability to issue eligible bonds. First, we find both eligible and ineligible firms increased total issuance in the short run following the announcement. However, we observe no difference between eligible and ineligible firms. Second, we show total issuance is correlated to firms' exposure to changes in risk premia. Overall, the results indicate both eligible and ineligible firms were affected by a decline in risk premia, which prompted them to increase total issuance after the CSPP announcement.

Consistent with a decline in risk premia, we find that firms shifted the composition of their issues toward riskier bond types. Specifically, issuers increased the issuance of unsecured and non-guaranteed bonds following the CSPP announcement. Notably, collateralization and guarantees are not necessary requirements for CSPP eligibility. Therefore, combining our results, it appears that firms followed a pecking order when altering their bond composition. They shifted toward safer bonds in terms of characteristics required for eligibility, such as issuing more investment-grade and senior bonds, while simultaneously moving toward riskier bonds in areas not required for eligibility, such as increasing the issuance of unsecured and non-guaranteed bonds.

We also provide more direct evidence of firms' intention to time the market using a revealed-preference approach. Specifically, we study the characteristics of bond issues to evaluate whether firms demonstrated a preference to issue bonds after the announcement, rather than wait

for future needs or opportunities. Firms, and eligible firms in particular, shifted toward longer-maturity bonds, moved away from commercial paper, and issued more fixed-coupon bonds. Overall, these patterns suggest that firms considered market conditions as favorable and, thus, wanted to hedge against the risk of market conditions changing in the future. Moreover, eligible firms also showed hints of opportunistic behavior as they increased issuance of bonds justified by general corporate purposes, rather than specific business purposes, and they took advantage of their established issuance programs to issue bonds quickly after the announcement of the CSPP.

To organize and interpret our empirical findings, we rely on the two main strands of theoretical literature on the transmission of QE as discussed by Bernanke (2020). One strand of the literature (Greenwood, Hanson, and Stein (2010); Krishnamurthy and Vissing-Jorgensen (2012); Modigliani and Sutch (1966, 1967); Tobin (1969); Vayanos and Vila (2021)) focuses on the effects of QE on eligible bonds. According to this literature, QE reduces the net supply of the eligible bonds, causing investors to bid up their prices and corporations to increase their issuance. We refer to this mechanism as the *scarcity channel* of transmission of QE. The other strand of the literature (Brunnermeier and Sannikov (2014); Cúrdia and Woodford (2011); Drechsler, Savov, and Schnabl (2018); He and Krishnamurthy (2013); Gertler and Kiyotaki (2010); Gertler and Karadi (2011)) focuses on the effects of QE on risk premia. According to this literature, QE relaxes the balance-sheet constraints of investors that become more willing to hold non-diversifiable risk, thus leading to a reduction in risk premia across multiple asset classes[3] and, hence, an increase in the issuance of risky assets. We, thus, refer to this mechanism as the *risk*

[3]Previous research (Gilchrist and Zakrajšek (2013); Gilchrist, Wei, Yue, and Zakrajšek (2020); Krishnamurthy and Vissing-Jorgensen (2011)) found that risk premia dropped following QE announcements by the Federal Reserve. In the context of the CSPP, Bonfim and Capela (2020) and Zaghini (2019) observe the CSPP generates spillover effects on ineligible bond yields.

channel of transmission of QE. Overall, our findings suggest both channels played a role in the transmission of the CSPP to corporate bond issuance.[4]

RELATED LITERATURE. This paper belongs to the literature that studies corporate market timing. We contribute to this literature by showing that firms modified the quantity and composition of their bond issues in response to change in market conditions brought about by a corporate QE policy. Previous market-timing literature has focused on equity issuance (Loughran and Ritter (1995); Baker and Wurgler (2000); Dong, Hirshleifer, and Teoh (2012)), debt maturity (Baker, Greenwood, and Wurgler (2003a)), interest-rate exposure (Faulkender (2005)), the choice between bank loans and bonds (Becker and Ivashina (2014)), and the joint timing of equity and debt markets (Ma (2019); Gao and Lou (2012)) in response to changes in relative prices or non-fundamental demand by investors. More generally, Friberg, Goldstein, and Hankins (2022) show firms are concerned about non-fundamental demand shocks for their securities.

We also contribute to the literature on European corporate bonds and the CSPP. Arce, Gimeno, and Mayordomo (2017), Betz and De Santis (2019), Ertan, Kleymenova, and Tuijn (2020), Galema and Lugo (2021), and Grosse-Rueschkamp, Steffen, and Streitz (2019) focus on the substitution between bonds and bank loans and its implications for ineligible firms. Adelino, Ferreira, Giannetti, and Pires (2023) investigate the effects of the CSPP on trade credit. Darmouni and Papoutsi (2021) study the entrance of new bond issuers. Abidi, Falagiarda, and Miquel-Flores (2023) show credit ratings improved after the CSPP. Abidi and Miquel-Flores (2018), Bonfim and Capela (2020), Li, Mercatanti, Mäkinen, and Silvestrini (2019), and Zaghini (2019) evaluate the

[4]Although our results are consistent with these two channels, we cannot fully disentangle each individual channel discussed in the literature. For example, part of the increased issuance of ineligible bonds may be due to a rebalancing channel, whereby bond holders tilted their portfolios toward ineligible bonds because of the lower net supply of eligible bonds caused by QE.

impact of the CSPP on corporate bond yields. Finally, Rischen and Theissen (2021) find evidence of less severe bond underpricing after the CSPP.

Among the papers on the CSPP, our research is related, in particular, to De Santis and Zaghini (2021) and Todorov (2020). In these papers, the authors focus on the effects of the CSPP on eligible issuance. They find an increase in overall eligible issuance following the CSPP announcement. Compared to them, we distinguish the effects of the increased demand for eligible bonds and the effects of the market-wide decline in credit risk premia that followed the announcement of the CSPP. Specifically, we show that the CSPP not only stimulated eligible issuance, but also influenced the quantity and composition of bond issuance by ineligible issuers.

As a first point of departure from existing literature, we compare *within-firm* shifts in eligible issuance and *across-firms* changes in total issuance, whereas previous research focused on overall eligible issuance. We find that eligible issuers shifted toward eligible bonds, but both eligible and ineligible issuers increased total issuance. This result suggests quantitative easing had broader effects on corporate issuance than the direct effect on eligible issuance.

Moreover, compared to De Santis and Zaghini (2021) and Todorov (2020), we show that firms modified the composition of their bond issues along a number of characteristics, and not only eligibility. We also show the market-wide decline in credit risk premia was the main driver of the increase in total bond financing. Our results on the market-wide effects of corporate QE have policy implications. Specifically, they suggest a central bank can generate positive spillover effects on ineligible firms, even if it targets eligible bonds issued by eligible firms.

In response to the 2020 pandemic, the Federal Reserve expanded its QE programs to include corporate bonds. Research on the Federal Reserve's Corporate Credit Facility has shown that the Fed's policy reduced risk premia, improved liquidity, and led to increased issuance for

both investment-grade and high-yield issuers (Boyarchenko, Kovner, and Shachar (2022); Haddad, Moreira, and Muir (2021); D'Amico, Kurakula, and Lee (2020); O'Hara and Zhou (2021); Darmouni and Siani (2021)). Although we focus on the CSPP, our work provides insights for understanding issuers' responses to any corporate QE program, even outside the euro area.

II. Background and Data

Before proceeding to our analysis, we provide a description of the CSPP, our data, and the corporate bond market in the euro area.

A. The Corporate Sector Purchase Program

The ECB announced its corporate QE program, the Corporate Sector Purchase Program (CSPP), on March 10, 2016. The CSPP's purpose was to provide monetary accommodation and to help the ECB achieve its inflation target. On April 21, 2016, the ECB released additional technical details on the CSPP and purchases began on June 8, 2016. In the first 12 months of operation, the ECB purchased €7.5 billion per month in corporate bonds, 85% of which were purchased in the secondary market. The initial end date for the CSPP was set at no earlier than March 2017, although it was progressively extended through December 2018. Net purchases later resumed in November 2019, although for smaller amounts.

With the CSPP announcement in March 2016, the ECB declared its intention to purchase corporate bonds, provided they satisfied three key requirements: bonds had to be i) euro-denominated; ii) issued by non-bank corporations established in the euro area; and iii) eligible to be posted as collateral for the ECB's credit operations. The ECB has always accepted

corporate bonds as collateral for its refinancing operations.[5] To be accepted as collateral, a bond needs to satisfy a list of eligibility requirements. We report this list in Internet Appendix A.8. Such requirements include, among others, that a bond be investment-grade rated, listed on an eligible regulated market, deposited with an eligible centralized security depository, and not subordinated. The eligibility requirements also restrict the type of coupon, the conditionality of the principal amount, and the form of the note. A list of eligible securities is published daily on the ECB's website.

On the same day of the March 2016 announcement, the ECB also expanded the size of its existing government-bond purchases (the Public Sector Purchase Programme, or PSPP), reduced interest rates by 5 bps, and launched a new round of Targeted Long-Term Refinancing Operations (TLTROs). In Internet Appendix A.7, we exploit the time-series variation in the announcement of other programs. In particular, we repeat our tests around the PSPP announcement in January 2015 and around the June 2014 announcement of a policy package which included a TLTRO and a 10-bps rate cut. In both cases, we find no evidence that these polices affected bond spreads and issuance in the same way as the March 2016 announcement did. Therefore, whereas we cannot rule out effects coming from the interaction of these three policies, the available evidence suggests that the CSPP played an important and potentially incremental role in shaping credit market outcomes after the March 2016 announcement.

B. Data

In our sample of bonds, we condition on the first two eligibility criteria: all bonds we consider are euro-denominated and issued by non-financial corporations domiciled in the euro

[5] Pelizzon, Riedel, Simon, and Subrahmanyam (2020) show a bond's yield and liquidity are affected by the bond's inclusion in the list of eligible collateral.

area. By doing so, we also identify more accurately the effects of the CSPP as a demand shock for corporate bonds. We also exclude all financial institutions (and not only banks) because, for them, quantitative easing changes their investment opportunities. We exclude foreign-denominated bonds and foreign corporations to avoid confounding effects due to variations in current and expected exchange rates.

We then define a bond as *eligible* if it is eligible to be used as collateral at the ECB.[6] Our definition of eligibility, thus, reflects the information the ECB provided with the first CSPP announcement on March 10, 2016. To maintain a consistent notion of eligibility through the sample period, we do not change the definition of eligibility when requirements were marginally modified at later dates.[7] Moreover, as Figure 1(b) ahead shows, firms began increasing collateral-eligible issuance starting in March 2016.

We obtain data primarily from the Centralized Security Database (CSDB). The CSDB provides security-level information on every equity, debt, and hybrid instrument issued by residents of the euro area. This dataset is managed by the Eurosystem and is updated monthly, with observations starting in February 2011, although the coverage is limited before the beginning of 2013. The CSDB provides comprehensive information about each security and its issuers. It also specifies whether a bond is eligible as collateral.

We then use credit ratings from the four ECB-recognized rating agencies: S&P, Fitch,

[6] Bond eligibility as collateral is determined by an extensive list of criteria and not only by credit rating. Therefore, the CSPP offers an ideal setting to study corporate market timing, because highly rated firms are able to chose between eligible and ineligible issuance. For example, an investment-grade issuer may issue an investment-grade bond with a step-up coupon, which would render the bond ineligible. In fact, according to Article 63 of the EU Guideline 2015/510 (reported in Internet Appendix A.8), bonds with step-up coupons are not eligible for the CSPP, regardless of their credit rating.

[7] In April 2016, the ECB excluded investment-management companies from the set of eligible issuers and required bonds to have a remaining maturity between 6 months and 31 years to qualify for purchase. The latter represented 90% of the collateral-eligible bonds outstanding in 2015.

Table 1: Summary statistics. The table shows the number of bonds outstanding in the 10 months before and after the CSPP announcement and summary statistics for the bonds' issued amount. A firm is classified as eligible if it had eligible bonds outstanding at some time in 2015.

	All	Eligible bonds	Ineligible bonds	Bonds issued by eligible firms	Bonds issued by ineligible firms	Bonds in Datastream	Bonds in Bloomberg
N. of bonds	32,288	7,151	25,679	9,293	22,995	12,119	2,818
Mean (€mln)	49.68	113.13	32.01	109.46	24.18	80.94	324.09
Median (€mln)	10	25	5	29	4.72	20	184.50
St. deviation (€mln)	157.74	255.17	110.68	241.81	91.55	197.44	368.16
Decile 1 (€mln)	0.75	5	0.50	5	0.50	3	10
Quartile 1 (€mln)	2	10	1.50	10	1.25	10	32
Quartile 3 (€mln)	25	50	20	50	14.06	50	500
Decile 9 (€mln)	75	500	50	350	37	192.72	750

Moody's, and DBRS. For each bond and for each issuer, we consider their best credit rating at each date, consistent with the ECB's use of the best rating when assessing eligibility of a bond.

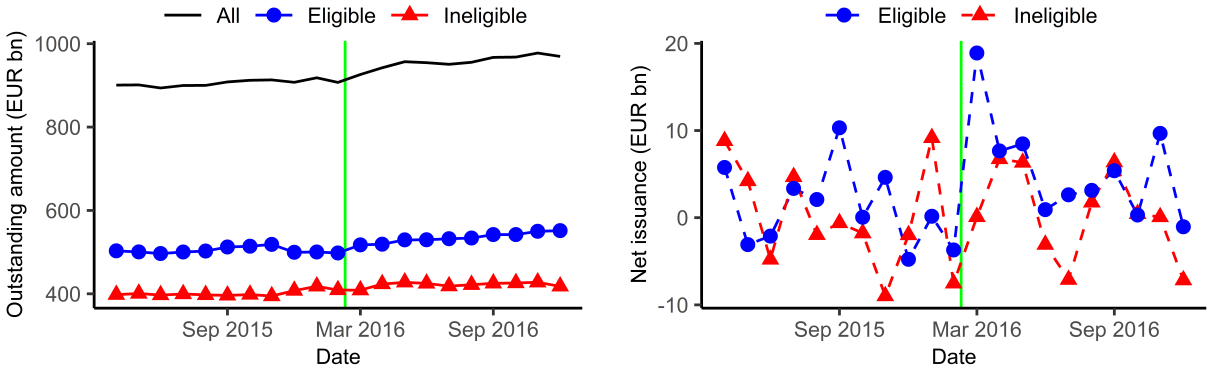
We gather additional bond information from commercial data providers. Daily bond yields and bid-ask prices are from Datastream. Use of proceeds data come from both Datastream and Bloomberg. Issuance-program information comes from Datastream. Dates for bond-issuance announcements come from Bloomberg. Stock return and dividend data are from Compustat. Yearly financial statements are from Bureau van Dijk's Orbis dataset.

We are interested primarily in the period surrounding the announcement of the CSPP. For the 10 months before and after the announcement, the CSDB provides information on 32,288 euro-denominated bonds issued by 3,587 non-financial corporations domiciled in the euro area. Of these corporations, 205 had eligible bonds outstanding at some time in 2015. We label such firms as *eligible firms* because their outstanding bonds were eligible to be purchased under the CSPP.

Table 1 shows summary statistics for the sample of bonds. We find fewer eligible than ineligible bonds (7,151 to 25,679), but eligible bonds were issued in larger amounts.[8] On average,

[8]Bonds can be added to or dropped from the list of eligible securities. Therefore, some bonds may appear both

Figure 1: Corporate bonds in the euro area. Outstanding amount and net issuance of euro-denominated bonds issued by non-financial corporations in the euro area. The vertical line marks the announcement of the CSPP (March 10, 2016).



(a) Outstanding amount

(b) Net issuance

eligible bonds are issued in amounts of €113 million, compared with €32 million for ineligible bonds. Similar differences can be seen for bonds issued by eligible versus ineligible firms.

For comparison, we also add statistics for the bonds available in Datastream and Bloomberg. Datastream and Bloomberg cover only 12,119 and 2,818 bonds of the CSDB's 32,288. Moreover, large issues are over-represented in these datasets. Whereas the average issued amount of a corporate bond is €50 million, the average issued amount of a bond in Datastream and Bloomberg is €81 million and €324 million, respectively.

C. The Corporate Bond Market in the Euro Area

To gain a more accurate perspective on the size and the relevance of the CSPP, in Figure 1(a), we plot the aggregate outstanding amount of euro-denominated corporate bonds issued by non-financial corporations domiciled in the euro area. The figure also shows the outstanding amount of eligible and ineligible bonds.

As of February 2016, the total outstanding amount of bonds was €907 billion, of which

as eligible and ineligible over time. For this reason, the sum of the number of eligible and ineligible bonds, when considered separately, exceeds the total number of bonds.

€498 billion were eligible. Over the course of the first year of the CSPP, the purchases of eligible bonds, averaging €7.5 billion per month, amounted to 18% of the eligible bonds outstanding just before the announcement. The CSPP was, therefore, a large program relative to the size of the market.

Figure 1(a) shows that the total outstanding amount of bonds increased at a faster pace in the months immediately following the announcement of the CSPP than in previous periods. In Figure 1(b), we compute the monthly net issuance of each individual bond and plot the aggregate series by eligibility. By doing so, we make sure that series are not affected by bonds that are added to or removed from the list of eligible collateral. Net issuance of eligible bonds sharply increased immediately after the announcement of the CSPP and remained above the net issuance of ineligible bonds for most of the subsequent months.

III. The Transmission of the CSPP to Credit Markets

In this section, we provide a framework to interpret our results on bond issuance in the next section and we study how the CSPP was transmitted to bond spreads.

A. Theoretical Framework

In a frictionless consumption-based asset-pricing model, quantitative easing is neutral (Wallace (1981)). Therefore, to study the transmission of quantitative easing to asset markets, the theoretical literature departed from this frictionless model. Next, I discuss the two main strands of said theoretical literature, which provide a framework to organize and interpret our empirical findings.

1. THE SCARCITY CHANNEL

In a first strand of theoretical literature, researchers argue that investors have preferences over their portfolio composition, also referred to as preferred habitats. For example, investors may prefer holding assets with a particular maturity, liquidity, or risk profile. Early theoretical contributions in this literature are Tobin (1969), Modigliani and Sutch (1966), and Modigliani and Sutch (1967). More recent models include Greenwood et al. (2010), Krishnamurthy and Vissing-Jorgensen (2012), Lenel (2018), and Vayanos and Vila (2021). In these models, the net supply of an asset determines investors' marginal valuation of the asset in equilibrium. If the net supply of eligible bonds declines because the central bank purchases them through a QE program, their prices will then increase. We refer to this first channel of transmission of QE as the *scarcity channel*.[9]

If the CSPP created a scarcity of eligible bonds, spreads of eligible bonds should fall compared to ineligible ones. As a result, corporations face the incentive to increase issuance of eligible bonds and meet the excess demand for these assets. We, therefore, test the following hypotheses.

HYPOTHESES (Scarcity Channel).

[9]Empirically, Greenwood and Vayanos (2014), Hamilton and Wu (2012), and Krishnamurthy and Vissing-Jorgensen (2012) provide evidence of a scarcity channel by showing that the supply of government bonds and their maturity structure affect yields and expected returns. Moreover, Demirci, Huang, and Sialm (2019), Greenwood et al. (2010), and Krishnamurthy and Vissing-Jorgensen (2015) show that the quantity and maturity structure of government debt affect private debt issuance by changing the net supply of securities available to investors. Within the context of QE programs, D'Amico, English, López-Salido, and Nelson (2012), D'Amico and King (2013), Krishnamurthy and Vissing-Jorgensen (2011), and Krishnamurthy and Vissing-Jorgensen (2013) find evidence of a scarcity channel when associated to the Fed QE programs, with yields of eligible assets declining. Several other papers have looked at QE announcements by the Fed, the ECB, the Bank of England and the Bank of Japan preceding the CSPP (Altavilla, Carboni, and Motto (2015); Andrade, Breckenfelder, De Fiore, Karadi, and Tristani (2016); Swanson (2011, 2015); Joyce, Lasaosa, Stevens, and Tong (2011); Ueda (2012); Lam (2011); Szczerbowicz (2015); Falagiarda and Reitz (2015); Fratzscher, Lo Duca, and Straub (2016)) and found a drop in the yields of eligible assets at the announcement.

1. *Eligible firms increased the issuance of eligible bonds relative to ineligible bonds persistently.*

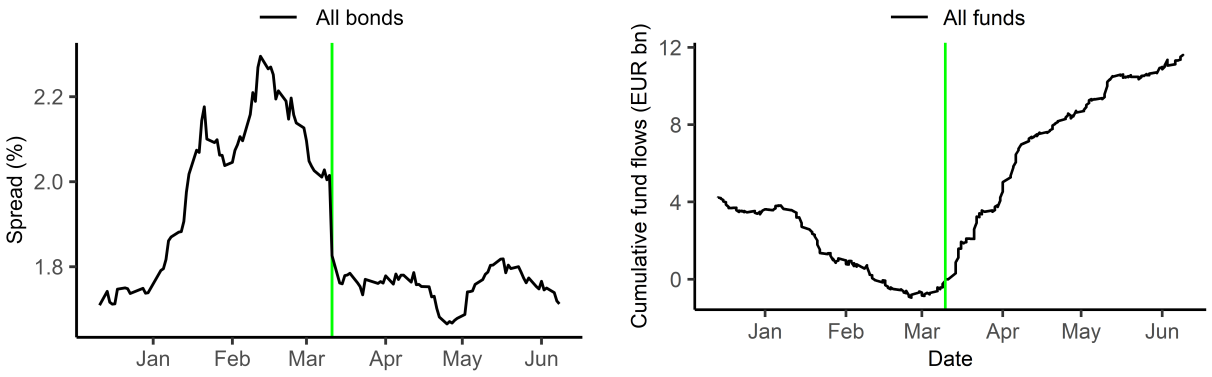
2. *Eligible firms increased total issuance primarily through eligible bonds. However, if firms can elastically supply bonds, the relation between the CSPP's price impact and issuance should be temporary.*

According to the first hypothesis, firms should respond to the ECB's demand for eligible bonds by supplying more eligible bonds. Over the longer horizon, firms should increase the supply of eligible bonds over ineligible ones for as long as the central bank purchases eligible bonds. According to the second hypothesis, we expect that, if firms supply bonds sufficiently elastically, they will increase issuance of eligibile bonds in response to a decline in spread, increasing also total issuance. As supply of eligible bonds expands, habitat investors will have their demand for eligible bonds satiated, thus offsetting the initial price impact of the CSPP on eligible bonds. In the long-run, the purchases of the CSPP should then affect the composition of total issuance, which will shift toward eligible bonds, but not the total amount of issuance.

2. The Risk Channel

In a second strand of literature, researchers study how QE affects asset prices by changing investors' valuation of risk. In intermediary asset pricing models (Brunnermeier and Sannikov (2014); Cúrdia and Woodford (2011); Drechsler et al. (2018); He and Krishnamurthy (2013); Gertler and Kiyotaki (2010); Gertler and Karadi (2011)), quantitative easing is non-neutral if the central bank, by swapping risky assets for riskless reserves, frees investors' risk-bearing capacity. Investors become more willing to hold non-diversifiable risk and, as they rebalance their

Figure 2: Bond spreads of euro-denominated corporate bonds and cumulative flows to euro-area corporate bond funds. Figure 2(a) shows average spreads for euro-denominated corporate bonds issued by corporations domiciled in the euro area. Figure 2(b) shows cumulative fund flows relative to the day of the CSPP announcement. We consider euro-denominated corporate bond funds domiciled in the European Economic Area. The figures show the 3 months before and after the CSPP announcement. The vertical line marks the first trading day after the announcement of the CSPP.



(a) Bond spreads

(b) Cumulative fund flows

portfolios, risk premia drop.[10] We refer to this second channel of transmission of QE as the *risk channel*.[11]

Importantly, in these models, quantitative easing lowers risk premia only when investors are reluctant to hold credit risk. Once investors become willing to hold credit risk and normal financial conditions are restored, quantitative easing will not affect asset prices further. Figure 2 shows that corporate bonds were experiencing high spreads and that corporate-bond funds were

[10]Whereas most theoretical contributions focus on the effect of monetary policy on risk premia, other literature reaches similar conclusions in models in which monetary policy reduces the quantity of risk in the economy (Greenwood, Hanson, and Stein (2015, 2016); Stein (2012); Woodford (2016)) or models in which QE signals a credible commitment from the central bank to support the economy (Bhattarai, Eggertsson, and Gafarov (2015); Clouse, Henderson, Orphanides, Small, and Tinsley (2003); Eggertsson and Woodford (2003)).

