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Abstract

We study how the Eurosystem Collateral Framework for corporate bonds helps the European Central Bank (ECB) fulfill its policy mandate. Using the ECBs eligibility list, we identify the first inclusion date of both bonds and issuers. We find that due to the increased supply and demand for pledgeable collateral following eligibility, (i) securities lending market trading activity increases, (ii) eligible bonds have lower yields, and (iii) the liquidity of newly-issued bonds declines, whereas the liquidity of older bonds is unaffected/improves. Corporate bond lending relaxes the constraint of limited collateral supply, thereby making the market more cohesive and complete. Following eligibility, bond-issuing firms reduce bank debt and expand corporate bond issuance, thus increasing overall debt size and extending maturity.

Keywords: Collateral Policy, ECB, Corporate Bonds, Corporate Debt Structure, Eligibility premium

JEL Classification: G12, G14, G32, E58

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1 Introduction

Central banks have three monetary instruments at their disposal to manage funding liquidity in the economy: open market operations, (OMOs) the minimum reserve system, and standing facilities. OMOs refer to the management of liquidity through the purchase or financing through repurchase agreements ("repo") of assets. The minimum reserve system allows the central bank to adjust the reserves required to be maintained by commercial banks. Standing facilities are monetary policy operations that are initiated by central banks counterparties, consisting of marginal lending and deposit facilities. The European Central Bank (ECB) and the National Central Banks (NCBs) in the Eurosystem use all three tools to affect money market rates, and to provide collateralized short-term funding to the banking sector.

The cornerstone of this liquidity provision is the set of guidelines for adequate collateral, the Eurosystem Collateral Framework, which serves an important policy function in both normal times and during crises. The Eurosystem Collateral Framework is comprehensive in both scale and scope, as it permits a large number of counterparties to partake of collateralized lending, by pledging various types of assets. The distinctive feature of the Eurosystem's collateral policy, however, is that the ECB is one of the few central banks around the world that accepts corporate bonds as pledgeable collateral.

Corporate bond pledgeability is an especially versatile and powerful policy tool, whereby banks in the Eurosystem can obtain funding against eligible assets through collateralized lending operations: open market operations via repurchase agreements, or lending in the marginal lending facility by those banks that cannot, or prefer not to, obtain funding from the interbank lending market.[1] In principle, including corporate bonds in the collateral framework helps the ECB to fulfill multiple policy objectives:

i Collateralized central bank monetary policy operations help control short-term

[1]Unlike the repo facility at the Fed, in Europe there is no stigma attached to using the ECB's marginal lending facility. Lee and Sarkar (2018) claim that this is partly due to central bank communication, since the ECB never portrays the marginal lending facility as a lending of last resort, and partly to their disclose policy, under which only daily aggregates are published, and not the identity of individual borrowing banks. Moreover, the ECB imposes the same collateral and counterparty requirements for open market operations and the standing facility, allowing for similar terms and, therefore, more widespread use of the overnight facility.

interest rates, and provide overnight funding to banks,

ii Collateral eligibility affects the liquidity in the secondary and primary markets for corporate bonds, decreasing bond yields and affecting financial decisions regarding the capital structure of non-financial firms,

iii Enlarging the pool of collateral eligible assets reduces the scarcity effects of government bonds, which instead can be used to obtain liquidity in the repo market, and

iv In the absence of an OTC repo market for corporate bonds, collateral eligibility gives rise to a positive externality by improving market functioning and completeness, as well as significantly increasing demand in the securities lending market for corporate bonds in the Eurozone.

The aim of this paper is to study the extent to which corporate bond collateral eligibility actually induces these hypothesized externalities, and helps the Eurosystem to fulfill its policy mandate. Furthermore, the inclusion of an asset in the Eurosystem's collateral eligible list directly affects its secondary market liquidity and yield, while also creating a spillover into the secondary market for collateral, the securities lending market. The advantage of performing such an analysis for the Eurozone is that we are able to disentangle the *direct* effect of central bank repo operations on the security lending market, given the virtual absence of a (private) corporate bond repo market in Europe. Moreover, we observe some of the indirect effects on firms, by examining the capital structure decisions of bond-issuing firms. We do so by using the ECB's eligible asset list, which allows us to identify the precise inclusion date of individual corporate bonds, and the first ever inclusion date at the issuer firm level.

We contribute in this paper to the literature on collateral and securities lending in two ways. First, we examine the extent to which corporate bond eligibility has an effect on the development of the European capital market development, the pricing of corporate bonds, and the subsequent debt financing decisions of firms. Second, we study how the collateral framework improves market completeness and the spillover between the overnight lending

facility and the securities lending market. This fills a gap in the literature, which has focused on the *actual purchases* of the securities rather than providing them as *collateral*.

In this paper, we consider the channels through which the collateral framework affects eligible bonds, as well as the bond issuing firms, as shown in Figure 1. The direct effect of collateral eligibility arises due to banks' increased demand for pledgeable assets in the secondary market for corporate bonds, as well as in the secondary market for collateral. This demand affects secondary market yields and liquidity, alongside securities lending activity, measured by borrowing costs and the quantities supplied for borrowing and in demand in this market. We also observe that following their first eligibility list inclusion, bond-issuing firms respond to the increased demand for their bonds by raising their public debt issuance activity, or otherwise influencing the primary market for corporate bonds.

[Figure 1 around here]

Our empirical analysis first examines the securities lending market activity of eligible bonds, where banks that do not yet own Eurosystem-pledgeable assets can borrow them from this secondary market for collateral. Studying the activity of newly eligible bonds, we find that an ECB eligibility event triggers an increase in both the supply (lendable value) of, and demand (on loan amount) for, eligible assets; however, the increase in demand is smaller than that of supply, leading to declining borrowing costs. The finding that eligibility also affects the secondary market for collateral suggests that the existence of corporate bond lending relaxes the constraint of limited collateral supply, and makes an otherwise fragmented market more cohesive and complete. This allows us to investigate eligibility as an exogenous shock, and draw causal inferences on bond liquidity and yields.

We then study the effect of the eligibility list inclusion of a corporate bond in the collateral list on its secondary market bond liquidity and yield. We find a significant and robust yield decline of 11-24 basis points for eligible bonds compared to their non-eligible counterparts, a magnitude comparable to other estimates from actual purchases in the Corporate Sector Purchase Programme (CSPP) of the ECB, and the Quantitative Easing (QE) literature more generally (Grosse-Rueschkamp et al., 2019; Todorov, 2019; Zaghini, 2017; Abidi and Miquel-Flores, 2018). This yield drop constitutes an "eligibility

premium" that arises due to the liquidity service or fungibility of the bond used as collateral. This means that once a bond becomes eligible, it acquires cash-like features, as it can be pledged at the ECB in exchange for overnight funding. Next, we shift our focus to the liquidity impact, measured by changes in the bid-ask spread and the proportion of zero returns in the secondary market, which reveals an asymmetric reaction to a bond's eligibility list inclusion. We find that newly-issued, "on-the-run" bonds experience a deterioration in liquidity in comparison to non-eligible bonds, driven by banks' building up precautionary reserves of pledgeable assets (Hildebrand et al., 2012; Acharya and Merrouche, 2013; Gale and Yorulmazer, 2013; Crosignani et al., 2017). In contrast, the liquidity of older, "off-the-run" bonds does not change, or even improves, in some cases. Focusing on a subsample of bond that are not available for securities lending, we show that in the absence of a secondary collateral market, the eligibility premium and the liquidity effects are larger, especially in a credit crunch with collateral shortages.

Finally, we investigate changes in the debt structure of firms whose bonds became collateral eligible for borrowing under the collateral framework, as a supply response. In particular, we focus on new ECB list-eligible firms, i.e., bond issuing firms that are chosen for eligibility for the first time. We find that the event triggers a corporate debt restructuring process at the issuing firm, during the four quarters following the announcement: newly eligible firms increase their public debt, and simultaneously reduce their bank debt. Eligibility creates a more favorable market environment for future debt issuances, which leads to a more public debt-tilted corporate debt structure. As a result, firms do not only substitute bank loans with corporate bond issuance, but also actually increase their overall supply of marketable bonds, particularly those with longer maturities. This eventually helps capital market development and, ultimately, capital market union in the Eurozone, which has already caused the European corporate bond market to double in size in the past decade, €1.3 trillion or about 10% of the Eurozone GDP by 2018.

To the best of our knowledge, ours is the first study to examine the plethora of implications collateral policy as a monetary tool has in a general setting. Prior to

the financial crisis, Bindseil and Papadia (2009) examine the collateral premium and find that the market's compensation for eligibility is negligible. This changes with the increasing scarcity of pledgeable collateral and the declining liquidity of the banking sector, as we find a significant compensation for eligibility in our sample period. Other studies either focus on crisis-triggered changes in collateral eligibility (Corradin and Rodriguez-Moreno, 2016; Van Bekkum et al., 2018), or on the announcement effect of unconventional monetary policy actions, such the CSPP or the QE. Empirical evidence suggests that both the CSPP announcement (Grosse-Rueschkamp et al., 2019; Todorov, 2019) and its associated implementation, the QE, (Galema and Lugo, 2017; Arce and Mayordomo, 2017) have an effect on firms' financing decisions and eventually on corporate debt structure. In contrast to these methodologically similar studies, our analysis is not only more general in that the collateral framework includes a wider range of firms than could be surmised from these studies, but the effect on yields and firm's capital structure is comparable in magnitude.

Nyborg (2016, 2017) argues that theoretically, collateral policy should have a direct effect on the real economy, as it should influence the relative production of certain types of collateral, and also, inclusion in the collateral framework and the subsequent demand pressure could move secondary market prices, liquidity, and perhaps repo rates of eligible assets. In fact, we observe that after experiencing the first-time bond eligibility event, firms tilt their financing toward public debt as opposed to bank debt. This confirms our finding that eligibility incentivizes non-financial firms to issue more public debt, as it eventually helps them access the capital market and reduce their refinancing risk. On the other hand, we also observe the second effect: bond eligibility directly affects the secondary market prices and liquidity, as well as the secondary market activity for collateral. Overall, we show that the efficacy of the Eurosystem's collateral framework goes beyond the collateralized lending market, by driving market activity of eligible bonds, and promoting the restructuring of European corporate debt towards capital market funding.

In the remainder of the paper, Section 2 reviews the literature, while Section 3

provides a detailed account of the Eurosystem's collateral framework. Section 4 describes our dataset and presents our descriptive statistics. In Section 5, we review the direct effects of eligibility on bonds of non-financial corporations, while Section 6 examines the predictability of the eligibility list inclusion and presents our firm-level identification strategy, followed by the capital and debt structure effects of collateral eligibility. Section 7 concludes.

2 Related Literature

This paper contributes to many strands of the economics literature. First, our study is part of a broader literature that examines the effect of monetary policy on the real economy. Part of this strand examines how banks access central bank liquidity through collateralized market funding (CGFS, 2013, 2015). In the euro area, following the financial crisis Allen and Moessner (2012) document that collateralised borrowing became more important than uncollateralised interbank lending. Consequently, eligibility under a central bank collateral framework emerged as an economic driving force behind not only bank funding cost and interbank market rates (Cassola and Koulischer, 2019; Kacperczyk et al., 2017), but as our results show, the composition of corporate leverage and firms' access to the capital market.

A series of studies look at the collateral frameworks of central banks in a broader context (Eberl and Weber, 2014; Bindseil et al., 2017). Some of these papers point out the potential direct effects of collateral policy on the real economy (Nyborg, 2016, 2017; Bindseil and Papadia, 2009), for which we provide empirical support: we find an increase in European corporate bond issuance driven by eligible firms, and we observe a decrease in yields, changing liquidity, and increased securities lending market activity following a bond's inclusion in the collateral framework. These findings are most similar, although with broader implications, to studies that focus on unexpected changes in collateral requirements of a given asset type, like Van Bekkum et al. (2018) for Dutch residential mortgage backed securities, or Corradin and Rodriguez-Moreno (2016) for

USD-denominated sovereign bonds.

Considering how banks' demand pressure on pledgeable collateral affects asset prices, our results are similar to asset pricing papers on repo market specialness (Duffie, 1996; Jordan and Jordan, 1997), the on-the-run-premium (Krishnamurthy, 2002), or the convenience yield documented in US Treasuries (Krishnamurthy and Vissing-Jorgensen, 2012; Longstaff, 2004). Looking at corporate bonds, Chen et al. (2018) present the value of pledgeability in the Chinese market, while de Roure (2016) estimates an eligibility premium for lower-rated collateral assets studying the fixed-income trading book of German banks. Defining the eligibility premium as a compensation for the liquidity service or fungibility of the pledgeable asset, Bindseil and Papadia (2009) document that, preceding the financial crisis, the price effect of eligibility was rather small, in the ballpark of 3-5 basis points. They also argue that the size of the eligibility premium depends on the following factors: i) collateral scarcity, ii) the overall liquidity of the banking sector, iii) the amount of government debt, and iv) the supply of other potentially eligible assets. In line with their prediction, during a time of collateral shortage and a credit crunch, we document the presence of a much larger eligibility premium, 11-24 basis points, as well as a significant pricing impact on the secondary market for collateral (securities lending market).

Next, we also relate to the growing literature on unconventional monetary policy actions. Following the inception of large scale asset purchase programs, early research on QE aims to disentangle the channels through which asset prices and risk premia are affected (Krishnamurthy and Vissing-Jorgensen, 2011, 2013). Often, specific asset classes (Di Maggio et al., 2016), or specific purchase programs, such as the SMP or the OMT in the Eurozone, are considered (Eser and Schwaab, 2016; Altavilla et al., 2015; Acharya et al., 2019). Others show the real effects of LSAPs, more specifically, an increasing number of studies look at the CSPP. For instance, Grosse-Rueschkamp et al. (2019), Abidi and Miquel-Flores (2018) and Todorov (2019) document how prices of assets eligible under the program are affected by the announcement of purchases, while Arce and Mayordomo (2017) and Galema and Lugo (2017) focus on the actual purchases.

Our paper is closely related methodologically, as well as in presenting the real effects of monetary policy in the context of capital structure decisions of eligible non-financial firms.

And last, we enrich the literature that studies corporate debt issuance. Rauh and Sufi (2010), for instance, document the within-debt heterogeneity of firms, although the decision as to whether to issue public debt or obtain bank financing depends on many factors, like monetary policy and aggregate loan supply (Kashyap et al., 1993; Becker and Ivashina, 2014), or the business cycle (Adrian et al., 2013; De Fiore and Uhlig, 2015). These papers suggest that firms prefer capital market finance when loan supply contracts. However, not only do firms adjust the relative proportion of bank and bond debt in response to the state of the macroeconomy, but also the overall size of leverage (Faulkender and Petersen, 2006), and the maturity structure of their public debt (Badoer and James, 2016). We show that the same effect applies to eligible corporate bonds in the Eurozone in our empirical analyses. This confirms that eligibility, similar to credit ratings or traded CDS contracts on the firms' debt (Faulkender and Petersen, 2006; Saretto and Tookes, 2013; Subrahmanyam et al., 2014, 2017, respectively), improves firms' access to the public debt market that helps maintain higher levels of leverage.

