The Pricing Implications of the Oligopolistic Securities Lending Market: A Beneficial Owner Perspective

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Abstract

We study the functioning of the securities lending market for the prime European benchmark securities, the German Treasuries, in the near zero interest environment. We show that despite the high demand pressure for pledgeable collateral, most lenders are unable to extract nontrivial market rents in the opaque, decentralized lending market. In the long maturity segment, where the marginal lender is likely to be a contractual savings institution with limited bargaining power, the inability of realizing material income from securities lending is likely to exacerbate solvency issues and lead to non-negligible welfare loss in pension contributions for most European citizens.

JEL classification: G12, G18, G21, G23

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Abstract

We study the functioning of the securities lending market for the prime European benchmark securities, the German Treasuries, in the near zero interest environment. We show that despite the high demand pressure for pledgeable collateral, most lenders are unable to extract nontrivial market rents in the opaque, decentralized lending market. In the long maturity segment, where the marginal lender is likely to be a contractual savings institution with limited bargaining power, the inability of realizing material income from securities lending is likely to exacerbate solvency issues and lead to non-negligible welfare loss in pension contributions for most European citizens.

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1. Introduction

The financial crisis had a twofold effect on the balance sheet of most European contractual savings institutions (CSIs), like pension funds and life insurers. On the one hand, the acquisition of high quality liquid assets (HQLA) become increasingly expensive due to scarcity of these assets. This scarcity is a result of quantitative easing (QE), flights-to-safety, regulatory efforts to increase bank capitalization, and the push for centralized clearing. On the other hand, falling equity prices and the near zero interest environment negatively affected CSIs' investments, making it difficult to generate the expected returns on existing policies (Blundell-Wignall et al. 2008; Pino and Yermo, 2010). The resulting steady decline in European pension institutions' solvency requires attention (Antolin et al. 2011; Yermo and Severinson, 2010; Greenwood and Vissing-Jorgensen, 2018; IPE, 2016). The economic concern is renewed in 2019, as central banks around the world restarted QE programs with large scale asset purchases (Bloomberg, 2019).

To meet obligations in this environment, CSIs either have to cut benefits or increase contributions, alter their investment portfolios, or look for new alternatives to generate income from their passive assets. Since the first two options are undesirable due to societal and political pushbacks, reaching for yield or seeking alternative income remain as feasible options. However, CSIs' risk taking and portfolio composition are rather restricted by regulation, where prudential risk management policies incentivize large holdings of safe, fixed income assets and sovereign bonds (see Appendix A for more details on European CSI portfolio holdings)[2]. Consequently, seeking new sources of revenue seems an optimal policy, especially as the practice of securities lending is even encouraged by European pension and

[2] The relevant European regulation on CSI accounting and risk management practices are the Institutions for Occupational Retirement Provision Directive (IORP Directive 2003/41/EC) and the Solvency II Directive (Directive 2009/138/EC) issued by the European Commission. For instance, according to the Solvency II Directive, CSIs should improve long-term risk management practices by duration matching asset and liability portfolios, which is easiest achieved by increasing exposure to long-term, safe fixed income assets (IPE, 2016).

insurance regulators. Lending out large holdings of HQLA in fully indemnified securities lending contracts not only generates income from the passive assets in low-risk transactions, but it also increases the loan supply of long-maturity collateral-eligible bonds, easing the demand pressure on the (very) long end of the bond yield and swap curves.

Following the decline of unsecured interbank lending after the financial crisis, institutions' search for liquidity or for safe, collateral eligible assets lead to significant growth in the fixed income segment of the securities lending market, resulting in a global business worth five-trillion dollars by 2016 (ISLA, 2016). In this study, we focus on the fixed-income, more specifically the HQLA segment of the securities lending market, and show that the realizable income for lenders remains economically small despite the high demand for the prime European benchmark securities, German Treasuries. We argue that this is a market inefficiency, that arises because the (global) securities lending market operates as a loosely connected, non-transparent over-the-counter (OTC) market with a handful of large, oligopolistic agent-dealers who have insights about demand and supply, while borrowers and lenders generally do not.[3]

We also provide supporting evidence for Duffie, Gârleanu, and Pedersen (2002)'s theory that less connected market participants are likely to be at a disadvantage and are therefore unable to extract real "market" rents. Pension funds and insurers, who typically do not manage their own lending desk, nor have sufficient insight about the market, have to rely on the services of about a dozen key prime brokers or agents lenders. These agents may rather act in the interest of the borrowers, such as banks or hedge funds for repeat business, and for

[3] The oligopolistic, non-transparent nature of the securities lending market is well document for equites by Kolasinksi et al. (2013) and it is generally assumed that the same large FIs (e.g., State Street, JP Morgan, Citi, Goldman Sachs, etc) are the agent-lenders in fixed income and equity segment.

this reason underrepresent the less connected lenders, suggested by the recent lawsuits filed by smaller U.S. pension funds (SLT, 2010; Reuters, 2017; WSJ, 2017)[4].

In this paper, to our knowledge, we are the first to explicitly examine the welfare implications of the European protracted interest rate environment in conjunction with the functioning of the securities lending market from July 2006 to June 2015.[5] We specifically examine the market segment for German nominal bonds where CDS or speculative trading on downside risk are unlikely to play a role. Aggarwal et al. (2016) also examine treasury securities lending activities in Europe, but their focus is on the interaction of the repo and securities lending markets to reveal important funding liquidity and macroeconomic policy implications. Our paper has a different focus, the passive beneficial owners' perspective, where the efficacy of the securities lending market can be directly linked with citizens' wealth preservation.

Theoretically, the demand pressure in the primary and secondary markets for HQLA could generate a sizeable securities lending revenue stream for beneficial owners, like CSIs. However, well-documented market inefficiencies, such as the inelasticity of lending fees (Kolasinski et al., 2013), and the low bargaining power of less-connected lenders (Duffie et al., 2002; 2005) may impede the realization of significant economic benefits from lending income. Our main empirical question is whether long-term passive investors of safe German treasuries are able to capitalize on the high demand in the non-transparent, OTC lending market.

After shortly introducing securities lending vis-a-vis repo transactions and comparing their income generating potential and risks, we document the relationship between bond yields and

[4] More information on CSIs' use of agents and litigation trends and the fore mentioned lawsuits can be found in Appendices D and E, respectively.

[5] Protracted interest environment is an interest rate regime, where both real and nominal interest rates are persistently low, neither declining, nor increasing. Antolin et al. (2011) emphasize that this regime can last for longer periods, i.e. for years or perhaps decades, posing great challenged to pension funds and insurers.

securities lending market information, such as lending fees, loan demand and supply shocks. Next, we show that demand pressure is incorporated in lending fees with a delay, despite the exceptionally high utilization rates of German Treasuries. This implies that even though German nominal bonds are highly sought after, the market takes longer to reflect this in the lending fees, perhaps due to agent-lenders "cream-skimming" the market (as in Bolton et al. 2016). Furthermore, we also document high relative price spreads on lending contracts, especially when fees are already high, suggesting that some lenders are unable to extract the "real" rents due to prime brokers' discriminatory pricing behaviour and information advantage.

Overall, by documenting the welfare implications of the fixed income segment of the securities lending market, we contribute to three strands of the literature. First, we complement the growing literature on securities lending, with focus on the sovereign bond segment. While the equity segment of the sec-lending market is well-studied, much less is known about the fixed income segment despite its economic importance.[6] Fixed income lending papers predominantly focus on corporate bonds in relation with short selling (Asquith et al., 2013; Kecskés et al., 2013), or specialness (Jordan and Jordan, 1997; Krishnamurthy, 2002), or the collateral channel (Baklanova et al., 2016; D'Amico et al., 2018, Pelizzon et al., 2019). The closest to our paper is Aggarwal et al. (2016)'s work, who study how treasury lending and repo markets support the transmission of monetary policy. Our paper is different, as we show that even at the time of severe collateral shortages, the agency model of treasury lending transactions does not allow less connected and less informed lenders to realize substantial lending income. We also provide new empirical evidence on market and pricing

[6] Equity lending activity has been shown to facilitate price discovery and market efficiency (Boehmer and Wu, 2013; Engelberg et al., 2012), by supporting short selling and revealing new, negative information (Boehmer et al. 2008; Desai et al. 2002; Diether et al. 2009). It also helps preventing the formation of price bubbles (Hong, Scheinkman, and Xiong, 2006). Lending fees also carry information, as Duong et al. (2016) show that they predict future stock returns, while Duffie et al. (2002) and Porras-Prado (2016) show that future lending income is priced in stocks.

efficiencies arising from opaque OTC market structures consistent with Duffie et al. (2002)'s theory and recent empirical studies (Bolton et al. 2016; Di Maggio and Tahbaz-Salehi, 2015; Di Maggio et al. 2017).

