Not Equally Special: Collateralised Trading of Nonbanks*

Angela Maddaloni, Hee Su Roh

This version: November 20, 2021

PRELIMINARY DRAFT

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Abstract

For a liquid bond market, it is important that bond holders actively lend their bonds. By being able to borrow bonds without delays, dealers can better intermediate trades in this market without carrying unnecessarily large inventories. The liquidity of the bond market is essential for many other financial markets such as the futures market or derivatives market. However, we show that nonbank financial institutions such as insurance companies or pension funds do not lend their bonds as actively as banks do. Even when they do lend bonds, they earn considerably less fees than banks. Because nonbanks hold much more bonds than banks in the euro-area, their inactive lending of bonds increases the scarcity of these assets and makes it costlier for investors to borrow bonds in the market.

JEL codes: G10; G22; G23

1 Introduction

The markets for borrowing and lending debt securities, particularly the repo and securities lending markets, play a pivotal role in supporting liquidity in all bond markets. Investors' capacity to execute various trading strategies relies on their ability to borrow bonds easily. For example, by borrowing bonds and selling them, investors can hedge interest rate risks or speculate on their movements. Dealers intermediating trades of bonds also need to borrow bonds (ICMA, 2021). By doing so, dealers can sell bonds to their customers almost immediately even if those bonds are not in their inventories. The alternative of carrying large inventories of bonds has become increasingly costly because of recent banking regulations (Duffie, 2018). In addition, the business of securities lending allows institutional investors in the bond market to earn additional revenues. These additional revenues can be particularly helpful when bond yields are extremely low.

The importance of the repo and securities lending markets in the financial sector is reflected in the large size of these markets. On average, investors of the repo and securities lending markets in Europe borrowed and lent approximately 646 billion euros of bonds each day in 2019 and 2020 (ECB, 2021).

Although the importance of these markets is recognized (Benoît Cœuré, 2019), little is known about the participation of different financial intermediaries. Most studies on the bond market have investigated borrowing and lending of bonds between banks and dealers.[1] Because of data limitations, how nonbanks (i.e., insurance companies, pension funds, and investment funds) participate in the bond market has not been investigated. However, addressing this gap in the literature is important for two key reasons. First, nonbanks in the euro area hold more bonds than banks and their holdings have increased steadily over the past decade, as shown in Figure 1. Insurance companies, pension funds, and non-MMF investment funds together hold about 50% more euro-denominated bonds than banks. Therefore, the overall availability of bonds for borrowing crucially depends on how those non-

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[1]See Ballensiefen and Ranaldo (2019); Bartolini et al. (2011); Bechtel et al. (2019); Boissel et al. (2017); Brand et al. (2019); Buraschi and Menini (2002); Corradin and Maddaloni (2020); D'Amico and Pancost (2018); Duffie et al. (2002); Dunne et al. (2011); Ebner et al. (2016); Ferrari et al. (2017); Graveline and McBrady (2011); Jank and Mönch (2018); Mancini et al. (2016); Miglietta et al. (2019); Nyborg and Rösler (2019); Piquard and Salakhova (2019); Ranaldo et al. (2020, 2021); Roh (2021); Sangiorgi (2018).

banks lend their bonds. Second, because government bond yields have reached historically low levels, additional income from lending bonds can support the financial stability of the nonbank sector (Berdin et al., 2017).

Figure 1: **Holdings of Euro-Denominated Bonds by Banks versus Nonbanks**
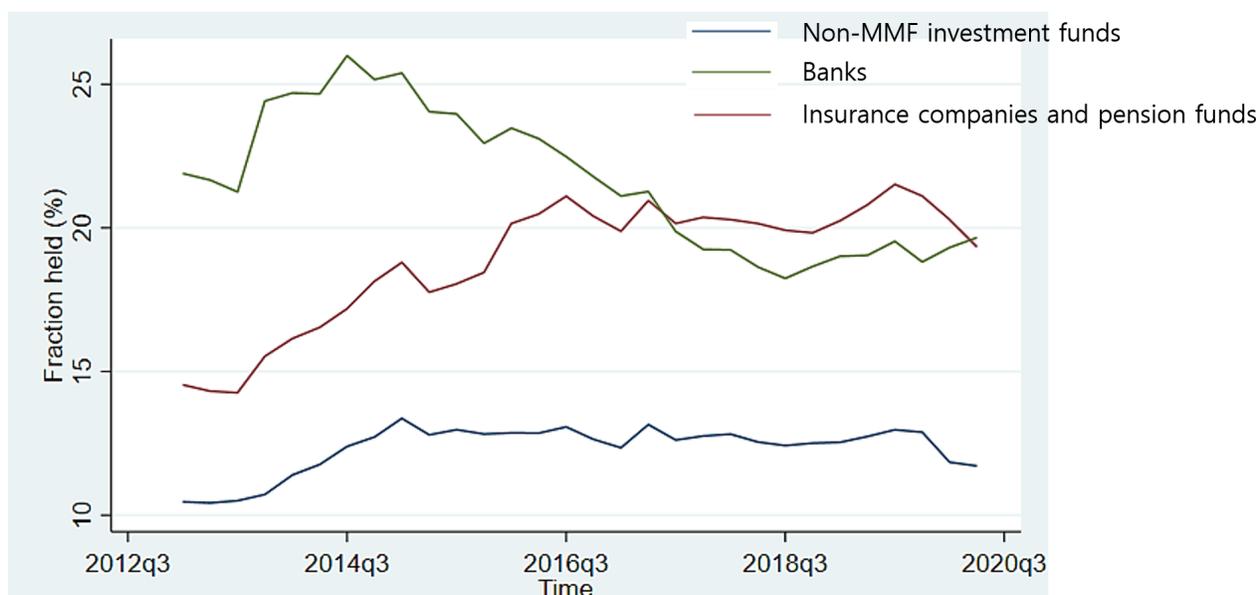
Notes: The graph shows the aggregate holdings of euro-denominated bonds by the three largest sectors as a fraction of the total outstanding amount. The data come from the Securities Holdings Statistics by Sector and Thomson Reuters Eikon.

In this study, we analyze bond lending of nonbanks in the euro area. Do nonbank financial institutions actively lend their bonds and earn fees? In a perfect market with no transaction costs, all bond holders should lend their bonds and earn any non-zero fees (Duffie, 1996). We base our analysis on the data set that the European Central Bank (ECB) collects for the Money Market Statistical Reporting (MMSR). The MMSR regulation requires approximately the 50 largest banks in the euro area to report their daily repo and securities lending transactions that are collateralized with cash.[2] This granular data set provides

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[2]See   https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/money_market/

full information on counterparties and terms of transaction. Because banks intermediate the vast majority of trades in the repo market and the securities lending market in the euro area, this data set allows us to grasp almost the entire landscape of the market. We also use the ECB's Securities Holdings Statistics by Sector (SHS-S) data. The SHS-S data capture how much of each security is held by investors belonging to different sectors (i.e., banks and insurance).

When there is high market demand for borrowing a bond and there is limited supply, the repo rate of that bond can become lower than a comparable risk-free rate in the money market (Duffie, 1996). In exchange for delivering a specific hard-to-find bond, holders of that bond can borrow cash at a very low (negative) repo rate. Investors can profit by reinvesting the borrowed cash in the money market at a slightly higher rate. In such cases, the difference between the repo rate and the comparable money market rate is called *specialness* premium. The specialness premium of a bond tends to be higher for a bond that is hard to find in the market. We define specialness similarly for securities-lending trades collateralized with cash.

We first show that bonds that are held by nonbanks have higher specialness in the interbank market. However, nonbanks do not actively lend their bonds to earn this high-level specialness. In terms of the nominal amount of bonds, nonbanks account for only 12% of the euro-denominated bonds borrowed by MMSR-reporting banks between July 2016 and March 2021. The relatively low participation of nonbanks in these markets is increasing bond scarcity and increasing the specialness premia paid on these bonds.

Second, we show that even when nonbanks lend their bonds, MMSR-reporting banks substantially price discriminate against clients that are neither banks nor dealers. The granularity of the MMSR data allows us to investigate transactions that are identical in all aspects, except for the identities of clients lending the bond. Then we see if reporting banks pay different specialness premia to bank clients versus nonbank clients. When money market funds (MMFs) lend bonds, they get specialness premia that are about 20 basis points lower than what the bank clients earn. Investment funds (excluding MMFs), insurance companies, and pension funds get about 10 basis points lower specialness premia. By con-

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trast, dealers get extra 20 basis points of specialness even when compared with bank clients.