[11]The available empirical evidence shows that monetary policy does affect the broad asset market and risk premia and not just the yields of the assets purchased by the central bank. Bernanke and Kuttner (2005), Hanson and Stein (2015), and Gertler and Karadi (2015) show monetary policy affects risk and term premia in multiple asset classes. Focusing on quantitative easing announcements, Gilchrist and Zakrajšek (2013), Gilchrist et al. (2020), Hattori, Schrimpf, and Sushko (2016), and Krishnamurthy and Vissing-Jorgensen (2011) found evidence of a decline in priced risk in the US, confirming quantitative easing transmits also through a risk-taking channel. Gagnon, Raskin, Remache, and Sack (2011) attribute the change in long-term yields after a QE announcement mostly to a reduction in risk premia. More broadly, research by Adrian, Etula, and Muir (2014), Baron and Muir (2022), Haddad and Muir (2021), He, Kelly, and Manela (2017), and Kargar (2021) provide evidence that intermediaries are marginal investors in the market.

experiencing outflows in the first two months of 2016.[12] The outflows from corporate-bond funds indicate that investors were increasingly reluctant to hold credit risk. However, these patterns quickly reversed following the CSPP announcement. Investors increased their capital allocation to corporate-bond funds, suggesting a renewed willingness to take on credit risk. Moreover, spreads experienced a correction and returned to the levels observed in December 2015.

If the ECB's intervention in March 2016 boosted demand for credit risk, we would therefore expect risk premia to drop and firms to issue bonds accordingly around the CSPP announcement. Specifically, we test the following hypotheses.

HYPOTHESES (Risk Channel).

1. *Firms increased total issuance in response to a decline in risk premia.*

2. *Firms shifted issuance toward riskier bonds.*

3. *Firms' issuance response to the risk channel was temporary.*

If the CSPP announcement increased demand for credit risk, risk premia should decline and all firms should increase total issuance and issue riskier securities. The risk channel represents a market-wide effect of QE, because it transmits to all issuers, regardless of whether they can issue eligible bonds or not. However, these effects should not be persistent. According to intermediary asset pricing models reviewed above, once normal financial conditions are restored, the CSPP should not influence longer-term issuance patterns through a risk channel.

[12] Internet Appendix A.4 provides details of the sample of funds used for the analysis. It also contains additional evidence of the stabilization of credit conditions using corporate-bond fund flows, insurance companies' CDSs and stock returns, and investors' disclosures suggesting that demand for credit risk did increase after the CSPP announcement.

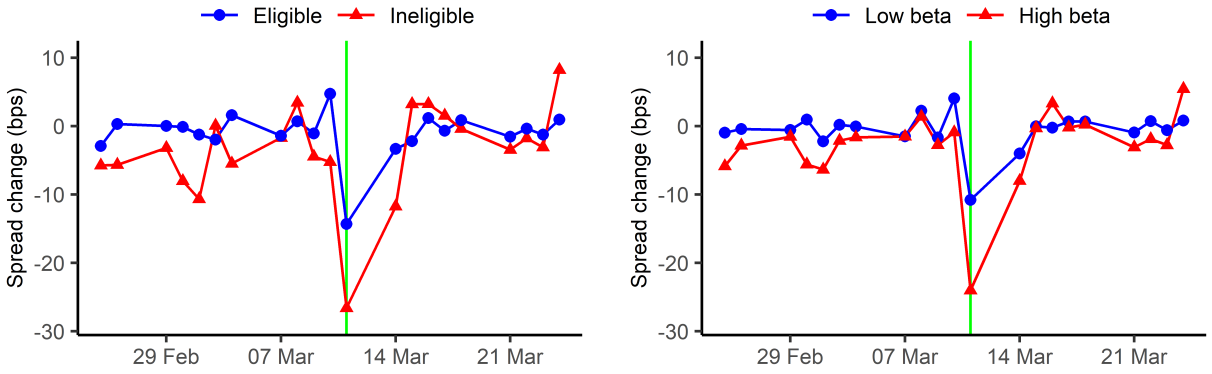
B. The Transmission to Bond Spreads

Before testing our hypotheses about corporate bond issuance around the CSPP announcement, we verify the predictions of the scarcity and risk channels on the spreads of outstanding bonds. Specifically, we study how bond spreads changed around the announcement and show that corporations faced the incentives we discussed in section A. In Internet Appendix A.1, we study the transmission of the CSPP to other asset classes, namely credit default swaps (CDSs), new corporate bond issues, and equity.

To study how bond spread changed after the announcement, we consider bonds that were outstanding in the three months before and after the announcement. By doing so, we identify the effect of QE on bond spreads only through changes in the spread of preexisting bonds. Our estimates are, therefore, not affected by a change in characteristics of newly issued bonds. We, thus, obtain a sub-sample of 1,709 bonds for which we have daily yield data over this period. In Internet Appendix A.1.2, we consider new bond issues and their spreads at issuance.

Starting from bonds' yields to maturity and the term structure of risk-free rates in the euro area, we compute each bond's daily *yield spread* as the difference between the bond yield and the maturity-matched risk-free rate. To measure a bond's exposure to non-diversifiable risk exposure, we compute its beta with the aggregate market. First, we build a bond market index as the weighted average of bond yield spreads, where the weights are the nominal amounts outstanding three months before the announcement of the CSPP. Then, we compute a bond's *beta* as the slope coefficient in a regression of the daily change in the bond's yield spread on the daily change in the index. To estimate the beta, we use trading days from December 11, 2015 (three months before the CSPP announcement) to February 25, 2016 (two weeks before the CSPP announcement).

Figure 3: Average change in yield spreads of euro-denominated corporate bonds around the 2016 CSPP announcement. Bonds are sorted according to their eligibility and their exposure to non-diversifiable risk. We measure a bond's exposure to non-diversifiable risk in terms of its beta before the announcement. The beta is the slope coefficient in a regression of the daily change in bond spreads on the change in the aggregate bond market's spread. Bonds are classified as high beta if their beta is above the median of the cross-sectional distribution of betas. The vertical line marks the first trading day after the announcement of the 2016 CSPP.



(a) Spreads by eligibility

(b) Spreads by exposure to non-diversifiable risk

Figure 3(a) shows the spreads of ineligible bonds dropped more than the spreads of eligible bonds, indicating that the scarcity channel was not the main determinants of the decline in spreads. In Internet Appendix A.1.2, we document a similar result for spreads at issuance using a regression discontinuity design. However, ineligible bonds are more exposed to non-diversifiable risk: their average beta is 1.22 units larger than eligible bonds' average beta, with a t-stat of 5.05 when clustering standard errors at the country-sector level. Figure 3(b) shows bonds with higher betas reacted more to the announcement than lower-beta bonds, consistent with the predictions of the risk channel. Thus, ineligible bonds' higher non-diversifiable risk exposure partially accounts for their relative drop in spreads.

To formally estimate the change in relative valuation of eligible and ineligible bonds, we run the following regression:

$$\Delta S_i = \alpha^{E}\text{EligibleBond}_i + \alpha^{BAS}\text{BidAsk}_i + \iota_{f(i)} + \iota_{m(i)} + \iota_{r(i)} + u_i, \tag{1}$$

Table 2: Liquidity and beta statistics. Distribution of initial outstanding amounts, average bid-ask spreads relative to midpoint, fractions of days with a change in bid or ask prices, and bond beta. Average bid-ask spreads and quote changes are computed over the three months before and after the CSPP announcement.

	Eligible bonds						Ineligible bonds					
	N	10^{th}pc	25^{th}pc	Median	75^{th}pc	90^{th}pc	N	10^{th}pc	25^{th}pc	Median	75^{th}pc	90^{th}pc
Amount out. (€mln)	771	100	300	500	750	1,000	938	20	50	180	464	700
Bid-Ask spread (%)	764	0.15	0.25	0.48	0.76	1.00	891	0.26	0.47	0.86	1.36	2.80
Quote change (%)	771	83.33	95.45	97.73	99.24	100	938	19.47	70.45	93.56	97.73	99.24
Bond beta	771	0.06	0.18	0.32	0.46	0.66	938	0.01	0.17	0.47	2.10	4.33

where i denotes the bond; ΔS_i is the change in the yield spread of bond i after the CSPP announcement; EligibleBond$_i$ = 1 if bond i is eligible at the beginning of the sample period, and 0 otherwise; BidAsk$_i$ is bond i's average bid-ask spread (relative to midpoint) in the period starting three months before the announcement and ending two weeks before the announcement; $\iota_{f(i)t}$ is either a country-sector fixed effect or a firm fixed effect; $\iota_{m(i)}$ is a maturity fixed effect, where the continuous maturity variable is grouped into eight maturity bins;[13] and $\iota_{r(i)}$ is a rating fixed effect. Standard errors are clustered at the country-industry level. We include bid-ask spreads in the regression specification to control for illiquidity. We also weight regressions by bonds' outstanding amounts. By weighting for outstanding amounts, we also obtain a better estimate of the CSPP's economic impact on the bond market.

Table 2 shows the distribution of bond statistics related to their liquidity for eligible and ineligible bonds. Overall, eligible bonds are characterized by larger outstanding amounts, better liquidity (namely, lower bid-ask spreads and more frequent quote changes) and lower exposure to non-diversifiable risk. Moreover, a comparison between Table 1 and the first line of Table 2 reveals that bonds for which we have yield data are issued in larger amounts compared to the entire sample. Moreover, eligible bonds are over-represented. In fact, the sub-sample contains

[13]The maturity bins are (i) under 6 months, (ii) 6 months to under 1 year, (iii) 1 to under 2 years, (iv) 2 to under 5 years, (v) 5 to under 10 years, (vi) 10 to under 20 years, (vii) 20 to under 30 years, and (viii) 30 years or longer. We include maturity fixed effects to control for potential changes in the term structure of credit risk.

Table 3: Changes in bond spreads after the CSPP announcement. We use bonds outstanding in the three months before and after the announcement of the CSPP. The dependent variable is the change in spread (columns 1-4) and the abnormal change in spread (columns 5-8). EligibleBond = 1 if the bond is eligible to be used as collateral at the ECB as of three months before the CSPP announcement. BidAsk is the bond's average bid-ask spread relative to the midpoint during the period starting three months before the announcement and ending two weeks before it. A firm is classified as eligible if it had eligible bonds outstanding at some time during the calendar year before the announcement. Regressions are weighted by the bond's outstanding amount. Standard errors are in parentheses and are clustered at the country-industry level.

	Two-day spread change (bps)				Two-day abnormal spread change (bps)			
	All firms		Eligible firms		All firms		Eligible firms	
	1	2	3	4	5	6	7	8
EligibleBond	8.193***	8.185*	9.201**	8.513**	−11.623***	−10.052**	−8.950**	−10.370**
	(3.033)	(4.396)	(3.958)	(4.042)	(3.758)	(4.299)	(3.405)	(4.274)
BidAsk	−1.425	−2.736	0.812*	1.076**	−0.189	−0.944	2.482**	2.052**
	(1.339)	(2.760)	(0.448)	(0.474)	(1.857)	(3.716)	(1.112)	(0.868)
Country-industry FE	Yes	No	Yes	No	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,624	1,310	955	926	1,624	1,310	955	926
R^2	0.111	0.541	0.394	0.533	0.070	0.549	0.622	0.428

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

bonds that are regularly traded by dealers, which tend to be issued by larger and more established corporations.

Besides considering spread changes, we study abnormal spread changes. The abnormal spread change is the difference between the change in yield spread and the change predicted by the bond's exposure to non-diversifiable risk. Specifically, let β_i be the bond's beta, let ΔS_i be the bond's spread change, and let ΔS^m be the average spread change in the market. The *abnormal spread change* is, thus, $\Delta S_i - \beta_i \Delta S^m$.

Results are reported in Table 3, where we consider cumulative changes over the first two trading days after the announcement. Here, we use the entire sample of bonds, whereas in Table A.10 of Internet Appendix A.6, we consider only those bonds that experience price changes in at least half of the trading days in the sample. These bonds represent 88% of the original set of

bonds. Similar to Krishnamurthy and Vissing-Jorgensen (2011), we consider two-day changes because of corporate bonds' illiquidity. In odd-numbered columns, we control for country-industry fixed effects, whereas in even-numbered columns, we control for firm fixed effects, thus exploiting heterogeneity across bonds issued by the same firm.

When we consider simple spread changes, eligible bond spreads still appear to drop less than ineligible bond spreads, even after controlling for bond fixed effects and firm fixed effects. The magnitude of the within-firm difference over the first two days is 8.5 bps for the set of eligible firms.

When we use abnormal spread changes, results flip. After accounting for exposure to non-diversifiable risk and for firm-level risk with firm fixed effects, eligible bond spreads dropped by about 10.4 bps over the first two days relative to ineligible bonds within the sample of eligible firms.

These results suggest the effect of CSPP was strongest for the bonds most exposed to non-diversifiable risk, indicating a decline in credit risk premia, consistent with risk channel. Hence, corporations were incentivized to increase total issuance and shift toward riskier bonds.[14] After accounting for exposure to non-diversifiable risk, we observe relative spreads dropping for eligible bonds, consistent with the scarcity channel.

[14]In Internet Appendix A.1.1, we further study whether credit risk premia declined, using information in CDS spreads and expected default frequencies (EDFs). Although the sample is limited by data availability, we observe patterns that are consistent with a decline in risk premia: CDS spreads dropped more for entities more exposed to non-diversifiable risk, and EDFs did not drop, but CDS risk premia did. We define CDS risk premium as the ratio between the one-year CDS spread and the one-year EDF.

IV. Issuance and Market Timing

In this section, we study how the quantity and composition of bond issuance changed after the announcement of the CSPP. We organize this section and interpret our findings using the theoretical framework provided by scarcity and risk channel which we discussed in section A. We also provide further evidence of market timing from the issuance choices of firms.[15]

A. Scarcity-Driven Issuance

1. Shift toward Eligible Issuance

We study the monthly net issuance of eligible and ineligible bonds by firms. We compute the *net issuance* of each bond as the change in the outstanding amount of the bond, including new issues and early and final redemptions. We then aggregate net issuance at the firm-eligibility level, so that for each firm i and each month t, we obtain two types of net issuance: eligible issuance I_{it}^E and ineligible issuance I_{it}^I. We investigate both the short-term and the longer-term issuance responses. For the short-term response, we compare issuance during the three months before the CSPP announcement with issuance in the subsequent three months. For the longer-term response, we compare the ten months before and after the announcement.

To conduct our empirical tests, we scale each firm's net issuance by the outstanding amount of the firm's bonds at the beginning of the sample period under consideration, B_i. That is, for the short-term response, we divide I_{it}^E and I_{it}^I by the notional value of all of firm i's bonds that

[15] Our paper is primarily concerned with the effects of the CSPP on bond issuance. In Internet Appendix A.5, we report the empirically observed correlations between changes in the quantity and composition of bond issuance and changes in corporate investments for the subsample of issuers for which we have financial-statement data.

Table 4: Summary statistics. The table shows the number of firms, the distribution of the initial outstanding amount of bonds ten months before the announcement of the CSPP, and the distribution of net issuance in the 10 months before and after the announcement of the CSPP. Net issuance is scaled by the initial outstanding amount of all the firm's bonds 10 months before the announcement. Wt.Avg. is the weighted average, where weights are given by the initial outstanding amount of all the firm's bonds ten months before the announcement.

Firms:	All	Eligible			Ineligible
Bonds:	All	All	Eligible	Ineligible	Ineligible
N firms	2,761	198	198	198	2,563
Initial amount: Mean (€mln)	326.59	3,205.29	2,541.30	663.99	104.20
Initial amount: St.Dev. (€mln)	1,491.35	4,487.26	3,859.54	1,493.51	397.26
Pre-CSPP net issuance: Mean (%)	-0.27	0.96	0.63	0.33	-0.36
Pre-CSPP net issuance: Wt.Avg (%)	-0.25	-0.03	0.03	-0.06	-0.78
Pre-CSPP net issuance: St.Dev (%)	49.04	21.07	18.90	9.35	50.56
Post-CSPP net issuance: Mean (%)	0.52	1.12	0.86	0.26	0.47
Post-CSPP net issuance: Wt.Avg (%)	0.31	0.58	0.75	-0.17	-0.33
Post-CSPP net issuance: St.Dev (%)	205.75	22.67	20.29	10.27	213.46

were outstanding on November 30, 2015. For the longer-term response, we divide the net-issuance variables by the notional value of all of firm i's bonds that were outstanding on April 30, 2015.

Table 4 reports summary statistics for scaled net issuance in the ten months before and after the announcement. This sample represents 2,761 issuers. Negative net issuance in the pre-CSPP period indicates maturing or redeemed bonds exceeded new issues. Eligible firms represent a group of 198 large and established issuers with an average outstanding amount of €3.2 bn. Ineligible firms represent a group of 2,563 issuers with an average outstanding amount of only €104 mln. Moreover, eligible issuers tend to have higher rates of net issuance than ineligible issuers.

To identify the role of the scarcity channel on bond issuance and quantify the elasticity of substitution between eligible and ineligible bonds, we need to focus on firms that can issue eligible bonds. Only these firms can substitute across bond types to meet the ECB's demand for eligible bonds. Because of the ECB's eligibility requirements in terms of credit rating and bond

listing, issuing eligible bonds can be excessively costly or simply unattainable for all but the most established issuers. To proxy for the ability to issue eligible bonds, we use past eligible bond issuance and focus on the firms that we defined as eligible. This approach was used also by Adelino et al. (2023) to identify eligible firms.

Our main regression specification for the set of eligible issuers is the following:

$$\frac{I_{it}^{T}}{B_i} = \alpha \times \text{Eligible}^{T} \times \text{Post}_t + \alpha_0 \times \text{Eligible}^{T} \times \text{FirstMonth}_t + \iota_{it} + \iota_{iT} + u_{iTt}, \tag{2}$$

where T denotes the type of issuance, that is, whether the issuance is eligible or not; i denotes the firm; and t denotes the month. Eligible^T = 1 if the issuance is eligible, that is, $T = E$; Post$_t$ = 1 if the month is after the announcement of the CSPP; FirstMonth$_t$ = 1 for March 2016, which is the month when the CSPP was announced; ι_{it} is firm-month fixed effect; and ι_{iT} is a firm-issuance eligibility fixed effect (one fixed effect for any i, T pair).[16] We double-cluster standard errors at the country-sector-month and firm level. Because issuance is very lumpy and a small denominator B_i could introduce a large amount of noise for firm i's observations, we weight regressions by the initial outstanding amount B_i to correct for the noise. By doing so, we also obtain estimates that are more informative of the aggregate issuance patterns.

If QE affected the composition of bond issuance through a scarcity channel, then we should empirically observe $\alpha > 0$. By controlling for firm-month fixed effect, we control for total issuance and all the time-varying firm characteristics, including investment opportunities, financing needs, and cost of issuance. A similar approach has been used in the banking literature

[16] We control for the first-month effect because the CSPP was announced on the 10th day of the month, and, thus, part of the issuance activity in March 2016 cannot be attributed to the CSPP.

Table 5: Net issuance of eligible and ineligible bonds around the CSPP announcement. The dependent variable is the monthly net issuance of eligible and ineligible bonds, scaled by the firm's outstanding amount of bonds at the beginning of the sample period. Eligible = 1 if the net issuance is eligible. Post = 1 after the announcement of the CSPP. FirstMonth = 1 for the month in which the CSPP was announced. FirmBeta is the average beta of the firm's outstanding bonds in the three months before the CSPP announcement. $\Delta^A S^F$ is the average abnormal spread change in the firm's outstanding bonds in the two days following the announcement. A firm is eligible if it had eligible bonds outstanding in the calendar year before the CSPP announcement. Odd-numbered columns consider the three months before and after the announcement; even-numbered columns consider the ten months before and after the announcement. Regressions are weighted by firms' outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Net issuance by eligibility (%)							
	All eligible firms				Eligible firms with listed bonds			
	3M	10M	3M	10M	3M	10M	3M	10M
	1	2	3	4	5	6	7	8
Post	0.167	−0.137						
	(0.301)	(0.154)						
Post×Eligible	1.516***	0.644**	1.516***	0.644**	1.523***	0.660***		
	(0.511)	(0.250)	(0.529)	(0.251)	(0.516)	(0.251)		
Post×Eligible×FirmBeta							1.878***	0.108
							(0.700)	(0.342)
Post×Eligible× $\Delta^A S^F$							−6.756***	0.094
							(2.046)	(1.354)
FirstMonth	Yes	Yes	-	-	-	-	-	-
FirstMonth interactions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-eligible FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Eligible-month FE	No	No	No	No	No	No	Yes	Yes
Observations	2,412	7,920	2,412	7,920	2,184	7,120	2,184	7,120
R^2	0.091	0.032	0.578	0.525	0.580	0.524	0.582	0.528
Notes:	$^*p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$							

to identify the effects of bank credit supply while controlling for firms' demand for credit (Jiménez, Mian, Peydró, and Saurina (2020); Khwaja and Mian (2008)),

Columns 1 to 4 of Table 5 report our results. Odd-numbered columns use issuance in the three months before and after the announcement. Even-numbered columns use a 10-month horizon. In columns 1 and 2, we omit firm-time fixed effects and include Post and FirstMonth time dummies to evaluate the change in ineligible issuance around the announcement.

The results in columns 1 and 2 indicate there was no statistically significant change in

ineligible issuance after the announcement, as indicated by the estimated coefficients on the Post variable in the first two columns. Moreover, according to the estimated coefficient on the Post×Eligible interaction, eligible issuance surged after the announcement, both in the three and ten months around the event. These results indicate that the positive demand shock for eligible bonds did not result in a negative demand shock for ineligible bonds.

In columns 3 and 4, we control for firm's time-varying demand for financing by using firm-time fixed effects. Even with this additional control, we find that firms increased eligible issuance relative to ineligible issuance after the announcement of the CSPP. From the estimates in columns 3 and 4, we find eligible issuance increased compared to ineligible issuance at an average monthly rate of 1.516% of their outstanding amount in the short term and 0.644% in the longer term.

These estimates enable us to quantify the amount of within-firm substitution of eligible for ineligible issuance. At the end of February 2016, the total outstanding amount of euro-denominated bonds issued by eligible firms was €641 billion. Multiplying this amount by the longer-term effect on eligible issuance in column 4, we estimate a €4.1 billion monthly substitution of eligible for ineligible bonds in the ten months following the announcement of the CSPP. This number accounts only for the within-firm increase in eligible issuance relative to ineligible issuance. It, therefore, does not account for the change in total net issuance among eligible firms, nor does it include any change in the total net issuance of ineligible firms. Yet, this relative increase alone represents 55% of the €7.5 billion monthly purchases that the ECB made over the course of the first year of the program.

We then investigate the relation between eligible firm's substitution and changes in bond spreads after the announcement. We decompose spread changes into their non-diversifiable

component, proportional to their beta, and their idiosyncratic component, measured by the abnormal spread change. We aggregate bond beta and abnormal spread change at the firm level using weighted averages of individual bonds' betas and abnormal changes, where the weights are given by the bonds' outstanding amounts. We, thus, obtain firm-level measure of bond beta, FirmBeta_i, and abnormal spread change, $\Delta^A S_i^F$. Like in section B, we consider abnormal spread changes in the two days following the announcement.