3 The Eurosystem's Collateral Framework

3.1 Monetary policy implementation in the Eurosystem[2]

The European System of Central Banks, comprising of NCBs and the ECB and referred to as the Eurosystem, uses three monetary instruments to achieve its policy goals: OMOs, the minimum reserve system, and standing facilities. The primary role of OMOs is to steer interest rates, but it also serves a liquidity management and monetary policy signaling purpose. OMOs are conducted by the ECB in the form of main refinancing operations, long-term refinancing operations, fine tuning and structural operations, most of which are based on scheduled repo transactions with credit institutions in need for funding

[2]Based on the ECB's website on monetary instruments: `https://www.ecb.europa.eu/mopo/implement/html/index.en.html`.

liquidity. Another policy tool is the array of minimum reserves requirements that apply to all credit institutions and aim to stabilize money market interest rates by creating liquidity shortages.

The most interesting tool from the perspective of this study is the set of standing facilities that, based on market conditions, provide or absorb overnight liquidity, at the same time determining the upper bound for overnight market interest rates. The facilities therein are the deposit facility, which allows a wide range of counterparties to make overnight deposits at central banks, and the marginal lending facility, which is mostly collateralized overnight lending against eligible assets between central banks and financial institutions. Both facilities can be accessed at the NCB level, although the same terms and conditions apply throughout the euro area.

Lending under the marginal lending facility takes the form of overnight repurchase agreements or overnight collateralized loans.[3] In both cases the ownership of the pledged asset stays with the debtor, thus only liquidity but not risk is transferred between the borrowing institutions and the central banks. These transactions have an overnight maturity, and interest payments that can be determined daily, and are payable each business day with the repayment of the credit. The marginal lending facility is accessible at the discretion of counterparties and provides full allotment, so long as the claim can be collateralized.

For risk management purposes of the central bank, collateralizing temporary refinancing operations is important. Since the Eurosystem operates with a single eligible asset list used in all of its liquidity providing operations, risk mitigation and monitoring are crucial. The tools for monitoring are valuation and margin calls, haircuts on pledged collateral and limits in exposure to i) counterparties, ii) the use of collateral by individual counterparties, and iii) the total submitted collateral by an individual issuer, all to reduce concentration risk.

[3]Note that this is different from the Federal Reserve System in the United States, where OMOs are outright asset purchases, and the repo facility is only accessible to the limited set of counterparties, namely to primary dealer banks.

3.2 The ECB's collateral policy

The cornerstone of the Eurosystem's marginal lending facility is its collateral policy, a set of guidelines for adequate collateral, and a framework that is both comprehensive in scale and scope. The ECB's collateral framework not only permits various asset types to be pledged, but also allows a large number of counterparties to partake in collateralized lending.

Accepting a range of assets, from corporate and government bonds, to covered and uncovered bank bonds and asset backed securities, across a wide range of credit quality is an approach that distinguishes the Eurosystem from other central banks. Moreover, the Eurosystem is among the few central banks that has a single collateral list, that is used for both open market operations, as well as for the standing facilities, which greatly simplifies financial institutions' access to this liquidity channel. As a consequence, the ECB maintains a larger and more diverse list of eligible marketable assets than other central banks, with on average about 25,000 securities on the list each trading day.

Corporate bonds have always been on the ECB's eligible asset list since its inception, encouraging more efficient utilisation of collateral for counterparties, as well as allowing the use of higher quality collateral, such as government bonds, in the often more profitable interbank repo or securities lending markets. Even today, corporate bonds represent a significant fraction of eligible assets, around 10% or about €1 trillion in stock, which has contributed to the growth of the European corporate bond market, and capital market development more generally (Bindseil et al., 2017).

In our sample, a fraction of about 6% of all assets, an equivalent to an average of 1,450 individual securities, represents eligible corporate bonds. In recent years, the collateral eligibility criteria for corporate bonds among other assets underwent both permanent and temporary adjustments, as depicted in Figure 2, resulting in some fluctuation in the number of eligible assets. The beginning of our sample period corresponds to the introduction of the single eligible asset list in 2007, whereby all Eurosystem central banks started using a single eligible asset list published by the ECB. Our sample extends until June 2016, the initiation of the Corporate Sector Purchase program (CSPP), since by

solely focusing on the period preceding the QE, we are able to estimate the price and real effects of eligibility alone, rather than the confounding effect of eligibility and actual purchases.

[Figure 2 around here]

In general, for an asset to be eligible, it has to trade either on a regulated or unregulated market that is accepted by the ECB. The most common accepted currency of eligible assets is the Euro, while the coupon type is preferably fixed. An important feature of eligible assets is credit quality. To mitigate credit risks in its portfolio, the ECB requires a minimum credit rating threshold, as well as it applies haircuts, dependent on maturity, non-coupon payment, and category. The rating requirements changed over time, mostly as a response given to the financial crisis and the collapse of Lehman Brother in October 2008, the ECB announced a temporary reduction of the minimum rating requirement from A- to BBB- until the end of 2009. However, in May 2009, the deadline was extended and it is still in place to date. A detailed description of eligible assets, eligible counterparties (institutions) and the legal background can be found in Appendix A.

4 Data and Descriptive Statistics

The cornerstone of our analysis is the ECB's list of eligible marketable assets, which we complement with bond level characteristics, price and securities lending data, and also merge with firm balance sheet and debt structure information from various sources.

4.1 The List of Eligible Marketable Assets

Our main dataset is the ECB's historical list of eligible marketable assets, which comprises of monthly (for the period 30 May 2007 to 31 Dec 2009 from Eberl and Weber (2014)), and then daily sub-lists for the period 8 April 2010 to 30 June 2016 that we directly obtain from the ECB website.[4] After merging the sub-lists, the resulting dataset includes the

[4]Download link for the daily EA information: `https://www.ecb.europa.eu/paym/coll/assets/html/list-MID.en.html`

list publication dates, the security identifiers (ISIN) of eligible assets, and information on asset category, issuance and maturity dates, haircuts, coupon, issuer residence, reference market, and currency denomination.[5] For the analysis, we restrict our sample to EUR-denominated bonds of non-financial corporations from the EU28.[6] In the final EA sample, about 65% of corporate bonds become eligible in the first month after issuance, and about 66% of bonds leave the eligible asset list a month prior to their maturity.

[Figure 3 around here]

The set of eligible bonds has a diverse composition in terms of country of origin, principal amount, maturity and rating, as Figure 3 illustrates. Panel A shows that the majority of eligible bonds are originated from Germany, France or Spain.The principal amount of eligible bonds, in Panel B, has decreased in recent years, while Panel C shows that bond maturity had increased over time. Finally, the ratings in Panel D indicate a deteriorating trend in bond quality, due to the looser collateral requirements following October 2008 or after the Lehman collapse. Overall, these panels illustrate how the composition of the eligible asset list evolves dynamically, suggesting that the ECB actively manipulates the list in response to market conditions.

4.2 Corporate Bonds

For all ECB-eligible corporate bonds, we obtain information on bond characteristics, daily yield-to-maturity and prices from Bloomberg. We complement the eligible bond sample with non-eligible corporate bonds from the same issuer, all of which become eligible later in the sample. Similar to Grosse-Rueschkamp et al. (2019), we restrict the sample to bonds from the EU28 countries, issued after 1999.[7] In our analyses, we focus on bonds with a principal amount larger than €1 million, and with sufficient liquidity

[5] A complete list of variables is provided on the ECB's website: `https://mfi-assets.ecb.int/resultEa/abbreviations`.

[6] These firms have a guarantor group "corporate and other issuers" or issuer group "corporate and other issuers". For the few bonds for which the issuer group category changes over time, we assign the issuer group category with the largest relative occurrence.

[7] For each bond, Bloomberg provides issuer information at three levels: (i) direct issuer, (ii) parent issuer, and (iii) ultimate parent issuer. All analyses are performed at ultimate issuer level, and the detailed bond selection procedure is described in Appendix B.

and trading activity, so that yields do not stay constant for 14 or more consecutive days within a month. In addition to the size and liquidity filters, we include only bonds with non-missing bid-ask and credit rating information from Standard&Poor's.

We merge the daily bond yield panel with proprietary securities lending market data from IHS Markit, that covers 85% of the OTC securities lending market activity worldwide. These data contain information on quantities available for demand and supply in the securities lending market, as well as a proxy for the cost of borrowing. As a result, the daily bond panel consists of 1515 separate ISINs, out of which 1403 bonds are eligible, while 113 are (currently) non-eligible corporate bonds of the same issuer. By restricting our analysis to bonds that at some point became eligible, we allow for an "apples-to-apples" comparison: since the "not yet eligible" bonds are likely to be similar to their eligible counterparts, any yield difference that arises upon the eligibility list inclusion should not be driven by underlying differences in bond or issuer characteristics, allowing for a cleaner analysis at the bond level. Also, our bond panel has a dynamic structure due to the entry of new bonds into the sample and the exit of old ones reaching maturity, leading to on average 867 ISINs in a month, with about 800 eligible bond issues. The summary statistics for this bond panel are in Table 1.

[Table 1 around here]

The summary statistics indicate that the average bond in our sample has a size of €700 million, was issued about 2.7 years ago, and has about 6 years until maturity, and a coupon of 4.53%. These variables are dispersed, especially size, while the time-to-maturity suggests that the initial bond tenors are between 1 and 20 years. The ratio of time-to-maturity to initial maturity, *TTM/tenor*, indicate whether the bond is on-the-run. In the market level analysis, we consider not only the overall sample, but also compare on-the-run to seasoned bonds, where the cut-off value is set at 25 trading days after the issuance, following which we categorize the bond as seasoned. The average value of *TTM/tenor* suggests that most bonds enter the sample shortly after issuance, although some get included in the list about half-way through their tenure. The average initial rating in our sample is BB+, but ratings range from BBB- to AAA. The average

yield is 1.598% above the maturity-matched risk free (Bund) curve, but varies widely. The average bid-ask spread is 0.53%, while on 21.75% of the days, or about 4 days a month, the bond does not trade, and its price remains unchanged. In the securities lending market we observe that 7.7% of the available supply is currently borrowed (on loan), captured by the variable *Utilisation*, with an average borrowing cost, *Indicative fee* of 0.73 basis points. Lending supply, captured by *Lendable value* is, on average, about $103 million, while the demand, *On Loan* is about $9 million.

4.3 Firm Characteristics

In addition to the bond dataset, we complement the eligibility dataset with bond-issuing firm level information for the period between Q1 2006 to Q4 2016. We obtain these data from the Global Fundamentals Quarterly database of Compustat. Starting from the raw data, we exclude observations from financial institutions and the real estate sector (GIC 40 and 60, respectively), along with observations with missing industry entries.We conduct our analyses on EU28 firms, and drop companies with total assets that are either missing or negative, or have cash holdings or total assets below EUR 50 million. Our focus is on firms for which we also have quarterly debt information from Capital IQ. In the resulting sample we keep firms with a minimum book value of assets above $10 million. Among eligible bond issuing firms, we look at those that experienced an eligibility event in October 2008 or later, then remove them from the sample four quarters post event.[8]

Our debt composition data come from Capital IQ of S&P, which differentiates between seven distinct types of debt: commercial paper, (drawn) credit lines, term loans, senior bonds and notes, subordinated bonds and notes, capital leases and other debt. We follow the definitions of Grosse-Rueschkamp et al. (2019), and assign (drawn) credit lines and term loans to bank debt, while public debt is composed of commercial paper, and subordinated and senior bonds and notes. Total debt is then defined as the sum

[8] Some firms have their first inclusion date prior to May 2007, and are thus unobservable in the dataset. By excluding the first six quarters of the eligibility list, we aim to minimize the likelihood of falsely assigning events in the analysis, while the 4-quarter post-inclusion window helps us focus on the immediate effect of the event.

of all individual debt components.[9] We merge the Capital IQ sample with Compustat fundamentals data. The resulting sample includes 67 eligible bond-issuing firms and 370 control firms. Summary statistics of the main capital structure and accounting variables are in Table 2, while Figure 4 presents the heterogeneity in the main properties of eligible and ineligible firms.

[Table 2 and Figure 4 around here]

Table 2 shows that the average firm in our sample has 61% bank and about 31% bond debt, while the total debt is about 20% of its total assets. Bank and bond debt maturities are rather comparable, at around 4 years (49 and 50 months), while the cost of debt differs. Bonds carry on average a higher interest than bank loans, and this difference persists throughout the distribution of each variable. Accounting variables are scaled by total assets and are denoted as percentages. The average firm holds cash in the value of about 10% of its total assets, has a 36.2% gross profit margin and 19% intangible assets. Figure 4 compares eligible and ineligible firms, and confirms that there is a difference in firm size and ratings. Eligible firms are typically large and have better credit quality than their ineligible counterparts. As for the geographical distribution of the two types of firms, most firms are incorporated in France, Germany, Italy and Spain, while eligible firms are mostly French, German, Spanish, Italian and Dutch.

5 Collateral Acquisition in the Secondary Market for Collateral and Corporate Bonds

The incentive of financial firms to buy pledgeable assets for precautionary reserves, to hedge against funding liquidity shocks, by borrowing from the ECB, increased the demand for eligible corporate bonds.[10] Allen and Moessner (2012) and CGFS (2013) show that

[9]For firms that report information only semiannually, we carry over the values from the previous publication date, while to mitigate the effect of data errors, the variables are winsorized at the top and bottom one percentile.

[10]See for instance Hildebrand et al. (2012); Acharya and Merrouche (2013); Gale and Yorulmazer (2013); Crosignani et al. (2017); Boermans and Vermeulen (2016)

European banks increased their reliance on collateralized market funding following the financial crisis, pushing up demand for the value of pledgeable collateral. On the one hand, this gave rise to an eligibility premium, and reduced bond supply leading to scarcity of high-quality liquid assets (HQLA).[11]

Institutions seeking adequate collateral have multiple channels through which they can obtain these assets (Figure 1). Those financial institutions, mainly banks, that do not yet own a pledgeable asset can either buy it on the secondary market for corporate bonds, or borrow it from the secondary market for collateral, the securities lending market. This section reviews how increased demand for collateral eligible assets affects secondary market yields and liquidity, and the spillover to the securities lending market around the eligibility inclusion event, in the period of April 2010 to June 2016, when daily eligibility data are available.

5.1 The secondary market for collateral

The regulatory reforms following the financial crisis created an increased need for collateral, at a time, when large scale asset purchases and quantitative easing effectively decreased the free float liquid, safe assets in the market. Amid this HQLA shortage, we saw the emergence of a secondary market for collateral, with repo and securities lending markets allowing the short-term borrowing of collateral. Many market participants no longer go to the securities lending market for funding, but also to obtain pleadgeable collateral via borrowing or collateral swaps (Aggarwal et al., 2016). Moreover, many central banks also set up repo and lending facilities to help with liquidity provision by utilizing their growing balance sheets.