Next, we analyze the factors that might explain why nonbanks do not earn the same specialness as banks and dealers. First, nonbanks do not have trading relationships with many banks. In an over-the-counter (OTC) market, a client that can shop from many banks can get better prices (Hau et al., 2021). Second, nonbanks except for dealers do not appear to have strong market power when dealing with MMSR-reporting banks. While non-reporting banks and dealers substantially price discriminate when lending bonds to MMSR-reporting banks, insurers, pension funds, and investment funds barely discriminate.

These results suggest that any policy action that increases bond specialness may benefit banks and dealers more than insurance companies, pension funds, or investment funds. For example, Arrata et al. (2020) have shown that the ECB's asset purchase program has increased the specialness of sovereign bonds in the euro area. This heightened specialness of sovereign bonds is likely to have benefited banks and dealers the most.

The rest of the paper is organized as follows. In Section 2, we briefly review the contribution of this study to the literature. In Section 3, we explain the basic institutional details. In Section 4, we review the data sets used in this paper and show that the specialness premia of bonds are quantitatively large. In Section 5, we show that nonbanks' holdings of a bond lead to the higher specialness of that bond in the inter-bank market. In Section 6, we show that nonbanks do not actively lend their bonds. In Section 7, we show that even when insurers, pension funds, and investment funds lend their bonds, they do not earn specialness premia that banks or dealers get. In Section 8, we investigate nonbanks' connection with MMSR-reporting banks and their market power while lending bonds. We conclude in Section 9.

2   Related Literature

Our work is related to the OTC market literature that analyzes the sources of specialness in the repo market. In many theoretical models of the OTC securities lending or repo market, the lending fee or repo specialness can be positive only if some bond owners cannot frictionlessly lend their bonds (Duffie, 1996; Duffie et al., 2002; Vayanos and Weill, 2008). The

empirical literature has highlighted the relation between bond holdings of buy-and-hold investors and the specialness of bonds Jordan and Jordan (1997); Graveline and McBrady (2011); Huszár and Simon (2018). Using granular data on the identities of bond lenders and owners, we present the first *direct* empirical evidence that buy-and-hold investors contribute to bond specialness.

We also contribute to the literature showing that centrally cleared and bilateral trading are affected by somewhat different factors. Our work is related to Grill et al. (2017) and Eisenschmidt et al. (2020), who show that repo rates depend on whether trades are bilaterally or centrally cleared. We depart from earlier studies by focusing exclusively on the bilateral market. Even within the same bilateral segment of the money market, we show that large intermediary banks price discriminate against clients who are neither banks nor dealers.

This paper is also related to the strand of literature that focuses on the role of securities lending fee or repo specialness as an additional stream of income for bondholders (Duffie, 1996; Jordan and Jordan, 1997; Krishnamurthy, 2002; Buraschi and Menini, 2002; Duffie et al., 2002; Vayanos and Weill, 2008; Bartolini et al., 2011; D'Amico and Pancost, 2018; D'Amico et al., 2018; Roh, 2021). We depart from the literature by showing that different financial institutions get different levels of income by lending the same bond. Our paper is also related to the empirical literature on how repo rates are determined.[3] While most studies examine the inter-dealer segment of the market, we focus on the transactions between banks and nonbanks.

Finally, this study is related to the recent literature that examines the impact of institutional investors' portfolio allocation decisions on asset prices (Gabaix and Koijen, 2020; Koijen and Yogo, 2019; Koijen et al., 2020). In the models of earlier studies, institutional investors have different private information, investment mandates, or preferences for holding assets with certain characteristics. Therefore, the asset owners's identities are important for

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[3]See Jordan and Jordan (1997), Dunne et al. (2011), Graveline and McBrady (2011), Ebner et al. (2016), Mancini et al. (2016), Boissel et al. (2017), Ferrari et al. (2017), D'Amico et al. (2018), Sangiorgi (2018), Ballensiefen and Ranaldo (2019), Bechtel et al. (2019), Brand et al. (2019), Miglietta et al. (2019), Nyborg and Rösler (2019), Piquard and Salakhova (2019), Arrata et al. (2020), Barbiero et al. (2020), Corradin and Maddaloni (2020), Dufour et al. (2020), Eisenschmidt et al. (2020), Jank et al. (2020), Ranaldo et al. (2020), Roh (2021), and Ranaldo et al. (2021).

asset pricing. We show that the equilibrium level of lending fees for bonds can depend on who holds those bonds; different investors have different propensities to lend their bonds.

3 Institutional Background – Repo Market and Securities Lending Market

This study focuses on two segments of the money market in Europe where investors borrow or lend bonds: repurchase agreement (repo) and securities lending markets. The repo market is the largest money market. As of June 2016, 61 largest banks participating in the European repo market had 7.9 trillion euros of trades outstanding (ICMA, 2019).

The repo market has two segments: general collateral (GC) and specific collateral (SC). In the GC market, investor A can deliver any security from a prespecified list called a "basket." For example, the GC German basket includes all bonds issued by the central government of Germany. Investors trade in the GC market mainly to borrow and lend cash using securities as collateral. Therefore, the cash lender accepts any security as long as the security is included in a given basket. However, investors in the SC repo market desire to borrow and lend a security with a specific International Securities Identification Number (ISIN). Investors exchange cash merely to collateralize their lending and borrowing of securities. Specialness premia can arise in the SC repo market.

The repo market can also be divided into two segments based on the type of participants. First, there is an electronic trading platform for the inter-bank market. Banks anonymously trade on this platform and clear their trades through central clearing counterparties (CCPs). Second, banks and nonbanks trade bilaterally in the OTC market. Banks intermediate most repo trades in the euro area. Nonbanks do not trade with one another directly.

In the repo market terminologies, a bond lender is said to be conducting a repo transaction. On the other hand, a bond borrower is said to be conducting a reverse-repo transaction.

In our paper, we use the GC Pooling ECB EXTended Basket rate with Tomorrow-Next (TN) tenor[4] as the benchmark risk-free rate to compute the specialness premia of bonds.

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[4]Investors exchange cash and bonds one business day after they agree on the terms. Investors return cash

The GC Pooling ECB EXTended Basket is the list of 14,000 securities that the ECB accepts as collateral. Eurex offers an electronic trading platform for GC repos using this basket. We compute the specialness premium of bond i on day t with the repo rate $RepoRate_{it}$ as in Equation (1). $GCRate_t$ is the GC Pooling ECB EXTended Basket rate. Bond i is said to be special if $Specialness_{it}$ is positive.

$$Specialness_{it} = max(0, GCRate_t - RepoRate_{it}) \qquad (1)$$

There are three important dates for a repo transaction: trade date, settlement date, and maturity date. Two investors agree on the terms of trade (i.e., repo rate) at the trade date. At the settlement date, investors deliver a bond and cash to each another. At the maturity date, investors return the bond and cash.

Investors can also borrow or lend bonds in the securities lending market. If cash is used as collateral, the transaction is similar to a repo transaction. We compute the "specialness" of a securities-lending trade similarly as we do for a repo trade. However, investors can use other securities to collateralize a securities-lending trade. In Europe, the securities-lending market is much smaller than the repo market. The total value of government and corporate bonds on loan in the securities-lending market was not higher than 400 billion euros and 60 billion euros, respectively, on any day in 2016 (ESMA, 2018).

The repo and the securities lending market are important for various financial markets (ICMA, 2021). For example, a customer might want to buy a bond from a dealer who does not have that bond in their inventory. The dealer can borrow the bond from the repo market and sell it to the customer. The dealer can later secure a bond from another client (sell order) and return it to the repo market. The repo market allows dealers to fulfill customer orders immediately without accumulating large inventories of bonds. Investors can also use the repo market to borrow bonds and short-sell them. Thus, investors can hedge against or speculate on interest rate movements. Futures investors, derivatives investors, or primary dealers underwriting bond issuance also rely on the repo market.

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and bonds after two business days.

4   Data and Sample Construction

4.1   Securities Holdings Statistics by Sector (SHS-S)

We use the Securities Holdings Statistics by Sector (SHS-S) data of the ECB to see how much euro-denominated debt instrument do investors of different sectors (e.g., banks) hold. The Eurosystem requires investors residing in the euro area to report all security holdings. We aggregate the holdings data at the sector level. The data define the sector of investors using the 2010 European System of Accounts (ESA). Of those sectors, we focus on the following three because they capture the majority of ownership. The remaining sectors include S11 nonfinancial corporations, S121 central banks, S123 MMFs, S125 other financial intermediaries, S13 governments, and S14 households. S125 intermediaries are mostly securities dealers.

- S122: deposit-taking monetary financial institutions except for central banks.

- S124: investment funds except for MMFs.

- S128, S129, and S12QU: insurance companies and pension funds (ICPFs).