We then run the following regression :

$$\begin{aligned}\frac{I_{it}^T}{B_i} =& \gamma^S \times \text{Post}_t \times \text{Eligible}^T \times \text{FirmBeta}_i + \gamma^A \times \text{Post}_t \times \text{Eligible}^T \times \Delta^A S_i^F \\ &+ \text{FirstMonth}_t \text{ interactions} + \iota_{it} + \iota_{iT} + \iota_{Tt} + u_{iTt},\end{aligned} \tag{3}$$

where FirmBeta_i is the average beta of firm i's outstanding bonds and $\Delta^A S_i^F$ is the average abnormal spread change experienced by firm i's bonds in the two days after the CSPP announcement. We also include interaction terms similar to those in the first line of equation (3), but with FirstMonth_t replacing the variable Post_t. Finally, ι_{Tt} is an eligibility-time fixed effects which controls for time variation in average eligible and ineligible issuance and which absorbs the Eligible×Post and Eligible×FirstMonth interactions from (2).

If a scarcity channel stimulated eligible bond issuance through price pressure on eligible bonds, we should expect $\gamma^A > 0$. From the results of section B, eligible bonds experienced the most negative abnormal changes in spreads after the announcement. Hence, abnormal spread changes measure how much a bond spread fell as a result of its exposure to the scarcity channel. A positive γ^A indicates that firms increased eligible issuance after experiencing a decline in spreads driven by scarcity.

Moreover, if a risk channel stimulated eligible bond issuance, we should also expect $\gamma^S > 0$. In this case, eligible firms increased total issuance primarily in the form of eligible bonds after benefiting from a decline in risk premia.

Because the set of eligible firms with traded bonds is a subset of the entire set of eligible issuers, in columns 5 and 6 we replicate the tests of columns 3 and 4 in this subset. We verify that the estimates on the relative increase of eligible issuance in this smaller sample are similar to the estimates we obtained for the entire sample of eligible issuers.

In columns 7 and 8, we estimate regression (3). We find that those firms which experienced larger spread declines through a higher beta or more negative abnormal spread changes issued more eligible bonds in the three months following the announcement. The effects disappear in the ten-month horizon, consistent with the notion that, over time, the increased supply of eligible bonds offsets the decline in spreads brought about by the CSPP announcement.[17] Longer-term issuance of eligible bonds is, thus, driven by the persistent purchases of the ECB, which prompted firms to shift the composition of their bond issues toward eligible bonds in the longer-term, regardless of the initial price impact of the CSPP.

2. Elasticity of Substitution: A Back-of-the-Envelope Estimate

The coefficient on the Post×Eligible×$\Delta^A S^F$ variable provides a measure of the monthly increase in eligible issuance over ineligible issuance for a 1% *absolute* abnormal drop in yields. According to the estimate in column 7 of Table 5, firms increase eligible issuance by an amount equal to 10.194% of the firms' outstanding amount *each month* for a 1% abnormal drop in

[17] Figure A.10 in Internet Appendix A.6 shows that eligible firms increase eligible supply steadily after the CSPP announcement, with the largest increments in the first three months after the announcement. Over the first three months, eligible bonds outstanding increased by EUR 29 bn. After 10 months, the outstanding amount of eligible bonds was up by EUR 44 bn.

spreads. Over three months, this represents a 30.582% increase in eligible issuance over ineligible one for a 1% abnormal drop in the absolute spread.

However, to measure the monthly increase in eligible issuance over ineligible issuance for a 1% *relative* abnormal drop in yields between the two types of bonds, one could combine the estimate in column 3 of Table 5 with the abnormal drops in *relative* bond spreads in column 8 of Table 3. According to these estimates, after an abnormal drop in relative spreads equal to 10.370 bps, firms increased eligible net issuance over ineligible issuance at a rate of 1.516% of the firms' outstanding amount *each month*. By dividing these quantities, we obtain a back-of-the-envelope estimate of the elasticity of substitution. In particular, eligible firms increased eligible issuance compared to ineligible issuance at a monthly pace equal to 14.619% of their outstanding amount for a 1% drop in the relative spread. Over three months, this represents a 43.857% increase in eligible issuance over ineligible one for a 1% abnormal drop in the relative spread.[18]

3. Issuance by Eligibility Requirements

Next, we provide additional evidence of market-timing behavior by showing eligible firms increased issuance of bonds meeting individual eligibility requirements. To be eligible, bonds need to satisfy an extensive set of criteria (see Internet Appendix A.8.) Although we do not observe all the eligibility-relevant characteristics of a bond, we observe some key ones, which are also relevant for the liquidity and risk of the bond. In particular, we observe whether a bond is listed, non-subordinated, and investment-grade rated, which are necessary conditions for

[18] In Internet Appendix A.2.1, we discuss the typical timeline of a bond issue for eligible firms. Unlike initial equity offerings or bond offerings by new and smaller firms, established issuers can place bonds in the market within a few days.

eligibility. Hence, we say a bond *meets the requirements* if it satisfies these three criteria, with the caveat that they are a subset of the entire set of eligibility criteria.

Using monthly bond-issuance data, we run regressions analogous to (2). However, instead of considering whether the issuance is eligible, here we consider four different characteristics in four separate regressions: (i) whether net issuance meets all three eligibility requirements, (ii) whether it is listed, (iii) whether it is senior, and (iv) whether it is investment-grade rated.[19]

Table 6 shows estimates of the coefficients on the interaction between the Post dummy and a dummy indicating whether the issuance meets all three or individual eligibility requirements. The empirical results support the hypothesis of the scarcity channel. Eligible firms shifted their issuance toward bonds meeting all three eligibility requirements, with statistically significant shifts over the three-month and ten-month horizons. In the short run, we also find statistically significant shifts toward listed bonds, senior bonds, and investment-grade bonds, although changes in these individual characteristics are marginally statistically significant in the longer horizon for listed and investment-grade bonds, and not significant for senior bonds. However, in all these cases, estimates range between 0.297% and 0.599%, which are economically meaningful if compared with the weighted average of eligible firms' total issuance after the announcement (0.58%, according to Table 4.)

In Table A.11 of Internet Appendix A.6, we investigate whether firms issued bonds meeting these three eligibility requirements as substitutes for eligible bonds or whether firms

[19]For unrated bonds, we follow criteria set in Chapter 2 of the Guideline (EU) 2015/510 of the European Central Bank of 19 December 2014 on the implementation of the Eurosystem monetary policy framework. In particular, if the issuer's rating is available, the unrated bond is assigned the investment-grade status of the issuer. We proxy for the issuer's investment-grade status by considering its outstanding rated bonds. Specifically, for each month, we classify an unrated bond as investment grade if more than half of the issuer's outstanding amount of rated bonds is investment-grade rated. The unrated bond is non-investment grade otherwise. If the issuer has no rated bonds outstanding, the unrated bond is considered to be non-investment-grade rated.

Table 6: Net issuance by characteristics related to eligibility around the CSPP announcement for the sample of eligible firms. In columns 1 and 2, we sort issuance based on whether it is listed, senior, and investment-grade rated (MeetReq = 1) or not (MeetReq = 0). In columns 3 and 4, we sort issuance based on whether it is listed (Listed = 1) or not (Listed = 0). In columns 5 and 6, we sort issuance based on whether it is senior (Senior = 1) or not (Senior = 0). In columns 7 and 8, we sort issuance based on whether it is investment-grade rated (InvGrade = 1) or not (InvGrade = 0). Post = 1 after the announcement of the CSPP. We control for an interaction between FirstMonth and indicators for the issuance type, where FirstMonth = 1 for the month in which the CSPP was announced. We include firm-month fixed effects and interactions between firm fixed effects and issuance-type indicators. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the ten months before and after the announcement. Regressions are weighted by firms' initial outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Net issuance by characteristics (%)							
	Requirements		Listing		Seniority		Rating	
	3M	10M	3M	10M	3M	10M	3M	10M
	1	2	3	4	5	6	7	8
Post×MeetReq	2.114***	0.722**						
	(0.584)	(0.312)						
Post×Listed			2.130***	0.595*				
			(0.601)	(0.326)				
Post×Senior					2.156***	0.297		
					(0.592)	(0.333)		
Post×InvGrade							1.862***	0.599*
							(0.593)	(0.312)
FirstMonth×IssuanceType	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-IssuanceType FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,412	7,920	2,412	7,920	2,412	7,920	2,412	7,920
R^2	0.593	0.530	0.593	0.526	0.598	0.531	0.589	0.530
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$							

increase bonds meeting the three eligibility requirements to increase the issuance of eligible bonds. In Panel A of Table A.11, we show that bonds meeting the three eligibility requirements were primarily issued as eligible bonds, although we observe also a marginal short-run increase in the issuance of ineligible bonds meeting such requirements. In Panel B of Table A.11, we show that the increase in bonds meeting listing and seniority requirements is observed primarily within the subsamples of eligible and investment-grade bonds. Overall, our results suggest that firms changed the features of their bond issues primarily to issue more eligible bonds, although we find

Table 7: Total Issuance around the CSPP announcement. The dependent variable is total net issuance scaled by the firm's outstanding amount of bonds at the beginning of the sample period. Post = 1 after the announcement of the CSPP. FirstMonth = 1 for the month in which the CSPP was announced. A firm is eligible (EligibleFirm = 1) if it had eligible bonds outstanding in the calendar year before the CSPP announcement. We control for interactions between FirstMonth and EligibleFirm, where FirstMonth = 1 for the month in which the CSPP was announced. Peer-group fixed effects are created by sorting firms into 20 groups (vigintiles) based on their outstanding amount of bonds in 2015 and by further sorting firms, within each vigintile, into three groups based on their gross issuance in 2015 and three groups based on their net issuance. Odd-numbered columns consider the three months before and after the announcement; even-numbered columns consider the ten months before and after the announcement. Regressions are weighted by firms' outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Total net issuance (%)							
	Eligible firms		Ineligible firms		All firms			
	3M	10M	3M	10M	3M	10M	3M	10M
	1	2	3	4	5	6	7	8
Post	1.850***	0.370	1.765**	0.580				
	(0.613)	(0.323)	(0.798)	(0.389)				
Post×EligibleFirm					−0.643	−0.337	−0.782	−0.249
					(1.306)	(0.593)	(1.463)	(0.719)
FirstMonth	Yes	Yes	Yes	Yes	-	-	-	-
FirstMonth interactions	-	-	-	-	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-month FE	No	No	No	No	Yes	Yes	Yes	Yes
PeerGroup-month FE	No	No	No	No	No	No	Yes	Yes
Observations	1,206	3,960	15,576	51,260	16,506	54,100	16,506	54,100
R^2	0.177	0.058	0.129	0.029	0.347	0.177	0.363	0.198

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

a marginal increase of ineligible bonds meeting eligibility requirements, which could thus serve as substitutes for the bonds purchased by the ECB.

4. Total Issuance and Firm Eligibility

To conclude our study of the scarcity channel, we compare the total issuance of eligible and ineligible issuers. If the scarcity channel were the primary channel determining a decline in cost of capital, eligible firms would increase total issuance more than ineligible firms.

In Table 7, we study total issuance around the CSPP announcement. As a dependent

variable, we consider the total net issuance of each firm i in month l, $I_{it}^E + I_{it}^I$, and scale it by the firm's outstanding amount of bonds at the beginning of the sample period, B_i. In columns 1 to 4, we separately consider eligible and ineligible firms and study whether their total issuance increased after the CSPP announcement. A positive coefficient on the Post_t variable indicates an increase in issuance. We control for FirstMonth_t and fixed effects. In columns 5 to 8, we consider all firms and study whether eligible firms increased issuance more than ineligible firms after the CSPP announcement. A positive coefficient on the Post×EligibleFirm interaction would reveal such a pattern. We control for the FirstMonth×EligibleFirm interaction and fixed effects.

Columns 1 through 4 show that eligible firms increased total issuance in the short run. However, ineligible firms increased total issuance by similar magnitudes. In the short run, eligible and ineligible firms increased issuance at a monthly rate of 1.850% and 1.765% of their outstanding amounts, respectively (columns 1 and 3.) No statistically significant increase in total issuance is observed over the ten-month period in either group of firms (columns 2 and 4.)

In columns 5 and 6, we consider the entire sample of firms and and test whether eligible firms changed total issuance compared to ineligible firms. In the three-month and ten-month horizon, we find no statistically significant difference in total issuance across the two groups.[20]

In columns 7 and 8, we repeat the same tests of columns 5 and 6 after controlling for firm heterogeneity using peer-group fixed effects. Eligible and ineligible firms represent fundamentally different issuers that might have faced different outcomes had the ECB not intervened. For

[20]In Figure A.11(a) of Internet Appendix A.6, we plot estimated regression coefficients and 95% confidence intervals on monthly indicators over time relative to the CSPP announcement and show that the increase in issuance is observed in the first three months. In Figure A.11(b) of Internet Appendix A.6, we plot estimated regression coefficients and 95% confidence intervals on the eligible-firm dummy interacted with the dynamic indicators over time relative to the CSPP announcement. The results show that, in March 2016, eligible firms appeared to issue more than ineligible firms, but the difference is not statistically significant. In each of the subsequent months, eligible firms increase issuance less than ineligible firms, although the difference is never statistically significant.

example, larger and more established issuers might have faced tighter financial constraints and the ECB alleviated constraints for eligible issuers by purchasing their bonds. To study whether eligible firms increased total issuance compared to ineligible, but otherwise similar issuers, we form peer groups of firms by sorting firms according to their outstanding amount of bonds, gross bond issuance, and net bond issuance in 2015. We then include peer group-time fixed effects. Columns 7 and 8 show that, even after controlling for heterogeneous effects across peer groups, we find no statistically significant difference between eligible and ineligible firms.

Overall, the similar changes in total issuance observed in both eligible and ineligible firms suggest that the scarcity channel was not the sole factor driving the increase in total issuance. Next, we examine the role of the risk channel in boosting firms' total issuance.

B. Risk-Driven Issuance

1. Spreads and Total Issuance

To investigate the role of the risk channel, we begin by studying the relation between changes in risk premia and total issuance, we restrict the sample to firms with traded bonds. In the first two columns of Table 8, we replicate regressions analogous to those in Table 7. We verify that, in this smaller sample, results are analogous to the full sample: firms with traded bonds increased total issuance in the short term, but not in the longer term, with no difference between eligible and ineligible firms.

We then test whether total issuance was driven by declines in credit spreads and, in particular, by a risk channel. Similar to Table 4, we decompose firm-level spread changes into their non-diversifiable component, proportional to the firms' average bond beta (FirmBeta_i), and

Table 8: Total issuance and changes in bond spreads for firms with traded bonds. FirmBeta is the average beta of the firm's outstanding bonds in the three months before the CSPP announcement. $\Delta^A S^F$ is the average abnormal spread change in the firm's outstanding bonds in the two days following the announcement. EligibleFirm = 1 if the firm had eligible bonds outstanding at some point during 2015. Post = 1 after the announcement. FirstMonth = 1 for the month in which the CSPP was announced. Peer-group fixed effects are created by sorting firms into 20 groups (vigintiles) based on their outstanding amount of bonds in 2015 and by further sorting firms, within each vigintile, into three groups based on their gross issuance in 2015 and three groups based on their net issuance. Less active issuers are firms in the lowest tercile of gross issuance within in each vigintile. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Regressions are weighted by the firms' initial outstanding amount of bonds. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level

	Total net issuance (%)							
	All firms				Less active issuers		More active issuers	
	3M	10M	3M	10M	3M	10M	3M	10M
	1	2	3	4	5	6	7	8
Post	2.134**	0.375						
	(0.943)	(0.424)						
Post×EligibleFirm	−0.318	−0.020						
	(1.103)	(0.515)						
Post×FirmBeta			1.071*	0.563	−0.011	−0.377	2.167**	1.603
			(0.627)	(0.602)	(0.480)	(0.330)	(1.086)	(1.152)
Post×$\Delta^A S^F$			−2.908**	−1.393	0.579	0.850	−5.067*	−3.550
			(1.386)	(1.142)	(1.185)	(0.916)	(2.646)	(2.279)
Post×FirmBeta×EligibleFirm			1.697	0.026	8.361**	1.947	2.544	0.210
			(1.423)	(0.654)	(4.056)	(1.408)	(1.815)	(0.876)
Post×$\Delta^A S^F$×EligibleFirm			−10.603	−1.261	−39.215*	−9.762	−12.666	−4.760
			(7.981)	(3.862)	(20.578)	(7.099)	(9.935)	(6.853)
FirstMonth	Yes	Yes	-	-	-	-	-	-
FirstMonth interactions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
EligibleFirm-month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
PeerGroup-month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,846	12,220	3,846	12,220	1,512	4,620	2,334	7,600
R^2	0.172	0.047	0.560	0.454	0.539	0.587	0.593	0.448
Notes:	$^*p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$							

their idiosyncratic component, measured by the average abnormal spread change across the firm's

bonds ($\Delta^A S_i^F$). We then run the following regression

$$\begin{aligned}\frac{I_{it}^{tot}}{B_i} =& \delta_0^S \times \text{Post}_t \times \text{FirmBeta}_i + \delta_0^A \times \text{Post}_t \times \Delta^A S_i^F \\ &+ \delta_1^S \times \text{Post}_t \times \text{FirmBeta}_i \times \text{EligibleFirm}_i + \delta_1^A \times \text{Post}_t \times \Delta^A S_i^F \times \text{EligibleFirm}_i \\ &+ \text{FirstMonth}_t \text{ interactions} + \text{fixed effects} + u_{it}\end{aligned} \tag{4}$$

where I_{it}^{tot} is the total net issuance of firm i in month t and where we control for interaction variables like those shown in (4), but with the FirstMonth dummy replacing the Post dummy. We saturate the regression using firm and country-industry-month fixed effects, firm eligibility-month fixed effects to control for the time variation in total issuance of eligible and ineligible firms, as well as peer group-month fixed effects, where peer groups are defined as in section 4.

If firms increased total issuance in response to the risk channel, then we should observe $\delta_0^S > 0$; that is, firms with higher beta should increase issuance because they benefited more from a decline in risk premia. Firms should also increase total issuance following an abnormal drop in spreads to take advantage of lower credit spreads. In this case, we should observe $\delta_0^A > 0$. Finally, if eligible firms increased total issuance in response to credit spreads more elastically than ineligible firms, we should also observe $\delta_1^S > 0$ and $\delta_1^A > 0$.

For the entire sample, in column 3 of Table 8, we observe that issuance increased in the short term when firms experienced a decline in spreads, either through a decline in risk premia, proportional to the firms' bond beta, or through an idiosyncratic decline in spreads, with no statistically significant difference between eligible and ineligible issuers. In column 4, we do not observe an increase in total issuance in the long term. This result mirrors our results on total issuance, shown in Table 7 and in Figure A.11(a) in Internet Appendix A.6, in which we find that

total issuance increased in the short term, but not in the long term. Combined, this set of results is consistent with the risk-channel hypotheses discussed in Section 2, suggesting that the CSPP relieved temporary distress in corporate bond markets and boosted demand for credit risk. As we discuss in Appendices A.3 and A.4, before the CSPP announcement, credit markets were experiencing a period of sell-offs and outflows from corporate bond funds. After the announcement, flows reverted and demand for credit risk increased.

Although the effect of risk premia in column 3 may appear marginally significant, the full sample of firms includes very heterogeneous borrowers and the effects of credit spreads may be attenuated by such heterogeneity. Specifically, riskier and smaller firms are more likely to borrow from intermediaries, rather than bond investors (Cantillo and Wright (2000); Faulkender and Petersen (2006)). Therefore, if credit conditions eased for higher-beta firms, which are riskier firms, the least active issuers among ineligible firms likely preferred to borrow from banks.[21]

To investigate the relation between spreads and issuance more deeply while controlling for firm's propensity to borrow from the bond market, we split issuers into less and more active issuers. Starting from our classification of bond issuers into peer groups, we define an issuer as less active if, within its size-based vigentile, it belongs to the first tercile of gross issuance in 2015. We define an issuer as more active if it belongs to the second and third. Issuers with larger (smaller) gross issuance within each size-based vigentile likely have easier (more difficult) access to the credit market. Depending on whether firms typically obtain financing from the bond market or not, they will likely have different elasticities of bond supply. Moreover, differences between eligible and ineligible firms should be larger among less active issuers because, even if eligible

[21]Research from Arce et al. (2017), Ertan et al. (2020), and Grosse-Rueschkamp et al. (2019) shows that banks increased credit to ineligible firms after the CSPP announcement.

firms were inactive in the bond market, they will be able to resume their issuance activity more easily thanks to their investment-grade status and their established reputation in the bond market.

In columns 5 and 6 of Table 8 we find that, among less active issuers, ineligible ones did not increase total issuance in response to a change in the non-diversifiable or in the idiosyncratic component of credit spreads. However, eligible issuers in this group did increase issuance following a decline in credit spreads in the three months following the announcement, especially in response to changes to risk premia, which are proportional to the firms' bond betas. The result is consistent with riskier and less established issuers facing frictions in accessing bond markets and, thus, turning to other sources of financing (Cantillo and Wright (2000); Faulkender and Petersen (2006)). Eligible issuers, which are more established and reputable issuers, were able to increase issuance following a decline in credit spreads.

In columns 7 and 8, we focus on more active issuers. Within this group, all firms increased issuance in the short term following a decline in the two components of credit spreads, with a particularly strong relation to the firm's beta. Among more active issuers, we find no statistically significant difference between eligible and ineligible firms.

Overall, the results support the prediction of the risk channel. Issuers increased total issuance in the short term following a decline in spreads. Bond issuers had different bond-supply elasticities, depending on their typical reliance on the bond market. In particular, among less active issuers, only eligible firms, which tend to be more established issuers, increased issuance following a decline in credit spreads. Among more active issuers, all of them reacted to a decline in credit spreads.

2. Shift Toward Riskier Issuance

In Table 6, we showed that eligible firms increased the issuance of senior and investment-grade bonds. This indicates eligible firms preferred to issue safer bonds along characteristics that were required for eligibility, namely credit ratings and seniority. Next, we consider other bond characteristics that are material for the bond's risk, but are not considered for CSPP eligibility. In our dataset, we observe whether bonds are secured and whether they are guaranteed. Although collateral and guarantees affect the risk of the bond, these are not requirements for CSPP eligibility. Because issuance of unsecured and non-guaranteed is not directly affected by a scarcity channel, we should, therefore, observe a shift toward unsecured and non-guaranteed issuance as a consequence of the risk channel.[22]

We run regressions analogous to (2), but now we sort bonds based on their collateralization and their guarantees. We do not focus only on eligible issuers because any firm could issue unsecured or non-guaranteed bonds to take advantage of lower risk premia. If a risk channel affected the composition of bond issuance, we should expect a positive coefficient on the interaction between the Post variable and the variables indicating the issuance is unsecured and non-guaranteed. In this case, unsecured and non-guaranteed issuance increased after the CSPP announcement relative to secured and guaranteed issuance, respectively.

In Panel A of Table 9, we study the change in unsecured issuance relative to unsecured issuance in the set of eligible, ineligible, and all issuers. In Panel B, we study the change in

[22] In Table A.13 of Internet Appendix A.6, we show unsecured bonds had larger declines in bond spreads after the CSPP announcement and larger bond betas than secured bonds, consistent with unsecured bonds being riskier and more exposed to non-diversifiable risk. The decline in unsecured bond spreads thus reflects a CSPP-triggered correction after a period of particularly elevated spreads among riskier bonds, as we discuss in Internet Appendix A.3. Bond guarantees did not appear to be correlated with spread declines or betas. Consistent with these empirical patterns, in Table 9 ahead, we show unsecured issuance responded more strongly to the CSPP announcement than non-guaranteed issuance.