5.1.1 The securities lending market

The securities lending market has grown substantially in the past decade. On the supply side, lenders, whose balance sheet assets are offered to be lent, are typically large passive investors, such as mutual funds, insurers and pension and sovereign wealth funds. On the

[11]Eligibility premium not only arises in corporate bonds, but also in, for instance, short-term commercial deposits (Kacperczyk et al., 2017).

demand side, there are borrowing institutions seeking a specific asset, most often banks seeking HQLA or specific assets to deliver into futures and CDS contracts, hedge funds shorting equities, or dealers or market-makers filling orders on assets that are not in their inventory.[12]

To examine the effect of the first-time inclusion in the eligibility list, we use proprietary securities lending data from IHS Markit. These data contain daily aggregate values across all reported transactions of securities lending supply and demand proxies, as well as lending fees at the individual ISIN level. The advantage of performing this analysis is that we are able to disentangle the direct effect of central bank repo operations on the security lending market, given the virtual absence of a corporate bond repo market in Europe. Consequently, ECB eligibility constitutes an exogenous shock, which allows us to make causal statements when showing the effect of bond eligibility on the securities lending market activity of corporate bonds in the following setting:[13]

$$SLproxy_{bt} = \alpha + \beta_1 EA_b \times Post_{bt} + \beta_2 EA_b + \beta_3 Post_{bt} + \mathrm{B}_b + \Phi_b + \Gamma_t + \epsilon_{bt}, \qquad (1)$$

where $SLproxy_{bt}$ is the the securities lending market variable at time t of bond b. EA_b is a time-invariant indicator that equals one for bonds that are on the eligibility list (*treated*), and is zero otherwise. $Post_{bt}$ is a dummy variable that equals one for the post-treatment period for bonds b that are on the eligibility list on day t, and is zero otherwise.[14] Φ_b and Γ_t are bond and time (monthly) fixed effects, respectively, while B_b denotes bond controls, such as issue size, payment rank, initial credit rating, and coupon.

In line with the fixed income securities lending literature, the main variables of interest are lending demand, proxied by *On loan*; lending market supply captured by *Lendable*

[12]These institutions either have their own lending desks, or are represented by an agent-lender or custodian.

[13]We consider plain vanilla, fixed coupon bonds with non-callable features and bullet maturity. Since the majority of eligible corporate bonds are unsecured or senior unsecured, we restrict our sample to these two categories.

[14]This definition of *Post* is somewhat different from the traditional DiD specifications, which allows us to account for the potential exclusion of a bond from the eligibility list, as well as to to compare features of bonds that are currently, on day t, on the eligibility list, to those that previously were or will be included in the list. Defining the control group this way is a conservative approach, which preserves the "apples-to-apples" comparison we explained in Section 4.2.

value; and *Indicative fee*, which represents borrowing costs on the lending market on a given day and for a specific security.[15] We also look at the *Utilization*, measured as how much of the lendable amount of a bond is currently borrowed (on loan). The results for the period of April 2010 to June 2016 can be found in Tables 3 and 4, where the dependent variables are *Lendable value* and *On loan*, and *Indicative fee* and *Utilization* in Panels A and B, respectively.

[Tables 3 and 4 about here]

In Table 3 Panel A, we see that an eligibility event triggers an increase in the lendable value of the eligible bonds relative to their non-eligible counterpart in the overall sample. This lending market supply increase is either due to lenders with the eligible asset on their balance sheet further increasing the amount that they allocate to lending, or more lenders entering the market hoping to capitalize on the income generating potential of securities lending. However, when looking at the split between on-the-run and seasoned bonds, we see that the lending supply increase is larger in the new bond segment, around 40-45% increase upon eligibility list inclusion, while it is only around 11-19% for seasoned bonds. Similar to supply, we see the lending market demand, proxied by *On Loan*, increase as shown in Panel B. While the first three columns of the overall sample suggest a 35-60% increase in demand, the rest of the table clarifies that new bonds account for most of the demand shift.

Table 1 suggests that even though the percentage change is larger in demand, the overall lending market supply is an order of magnitude larger, which is why we observe a short-term drop in *Indicative fees* in Panel A of Table 4.[16] This case is also depicted on Figure 5, in case (2). Nevertheless, the total volume increase is so substantial that it compensations for the drop in fees, making securities lending more profitable for lenders. Finally, in Panel B, *Utilization*, the ratio between on loan and lendable amounts also

[15]The buy-side fixed income securities lending literature mostly focuses on corporate bond lending for shorting (Asquith et al., 2013; Kecskés et al., 2013; Nashikkar and Pedersen, 2007) and corporate and government bond based collateral swaps (Bai et al., 2018; Aggarwal et al., 2016).

[16]An alternative explanation is the opaque, oligopolistic market structure, where agent-lenders and custodians could exert market power hindering the informational efficiency of lending fees, which have been shown to be inelastic (Kolasinski et al., 2013), and exhibit large spreads depending on the connectedness of each lender (Duffie et al., 2005; Huszar and Simon, 2018).

increases, suggesting an overall increased lending market activity around the eligibility list inclusion. All the above effects are statistically significant and robust to the various specifications; moreover, we see that the securities lending market activity is highly concentrated in on-the-run, newly-issued corporate bonds.

[Figure 5 about here]

Overall, we see that the eligibility list inclusion not only affects the primary and secondary markets for European corporate bonds, but also the secondary market for collateral. Interestingly though, in the securities lending market on-the-run bonds are borrowed and lent almost exclusively, suggesting that the cash market alone cannot meet the increased need for collateral, pushing banks seeking collateral to borrow from the securities lending market. This also means that corporate bond lending mitigates the collateral shortage by opening a channel through which collateral can be traded, thereby compensating at least partly for the lack of a formal, OTC corporate bond repo market in the Eurozone. Eligibility not only affects the cash market of corporate bonds but by promoting securities lending, but also makes an otherwise incomplete market more cohesive and complete. Furthermore, the existence of corporate bond lending relaxes the constraint of limited collateral supply, and thus makes both the eligibility premium and the liquidity effects that we observe in the secondary bond market smaller. In other words, given the lack of secondary market for collateral, we would observe even larger eligibility premium and liquidity effects in periods of credit crunch and collateral shortages.

5.1.2 The repo market

Theoretically, the repo market could be another channel through which banks can acquire collateral. Nyborg and Roesler (2019), however, report that only about 1% of the total volume of general collateral repo transactions are based on pledged corporate bond collateral. This suggests that the corporate bond repo market is virtually absent in the Eurozone, but for collateralized lending operations provided by the ECB.

We show, that in the absence of an OTC repo market for corporate bonds, collateral eligibility gives rise to a positive externality by improving market functioning and

completeness, as well as significantly increasing demand in the secondary market for collateral, captured by corporate bond lending activity.

5.2 The Secondary Market for Corporate Bonds

5.2.1 Secondary market yield reaction

Following the inclusion of a bond in the ECB's eligible asset list, the demand from banks and other financial institutions seeking adequate collateral will increase in the secondary market. This aim of hedging against unexpected funding liquidity shocks by building up precautionary reserves of collateral is likely to push secondary market yields down. Moreover, eligibility should decrease yields as an eligible asset has a liquidity service, allowing for it to be repeatedly pledged at the central bank against overnight funding (cash). This feature, similar to repo market specialness (Duffie, 1996; Jordan and Jordan, 1997) or Treasury convenience yield (Longstaff, 2004; Krishnamurthy and Vissing-Jorgensen, 2013), should be priced in the bond, pushing yields down by the present value of fungibility. As such, we expect the eligibility list inclusion to have a significant yield effect on the included bonds, which we test by the following regression:

$$Yield\ spread_{bt} = \alpha + \beta_1 EA_b \times Post_{bt} + \beta_2 EA_b + \beta_3 Post_{bt} + \mathrm{B}_b + \Phi_b + \Gamma_t + \epsilon_{bt}, \quad (2)$$

where $Yield\ spread_{bt}$ is the spread at time t on the end-of-day yield-to-maturity of bond b and the maturity-matched risk free rate derived from the German Bund yield curve.[17] The definition of EA and $Post$, as well as the bond controls denoted by B_b are the same as in Equation 1. Φ_b and Γ_t are bond and monthly time fixed effects, respectively.

The results for the difference-in-differences analysis for the period of April 2010 to June 2016 can be found in Table 5. In the first three columns, looking at the overall sample, we find that $EA*Post$ is negative, statistically significant, and robust to the inclusion of various controls and fixed effects. This suggests that once a bond becomes

[17]The risk-free rate is based on the Nelson-Siegel forward curve, where the parameter are estimated from the Bund yield curve and are taken from the website of the Deutsche Bundesbank. We compute the yield spread following Dick-Nielsen et al. (2012). More information can be found in Appendix B.

adequate collateral, its yield decreases by on average 11-24 basis points (bps) relative to its non-eligible counterparts. This result is further confirmed by Figure 6, which depicts the average yield reaction to a bond's list inclusion.

[Table 5 and Figure 6 about here]

In the overall sample, *TTM/tenor* is also highly significant. This variable, close to one if a bond is on-the-run, helps to controls for the initially lower yield of newly-issued bonds, but also suggests an examination of the yield effect in the sub-samples of on-the-run and seasoned bonds.[18] We find that for newly-issued bonds, the yield drop is smaller, around 7 basis points, as opposed to the 15-18 basis point observable for their seasoned counterparts. This pattern is likely due to the fact that on-the-run bonds already have low(er) yields as they tend to be more liquid, while for seasoned bonds, eligibility can revive trading activity by bringing investors' attention to these bonds.

This yield drop is a form of compensation for eligibility that arises due to the fungibility of adequate collateral. This means that once a bond becomes eligible, it acquires cash-like features, due to which it is not only easier to sell, but also, it can be pledged at the ECB in exchange for overnight funding. Furthermore, the magnitude of the eligibility premium is comparable to the estimates of Corradin and Rodriguez-Moreno (2016), who find a 13 bps effect of eligible USD-denominated bonds during the financial crisis, or Todorov (2019) and Grosse-Rueschkamp et al. (2019) focusing on corporate bonds, whose estimated yield reactions to the CSPP purchase announcements are around 30 and 40 bps over 3 and 12 months, respectively. Nevertheless, in the presence of an active secondary market for collateral, such as repo or securities lending, the demand pressure on eligible assets is mitigated, thereby decreasing the magnitude of the eligibility premium. In the absence of these markets, the premium is substantially larger, which is suggested by our larger eligibility premium estimates for seasoned bonds, for which securities lending activity is negligible, even following an eligibility event.

[18] As most bonds get included in the eligibility list shortly after issuance, the majority of the bonds in our sample are on-the-run.

5.2.2 Secondary market liquidity reaction

When a bond becomes eligible, its visibility and subsequently increased demand can give rise to two opposing effects. On the one hand, the newly emerged investor attention leads to higher trading activity; following Pelizzon et al. (2017), we call this the "spotlight effect", which increases market liquidity. On the other hand, banks may have an incentive to locking in eligible assets in their portfolios by increasing holding, which, in turn, reduces the free float of the bond in the market. This "hoarding effect" decreases liquidity and could lead to a liquidity dry-up if bond supply remains unchanged. Determining which of the two effects dominates in case of eligible bonds is an empirical question.

We investigate whether liquidity changes significantly around bond eligibility events in a setting similar to Equation 2. We use two distinct liquidity proxies, the bid-ask spread, measured as the difference between the bonds quoted bid and ask prices, and the percentage of zero returns measure, which we define the percentage of monthly occurrences of zero daily returns. These two measures capture different aspects of liquidity: the bid-ask spread is the standard proxy for trading costs and dealer inventory risk, while the zero returns measure captures the prevalence of infrequent trading. The results for the period of April 2010 to June 2016 can found be in Table 6, where the dependent variables are the bid-ask spread and the percentage of zero returns, in Panels A and B, respectively.

[Table 6 about here]

In Panel A, we find that the bid-ask spread exhibits a mixed sign, with *TTM/tenor* being highly significant. This suggests that on-the-run and seasoned bonds are likely to experience different liquidity reactions. For the sample of on-the-run bonds, the bid-ask spread is highly significant and positive, while for seasoned bonds *EA*Post* is insignificant. Once included in the eligibility list, on-the-run bonds experience an increase in trading costs or a deterioration in liquidity, as their bid-ask spread increases by about 15-21 basis points relative to non-eligible bonds. This seems to be in line with the hoarding effect, while for seasoned bonds we do not observe a significant change in this aspect of liquidity.

Shifting our focus to the percentage of zero return measure in Panel B, we find that in the entire sample the measure robustly and significantly increases, indicating declining liquidity. Looking into the sub-samples, we see that on-the-run bonds, experience their liquidity deteriorate by 4.1-4.5% in comparison to non-eligible bonds. This effect could be driven by banks hoarding adequate collateral, whereas for seasoned bonds, the small sample makes it hard to pin down whether this is the lack of liquidity reaction or an improvement in liquidity due to the spotlight effect.

Overall, we conclude that upon the inclusion in the eligibility list, on-the-run bonds, making up about 90% of our sample, experience a decline in liquidity due to the increased demand and banks' hoarding of pledgeable collateral. For seasoned bonds, we lack the statistical power to document whether the spotlight effect is at work; however by not finding large and pronounced liquidity effects, we show that the eligibility premium documented in the previous section is not an artifact of fungibility, and hence is unlikely to be (solely) driven by liquidity.

5.2.3 Bonds without Securities Lending Activity

In this section, we repeat the yield and liquidity analyses for a subset of bonds that is not available for securities lending. Overall, we have 122 such bonds in our data, out of which 68 bonds become eligible in the sample period, while 54 of them are always in the control group.

We expect that for bond issues without lending activity, both the yield and secondary market liquidity reactions would be more pronounced. Finding empirical support for this hypothesis would also verify our claim that the presence of a secondary market for collateral, the securities lending market for Eurozone corporate bonds, alleviates the collateral shortage by allowing the short-term borrowing of collateral eligible assets. The result for the period of April 2010 to June 2016 can be found in Table 7:

[Table 7 about here]

Table 7 repeats the analyses of the first three columns of Tables 5 and 6. These findings confirm our expectations that for non-lendable bonds, both the yield and liquidity effects

are more pronounced. While the average yield reaction of bond eligible for lending is between 11-24 basis point, this effects is 30-50 basis points for non-eligible bonds, while the bid-ask spread also increases to an extent comparable to on-the-run bonds in Table 6. The effect on the percentage of zero returns is insignificant.

6 Firms' supply response

In the previous section, we analyzed how inclusion in the Eurosystem's collateral framework affects prices, liquidity, and the secondary collateral market demand of eligible corporate bonds. In this section, we exploit the unique feature of the collateral eligibility list that allows us to identify the first inclusion date of an eligible bond issuing firm. We first consider whether issuers (or banks) can anticipate a firm's inclusion in the eligibility list, and then we show how the lack of predictability and the mechanism of the eligibility assessment process helps our identification at the firm level. We proceed thereafter by investigating the debt structure of firms, including the debt composition, debt size and maturity decisions of newly eligible issuers.

6.1 Predictability of the Eligibility List inclusion

To address the potential concern that bond issuing firms or banks holding these assets can foresee and manage their portfolios in expectations of the Eurosystem's eligibility list inclusions, we test the extent to which firm characteristics and other variables can predict inclusion in the eligibility list. We run a bivariate logistic regression on *currently eligible issuer* (CEI), where *CEI* is an indicator variable that equals one, if at least one of the firm's outstanding bonds was an eligible asset during the sample period Q2 2007 and Q2 2016, and zero otherwise. Firm-related information includes sample-averaged balance sheet variables, cash and short-term investments to total assets, gross profit margin, total intangible assets to total assets, net sales to total assets, operating expenses to total assets, and size. Additionally, we include the average issuer's credit rating, provided by

one of the rating agencies, S&P, Moody's, or Fitch.[19] The results for the 127 EIs and 812 non-eligible control firms can be found in Table 8.