We consider ICPFs jointly because of the S12QU code. An institution identified with the S12QU code can be either an insurance company or a pension fund, but the specific classification is not identifiable. The ECB collects the SHS-S quarterly since the fourth quarter of 2013.

4.2   The Money Market Statistical Reporting Data

The second data set is the MMSR of the ECB. The 48 largest banks in the eurozone report their transactions in the money market to the ECB every day. We focus on the transactions in the repo and the securities-lending market. However, in the data, we cannot distinguish between repo trades and securities lending trades. Banks report trades that are collateralized with cash and whose tenors are no older than 397 days. In this study, we call these 48

banks "MMSR banks." Our data cover the period from July 2016 to March 2021. We analyze trades through which reporting banks borrow euro-denominated bonds from their clients. We only consider trades that are not cleared through CCPs.

"Deal rate" is the primary variable in the MMSR data studied. The deal rate is a repo rate if a trade is a repo. For a securities lending trade, it is the remuneration rate on the cash collateral. For example, suppose an investor gives 100 million euros of cash as collateral to borrow a bond. After one year, suppose the bond borrower gets back 102 million euros of cash. In this case, the deal rate is 2%. The lower the deal rate, the more compensation an investor gets for lending a bond.

The MMSR data show that bonds traded in the euro area have economically large specialness. Figure 2 shows that more than half the trades since 2016 had specialness in terms of the nominal amount of bonds. Figure 3 shows the weighted-average specialness of corporate and sovereign bonds observed in the MMSR data. For each bond and quarter, we can compute the trade-volume-weighted-average specialness. Then for each type of bond (i.e., corporate bonds), we can again compute the average specialness, but this time using the outstanding amount of each bond as the weight. The specialness of sovereign bonds grew to 25 basis points in the last quarter of 2016. The specialness of corporate bonds was also nearly 15 basis points in the same period.

4.3 The Securities Financing Transactions Regulations Data

The third data set is the regulatory data that the ECB collects for the Securities Financing Transactions Regulations (SFTR). The SFTR mandates all entities, financial and nonfinancial, to report their securities financing transactions to trade repositories. The ECB receives the data from trade repositories. The securities financing transactions include repo transactions, securities lending transactions, buy–sell back transactions, and margin-lending transactions. Unlike the MMSR data, the SFTR data also include securities lending transactions with noncash collateral.

Institutions such as banks, investment funds, insurance companies, CCPs, central securities depositories, and nonfinancial corporations should report their trades for the SFTR.

Starting with banks and investment funds in April 2020, all entities were required to report their trades by January 2021. The SFTR data used for this study cover transactions that concluded between April 26, 2021, and April 30, 2021.

4.4 Other Data

The fourth data set is the historical trade data from BrokerTec, which is the leading electronic platform for specific repo trades between banks. We see the trade volumes and the daily traded-volume-weighted-average repo rates at the individual bond level. Our MMSR data covers both the inter-bank CCP-cleared market and the bilateral OTC market. In contrast, BrokerTec covers only the inter-bank market.

We use the ECB's Centralized Securities Database (CSDB) to obtain the basic information about bonds (i.e., maturity date, issue date, duration, and credit rating) in monthly frequency. However, we obtain information about the outstanding amounts of debt securities from Thomson Reuters Eikon. GC repo data come from the Bloomberg terminal. Table 1 summarizes the data used in this study.

5 Bond Ownership and Specialness

We show that a bond held primarily by nonbanks has higher specialness in the interdealer repo market. Because all trades for this analysis are between banks, the institutional sector of counterparties cannot explain this variation in rates. Instead, the general level of supply and demands for bonds in the market is the main source of variation.

Equation (2) shows our empirical specification. Subscripts i, r, and t represent bonds, the credit ratings of bonds, and quarters, respectively. The CSDB data have information about the credit ratings of bonds obtained from Fitch, Moody's, and Standard and Poor's. As in Bubeck et al. (2020), we convert each credit rating to numerical scales and take their simple average. See Table 5 for the numerical scale. $Specialness_{irt}$ is the transaction volume-weighted-average specialness premium of bond i on day t. We use bilaterally cleared trades between banks observed from the MMSR data. $Duration_{irt}$ is the duration of bond i in units

Table 1: **Descriptive Statistics**

Variable	Unit	Mean	Median	Std Dev	Obs	Source
Specialness	Basis Points	18.83	13.70	25.12	18,276,612	BrokerTec
Nominal Amt of Collateral	Millions of Euros	17.12	3.11	636.50	15,446,069	MMSR
Deal Rate	%	-0.78	-0.61	1.26	15,446,069	MMSR
Tenor	Days	3.90	3.00	10.93	15,446,069	MMSR
Age	Quarters	14.05	10.00	13.23	1,181,739	CSDB
Duration	Years	4.475	3.330	4.872	421,995	CSDB
F(ICPF)		0.065	0.000	0.212	1,181,821	Eikon, SHS-S
F(S122)		0.209	0.004	0.356	1,181,821	Eikon, SHS-S
F(S123)		0.000	0.000	0.001	1,181,821	Eikon, SHS-S
F(S124)		0.036	0.000	0.129	1,181,821	Eikon, SHS-S
F(S125)		0.030	0.000	0.146	1,181,821	Eikon, SHS-S
Original Maturity	Years	7.913	6.003	7.098	1,173,359	CSDB
Residual Maturity	Years	4.421	3.000	6.108	1,173,440	CSDB
Outstanding Amount	Million of Euros	231.0	11.9	1,626.9	1,181,821	Eikon

Notes: The table shows the mean, median, standard deviation, and the number of observations for key variables used in the study. We define specialness as the downward deviation of the deal rates from the GC Pooling ECB EXTended Basket Rate with TN tenor. Deal rate is the rate at which MMSR-reporting banks lend cash to their counterparties. Age is the number of quarters since the bond was issued. $F(s)$ is the holdings of a bond by investors of sector s as a fraction of the outstanding amount of that bond. S122, S123, S124, and S125 are the ESA 2010 codes for banks, MMFs, non-MMF investment funds, and dealers, respectively. A tenor of a transaction is the number of days between the trade date and the maturity date. Data come from BrokerTec, MMSR, SHS-S, and CSDB. The MMSR data cover the period between July 1, 2016, and March 31, 2021. The BrokerTec data cover the period between July 23, 2014, and November 19, 2019. The SHS-S and the CSDB data cover the period between 2013Q1 and 2020Q2.

of years. Age_{irt} is the age of the bond in units of quarters. $Outstanding_{irt}$ is the outstanding amount bond i in quarter t.

$$Specialness_{irt} = \beta_1 \cdot Duration_{irt} + \beta_2 \cdot Age_{irt} + \beta_{3s} \cdot Fraction(s)_{irt}$$
$$+ \beta_4 \cdot Outstanding_{irt} + FE_t + FE_r + \epsilon_{irt} \quad (2)$$

The main explanatory variable $Fraction(s)_{irt}$ is the holdings of bond i by sector s as a fraction of the outstanding amount of bond i in quarter t.[5] Finally, we control for rating fixed effect FE_r and time fixed effect FE_t.

$$Fraction(s)_{irt} = \frac{\text{(Amount Held by Investors of Sector s)}_{irt}}{Outstanding_{irt}} \quad (3)$$

An ordinary least squares estimate of this model can be biased if investors adjust their holdings of bond i in response to the specialness of the bond. To mitigate this potential bias, we instrument $Fraction(s)_{irt}$ with its lagged value $Fraction(s)_{ir,2013Q4}$ as of the fourth quarter of 2013. The sample period for this regression is from the third quarter of 2016 to the first quarter of 2020. The identification assumption is that investors did not rely on accurate forecasts of increases in the specialness of bonds in 2016 and afterward while deciding which bonds to hold. Through the Public Sector Purchase Program (PSPP), the ECB bought government bonds in the eurozone and significantly increased the specialness of those bonds (Arrata et al., 2020). The ECB officially announced the PSPP in January 2015, while investors had begun anticipating its announcement in September 2014 (Altavilla et al., 2015).

Table 2 shows the two-stage least squares (2SLS) estimation results of the model. The first-stage estimation result in Table 6 shows that bond holdings by each sector are persistent over time. An additional holding of 10% of the outstanding by ICPFs leads to an additional specialness of 3.92 basis points in the inter-bank market. An extra 10% holdings by non-MMF investment funds raises the specialness of the bond by 11.61 basis points. On the

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[5]When investors lend their bonds, the SHSS still records those investors as the owners of the bonds. Therefore, investors' lending of bonds does not mechanically drive the relation between $Specialness_{irt}$ (by increasing the supply of bonds available for borrowing in the market) and $Fraction(s)_{irt}$.

other hand, an additional holding of 10% by banks lowers the specialness of the bond by 0.72 basis points; more holdings by banks mechanically decrease holdings by nonbanks.