Table 9: Net issuance by characteristics related to riskiness around the CSPP announcement. Unsecured = 1 if the issuance is unsecured. NonGuaranteed = 1 if the issuance is not guaranteed. Post = 1 after the announcement of the CSPP. We control for FirstMonth-interactions and indicators for the issuance type, where FirstMonth = 1 for the month in which the CSPP was announced. We include firm-month fixed effects and interactions between firm fixed effects and issuance-type indicators. A firm is eligible if it had eligible bonds outstanding in the calendar year before the CSPP announcement. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Regressions are weighted by firms' initial outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

PANEL A: UNSECURED AND SECURED ISSUANCE

	Net issuance by security (%)					
	All firms		Eligible firms		Ineligible firms	
	3M	10M	3M	10M	3M	10M
	1	2	3	4	5	6
Unsecured×Post	1.863***	0.385	1.849***	0.339	1.897**	0.493
	(0.496)	(0.261)	(0.613)	(0.327)	(0.824)	(0.390)
Unsecured×FirstMonth	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Unsecured FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,564	110,440	2,412	7,920	31,152	102,520
R^2	0.580	0.523	0.590	0.528	0.569	0.520
Notes:	$^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$					

PANEL B: NON-GUARANTEED AND GUARANTEED ISSUANCE

	Net issuance by guarantees (%)					
	All firms		Eligible firms		Ineligible firms	
	3M	10M	3M	10M	3M	10M
	1	2	3	4	5	6
NonGuaranteed×Post	1.084**	0.220	0.980	0.248	1.331*	0.154
	(0.471)	(0.250)	(0.649)	(0.320)	(0.755)	(0.389)
NonGuaranteed×FirstMonth	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-NonGuaranteed FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,564	110,440	2,412	7,920	31,152	102,520
R^2	0.582	0.521	0.591	0.526	0.572	0.519
Notes:	$^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$					

non-guaranteed issuance relative to guaranteed issuance. The results are consistent with the shift toward riskier bonds predicted by the risk channel. In the short term, issuers shifted toward unsecured and non-guaranteed issuance. We do not observe shifts in the longer term, consistent with the predictions of the risk channel and our empirical results in Table 8, which also indicate a risk channel has a temporary effect on issuance.

The increase in unsecured issuance in the short term is statistically significant also within the sub-samples of eligible and ineligible firms. Although we find a statistically significant increase in non-guaranteed issuance in the entire sample and for ineligible firms, results are not statistically significant for eligible issuers. The stronger response in unsecured issuance, rather than non-guaranteed issuance, is consistent with the larger exposure of unsecured bonds to non-diversifiable risk and their larger spread declines after the CSPP, as we document in Table A.13 of Internet Appendix A.6.

Overall, combining the results in Tables 6 and 9, it appears that firms followed a pecking order when shifting the characteristics of their issuance related to risk. In particular, they prioritized the issuance of safer bonds along characteristics that were required for CSPP eligibility, thus increasing the issuance of senior and investment-grade bonds, as predicted by the scarcity channel. For characteristics that were not required for eligibility, firms shifted toward riskier bonds, thus increasing the issuance on unsecured and non-guaranteed bonds, as predicted by the risk channel.

C. Further Evidence of Market Timing

To conclude our analysis of firms' issuance response, we look for more direct evidence on whether firms tried to time the market after the announcement of the CSPP. Although we cannot

observe managers' intentions, here we take a revealed-preference approach. We look for hints suggesting a preference to issue bonds after the announcement, rather than wait for future needs or investment opportunities to arise.

We consider four bond characteristics that reveal a firm's preferences regarding the timing of its issuance. We study whether firms issued less commercial paper and fewer short-maturity bonds, thus indicating an intention to collect funds to be used over a longer period. We also explore if firms issued more fixed-coupon bonds, thus suggesting firms intended to lock in current spreads, which fell after the CSPP announcement, as shown in section B. Overall, an increase in longer-maturity, fixed-coupon issuance suggests firms viewed the current market conditions as favorable.[23] Then, we check whether firms increased the net issuance of bonds whose prospectus mentions "general corporate purposes" as the sole use of proceeds. We consider an increase in this lack of specificity as a hint that firms were issuing opportunistically, possibly in the absence of specific investment projects or financing needs. Finally, we assess whether firms took advantage of their issuance programs, which give frequent issuers the flexibility to issue bonds using a pre-agreed documentation and a streamlined registration process.

We run five separate regressions in the same form of (2). We consider whether bonds are commercial paper, whether they have maturity below one year, whether they have a fixed coupon, whether their issuance is justified by general corporate purposes (as opposed to specific investment and business needs), and whether their issuance is part of an issuance program.

Table 10 reports the estimated coefficients on the IssuanceType$\times$Post interaction in the five regressions. In all five cases, we find hints of market-timing behavior, especially in the case of

[23] By issuing longer-maturity, fixed-coupon bonds, firms are hedging against the risk that market conditions change in the future, suggesting firms viewed the current favorable market conditions as not permanent. However, they did not necessarily view them as short-lived. As we show ahead in Table 10 the increase in longer-maturity, fixed-coupon issuance is persistent and can be observed over the longer horizon around the CSPP announcement.

Table 10: Net issuance by characteristics related to a willingness to time the market after the CSPP announcement. We run separate regressions of net issuance of bonds with and without a certain characteristic on the interaction IssuanceType×Post and controls. IssuanceType = 1 if the issuance has the characteristic being considered. Post = 1 after the announcement of the CSPP. We control for an IssuanceType×FirstMonth interaction, firm-month fixed effects, and firm-IssuanceType fixed effects. For each row, we report the coefficients on the interaction IssuanceType×Post for a different issuance type: CommPaper = 1 if the issuance is commercial paper (row 1); ShortMaturity = 1 if the issuance's maturity is shorter than one year (row 2); FixedCoupon = 1 if the issuance has a fixed coupon rate (row 3); GeneralPurpose = 1 if the issuance prospectus indicates general corporate purposes as the only use of proceeds (row 4); and IssuanceProgram = 1 if the issue is part of an issuance program (row 5). A firm is eligible if it had eligible bonds outstanding in the calendar year before the CSPP announcement. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Net issuance by type (%)					
	All firms		Eligible firms		Ineligible firms	
	3M	10M	3M	10M	3M	10M
	1	2	3	4	5	6
CommPaper×Post	-1.671^{***}	-0.707^{***}	-1.790^{***}	-0.765^{**}	-1.383^{*}	-0.568
	(0.513)	(0.274)	(0.621)	(0.346)	(0.807)	(0.386)
ShortMaturity×Post	-1.463^{***}	-0.616^{**}	-1.500^{**}	-0.542	-1.375	-0.792^{*}
	(0.506)	(0.263)	(0.619)	(0.335)	(0.851)	(0.410)
FixedCoupon×Post	1.817^{***}	0.737^{***}	2.085^{***}	0.822^{***}	1.171	0.536
	(0.495)	(0.246)	(0.595)	(0.305)	(0.799)	(0.341)
GeneralPurpose×Post	0.914^{*}	0.626^{***}	1.413^{**}	0.917^{***}	-0.281	-0.067
	(0.466)	(0.241)	(0.548)	(0.309)	(0.790)	(0.326)
IssuanceProgram×Post	1.048^{**}	0.146	1.221^{**}	0.230	0.632	-0.056
	(0.412)	(0.185)	(0.506)	(0.223)	(0.694)	(0.321)
IssuanceType×FirstMonth	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-IssuanceType FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,564	110,440	2,412	7,920	31,152	102,520
Notes:	$^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$					

eligible firms. Eligible firms moved away from commercial paper and short-maturity bonds, and shifted toward fixed-coupon bonds. These patterns indicate firms attempted to lock in current market conditions by shifting toward bonds with longer maturity and fixed interest payments. Moreover, eligible firms increased their issuance of bonds for general corporate purposes, suggesting an increased eagerness to issue after the CSPP announcement, rather than wait for

future needs to arise. Finally, in the short run, eligible firms relied more heavily on issuance programs which allow for a quicker access to the bond market, with the effect lessening in the longer run, when firms may have sufficient time to issue bonds through other channels.

V. CONCLUSIONS

Using the announcement of the ECB's corporate QE program (the CSPP), we showed that firms changed the quantity and composition of their bond issues in response to corporate quantitative easing. Firms shifted the composition of their bond issuance toward bonds meeting eligibility requirements and toward bonds which were riskier along characteristics not considered for eligibility. Both eligible and ineligible firms increased total issuance following the CSPP announcement, although the boost in total issuance was temporary. We also find evidence of opportunistic behavior by looking at other characteristics of bond issues, suggesting firms viewed market conditions as favorable for bond issuance.

Several avenues for research remain open to study the transmission of corporate QE to the real economy. For example, one could investigate whether firm executives and employees benefited from corporate QE or whether QE affected long-term patterns in corporate investments, innovation and, ultimately, productivity. Moreover, one could study central banks' incentives and the optimal design of corporate QE. Finally, one could systematically investigate the transmission of QE through financial intermediaries. Any future research on these issues will provide valuable information to regulators and policy makers interested in designing and implementing asset-purchase programs.

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INTERNET APPENDIX FOR

DEMAND-DRIVEN BOND FINANCING IN THE EURO AREA*

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September 19, 2024

A.1 CHANGES IN RISK PREMIA ACROSS ASSET CLASSES

In this Appendix, we study the effect of the CSPP announcement on spreads and returns in a variety of asset classes. In the paper, we focused on outstanding bonds. Here, we consider CDS spreads, default probabilities, spreads at issuance, and equity returns. We show that, across a variety of asset classes, the CSPP improved the valuation of those assets that were most exposed to non-diversifiable risk, thus providing additional evidence the CSPP lowered risk premia.

A.1.1 CDS SPREADS AND DEFAULT RISK PREMIA

We extend our analysis on valuation of credit risk by looking at CDS spreads and expected default frequencies (EDFs) around the announcement of the CSPP. We use CDS data from IHS Markit and EDF data from Moody's KMV. For CDS spreads, we find information on 133 of the issuers in our sample. We then match Markit's data with KMV's, resulting in a sample of 80 issuers for which we observe both CDS spreads and EDFs.

A.1.1.1 CDS SPREADS

Figure A.1(a) plots the average five-year CDS spread of eligible and ineligible issuers, where an issuer is defined as eligible if it had eligible bonds outstanding in 2015. Consistent with our arguments so far, the spreads of eligible and ineligible issuers declined by a comparable amount when the CSPP was announced.

*This paper should not be reported as representing the views of the European Central Bank (ECB). The views expressed are those of the authors and do not necessarily reflect those of the ECB.

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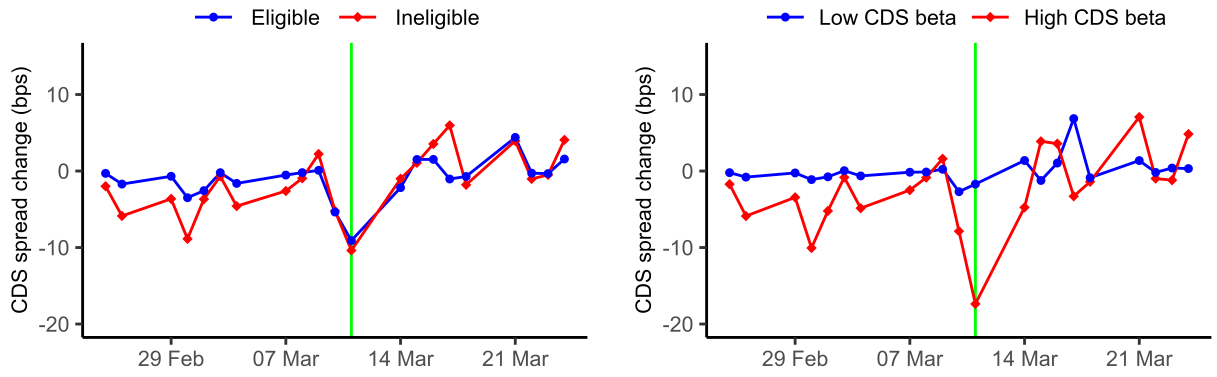


(a) Entities by issuer eligibility

(b) Entities by beta

Figure A.1: Daily change in five-year CDS spreads of euro-area non-financial issuers around the announcement of the CSPP. Issuers are sorted according to eligibility and exposure to non-diversifiable risk. An issuer is classified as eligible if it had eligible bonds outstanding at some time during the calendar year before the announcement. We measure an issuer's exposure to non-diversifiable risk in terms of its CDS beta before the announcement. The CDS beta is the slope coefficient in a regression of the change in the issuer's five-year spread on the change in the average five-year spread of the market. Issuers are classified as high CDS beta if their CDS beta is above the median. The vertical line marks the first trading day after the announcement of the CSPP.

In Figure A.1(b), we sort reference entities on the basis of the beta of their CDS spread. Again, entities with the highest beta experienced the greatest improvement in the valuation of their credit risk. To compute the CDS beta, first we construct a CDS index as the cross-sectional average of the five-year spreads of non-financial issuers domiciled in the euro area. Then, we compute an entity's CDS beta as the slope coefficient in a regression of the daily change in the entity's five-year spread on the daily change in the index's five-year spread.

As a first approximation, we can interpret the level of a CDS spread as a function of the entity's probability of default and of the correlation of the entity's default with the aggregate market. Entities whose default is more likely to happen during economic downturns will have a higher spread for a given (unconditional) probability of default. The CDS beta measures the co-movement of a change in CDS spreads with a change in the aggregate market's spread, regardless of the level of the spread. The CDS beta, therefore, captures the entity's exposure to non-diversifiable credit risk only, and not the entity's idiosyncratic risk.

Table A.1 shows summary statistics for CDS spreads before and after the announcement for all entities, for eligible entities, and for ineligible entities. We consider daily data for the five-year CDS contract, which is the most actively traded, and the 30-year CDS contract, which is the longest maturity in our data. Later, in Table A.3, we show summary statistics for the one-year contract for the subsample of entities for which we

Table A.1: Summary statistics for CDS spreads. The table reports the number of entities and summary statistics for the five-year and 30-year CDS spreads. Summary statistics are separately computed for the three months before and after the announcement of the CSPP using daily data.

	5yr spread (%)			30yr spread (%)		
Issuers:	All	Eligible	Ineligible	All	Eligible	Ineligible
N entities	133	80	53	121	73	48
Pre-CSPP: Mean (%)	1.531	0.942	2.415	1.950	1.377	2.863
Pre-CSPP: Median (%)	0.902	0.789	1.501	1.384	1.203	2.029
Pre-CSPP: St.Dev. (%)	1.894	0.612	2.667	1.780	0.718	2.458
Post-CSPP: Mean (%)	1.406	0.821	2.292	1.804	1.230	2.707
Post-CSPP: Median (%)	0.824	0.718	1.520	1.242	1.092	1.959
Post-CSPP: St.Dev (%)	1.815	0.455	2.582	1.707	0.560	2.383

also have data on their probability of default. In general, we notice the same patterns we observed in Figure A.1: higher-beta entities experience a greater decline in CDS spreads after the announcement.

In Table A.2 we run regressions of changes in CDS spreads after the announcement on an indicator for whether the firm is eligible and the beta of the firm CDS. We also study abnormal CDS spread changes, defined as the change in CDS spreads in excess to the change predicted by the firm's beta. Betas are computed for each maturity of the two maturities. Consistent with theories predicting a decline in risk premia, we observe a larger decline in CDS spreads for entities exposed to more non-diversifiable risk. Whereas the CSPP may have generated scarcity of eligible bonds, it did not generate a scarcity of CDSs. Therefore, we observe no statistically significant changes in CDS spreads for eligible entities, even when considering abnormal changes.

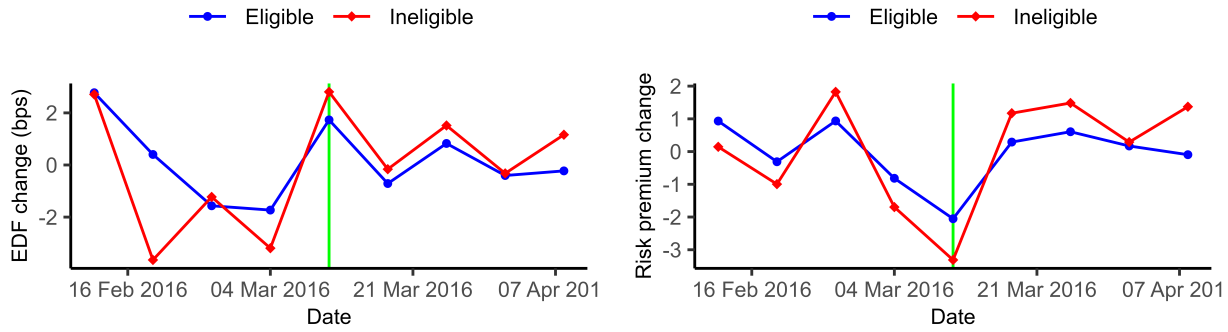
A.1.1.2 CSD Risk Premia

To obtain a measure of risk premia, we consider the ratio between the CDS spread and the expected default frequency (EDF) of bond issuers. We find EDF data for 80 of the 133 issuers in the CDS sample. The ratio between the CDS spread and the entity's EDF represents, approximately, the ratio between the risk-neutral expected default frequency and the default frequency under the physical probability measure. The ratio, therefore, captures a default risk premium. We focus on one-year EDFs and CDS spreads because we can directly interpret these quantities as annualized arrival rates of defaults under the physical and risk-neutral measure, respectively. We use weekly data to reduce mi-

Table A.2: Changes in five-year and thirty-year CDS spreads after the CSPP announcement. The dependent variable is the daily change in CDS spreads (columns 1-4) and the abnormal change in CDS spread (columns 5 and 6). EligibleFirm = 1 if the reference entity had eligible bonds outstanding at some time during the calendar year before the announcement. CDSBeta is the entity's CDS beta. Standard errors are in parentheses and are clustered at the country-industry level.

	Δ CDS spread (bps)				Abn. Δ CDS spread (bps)	
	5yr		30yr		5yr	30yr
	(1)	(2)	(3)	(4)	(5)	(6)
EligibleFirm	−2.191	−0.886	−0.306	0.743	−1.205	2.759
	(3.932)	(2.230)	(4.028)	(3.546)	(4.365)	(3.095)
CDSBeta		−6.390***		−3.379***		
		(0.955)		(0.979)		
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	131	131	114	113	111	113
R^2	0.328	0.694	0.412	0.546	0.357	0.493
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$					

crostructure noise in the daily estimates of the EDFs (Berndt et al., 2005).



(a) Expected default frequency

(b) Risk premium

Figure A.2: Weekly changes in average one-year EDF and risk premium of euro-area non-financial issuers in the three months before and after the announcement of the CSPP. The vertical line marks the first trading day after the announcement of the CSPP.

Figure A.2 shows the announcement brought about a decline in risk premia. Table A.3 shows summary statistics for EDFs, one-year spreads, and risk premia before and after the announcement. Table A.4 shows regressions of the weekly change in 1-year spreads, 1-year EDFs, and 1-year risk premia. Consistent with the risk channel of monetary pol-

Table A.3: Summary statistics for EDFs, one-year spreads, and risk premia. The table reports the number of entities and summary statistics for entities with EDF and CDS data available. Summary statistics are separately computed for the three months before and after the announcement of the CSPP using daily data.

	1yr EDF (%)			1yr spread (%)			Risk premium		
Issuers:	All	Eligible	Ineligible	All	Eligible	Ineligible	All	Eligible	Ineligible
N entities	80	50	30	80	50	30	80	50	30
Pre-CSPP: Mean	0.184	0.185	0.182	0.599	0.372	0.996	8.669	8.404	9.134
Pre-CSPP: Median	0.050	0.040	0.060	0.280	0.244	0.357	5.652	5.143	6.941
Pre-CSPP: St.Dev.	0.421	0.456	0.352	1.346	0.457	2.090	15.178	15.627	14.351
Post-CSPP: Mean	0.192	0.183	0.207	0.481	0.268	0.854	7.863	6.850	9.631
Post-CSPP: Median	0.050	0.040	0.050	0.210	0.183	0.331	4.680	4.103	5.343
Post-CSPP: St.Dev	0.484	0.481	0.490	1.126	0.356	1.744	17.453	15.412	20.417

icy, risk premia declined the week of the CSPP announcement. No statistically different change in risk premia was observed based on firms' eligibility or based on their CDS beta, consistent with a generalized decline in the premium investors required for risk.

A.1.2 Spreads at Issuance

Next, we consider spreads of new bond issues. Grosse-Rueschkamp et al. (2019) observe that the spreads of new issues declined for bonds rated between BBB+ and BBB- in the second quarter after the announcement of the CSPP. They do not observe any significant decline in spreads in the quarter immediately after the announcement. In the same spirit of Grosse-Rueschkamp et al. (2019), we consider the spreads of new issues. Unlike them, we focus on the change in spreads in the days immediately following the announcement.

Although spreads at issuance provide additional information about changes in valuation around the CSPP announcement, we avoid a causal interpretation of the following results. Unlike outstanding bonds, changes in the yields of new bond issues are affected by firms' market-timing activity, because firms choose which type of bonds to issue and when to issue them. In fact, in section B, we show firms shifted toward riskier issuance after the CSPP announcement, favoring unsecured and non-guaranteed bonds. Because firms shifted toward riskier bonds, changes in spreads at issue underestimate the effect of the CSPP on bond spreads.

We consider zero-coupon and fixed-coupon bonds issued in the six months before and after the CSPP announcement. For these bonds, we can compute yields at issue given information on their issue price, redemption price, maturity, and coupon payments. We then compute each bond's spread at issue as the difference between the yield at issue and the maturity-matched risk-free rate.

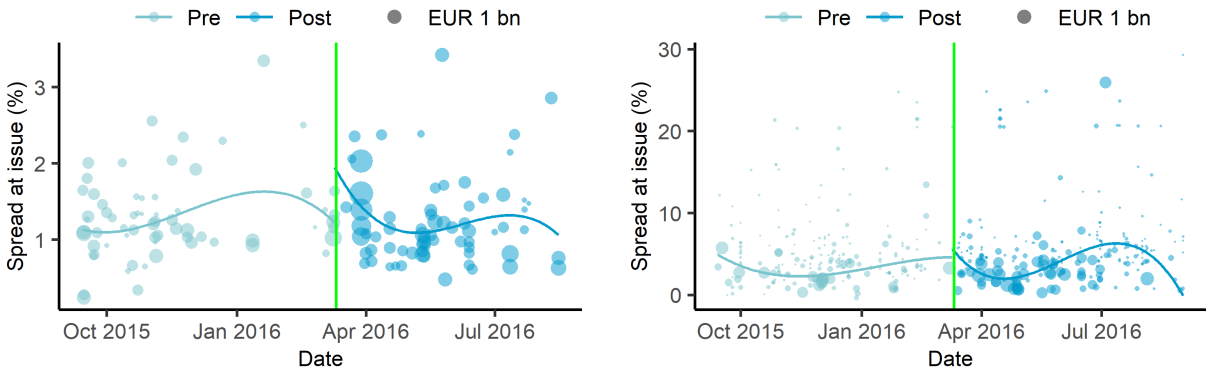
Figure A.3 plots yield spreads at issue around the CSPP announcement, together

Table A.4: Change in one-year CDS spreads, EDF, and risk premium in the week of the CSPP announcement. EligibleFirm = 1 if the reference entity had eligible bonds outstanding at some time during the calendar year before the announcement. CDSBeta is the entity's CDS beta. Standard errors are in parentheses and are clustered at the country-industry level.

	Δ 1yr spread (bps)		Δ 1yr EDF (bps)		Δ Risk premium	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-9.623^{***}		0.021^{**}		-2.387^{***}	
	(3.297)		(0.009)		(0.532)	
EligibleFirm		-0.579		0.039		0.322
		(5.281)		(0.070)		(0.942)
CDS β		-6.322^{**}		0.012		-0.225
		(2.430)		(0.010)		(0.351)
Country FE	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Rating FE	No	Yes	No	Yes	No	Yes
Observations	74	62	83	66	74	62
R^2	-0.000	0.974	0.000	0.577	0.000	0.119
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$					

with the predicted values using third-degree polynomials for the pre-announcement and the post-announcement period. Polynomial regressions are weighted by bonds' issued amounts. One can immediately observe two patterns around the CSPP announcement. First, firms increased their issuance activity rapidly after the announcement. Second, the predicted spreads do not appear to immediately decline for either group of bonds.

Next, we adopt a regression discontinuity design using new bond issues in the six months before and after the announcement of the CSPP. Controlling for high-order polynomials, we estimate the discontinuity in spreads around the CSPP announcement. We view our discontinuity estimates as illustrations of a pattern, rather than as measures of a causal effect of the CSPP on coupon rates. In fact, Gelman and Imbens (2019) encourage the use of local linear or quadratic regressions instead of higher-order polynomials. Unfortunately, our data are not dense enough near the discontinuity for us to implement their suggested approach. Moreover, firms changed the characteristics of their bond issues after the announcement, as we show in section B, with firms shifting toward riskier bond issues.