[Table 8 around here]

The first columns look at firm characteristics individually, while Columns 8 and 9 are based on pooled multivariate logit regressions. The result suggest that a firm is more likely to become an eligible issuer, if it is more profitable, large(r), and it has more intangible assets and a high(er) credit rating. We also observe, based on the $pseudo-R^2$, that the most important predictor is credit quality (rating), although this variable alone seems insufficient to reliably predict the inclusion outcome. This is due to the the ECB's right to not accept otherwise eligible assets due to i) risk management, ii) operational reasons, or iii) other discretionary measures. Consequently, the eligibility list inclusion is not mechanical and, therefore, not precisely predictable even for issuers, that fulfill all the requirements of the collateral assessment framework.

6.2 Identification Strategy and the Difference-in-Differences Analysis

The Eurosystem's collateral framework allows us to identify the precise inclusion and exclusion dates of individual assets, as well as the first inclusion date at the issuer-level. This is done by pooling all eligible bonds of the same firm and define the earliest inclusion date across the pooled assets as the issuer's treatment date, i.e., prior to this date, none of the firm's bonds were eligible under the collateral framework. Even though the details on the eligibility assessment are stated in the General Documentation Guideline, the Eurosystem never confirms the eligibility of an asset prior to its issuance. In addition, the ECB reserves the right to decline to accept otherwise eligible assets due to risk management and operational reasons, or any other discretionary measures.

An additional challenge is the unobserved firm-bank relationship. According to the ECB, banks are allowed to propose bonds for eligibility assessment if they were not

[19] When multiple ratings are available for the same quarter, we conservatively chose the lowest one before averaging the ratings over time.

already listed. Thus, firms with tight bank relationships might have a supportive partner, who would actively promote a bond's eligibility status attainment.[20] Assuming that a strong firm-bank relationship develops over time, we use firm age to control for this trait. Another, rather predictable, inclusion event, on the other hand, is a credit rating upgrade at the firm level that leads to bond inclusions following the announcement. To avoid any issues concerning such cases, newly eligible issuers that experience a rating upgrade are excluded from the analysis.

Similar to the bond level analyses, our approach to tease out the effect of the eligibility list inclusion at the bond-issuing firm level is based on the difference-in-difference approach. We define the treatment date as the date on which a firm becomes a newly eligible issuer, the the first-time bond eligibility for a given firm. Since the treatments often occur at different times across treated firms, we use the two-way fixed effects DiD model:[21]

$$
\begin{aligned}
CS\_proxy_{f,t} = \qquad & (3) \\
& \alpha + \beta_1 EA_f \times Post_{ft} \times Crisis_t + \beta_2 EA_f \times Crisis_t + \beta_3 Post_{ft} \times Crisis_t \\
& + \beta_4 EA_f \times Post_{ft} + \beta_5 EA_f + \beta_6 Post_{ft} + \beta_6 Crisis_t + \mathrm{B}_{ft} + \Phi_f + \Gamma_t + \epsilon_{ft}.
\end{aligned}
$$

where $CS\_proxy_{f,t}$ is the outcome variable of firm f at time t, EA_f is a time-invariant indicator variable that equals one for treated, and zero for control firms. $Post_{ft}$ is a dummy that equals one for post-treatment periods and is zero otherwise, while the $Crisis_t$ dummy equals one for the period between Q3 2008 and Q2 2009, and is zero otherwise. $X_{f,t}$ are firm-level control variables, while Φ_f and Γ_t are firm and quarter fixed effects, respectively.

We estimate Equation (3) as the baseline specification, to evaluate the effects of firm eligibility, where the firm outcome variables of interest are debt structure, aggregate debt size, cost and debt maturity of treated firms. We study these aspects in a sample in which

[20] According to Belke (2015), NCBs are said to have occasionally violated the assessment of collateral assets' credit standing in favor of banks that submitted the securities.

[21] This follows the work of Wolfers and Stevenson (2006) and Goodman-Bacon (2018).

we require newly eligible issuers to enter the eligible asset list after Q4 2008, and drop them four quarters after the event date.[22] The resulting sample consists of 67 eligible issuers and 370 control firms in total.

We also account for the predictability of inclusion in the eligibility list by adding the estimated inclusion probability from Section 6.1, and for firm heterogeneity by including lagged quarterly balance sheet information.[23] Size (log total assets) and turnover (the ratio between net sales and total assets) control for larger firms' better access to the credit market (Baker and Wurgler, 2002). We add firms' liquidity (cash holdings to total assets) and profitability variables (gross profit margin or selling, general and administrative expense to total assets), and control for the strong positive relation between intangible assets and firms' capital structure by including the ratio of intangible assets to total assets (Lim et al., 2018). We also control for age to capture the unobserved firm-bank relationships, while sector and country controls account for the variations of capital intensity across different industries and capital markets, or bank sector development. The quarter dummies absorb common shocks, as well as help account for the lack of a single treatment date that affects all firms simultaneously.

6.3 Debt structure

While the primary purpose of the Eurosystem's collateral framework is to facilitate bank refinancing operations, Nyborg (2016, 2017) points out that its breadth and depth are likely to affect other financial market participants and the real economy. Following this argument, we postulate that eligibility has an effect on the debt structure of eligible bond-issuing firms. If none of the company's past bond issues were ever eligible under the collateral framework, then the first-time inclusion of its bond is an exogenous and unexpected shock to the issuer. This shock signals that (i) the newly eligible bond is likely to attract a new pool of investors, like banks who want to borrow from the ECB

[22]The inclusion dates of the treated firms vary over time: 34 companies were affected by the ECB's collateral expansion in October 2008, while the other firms are included at different dates between January 2009 and June 2016.

[23]The results are computed using firm information at the ultimate parent-level but they are quantitatively and qualitatively similar both at the issuer and the parent-level.

(Allen and Moessner, 2012), and (ii) its future bond issues are also more likely to become eligible, iii) the yield decrease of eligible bonds make refinancing with bond issuance cheaper, and iv) the demand for pledgeable collateral improves the capital market access of bond-issuing firms. Consequently, an eligibility shock likely affects a firm's beliefs about its future refinancing costs and the demand for its new issuances. This should directly influence the firm's debt financing decisions, shifting from bank financing to the newly favourable public debt issuance channel.

Figures 7 and 8 show the difference in debt structure between eligible and non-eligible issuers. Figure 7 depicts the time-series evolution of how the public to total debt ratio (bond debt share) of the average eligible firm widens following its inclusion in the ECB's collateral framework, relative to the control group of non-treated firms. Figure 8 focuses on the cross-sectional differences of the average eligible versus non-eligible issuers. Panel A shows how the bank debt share of eligible issuers drops following the treatment, while their public debt ratio increases. The average effect suggest that this phenomenon goes beyond substitution, as the increase in public debt exceeds the magnitude of the drop in bank financing. Panel B and Panel C focus on the public and bank debt share distributions of eligible and non-eligible issuers and reveal that prior to the eligibility treatment, eligible and non-eligible firms are rather similar.

[Figures 7 and 8 about here]

Next, we formally evaluate the effects of firm eligibility on its debt structure by using Equation (3). The results for the period of Q2 2007 to Q2 2016 can be found in Table 9, where the dependent variables are the ratio of bank to total debt and public to total debt, in Panels A and B, respectively.

[Table 9 about here]

Panel A, focusing on bank debt share, shows that the firm's first-time eligibility inclusion under the Eurosystem's collateral framework has a significant negative effect on the bank debt share of a firm, triggering a significant decrease of 16.32 to 22.84 percentage points. The triple interaction term, *Eligibility*Post*Crisis*, indicates that this effect is somewhat

weaker during the global financial crisis; howeverm the effect is persistently present. In Panel B, we focus on the public debt share of a firm, and find that the inclusion significantly increases the public debt share, by between 12.44 and 18.94 percentage points. This effect shrinks during the global financial crisis, but even then we observe a slight increase of corporate bond issuance. Both results are robust to the inclusion of various firm characteristics, as well as to firm and quarter fixed effects. Overall, the results suggest that firms gradually restructure their debt composition in response to the positive shock of an eligibility event.

6.4 Aggregate debt size

Given the descriptive evidence in Panel A of Figure 8 and the results of the previous section, the question arises whether the size of firms' aggregate debt is also affected. In other words, do newly eligible issuers substitute bank debt with public debt, or do they increase their overall stock of debt? To answer this question, we analyze Equation 3, with the firm specific outcome variable defined as the firm's total debt normalized by its total assets. The results for the period of Q2 2007 to Q2 2016 can be found in the two panels of Table 10.

[Table 10 about here]

In Panel A, specifications (1) to (3) examine firms' bank debt share, while (4) to (6) the public debt share, both scaled by size, while Panel B looks at total debt to total assets. Panel A demonstrates that our baseline results from Table 9 are robust to scaling: bank debt slightly decreases, although insignificantly so, while public debt shows a highly significant increase following the eligibility announcement. Overall, we find that normalizing debt components by total debt or by total assets does not affect our main findings qualitatively. In Panel B, focusing on the total debt, we show that firms increase their overall debt level in response to the eligibility announcement. We also observe a positive net effect for public debt, meaning that firms do not only substitute bank debt but actually increase their overall level of leverage.[24]

[24]Interestingly, the change in the level of indebtedness does not seem to affect the overall riskiness of

6.5 Debt maturity

As lenders often have discretion over loan terms, like maturity (Roberts and Sufi, 2009), or they can ration firms in loan volume or in loan maturity (Faulkender and Petersen, 2006), public debt financing can be an attractive alternative for eligible companies. These companies already have access to the capital markets, and the increased demand and lower bond yields helps them overcome the financing constraint banks face in a period of credit crunch. According to Baker et al. (2003), firms use debt market conditions in an effort to determine the lowest-cost maturity at which to borrow. Lenel (2017) documents that most risk-tolerant investors hold long-maturity safe assets, which are valued as good collateral.

Banks' demand for ECB-eligible collateral and eligible firms' improved access to the public debt market are likely to push firms towards issuing longer maturity public debt. This behavior is also in line with studies that show how firms act as macro-liquidity providers across debt maturities by filling the supply gaps that can arise due to changes in the maturity structure of government debt (Greenwood et al., 2010; Eidam, 2018) and due to unconventional monetary policy shocks (Foley-Fisher et al., 2016). Descriptive evidence in Panel C in Figure 3 suggests that bond maturity grows over time, which is why we expect newly eligible firms to issue longer-maturity debt. The results for the period of Q2 2007 to Q2 2016 can be found in Table 11.

[Table 11 about here]

We observe that eligible firms issue public debt with relatively longer maturities post treatment, while the effect on bank debt maturity is insignificant. It seems reasonable to conclude that bank debt maturity remains unaffected, since newly eligible issuers tend to capitalize on the new financing channel of the corporate bond market. These results are robust to the inclusion of various firm controls and even the probability of eligibility list inclusion. The highly significant and large increase in bond debt maturity, on the other hand, is also in line with the gap-filling argument, which stems from firms' incentive

firms, as unreported results from analyzing stock market response in stock returns, bid-ask spreads or changes in trading volume show.

to exploit favorable market conditions and obtain relatively more accessible debt with favorable terms.

6.6 Robustness tests

First, we examine how sensitive our analyses are to the timing of the treatment, by including a placebo test, a DiD specification with fictional treatment dates. For each newly eligible issuer, we define a placebo event by lagging the actual treatment date by eight quarters. The placebo treatment effect is then estimated using the baseline model specification. In line with our expectations, we find that the new placebo treatment dates do not have an effect on firms' debt structure. Considering that timing matters, we also investigate whether our findings are driven by any specific time trend. Our main results are also robust to the inclusion of a time trend. From a methodological standpoint, one might argue that the two-way DiD approach is inappropriate for an analysis with varying treatment dates. Thus, we re-estimate the treatment effect by applying a stacked DiD estimation (Gormley and Matsa, 2011), and find that the results are both quantitatively and qualitatively similar to the baseline specifications. In the Online Appendix available upon request, we also present the results for a matched sample analysis, based on the technique of coarsened exact matching. We find that the results are qualitatively similar to those presented in the paper.

7 Conclusion

In this paper, we examine the plethora of implications of central bank collateral policy as a monetary tool in a general setting. More specifically, we study the extent to which corporate bond collateral eligibility induces externalities, which help the Eurosystem to fulfill its policy mandate. By analyzing the ECB's collateral framework, we are able to disentangle the extent to which corporate bond eligibility has an effect on the development of the European capital market through the efficient pricing of corporate bonds, and the subsequent debt financing decisions of firms. Moreover, we are able to disentangle the

direct effect of central bank repo operations on the security lending market, thereby showcasing how the collateral framework improves market completeness, in particular the spillover between the overnight lending facility and the securities lending market.

Our empirical analysis first examines the effect of a corporate bond's inclusion in the ECB's collateral framework, where we find an eligibility premium in bond yields, which compensates for the fungibility of pledgeable collateral. Then, studying the liquidity of eligible bonds, we find that newly-issued more liquid bonds experience a deterioration in liquidity due to scarcity, while the liquidity of old bonds does not change materially. The increased demand from banks seeking pledgeable assets also spills over to the securities lending market, where we find increased lending market activity, both in terms of prices and quantities. In the absence of an OTC repo market for corporate bonds, collateral eligibility gives rise to a positive externality by improving market functioning and completeness, as well as significantly increasing demand in the securities lending market for corporate bonds in the Eurozone.

Finally, we investigate firms financing decisions after they experience their first-time eligibility event under the collateral framework. Our findings suggest that such firms tilt their financing towards public debt: eligible firms tend to increase public debt and reduce their bank debt share. Although the primary role of collateral policy is to affect collateralized lending, we document that eligibility also provides firms with a more favorable market environment for future debt issuances, leading to a public debt-favored corporate debt structure. We further observe that firms not only substitute bank debt with bond debt, but also increase the overall volume of marketable bonds, especially those with longer maturities.

Our empirical results highlight the relevance of corporate bond collateral eligibility and its externalities, which have clear policy implications. We show that enlarging the set of asset classes that central banks accept for open market and collateralized lending operations might provide larger flexibility than the standard practice of open market operations. This also holds for quantitative easing, i.e., buying treasury securities to solve liquidity issues in the repo market, such as those witnessed from time to time in

other jurisdictions. In light of this, the collateral framework could be employed effectively to manage crises by expanding or contracting the size of the eligible asset list as well as the specific set of asset classes therein, following the business cycle.

It is also noteworthy that, on the one hand, including corporate bonds as a collateral eligible asset class gives rise to a positive externality by improving market functioning and completeness, as well as significantly increasing demand in the securities lending market for corporate bonds. On the other hand, corporate bond eligibility helps capital market development and, ultimately proves to be an effective tool to promote the capital market union in the Eurozone. Indeed, collateral pledgeability of corporate bonds has already caused the European corporate bond market to double in size in the past decade, reaching €1.3 trillion or about 10% of the Eurozone GDP by 2018.