The average specialness of bonds in our BrokerTec sample is 18.8 basis points. The standard deviations of $Fraction(ICPF)_{irt}$ and $Fraction(S124)_{irt}$ in our sample are 0.212 and 0.129, respectively. Therefore, a one-standard-deviation increase in the holdings by ICPFs and non-MMF investment funds increase specialness by 8.30 basis points and 24.61 basis points, respectively. The impact of the holdings by nonbanks on the specialness is quantitatively important.

6 Do Nonbanks Lend Their Bonds?

In this section, we show that nonbank financial institutions do not actively lend their bonds, although they hold a significant amount of bonds that trade with specialness in the interbank market. On each day between August 2017 and March 2021, a snapshot of all outstanding transactions through which investors in the euro area lend euro-denominated bonds to MMSR-reporting banks is taken. Let V_{ts} denote the aggregate nominal amount of bonds that investors of sector s lent through transactions that are outstanding as of day t. Then we compute the share of each sector as $\sum_t V_{ts} / \sum_{t,s} V_{ts}$. Figure 4 shows that in terms of the nominal amount of bonds, MMSR-reporting banks get only 12% of their bonds from nonbank financial institutions.

It might be unclear who is behind CCP-cleared transactions. MMSR-reporting banks might be receiving bonds from nonbank financial institutions through CCPs. To address this concern, we produced similar statistics using the SFTR data. Even if a CCP interposes itself between two investors, we can still track the sector of an entity that provides bonds.

For securities lending transactions, a bond can move as either security or collateral. For example, suppose investor A borrows equity from investor B. In return, investor A gives a bond to investor B as collateral. Then we flag investor A as the bond lender in this example. We compute the aggregate nominal amount of euro-denominated bonds lent by each institutional sector. We only consider bonds whose issuer is based in the euro area.

Table 2: **Holdings and Level of Specialness**

	Bank	ICPF	Non-MMF Funds	Dealers
$Duration_{irt}$	0.132	-0.127	0.178	-0.0242
	(0.49)	(-0.60)	(0.68)	(-0.10)
Age_{irt}	-0.297***	-0.374***	-0.239***	-0.338***
	(-4.31)	(-4.34)	(-3.70)	(-7.85)
$Outstanding_{irt}$	-0.659***	-0.710***	-0.600***	-0.903***
	(-12.85)	(-14.13)	(-16.59)	(-7.03)
$Fraction(s)_{irt}$	-7.201**	39.16***	116.1***	-90.01
	(-2.64)	(4.55)	(4.24)	(-0.23)
N	2,986	2,986	2,986	5,306
First-stage F stat	1743.3	3079.7	424.6	285.4
Effective F stat	1,218.14	4,018.24	572.77	460.703
Cluster	Quarter	Quarter	Quarter	Quarter
Quarter FE	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y

Notes: The table shows the 2SLS estimation of the model $Specialness_{irt} = \beta_1 \cdot Duration_{irt} + \beta_2 \cdot Age_{irt} + \beta_{3s} \cdot Fraction(s)_{irt} + \beta_4 \cdot Outstanding_{irt} + FE_t + FE_r + \epsilon_{irt}$. Subscripts i, r, and t represent bonds, bond credit ratings, and quarters, respectively. $Specialness_{irt}$ is the specialness premium of bond i in quarter t. We define specialness as the downward deviation of the repo rate from the GC Pooling ECB EXTended Basket rate. $Duration_{irt}$ is the duration of bond i in units of years. Age_{irt} is the age of bond i in units of quarters. $Outstanding_{irt}$ is the outstanding amount of bond i in billion of euros. $Fraction(s)_{irt}$ is the holdings of bond i by investors of sector s as a fraction of the outstanding amount. We run separate regressions for each counterparty sector s. ICPF stands for insurance companies and pension fund. The sample period is from 2016Q3 to 2020Q1. We instrument $Fraction(s)_{irt}$ with its lagged value $Fraction(s)_{ir,2013Q4}$ as of 2013Q4. The effective F-statistics result from the test of weak instruments by Olea and Pflueger (2013). The critical value for 5% Nagar (1959) bias is 37.418. Cluster-robust standard errors at the quarter level are reported in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 3: **The Aggregate Nominal Amount of Bonds Lent by Different Institutional Sectors**

	Repo	Securities Lending	Centrally Cleared Repo	All
Banks	46.524	78.988	43.936	46.524
CCP	48.566	0.000	54.255	48.566
Funds	4.409	0.000	1.489	4.409
Insurance	0.023	0.000	0.000	0.023
Pension Funds	0.024	0.000	0.000	0.024
Government	0.007	0.000	0.000	0.007
Other Financial Institutions	0.186	0.000	0.204	0.186
Others	0.260	21.012	0.116	0.260

Notes: For each column, we compute the share of each institutional sector in terms of the nominal amounts of euro-denominated bonds they have lent in a given market. For example, banks account for 46.524% of all bonds that have been lent in the repo market. The first column combines bilaterally and centrally cleared repos. The last column combines both repo transactions and securities lending transactions. The data source is the regulatory reporting of trades under the SFTR. The sample covers the period between April 26, 2021, and April 30, 2021. We consider only bonds whose issuers are based in the euro area. Investors in the securities lending market can give bonds to their counterparties as security or collateral. We consider both cases. Funds include alternative-investment funds, Undertakings for the Collective Investment in Transferable Securities (UCITs), and MMFs.

Table 3 shows the decomposition by each market. For the third column, we only consider CCP-cleared repo trades. The second column includes both CCP-cleared and bilateral repos. Funds include both MMFs and non-MMF investment funds. The table shows that nonbanks account for less than 5% of bond lending activities in terms of the nominal amount of bonds. Particularly, nonbanks account for less than 1.7% of bond lending activities in the CCP-cleared repo market. The negligible presence of nonbanks in this market addresses the concern that nonbanks might be behind CCPs in Figure 4.

Figure 4 and Table 3 together show that nonbanks do not actively lend their bonds. This result can explain why nonbanks' bond holdings lead to a higher specialness of the

bond. Nonbanks' holding reduces the effective supply of bonds available for borrowing in the market, including the inter-bank market. Consequently, investors find it costlier to search for the bond in this OTC market. Increased search frictions lead to a higher bond specialness (Duffie, 1996; Vayanos and Weill, 2008; Corradin and Maddaloni, 2020).

Professionals in the repo industry suggest that banks might be lending their bonds more actively because of their unique business model. For example, consider the repo desk of a commercial bank (i.e., Deutsche Bank) shown in Figure 5. Suppose the desk borrows a bond from an insurance client (i.e., AXA) through a reverse-repo transaction. To complete this transaction, the desk needs to give cash to AXA. The desk can ask the bank's treasury department for cash or raise cash from the unsecured funding market. However, both options are costly because they expand the bank's balance sheet. Instead, the desk can find another client (i.e., hedge fund) willing to borrow the same bond. This repo transaction with the hedge fund gives the desk the necessary cash to finalize the reverse-repo transaction with AXA. Thus, the desk can avoid expanding the bank's balance sheet by having repo and reverse-repo trades that exactly offset each other. Therefore, the desk always wants to re-lend the bond that has been borrowed from its client. Jank et al. (2020) also finds that German banks significantly reuse their bond collateral.

The market-making desk of a bank purchasing a bond has similar incentives to lend bonds. To avoid getting cash from the treasury department or unsecured funding market, the desk often supplies the bond to the repo market simultaneously as it buys the bond. The desk can use the cash raised from the repo market to buy the bond.

However, many buy-side nonbank financial institutions do not have similarly strong incentives to lend their bonds to raise cash. For example, insurance companies already have cash from selling their insurance products to customers, which they use to buy a bond and hold it until maturity. Long-only investment funds also do not usually need to lend their bonds to raise cash.

In principle, nonbanks lend their bonds as long as the specialness premia of their bonds are positive. However, complying with legal requirements and maintaining relations with many bank intermediaries can be costly (Hill, 2017). If these operational costs exceed the specialness premia, nonbanks can choose not to lend their bonds. A fund manager inter-

viewed by the International Capital Markets Association said, "we do not have to lend our securities" (Hill, 2015).

7   Price Discrimination

In this section, we show that large MMSR-reporting banks price discriminate against clients who are neither than banks nor dealers. Price-discriminated nonbank financial institutions borrow cash at higher rates in exchange for lending bonds.

Equation (4) shows our empirical specification. Subscript d represents the MMSR-reporting banks, i the bonds, j the transactions, t_1 the trade dates, t_2 the settlement dates, t_3 the maturity dates, and s the counterparty sectors. Subscript j represents the transactions, because an MMSR-reporting bank can have multiple transactions with investors of sector s on the same day with the same bond.