(a) Eligible bonds **(b)** Ineligible bonds

Figure A.3: Spreads at issue of newly issued zero-coupon and fixed-coupon bonds around the CSPP announcement. The dots represent the spreads of newly issued bonds, and their area is proportional to the amount issued. The lines represent the predicted value from a third-degree polynomial regression of spreads on issue date. Regressions are separately estimated for the six months before and after the announcement, and they are weighted by the bonds' issued amounts.

Table A.5: Estimates of the discontinuity in a regression of spreads at issue on issue date. In the first row, we control for a third-degree polynomial; in the second row, we control for a fourth-degree polynomial. We also control for rating, maturity, country, and sector fixed effects. Odd columns show the results from unweighted regressions, whereas even columns show the results for regressions weighted by the amount issued. Standard errors are clustered at the firm level.

	Discontinuity in coupon spread (%)											
	Eligible bonds		Ineligible bonds		Invest. grade bonds		Non-invest. grade bonds		Eligible firms		Ineligible firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
3rd degree poly.	0.627**	0.490	−3.914*	2.203	0.523**	0.558*	−3.952*	0.761	0.490	0.345	−1.605	2.317
	(0.286)	(0.302)	(2.044)	(2.718)	(0.247)	(0.330)	(2.033)	(2.645)	(0.525)	(0.303)	(2.063)	(2.468)
4th degree poly.	0.750*	0.425	−5.705**	−2.656	0.433	0.142	−5.580**	−3.807	0.551	0.352	−2.425	−0.921
	(0.441)	(0.446)	(2.532)	(2.147)	(0.366)	(0.455)	(2.558)	(2.678)	(0.740)	(0.501)	(2.627)	(2.626)
Weighted	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	134	134	396	396	155	155	375	375	163	163	367	367

Notes: $^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$

We consider a regression in the following form:

$$s_{it} = a_0^0 + a_0^1 x^1 + \cdots + a_0^p x^p + \text{Post}_t \times (a_1^0 + a_1^1 x^1 + \cdots + a_1^p x^p) + \iota_{r(i)} + \iota_{m(i)} + \iota_{c(i)} + \iota_{s(i)} + u_{it}, \quad \text{(A.1)}$$

where s_{it} is the spread of issue i at date t, x_{it} is the time difference in days between t and the first trading day after the announcement of the CSPP, $\iota_{r(i)}$ is a rating fixed effect, $\iota_{m(i)}$ is a maturity-bin fixed effect like the one used in (1), $\iota_{c(i)}$ is a country fixed effect, and $\iota_{s(i)}$ is a sector fixed effect.

The coefficient a_1^0 provides an estimate of the change in spreads immediately after

the announcement. We report estimates in Table A.5. Here, we consider polynomials of the third and fourth degree. We include estimates obtained with and without weighting observations by the issued amount.

The CSPP announcement was followed by a decline in the spreads of smaller issues of ineligible and non-investment-grade bonds, as a comparison between unweighted and weighted regressions reveal. However, it was not followed by a drop in the spreads of eligible bonds.

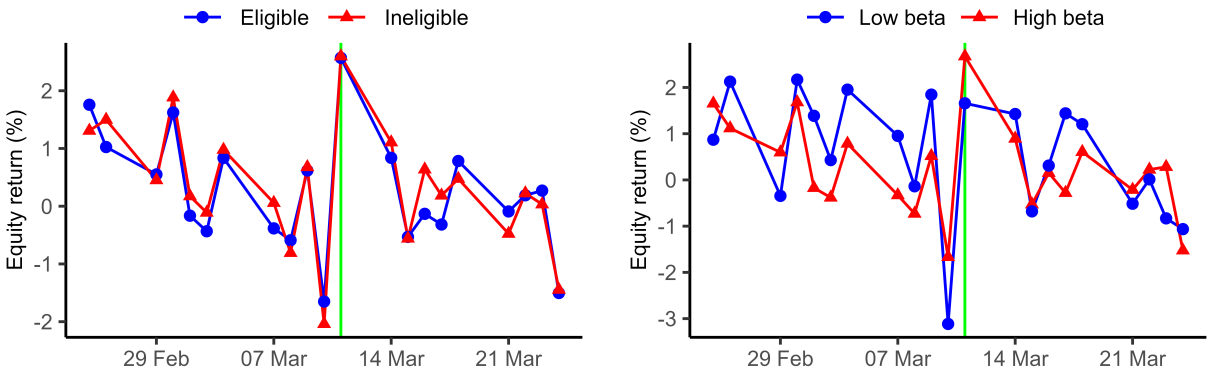
A.1.3 Equity Returns

Finally, we consider equity returns after the CSPP announcement. Whereas a risk channel predicts positive stocks returns for stocks exposed to non-diversifiable risk, the scarcity channel should not affect returns of eligible firms because the CSPP did not create scarcity of corporate stocks. We show stocks of bond issuers experienced positive returns and abnormal returns at the announcement. We find changes in valuation reflect changes in risk premia, consistent with the risk channel of QE and previous findings in bond and CDS markets. We also find no higher abnormal returns for the stocks of eligible and ineligible issuers, consistent with the CSPP not exerting price pressure on stocks through a scarcity channel.

We consider issuers' stock performance. Using Orbis and Compustat data, we match issuers to their stocks. We obtain a sample of 105 publicly traded eligible firms and 534 publicly traded ineligible firms.

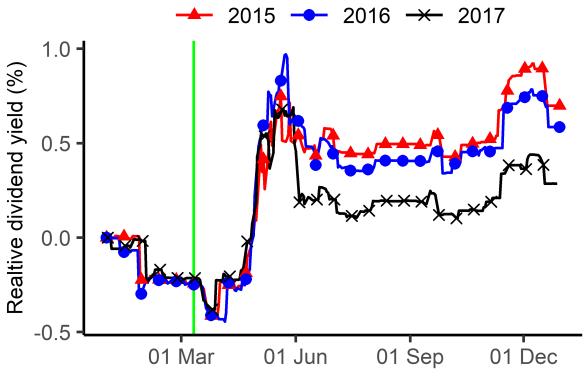
We sort firms based on their eligibility and their beta. We form value-weighted portfolios of eligible and ineligible firms and study their performance and cumulative dividend yield. Figure A.4(a) shows the portfolios of eligible and ineligible firms performed equally well after the CSPP announcement. We then form portfolios based on the betas of stocks with the aggregate portfolio of bond issuers in the euro area. As for bonds, a stock's beta measures the stock's exposure to non-diversifiable risk. Figure A.4(b) illustrates that, at the time of the announcement, the portfolio of high-beta firms experienced higher abnormal returns than the portfolio of low-beta firms.

To formally investigate cross-sectional differences in stock returns after the announcement, we run regressions where the dependent variables are stock returns and abnormal stock returns on the announcement day. Results are in the first four columns in Table A.6. In columns 1 and 3, we show stocks experienced positive and statistically significant returns after the announcement. In columns 2 and 4 we control for country-sector and rating fixed effects and add indicators for firm eligibility and, in case of returns, the beta of the stock. In column 2, we find eligible issuers experienced no better stock returns as in-



(a) Stock returns by issuer eligibility

(b) Stock returns by stock beta



(c) Relative dividend yields

Figure A.4: Stock returns and relative dividend yield of eligible and ineligible issuers. In Figure (a), we plot the daily equity returns of portfolios of eligible and ineligible issuers. In Figure (b), we plot the daily equity returns of portfolios of firms with equity beta above or below median. The vertical line marks the first trading day after the announcement of the 2016 CSPP. In Figure (c), we plot the difference between the cumulative dividend yield of the portfolio of eligible firms and the portfolios of ineligible firms as a function of the day of the year for three different years. The vertical line marks the day of the year corresponding, in 2016, to the first trading day after the announcement of the CSPP.

eligible issuers after the CSPP announcement. However, returns increased with the stock beta, consistent with the risk channel. Finally, in column 4, we observe no relation between abnormal stock returns and the eligibility of the issuers, consistent with the CSPP not exerting price pressure on the stocks of eligible firms other than through a decline in risk premia.

DIVIDEND YIELDS. Finally, we investigate whether eligible firms delivered higher returns to shareholders in the form of dividend payments after the CSPP announcement. Figure A.4(c) plots the difference between the cumulative dividend yield of the portfolio of eligible firms and the portfolio of ineligible firms in years 2015, 2016, and 2017. In Figure A.4(c), a positive (negative) value at a given date indicates that, up to that day of the year, the dividend yield of eligible firms was higher (lower) than ineligible firms.

Table A.6: Stock performance and change in dividend yield. In columns 1 and 2, the dependent variable is the issuer's stock return after the CSPP announcement. In columns 3 and 4, the dependent variable is the abnormal stock return after the CSPP announcement. In columns 5 and 6, the dependent variable is the dividend yield paid within the first ninety days after the CSPP announcement minus the divided yield paid over the same calendar period the previous year. EligibleFirm = 1 if the firm had eligible bonds outstanding at some point during 2015. EquityBeta is the beta of the firm's stock. Standard errors are in parentheses and are clustered at the country-sector level.

	Stock return (%)		Abn. stock return (%)		Δ div. yield (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.455^{***}		0.595^{***}		-0.031	
	(0.135)		(0.130)		(0.055)	
EligibleFirm		0.149		0.054		0.115
		(0.361)		(0.349)		(0.274)
Equity β		1.993^{***}				-0.213
		(0.584)				(0.186)
Country FE	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Rating FE	No	Yes	No	Yes	No	Yes
Observations	621	612	618	612	600	593
R^2	0.000	0.148	0.000	0.108	0.000	0.081
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$					

Figure A.4(c) shows eligible firms increased their dividend yields relative to ineligible firms in the months after the announcement, as Todorov (2020) also observed. However, the pattern is typical for the time of the year. In fact, even in 2015 and 2017, eligible firms sharply increased their dividend yield relative to ineligible firms starting in May.

In columns 5 and 6 of Table A.6, we study the change in divided yield after the announcement, while controlling for seasonality in dividend payments in eligible and ineligible firms. The left-hand side variable is the dividend yield paid within the first ninety days after the CSPP announcement, minus the divided yield paid over the same calendar period the previous year. By comparing dividend yields over the same period of the year, we assess whether eligible firms increased dividend payments as a result of the CSPP. After controlling for seasonality, no significant increase in dividend yields can be observed around the CSPP announcement.

A.2 Additional Results on Bond Issuance

In this Appendix, we provide details on lag between bond-issuance announcements and bond issuance for eligible firms. We also conduct an additional analysis on the relation between the total issuance and the market-timing activity of eligible firms.

A.2.1 The Timeline of Corporate Bond Issuance

Table A.7: Summary statistics of issue amounts and the announcement-to-issuance lag of bonds available on Bloomberg. The sample includes all euro-denominated bonds issued between January 1, 2014 and December 31, 2017 by non-financial corporations domiciled in the euro area.

	All bonds	Eligible bonds	Ineligible bonds
Number of issues	1350	374	976
Avg. issued amount (€mln)	228.74	387.67	167.47
Median issued amount (€mln)	100.00	500.00	54.97
Std. of issued amount (€mln)	258.84	287.43	218.05
Mean announcement-to-issuance lag (days)	8.64	7.97	8.89
Median announcement-to-issuance lag (days)	7.00	7.00	7.00
Std. of announcement-to-issuance lag (days)	9.38	2.82	10.89

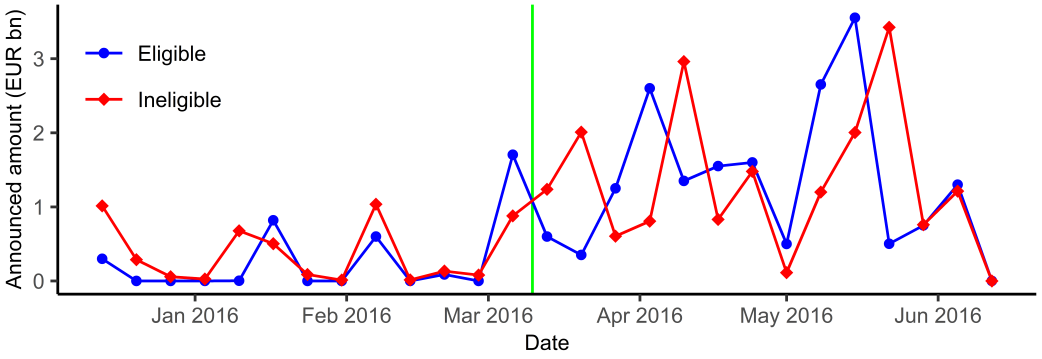


Figure A.5: Weekly announced bond issuance for the three months before and after the CSPP. All bonds are euro-denominated and issued by non-financial corporations domiciled in the euro area. The vertical line marks the announcement of the CSPP.

To shed some light on the typical timeline of a bond issue for eligible firms, we collect some anecdotal evidence by manually searching for information about eligible issuers issuing bonds in the second half of March 2016. Most of the issuers had long-term issuance agreements already in place with major banks. These agreements allow firms to issue bonds of a predetermined type "from time to time," thus giving firms substantial flexibility to issue when they deem it appropriate.

To conduct a more systematic analysis, we use data from Bloomberg, which provides both bonds' issue dates and the dates of the issues' public announcements. Table A.7 provides summary statistics of the time lag between issuance announcements and bond-issue dates. In particular, the median time lag is only seven days. We also plot the weekly time series of bond-issuance announcements in Figure A.5. Here, we observe an increase in bond issuance announcements after the CSPP announcement, thus suggesting the bond issues that took place in the Spring of 2016 had not already been scheduled before the ECB intervention.

Issuance-announcement data provide information on the typical timeline for eligible firms to issue bonds. However, one should not interpret these numbers as representative of the entire bond market. As Table 1 shows, bonds in Bloomberg are biased toward the largest issuers, and eligible firms tend to be large and established issuers themselves. However, new and smaller issuers will face longer delays if they have to present themselves to investors by roadshow or establish relations with rating agencies.

A.2.2 Total Issuance and Market-Timing Activity Among Eligible Firms

To further investigate the effects of scarcity on bond issuance, we study whether firms that timed the market also increased total issuance compared to other firms. As discussed in section A, the relation between market timing and total issuance depends on the elasticity of firms' bond supply. If firms supply bonds very elastically, we might observe no relation between market timing and total issuance.

In section IV, we showed firms elastically supplied bonds in response to the ECB's demand and the decline in risk prima. In particular, in section B, we showed firms increase total issuace in the short term primarily in response to a decline in risk premia. Here, we focus on eligible firms and show that, consistent with these other findings, firms which timed the market more aggressively did not increase total issuance relative to other firms.

We calculate a firm's change in total net issuance by considering the change in net issuance after the CSPP announcement. We calculate the firm's eligible shift by running the same regressions as (2) while omitting the Post×Eligible independent variable. We obtain residuals for eligible and ineligible issuance before and after the announcement and compute the eligible shift as the difference between the change in eligible-issuance residuals and the change in ineligible-issuance residuals around the announcement. We calculate the *requirement shift* in a similar way for the issuance meeting the three eligibility requirements, as discussed in Section A.

A potential concerns is that an eligible shift could mechanically correlate with total issuance. For example, one would observe perfect correlation if all eligible firms had a

net issuance of ineligible bonds always equal to zero.[1] Therefore, to clearly interpret our results, we conduct the tests in this section using an alternative measure of market timing.

As an additional measure of market timing, we define a firm's *eligible share* as the period's fraction of gross issuance that is eligible. We construct this measure for the three- and 10-month periods before and after the announcement. Because gross issuance includes only increases in a bond's outstanding amount, eligible share measures a firm's propensity to use eligible bonds when borrowing funds from the market. If a firm's eligible share increased after the announcement, the firm's propensity to use eligible bonds increased as well. Thus, the change in eligible share offers a measure of market timing that does not mechanically correlate on the amount of bonds issued.

Using the sample of eligible firms, we study whether the change in eligible share around the announcement of the CSPP is correlated with the eligible shift and with the change in total net issuance, by running a regression in the form

$$\mathrm{y}_i = \Delta\text{EligibleShare}_i + \iota_{c(i)} + \iota_{s(i)} + u_i,$$

where y_i is either firm i's eligible shift or its change in total net issuance. The variables $\iota_{c(i)}$ and $\iota_{s(i)}$ are, respectively, country and industry fixed effects. Note that because of the definition of eligible share, the sample for this regression is reduced relative to Table 5. In fact, here we may include only firms with positive gross issuance both before and after the announcement, whereas in Table 5, we could include any firm with a positive outstanding amount of bonds at the beginning of the sample period.

Because eligible bonds may have characteristics that investors find attractive besides their eligibility, in some regressions, we control also for the change in the share of bonds having those characteristics. We then calculate the *meet-the-requirement share* as the fraction of gross issuance that meets the three eligibility requirements; namely, being listed, senior, and investment-grade rates. We thus include the change in the meet-the-requirement share in some of the regressions as a control.

In the first six columns of Table A.8, we verify the change in eligible share is a valid measure of market timing. In particular, we show the change in eligible share is positively correlated with eligible shift. Firms that increased their eligible share the most are also those that increased eligible issuance over ineligible issuance the most, even after controlling for the change in the share of gross issuance meeting requirements.

In the remaining columns of Table A.8, we show firms that timed the market more ag-

[1] The in-sample correlation between total issuance and eligible shift is 18.4% for the three-month horizon and 33.2% for the 10-month horizon.

Table A.8: Issuance and market-timing activity in eligible firms. In the first six columns, the dependent variable is firms' eligible shift in the three months (columns 1-3) and 10 months (columns 4-6) around the CSPP announcement. In the last six columns, the dependent variable is the change in firms' total net issuance in the three months(columns 7-9) and 10 months (columns 10-12) around the CSPP announcement. ΔEligibleShare is the change in the share of eligible gross issuance in the three or 10 months around the CSPP announcement. ΔMeetReqShare is the change in the share of gross issuance meeting eligibility requirements in the three or 10 months around the CSPP announcement. The eligibility requirements are being listed, being senior, and being investment-grade rated. Regressions are weighted by the firms' initial outstanding amount of bonds. Standard errors are in parentheses and are clustered at the firm level.

	Eligible shift (%)						Total issuance (%)					
	3M			10M			3M			10M		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ΔEligibleShare (%)	0.293*		0.400***	0.387**		0.494***	−0.116		−0.166	−0.079		−0.272
	(0.150)		(0.149)	(0.159)		(0.162)	(0.168)		(0.214)	(0.140)		(0.183)
ΔMeetReqShare (%)		−0.405*	−0.611***		−0.153	−0.505		−0.046	0.039		0.572	0.767*
		(0.204)	(0.224)		(0.258)	(0.341)		(0.211)	(0.267)		(0.391)	(0.400)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	78	78	78	101	101	101	78	78	78	101	105	105
R^2	0.544	0.529	0.599	0.265	0.218	0.287	0.338	0.346	0.360	0.172	0.207	0.225

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

gressively by increasing their eligible share did not issue more than other firms. Hence, the change in total issuance among eligible firms is not related to the market-timing activity of firms in terms of changes in the share of eligible bonds issued. The share of gross issuance meeting eligibility requirements is only weakly related to total issuance in the 10-month horizon after controlling for the change in eligible share.

Therefore, the results are consistent with a high elasticity of bond supply and the result in section B whereby total issuance was driven by a change in risk premia.

A.3 The Bond Market before the CSPP Announcement

The corporate bond market in Europe was going through a period of price declines in the two months leading to the CSPP announcement. In January 2016, The Wall Street Journal wrote that "A wave of selling has taken Europe's corporate-bond market to levels typically seen during recessions, another indication that the turmoil in global markets could spread into the wider economy" (Whittall, 2016). Other newspaper articles can later be found discussing the low valuation of corporate bonds at the beginning of 2016 (Barley, 2016; Platt, 2016; Smith, 2016). Signs of distress in the corporate bond market are also discussed in the February and March 2016 Economic Bulletins of the ECB (ECB, 2016a,b).

Figure 2(a) in section A plots the average daily spreads of corporate bonds in the months leading up to the CSPP announcement. From these figures, it appears that European corporate bonds, and non-eligible bonds in particular, had been going through a period of particularly high spreads in the months before the CSPP announcement.

Because credit spreads widened in the first two months of 2016, conditions were particularly suitable for the CSPP announcement to produce the effects predicted by the risk channel of monetary policy. Consistent with the predictions of the risk channel, we find that spreads of bonds exposed to non-diversifiable risk fell the most after the CSPP announcement. These patterns cannot be observed around other QE announcements. Indeed, in Figure A.12 and A.13 of Internet Appendix A.7, we plot similar series for the PSPP and 2014 TLTRO announcements. In the month preceding these announcements, there was no significant decline in bond prices. In this case, bond spreads do not seem to display any heterogeneity in their response to these monetary policy announcements based on their exposure to undiversifiable risk.

No research article, to our knowledge, rigorously attempts to identify the causes of the corporate bond stress at the beginning of 2016 and investigating them is well beyond the scope of our paper. However, it suffices to highlight that the European corporate bond market was, at that time, going through a period of high pressure and increasing uncertainty. While the ECB policy decision may well have been an endogenous response to this situation, this does not detract from our analysis. On the contrary, we can exploit the fact that eligible bonds targeted for purchase tend to have lower levels of undiversifiable risk. We can, thus, disentangle the transmission of QE through the scarcity channel and the risk channel.

A.4 INTERMEDIARIES AND THE CSPP

According to our results, the CSPP generated substantial spillover effects on ineligible bonds which are consistent with a risk channel. In this Appendix, we document a series of facts about the reaction of major bond holders to the CSPP. According to the Securities Holding Statistics, as of December 2015, the largest holders of corporate bonds in the euro area were "Insurance corporations and pension funds" and "Financial corporations other than monetary financial institutions, insurance corporations and pension funds." The latter group is primarily made of investment funds.

Because a full investigation of the transmission of QE through intermediaries is well beyond the scope of this paper, we focus on evidence from flows to bond funds and changes in CDS spreads and stock prices of insurance companies. We also provide evidence from intermediaries' disclosures.

Overall, the evidence suggests major bond holders benefited from the CSPP announcement. Specifically, flows to corporate bond funds rapidly increased after the announcement. As long as bond funds did not invest their entire inflows in eligible bonds, these inflows likely generated demand pressure and spillover effects also on ineligible bonds. Insurance companies enjoyed a reduction in their credit spreads and an increase in their net equity value, suggesting their risk-bearing capacity increased. Moreover, in their disclosures, institutional bond holders made observations on the increased investors' demand for ineligible bonds.

A.4.1 EVIDENCE FROM FUND FLOWS AND STOCK RETURNS

We consider mutual fund flows and CDS spreads. We show that corporate bond funds experienced substantial inflows after the CSPP announcement. This finding suggests investors desired to increase their exposure to corporate credit risk through funds. We also show insurance companies benefited from a drop in their CDS spreads and from an increase in their equity valuation when the CSPP was announced. This finding suggests financial constraints were eased for insurance companies by the CSPP announcement.