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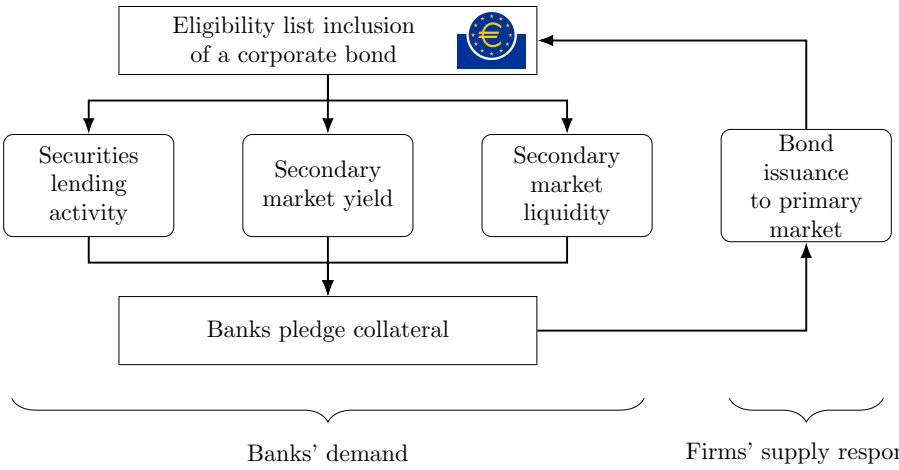
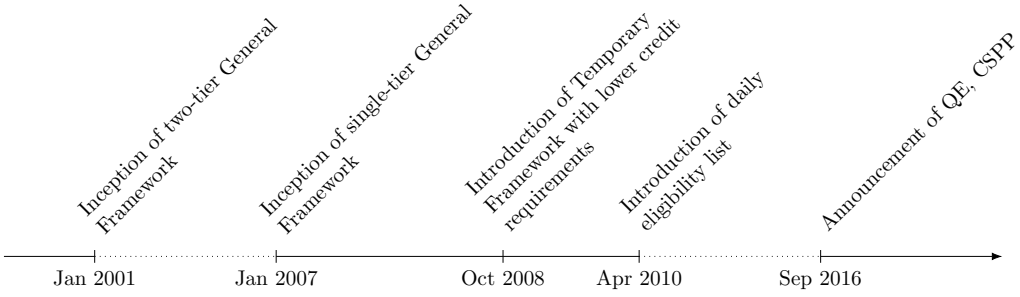
Figures

Figure 1: The Channels of Corporate Bond Pledgeabililty



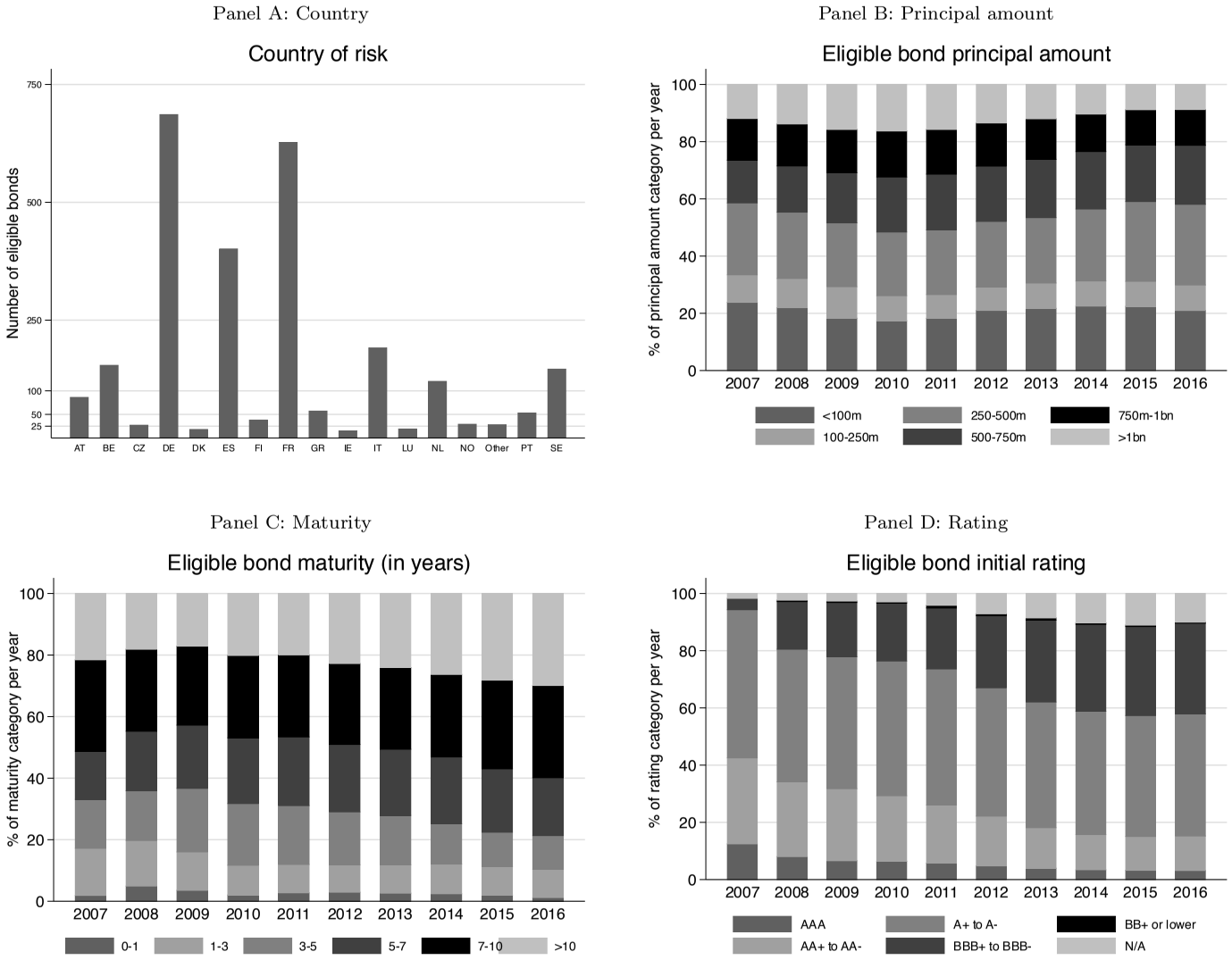
The figure depicts the channels through which increased bank demand affects eligible bonds following their inclusion in the ECB's collateral framework, as well as the firms' reaction to the increased demand for their bonds by adjusting their financing decisions and further increasing bond supply that can later become eligible.

Figure 2: Timeline of Eligibility List



The figure depicts the time evolution of the ECB's General Collateral Framework, the set of rules that determine eligibility criteria in the Eurosystem. We mention only the most significant changes, while more details can be found in Appendix A.

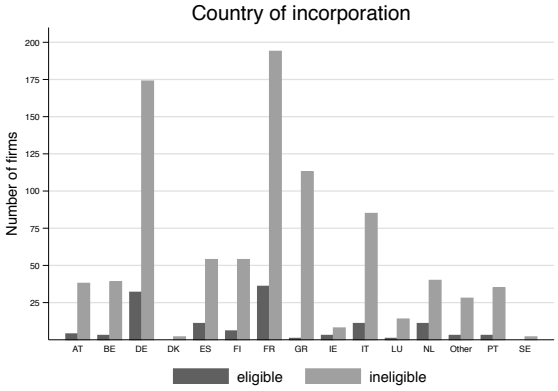
Figure 3: Eligible bond characteristics



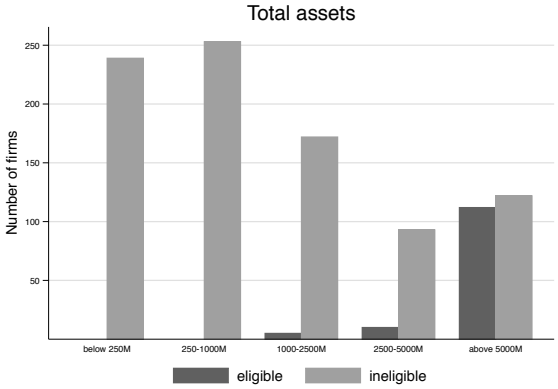
Panel A of the figure presents the distribution of eligible bonds across EEA countries. Panel B reports the distribution of bond issue size over time for the following six categories: below EUR 100 million, 100–250m, 250–500m, 500–750m, and >1bn. Panel C reports the maturity distribution of bonds over time. Maturity is measured as the difference between maturity and issuance date for each corporate bond that was eligible in the period of 2007 and 2016. The bar chart reports six maturity categories: below 1 year, 1 to 3 years, 3 to 5 years, 5 to 7 years, 7 to 10 years, above 10 years. Panel D reports the initial rating distribution over time, where Initial rating is defined as the average initial bond rating from Moody's, S&P and Fitch. Bonds with missing initial ratings are assigned to N/A. All panels are based on the period between April 2010 and June 2016.

Figure 4: Eligible Firm characteristics

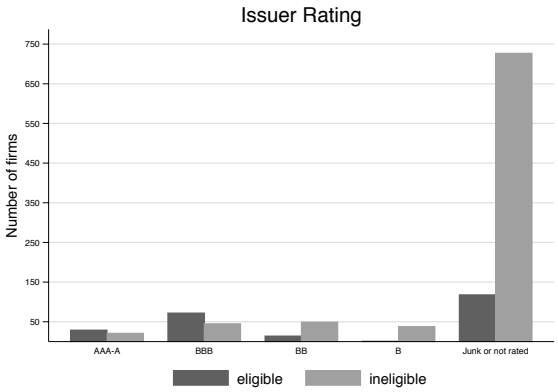
Panel A: Distribution of eligible firms



Panel B: Firm size

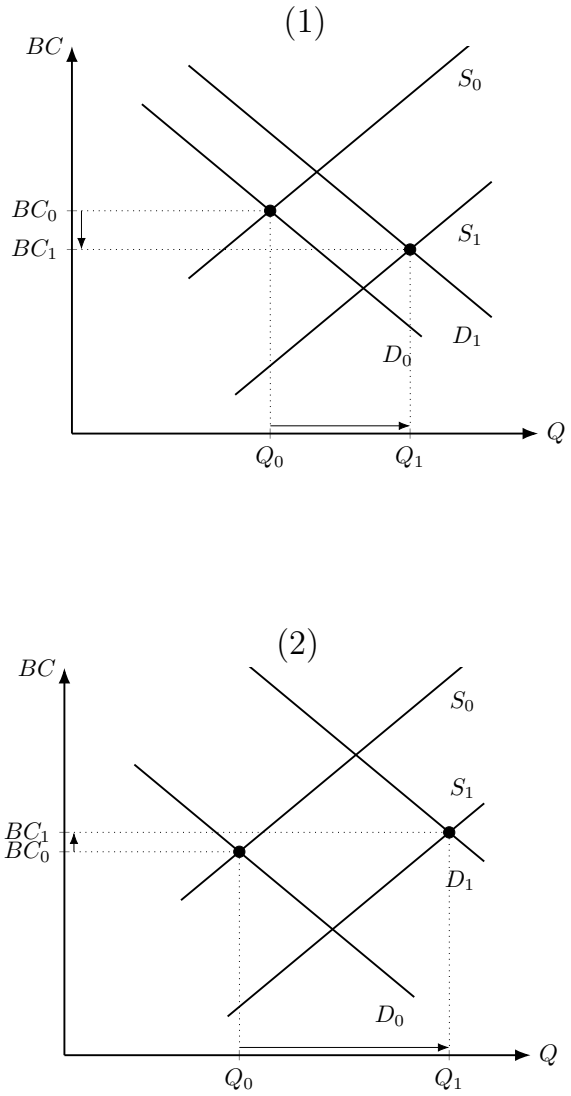


Panel C: Rating



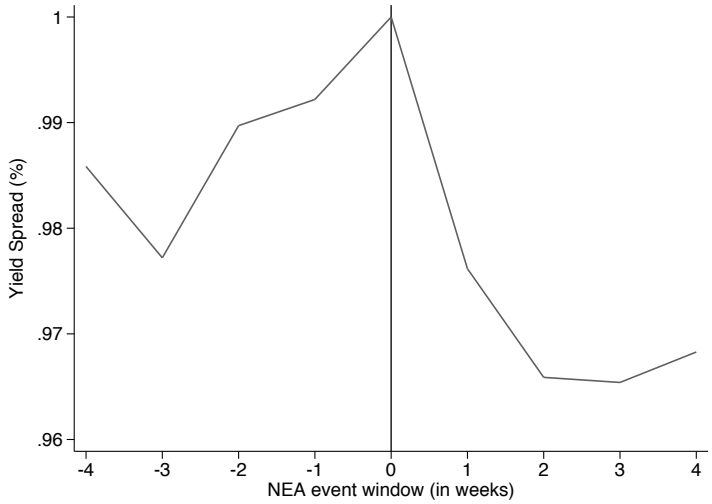
Panel A of the figure presents the distribution of eligible and non-eligible firms across EEA countries. Panel B reports the size distribution across eligible and non-eligible firms, with the following size categories: below 250M, 250-1000M, 1000-2500M, 2500-5000, and above 5000M. Size is measured by total assets and M denotes €mill. Panel C shows the rating distribution acress eligible and non-eligible firms. Initial rating is defined as the average initial bond rating from Moody's, S&P and Fitch, and the following categories are depicted: AAA-A, BBB, BB, B, and Junk or non-rated. We assign firms with missing rating information to Junk or non-rated. All panels are based on the period between Q2 2007 and Q2 2016.

Figure 5: Demand and supply dynamics in the securities lending market



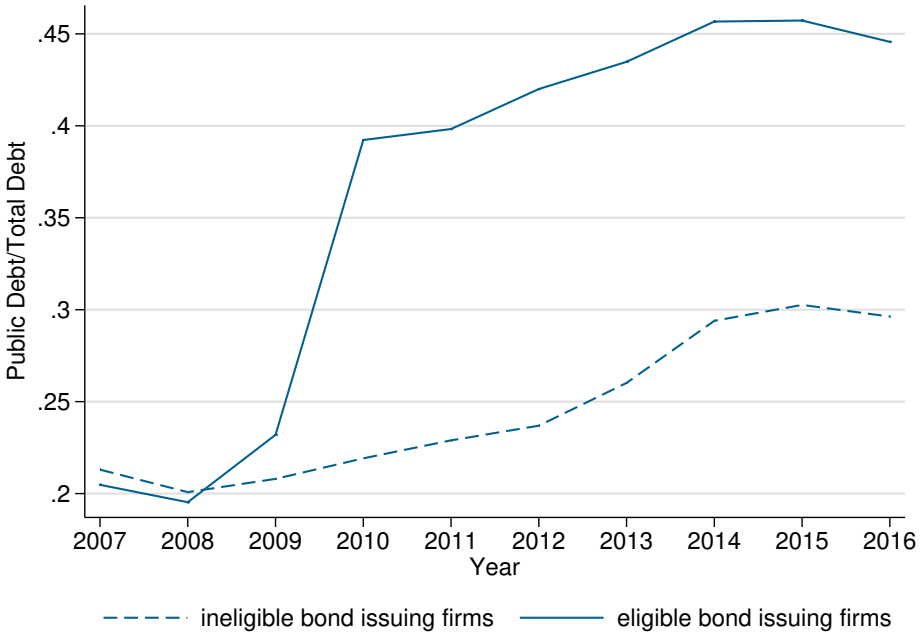
The figure depicts how the securities lending market demand and supply move, and the implications on the resulting equilibrium borrowing costs. In the upper panel, supply increases faster than demand, resulting in a temporary decrease in borrowing cost, while in the lower panel, the increase in demand exceeds that of supply, subsequently pushing the borrowing cost up.

Figure 6: Yield reaction to eligibility list inclusion



The figure depicts the average normalized yield reaction to the eligibility list inclusion of a bond in the following 30 days.