Last, by studying the lender's side of the securities lending market, we provide new insights for pension and insurance research. Engaging in securities lending is a prudentially acceptable way of generating additional portfolio income. This conservative alternative should be encouraged or supported with transparency instead of the "gambling for redemption" or yield seeking investment strategies described in Antolin et al. (2011) and Domanski et al. (2015). In addition, activating the hidden supply of long maturity, collateral-eligible bonds from long-term passive portfolios can alleviate the demand pressure on the long end of the bond yield and swap curves (Domanski et al., 2015; Greenwood and Vissing-Jorgensen, 2018; Klinger and Sundaresan, 2018; Driessen et al., 2018); and thus, CSIs sec-lending should be in the interest of regulators and market participants alike.

2. Introduction to Securities Lending and its Role for Wealth Preservation

2.1. Introduction to Securities Lending from Lenders' Perspective

Due to the increasingly important role of securities financing transactions (SFT), such as repo and securities lending, in liquidity provision and transformation, SFTs have attracted significant academic and regulatory attention after the global financial crisis (Agarwal et al. 2016; Arnesen, 2017; Baklanova et al. 2016; Mancini et al. 2016). Financial institutions heavily rely on repo financing, where they use HQLA, like treasuries, to secure overnight or short term financing at the general collateral (GC) rate. In these *supply-driven* transactions, the owner of the treasury lends out the asset at a discount. However, in some cases, the demand for specific treasuries gives rise to specialness, where specific treasuries can be lent

out at a high rate, in which case the lending transaction is driven by the demand side of the market (Duffie, 1996; Jordan and Jordan, 1997).

Securities lending (SL) transactions and repos are both SFTs that have many similarities and can substitute for one another. The main difference is that SL transactions are generally *demand-driven*, where the asset owner is not liquidity constrained and wants to lend their asset only at a premium. In SL, the beneficial owner lends out asset X, typically in an overnight transaction, and the borrower posts collateral in excess of the transaction value, 102-104% thereof, depending on the collateral quality or the specific regulatory environment.[7] Figure 1 compares SL and repo transactions, and suggests that securities lending and the "specials" segment of the repo market are rather similar, as the latter is also driven by the demand to borrow particular, highly demanded securities.

[Figure 1 about here]

Securities lending transactions are fully indemnified and collateralized contracts, in which one party gives legal title of a security to another party for a limited period of time, in exchange for legal ownership of the collateral. The first party is called the "lender", even though they are transferring the legal title to the other party, who is called the "borrower" (ICMA, 2018). The other important difference between repos and SL, is that securities lending transactions are mostly tri-party deals, while repos are mostly bilateral in the Eurozone. Consequently, SL is based on a profit-sharing scheme between the agent-lender and the beneficial owner, where the fee that is generally agreed daily, is shared, especially when the collateral cannot be easily reinvested for additional revenue. In cases of cash or

[7] For simplicity, we use beneficial owners and lenders interchangeably in the text. The effective de-facto lenders are however often the prime brokers and the agents acting on behalf of the owners, who may not have the capability (e.g., lending facility) to lend directly.

other liquid collateral, a rebate rate is negotiated between the lending agent and the borrower.[8]

Globally, securities lending contracts are predominantly OTC transactions, where lenders and borrowers are connected through agent-lenders and/or prime brokers, which results in a high degree of opaqueness.[9] Although there have been efforts to establish a centralized and more transparent securities lending market, such as SecFinex, in the current oligopolistic market setting about a dozen prime brokers/agent-lenders control their own significant market share. In fact, this gives rise to high search costs, moreover, less connected borrowers or borrowers with limited bargaining power are often unable to arrange transactions to execute their trades (Duffie et al. 2002; 2005; Kolasinski et al. 2013). These inefficiencies are well-documented in the equity segment of the securities lending market because they cause binding short-sale constraints, which negatively affect market quality and price efficiency (e.g., Boehmer and Wu, 2013; Chague et al. 2017; Saffi and Sigurdsson, 2011). However, thus far, these inefficiencies have been unexplored in the fixed income segment.

In recent years, the fixed income segment of the securities lending market became increasingly important for collateral swaps and derivative settlement, i.e., CDS and futures contracts, where the demand for specific assets drives these transactions. Natural lenders are pension funds, trusts, and insurance firms, who hold large passive asset portfolios over a long

[8] Traditionally, cash collateral is used in the U.S. and non-cash securities in Europe and Asia. Depending on the credit quality and liquidity of the non-cash collateral re-hypothecation or collateral re-pledging might be feasible, which could further enhance the income generating potential of SL transactions,.

"This rebate rate, stated as an interest rate, represents the interest on the borrower's cash collateral that the lending agent agrees to pay back to them at the termination of the loan. In order to generate a yield, the lending agent will invest the cash via a commingled fund or in a separate account in short-term fixed income instruments in order to generate a spread above the rebate rate. The difference between the yield on the cash collateral and the rebate rate is the revenue that will be shared between the lender and their lending agent. Consequently, lenders should be aware of the market risk." (JP Morgan, 2011)

[9] Although there is a significant growth in CCP cleared securities lending contracts, which can reduce counterparty risk, thus far it has not significantly improved transparency. In January 2009, the OCC began centrally clearing all stock loan transaction on AQS, a wholly owned subsidiary of Quadriserv. Quadriserv is currently in the centre of a heated debate, where pension funds are suing major banks, which "tend" to boycott the system (Reuters, 2017).

horizon. As State Street (2016) reports, these institutions account for about 75% of the lending supply in our sample. Consequently, in the persistently low interest rate environment, securities lending has emerged as an important non-conventional source of income, where the received collateral is passed through to invest in potentially more profitable structured financing vehicles. This income source is especially valuable in the Eurozone, where most pension funds hold a large portfolio of sovereign debt, while in the past decade, both nominal and real yields have been hovering around and below zero.

2.2. The Welfare Implications of Securities Lending

Pension funds and insurers play a key role in wealth preservation, by supporting retirees. In the US, most pension funds have been actively investing in a diversified portfolio and increasingly rely on the securities lending market to create addition income from their large portfolios of assets. For example, California Public Employee's Retirement System (CalPERS) reported material income from securities lending by auctioning off part of its portfolio to key financial institutions (FIs). Although CalPERS realized losses from inappropriate collateral reinvestment during the financial crisis, securities lending income remains an important revenue stream for the fund, with a focus shifted on lending fee components instead of reinvestment income.[10]

In Europe, the economic role of pension funds and insurance companies is critical because the majority of retirees rely on public or occupational pension income at old age. Because of this societal importance of the European pension and insurance sectors, market participants are heavily regulated. For instance, the Solvency II Directive of the European Commission promotes better risk management practices, which calls for greater exposure to low-risk,

[10] There has been a significant shift toward term lending in the fixed income space of the securities lending market in the last years, due to the subsequently higher realizable income. "Term lending increases revenue for the lender because it earns a premium for it – often 15 or 20 basis points higher than an overnight contract, depending on the demand for the particular security, the collateral being pledged and the contract length." (IPE, 2017).

fixed income assets, like long-term treasuries (IPE, 2016; EIOPA, 2019). The 2014 Mercer survey finds, that in compliance with the regulation, German pension funds allocate 42% of their total assets to domestic nominal government bonds. Although this regulatory push towards safe asset holding prevents from significant value deterioration in market downturns, the historically low interest rates have attributed to a decline in the aggregate net worth of the European pension industry, dipping below zero in 2016 (ECB, 2016).

Similar to the US Treasury market, only a select group of FIs (can) participate in the German primary market and purchase directly from the treasury issuing these assets. Consequently, long term investors, who are not primary dealer, have to buy the desired assets from other FIs and agents, as presented in Figure 1 and in Appendix B, where we describe the German government bond market, and the role of CSIs therein. The German Finance Agency, the issuer of sovereign debt, reports that the primary investors (asset holders) in treasuries are institutions, such as banks, brokers and asset managers, and for long maturities predominantly pension funds and insurers (Finanzagentur GmbH, 2015).

Thus, pension funds and insurance firms obtain large volumes of HQLAs from FIs (e.g., large investment or universal banks) who are often also active security agent-lenders at the same time. These FI agents have a comprehensive overview of the lending market demand, and therefore can activate supply from insurance companies and pension funds, who most often do not manage their own lending desks. Since the additional income from securities lending is valuable, CSIs willingly engage in lending out their passive assets holdings, as depicted by the HQLA lifecycle in a CSI's portfolio in Figure 2.

[Figure 2 about here]

While maintaining a lending desk can be costly for a specific CSI, the realizable income from lending is likely economically important and could offset the costs. For instance, if a pension fund holds a €200 million position in a bond with 20 years remaining maturity that has a lending fee of 5 basis points (bps), engaging in securities lending would generate €2 million

in lending income throughout the holding period of this single bond. If we consider that not every asset can be lent out at any point in time, i.e. we assume a utilization rate of 50%, the realizable income still amounts to €1 million with the 5bp rate. But if the lender had greater bargaining power and potentially willing to lend at term contract, reducing recall risk for the borrower, the lending fee and the total realizable income could be significantly higher.[11] Then considering an entire portfolio of passive HQLA holdings, even without collateral reinvestment, the realizable lending income is economically non-negligible. In terms of cost savings, smaller European pension funds and life insurers could manage one lending desk for their pooled assets to reduce operating costs and increase the bargaining power of the CSIs' lending co-operative.