We only consider bilateral transactions through which MMSR-reporting banks borrow bonds. Banks can charge better rates for trades they can clear through CCPs (Grill et al., 2017; Eisenschmidt et al., 2020); by netting multiple trades through CCPs, banks can reduce balance sheet costs. We control for this factor by focusing only on bilateral trades. For more information on how we cleaned the MMSR sample, see Section 10.2 of the Appendix.

$volume_{dijt_1t_2t_3s}$ is the nominal amount of the bond. $rate_{dijt_1t_2t_3s}$ is the deal rate at which MMSR-reporting bank d lends cash. Then we have an indicator variable for each counterparty sector. The classification of the counterparty sector follows the 2010 ESA. MMF_s takes the value of 1 if the counterparty is an S123 MMF and 0 otherwise. We define NFC_s, $Fund_s$, $Dealer_s$, $Insurance_s$, and $Pension_s$ similarly for S11 nonfinancial corporations, S124 non-MMF investment funds, S125 dealers, S128 insurance companies, and S129 pension funds, respectively. Finally, we have a fixed effect $FE_{dit_1t_2t_3}$ for each combination of MMSR-reporting bank d, bond i, trade date t_1, settlement date t_2, and maturity date t_3. $volume_{dijt_1t_2t_3s}$ is in euros, while $rate_{volume_{dijt_1t_2t_3s}}$ is in percentage points. The main parameters of interest are β_{NFC}, β_{MMF}, β_{Funds}, $\beta_{Dealers}$, $\beta_{Insurance}$, and $\beta_{Pension}$. The baseline sector is S122 banks.

We define five subsamples of transactions based on the specialness of the same bond observed in the BrokerTec data on the same day. The first subgroup consists of all trades.

The second consists of bonds with BrokerTec specialness higher than 10 basis points. The third, fourth, and fifth subgroups include bonds with BrokerTec specialness higher than 20, 30, and 40 basis points, respectively. We estimate the model separately by each subgroup. Note that BrokerTec is a platform for inter-bank repos. Our goal is to investigate whether the price discrimination behavior of MMSR-reporting banks depends on the scarcity of bonds in the inter-bank market.

Table 4 shows the estimation results. First, the estimated values for coefficients on sector indicator variables do not vary much by subsamples. MMSR-reporting banks do not price discriminate differently based on the scarcity of the bond in the inter-bank market.

Second, when MMFs lend bonds to MMSR-reporting banks, their repo rates are at least 20 basis points higher than those received by nonreporting banks. High repo rates are unfavorable to these MMFs that borrow cash in exchange for lending bonds. High repo rates imply smaller specialness for bond lenders. Non-MMF investment funds, insurance companies, and pension funds also get specialness premia about 10 basis points smaller than what nonreporting banks get. At the same time, dealers get extra 20 basis points of specialness even when compared with nonreporting banks.

$$
\begin{aligned}
rate_{dijt_1t_2t_3s} = {} & \alpha \cdot volume_{dijt_1t_2t_3s} + \beta_{NFC} \cdot NFC_s + \beta_{MMF} \cdot MMF_s + \beta_{Fund} \cdot Fund_s \\
& + \beta_{Dealer} \cdot Dealer_s + \beta_{Insurance} \cdot Insurance_s \\
& + \beta_{Pension} \cdot Pension_s + FE_{dit_1t_2t_3} + \epsilon_{dijt_1t_2t_3s} \quad (4)
\end{aligned}
$$

Figure 2: **The Fraction of Transactions with Specialness**
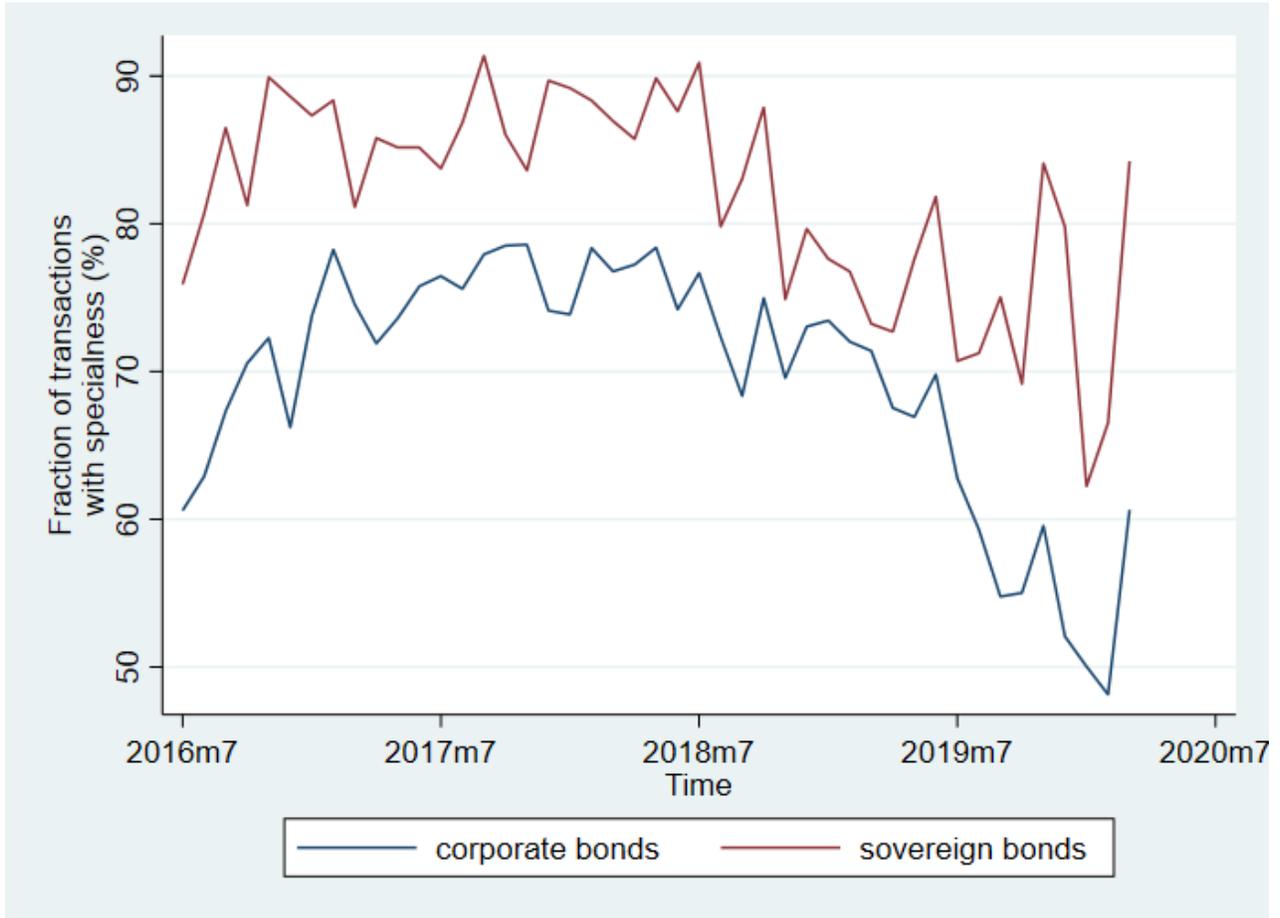
Notes: The figure shows the fraction of transactions with specialness in terms of trade volume for each type of bond. A transaction has specialness if its deal rate is below the GC Pooling ECB EXTended Basket Rate with TN tenor. TN tenor means that investors exchange cash and bonds one business day after they agree on the terms. They return cash and bonds after two business days. The deal rate is that at which investors lend cash in exchange for borrowing bonds. It is the repo rate if a trade is a repo trade. The data come from the MMSR data and the Bloomberg terminal.