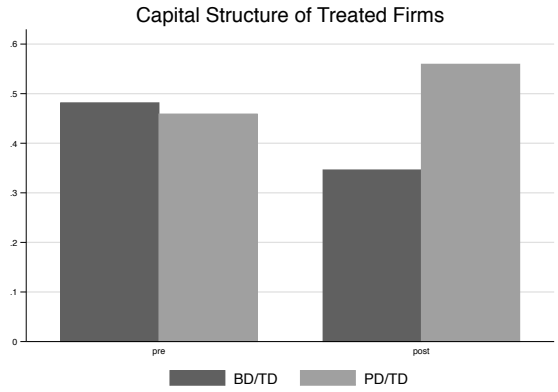
Figure 7: Aggregate public debt to total debt over time, across EI and non-EI



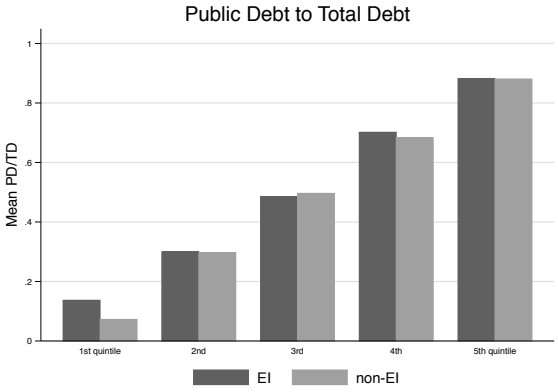
The figure depicts the ratio of public debt to total debt for European firms between Q2 2007 and Q2 2016. The dashed line depicts the average value across all European firms in the Capital IQ database that have issued public debt at least once during the sample period and whose bonds were never eligible under Eurosystems collateral framework, in total 1660 firms. The solid line represents the average public debt share of firms that were either (i) eligible companies at the beginning of the sample, in Q2 2007, or (ii) became eligible during the sample period, 360 firms in total.

Figure 8: Comparative figure of eligible and non-eligible firms

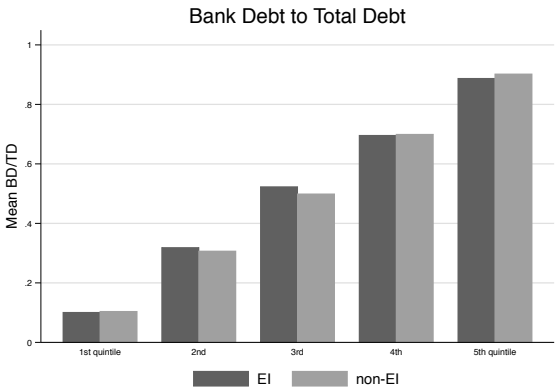
Panel A: Capital Structure of Treated Firms



Panel B: Public Debt to Total Debt



Panel C: Bank Debt to Total Debt



Panel A of the figure compares the capital structure of treated firms pre and post eligibility list inclusion. BD/TD is the bank to total debt, capturing the bank debt share, while PD/TD is the public to total debt or public debt share of the firm. Panel B and C focus on the quintile distribution of the public debt share and bank debt share of eligible and non-eligible firms, respectively.

Table 1: Descriptive Statistics of Corporate Bonds

The table presents the summary statistics of the corporate bond level variables for the period April 2010 to June 2016. *Size* of an issue is measured in €million, the coupon rate is in percentage, while *Age* and *Time-to-maturity* are measured as years since issuance and until maturity, respectively. *TTM/tenor* is the ratio of time-to-maturity to original maturity, a variable between 0 and 1 capturing the on-the-run status of a bond. The credit rating is based on *S&Ps initial rating*. *Yield spread* is the difference between the yield-to-maturity and the maturity matched risk free rate derived from the Bund curve. The *Bid-ask* spread is the difference between bid and ask prices, and the *% of zero returns* measure is defined as the percentage of zero return trading days over a month, both in percentages. *Lendable value* is the supply, while *On Loan* is the demand in the securities lending market, both measured in $million. *Utilization* is the ratio of lending demand over supply, measured as a percentage. *Indicative fee* captures the borrowing costs and are measured in basis points. The data come from Bloomberg and IHS Markit.

Variable	Obs.	Mean	SD	p5	Median	p95
Issue size	113,815	700.000	296.000	300.000	750.000	1,250.000
Coupon	113,815	4.534	1.678	1.875	4.500	7.625
Age	113,815	2.694	2.183	0.000	2.000	7.000
Time-to-maturity	113,815	6.061	5.144	0.762	5.093	14.926
TTM/tenor	113,815	0.644	0.284	0.133	0.689	0.996
S&P initial rating	111,461	BB+	-	BBB-	BBB	A
YieldSpread	113,815	1.598	1.185	0.498	1.213	4.113
Bid-ask spread	112,940	0.534	0.368	0.120	0.465	1.205
% zero returns	113,815	21.748	4.910	20.000	20.000	25.000
Lendable value	113,805	103.000	121.000	0.696	89.400	241.000
On Loan	86,445	9.032	9.959	0.589	5.632	28.400
Utilisation	113,805	7.704	11.410	0.000	3.247	30.951
Indicative fee	86,165	0.007	0.004	0.005	0.006	0.014

Table 2: Descriptive Statistics of Firms

The table presents summary statistics at the firm level capital structure, balance sheet and other accounting information for the period of Q2 2007 and Q3 2016. *Bank (Bond) debt share* are scaled by total assets, *Bank (Bond) debt interest* is the average percentage cost of debt, while *Bank (Bond) debt maturity* is the average maturity of the debt components in months. The accounting variables and total debt are scaled by total assets, unless indicated otherwise. All data come from Compustat and S&P's Capital IQ.

Variable	Obs.	Mean	SD	p5	Median	p95
Bank debt/Total debt	21,826	0.613	0.324	0.040	0.665	1.000
Bank debt maturity	10,099	48.655	34.340	8.885	43.000	108.000
Bank debt interest	5,316	2.116	2.362	0	1.400	6.340
Bond debt/Total debt	20,262	0.311	0.309	0.000	0.235	0.903
Bond debt maturity	7,442	49.777	35.134	9.000	45.355	104.189
Bond debt interest	5,865	3.980	2.510	0.000	4.040	8.100
Total debt/TA	22,159	0.204	0.169	0.007	0.180	0.469
Cash/TA	21,551	0.099	0.078	0.012	0.077	0.264
Gross Profit Margin	21,525	0.362	0.187	0.090	0.343	0.701
Operating Expenses/TA	21539	0.837	0.475	0.203	0.764	1.747
Net sales/TA	21986	0.949	0.575	0.249	0.865	1.918
Intangible assets/TA	22135	0.188	0.172	0.002	0.141	0.533

Table 3: The Effects of Eligibility on Securities Lending Supply and Demand

The table presents the results of daily panel regressions of the event study on the effect of the eligibility list inclusion on bond-level securities lending market proxies. *Lendable value* is the natural logarithm of the value of a given bond available for lending, *On loan* is the logarithm of the amount borrowed of the bond on a given day. *EA* is a dummy that equals one if on a given day a bond is included in the List, and is zero otherwise. *Post* is the 30-day post-treatment window. *TTM/tenor* is the ratio of time-to-maturity to original maturity, a variable between 0 and 1 capturing the on-the-run status of a bond. Bond controls are size, coupon and age of a given issue, and credit rating of the bond. Bond and day fixed effects are included where indicated. The sample period spans April 2010 to Q2 2016. Standard errors are clustered at the bond level and are in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

Panel A: Lendable value

	Overall sample			**On-the-run bonds**			**Seasoned bonds**		
log(lendable)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EA*Post	0.540***	0.188	0.289***	0.123	0.453***	0.393***	0.191**	0.118**	0.024
	[0.147]	[0.154]	[0.026]	[0.152]	[0.143]	[0.035]	[0.074]	[0.054]	[0.019]
Post	-0.029	-0.034**	-0.025**	0.174	-0.257*	-0.029	-0.036**	-0.032**	-0.022*
	[0.018]	[0.016]	[0.011]	[0.136]	[0.137]	[0.021]	[0.017]	[0.015]	[0.011]
EA	-0.534***	-0.462***		-0.002	-0.598***		-0.859**	-0.497	
	[0.196]	[0.177]		[0.194]	[0.159]		[0.360]	[0.352]	
TTM/tenor		0.874**	-0.003						
		[0.436]	[0.497]						
Observations	113,805	113,805	113,803	21,212	21,212	21,210	92,593	92,593	92,591
R-squared	0.036	0.253	0.903	0.095	0.464	0.921	0.041	0.212	0.908
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bond FE	No	No	Yes	No	No	Yes	No	No	Yes
# Bond Clusters	821	821	819	737	737	735	148	148	146

Panel B: On loan

	Overall sample			**On-the-run bonds**			**Seasoned bonds**		
log(onloan)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EA*Post	0.620***	0.354**	0.505***	0.628**	0.546**	0.841***	0.284	0.256	0.291
	[0.150]	[0.156]	[0.115]	[0.243]	[0.264]	[0.232]	[0.267]	[0.259]	[0.233]
Post	0.023	0.030	-0.005	-0.097	-0.068	-0.312	0.028	0.029	0.008
	[0.036]	[0.035]	[0.031]	[0.224]	[0.249]	[0.197]	[0.036]	[0.035]	[0.032]
EA	-0.455***	-0.600***		-0.705***	-0.580**		-0.613**	-0.680**	
	[0.160]	[0.175]		[0.250]	[0.282]		[0.276]	[0.285]	
TTM/tenor		1.178***	3.120***						
		[0.251]	[0.686]						
Observations	86,445	86,445	86,441	15,993	15,993	15,990	70,452	70,452	70,450
R-squared	0.058	0.119	0.344	0.141	0.182	0.676	0.050	0.074	0.279
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bond FE	No	No	Yes	No	No	Yes	No	No	Yes
# Bond Clusters	749	749	745	676	676	673	125	125	123

Table 4: The Effects of Eligibility on Borrowing Costs and Securities Lending Market Utilisation

The table presents the results of daily panel regressions of the event study on the effect of the eligibility list inclusion on bond-level securities lending market proxies. *Indicative fee* is the logarithm of the indicative lending fee in basis points, while *Utilization* is the ratio of on loan to lendable amounts, in percentage. *EA* is a dummy that equals one if on a given day a bond is included in the List, and is zero otherwise. *Post* is the 30-day post-treatment window. *TTM/tenor* is the ratio of time-to-maturity to original maturity, a variable between 0 and 1 capturing the on-the-run status of a bond. Bond controls are size, coupon and age of a given issue, and credit rating of the bond. Bond and day fixed effects are included where indicated. The sample period spans April 2010 to Q2 2016. Standard errors are clustered at the bond level and are in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

Panel A: Borrowing costs

	Overall sample			**On-the-run bonds**			**Seasoned bonds**		
log(Indicative fee)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EA*Post	-0.157***	-0.118***	-0.151***	-0.259***	-0.240***	-0.254***	-0.002	0.016	-0.057
	[0.041]	[0.040]	[0.029]	[0.055]	[0.056]	[0.049]	[0.051]	[0.054]	[0.051]
Post	0.025**	0.025**	0.026***	0.088*	0.082*	0.095**	0.025**	0.026**	0.025**
	[0.010]	[0.010]	[0.010]	[0.047]	[0.048]	[0.040]	[0.010]	[0.011]	[0.010]
EA	0.169***	0.121**		0.256***	0.248***		0.133	0.045	
	[0.048]	[0.049]		[0.064]	[0.065]		[0.083]	[0.084]	
TTM/tenor		0.012	-0.157						
		[0.076]	[0.143]						
Observations	86,165	86,165	86,161	15,876	15,876	15,873	70,289	70,289	70,287
R-squared	0.050	0.092	0.312	0.121	0.133	0.471	0.046	0.098	0.300
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bond FE	No	No	Yes	No	No	Yes	No	No	Yes
# Bond Clusters	747	747	743	674	674	671	125	125	123

Panel B:Utilization

	Overall sample			**On-the-run bonds**			**Seasoned bonds**		
Utilisation	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EA*Post	3.919***	2.957***	2.617***	3.469***	3.780***	3.489***	2.015	1.926	1.089
	[0.712]	[0.809]	[0.590]	[1.184]	[1.120]	[0.841]	[1.574]	[1.557]	[1.307]
Post	-0.062	-0.056	-0.191	0.670	0.130	-1.192*	0.005	0.006	-0.066
	[0.159]	[0.161]	[0.149]	[1.059]	[1.021]	[0.624]	[0.151]	[0.153]	[0.142]
EA	-3.392***	-4.029***		-3.953**	-4.034**		-2.764*	-2.960*	
	[0.980]	[1.237]		[1.797]	[1.712]		[1.455]	[1.628]	
TTM/tenor		4.895**	11.976						
		[2.457]	[7.552]						
Observations	113,805	113,805	113,803	21,212	21,212	21,210	92,593	92,593	92,591
R-squared	0.040	0.051	0.427	0.115	0.127	0.767	0.032	0.037	0.372
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bond FE	No	No	Yes	No	No	Yes	No	No	Yes
# Bond Clusters	821	821	819	737	737	735	148	148	146

Table 5: The Effects of Eligibility on the Secondary Market Yield of Corporate Bonds

The table presents the results of daily panel regressions of the event study on the effect of the eligibility list inclusion on corporate bond yield spreads. *YieldSpread* is the difference between the bond's daily mid yield-to-maturity and the matched risk free yield that is derived form the German Bund curve provided by Bundesbank. *EA* is a dummy that equals one if on a given day a bond is included in the List, and is zero otherwise. *Post* is the 30-day post-treatment window. *TTM/tenor* is the ratio of time-to-maturity to original maturity, a variable between 0 and 1 capturing the on-the-run status of a bond. Bond controls are size, coupon and age of a given issue, payment rank and credit rating of the bond. Bond and month fixed effects are included where indicated. The sample period spans April 2010 to Q2 2016. Standard errors are clustered at the bond level and are in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

	Overall sample			**On-the-run bonds**			**Seasoned bonds**		
Yield spread	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EA*Post	-0.235***	-0.238***	-0.110***	-0.058	-0.002	-0.070**	-0.186**	-0.148*	-0.165***
	[0.070]	[0.089]	[0.017]	[0.166]	[0.135]	[0.032]	[0.080]	[0.079]	[0.038]
Post	0.052***	0.054***	0.066***	-0.095	-0.046	0.041	0.067***	0.063***	0.062***
	[0.010]	[0.010]	[0.006]	[0.145]	[0.117]	[0.030]	[0.008]	[0.008]	[0.006]
EA	0.072	-0.069		-0.117	0.179		0.111	-0.083	
	[0.113]	[0.137]		[0.200]	[0.160]		[0.157]	[0.209]	
TTM/tenor		1.620***	3.111***						
		[0.334]	[1.025]						
Observations	113,815	113,815	113,813	21,212	21,212	21,210	92,603	92,603	92,601
R-squared	0.145	0.272	0.750	0.209	0.611	0.984	0.145	0.186	0.716
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bond FE	No	No	Yes	No	No	Yes	No	No	Yes
# Bond Clusters	821	821	819	737	737	735	148	148	146

Table 6: The Effects of Eligibility on the Secondary Market Liquidity for Corporate Bonds