3. Data, Summary Statistics and Hypothesis Development

3.1 Data and Variable Constructions

Our dataset contains daily yields of German treasuries from July 3, 2006 to June 1, 2015. We use daily closing mid-prices, obtained from Bloomberg, to calculate yields-to-maturity following market conventions. German Federal bonds (Bunds), five-year Federal notes (Bobls), and Federal Treasury notes (Schätze) are also listed on the German stock exchanges, which provides price transparency (Deutsche Bundesbank, 2016).[12] We complement these yields with bond characteristics, such as issue and maturity dates, coupon rates, and issuance amounts from Bloomberg. To adjust for market liquidity and demand for a security, we also create an on-the-run dummy, similar to that in Krishnamurthy (2002).

Using International Securities Identification Numbers (ISIN), we match bond yields and characteristics from Bloomberg with securities lending market information from IHS Markit.

[11] Based on the following back of the envelop calculation: €200,000,000*0.0005*20= €2,000,000.

[12] Despite excluding government bills due to differences in market conventions and microstructure, our bond sample covers 70% flow and 90% stock of German sovereign debt.

In the merged dataset, we have information on the total supply and borrowing values in USD.[13] In the empirical analysis, we use the natural logarithm of the total supply and demand values in EUR millions (*LogSupply* and *LogDemand*), converted from the USD values provided by IHS Markit, using the daily official exchange rates from the Statistical Warehouse of the ECB.

In addition to demand and supply variables, we also use the utilization rate (*Utilization*), defined as the percentage of the total supply that is currently on loan. The other key measures are related to the lending income. We use the annualized value-weighted average lending fee (*Allfees*) that is based on all outstanding contracts for a given ISIN, measured in basis points. Since the variable is highly skewed, in line with the equity lending literature (Duong et al., 2018; Gagnon, 2018), we use the natural logarithm of the value-fees (*LogFees*) in the empirical analysis. Last, we also apply the *Feespread* measure, which is the basis point difference between the highest and lowest fee contracts for a given ISIN on a given day.

IHS Markit also provides information on total return from securities lending, capturing the reinvestment income that depends on the agreement of the beneficial owner and agent-lender. However, in recent years, lenders increasingly focus on the fee component (SLT, 2010), which, in fact, is the outcome of negotiation not based on market conditions or the success of re-hypothecation. This makes fees a true measure of the beneficial owner's bargaining power, and therefore it is the most suitable metric to address our research question. The definitions of the individual variables can be found in Table 1.

[Table 1 about here]

3.2 Summary Statistics

[13] While the equity focused securities lending studies use relative measures, scaling with the total shares outstanding, we are forced to rely on aggregate nominal values because the total outstanding bond volume is unavailable on the daily basis. At any point in time, in the secondary sovereign bond market, it is difficult to measure the exact available total quantity because of ongoing central bank interventions and bond volumes retained and re-issued following primary auctions.

Table 2 presents the summary statistics of the key variables based on our German nominal bond sample between July 2006 and June 2015. It shows that the average bond has an issue size of EUR 17.5 billion, it was issued about 5.5 years ago (*Age*) and has 7.8 years remaining until maturity (*TTM*). The average coupon rate is 3.57%, while yield-to-maturity is 1.99%. On average, 5.1% of the outstanding bonds are on-the-run. Considering the securities lending market activity measures, the average total supply is about €3.7 billion (*Suppleurval*) per issue, with an average total demand of 2.3 billion (*Demandeurval*). The average annualized lending fee (*Allfees*) is 10.8 bps with an average spread (*Feespread*) of 3.83 bps, while the utilization rate (*Utilization*) is 51.6%. This is strikingly high in comparison with the equity market, and signals the importance of the securities lending activity for safe and liquid fixed income securities.

[Table 2 about here]

In the lower section of Table 1, we provide summary statistics for the subsample of bonds with 10 years or longer maturity. It is well documented that pension funds and life insurers hold long maturity assets to minimize the duration gap between their asset and liability portfolios (Antolin et al. 2011; Blundell-Wignall et al. 2008). In Europe, where portfolio risk-taking is limited by the prudential regulatory framework of Solvency II, many pension and insurance funds hold long maturity government bonds (Domanski et al. 2015, EIOPA stress tests 2014, 2016; GVD, 2017). About one fourth of the bonds fall in the longer maturity segment, with an average coupon rate of 5% and TTM about 21.5 years. Interestingly, the securities lending market variables are comparable across the two samples. The average fee is about 11.6 bps, and while the lending supply is somewhat larger, about €4.4 billion in comparison with the €3.7 billion in the full sample, the demand is slightly lower, about €1.6 billion in comparison with €2.3 billion in the full sample.

In addition to pooled panel summary statistics of Table 1, Figure 3 provides time-series insights into the moving monthly averages of the key variables. The upper panel depicts the

average of value-weighted fees and the utilization rates over time. Exhibiting significant variation over time, the average fee notably increases after the Lehman bankruptcy in 2008, and peaks around 40 bps at the height of the European debt crisis. Fees also spike up preceding the largest ever credit infusion into the European banking system implemented by the ECB (Reuters, 2011). As opposed to fees, utilization is rather stable, and ranges between 40% and 60%, significantly above its equity lending counterpart. The lower panel focuses on supply and demand values, which follow a similar time-series patter to fees and seem to move in lockstep.

[Figure 3 about here]

3.3 Hypothesis Development

In this study, we are interested in the potential welfare implication of the functioning of the securities lending market for the prime European benchmark bonds in times of protracted interest rates. To examine this question, our empirical hypotheses concern market frictions and conflicts of interest between beneficial owners and agent-lenders throughout the life-cycle of a safe treasury investment. We specifically focus on pension funds and life insurers, and assume that these investors are the de facto beneficial owners of long-term, safe government bonds, since these holdings help minimize the duration gap between their asset and liability portfolios.[14]

In Figure 2, we depict the three stages of the life-cycle of a treasury investments, and demonstrate how agent-lenders have an integral role both in the purchase/acquisition (Stage 1), as well as during the holding period of the bond (Stage 2). First, in Stage 1, government bonds are directly auctioned to a small group of primary dealers, many of whom are prime

[14] According to the 2015 BIS report, the average duration of insurance firms' holdings is above 10 years, while the average German pension duration is about 22 years across men and women in 2016, suggesting that the asset duration of these investors is longer than 10 years at the portfolio level. These statistics are further confirmed by the EIOPA stress tests and the 2017 edition of the Statistical Yearbook of German Insurance.

brokers and also active agent-lenders. Following the auction, pension funds and insurers access the newly issued bonds through these intermediaries, whose pricing behaviour at the auction likely factors in the bond's future ability to fulfil capital reserve requirements, become cheapest to deliver in derivative markets or special in the repo market. A potential conflict of interest could arise, if the dealers knew that by selling a bond to pension funds, they could later regain access to it by acting as agent-lenders.

Our focus is on Stage 2, which is a repeated game setting between agent-lenders and beneficial owners, where securities lending transactions and collateral reinvestment take place, and fees and rebates are negotiated each time. Theoretically, the demand pressure in the secondary market for HQLA could generate a significant revenue stream from securities lending over the long investment horizon, if agent-lenders represented beneficial owners well in the opaque securities lending market. This representation materializes in lending fees, fee elasticity, and the spread on contracts written on the same bond between various beneficial owners. Our null hypothesis is that in a well-developed, competitive securities lending market, prices, i.e. lending fees, dynamically capture (shocks to) demand and supply. During our sample period, the high demand for HQLAs would create market conditions, where the demand and supply shocks are more likely to be priced in, as suggested by Kolasinski et al. (2013) in the equity lending context.

H0: In a well-functioning securities lending market with rational expectations, lending fees should instantaneously incorporate expected and realized demand pressures.

The alternative hypothesis stems from market inefficiencies and the agency conflict between agent-lenders and beneficial owners. For instance, Kolasinski et al. (2013) find that lending fees are inelastic up to a certain threshold in the equity segment and document that the incorporation of new information, such as supply and demand shocks, is delayed. We expect that these issues are exacerbated in the long maturity segment of the bond market, where beneficial owners are likely to be smaller pension funds or insurers, who generally do not

manage active lending desks and have limited bargaining power. Consequently, these less connected lenders are vulnerable in the lending transactions where agent-lenders are likely to underrepresent their interest by giving them a smaller cut from the lending fee or set a smaller fee (similar to Bolton et al. 2016; Duffie et al. 2002, 2005). This "cream-skimming" could arise when the borrower is a preferred client of the agent, such as a bank or a hedge fund, and the agent wants to arrange a special deal, a low borrowing cost transaction.

HA: In an inefficient securities lending market, fees react to changes in demand with a delay; and not all lenders are equally compensated.

