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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.

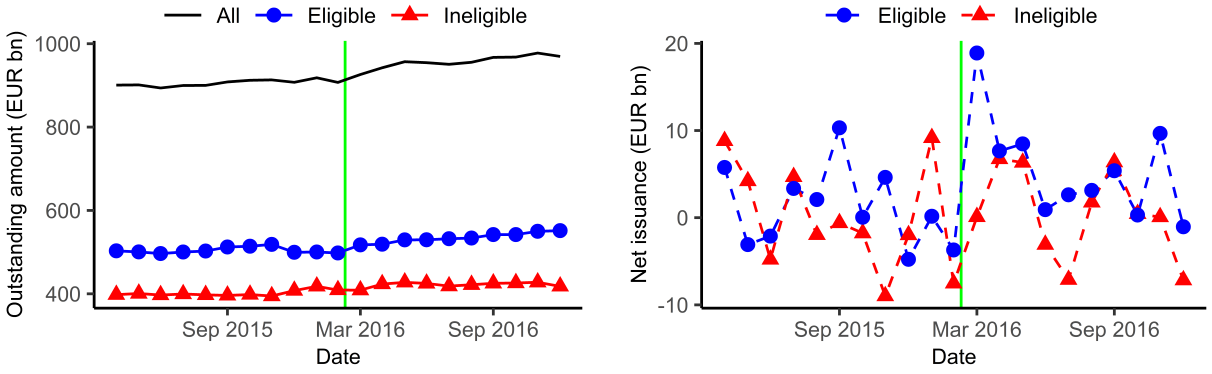
We gather additional bond information from commercial data providers. Daily bond yields and bid-ask prices are from Datastream. Use of proceeds data come from both Datastream and Bloomberg. Issuance-program information comes from Datastream. Dates for bond-issuance announcements come from Bloomberg. 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.*

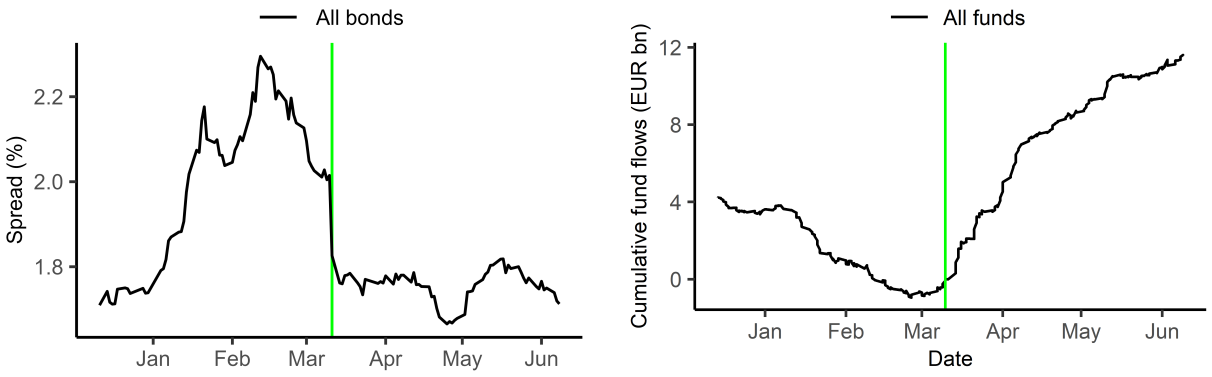
2. *Eligible firms increased total issuance primarily through eligible bonds. However, if firms can elastically supply bonds, the relation between the CSPP's price impact and issuance should be temporary.*

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.

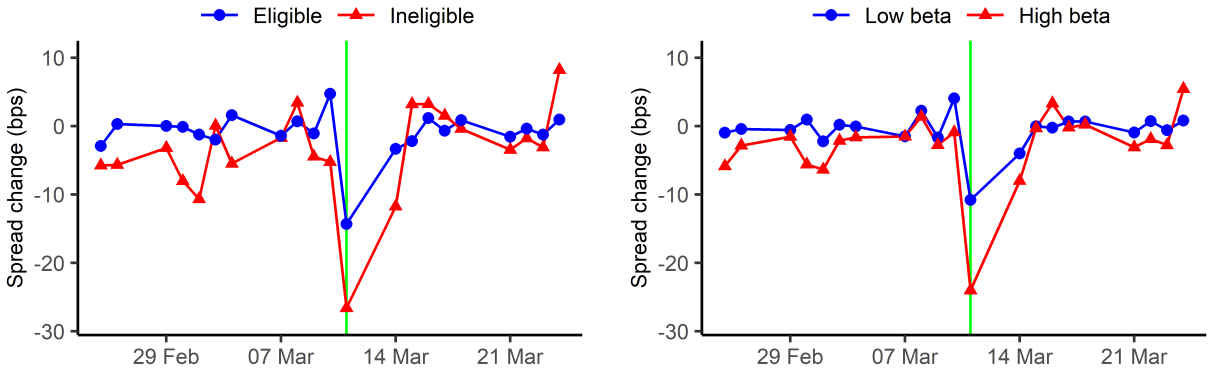
B. The Transmission to Bond Spreads

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), 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 **??** and **??**, 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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