Figure 3: **The Average Specialness of Bonds**
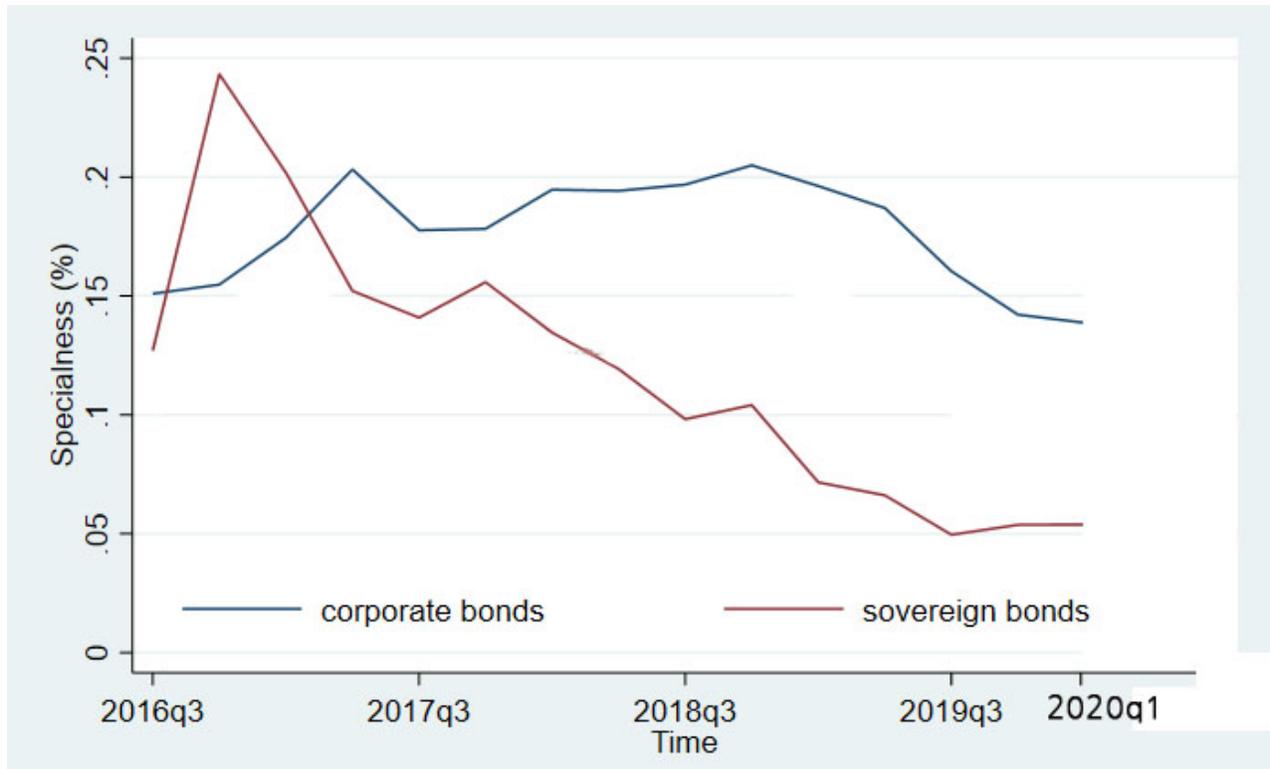
Notes: The figure shows the time series of the trade-volume-weighted-average specialness of each type of euro-denominated bond. We only consider overnight trades for which the maturity date is one business day after the settlement date. Specialness is defined as the downward deviation of the deal rate from the GC Pooling ECB EXTended Basket rate. Banks lend cash at the deal rate to borrow bonds. The deal rate is the repo rate if a trade is a repo trade. The data come from the MMSR data and Thomson Reuters Eikon.

Figure 4: **Counterparties that Lend Bonds to MMSR-Reporting Banks**
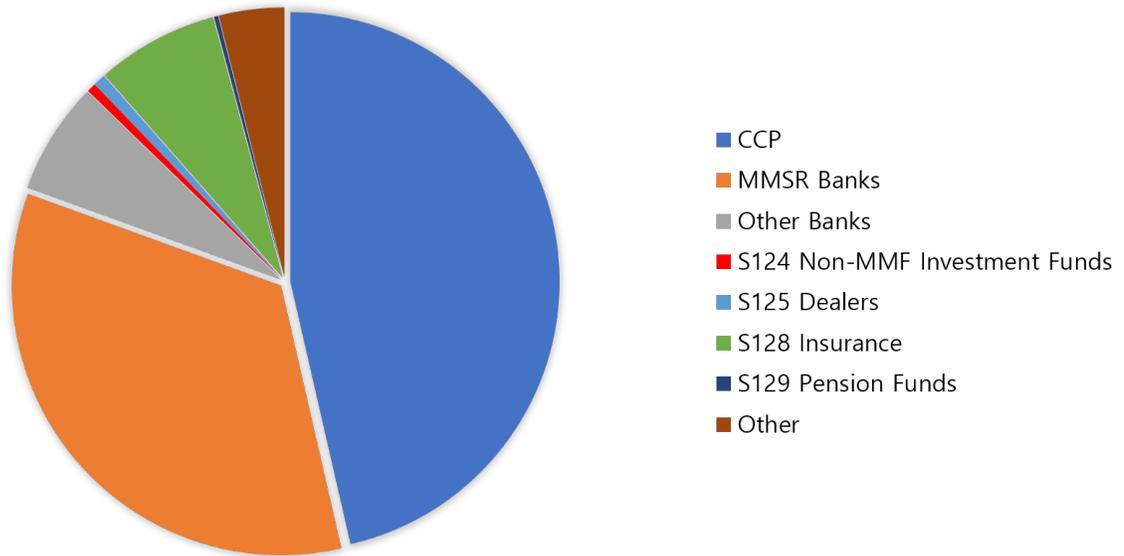
Notes: Let V_{ts} denote the aggregate nominal amount of euro-denominated bonds that investors of sector s lent to MMSR-reporting banks through transactions outstanding as of day t. Then we compute the share of each sector as $\sum_t V_{ts} / \sum_{t,s} V_{ts}$. The sample period is from August 2017 to March 2021. We only consider investors based in the euro area. Central clearing counterparties (CCPs), MMSR-reporting banks, and other banks (nonreporting banks) account for 47%, 34%, and 6.7%, respectively. Non-MMF investment funds, dealers, insurance companies, and pension funds account for 0.6%, 0.7%, 7.3%, and 0.3%, respectively. The data are from the MMSR.

Figure 5: **An Illustrative Example of the Repo Desk of a Bank**
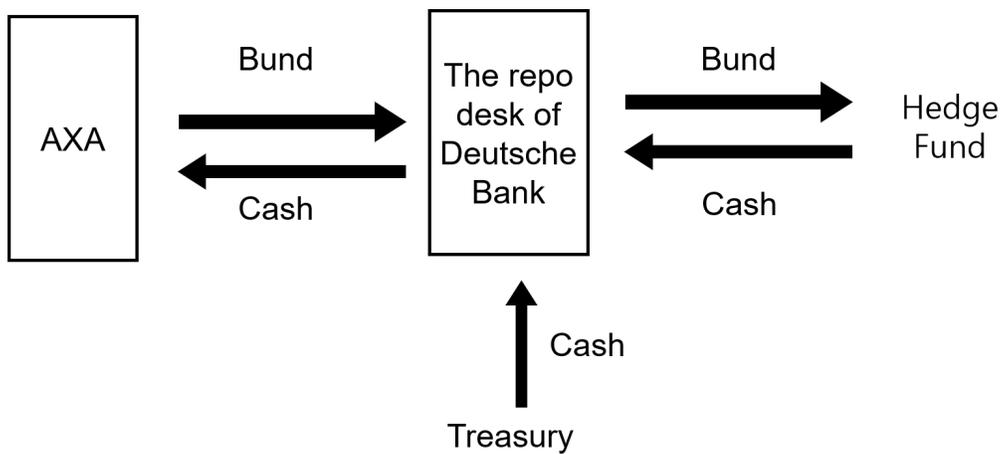
Notes: The diagram is an illustrative example of bank's repo desk conducting matched repo intermediation. By the end of each trading day, the desk wants to have repo and reverse repo transactions that exactly offset each another. For example, after borrowing a bond from AXA, the desk should find another client willing to borrow that bond. Thus, there is no net inflow or outflow of bonds and cash. However, if the desk cannot find a customer, the desk needs to get cash from the bank's treasury department or unsecured funding market, which is costlier.