FUND FLOWS. We obtain daily data on funds' total net assets (TNA) and returns from Morningstar. We select funds that specialize in European corporate bonds, are located in the European Economic Area, and whose shares are denominated in euro. In the three months before and after the announcement, we have a total of 519 mutual funds and 48 exchange-traded funds specializing in euro-area corporate bonds. For each fund f and

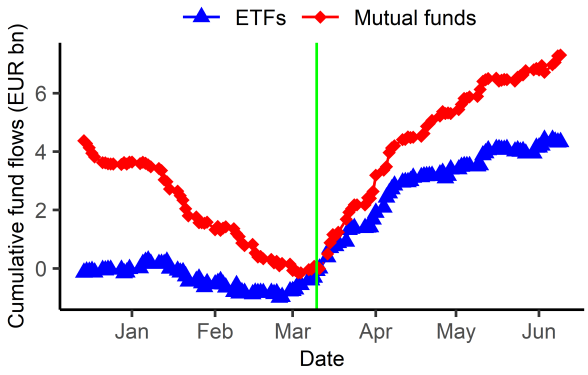


Figure A.6: Corporate bond ETFs and mutual funds

Figure A.7: Cumulative flows to euro-area corporate bond funds. The figure shows cumulative fund flows relative to the day of the CSPP announcement. We consider euro-denominated corporate bond funds domiciled in the European Economic Area in the 3 months before and after the CSPP announcement. The vertical line marks the first trading day after the announcement of the CSPP.

day t we compute daily fund flows as

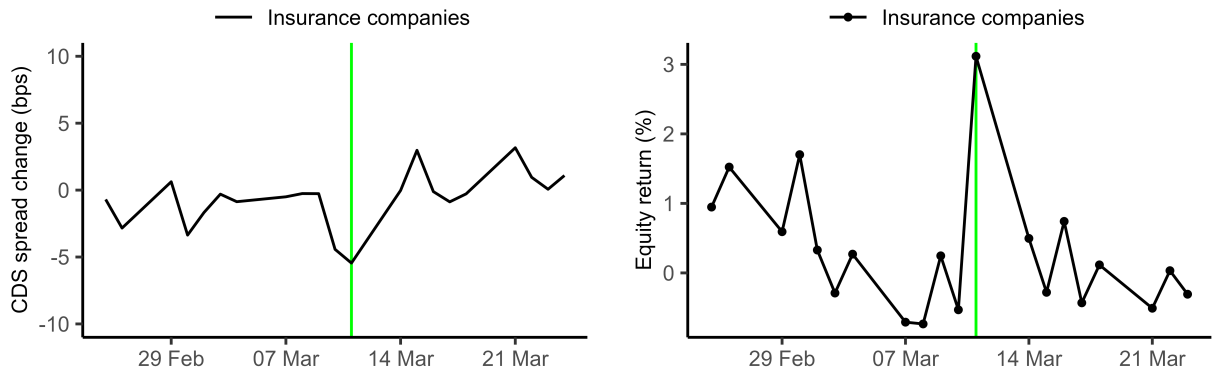
$$\text{Flow}_{ft} = \text{TNA}_{ft} - \text{TNA}_{ft-1}(1 + R_{ft})$$

where TNA_{ft} are fund f's TNA at the end of day t and R_{ft} is the fund's net return from day $t-1$ to day t. Hence, Flow_{ft} measures the net inflow of money into the fund.

Starting from 90 days before the CSPP announcement, we then compute cumulative fund flows relative to the day of the announcement. Figure 2(b) in the main text shows cumulative flows for the entire sample of funds. Figure A.7 shows results for mutual funds and ETFs separately. The figures show that, before the CSPP announcement, corporate bond funds were experiencing outflows. In the three months preceding the announcement, funds lost about €4 bn to outflows. However, after the announcement of the CSPP, flows rapidly reverted and corporate bond funds experience a period of robust inflows. By April, funds had already recovered the €4 bn lost in the three months before the CSPP. By June, funds had gained a total of about €12 bn from day day of the CSPP announcement.

These results from fund flows suggest that investor's appetite for credit risk increased. To the extent that bond funds did not tilt their portfolio entirely toward eligible bonds, fund flows likely created demand pressure across all bonds held by these funds, including ineligible bonds. As a matter of fact, at least some funds were positioned "long credit and duration risk versus the index throughout June",[2] indicating some asset managers

[2]See interview with the Co-Manager of the Henderson Horizon Euro Corporate Bond Fund: https://www.fundssociety.com/en/news/markets/



(a) Change in CDS spreads

(b) Equity returns

Figure A.8: Changes in CDS spreads and equity returns of insurance companies. Figure A.8(a) plots the average daily change in the five-year CDS spreads of euro-area insurance companies. Figure A.8(a) plots the daily return of value-weighted portfolio of stocks of euro-area insurance companies. The vertical line marks the first trading day after the announcement of the CSPP.

increased exposure to credit risk compared to their benchmarks in the short period after the CSPP announcement.

INSURANCE COMPANIES. Next, we investigate whether insurance companies benefited from the CSPP announcement. First, we consider five-year CDS spreads from Markit, for which we have data on 20 euro-area insurance companies in the days around the CSPP announcement. Figure A.8(a) shows CDS spreads dropped by about 5 bps after the CSPP announcement.

Second, we consider stock returns from Compustat, from which we obtain data on 43 euro-area insurers. Figure A.8(b) shows insurers experienced a substantially positive stock return on the day of the announcement. The average return for insurers was 3.12% with a heteroskedasticity-consistent standard error of 0.406% (p-val < 0.1%).

Hence, these findings from insurance companies suggest their perceived risk declined and their net worth increased, thus likely allowing insurers to increase exposure to credit risk.

A.4.2 EVIDENCE FROM INVESTORS' DISCLOSURES

We consider statements made by professional investors during dialogues with the ECB. We also provide quotes from the manager of the largest corporate bond fund at the time of the CSPP announcement. Overall, consistent with our findings, also institutional investors observed an increase in investors' demand for ineligible bonds and the spillover

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effects on ineligible credit spreads.

INSTITUTIONAL INVESTOR DIALOGUES. The ECB holds regular Institutional Investor Dialogues (IIDs) to discuss industry developments and structural trends in the financial sector.[3] On November 16, 2016, the ECB held an IID with representatives of major pension funds, asset managers, and insurance companies[4] to discuss, among other issues, the ongoing monetary policy measures of the ECB.[5] The summary of the meeting reports: "With regards to the Corporate Sector Purchase Programme (CSPP), the most widely acknowledged consequence was spread tightening in the corporate bond market and in other (non-eligible) credit markets while increased issuance activity was not mentioned as frequently as in June 2016. [...] Some investors also mentioned that the ECB's purchases affect private investors' allocation strategies."

In a subsequent IID, held on April 5, 2017, participants reiterated that "With regards to the Corporate Sector Purchase Programme (CSPP), the most widely acknowledged consequence of the programme was spread tightening, followed by reduced financial fragmentation. Increasing issuance, which was expected to be the main impact of the CSPP in the responses received last year, has become less important."

Therefore, based on investors' statements during the IIDs, one can infer that institutional investors noticed a decline in the spreads of non-eligible assets, consistent with our findings on the spillover effects on ineligible bonds.

DISCLOSURE TO FUNDS' CLIENTS. In a commentary to professional clients dated July 31, 2016, Morgan Stanley, which managed the largest euro corporate bond fund at the time of the CSPP announcement, notes that "We continue to expect higher-yielding markets to be supported by ongoing central bank action over the coming months. The ECB bought in excess of €13 billion of corporate bonds in the first seven weeks of the CSPP, and we anticipate continued ECB activity in the market. As a result of the conglomeration of easy central bank policy measures, we expect continued demand for credit. Specifically, we anticipate markets that benefit most from portfolio rebalancing efforts, such as higher-

[3] A list of IIDs and summaries is available at https://www.ecb.europa.eu/mopo/market-contact-groups/iid/html/index.en.html.

[4] Participants included representatives of Aegon Asset Management, Allianz SE, Amundi, Assicurazioni Generali, Aviva Investors, AXA, Nomura Asset Management UK, Norges Bank Investment Management, PGGM, Pioneer Investments, State Street Global Advisors, Swiss Re, Union Investment and Zurich Insurance Group

[5] On June 22, 2016, the ECB held the first IID after the CSPP, but, on that occasion, "Investors agreed that it was too early to draw consequences from the ECB's Corporate Sector Purchase Programme. Nevertheless, they expected increasing issuance and spread tightening going forward"

quality high yield and subordinated notes, to see ongoing demand."[6]

Interestingly, Morgan Stanley expected an increase in demand for high yield and subordinated notes. As discussed in section A, subordinated bonds were not eligible for the CSPP. Hence, the manager of the the largest euro corporate bond fund explicitly acknowledged how the CSPP boosted demand for ineligible bonds.

[6]Source: https://www.morganstanley.com/im/publication/msinvf/commentary/ic_en_msinvf_globalbond.pdf

A.5 CORPORATE INVESTMENTS

Our paper focuses on the effects of corporate QE on the quantity and composition of bond issuance, for which we possess an established theoretical framework. To date, no established theoretical framework exists to predict how corporate QE should affect corporate investments. We leave the study of how a change in the quantity and composition of bond issuance causally affects corporate investments for future research. As a first step in this research direction, in this Internet Appendix, we report the empirically observed correlations between changes in the quantity and composition of bond issuance after the CSPP announcement and changes in real investments for the subsample of firms for which we have financial-statement data.

To explore how firms changed their investments, we use end-of-the-year detailed financial statements from Orbis. We are able to match 569 issuers from the CSDB to Orbis. Out of these, 113 are eligible firms. We consider changes in growth rates for seven quantities: (i) total assets; (ii) fixed assets, (iii) property, plant and equipment (PPE); (iv) intangible assets excluding goodwill; (v) long term financial investments; (vi) employment; and (vii) cash and equivalent instruments. We also consider the change in the research and development (R&D) expenses-to-sales ratio to evaluate firm investments in long-term projects which may not be immediately reflected in firms' assets. To limit the influence of outliers, we winsorize the top and bottom 1% of the observations. Tables A.14 and A.15 in the Internet Appendix show results when we winsorize at the 0.5% and 2.5% level.

We measure each firm's change in total issuance and its shift to eligible bonds. We compute a firm's *change in total net issuance* (ΔNetIssuance) as its change in net issuance around the CSPP announcement. We use the 10-month period before and after the CSPP to evaluate the change to cover issuance over the entire 2016. We also compute a firm's *eligible shift* (EligibleShift) as a measure of a firm's market-timing activity in response to the scarcity channel. Specifically, we run the same regressions as (2) for the 10-month horizon, but we omit the Post$\times$Eligible independent variable. We obtain residuals for eligible and ineligible issuance before and after the announcement. For each firm, eligible shift is computed as the difference between the change in eligible-issuance residuals and the change in ineligible-issuance residuals around the announcement. A cross-sectional average of this firm-level measure of eligible shift provides the same point estimates on the Post$\times$Eligible coefficient in column 4 of Table 5. We use this measure of eligible shift when studying the market-timing activity of eligible firms in the cross section.

Let quantity q_{it} represent either a growth rate for firm i during year t or the R&D-to-sales ratio at the end of year t. Let $\Delta q_{it} \coloneqq q_{it} - q_{it-1}$ represent the change in this quantity

from year $t-1$ to year t. For the sample of eligible firms, we run the following regression:

$$\Delta q_{i2016} = \beta^{TI} \Delta \text{NetIssuance}_i + \beta^{TE} \text{EligibleShift}_i + \text{Controls}_i + \iota_{c(i)} + \iota_{s(i)} + u_i. \quad \text{(A.2)}$$

ΔNetIssuance$_i$ is the firm's change in total net issuance around the CSPP announcement, and EligibleShift$_i$ measures the firm's shift toward eligible issuance after the CSPP announcement. We control for the log of total assets as of 2015 and the log of liabilities as of 2015. By doing so, we control for size and leverage. The indicators $\iota_{c(i)}$ and $\iota_{s(i)}$ are, respectively, country and sector fixed effects. Although our focus is on the relation between market timing, measured by the eligible shift, and investments, we include the change in total net issuance because firms with better investment opportunities are, in general, more likely to increase total bond issuance.

Panel A of Table A.9 reports the results. Total net issuance is positively associated with asset growth and, in particular, growth of fixed assets. A one standard deviation increase in ΔNetIssuance is associated with a 0.5 standard deviation increase in the growth of fixed assets. Moreover, we find a statistically significant relation between changes in net issuance and the growth of real long-term investments, namely PPE and intangible assets. The relation between issuance and growth in long term financial assets is similar in terms of magnitude, but is not statistically significant.

Focusing on firms' eligible shift, we find no statistically significant relation between eligible shift and investments. According to the point estimates, firms that shifted the most toward eligible issuance increased growth in total assets, fixed assets, long-term financial investments, employment, and cash holdings. We find a negative relation with R&D expenses. However, none of these estimates are statistically significant.

Finally, we explore the relation between unsecured issuance and firm investments. In section B we showed eligible and ineligible firms shifted toward unsecured issuance after the CSPP announcement. For the sample of all firms, we run regressions similar to (A.2) where we replace the eligible shift with the unsecured shift, which is calculated in the same manner.[7] We also include an indicator for the firm's eligibility and interact it with the change in total net issuance and the unsecured shift. By doing so, we assess heterogeneity between eligible and ineligible firms.

Panel B of Table A.9 shows the results. We find eligible firms increased cash holdings compared to ineligible firms. However, consistent with De Santis and Zaghini (2021)

[7]Specifically, we run the same regressions as those in Panel A of Table 9, but we omit the Post×Unsecured independent variable, thus obtaining residuals for unsecured and secured issuance before and after the announcement. For each firm, unsecured shift is calculated as the difference between the change in unsecured-issuance residuals and the change in secured-issuance residuals around the announcement.

Table A.9: Changes in growth rates and R&D from 2015 to 2016. In columns 1-7, the dependent variables are changes in the growth rates of total assets (A), fixed assets (FA), property, plant, and equipment (PPE), intangibles excluding goodwill (IA), long-term financial investments (LTFI), employees (Empl), and cash (Cash). In column 8, the dependent variable is the change in the ratio of R&D expenses to sales. EligibleFirm = 1 if the firm had eligible bonds outstanding at some point during 2015. ΔNetIssuance is the change in total net issuance from the 10 months before to the 10 months after the announcement. EligShift measures the shift toward eligible issuance with the methodology described in section A.2.2. UnsecuredShift measures the shift toward unsecured issuance obtained with a similar methodology. We control for country and industry fixed effects and lagged values of log-assets and log-liabilities. Dependent variables and issuance measures are expressed in units of standard deviation. Regressions are weighted by firms' outstanding amount of bonds. Standard errors are in parentheses and are clustered at the country-sector level.

PANEL A: SCARCITY CHANNEL AND INVESTMENTS (ELIGIBLE ISSUERS)

	A	FA	PPE	IA	LTFI	Empl	Cash	R&D
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNetIssuance	0.567**	0.509**	0.290**	0.242***	0.234	−0.167	0.165	−0.043
	(0.269)	(0.233)	(0.118)	(0.087)	(0.252)	(0.230)	(0.117)	(0.210)
EligibleShift	0.216	0.131	0.001	0.089	0.117	0.321	0.256	−0.338
	(0.192)	(0.151)	(0.076)	(0.073)	(0.124)	(0.239)	(0.174)	(0.249)
FEs and controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	108	108	106	106	107	100	107	107
R^2	0.596	0.585	0.319	0.647	0.671	0.633	0.266	0.371
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$							

PANEL B: RISK CHANNEL AND INVESTMENTS (ALL ISSUERS)

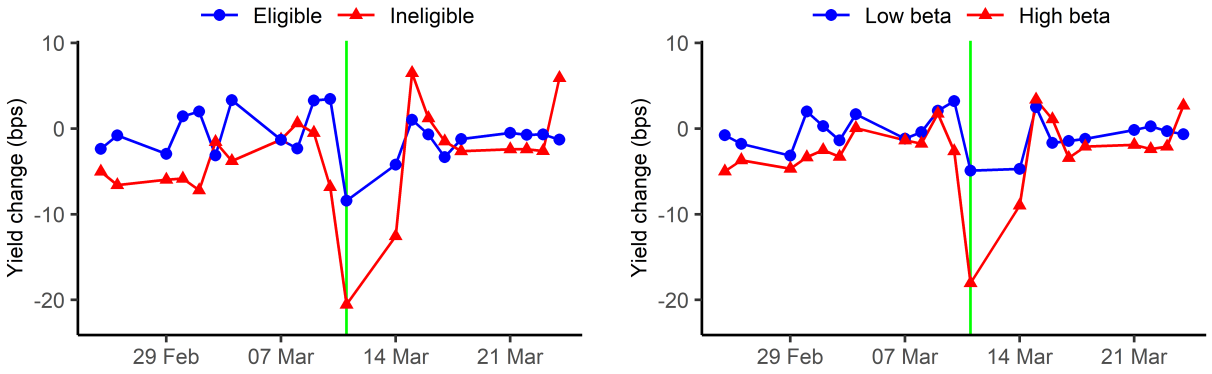
	A	FA	PPE	IA	LTFI	Empl	Cash	R&D
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EligibleFirm	−0.049	0.017	−0.025	−0.149*	−0.090	−0.107	0.139***	0.192
	(0.086)	(0.128)	(0.055)	(0.084)	(0.125)	(0.274)	(0.053)	(0.146)
ΔNetIssuance	0.558***	1.002**	0.027	0.295***	0.588**	0.082	0.134*	0.243*
	(0.205)	(0.468)	(0.085)	(0.106)	(0.256)	(0.353)	(0.075)	(0.130)
UnsecuredShift	−0.405*	−0.903*	−0.144**	−0.244*	−0.589**	−0.252	0.109	−0.399***
	(0.220)	(0.478)	(0.071)	(0.127)	(0.241)	(0.340)	(0.075)	(0.137)
EligibleFirm×ΔNetIssuance	1.501*	0.530	0.374*	0.027	−0.242	0.911	0.615	0.407
	(0.881)	(0.821)	(0.226)	(0.538)	(0.659)	(0.775)	(0.740)	(0.614)
EligibleFirm×UnsecuredShift	−0.990	−0.115	−0.156	0.108	0.410	−0.688	−0.578	−0.362
	(0.720)	(0.706)	(0.204)	(0.518)	(0.498)	(0.698)	(0.651)	(0.506)
FEs and controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	455	451	447	433	446	402	451	459
R^2	0.389	0.344	0.126	0.377	0.385	0.512	0.189	0.234
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$							

and Todorov (2020), eligible issuers did not increase investments compared to ineligible ones. Moreover, similar to the set of eligible firms in panel A, we find an increase in total issuance is associated with an increase in assets and fixed assets, with intangible and long-term financial investments increasing significantly among ineligible issuers.

A shift toward unsecured issuance is correlated with a decline in assets and fixed assets. The association is statistically significant for all components of fixed assets and strongest for PPE and long-term investments. Moreover, a shift toward unsecured issuance is also associated with a decline in R&D expenses. No stastistically significant difference exists between eligible and ineligible firms in their relation between unsecured shift and investments.

Overall, these results indicate that firm issuance choices were correlated with real investments. Firms that issued more also increased the growth in long-term assets. Moreover, for firms that shifted toward unsecured issuance, we observe a decline in investments in long-term assets and projects. However, further research is needed to establish a causal link between issuance choices and investments.

A.6 Additional Figures and Tables



(a) Yields by eligibility

(b) Yields by exposure to non-diversifiable risk

Figure A.9: Average change in yields of euro-denominated corporate bonds around the CSPP announcement. Bonds are sorted according to their eligibility and their exposure to non-diversifiable risk. We measure a bond's exposure to non-diversifiable risk in terms of its beta before the announcement. The beta is the slope coefficient in a regression of the daily change in bond yields on the change in the aggregate bond market's yield. Bonds are classified as high beta if their beta is above the median of the cross-sectional distribution of betas. The vertical line marks the first trading day after the announcement of the CSPP.

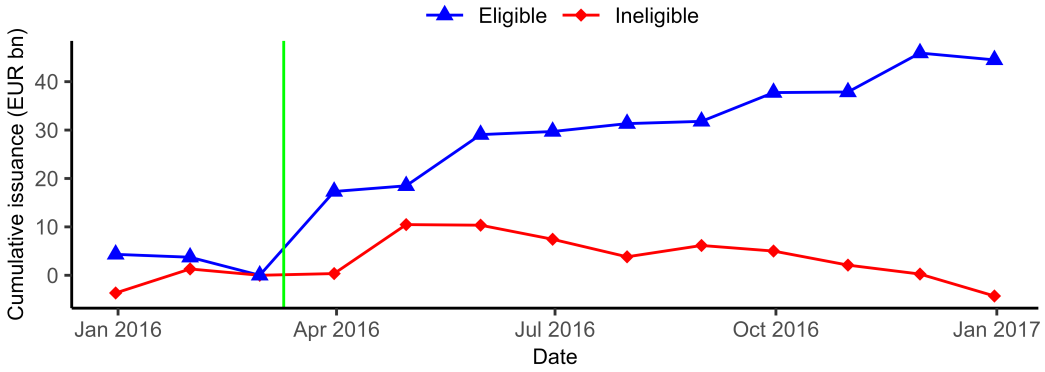
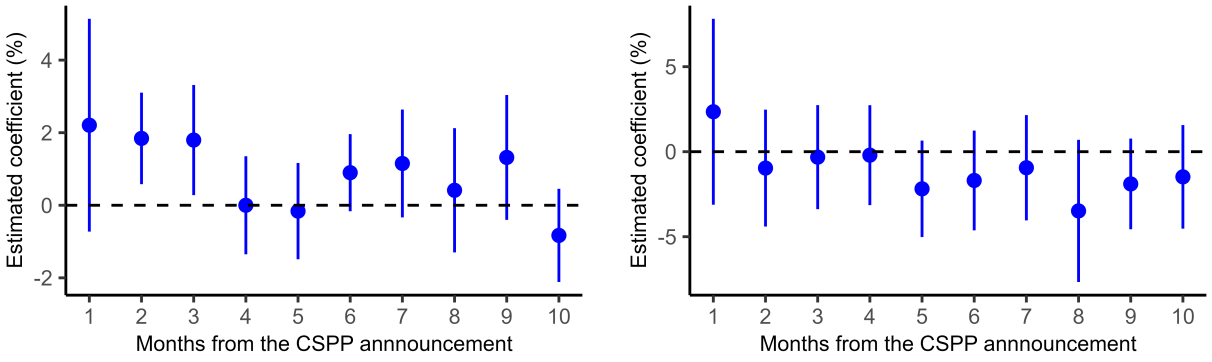


Figure A.10: Cumulative issuance of eligible firms. The figure shows the cumulative change in the outstanding amount of eligible and ineligible bonds for eligible firms. The plot shows the difference in outstanding amounts relative to the month before the announcement of the CSPP.



(a) Total issuance

(b) Relative total issuance

Figure A.11: Relative total issuance after the CSPP announcement. Figure A.11(a) plots the estimates and 95% confidence intervals for the coefficients γ_τ's in the following regression:

$$\frac{I_{it}}{B_i} = \sum_{\tau=1}^{10} \gamma_\tau \mathbb{I}[t = t_0 + \tau] + \iota_i + u_{it},$$

where I_{it} is the total net issuance of firm i in moth t, $\mathbb{I}[\cdot]$ is a indicator function, t_0 is the month before the CSPP announcement, and ι_i is a firm fixed effect. We consider the three months before the CSPP announcement for the pre-announcement period and B_i is firm i's outstanding amount of bonds at the beginning of the pre-announcement period. Standard errors are double clustered at the firm and country-industry-month level. Figure A.11(b) plots the estimates and 95% confidence intervals for the coefficients β_τ's in the following regression:

$$\frac{I_{it}}{B_i} = \sum_{\tau=1}^{10} \beta_\tau \text{EligibleFirm}_i \times \mathbb{I}[t = t_0 + \tau] + \iota_i + \iota_{c(i)s(i)t} + u_{it},$$

where I_{it} is the total net issuance of firm i in moth t, EligibleFirm_i is an indicator variable taking the value of one if firm i had eligible bonds outstanding in the year before the the announcement of the CSPP, $\mathbb{I}[\cdot]$ is a indicator function, t_0 is the month before the CSPP announcement, ι_i is a firm fixed effect, and $\iota_{c(i)s(i)t}$ is a country-industry-month fixed effect. We consider the three months before the CSPP announcement for the pre-announcement period and B_i is firm i's outstanding amount of bonds at the beginning of the pre-announcement period. Standard errors are double clustered at the firm and country-industry-month level.

Table A.10: Changes in bond yield spreads after the CSPP announcement for the sample of bonds with price changes in at least half of the trading days in the three months before and after the announcement. We use bonds outstanding in the three months before and after the announcement of the CSPP. The dependent variable is the change in spread (columns (1)-(4)) and the abnormal change in spread (columns (5)-(8)). EligibleBond = 1 if the bond is eligible to be used as collateral at the ECB as of three months before the CSPP announcement. BidAsk is the bond's average bid-ask spread relative to the midpoint during the period starting three months before the announcement and ending two weeks before it. A firm is classified as eligible if it had eligible bonds outstanding at some time during the calendar year before the announcement. Regressions are weighted by the bond's outstanding amount. Standard errors are in parentheses and are clustered at the country-industry level.