We examine the market reaction to both realized and expected demand and supply changes. Unlike the extant empirical studies on the efficiency of the equity lending market, which focus only on fee elasticity with respect to endogenous demand and supply changes, we are also able to consider exogenous demand and supply effects. In efficient markets, securities lending should not only capture the ex post demand pressure but also incorporate changes in the expected demand or supply. For instance, around financial reporting dates, banks drive HQLA demand up, as the portfolio inclusion of these assets decreases risk weighted assets and liquidity coverage ratios, temporarily helping banks to window-dress their balance sheets.

More importantly, we also attempt to address lender heterogeneity by studying the spread on lending fees. High spreads on a given bond indicate that the same security is lent out at different prices (Duffie et al. 2007), suggesting that some beneficial lenders realize significantly lower income than others. In other words, if prime brokers and dealers withhold information or exercise their market power, the connectedness of lenders can play a significant role in extracting "real" rents from lending (Bolton et al. 2016; Di Maggio and Tahbaz-Salehi, 2015; Di Maggio et al. 2017). Specifically, lenders with weak bargaining power, such as non-active traders like CSIs, are more likely to face impediments in realizing real market rents from securities lending.

4. Empirical Analysis

In the empirical analysis, in Section 4.1, we first present the general time trend in German treasury yields during our sample period from 2006 to 2015. Next, in Section 4.2, we study the pricing efficiency of the securities lending market and test our hypothesis, by linking lending fees to endogenous and expected demand shocks, as well as examining fee spreads, to shed light on the fore mentioned market and pricing inefficiencies.

4.1 Panel Regression Analysis of Daily German Treasury Yields in the Secondary Market

We first document the downward trend in German sovereign bond yields, as a by-product of the increasing collateral shortage and unconventional monetary policies following the global financial crisis and the 2010 European debt crisis. Next, we are interested in the pricing implications of the securities lending market, whether the expected lending income is material, and therefore should be captured in secondary market, as suggested by Duffie et al. (2002). However, if market demand is low, or beneficial owners have limited bargaining power or weak representation by the agent-lenders, lending income could be negligible; and thus, would not influence yields and asset prices.

[Table 3 about here]

The results in Table 3 Panel A show that higher securities lending market utilization rates are associated with lower yields, suggesting that investors are willing to pay higher prices for securities with higher realizable expected lending income.[15] We find similar results in Models 4 and 5, where we focus on securities lending demand and supply measures. In Table 3 Panel B, we repeat the analysis including an additional dummy variable (*Longmat*) that takes on the value of one for bonds with more than 10 years to maturity. We also include an interaction of

[15] In Online Appendix C, we provide extended tables, displaying year fixed effects.

this dummy with the main securities lending variables, and in Model 5, we find that utilization rates have a pronounced effect for long maturity bonds in addition to lending fees.

4.2. Price Dynamics for German Treasuries in the Securities Lending Market

To test our first hypothesis, we examine lending fee dynamics in the panel setting. Lending fees effectively proxy for lending market liquidity of a specific bond, where the fees are established as the intersection of demand and supply. Higher fees imply that the owner of the security can earn some additional income, which is why beneficial owners may accept holding assets with lower yields (Duffie, 1996). In Table 4, we find a significant positive coefficient on the demand change dummy variable $DemIncrease_t$, which takes on the value of one when the lagged one day change in realized demand is greater than 2%, an increase within the top quartile of the demand change distribution. More importantly, we find that fees react to an increase in demand with a delay, thereby supporting our alternative hypothesis regarding securities lending market pricing efficiency. Last, in Models 4-6, we include the long maturity dummy (*Longmat*) and its interactions with the $DemIncrease_t$ measure. Further confirming our hypothesis, we find that the price (lending fee) effect of demand changes in the longer end of the yield curve is muted.

[Table 4 about here]

Next, in Table 5, we focus on exogenous demand shocks that are known to market participants in advance.[16] The most prominent expected shock is the cyclical demand pressure for HQLAs at year-end regulatory reporting dates, and new issuances of comparable Treasuries, where dates are known in advance from the issuance calendar. In efficient markets, all public information should be fully captured in prices. Table 5 presents the relevant empirical results with the lending fee dynamics at year-end reporting dates.

[16] Additional regression results are available for Tables 7 and 8, where we find insignificant results based on fees. This suggests that lending supply changes do not have a major effect on fees.

[Table 5 about here]

Banks with large trading desks have traditionally been active participants of repo and securities lending markets. However, due to the increasingly stringent prudential regulation and reporting requirements, banks are incentivized to lock in HQLA in their portfolios for year-end reporting dates, to minimize their required risk-weighted capital and liquidity buffers. Consequently, around these dates, nonbank lenders may be able to capitalize on their "unique" lender position (ICMA 2017).

In Table 5, we find that fees are significantly higher around year-end, using five calendar days to proxy for year-end (*Repwind*).[17] This result is robust to the inclusion of controls for contemporaneous and lagged securities lending markets supply and demand. In Table 5, Models 2 to 4 also incorporate the long maturity dummy, *Longmat*. We find that at the long end of the yield curve, fees are less sensitive to the changes in expected demand shocks around year-end reporting dates. Models 3 and 4 also incorporate a dummy *Aft2010* that takes the value of one in 2010 and years thereafter. This variable captures the fee increase following the inception of the European debt crisis, but its interactions with *Repwind* and *Longmat* produce mixed results.

The fees seem to increase at the year-end after 2010, captured by the positive coefficient on the *Aft2010*Repwind* interaction variable in Model 3. However, once we include the triple interaction term *Aft2010*Repwind*Longmat* in Model 4, the coefficient on *Aft2010*Repwind* becomes less significant. This suggests an absence of a significant fee reaction in the natural habitat of long-term investors at year-ends even after 2010. In other words, while pension funds and insurers may have become more important as liquidity providers and lenders in the treasury segment of the securities lending market, they are not able to realize additional

[17] In auxiliary analyses, we use 3 and 4 calendar days, as well as 3, 4, and 5 trading days. The results are economically and statistically similar to the reported ones.

compensation. These results support our hypothesis that wealth preservation agents are in an adverse position due to limited bargaining power; and thus, they are unable to fully realize the potential income benefits from securities lending.

[Table 5 about here]

At last, in Table 6, we examine the heterogeneity in lending fees to provide additional evidence on agent-lenders' discriminative pricing behaviour. Specifically, we examine the *Feespread*, the difference in the highest and lowest fees on all contracts, on a specific date, for a specific ISIN. Given the high utilization rates, beneficial owners should equally benefit from high demand, and therefore generate comparable lending income. However, if their interests are not well-represented, we expect to find that while some lenders are able to capitalize on the high demand, others cannot, which leads to wide spreads on the outstanding lending contracts. Indeed, the results from Table 6 show that with a higher utilization rate, the fee spread narrows on average.

On the other hand, we see that *Feespread* increases with supply and at year-end, confirming that not all lenders are able to capitalize on temporarily increased lending fees around reporting dates. Results from Models 6 and 7 show that with higher fees and higher demand, the spread increases, which suggests price discrimination in the market on the sale side, complementing the buy-side results of Kolasinski et al. (2012) and Chague et al. (2017). To further explore this issue, we focus on the role of conservative long-term investors by including the *Longmat* dummy and its interaction with utilization, fees and demand. We find that most coefficients are positive, albeit statistically insignificant in this small subsample. This is suggestive evidence of the differential price treatment of less connected beneficial owners, who seem to receive a persistently low fee income, while other, special clients with greater bargaining power receive higher fees. In other words, agent-lenders potentially take higher cuts in the profit-sharing scheme with less connected borrowers, similar to Bolton et al. (2016), further confirming our hypothesis that fees are not only slow to incorporate

lending market information, but they are also dependent on the market power and connectedness of lenders.

[Table 6 about here]

Taken together, the results from Tables 3-6 provide important evidence of market inefficiencies on the sell-side of the securities lending market. While the securities lending literature primarily focuses on buy-side borrower discrimination, we are the first to provide insights on the sell-side of the fixed securities lending market, with a special focus on the beneficial owners' perspective. We present evidence of price discrimination and suggest that agent-lenders systematically underrepresent less connected beneficial owners in the non-transparent, oligopolistic treasury securities lending market.

5. Conclusion

In this study, we provide empirical evidence of market inefficiencies in the German sovereign bond segment of the global securities lending market from July 2006 to June 2015. We document price inelasticity of lending fees and potential discriminatory pricing behaviour of agent-lenders in the HQLA segment, where there is exceptionally high demand pressure due to collateral scarcity in the aftermath of the global financial crisis. The inefficiencies, where lenders are unable to derive market rents, can arise because the market is non-transparent and decentralized, so that smaller, less connected lenders must rely on their agents. Moreover, the inefficiencies are more evident in the long maturity segment, where the marginal lender is a contractual savings institution, responsible for the wealth preservation of the average European citizen. Consequently, these institutions' inability to capitalize on lending income has non-negligible negative welfare consequences in the protracted interest environment, which remains the status quo even in 2019, more than ten years after the global financial crisis.