Table 4: **The Relationship between Rates and Counterparty Sectors**

	(1)	(2)	(3)	(4)	(5)
NFC_s	0.0395	0.0433	0.0518	0.0556	0.0585
	(0.103)	(0.111)	(0.115)	(0.121)	(0.124)
MMF_s	0.213***	0.214***	0.213***	0.211***	0.212***
	(0.0187)	(0.0204)	(0.0215)	(0.0226)	(0.0228)
$Fund_s$	0.0996***	0.102***	0.114***	0.118***	0.119***
	(0.0419)	(0.0423)	(0.0423)	(0.0432)	(0.0440)
$Dealer_s$	-0.205***	-0.206***	-0.206***	-0.207***	-0.208***
	(0.0298)	(0.0298)	(0.0299)	(0.0301)	(0.0304)
$Insurance_s$	0.0889***	0.0894***	0.0932***	0.0983***	0.101***
	(0.0304)	(0.0303)	(0.0291)	(0.0268)	(0.0263)
$Pension_s$	0.0995***	0.101***	0.107***	0.112***	0.126***
	(0.0383)	(0.0385)	(0.0404)	(0.0459)	(0.0440)
N	2,183,244	2,119,424	2,031,444	1,980,748	1,958,054
R^2	0.943	0.942	0.942	0.942	0.942
FE	Reporting bank × bond × trade date × settlement date × maturity date				
Cluster	Trade Date	Trade Date	Trade Date	Trade Date	Trade Date
	Bank	Bank	Bank	Bank	Bank

Notes: The table shows the OLS estimation of the model $rate_{dijt_1t_2t_3s} = \alpha \cdot volume_{dijt_1t_2t_3s} + \beta_{NFC} \cdot NFC_s + \beta_{MMF} \cdot MMF_s + \beta_{Fund} \cdot Fund_s + \beta_{Dealer} \cdot Dealer_s + \beta_{Insurance} \cdot Insurance_s + \beta_{Pension} \cdot Pension_s + FE_{dit_1t_2t_3} + \epsilon_{dijt_1t_2t_3s}$. Subscript d represents the MMSR-reporting banks, i the bonds, j the transactions, s the counterparty sectors, t_1 the trade dates, t_2 the settlement dates, and t_3 the maturity dates. MMSR-reporting banks lend cash at the rate $rate_{dijt_1t_2t_3s}$ to borrow bond i. $volume_{dijt_1t_2t_3s}$ is the nominal amount of borrowed bonds in units of euros. The variable MMF_s takes the value of 1 if the counterparty is an S123 MMF and 0 otherwise. We define NFC_s, $Fund_s$, $Dealer_s$, $Insurance_s$, and $Pension_s$ similarly for S11 nonfinancial corporations, S124 non-MMF investment funds, S125 dealers, S128 insurance companies, and S129 pension funds. We determine the sector of bond lenders using the 2010 ESA. Standard errors are double-clustered by day and MMSR-reporting bank. We define five subgroups of trade based on the specialness premia of bonds on BrokerTec. We estimate the model separately by each subgroup. The first column uses all bonds. The second group, third, fourth, and firth subgroups use bonds with BrokerTec specialness higher than 10, 20, 30, and 40 basis points, respectively. The baseline sector is S122. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

8 Why Don't Nonbanks Get Specialness?

In this section, we reveal two factors that can explain why investment funds, insurance companies, and pension funds do not earn specialness as much as banks or dealers do.

8.1 The Market Power of Nonbanks

A reason why investment funds, insurance companies, and pension funds do not earn specialness as much as banks or dealers do is that nonbanks do not have market power when lending their bonds. We infer the market power of different clients by examining their price discrimination when lending bonds; do clients charge different rates when lending the same bond to different MMSR-reporting banks?

First, we collect multiple identical bilaterally cleared transactions: the same client c of sector s lends the same bond i to MMSR-reporting bank d with the same trade date t_1, settlement date t_2, and maturity date t_3. A client and a reporting bank may have executed identical transactions multiple times; let subscript j represent transactions. Let $vol_{dijst_1t_2t_3c}$ denote a nominal amount of bond i that client c and MMSR-reporting bank d traded for transaction j. Let $rate_{dijst_1t_2t_3c}$ denote the deal rate of transaction j. We compute the weighted-average deal rate as shown in Equation (5).

$$rate_{dist_1t_2t_3c} = \frac{\sum_j (rate_{dijst_1t_2t_3c} \times vol_{dijst_1t_2t_3c})}{\sum_j vol_{dijst_1t_2t_3c}} \tag{5}$$

Second, we compute the standard deviation of deal rates across transactions with the same bond i, trade date t_1, settlement date t_2, maturity date t_3, and client c of sector s. The identity of MMSR-reporting bank borrowing bond i is the only source of variation for these deal rates. $N_{ist_1t_2t_3c}$ is the number of distinct MMSR-reporting banks that borrowed bond i from client c of sector s with trade date t_1, settlement date t_2, and maturity date t_3.

$$\sigma_{ist_1t_2t_3c} = \sqrt{\frac{1}{N_{ist_1t_2t_3c}} \cdot \sum_d \left(rate_{dist_1t_2t_3c} - \frac{1}{N_{ist_1t_2t_3c}} \cdot \sum_d rate_{dist_1t_2t_3c}\right)^2} \tag{6}$$

Third, we compute the simple average of these standard deviation measures by each sector s as shown in Equation (7). There are N_s combinations of bond, trade date, settlement date, and client for sector s. We get a dispersion index specific to each sector s. The higher this dispersion index, the higher the price discrimination by investors of sector s when lending their bonds. For example, suppose that insurance companies charge the same rate to any MMSR-reporting banks when lending their bonds. Because there is no variation in rates across reporting banks, $\sigma_{ist_1t_2t_3c}$ is always zero. Therefore, the dispersion index for the insurance sector is also zero.

$$Dispersion_s = \frac{1}{N_s} \sum_{it_1t_2t_3c} \sigma_{ist_1t_2t_3c} \tag{7}$$

Figure 6 shows the results. Dealers substantially price discriminate. For example, even when lending the same bond, a dealer might charge 10 basis points of specialness to one bank and 60 basis points of specialness to another. However, non-MMF investment funds, insurance companies, and pension funds price discriminate substantially less than banks or dealers.

This result is consistent with the hypothesis that banks and dealers have the preponderance of market power.[6] Other nonbanks are charged by MMSR-reporting banks accordingly. Additionally, these nonbanks might be getting bad prices when lending bonds because they have weak bargaining power vis-a-vis MMSR-reporting banks.

8.2   Nonbanks' Connection with Intermediaries

We also document that relative to nonreporting banks, nonbanks have trading relationships with fewer MMSR-reporting banks. Connection with more MMSR-reporting banks can be advantageous for two reasons. First, a customer can seek quotes from many MMSR-reporting banks and trade with the one that presents the most favorable quote. Second, the possibility of seeking quotes from many other MMSR-reporting banks in case the negotiation breaks down gives a customer a better outside option. With a better outside option, a

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[6]See Hill (2015) for an interview of bankers in the European repo market that supports this result.

Figure 6: **Price Discrimination by Clients**
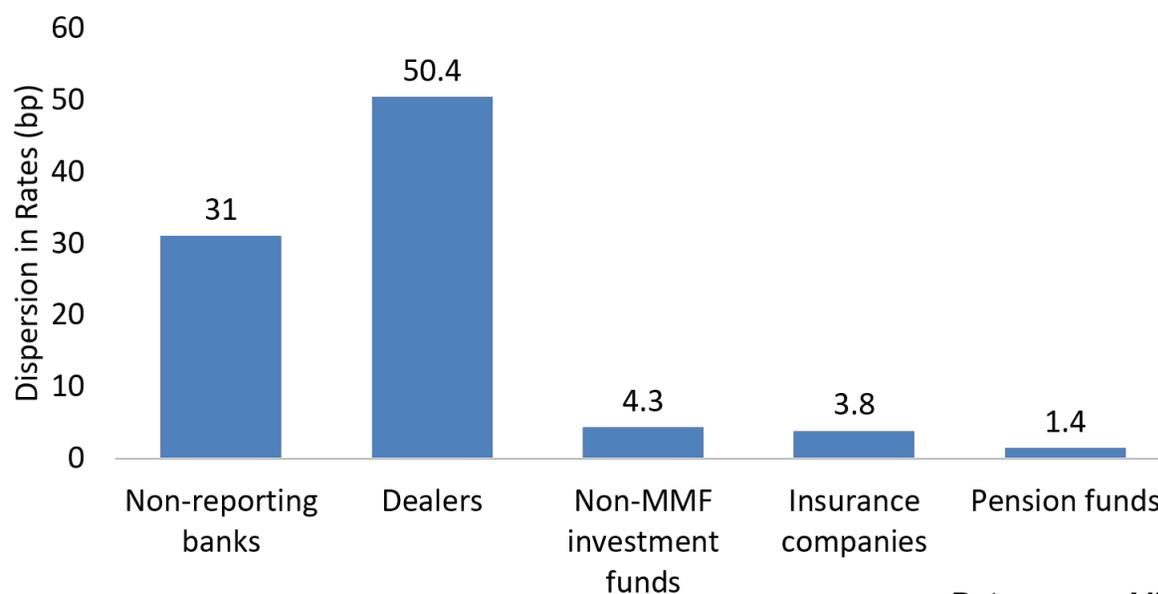
Notes: We compute the standard deviation of deal rates across transactions through which the same client lends the same bond with the same trade, settlement, and maturity dates. All transactions are bilaterally cleared. The only source of variation in deal rates is which MMSR-reporting bank is borrowing the bond. Clients lending bonds borrow cash at deal rates. Then we take the simple average value of those standard deviation measures by each sector to get sector-specific dispersion indices. A high value of this dispersion index implies that investors of a given sector do substantial price discrimination when lending bonds. The data source is the MMSR. The sample period is from July 2016 to March 2021.

customer can extract a better quote from an MMSR-reporting bank. Hau et al. (2021) show that clients connected to more banks get better prices in the foreign-exchange derivatives market.