The table presents the results of daily panel regressions of the event study on the effect of the eligibility list inclusion on secondary market bond liquidity measures. The *BAspread*, is the difference between the bond's quoted bid and ask prices, while the percentage of zero returns, *% zero returns*, is the percentage of monthly occurrences of zero daily returns. *EA* is a dummy that equals one if on a given day a bond is included in the List, and is zero otherwise. *Post* is the 30-day post-treatment window. *TTM/tenor* is the ratio of time-to-maturity to original maturity, a variable between 0 and 1 capturing the on-the-run status of a bond. Bond controls are size, coupon and age of a given issue. Bond and month fixed effects are included where indicated. The sample period spans April 2010 to Q2 2016. Standard errors are clustered at the bond level and are in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

Panel A: Bid-ask spread

	Overall sample			**On-the-run bonds**			**Seasoned bonds**		
Bid-ask spread	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EA*Post	-0.033	-0.085**	0.065***	0.216***	0.205***	0.149**	0.012	0.021	0.038
	[0.035]	[0.041]	[0.016]	[0.072]	[0.071]	[0.061]	[0.046]	[0.045]	[0.043]
Post	0.006	0.007	0.007	-0.161**	-0.134**	-0.088	0.013***	0.012**	0.011***
	[0.006]	[0.005]	[0.005]	[0.068]	[0.067]	[0.060]	[0.004]	[0.005]	[0.004]
EA	-0.072	-0.205***		-0.393***	-0.318***		0.053	-0.060	
	[0.046]	[0.054]		[0.093]	[0.093]		[0.085]	[0.095]	
TTM/tenor		0.760***	0.783***						
		[0.105]	[0.137]						
Observations	112,940	112,940	112,938	20,936	20,936	20,934	92,004	92,004	92,002
R-squared	0.117	0.353	0.752	0.275	0.379	0.860	0.109	0.176	0.752
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bond FE	No	No	Yes	No	No	Yes	No	No	Yes
# Bond Clusters	816	816	814	731	731	729	147	147	145

Panel B: Percentage of zero returns

	Overall sample			**On-the-run bonds**			**Seasoned bonds**		
% zero returns	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EA*Post	1.425***	1.447***	2.816***	4.346***	4.160***	4.571***	-0.147	-0.133	-0.188
	[0.312]	[0.301]	[0.286]	[0.970]	[1.063]	[0.551]	[0.181]	[0.187]	[0.161]
Post	-0.231***	-0.229***	-0.194***	-1.552*	-1.330	-1.574***	0.005	0.002	-0.002
	[0.052]	[0.052]	[0.045]	[0.803]	[0.908]	[0.468]	[0.012]	[0.012]	[0.011]
EA	-3.137***	-3.487***		-7.123***	-6.987***		-0.486	-0.773	
	[0.450]	[0.761]		[0.812]	[0.761]		[0.506]	[0.733]	
TTM/tenor		0.463	-0.352						
		[0.710]	[1.263]						
Observations	113,815	113,815	113,813	21,212	21,212	21,210	92,603	92,603	92,601
R-squared	0.242	0.247	0.540	0.184	0.188	0.843	0.305	0.310	0.517
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bond FE	No	No	Yes	No	No	Yes	No	No	Yes
# Bond Clusters	821	821	819	737	737	735	148	148	146

Table 7: The Effects of Eligibility for Corporate Bonds in the Absence of Securities Lending Activity

The table presents the results of daily panel regressions of the event study on the effect of the eligibility list inclusion for a subset of corporate bonds that are not available for securities lending. The variable definitions are the same as in Tables 5 and 6. Bond controls are size, coupon and age of a given issue, payment rank and credit rating of the bond. Bond and month fixed effects are included where indicated. The sample period spans April 2010 to Q2 2016. Standard errors are clustered at the bond level and are in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

	Yield spread			**Bid-ask spread**			**% zero returns**		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EA*Post	-0.556***	-0.365***	0.049	0.156***	0.182***	0.023	1.737	1.678	0.876***
	[0.131]	[0.130]	[0.037]	[0.048]	[0.051]	[0.058]	[1.407]	[1.382]	[0.311]
Post	0	-0.005	0.001	-0.022***	-0.026***	-0.024***	0.079	0.079	0.063
	[0.008]	[0.008]	[0.004]	[0.008]	[0.008]	[0.007]	[0.091]	[0.092]	[0.050]
EA	0.043	0.049		-0.209***	-0.346***		-0.072	-0.112	
	[0.203]	[0.181]		[0.071]	[0.071]		[0.493]	[0.549]	
TTM/tenor		0.306	1.974		1.202***	3.265**		0.462	-0.393
		[0.584]	[1.369]		[0.215]	[1.344]		[0.519]	[1.217]
Observations	35,052	35,052	35,052	30,524	30,524	30,524	35,052	35,052	35,052
R-squared	0.288	0.411	0.726	0.071	0.218	0.384	0.347	0.347	0.923
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bond FE	No	No	Yes	No	No	Yes	No	No	Yes
# Bond Clusters	122	122	122	110	110	110	122	122	122

Table 8: The Probability of Eligibility Inclusion

This table presents the logistic regression results of firm-level characteristics predicting a firm's eligibility status for the period between Q2 2007 to Q2 2016. *CEI* equals one if in a given quarter any of a firm's outstanding bonds are included in the List, and is zero otherwise. The independent variables are firms' quarterly balance sheet information (log(total assets), gross profit margin, cash holdings, intangible assets, operating expenses, and sales – the latter four are normalized by total assets), firm rating (a firm rating is defined as the lowest current local, long-term issuer's credit rating provided by either S&P, Moody's, or Fitch - categories: AAA–A, BBB, BB, B, lower than B- or unrated), firm age (categories: 0–10, 11–20, 21–50, 51 and above years), firm's sector of operation, and country of incorporation. Quarter fixed effects are included where indicated. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% level, respectively.

CEI	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cash/TA	-2.0958***							-1.2315***	-0.2204
	[0.3214]							[0.4508]	[0.5323]
Gross profit margin		0.5565***						0.0341	0.3451**
		[0.0784]						[0.1435]	[0.1497]
Intangible assets/TA			2.1712***					1.0380***	1.6369***
			[0.1154]					[0.1706]	[0.2104]
Net sales/TA				-1.4498***				1.8893**	2.4642**
				[0.0808]				[0.7611]	[1.0240]
Operating expenses/TA					-1.7973***			-2.4075***	-2.7653***
					[0.0918]			[0.8205]	[1.0590]
Log(TA)						1.2519***		0.9111***	1.1304***
						[0.0235]		[0.0294]	[0.0385]
B							-0.4843	-1.1619**	-1.2252**
							[0.5087]	[0.5123]	[0.5200]
BB							2.3554***	0.9669***	0.8580***
							[0.1292]	[0.1370]	[0.1463]
BBB							4.3479***	2.5692***	2.5774***
							[0.0955]	[0.1026]	[0.1077]
AAA–A							4.7199***	2.4222***	2.3130***
							[0.1020]	[0.1150]	[0.1250]
Age	No	No	No	No	No	No	No	No	Yes
Country	No	No	No	No	No	No	No	No	Yes
Quarter FE	No	No	No	No	No	No	No	No	Yes
Rating	No	No	No	No	No	No	Yes	Yes	Yes
Sector	No	No	No	No	No	No	No	No	Yes
Observations	26,270	26,270	26,270	26,270	26,270	26,270	26,270	26,270	26,113
Pseudo R2	0.00334	0.00387	0.0238	0.0305	0.0380	0.404	0.394	0.493	0.505

Table 9: Firms' supply response: Corporate debt structure

The table presents DiD estimates for European firms for the period between Q2 2007 to Q2 2016. In Panel A (Panel B), the dependent variable is defined as the ratio of bank debt (public debt) to total debt. *Prob(CEI)* is the probability of inclusion for a given firm in a given quarter, following Table 8. The dummy variable *EI* equals one if a firm belongs to the group of treated firms, and is zero otherwise. All model specifications consider corporate bond issuers that experienced an NEI event in or after Q4 2008. *Post* equals one for the quarter of treatment and the four consecutive post-treatment quarters. Treated firms are excluded from the sample one year after treatment. The *Crisis* dummy indicates the period Q3 2008 to Q2 2009. Firm controls include lagged quarterly balance sheet information: log(total assets), gross profit margin, cash holdings, intangible assets, operating expenses, and sales – the latter four are normalized by total assets, firm age buckets (0–10, 11–20, 21–50, 51 and above years), firm's sector of operation, and country of incorporation. Firm and quarter fixed effects are included where indicated. Standard errors are clustered at the bond level and are in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

Panel A: Bank Debt/Total Debt

Bank Debt/Total Debt	(1)	(2)	(3)	(4)	(5)	(6)
EI*Post	-0.1632**	-0.1802***	-0.2000***	-0.2138***	-0.2264***	-0.2284***
	[0.0634]	[0.0600]	[0.0534]	[0.0525]	[0.0505]	[0.0499]
EI*Post*Crisis	-0.0789	-0.0574	0.1057**	0.1135***	0.1471***	0.1417***
	[0.0761]	[0.0744]	[0.0414]	[0.0409]	[0.0390]	[0.0386]
EI*Crisis	0.0585	0.0572	0.0111	0.0078	0.0143	0.0124
	[0.0560]	[0.0565]	[0.0245]	[0.0251]	[0.0248]	[0.0251]
Post*Crisis	0.0140		0.0447***	0.0253**		
	[0.0137]		[0.0121]	[0.0123]		
Crisis	0.0227**		0.0122	0.0174**		
	[0.0090]		[0.0076]	[0.0078]		
EI	0.0034	0.0074				
	[0.0600]	[0.0594]				
Post	-0.0106		-0.0593***	-0.0370***		
	[0.0140]		[0.0132]	[0.0134]		
Prob(CEI)	-0.0167	-0.0403	0.0703	0.0881	0.0248	0.0470
	[0.0834]	[0.0835]	[0.0658]	[0.0663]	[0.0631]	[0.0644]
Firm Controls	Yes	Yes	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	No	No	Yes	Yes
SE	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.
Firm Clusters	826	826	813	813	813	813
Observations	18,318	18,318	18,305	18,305	18,305	18,305
R-squared	0.1602	0.1670	0.6081	0.6152	0.6148	0.6201

Panel B: Public Debt/Total Debt

Public Debt/Total Debt	(1)	(2)	(3)	(4)	(5)	(6)
EI*Post	0.1244**	0.1545***	0.1599***	0.1753***	0.1880***	0.1894***
	[0.0626]	[0.0598]	[0.0517]	[0.0503]	[0.0487]	[0.0476]
EI*Post*Crisis	0.0689	0.0362	-0.0949**	-0.1035**	-0.1390***	-0.1326***
	[0.0769]	[0.0759]	[0.0431]	[0.0422]	[0.0416]	[0.0409]
EI*Crisis	-0.0495	-0.0429	-0.0094	-0.0066	-0.0152	-0.0136
	[0.0560]	[0.0567]	[0.0270]	[0.0272]	[0.0282]	[0.0279]
Post*Crisis	-0.0277**		-0.0496***	-0.0276**		
	[0.0123]		[0.0112]	[0.0114]		
Crisis	-0.0207**		-0.0123*	-0.0175**		
	[0.0082]		[0.0072]	[0.0075]		
EI	0.0403	0.0279				
	[0.0602]	[0.0596]				
Post	0.0328**		0.0690***	0.0430***		
	[0.0128]		[0.0122]	[0.0124]		
Prob(CEI)	-0.0435	-0.0166	-0.0932	-0.1112	-0.0385	-0.0610
	[0.0860]	[0.0867]	[0.0682]	[0.0682]	[0.0637]	[0.0651]
Firm Controls	Yes	Yes	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	No	No	Yes	Yes
SE	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.
Firm Clusters	826	826	813	813	813	813
Observations	18,318	18,318	18,305	18,305	18,305	18,305
R-squared	0.1680	0.1789	0.6319	0.6404	0.6430	0.6484

Table 10: Firms' supply response: Debt size

The table presents DiD estimates for European firms for the period between Q2 2007 to Q2 2016. In Panel A, specification 1 to 3 (spec. 4 to 6), the dependent variable is defined as the ratio of bank debt (public debt) to total assets. In Panel B, the dependent variable is the ratio of total debt to total assets. *Prob(CEI)* is the probability of inclusion for a given firm in a given quarter, following Table 8. *EI* equals one for treated firms, and is zero otherwise. All model specifications consider corporate bond issuers that experienced an NEI event in or after Q4 2008. *Post* equals one for the quarter of treatment and the four consecutive post-treatment quarters. Treated firms are excluded from the sample one year after treatment. *Crisis* indicates the period Q3 2008 to Q2 2009. Firm controls include lagged quarterly balance sheet information (log(total assets), GPM, cash, intangible assets, operating expenses, and sales – the latter four are normalized by total assets), firm age, sector, and country of incorporation. Firm and quarter fixed effects are included where indicated. Standard errors are clustered at the bond level and are in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

Panel A: Debt structure

	Bank Debt/Total Assets			**Public Debt/Total Assets**		
	(1)	(2)	(3)	(4)	(5)	(6)
EI*Post	-0.0097	-0.0010	-0.0143	0.0578***	0.0552***	0.0642***
	[0.0269]	[0.0189]	[0.0177]	[0.0190]	[0.0190]	[0.0178]
EI*Post*Crisis	-0.0133	0.0240	0.0313**	0.0189	-0.0232	-0.0434***
	[0.0312]	[0.0165]	[0.0147]	[0.0227]	[0.0177]	[0.0168]
EI*Crisis	-0.0040	-0.0037	-0.0032	-0.0057	0.0021	0.0022
	[0.0258]	[0.0123]	[0.0114]	[0.0112]	[0.0083]	[0.0080]
Post*Crisis	-0.0027	0.0155**		-0.0217***	-0.0273***	
	[0.0083]	[0.0070]		[0.0055]	[0.0048]	
Crisis	0.0055	0.0046		-0.0009	0.0053*	
	[0.0062]	[0.0053]		[0.0036]	[0.0031]	
EI	-0.0353			0.0000		
	[0.0232]			[0.0137]		
Post	0.0050	-0.0227***		0.0238***	0.0284***	
	[0.0081]	[0.0068]		[0.0051]	[0.0047]	
Prob(CEI)	-0.0340	-0.0285	-0.0171	-0.0630**	-0.0513***	-0.0262
	[0.0463]	[0.0262]	[0.0244]	[0.0304]	[0.0193]	[0.0188]
Firm Controls	Yes	No	Yes	Yes	No	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Quarter FE	No	No	Yes	No	No	Yes
SE	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.
Firm Clusters	826	813	813	826	813	813
Observations	18,318	18,305	18,305	18,318	18,305	18,305
R-squared	0.1176	0.6747	0.6867	0.1863	0.6593	0.6716