Our findings are an important and timely contribution, since the rapid growth and increasing importance of securities financing transactions following the financial crisis has also attracted regulatory attention. As such, the European Securities and Markets Authority (ESMA) is currently collaborating with the European Commission to come up with a unified regulatory framework for repo and securities lending transactions, while starting from mid-2019, securities financing transactions will become subject to post-trade reporting obligations under the Markets in Financial Instruments Directive of the European Commission, also known as MiFID II.

While most of these regulatory efforts aim to mitigate the systemic risk that can arise from these shadow-banking operations, we urge the regulators, perhaps also the European Insurance and Occupational Pensions Authority (EIOPA), to consider introducing some measures that protect smaller, less informed market participants. These are mostly smaller pension funds and life insurers, who do not manage their own, internal lending desk due to economies of scale and cost considerations. These institutions could either set up lending desks together as a CSI co-operative, in which case the pooled assets could increase their bargaining position in the market, or they start lobbying for regulatory oversight that would grant more transparency to reduce the information asymmetry and the subsequently arising market inefficiencies.

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Table 1. Description of Main Variables

Variables	Definition and explanation
Aft2010	Aft2010 is an indicator variable that takes on the value one in 2010 and in years thereafter.
Allfees	Allfees is the value-weighted average annualized lending fee, based on all outstanding contracts for a given day, as provided by the IHS Markit. The variable is reported in basis points.
Coupon	Coupon rate is the annual percentage amount, as reported by the Bundesbank.
DemIncrease	DemIncrease is an indicator variable that takes in the value of one when the lagged one day change in realized demand is greater than 2%, an increase within the top quartile of the demand change distribution.
Feespread	Feespread is the difference between the highest and the lowest fees on all outstanding borrowing contracts for a specific security, on a given day.
Issue size (LogSize)	Issue size is the total issue size in million euros, as reported by the German Bundesbank at the time of issuance.
LogDemand	LogDemand is the natural logarithm of the total securities lending market demand for a given security, as provided by the IHS Markit. IHS Markit reports lending market quantities in USD, which is converted into EUR using the daily exchange rate from the Statistical Data Warehouse of the ECB.
LogSupply	LogSupply is the natural logarithm of the total securities lending market supply for a given security, as provided by the IHS Markit. IHS Markit reports lending market quantities in USD, which is converted into EUR using the daily exchange rate from the Statistical Data Warehouse of the ECB.
Longmat	Longmat is an indicator variable that takes the value of one for issues with more than 10 years of remaining maturity.
Ontherun	Ontherun is an indicator variable that takes the value of one for the days when the specific security is on-the-run for its tenor, and is zero for all seasoned securities.
Repwind	Repwind is an indicator variable that takes on the value of one for the last 5 days of the calendar year, the most prominent reporting date from a prudential regulatory perspective.
Time-to-maturity (TTM) and age (Age)	TTM is the time-to-maturity of specific Germany treasury, measured in years and with a 2-digit accuracy. Age is the number of years since issuance, at the 2-digit accuracy.
Utilization	Utilization is the percentage value of assets on loan from lenders, divided by the total lendable value. IHS Markit reports lending market quantities in USD, which is converted into EUR using the daily exchange rate from the Statistical Data Warehouse of the ECB.
Yield	Yield-to-maturity is at the daily frequency and is calculated based on the daily closing secondary market mid prices from Bloomberg, following market conventions.

Table 2. Summary Statistics

The table reports summary statistics of the main variables used in the empirical analysis, where the sample contains German nominal treasury securities lending market information based on IHS Markit data from July 3, 2006 to June 1, 2015. Detailed variable definitions are in Table 1.

Label	N	Mean	Std. Dev	Minimum	Maximum
Full Sample					
Age	115611	5.475	5.628	0.000	28.970
TTM	115611	7.779	8.025	0.500	32.480
Coupon	115611	3.566	1.620	0.000	6.500
Ontherun	115611	0.051	0.219	0.000	1.000
Sizeineuro	115611	17472.900	5107.939	750.000	27000.000
Yield	115574	1.986	1.547	-0.300	4.900
AllFees	115611	0.108	0.122	-0.663	4.172
Feespread	104505	3.834	1.047	-6.908	8.161
Suppleurval	115611	3697.902	2695.570	0.000	35164.830
Demandeurval	115611	2334.356	2116. 582	0.000	15640.650
Utilization	115611	0.516	0.243	0.000	1.000
Bonds with TTM >10 years					
Age	24572	9.003	5.068	0.000	20.020
TTM	24572	21.507	5.965	10.010	32.480
Coupon	24572	5.005	1.114	0.500	6.500
Ontherun	24572	0.092	0.289	0.000	1.000
Sizeineuro	24572	14730.760	4251.487	750.000	24000.000
Yield	24554	3.029	1.121	0.100	4.900
AllFees	24572	0.116	0.135	-0.613	2.650
Feespread	22012	3.957	1.039	-2.3026	8.160
Suppleurval	24572	4414.363	3063.018	0.000	21506.620
Demandeurval	24572	1677.4579	664.67491	0.000	21506.620
Utilization	24572	0.380	0.217	0.000	1.000

Table 3. Securities Lending Variables and Secondary Market Yields

The table reports results of daily panel data regressions of German nominal treasury and securities lending market information based on IHS Markit data from July 2006 to June 2015. The dependent variable is the daily yield-to-maturity in percentage, while other variable definitions are in Table 1. *LogDemand*Longmat, Uti*Longmat* and *LogFees*Longmat* are interaction terms between the respective variables. Coefficient estimates, reported from panel regression with year and bond fixed effects and clustered standard errors at the bond level, are reported with t-stats (in parenthesis). ***, **, and * denote the 1%, 5% and 10% significance levels.

Panel A. Panel Regression Results of Bond Yields with Securities Lending Variables

	(1) Yield	(2) Yield	(3) Yield	(4) Yield	(5) Yield
Utilization		-0.306***	-0.311***		
		(-4.93)	(-5.18)		
LogSupply			0.003	0.022**	0.024*
			(0.63)	(2.01)	(1.69)
LogDemand				-0.031**	-0.037**
				(-2.40)	(-2.18)
LogFees					-0.077***
					(-5.69)
LogTTM	1.204***	1.143***	1.142***	1.185***	1.190***
	(12.10)	(12.11)	(12.16)	(11.83)	(11.64)
OnTheRun	0.126*	0.096	0.097	0.108	0.117*
	(1.87)	(1.46)	(1.48)	(1.59)	(1.72)
Constant	0.835***	1.147***	1.130***	0.927***	1.079***
	(3.29)	(4.71)	(4.50)	(3.48)	(3.92)
Time and bond FE	Yes	Yes	Yes	Yes	Yes
Observations	115,574	115,574	115,574	115,574	112,851
R-squared	0.929	0.930	0.930	0.929	0.929

Table 3. Continued

Panel B. Panel Regression Results of Bond Yields With Securities Lending Variables Focusing On The Long End Of The Yield Curve

	(1) Yield	(2) Yield	(3) Yield	(4) Yield	(5) Yield
Utilization			-0.209***	-0.318***	-0.209***
			(-2.78)	(-5.38)	(-2.87)
LogSupply	0.024*	0.024*	-0.000	-0.000	-0.000
	(1.70)	(1.67)	(-0.02)	(-0.00)	(-0.02)
LogDemand	-0.037**	-0.037**			
	(-2.18)	(-2.22)			
LogFees	-0.078***	-0.078***	-0.089***	-0.128***	-0.124***
	(-5.78)	(-5.74)	(-6.71)	(-7.94)	(-7.83)
Longmat	0.310***	0.313**	0.517***	-0.199	0.029
	(3.38)	(2.57)	(5.49)	(-1.51)	(0.26)
LogDemand*Longmat		-0.000			
		(-0.03)			
Uti*Longmat			-0.594***		-0.491***
			(-3.71)		(-3.13)
LogFees*Longmat				0.197***	0.174***
				(5.75)	(5.44)
LogTTM	1.199***	1.199***	1.079***	1.064***	1.014***
	(11.85)	(11.72)	(10.96)	(11.16)	(10.37)
OnTheRun	0.098	0.098	0.090	0.075	0.080
	(1.44)	(1.44)	(1.45)	(1.17)	(1.30)
Constant	0.984***	0.984***	1.382***	1.565***	1.653***
	(3.55)	(3.57)	(4.89)	(5.99)	(6.03)
Time and Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	112,851	112,851	112,851	112,851	112,851
R-squared	0.930	0.930	0.932	0.932	0.932

Table 4. Lending Fee Dynamics With Realized Lending Market Demand And Supply Shocks

The table reports the securities lending fee dynamics based daily panel data of Germany nominal treasury securities lending market information based on IHS Markit data from July 2006 to June 2015. Detailed variable definitions are in Table 1. The table includes some lagged versions of the key variables where the lags are indicated in the subscripts. Coefficient estimates, reported from panel regression with year and bond fixed effects and clustered standard errors at the bond level, are reported with t-stats (in parenthesis). ***, **, and * denote the 1%, 5% and 10% significance levels.