	Two-day spread change (bps)				Two-day abnormal spread change (bps)			
	All firms		Eligible firms		All firms		Eligible firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EligibleBond	8.210***	7.015**	8.427***	7.072**	−9.532***	−8.867**	−8.152***	−9.506**
	(2.685)	(3.486)	(3.151)	(3.055)	(3.517)	(3.815)	(3.038)	(3.852)
BidAsk	−7.027*	−1.058	−2.958	−0.870	2.288	3.604	6.763***	4.199*
	(3.643)	(2.490)	(2.935)	(3.210)	(6.798)	(8.898)	(2.115)	(2.325)
Country-industry FE	Yes	No	Yes	No	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,483	1,220	917	889	1,483	1,220	917	889
R^2	0.165	0.590	0.409	0.545	0.117	0.578	0.633	0.435

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

Table A.11: Net issuance by characteristics related to eligibility by eligible firms within subsamples. In Panel A, MeetReq = 1 if the issuance is listed, senior, and investment-grade rated, otherwise MeetReq = 0. We consider subsamples of eligible issuance (columns 1 and 2), ineligible issuance (columns 3 and 4), issuance rated AA- or above (columns 5 and 6), issuance rated from A- to A+ (columns 7 and 8), and issuance rated BBB- to BBB+ (columns 9 and 10). In Panel B, MeetNonRatingReq = 1 if the issuance is listed and senior, otherwise MeetNonRatingReq = 0. We consider subsamples of eligible issuance (columns 1 and 2), ineligible issuance (columns 3 and 4), investment-grade issuance (columns 5 and 6), and non-investment grade issuance (columns 7 and 8). In both panels, Post = 1 after the announcement of the CSPP. We control for an interactions between FirstMonth and indicators for the issuance type, where FirstMonth = 1 for the month in which the CSPP was announced. We include firm-month fixed effects and interactions between firm fixed effects and issuance-type indicators. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Regressions are weighted by firms' initial outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

PANEL A: ISSUANCE MEETING LISTING, SENIORITY, AND RATING REQUIREMENTS

	Net Issuance by requirements (%)									
	Eligible		Ineligible		AA and above		A		BBB	
	3M	10M	3M	10M	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post×MeetReq	1.521***	0.665***	0.738*	0.066	2.514**	0.986*	1.221**	0.330	0.953*	0.327
	(0.446)	(0.235)	(0.393)	(0.177)	(1.141)	(0.473)	(0.591)	(0.211)	(0.532)	(0.298)
FirstMonth×MeetReq	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-MeetReq FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,328	7,880	1,632	5,680	216	800	696	2,480	1,308	4,440
R^2	0.596	0.532	0.587	0.538	0.629	0.551	0.618	0.546	0.587	0.531

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

PANEL B: ISSUANCE MEETING LISTING AND SENIORITY REQUIREMENTS

	Net Issuance by requirements (%)							
	Eligible		Ineligible		Investment grade		Non-invest. grade	
	3M	10M	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post×MeetNonRatingReq	1.695***	0.530**	0.712*	−0.035	2.174***	0.623**	1.699	−0.860
	(0.481)	(0.246)	(0.369)	(0.212)	(0.595)	(0.305)	(1.169)	(1.062)
FirstMonth×MeetNonRatingReq	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-MeetNonRatingReq FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,328	7,880	1,632	5,680	2,028	6,760	480	2,040
R^2	0.596	0.531	0.589	0.531	0.599	0.529	0.534	0.512

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

Table A.12: Net issuance by characteristics related to eligibility around the CSPP announcement for the sample of ineligible firms. In columns 1 and 2, we sort issuance based on whether it is listed, senior, and investment-grade rated (MeetReq = 1) or not (MeetReq = 0). In columns 3 and 4, we sort issuance based on whether it is listed (Listed = 1) or not (Listed = 0). In columns 5 and 6, we sort issuance based on whether it is senior (Senior = 1) or not (Senior = 0). In columns 7 and 8, we sort issuance based on whether it is investment-grade rated (InvGrade = 1) or not (InvGrade = 0). Post = 1 after the announcement of the CSPP. We control for interactions between FirstMonth and indicators for the issuance type, where FirstMonth = 1 for the month in which the CSPP was announced. We include firm-month fixed effects and interactions between firm fixed effects and issuance-type indicators. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Regressions are weighted by firms' initial outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Net issuance by characteristics (%)							
	Requirements		Listing		Seniority		Rating	
	3M	10M	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post×MeetReq	−1.226*	−0.277						
	(0.733)	(0.373)						
Post×Listed			0.793	0.473				
			(0.856)	(0.388)				
Post×Senior					0.330	−0.234		
					(0.800)	(0.358)		
Post×InvGrade							−0.508	0.228
							(0.825)	(0.396)
FirstMonth×IssuanceType	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-IssuanceType FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,152	102,520	31,152	102,520	31,152	102,520	31,152	102,520
R^2	0.567	0.515	0.543	0.511	0.579	0.523	0.564	0.515

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

Table A.13: Relation between bond characteristics and changes in bond yield spreads after the CSPP announcement and bond betas. We use bonds outstanding in the three months before and after the announcement of the CSPP. The dependent variable is the change in spread in the two days following the CSPP announcement(columns (1)-(3)) and the bond beta (columns (4)-(6)). Unsecured = 1 if the bond is unsecured. NonGuaranteed = 1 if the bond is not guaranteed. BidAsk is the bond's average bid-ask spread relative to the midpoint during the period starting three months before the announcement and ending two weeks before it. Regressions are weighted by the bond's outstanding amount. Standard errors are in parentheses and are clustered at the country-industry level.

	Two-day spread change (bps)			Bond beta		
	(1)	(2)	(3)	(4)	(5)	(6)
Unsecured	-23.798^{***}		-24.731^{***}	0.708^{**}		0.681^{**}
	(7.672)		(8.386)	(0.304)		(0.301)
NonGuaranteed		1.981	3.513		0.146	0.104
		(5.970)	(6.377)		(0.163)	(0.165)
BidAsk	19.871	19.438	20.053	2.845	2.867	2.850
	(60.702)	(60.696)	(60.547)	(2.908)	(2.914)	(2.910)
Country-industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,601	1,601	1,601	1,601	1,601	1,601
R^2	0.104	0.102	0.104	0.113	0.113	0.113
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$					

Table A.14: Change in growth rates and R&D from 2015 to 2016 with a 0.5% winsorization. In columns 1-7, the dependent variables are changes in the growth rates of total assets (A), fixed assets (FA), property, plant, and equipment (PPE), intangibles excluding goodwill (IA), long-term financial investments (LTFI), employees (Empl), and cash (Cash). In column 8, the dependent variable is the change in the ratio of R&D expenses to sales. EligibleFirm = 1 if the firm had eligible bonds outstanding at some point during 2015. ΔNetIssuance is the change in total net issuance from the 10 months before to the 10 months after the announcement. EligShift measures the shift toward eligible issuance with the methodology described in section A.2.2. UnsecuredShift measures the shift toward unsecured issuance obtained with a similar methodology. We control for country and industry fixed effects and lagged values of log-assets and log-liabilities. Dependent variables and issuance measures are expressed in units of standard deviation. Regressions are weighted by firms' outstanding amount of bonds. Standard errors are in parentheses and are clustered at the country-sector level.

PANEL A: ELIGIBLE ISSUERS

	A	FA	PPE	IA	LTFI	Empl	Cash	R&D
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNetIssuance	0.567**	0.509**	0.290**	0.241***	0.196	−0.437	0.091	−0.069
	(0.269)	(0.233)	(0.118)	(0.087)	(0.211)	(0.315)	(0.058)	(0.207)
EligibleShift	0.216	0.131	0.001	0.088	0.098	0.373	0.119	−0.316
	(0.192)	(0.151)	(0.076)	(0.072)	(0.104)	(0.303)	(0.084)	(0.250)
FEs and controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	108	108	106	106	107	100	107	107
R^2	0.596	0.585	0.319	0.650	0.753	0.635	0.248	0.339
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$							

PANEL B: ALL ISSUERS

	A	FA	PPE	IA	LTFI	Empl	Cash	R&D
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EligibleFirm	−0.023	−0.024	−0.039	−0.189*	−0.033	−0.135	0.064**	0.066
	(0.032)	(0.093)	(0.046)	(0.107)	(0.050)	(0.372)	(0.026)	(0.056)
ΔNetIssuance	0.216***	0.609**	−0.038	0.224**	0.239**	−0.234	0.081*	0.102**
	(0.074)	(0.301)	(0.081)	(0.105)	(0.105)	(0.422)	(0.044)	(0.051)
UnsecuredShift	−0.168**	−0.557*	−0.112*	−0.121	−0.238**	0.068	0.023	−0.170***
	(0.083)	(0.309)	(0.061)	(0.142)	(0.099)	(0.375)	(0.039)	(0.054)
EligibleFirm×ΔNetIssuance	0.510	0.301	0.336*	−0.051	−0.102	−0.101	0.142	0.134
	(0.323)	(0.501)	(0.193)	(0.450)	(0.266)	(0.953)	(0.339)	(0.261)
EligibleFirm×UnsecuredShift	−0.319	−0.048	−0.116	0.065	0.168	−0.028	−0.138	−0.125
	(0.269)	(0.437)	(0.155)	(0.439)	(0.201)	(0.815)	(0.313)	(0.208)
FEs and controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	455	451	447	433	446	402	451	459
R^2	0.277	0.293	0.114	0.285	0.449	0.529	0.144	0.183
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$							

Table A.15: Changes in growth rates and R&D from 2015 to 2016 with a 2.5% winsorization. In columns 1-7, the dependent variables are changes in the growth rates of total assets (A), fixed assets (FA), property, plant, and equipment (PPE), intangibles excluding goodwill (IA), long-term financial investments (LTFI), employees (Empl), and cash (Cash). In column 8, the dependent variable is the change in the ratio of R&D expenses to sales. EligibleFirm = 1 if the firm had eligible bonds outstanding at some point during 2015. ΔNetIssuance is the change in total net issuance from the 10 months before to the 10 months after the announcement. EligShift measures the shift toward eligible issuance with the methodology described in section A.2.2. UnsecuredShift measures the shift toward unsecured issuance obtained with a similar methodology. We control for country and industry fixed effects and lagged values of log-assets and log-liabilities. Dependent variables and issuance measures are expressed in units of standard deviation. Regressions are weighted by firms' outstanding amount of bonds. Standard errors are in parentheses and are clustered at the country-sector level.

PANEL A: ELIGIBLE ISSUERS

	A	FA	PPE	IA	LTFI	Empl	Cash	R&D
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNetIssuance	0.580**	0.541**	0.290**	0.303***	0.277	0.079	0.216	0.182
	(0.267)	(0.249)	(0.118)	(0.111)	(0.299)	(0.171)	(0.158)	(0.222)
EligibleShift	0.239	0.147	0.001	0.126	0.139	0.268	0.287	−0.460*
	(0.202)	(0.156)	(0.076)	(0.085)	(0.147)	(0.193)	(0.203)	(0.240)
FEs and controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	108	108	106	106	107	100	107	107
R^2	0.580	0.581	0.319	0.537	0.578	0.617	0.275	0.486

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

PANEL B: ALL ISSUERS

	A	FA	PPE	IA	LTFI	Empl	Cash	R&D
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EligibleFirm	−0.034	0.070	0.024	−0.192*	−0.149	−0.117	0.183**	0.280
	(0.095)	(0.158)	(0.091)	(0.111)	(0.182)	(0.196)	(0.074)	(0.222)
ΔNetIssuance	0.665***	0.926**	0.219*	0.497***	0.869**	0.312	0.153	0.356**
	(0.241)	(0.372)	(0.130)	(0.165)	(0.365)	(0.337)	(0.101)	(0.165)
UnsecuredShift	−0.491*	−0.823**	−0.262**	−0.496***	−0.822**	−0.449	0.176*	−0.594***
	(0.259)	(0.373)	(0.119)	(0.181)	(0.340)	(0.339)	(0.099)	(0.164)
EligibleFirm×ΔNetIssuance	1.766*	1.172	0.487	0.174	−0.349	1.890**	0.914	0.583
	(1.023)	(1.000)	(0.368)	(0.878)	(0.958)	(0.764)	(0.987)	(0.669)
EligibleFirm×UnsecuredShift	−1.164	−0.567	−0.228	0.180	0.559	−1.402**	−0.875	−0.240
	(0.843)	(0.806)	(0.360)	(0.841)	(0.725)	(0.680)	(0.864)	(0.604)
FEs and controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	455	451	447	433	446	402	451	459
R^2	0.385	0.372	0.195	0.344	0.345	0.503	0.208	0.294

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

A.7 Disentangling the Effects of Concurrent Announcements

The CSPP in March 2016 was announced in a policy package that included the expansion of the ECB's public sector QE program, the PSPP, a new round of Targeted Long-Term Financing Operations (TLTRO) for banks, and a interest rate cut of 5 bps. The CSPP was the most novel policy in the package. At the time of the March 2016 announcement, the ECB was already conducting asset purchases totaling €60bn each month combined, with the PSPP constituting the great majority of the total. Moreover, in June 2014, the ECB had already implemented a first round of TLTRO along with a rate cut of 10 bps.

In this Appendix, we exploit the staggered announcement and implementation of previous PSPP and TLTRO-plus-rate-cut policies to show that that these additional policy announcements cannot account for the empirical patterns we observe after the March 2016 announcement. Although we are unable to assess whether the CSPP *in isolation* would have achieved the same results, our empirical analyses indicate that the CSPP was a crucial, at least as an additional policy measure, to drive the results we document in this paper.

We repeat the key tests of our paper for the January 22, 2015 announcement of the PSPP and the June 5, 2014 announcement of a TLTRO and a 10 bps rate cut. These announcements represent larger policy innovations than the March 2016 PSPP and TLTRO-plus-rate-cut policies. In particular, in January 2015, the ECB announced a €60 bn-per-month PSPP program, wheres the March 2016 announcement involved an expansion of €20 bn per month, to be divided between PSPP and CSPP purchases. Moreover, whereas the 2016 TLTRO was similar to the 2014 one, in June 2014 the ECB cut rates by 10 bps, as opposed to the 5 bps rate cut in March 2016.

Results for the 2015 PSPP announcement and the 2014 TLTRO-plus-rate-cut announcement are reported below. In Figures A.12 and A.13 we see spreads *did not* drop, on average, after these two policy announcements. Moreover, there is limited heterogeneity across high-beta and low-beta bonds, suggesting credit risk premia did not substantially drop.

We formally investigate this pattern in Table A.16. Whereas we observe a large and statistically significant baseline drop of 14.107 bps in credit spreads on the day of the March 2016 announcement, credit spreads actually increase, on average, on the day of the PSPP and TLTRO-plus-rate-cut announcements, by respectively 2.522 and 5.325 bps. Moreover, a one-unit increase in a bond's beta was associated with a 5.125 bps further decline in spreads after the March 2016 announcement. After the PSPP announcement, we find no statistically significant relation between bond beta and spreads. After the 2014 TLTRO-

plus-rate-cut announcement, we find a negative and statistically significant relation between bond beta and spread changes. However, the relation is economically marginal and two orders of magnitude smaller than the estimated relation between spread changes and beta we observe after the CSPP announcement. Moreover, results for the 2014 TLTRO-plus-rate-cut announcement indicate that the spreads of bonds with higher beta did not decline. Instead, they *increased less* than the spreads of bonds with lower betas. Overall, these findings indicate the risk channel played a minor role, if any role at all, in easing credit market conditions after the 2015 PSPP announcement and the 2014 TLTRO-plus-rate-cut announcement.

In Tables A.17 and A.18 we repeat the tests of table 3. Whereas in Table 3 we find that, after the CSPP announcement, spreads fell for eligible bonds after controlling for exposure to non-diversifiable risk, we do not observe a similar result after the 2015 PSPP announcement and the 2014 TLTRO-plus-rate-cut announcement. We find no abnormal change in eligible bond spreads compared to ineligible ones after the PSPP announcement. After the TLTRO-plus-rate-cut announcement, eligible bond spreads experienced an abnormal increase compared to ineligible ones. Overall, these results suggest that a scarcity channel did not affect bond spreads after the PSPP and TLTRO-plus-rate-cut announcements, consistent with these policies not generating scarcity of eligible bonds.

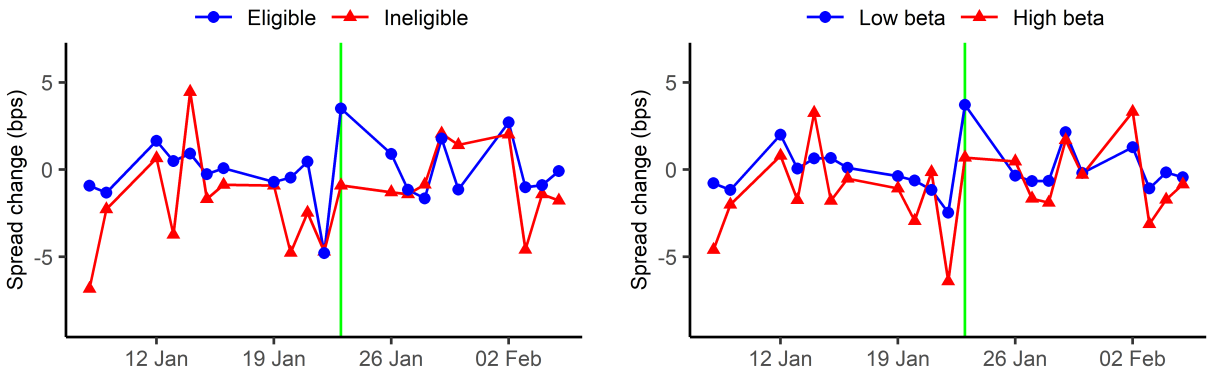
In the subsequent tables, we repeat tests on bond issuance similar to those we conducted for the March 2016 announcement. In Tables A.19 and A.20, we report results of the main tests on substitution across bond characteristics corresponding to results in Tables 5, 6, and 9. Consistent with a lack of a scarcity channel, we find no shift toward eligible bonds and bonds meeting eligibility requirements. Moreover, consistent with a lack of a risk channel, we find no shift toward unsecured and non-guaranteed issuance after the 2014 TLTRO-plus-rate-cut announcement. Although we find a shift toward unsecured and non-guaranteed issuance after the 2015 PSPP announcement, the shift is observed primarily among eligible firms (that is, established investment-grade issuers), whereas the March 2016 announcement had spillover effects also on ineligible issuers.

We then consider total bond issuance. Table A.21 and A.22 correspond to Table 7. Table A.23 corresponds to 8. After the PSPP announcement, we find an increase in the total issuance of eligible firms, but no spillover to ineligible firms. Moreover, when comparing eligible and ineligible firms and controlling for fixed effects, we find no heterogeneous increase in total issuance. Furthermore, we find no relation between total issuance and firm betas. After the TLTRO-plus-rate-cut, we observe no increase in total issuance, nor any statistically significant heterogeneity between eligible and ineligible issuers, or between issuers with different betas. These results are consistent with Figure A.12, Figure

A.13, and Table A.16 which show that bond spreads did not decline after the PSPP and TLTRO-plus-rate-cut announcements, therefore ruling out that a risk channel boosted total issuance after these announcements.

Finally, Tables A.24 and A.25 repeat the tests of Table 10 by studying the revealed preferences of firms suggesting an intention to time the market. Consistent with the lack of evidence regarding a scarcity and risk channel in bond-spread data, we find none of the patterns observed after the March 2016 announcement.

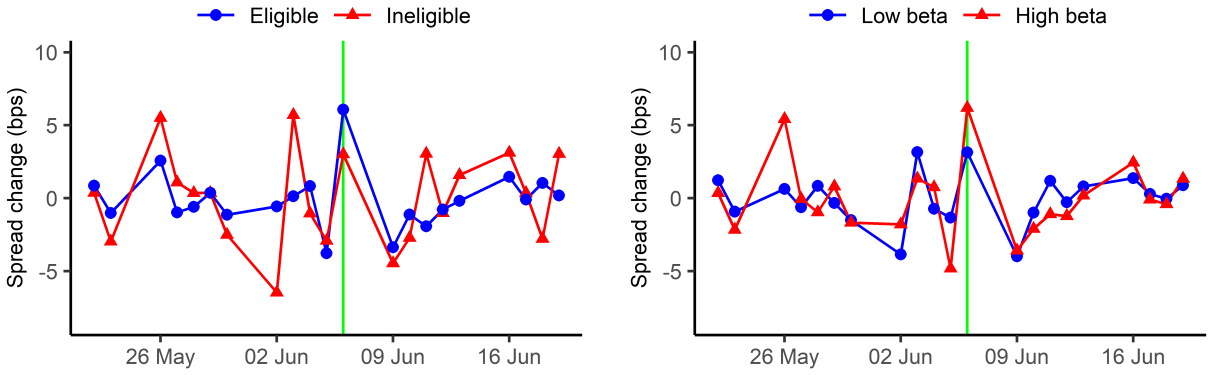
Overall, whereas empirical results around the March 2016 announcement provide systematic evidence of a scarcity and risk channel affecting credit spreads and corporate issuance, we do not find such evidence around the 2015 PSPP announcement and the 2014 TLTRO-plus-rate-cut announcement. Taken together, our study thus indicates the CSPP was crucial in determining the observed credit-market outcomes.



(a) Spreads by eligibility

(b) Spreads by exposure to non-diversifiable risk

Figure A.12: Average change in yield spreads of euro-denominated corporate bonds around the PSPP announcement. Bonds are sorted according to their eligibility as collateral at the ECB and their exposure to non-diversifiable risk. We measure a bond's exposure to non-diversifiable risk in terms of its beta before the announcement. The beta is the slope coefficient in a regression of the daily change in bond spreads on the change in the aggregate bond market's spread. Bonds are classified as high beta if their beta is above the median of the cross-sectional distribution of betas. The vertical line marks the first trading day after the announcement of the PSPP.



(a) Spreads by eligibility

(b) Spreads by exposure to non-diversifiable risk

Figure A.13: Average change in yield spreads of euro-denominated corporate bonds around the 2014 TLTRO-plus-rate-cut announcement. Bonds are sorted according to their eligibility as collateral at the ECB and their exposure to non-diversifiable risk. We measure a bond's exposure to non-diversifiable risk in terms of its beta before the announcement. The beta is the slope coefficient in a regression of the daily change in bond spreads on the change in the aggregate bond market's spread. Bonds are classified as high beta if their beta is above the median of the cross-sectional distribution of betas. The vertical line marks the first trading day after the announcement of the 2014 TLTRO and rate cut.

Table A.16: Daily changes in bond spreads during the CSPP, PSPP, and 2014 TLTRO-plus-rate-cut announcements. In columns 1 and 2, we consider the 2016 CSPP announcement. In columns 3 and 4, we consider the 2015 PSPP announcement. In columns 5 and 6, we consider the 2014 TLTRO-plus-rate-cut announcement. We use bonds outstanding in the three months before and after each announcement. The dependent variable is the daily change in spread in the thirty days before and after the monetary policy announcements. EventDate = 1 on the day of the policy announcement. The BondBeta is the slope coefficient in a regression of the daily change in bond spreads on the change in the aggregate bond market's spread. BondBeta is calculated in the period starting three months before the announcement and ending two weeks before it. EligibleBond = 1 if the bond is eligible to be used as collateral at the ECB as of three months before the policy announcement. BidAsk is the bond's average bid-ask spread relative to the midpoint during the period starting three months before the announcement and ending two weeks before it. Regressions are weighted by the bond's outstanding amount. Standard errors are in parentheses and are clustered at the country-industry level.