Panel B: Debt size

Total Debt/Total Assets	(1)	(2)	(3)	(4)	(5)	(6)
EI*Post	0.0482*	0.0665***	0.0542***	0.0479***	0.0528***	0.0499***
	[0.0253]	[0.0246]	[0.0174]	[0.0175]	[0.0163]	[0.0165]
EI*Post*Crisis	0.0056	-0.0132	0.0008	-0.0020	-0.0028	-0.0121
	[0.0312]	[0.0311]	[0.0139]	[0.0141]	[0.0123]	[0.0126]
EI*Crisis	-0.0097	-0.0013	-0.0015	-0.0010	-0.0016	-0.0011
	[0.0244]	[0.0242]	[0.0133]	[0.0127]	[0.0128]	[0.0119]
Post*Crisis	-0.0244***		-0.0118	-0.0186**		
	[0.0092]		[0.0075]	[0.0079]		
Crisis	0.0047		0.0099*	0.0143**		
	[0.0064]		[0.0056]	[0.0058]		
EI	-0.0352	-0.0456**				
	[0.0222]	[0.0220]				
Post	0.0287***		0.0057	0.0140**		
	[0.0089]		[0.0070]	[0.0071]		
Prob(CEI)	-0.0971*	-0.0922*	-0.0797***	-0.0588**	-0.0700**	-0.0433
	[0.0563]	[0.0558]	[0.0301]	[0.0284]	[0.0307]	[0.0288]
Firm Controls	Yes	Yes	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	No	No	Yes	Yes
SE	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.	Firm Cl.
Firm Clusters	826	826	813	813	813	813
Observations	18,318	18,318	18,305	18,305	18,305	18,305
R-squared	0.1472	0.1532	0.6969	0.7058	0.6987	0.7088

Table 11: Firms supply response: Debt maturity

The table presents DiD estimates for European firms for the period between Q2 2007 to Q2 2016. The dependent variables, bank and public debt maturity, are defined as the outstanding debt amount-weighted average number of months to maturity in a given quarter. *Prob(CEI)* is the probability of inclusion for a given firm in a given quarter, following Table 8.*EI* equals one for treated firms, and is zero otherwise. All model specifications consider corporate bond issuers that experienced an NEI event in or after Q4 2008. *Post* equals one for the quarter of treatment and the four consecutive post-treatment quarters. Treated firms are excluded from the sample one year after treatment. *Crisis* indicates the period Q3 2008 to Q2 2009. Firm controls include lagged quarterly balance sheet information: log(total assets), GPM, cash, intangible assets, operating expenses, and sales – the latter four are normalized by total assets), firm age, sector, and country of incorporation. Firm and quarter fixed effects are included where indicated. Standard errors are clustered at the bond level and are in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

	Bank Debt Maturity			**Public Debt Maturity**		
Debt maturity	(1)	(2)	(3)	(4)	(5)	(6)
EI*Post	2.6424	3.8651	3.8718	20.5009***	21.3645***	14.2390***
	[4.5590]	[4.0168]	[3.3499]	[3.2424]	[2.8753]	[2.3212]
EI*Post*Crisis	-1.8608	-2.9960	2.6645	-11.0378	-25.5935***	-12.1107**
	[11.7604]	[8.2452]	[7.4482]	[8.5322]	[6.1599]	[5.5377]
EI*Crisis	-8.5304	-10.6018*	-8.0096	-10.3075*	-1.4387	-3.2408
	[7.5471]	[5.8667]	[5.2550]	[5.7798]	[4.4360]	[3.9569]
Post*Crisis	6.6881	6.4474*		6.8076	14.3946***	
	[4.4859]	[3.5987]		[4.8323]	[3.4689]	
Crisis	11.7446***	12.1192***		1.8726	-3.2278	
	[3.5407]	[3.0114]		[3.7633]	[2.7689]	
EI	-2.9227			-14.4001***		
	[3.2797]			[2.5775]		
Post	-2.2734	-5.6841**		-6.7747***	-15.3873***	
	[2.0905]	[2.2172]		[1.8390]	[1.8001]	
Prob(CEI)	-0.2101	7.8703	0.7092	1.9961	21.7836***	11.7651***
	[5.3022]	[6.4958]	[6.3305]	[3.7051]	[4.3938]	[4.5463]
Firm Controls	Yes	No	Yes	Yes	No	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Quarter FE	No	No	Yes	No	No	Yes
SE	Rob.	Rob.	Rob.	Rob.	Rob.	Rob.
Observations	7,511	7,487	7,487	7,511	7,487	7,487
R-squared	0.0751	0.5448	0.5814	0.1282	0.6093	0.6416

Appendices

A The Eligibility List

The ECB has three main monetary instruments: open market operations, the minimum reserve system and standing facilities. The ECB, like any other central bank, uses these tools to affect short-term money market rates and to provide liquidity to banks. In practice, monetary policy tools are implemented by national central banks (NBCs), who interact with eligible counterparties. These institutions are subject to a minimum reserve system and are supervised by a European Economic Area (EEA) national authority to ensure a financially sound operation.

The Statute of the European System of Central Banks (ESCB or Eurosystem) requires all Eurosystem credit operations to be based on adequate collateral. As such, collateral policy plays a vital part in the overnight and unlimited liquidity providing, i.e. full allotment, marginal lending facility, or standing facility. The guidelines and criteria for assets to be eligible as adequate collateral can be found in the General Documentation (GD) Guideline (ECB/2014/60) for the General and Temporary Frameworks of the ECB.[25]

The Eurosystem's collateral framework has evolved over time, as Figure 2 indicates. It was implemented at the inception of the euro area, the first version of the General Framework was published in January 2001. Since then, however, the collateral eligibility criteria for corporate bonds and other asset types underwent both permanent and temporary adjustments.[26]

Permanent adjustments were introduced to streamline the general collateral requirements, while certain criteria remained unchanged. For instance, for an asset

[25]The details on the eligibility assessment are stated in the General and the Temporary Frameworks, that can be found on the ECB website: `https://www.ecb.europa.eu/ecb/legal/1002/1014/html/index-tabs.en.html`.

[26]Additional to the Eurosystem central banks, the following central banks accept corporate bonds as collateral: Reserve Bank of Australia (minimum credit rating of AAA required), Bank of Canada, Bank of Japan, Bank of Sweden, Swiss National Bank and the Federal Reserve System (refer to BIS, 2013). Among those, only the Eurosystem and the Bank of Japan accept a non-negligible proportion of corporate debt to the total size of eligible assets.

to become eligible collateral in the Eurosystem, it is required that it is issued in the European Economic Area (EEA) by an issuer incorporated in either the EEA or one of the non-EEA G10 countries. Eligible assets have to trade on regulated markets or on unregulated markets that are accepted by the ECB. In general, the currency of eligible assets is the Euro, although assets issued in U.S. dollar, pound sterling and Japanese yen were temporarily accepted between October 2008 and December 2010 and reintroduced in September 2012 until further notice. The coupon type is preferably fixed, however in November 2012 the coupon criterion was further streamlined by (i) excluding complex coupon structures and inverse floaters, and (ii) requiring floating-rate coupons to be linked to a single standard Euro interest rate reference or euro area inflation index.

Apart from smaller amendments, the next significant adjustment to eligibility criteria was the introduction of the Temporary Framework, a form of monetary policy response to the challenging market environment of the financial crisis and subsequent European debt crises. In this period rating requirements were under special attention: on 15 October 2008, the ECB announced a temporary reduction of the minimum rating requirement from A- to BBB- until the end of 2009. On 7 May 2009, the ECB extended the new rating requirement until the end of 2010. This Temporary Framework is still in place to date.

In order for an asset to be included in the eligibility list, the ECB applies valuation and credit principles, which can be found in more detail in Eberl and Weber (2014) and Bindseil et al. (2017). However, what is especially important for our analysis, is that according to Article 58(6), the eligibility assessment begins only after the asset is issued and when all the necessary documentation is available to the respective national central bank, which typically takes about 30 days. Although the national central banks automatically assess the eligibility of a bond after its issuance, there are cases when a bond is not covered by the NCB. In this case, it is the borrowing bank that proposes an asset to be assessed for eligibility. This can happen during the lifetime of the bond which is one of the reasons for bonds being included months or even years after issuance date. Additionally, NCBs might lack the relevant bond documentation which can prolong the

assessment process for months. In addition, sometimes bonds experience a rating upgrade, due to which new assessment is required.

The documentation that has to be provided by banks are (i) the letter of rating from the rating agencies, (ii) rating agencies' pre-sale reports, (iii) final offering circulars for the transaction, (iv) ISIN codes of the security, Reuters/Bloomberg page codes, and (v) confirmation of New Global Note (NGN), if applicable. This means that the Eurosystem never confirms the eligibility of an asset prior to its issuance and, thus, market participants cannot reliably predict based on prior beliefs the outcome of the assessment when an asset starts trading in the market. Additionally, the ECB reserves the right to not accept eligible assets due to (i) risk management reasons, (ii) operational reasons, and (iii) any other discretionary measures, as described in Articles 59(6) and 128(2), Article 144, and Article 159 of the GD ECB/2014/60, respectively. This information is the cornerstone of our identification strategy presented in Section 6.2.

As a result of the ECB's collateral strategy, in comparison to other central banks, it maintains the largest and most diverse list of eligible marketable assets. Over the sample period 2007 to 2016, the List is comprised, on average, of about 35,000 securities, with the shortest listing of about 25,000 securities observed in June 2007, and a peak of about 51,000 securities in November 2008. Since the end of 2008, the overall size of the List gradually declines.

The sample period spans the period of 2007 and 2016, namely the time between the introduction of the single tier eligibility list and the announcement of the Corporate Sector Purchase Program as part of the QE of the ECB. Within this period, we focus most of our analyses on the sub-period between April 2010 and Q2 2016, where the eligibility list is published at a daily frequency, as opposed to the monthly regularity prior to 2010. This allows us to precisely pin down the treatment date, i.e. the eligibility list inclusion of individual corporate bonds or the first time list inclusion of issuers of those bonds. Our focus is on eligible corporate bonds, which represent about 6% (equivalent to an average of 1450 individual securities) of all eligible corporate bonds. The monthly corporate bond turnover in the eligibility list – measured as the ratio between the sum of excluded and

newly included securities to the total number of securities in the previous month – is about 7%.[27]

B Data Appendix

B.1 Databases

The data of this study come from various sources:

- The main databases are **Compustat** and **Dealscan** that we use to establish our universe of non-financial firms, which we access via Thomson Reuters EIKON. Information from Reuters SDC and Dealscan allow us to classify debt into 7 categories, following Rauh and Sufi (2010) and Grosse-Rueschkamp et al. (2019).

- We obtain general bond information and daily price data for European corporate bonds from **Bloomberg**. We download the following data items: bond characteristics (coupon, issue/maturity date, outstanding amount), corporate bond yields, bond market controls, and bid-ask spreads for the period of 2007 to 2016.

- For each bond issuer, we collect quarterly debt information from **Standard&Poor's Capital IQ** and merge these data with firm characteristics obtained from Compustat. We exclude from our sample any bonds with issuer industry banks or financial. Starting with the whole available universe of European companies and EUR denominated bonds in both datasets, we filter and drop firms and bonds with insufficient data.

- Using the **FactSet**, we collect the historical monthly ABS rating changes published by Moody's (MDR_RATING_INFO) and S&P (SPR_RATING_INFO) for the period 1997 to 2016. In general, Moody's covers a much larger proportion of our security universe than S&P. The bottleneck of our analyses, is that that monthly ratings sample is limited. This issue we resolve by using the bonds' initial ratings, as a

[27] When computing the turnover, we do not take into account instances when securities are temporarily excluded from the eligibility list for several days or weeks within a given month.

static bond-level characteristic in our regressions. We standardize the ratings of the four international rating agencies according to a step-wise decreasing scale: we assign to a AAA+ rating the value 19, to AAA 18, and so on. Since the ECB usually requires a certain rating for an eligible asset by at least one of the rating agencies (e.g. an A- rating by at least one of the three international rating agencies), we decide to take the maximum rating of the four as our final initial bond rating.

- The **ECB**'s website provides us with the list of eligible marketable assets (May 2007 - 2016, monthly/daily) and the Securities Holdings Statistics by Sector (SHSS), accessible via `https://www.ecb.europa.eu/stats/money/shs/html/index.en.html` (2013Q4-2016Q2)

- The website of the **Deutsche Bundesbank**, where we obtain the Nelson-Siegel-Svensson paramater estimates, that we use to extrapolate the maturity-matched, German Bund based risk-free curve, to calculate the yield spread, variable *YieldSpread*, used to show bond level eligibility effects.[28]

- From **IHS Markit**, we get proprietary securities lending data for prices (borrowing cost) and quantities (supply and deman, utilization) at the individual bond level.

The bond and firm level variables are winsorized at the 1 and 99 percent level to minimize the influence of extreme outliers.

B.2 Bond selection

Since the liquidity of bonds is crucial for bond pricing (Driessen, 2005; Amato and Remolona, 2003; Bao et al., 2011), we only include bonds with an issue size of at least 150 million U.S. dollars equivalent. The price of smaller issues might get distorted by a liquidity premium. We recalculate 22 local currencies with their exchange rate at the respective date of new issue into U.S. dollars. Using corporate bond characteristics that were collected from Bloomberg, we obtain up to three different issuing firm identifiers

[28] Download link: `http://www.bundesbank.de/Navigation/EN/Statistics/Time_series_databases/Money_and_capital_markets/money_and_capital_markets_list_node.html?listId=www_skms_it03c`.

for each bond. The first–issuer-level–identifier refers to the firm that is reported as the immediate issuer of the bond. It is not unusual for a firm to issue debt through a specially established financing subsidiary due to tax purposes. Consequently, firms at issuer-level are not necessarily representative of the actually bond issuing firm. Thus, we define the second–parent-level–identifier as the reported parent company of the issuer-level firm. The third–ultimate parent-level–identifier is the ultimate parent company of the issuing firm.

This firm-level information for each bond allows us to merge bond level information with firm-specific data. Namely, we obtain the firms' quarterly debt and balance sheet information from Compustat's Capital IQ database.. We use the corporate bond sample from the ECB's list of eligible marketable assets to identify any non-eligible bonds of the same corporate bond issuers. For this purpose, we use each bond's ISIN to collect the issuer's legal entity identifier (Bloomberg field ID: ID252) and bond issuer's equity ticker (if not available, its direct parent company's) and exchange code (DS671) via Bloomberg. The exchange code is only available for listed companies, while the equity ticker is also provided for privately held companies. We utilize both fields to identify any bonds that are associated with either of the two.

We employ Bloomberg's SRCH function and conduct manual searches where appropriate, to download bond-level, characteristic (henceforth static) information for all EUR denominated bonds with maturity year after 2007, fixed rate coupon type (DS086), and bullet type maturity (DS092). The static variables include issuance date (DS031), maturity date (DS035), amount issued (DS218), coupon (DS033), coupon frequency (DS034), first coupon payment date (MM020), maturity/refund type (DS092), country of risk (DX129), payment rank (DY381), Moody's initial rating (RN205), Moody's initial rating date (RN206), S&P's initial rating (RN207), S&P initial rating date (RN208), Fitch's initial rating (RN209), Fitch's initial rating date (RN210), DBRS initial rating (RN211), DBRS initial rating date (RN212), market issue (DS061), ultimate parent country of risk (DY010), country of incorporation (DX650), currency (DS004), announce date (DS219), company is private (DY539), issuer name (DS134), issuer parent equity

ticker (DS671), and industry group (DS201). The exact definitions of the stated variables can be viewed in Bloomberg using FLDS <go>.

After some inspection of the sample, we exclude any bonds with issuer industry specification (DS008) "BANK" or "FINANCIAL" and keep only bonds with rank of payment priority (DY381) "Sr. Unsecured" or "Unsecured". For each bond in the sample, we download daily yield to maturity (YLD_CNV_LAST), the bid (PX_BID) and ask prices (PX_ASK) using Bloomberg Valuation Services (BVAL) as our source. BVAL combines data from various pricing sources, such as TRACE, Municipal Securities Rulemaking Board (MSRB), exchanges and broker quotes.

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