	(1) LogFees	(2) LogFees	(3) LogFees	(4) LogFees	(5) LogFees	(6) LogFees
$LogDemand_{-3}$	0.019	0.019*	0.018	0.019*	0.020*	0.019
	(1.63)	(1.69)	(1.52)	(1.68)	(1.75)	(1.60)
$LogSupply_{-3}$	-0.028***	-0.028***	-0.029***	-0.028***	-0.028***	-0.030***
	(-2.89)	(-2.91)	(-3.11)	(-2.94)	(-2.96)	(-3.21)
$DemIncrease_{-1}$	0.036**	0.038**	0.038**	0.036**	0.039**	0.038**
	(2.20)	(2.23)	(2.22)	(2.50)	(2.58)	(2.54)
$DemIncrease_{-2}$		0.024*	0.020		0.028**	0.025
		(1.78)	(1.34)		(2.02)	(1.59)
$DemIncrease_{-3}$			-0.026			-0.018
			(-1.53)			(-0.95)
Longmat				0.158	0.159	0.167
				(1.47)	(1.47)	(1.53)
$DemIncrease_{-1}$*Longmat				-0.004	-0.005	-0.002
				(-0.07)	(-0.10)	(-0.04)
$DemIncrease_{-2}$*Longmat					-0.019	-0.022
					(-0.49)	(-0.54)
$DemIncrease_{-3}$*Longmat						-0.038
						(-1.15)
LogTTM	0.043	0.041	0.043	0.047	0.045	0.044
	(0.46)	(0.44)	(0.46)	(0.50)	(0.48)	(0.47)
OnTheRun	0.089*	0.089	0.088	0.080	0.080	0.077
	(1.66)	(1.65)	(1.63)	(1.55)	(1.54)	(1.49)
Constant	1.715***	1.710***	1.735***	1.666***	1.664***	1.693***
	(7.23)	(7.22)	(7.33)	(6.78)	(6.78)	(6.93)
Time and Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112,667	112,667	112,667	112,667	112,667	112,667
R-squared	0.344	0.344	0.344	0.344	0.344	0.344

Table 5. Lending Fee Dynamics With Expected Changes In Lending Market Supply And Demand

The table reports the securities lending fee dynamics based daily panel data of Germany nominal treasury securities lending market information based on IHS Markit data from July 2006 to June 2015. Detailed variable definitions are in Table 1, and the lags are indicated in the subscripts. *Repwind*Longmat, Repwind*Aft2010* and *Aft2010*Repwind*Longmat* are interaction terms between the respective variables. Coefficient estimates, reported from panel regression with year and bond fixed effects and clustered standard errors at the bond level, are reported with t-stats (in parenthesis). ***, **, and * denote the 1%, 5% and 10% significance levels.

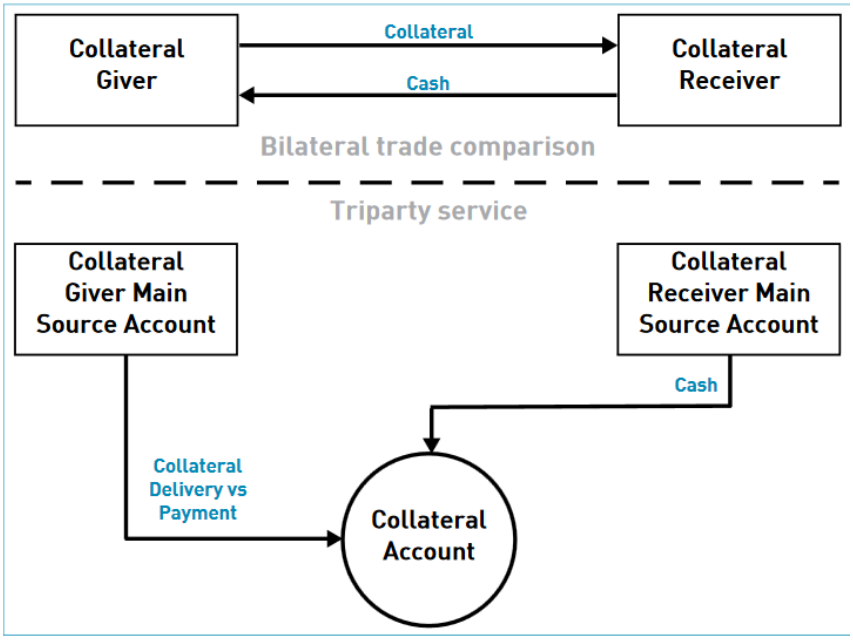
	(1) LogFees	(2) LogFees	(3) LogFees	(4) LogFees
LogSupply	-0.028***	-0.028***	-0.028***	-0.028***
	(-4.05)	(-4.03)	(-4.03)	(-4.03)
Repwind	0.098***	0.080***	0.024	0.052
	(4.63)	(3.26)	(0.61)	(1.08)
$LogSupply_{-5}$	-0.022**	-0.023**	-0.023**	-0.023**
	(-2.51)	(-2.57)	(-2.57)	(-2.58)
$LogDemand_{-5}$	0.021*	0.022**	0.022**	0.022**
	(1.95)	(2.03)	(2.03)	(2.04)
Longmat		0.165	0.165	0.165
		(1.63)	(1.63)	(1.63)
Repwind*Longmat		0.080*	0.079*	-0.050
		(1.69)	(1.67)	(-0.45)
Aft2010			0.820***	0.818***
			(5.55)	(5.57)
Aft2010*Repwind			0.090*	0.045
			(1.83)	(0.78)
Aft2010*Repwind*Longmat				0.204
				(1.39)
LogTTM	0.051	0.055	0.055	0.054
	(0.54)	(0.59)	(0.59)	(0.58)
OnTheRun	0.084	0.075	0.075	0.075
	(1.54)	(1.42)	(1.42)	(1.42)
Constant	1.852***	1.799***	1.800***	1.804***
	(7.81)	(7.30)	(7.31)	(7.35)
Bond and Time FE	Yes	Yes	Yes	Yes
Observations	112,479	112,479	112,479	112,479
R-squared	0.347	0.347	0.347	0.347

Table 6. Panel Regression Analysis Of Securities Lending Fee Spreads

The table reports the regressions of lending fee spreads on Germany nominal treasury securities lending market information based on IHS Markit data from July 2006 to June 2015. Detailed variable definitions are in Table 1. *LogFees*Longmat, LogDem*Longmat*, *and Uti*Longmat* are interaction terms between the respective variables. Coefficient estimates, reported from panel regression with year and bond fixed effects and clustered standard errors at the bond level, are reported with t-stats (in parenthesis). ***, **, and * denote the 1%, 5% and 10% significance levels.

	(1) Feespread	(2) Feespread	(3) Feespread	(4) Feespread	(5) Feespread	(6) Feespread	(7) Feespread
LogSupply	0.716***	0.716***	0.716***	0.717***	0.717***	0.619***	0.621***
	(12.32)	(12.32)	(12.47)	(12.35)	(12.50)	(7.76)	(7.82)
Repwind	0.136***	0.135***	0.135***	0.131***	0.131***	0.149***	0.153***
	(4.75)	(4.77)	(4.79)	(4.67)	(4.70)	(5.20)	(5.50)
LogFees	0.141***	0.141***	0.141***	0.124***	0.124***	0.146***	0.146***
	(5.86)	(5.84)	(5.85)	(4.14)	(4.16)	(6.16)	(6.14)
Utilization	-0.607***	-0.607***	-0.598***	-0.595***	-0.593***		
	(-3.52)	(-3.52)	(-3.20)	(-3.47)	(-3.19)		
Longmat		0.071	0.086	-0.154	-0.151	0.070	-0.354
		(0.68)	(0.49)	(-0.71)	(-0.59)	(0.63)	(-0.51)
Uti*Longmat			-0.042		-0.008		
			(-0.11)		(-0.02)		
LogFees*Longmat				0.085	0.085		
				(1.19)	(1.20)		
LogDemand						0.091*	0.075
						(1.77)	(1.39)
LogDem*Longmat							0.066
							(0.64)
LogTTM	-0.518***	-0.516***	-0.522***	-0.554***	-0.555***	-0.353***	-0.319**
	(-4.81)	(-4.78)	(-4.36)	(-4.77)	(-4.40)	(-3.27)	(-2.52)
OnTheRun	0.003	-0.001	-0.001	-0.005	-0.005	0.059	0.058
	(0.04)	(-0.02)	(-0.01)	(-0.06)	(-0.06)	(0.70)	(0.69)
Constant	-0.544	-0.566	-0.554	-0.427	-0.425	-1.229**	-1.232**
	(-1.14)	(-1.17)	(-1.04)	(-0.83)	(-0.77)	(-2.28)	(-2.37)
Bond and Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	104,505	104,505	104,505	104,505	104,505	104,505	104,505
R-squared	0.461	0.461	0.461	0.461	0.461	0.454	0.454

Clearstream Triparty Repo Service is designed to simplify the process of administering multicurrency repurchase agreements for both Collateral Receivers and Collateral Givers, it reduces operational risks through an effective delivery against payment settlement process and it is a comprehensive securities safekeeping service. Collateral received in connection with a triparty repo exposure is monitored and marked-to-market on a daily basis to ensure that collateral margin requirements are maintained.