Using the MMSR data, we count the number of MMSR-reporting banks that each client has traded with between July 2016 and March 2021. Then we obtain the average of those numbers by each sector. Figure 7 shows the results. On average, a nonreporting bank traded with four to five MMSR-reporting banks. However, investment funds and insurance companies traded with approximately three MMSR-reporting banks. Dealers and pension funds traded with less than two MMSR-reporting banks.

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Connection with fewer MMSR-reporting banks can explain why investment funds, insurance companies, and pension funds get smaller specialness when lending their bonds. Dealers are exceptional. However, their strong market power shown in the previous section can explain why they get good prices from MMSR-reporting banks.

Figure 7: **Connections with MMSR-Reporting Banks by Sector**
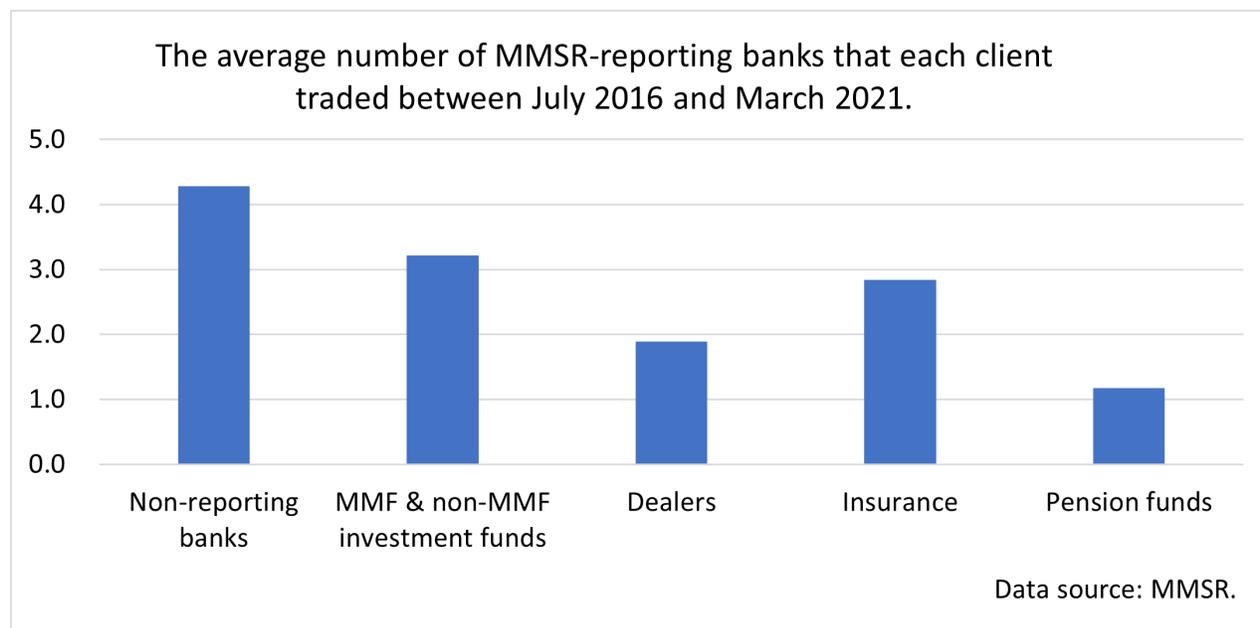
Notes: We count the number of MMSR-reporting banks with which each client had traded between July 1, 2016, and March 31, 2021. Then we take the average of those numbers by each sector. The data source is the MMSR.

9 Concluding Remarks

In the repo and the securities lending markets, investors can temporarily borrow and lend bonds. The supplementary income from lending bonds can greatly help the institutional investors' financial health in the current low-yield environment (Berdin et al., 2017). Simul-

taneously, many other financial markets (i.e., the derivatives market, the futures market, and the primary market for debt issuance) rely on the repo and securities lending markets.

We investigate how different types of nonbank financial institutions participate in these important markets. In the euro area, nonbanks hold more euro-denominated bonds than banks. However, we find that nonbanks do not lend their bonds as actively as banks. Therefore, their bond holdings reduce the effective supply of bonds circulating in the market. Consequently, nonbanks' bond holdings increase the specialness of that bond. Moreover, even when nonbanks lend their bonds to the market, large bank intermediaries price discriminate against them, except for dealers. Connection with fewer intermediaries and weaker market power can potentially explain why nonbanks do not earn high specialness.

These results imply that any policy action affecting the bonds' specialness can have differential impacts across financial sectors. For example, earlier works (D'Amico et al., 2018; Arrata et al., 2020; Corradin and Maddaloni, 2020) have shown that quantitative easing (QE) programs of central banks have increased the specialness of government bonds in the repo market. The higher specialness of government bonds induced by QEs is likely to have benefited banks more than nonbanks.

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10 Appendix

10.1 Tables

Table 5: **The Numeric Scores for Credit Ratings**

Rating	Numerical Value	Rating	Numerical Value
AAA	1	BBB-	10
AA+	2	BB+	11
AA	3	BB	12
AA-	4	BB-	13
A+	5	B+	14
A	6	B	15
A-	7	B-	16
BBB+	8	C	17
BBB	9	D	18

Notes: The table shows how we convert the credit ratings assigned by S&P, Moody's, and Fitch to numerical scores, as in Bubeck et al. (2020).

Table 6: **Holdings and Level of Specialness: First-Stage Estimation**

	ICPF	Bank	Non-MMF Funds	Dealers
$Duration_{irt}$	0.00491***	0.000427	1.40e-06	-0.000163***
	(0.000388)	(0.000641)	(0.000147)	(0.0000284)
Age_{irt}	-0.000205***	-0.000731***	-0.0000971***	-0.0000136*
	(0.0000695)	(0.0000917)	(0.0000365)	(7.73e-06)
$Outstanding_{irt}$	9.06e-13***	-4.19e-12***	-2.61e-14	1.43e-13***
	(2.62e-13)	(3.72e-13)	(5.81e-14)	(7.19e-15)
$Fraction(s)_{ir,2013Q4}$	0.823***	0.812***	0.499***	0.554***
	(0.013)	(0.023)	(0.0209)	(0.0258)
N	2,661	2,661	2,661	2,661
Cluster	Quarter	Quarter	Quarter	Quarter
Quarter FE	Y	Y	Y	Y
Rating FE	Y	Y	Y	Y

Notes: The table shows the first stage of the 2SLS estimation of the model $Specialness_{irt} = \beta_1 \cdot Duration_{irt} + \beta_2 \cdot Age_{irt} + \beta_{3s} \cdot Fraction(s)_{irt} + \beta_4 \cdot Outstanding_{irt} + FE_t + FE_r + \epsilon_{irt}$. Subscripts i, r, and t represent bonds, bond credit ratings, and quarters, respectively. $Specialness_{irt}$ is the specialness premium of bond i in quarter t. We define specialness as the downward deviation of the repo rate from the GC Pooling ECB EXTended Basket rate. $Duration_{irt}$ is the duration of bond i in units of years. Age_{irt} is the age of bond i in units of quarters. $Outstanding_{irt}$ is the outstanding amount of bond i in units of euros. $Fraction(s)_{irt}$ is the holdings of bond i by investors of sector s as a fraction of the total outstanding amount. We run separate regressions for each counterparty sector s. ICPF stands for insurance companies and pension funds. Cluster-robust standard errors at the quarter level are reported in parentheses are standard errors. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

10.2 Sample Construction for Section 7

Here we provide additional information on how we constructed the sample of transactions for analysis from the raw MMSR data.

First, we only consider transactions with single collateral. We do not consider transactions with multiple collaterals or with collateral pool (basket). For multiple collaterals, the bond lender can deliver more than one type of bond. For example, it can be an OAT and a Bund. For collateral pool, the bond lender can deliver any bonds from a prespecified list of bonds (basket).

Second, we only consider fixed-rate transactions because investors know the exact deal rate that will be applied in these transactions. However, for variable-rate transactions, deal rates are linked to other index rates (i.e., Euro Overnight Index Average rate). For example, consider a repo that settles on June 25, 2021, and matures on June 28, 2021. The interest that the cash borrower (the bond lender) pays on June 28, 2021, can be linked to the EONIA rate realized on June 28, 2021.

Third, we exclude triparty repo transactions because investors delegate the task of due diligence, managing collateral, and others to triparty agents. However, triparty repos constitute a minority of the market in the euro area.