	Daily spread change (bps)					
	CSPP		PSPP		2014 TLTRO	
	(1)	(2)	(3)	(4)	(5)	(6)
EventDate	-14.107^{***}		2.522^{***}		5.325^{***}	
	(0.551)		(0.295)		(0.348)	
EventDate×BondBeta	-5.125^{***}	-5.088^{***}	-0.010	0.032	-0.132^{***}	-0.056^{***}
	(0.628)	(0.740)	(0.174)	(0.170)	(0.023)	(0.009)
EventDate×BidAsk	1.007	1.652^{**}	-0.361^{**}	-0.378^{***}	-0.203	2.043^{***}
	(0.661)	(0.777)	(0.137)	(0.119)	(0.519)	(0.472)
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-day FE	No	Yes	No	Yes	No	Yes
Maturity-day FE	No	Yes	No	Yes	No	Yes
Rating-day FE	No	Yes	No	Yes	No	Yes
Observations	67,650	67,650	58,851	58,851	61,732	61,732
R^2	0.012	0.204	0.023	0.079	0.050	0.538
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$					

Table A.17: Changes in bond spreads after the PSPP announcement. We use bonds outstanding in the three months before and after the announcement of the PSPP. The dependent variable is the change in spread (columns 1-4) and the abnormal change in spread (columns 5-8). EligibleBond = 1 if the bond is eligible to be used as collateral at the ECB as of three months before the PSPP announcement. BidAsk is the bond's average bid-ask spread relative to the midpoint during the period starting three months before the announcement and ending two weeks before it. A firm is classified as eligible if it had eligible bonds outstanding at some time during the calendar year before the announcement. Regressions are weighted by the bond's outstanding amount. Standard errors are in parentheses and are clustered at the country-industry level.

	Two-day spread change (bps)				Two-day abnormal spread change (bps)			
	All firms		Eligible firms		All firms		Eligible firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EligibleBond	2.570	9.308	7.681	9.343	5.265	10.634	8.670	10.739
	(3.444)	(6.012)	(5.100)	(6.050)	(3.287)	(6.582)	(5.569)	(6.641)
BidAsk	−0.702	−13.002*	−0.611	−0.840	−1.582**	−12.245**	−1.108	−1.344
	(0.819)	(7.369)	(1.569)	(1.971)	(0.736)	(4.659)	(1.733)	(2.177)
Country-industry FE	Yes	No	Yes	No	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,486	1,158	830	796	1,486	1,158	830	796
R^2	0.032	0.778	0.409	0.551	0.045	0.812	0.368	0.513

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

Table A.18: Changes in bond spreads after the 2014 TLTRO-plus-rate-cut announcement. We use bonds outstanding in the three months before and after the announcement of the 2014 TLTRO and rate cut. The dependent variable is the change in spread (columns 1-4) and the abnormal change in spread (columns 5-8). EligibleBond = 1 if the bond is eligible to be used as collateral at the ECB as of three months before the 2014 TLTRO-plus-rate-cut announcement. BidAsk is the bond's average bid-ask spread relative to the midpoint during the period starting three months before the announcement and ending two weeks before it. A firm is classified as eligible if it had eligible bonds outstanding at some time during the calendar year before the announcement. Regressions are weighted by the bond's outstanding amount. Standard errors are in parentheses and are clustered at the country-industry level.

	Two-day spread change (bps)				Two-day abnormal spread change (bps)			
	All firms		Eligible firms		All firms		Eligible firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EligibleBond	3.786**	3.737*	3.254*	4.602***	2.588	3.145	3.169*	4.437***
	(1.677)	(1.920)	(1.646)	(1.674)	(2.385)	(1.900)	(1.844)	(1.545)
BidAsk	2.991	−5.022*	2.272	1.292	1.693	−3.718	0.444	−0.463
	(1.834)	(2.922)	(2.831)	(2.471)	(1.826)	(3.248)	(3.095)	(2.726)
Country-industry FE	Yes	No	Yes	No	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,381	1,090	776	744	1,381	1,090	776	744
R^2	0.078	0.530	0.286	0.442	0.067	0.509	0.400	0.481

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

Table A.19: Net issuance by characteristics related to eligibility and riskiness around the PSPP announcement. We run separate regressions of net issuance of bonds with and without a certain characteristic on the interaction IssuanceType×Post and controls. IssuanceType = 1 if the issuance has the characteristic being considered. Post = 1 after the announcement of the PSPP. We control for an IssuanceType×FirstMonth interaction, firm-month fixed effects, and firm-IssuanceType fixed effects. For each row, we report the coefficients on the interaction IssuanceType×Post for a different issuance type: Eligible = 1 if the issuance is eligible to be used at collateral at the ECB (row 1); MeetReq = 1 if the issuance is listed, senior, and investment-grade rated (row 2); Listed = 1 if the issuance is listed (row 3); Senior = 1 if the issuance is senior (row 4); InvGrade = 1 if the issuance is investment-grade rated (row 5); Secured = 1 if the issuance is secured (row 6); Guaranteed = 1 if the issuance is guaranteed (row 7). A firm is eligible if it had eligible bonds outstanding in the calendar year before the PSPP announcement. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Regressions are weighted by firms' initial outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Net issuance by type (%)					
	All firms		Eligible firms		Ineligible firms	
	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)
Eligible×Post			0.157	0.146		
			(0.631)	(0.266)		
MeetReq×Post	0.331	0.368*	0.744	0.530**	−0.652	−0.058
	(0.462)	(0.209)	(0.549)	(0.249)	(1.309)	(0.372)
Listed×Post	1.176**	0.188	0.861	0.287	1.924	−0.073
	(0.464)	(0.226)	(0.579)	(0.259)	(1.300)	(0.436)
Senior×Post	−2.772***	−2.330***	−2.723***	−2.141***	−2.889**	−2.829***
	(0.574)	(0.249)	(0.679)	(0.285)	(1.416)	(0.425)
InvGrade×Post	0.311	0.175	0.787	0.345	−0.819	−0.270
	(0.496)	(0.224)	(0.618)	(0.281)	(1.306)	(0.371)
Unsecured×Post	0.841*	0.322	1.169**	0.275	0.061	0.448
	(0.486)	(0.230)	(0.578)	(0.282)	(1.237)	(0.382)
NonGuaranteed	1.323***	0.544**	1.783***	0.484*	0.232	0.700*
	(0.496)	(0.226)	(0.572)	(0.267)	(1.254)	(0.392)
IssuanceType×FirstMonth	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-IssuanceType FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30,840	100,960	2,376	7,880	28,464	93,080

Notes: $^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$

Table A.20: Net issuance by characteristics related to eligibility and riskiness around the 2014 TLTRO-plus-rate-cut announcement. We run separate regressions of net issuance of bonds with and without a certain characteristic on the interaction IssuanceType×Post and controls. IssuanceType = 1 if the issuance has the characteristic being considered. Post = 1 after the announcement of the 2014 TLTRO and rate cut. We control for an IssuanceType×FirstMonth interaction, firm-month fixed effects, and firm-IssuanceType fixed effects. For each row, we report the coefficients on the interaction IssuanceType×Post for a different issuance type: Eligible = 1 if the issuance is eligible to be used at collateral at the ECB (row 1); MeetReq = 1 if the issuance is listed, senior, and investment-grade rated (row 2); Listed = 1 if the issuance is listed (row 3); Senior = 1 if the issuance is senior (row 4); InvGrade = 1 if the issuance is investment-grade rated (row 5); Secured = 1 if the issuance is secured (row 6); Guaranteed = 1 if the issuance is guaranteed (row 7). A firm is eligible if it had eligible bonds outstanding in the calendar year before the 2014 TLTRO-plus-rate-cut announcement. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Regressions are weighted by firms' initial outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Net issuance by type (%)					
	All firms		Eligible firms		Ineligible firms	
	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)
Eligible×Post			0.273	−0.624**		
			(0.650)	(0.295)		
MeetReq×Post	0.078	−0.100	0.072	−0.200	0.094	0.154
	(0.516)	(0.236)	(0.643)	(0.273)	(0.757)	(0.535)
Listed×Post	0.438	0.079	0.721	0.113	−0.282	−0.005
	(0.465)	(0.274)	(0.580)	(0.325)	(0.876)	(0.561)
Senior×Post	−0.877*	0.103	−1.138*	−0.168	−0.213	0.788
	(0.455)	(0.302)	(0.602)	(0.360)	(0.692)	(0.573)
InvGrade×Post	0.010	−0.049	0.108	−0.112	−0.241	0.110
	(0.493)	(0.242)	(0.607)	(0.289)	(0.774)	(0.536)
Unsecured×Post	−0.161	−0.043	−0.052	0.078	−0.438	−0.348
	(0.459)	(0.261)	(0.608)	(0.304)	(0.805)	(0.552)
NonGuaranteed×Post	0.383	0.296	0.769	0.533	−0.598	−0.301
	(0.456)	(0.272)	(0.606)	(0.329)	(0.702)	(0.534)
IssuanceType×FirstMonth	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-IssuanceType FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,796	100,280	2,304	7,520	27,492	92,760

Notes: $^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$

Table A.21: Total Issuance around the PSPP announcement. The dependent variable is total net issuance scaled by the firm's outstanding amount of bonds at the beginning of the sample period. Post = 1 after the announcement of the PSPP. FirstMonth = 1 for the month in which the PSPP was announced. A firm is eligible (EligibleFirm = 1) if it had eligible bonds outstanding in the calendar year before the PSPP announcement. We control for an interaction between FirstMonth and EligibleFirm, where FirstMonth = 1 for the month in which the PSPP was announced. Peer-group fixed effects are created by sorting firms into 20 groups (vigintiles) based on their outstanding amount of bonds in 2014 and by further sorting firms, within each vigintile, into three groups based on their gross issuance in 2014 and three groups based on their net issuance. Odd-numbered columns consider the three months before and after the announcement; even-numbered columns consider the ten months before and after the announcement. Regressions are weighted by firms' outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Total net issuance (%)							
	Eligible firms		Ineligible firms		All firms			
	3M	10M	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	1.169**	0.239	0.661	0.381				
	(0.579)	(0.278)	(1.309)	(0.376)				
Post×EligibleFirm					−0.046	−0.161	2.205	1.567*
					(1.859)	(0.797)	(3.005)	(0.910)
FirstMonth	Yes	Yes	-	-	-	-	-	-
FirstMonth interactions	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-month FE	No	No	No	No	Yes	Yes	Yes	Yes
PeerGroup-month FE	No	No	No	No	No	No	Yes	Yes
Observations	1,188	3,940	14,232	46,540	15,150	49,600	15,150	49,600
R^2	0.101	0.013	0.093	0.043	0.222	0.077	0.244	0.100
Notes:	$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$							

Table A.22: Total Issuance around the 2014 TLTRO-plus-rate-cut announcement. The dependent variable is total net issuance scaled by the firm's outstanding amount of bonds at the beginning of the sample period. Post = 1 after the announcement of the 2014 TLTRO and rate cut. FirstMonth = 1 for the month in which the 2014 TLTRO and rate cut were announced. A firm is eligible (EligibleFirm = 1) if it had eligible bonds outstanding in the calendar year before the 2014 TLTRO-plus-rate-cut announcement. We control for an interaction between FirstMonth and EligibleFirm, where FirstMonth = 1 for the month in which the TLTRO and rate cut were announced. Peer-group fixed effects are created by sorting firms into 20 groups (vigintiles) based on their outstanding amount of bonds in 2013 and by further sorting firms, within each vigintile, into three groups based on their gross issuance in 2013 and three groups based on their net issuance. Odd-numbered columns consider the three months before and after the announcement; even-numbered columns consider the ten months before and after the announcement. Regressions are weighted by firms' outstanding amount of bonds at the beginning of the sample period. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Total net issuance (%)							
	Eligible firms		Ineligible firms		All firms			
	3M	10M	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	−0.052	0.070	−0.438	−0.117				
	(0.608)	(0.303)	(0.805)	(0.552)				
Post×EligibleFirm					0.797	1.230	−2.362	1.779
					(1.490)	(0.839)	(1.802)	(1.250)
FirstMonth	Yes	Yes	-	-	-	-	-	-
FirstMonth interactions	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-month FE	No	No	No	No	Yes	Yes	Yes	Yes
PeerGroup-month FE	No	No	No	No	No	No	Yes	Yes
Observations	1,152	3,760	13,746	46,380	14,622	49,180	14,622	49,180
R^2	0.184	0.016	0.060	0.020	0.152	0.080	0.178	0.092

Notes: $^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

Table A.23: Total issuance and changes in bond spreads around the 2015 PSPP and 2014 TLTRO-plus-rate-cut announcements for firms with traded bonds. In the first four columns, we consider the PSPP announcement. In the last four columns, we consider the TLTRO-plus-rate-cut announcement. FirmBeta is the average beta of the firm's outstanding bonds in the three months before the policy announcement. $\Delta^A S^F$ is the average abnormal spread change in the firm's outstanding bonds in the two days following the announcement. EligibleFirm = 1 if the firm had eligible bonds outstanding at some point during the calendar year before the announcement. Post = 1 after the announcement. FirstMonth = 1 for the month in which the policy was announced. Peer-group fixed effects are created by sorting firms into 20 groups (vigintiles) based on their outstanding amount of bonds in the calendar year before the announcement and by further sorting firms, within each vigintile, into three groups based on their gross issuance in that year and three groups based on their net issuance. Less active issuers are firms in the lowest tercile of gross issuance within in each vigintile. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Regressions are weighted by the firms' initial outstanding amount of bonds. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level

	Total net issuance (%)							
	PSPP				TLTRO-plus-rate-cut			
	3M	10M	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	1.770*	−0.240			−0.163	−0.346		
	(0.919)	(0.413)			(0.785)	(0.499)		
Post×EligibleFirm	−0.655	0.421			0.281	0.331		
	(1.079)	(0.494)			(1.029)	(0.561)		
Post×FirmBeta			−0.110	0.025			0.335	0.115
			(0.084)	(0.019)			(0.287)	(0.134)
Post×$\Delta^A S^F$			−0.159	−0.458**			0.711	−0.180
			(0.650)	(0.221)			(0.551)	(0.168)
Post×FirmBeta×EligibleFirm			−3.338	0.329			−0.363	−0.286
			(3.204)	(1.072)			(0.382)	(0.182)
Post×$\Delta^A S^F$×EligibleFirm			−34.585	0.430			−8.929	−8.358*
			(26.855)	(5.202)			(6.185)	(4.931)
FirstMonth	Yes	Yes	-	-	-	-	-	-
FirstMonth interactions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
EligibleFirm-month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
PeerGroup-month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,684	10,840	3,684	10,840	3,330	10,520	3,330	10,520
R^2	0.140	0.043	0.396	0.378	0.122	0.051	0.519	0.450

Notes: $^*p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$

Table A.24: Net issuance by characteristics related to a willingness to time the market after the PSPP announcement.We run separate regressions of net issuance of bonds with and without a certain characteristic on the interaction IssuanceType×Post and controls. IssuanceType = 1 if the issuance has the characteristic being considered. Post = 1 after the announcement of the PSPP. We control for an IssuanceType×FirstMonth interaction, firm-month fixed effects, and firm-IssuanceType fixed effects. For each row, we report the coefficients on the interaction IssuanceType×Post for a different issuance type: CommPaper = 1 if the issuance is commercial paper (row 1); ShortMaturity = 1 if the issuance's maturity is shorter than one year (row 2); FixedCoupon = 1 if the issuance has a fixed coupon rate (row 3); GeneralPurpose = 1 if the issuance prospectus indicates general corporate purposes as the only use of proceeds (row 4); IssuanceProgram = 1 if the issue is part of an issuance program (row 5). A firm is eligible if it had eligible bonds outstanding in the calendar year before the PSPP announcement. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Net issuance by type (%)					
	All firms		Eligible firms		Ineligible firms	
	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)
CommPaper×Post	0.187	0.890***	0.749	0.920***	−1.149	0.811**
	(0.535)	(0.189)	(0.627)	(0.227)	(1.473)	(0.363)
ShortMaturity×Post	−0.038	0.413**	0.683	0.651**	−1.749	−0.214
	(0.522)	(0.209)	(0.651)	(0.255)	(1.331)	(0.391)
FixedCoupon×Post	0.241	−0.115	−0.388	−0.380	1.732	0.583
	(0.479)	(0.195)	(0.608)	(0.237)	(1.257)	(0.363)
GeneralPurpose×Post	0.030	0.177	0.147	0.120	−0.247	0.328
	(0.376)	(0.222)	(0.512)	(0.282)	(0.686)	(0.353)
IssuanceProgram×Post	0.592	−0.001	0.612	−0.030	0.546	0.078
	(0.414)	(0.200)	(0.507)	(0.248)	(0.648)	(0.305)
IssuanceType×FirstMonth	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-IssuanceType FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30,840	100,960	2,376	7,880	28,464	93,080
Notes:	$^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$					

Table A.25: Net issuance by characteristics related to a willingness to time the market after the 2014 TLTRO-plus-rate-cut announcement.We run separate regressions of net issuance of bonds with and without a certain characteristic on the interaction IssuanceType×Post and controls. IssuanceType = 1 if the issuance has the characteristic being considered. Post = 1 after the announcement of the 2014 TLTRO and rate cut. We control for an IssuanceType×FirstMonth interaction, firm-month fixed effects, and firm-IssuanceType fixed effects. For each row, we report the coefficients on the interaction IssuanceType×Post for a different issuance type: CommPaper = 1 if the issuance is commercial paper (row 1); ShortMaturity = 1 if the issuance's maturity is shorter than one year (row 2); FixedCoupon = 1 if the issuance has a fixed coupon rate (row 3); GeneralPurpose = 1 if the issuance prospectus indicates general corporate purposes as the only use of proceeds (row 4); IssuanceProgram = 1 if the issue is part of an issuance program (row 5). A firm is eligible if it had eligible bonds outstanding in the calendar year before the 2014 TLTRO-plus-rate-cut announcement. Odd-numbered columns consider the three months before and after the announcement. Even-numbered columns consider the 10 months before and after the announcement. Standard errors are in parentheses and are double-clustered at the country-industry-month and firm level.

	Net issuance by type (%)					
	All firms		Eligible firms		Ineligible firms	
	3M	10M	3M	10M	3M	10M
	(1)	(2)	(3)	(4)	(5)	(6)
CommPaper×Post	0.454	1.058***	0.430	1.129***	0.515	0.878**
	(0.344)	(0.189)	(0.448)	(0.234)	(0.453)	(0.405)
ShortMaturity×Post	0.735	0.185	1.089	0.528*	−0.166	−0.679
	(0.542)	(0.255)	(0.684)	(0.294)	(0.801)	(0.537)
FixedCoupon×Post	−0.363	0.171	−0.545	0.096	0.101	0.358
	(0.508)	(0.264)	(0.643)	(0.315)	(0.883)	(0.548)
GeneralPurpose×Post	−0.286	−0.080	−0.266	−0.019	−0.338	−0.234
	(0.434)	(0.214)	(0.544)	(0.264)	(0.706)	(0.365)
IssuanceProgram×Post	0.014	0.121	0.152	0.307	−0.337	−0.348
	(0.351)	(0.199)	(0.464)	(0.248)	(0.516)	(0.288)
IssuanceType×FirstMonth	Yes	Yes	Yes	Yes	Yes	Yes
Firm-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-IssuanceType FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,796	100,280	2,304	7,520	27,492	92,760
Notes:	$^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$					

A.8 Eligibility Criteria

Here we report general eligibility criteria for marketable assets that are relevant for our sample of corporate bonds issued by euro-area nonfinancial corporations. We copy them verbatim from Part Four of Guideline (EU) 2015/510 of the European Central Bank of 19 December 2014 on the implementation of the Eurosystem monetary policy framework. Certain types of assets and non-marketable assets may be subject to specific criteria. For details, see the Guideline available at https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32014O0060.

Article 62: Principal amount of marketable assets

1. In order to be eligible, until their final redemption, debt instruments shall have:
   (a) a fixed and unconditional principal amount; or
   (b) an unconditional principal amount that is linked, on a flat basis, to only one euro area inflation index at a single point in time, containing no other complex structures.
2. Debt instruments with a principal amount linked to only one euro area inflation index at a single point in time shall also be permissible, given that the coupon structure is as defined in Article 63(1)(b)(i) fourth indent and linked to the same euro area inflation index.
3. Assets with warrants or similar rights attached shall not be eligible.

Article 63: Acceptable coupon structures for marketable assets

1. In order to be eligible, debt instruments shall have either of the following coupon structures until final redemption:
   (a) the reference rate is only one of the following at a single point in time:
      – a euro money market rate, e.g. EURIBOR, LIBOR or similar indices;
      – a constant maturity swap rate e.g. CMS, EIISDA, EUSA;
      – the yield of one or an index of several euro area government bonds that have a maturity of one year or less;
      – a euro area inflation index; and

(b) f (floor), c (ceiling), l (leveraging/deleveraging factor) and x (margin) are, if present, numbers that are either pre-defined at issuance, or may change over time only according to a path pre-defined at issuance, where f and c are greater than or equal to zero and l is greater than zero throughout the entire lifetime of the asset. For floating coupons with an inflation index reference rate, l shall be equal to one.

2. Debt instruments with a floating coupon, as referred to in paragraph 1(b), shall be considered ineligible if at any time following the application of the coupon rate formula, the coupon rate results in a negative value.

3. Any coupon structure that does not comply with paragraphs 1 and 2 shall not be eligible, including instances where only part of the remuneration structure, such as a premium, is non-compliant.

4. For the purpose of this Article, if the coupon is either of a fixed multi-step type or of a floating multi-step type, the assessment of the relevant coupon structure shall be based on the entire lifetime of the asset with both a forward- and backward-looking perspective.

5. Acceptable coupon structures shall have no issuer optionalities, i.e. during the entire lifetime of the asset, based on a forward- and backward-looking perspective, changes in the coupon structure that are contingent on an issuer's decision shall not be acceptable.

Article 64: Non-subordination with respect to marketable assets

Eligible debt instruments shall not give rise to rights to the principal and/or the interest that are subordinated to the rights of holders of other debt instruments of the same issuer.

Article 65: Currency of denomination of marketable assets

In order to be eligible, debt instruments shall be denominated in euro or in one of the former currencies of the Member States whose currency is the euro.

Article 67: Settlement procedures for marketable assets

1. In order to be eligible, debt instruments shall be transferable in book-entry form and shall be held and settled in Member States whose currency is the euro through an account with an NCB or with an SSS that has been positively assessed pursuant to the Eurosystem User Assessment Framework, so that perfection and realisation of collateral are subject to the law of a Member State whose currency is the euro.

2. If the CSD/SSS where the asset is issued and the CSD/SSS where the asset is held, are not identical, for the purposes of eligibility, the two must be connected by an eligible link positively assessed pursuant to the Eurosystem User Assessment Framework in accordance with Article 150.

ARTICLE 68: ACCEPTABLE MARKETS FOR MARKETABLE ASSETS

1. In order to be eligible, debt instruments shall be those which are admitted to trading on a regulated market as defined in Directive 2014/65/EU of the European Parliament and of the Council, or admitted to trading on certain acceptable non-regulated markets.

2. The ECB shall publish the list of acceptable non-regulated markets on its website and shall update it at least once a year.

3. The assessment of non-regulated markets by the Eurosystem shall be based on the following principles of safety, transparency and accessibility.

   (a) Safety refers to certainty with regard to transactions, in particular certainty in relation to the validity and enforceability of transactions.

   (b) Transparency refers to unimpeded access to information on the market's rules of procedure and operation, the financial features of the assets, the price formation mechanism, and the relevant prices and quantities, e.g. quotes, interest rates, trading volumes, outstanding amounts.

   (c) Accessibility refers to the ability of the Eurosystem to take part in and access the market. A market is considered accessible if its rules of procedure and operation allow the Eurosystem to obtain information and conduct transactions when needed for collateral management purposes.

4. The selection process for non-regulated markets shall be defined exclusively in terms of the performance of the Eurosystem collateral management function and should not be regarded as an assessment by the Eurosystem of the intrinsic quality of any market.

ARTICLE 71: CREDIT QUALITY REQUIREMENTS FOR MARKETABLE ASSETS

> In order to be eligible, debt instruments shall meet the credit quality requirements specified in Chapter 2, except where otherwise stated.

Article 71 and Chapter 2 establish that, to be eligible, a bond needs to have a credit rating of BBB- or better from at least one of the four recognized rating agencies (S&P, Moody's, Fitch, DBRS.)

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