Clearstream Triparty Securities Lending Service provides complete settlement and valuation of a securities loan, as well as the related collateral management for the duration of the trade. Simultaneous exchange of the loan principal against collateral enables settlement of both sides of the transaction, thus reducing risk and increasing efficiency. The collateral is allocated to a special segregated account, the collateral account, and is marked-to-market daily. Detailed and comprehensive reporting is sent to both counterparties.

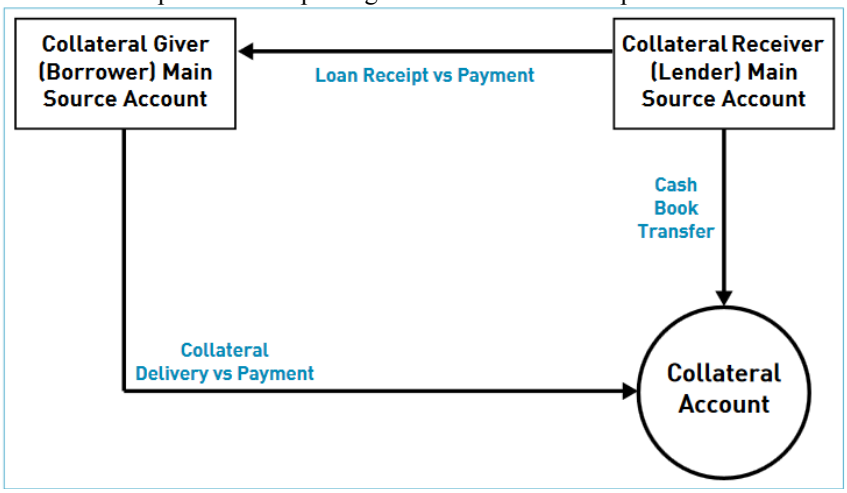
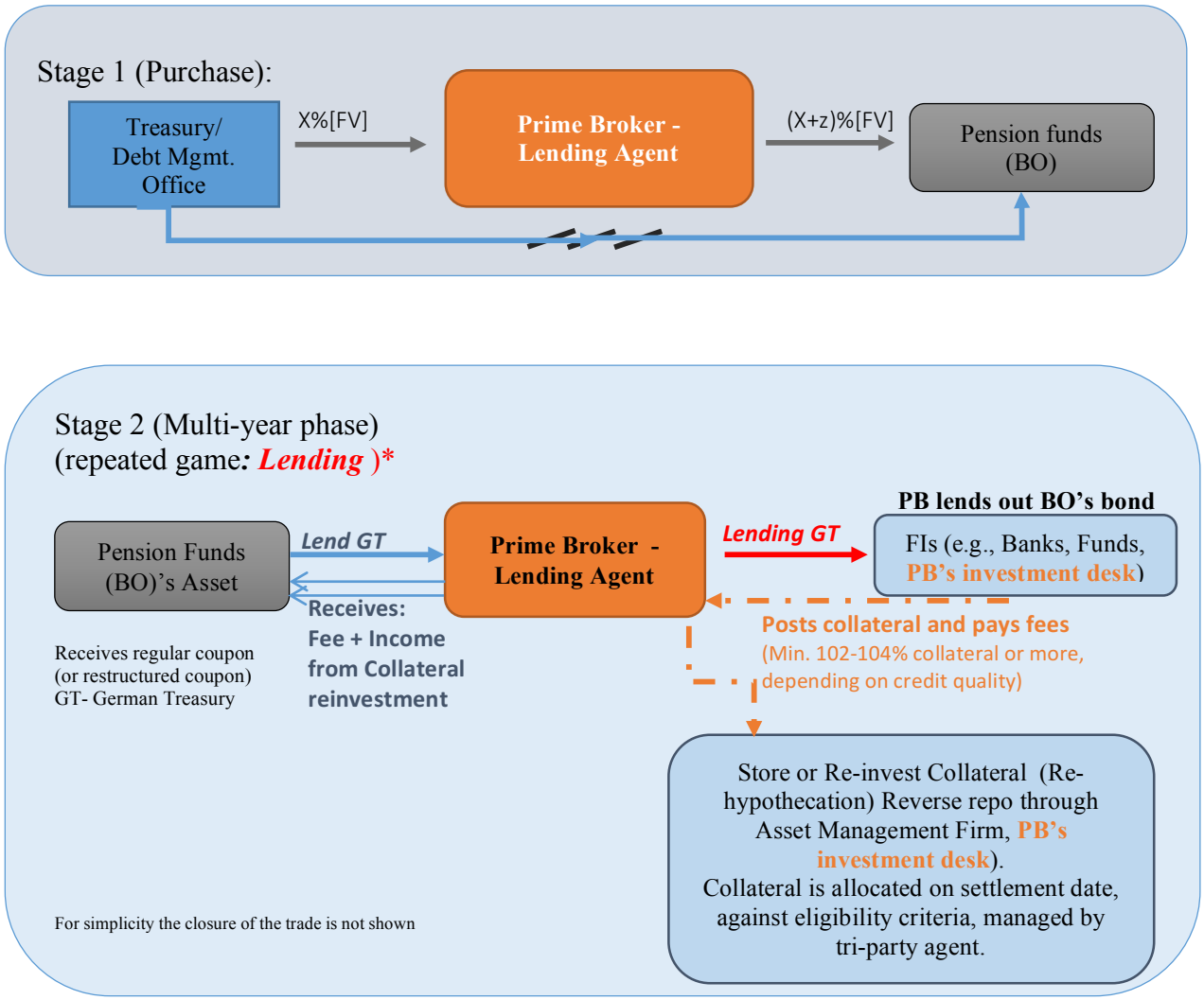


Figure 1. Securities Financing Transactions: Securities Lending Vs. Repo
Source: Triparty Collateral Management Service (CmaX), Clearstream
http://www.clearstream.com/blob/9766/33fa44d6dcc545ff41880d5d0115861d/cmax-product-guide-pdf-data.pdf

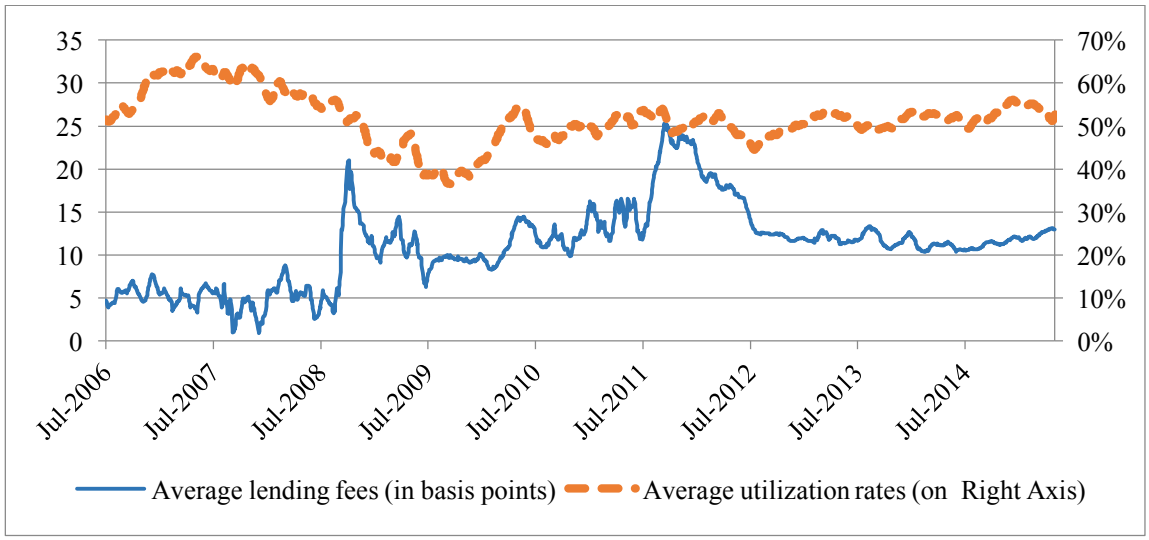


**In Step 2, at times when there is no demand for the asset in the securities lending market, the prime broker-agent, can act as, or arrange custodian services.*

Figure 2. Treasury investment life-cycle for pension funds and insurance firms with buy-and-hold strategy

The figure provides tentative explanation for the life-cycle of treasury holdings by pension funds or insurance firms, as these investors are engage in a buy and hold strategy.[18]

[18] The German Finanzagentur report that pension funds and retail investors are responsible for less than 1% of the total trading volume, indicating that they are generally buy and hold investors (source: https://www.deutsche-finanzagentur.de/en/institutional-investors/secondary-market/structures/)



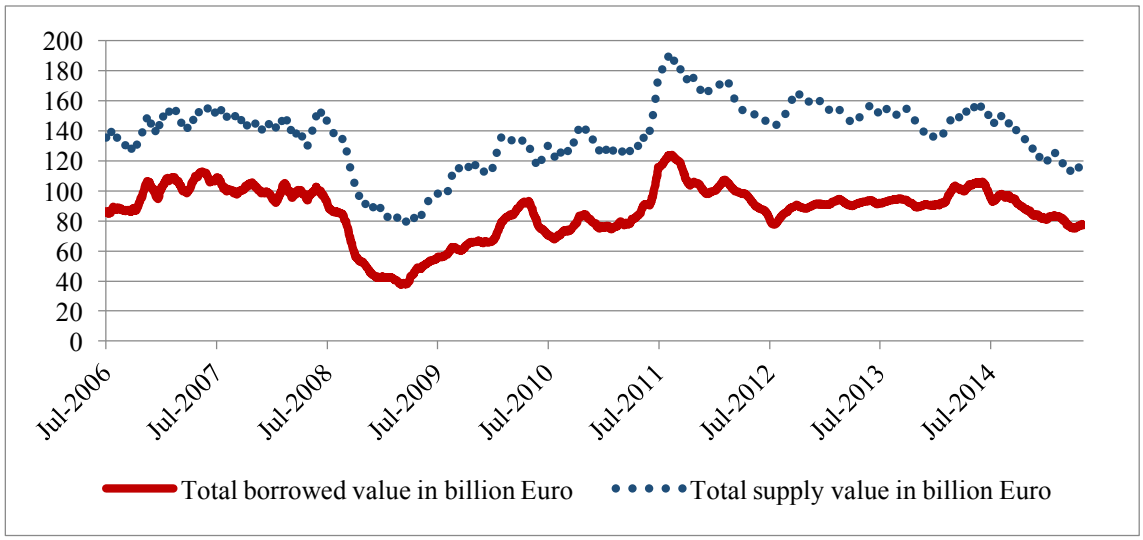


Figure3. Time-series of average securities lending market variables for German sovereign bonds

The figures depicts the time-series of average lending market variables for German sovereign bonds from July 2006 to June 2015. The top panel shows the time-series of the monthly moving average lending fee and utilization rates across all available nominal bonds in our sample, while the bottom panel depicts the aggregate borrowed and supply values in the market in EUR billions.

Online Appendix for
The Pricing Implications of Oligopolistic Securities Lending Market: A Beneficial Owner Perspective

Online Appendix A. Overview of the Pension Funds and Insurance Firms Asset Allocation in Europe and in Germany

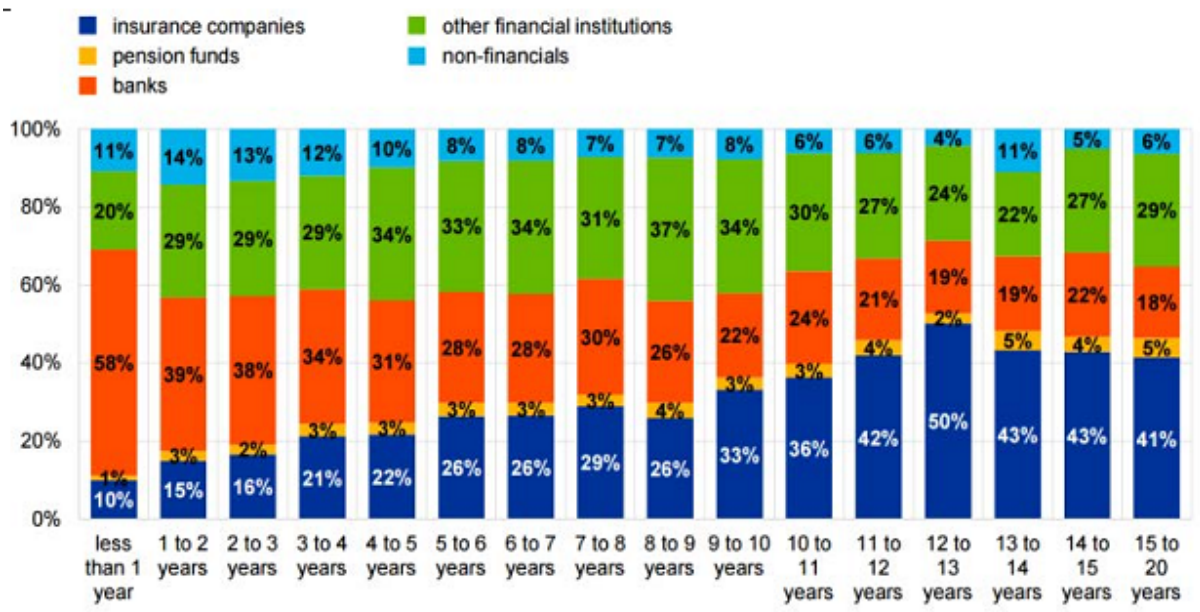


Fig. A. 1 Asset Allocation Breakdown by Maturity (ECB, 2019)

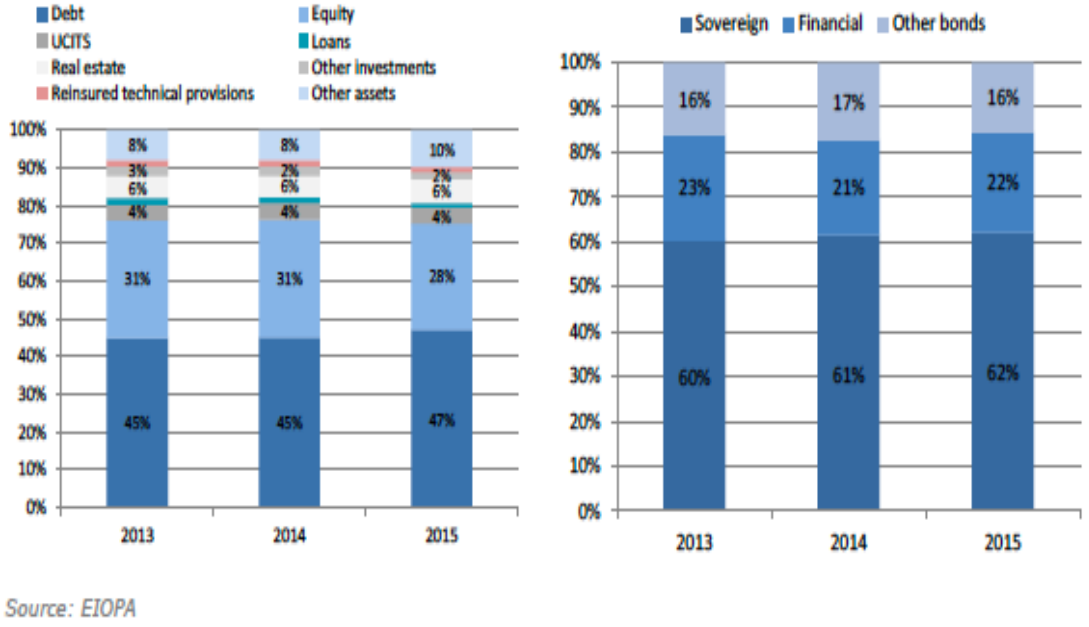


Fig. A. 2 Asset allocation breakdown of European Pension Funds (EIOPA, 2016)
The left panel shows the total investment allocation for 2013-2015, while the right panel shows specifically the bond investment breakdown for 2013-2015, based on all reporting European pension funds.

Online Appendix B. Overview of the German Sovereign Debt Market

Primary Market of German Sovereign Bonds

The Finanzagentur has been responsible for issuing German Federal securities on behalf of the German Federal Government since June 2001. German sovereign debt issues are not only highly liquid; they also carry low risk, reflected by the continuous AAA rating throughout the Euro crisis. German government bonds are available in various maturities, such as 6- and 12-month treasury discount papers, 2-year Federal treasury notes (Schaetze); five-year Federal notes (Bobls) and 10- and 30-year Federal bonds (Bunds). The two-year notes account for 9% of the outstanding tradable German public debt and about 11% of the total trading volume, while five-year notes account for about 20% of the outstanding public debt and constitute about 17% of the overall trading volume. Overall, the 2-year, 5-year, 10-year, and 30-year treasuries account for about 90% of the total outstanding tradable government debt (stock) and 70% of the total issuance (flow)(Finanzagentur, 2015).

The Finanzagentur reports that 90% of the funding needs of the Federal Government are covered by placing issues to primary dealers in the form of single issues via auctions, where the dealers are approved financial institutions, members of the Bund Issues Auction Group. In principle, any EU credit or securities trading institution or investment firm can become a member of the Auction Group, with no obligation to bid at the auctions. The publicly disseminated issuance calendar is released a year in advance, and provides information on all forthcoming issuances including the type of the security, the day of the issuance, maturity date, and targeted nominal issuance amount, potentially subject to change. Such high level of transparency and detailed schedule makes the German government a globally recognized and reliable issuer. All regularly issued capital market securities are issued in a tender process, where members of the Bund Issues Auction Group participate in a multi-price auction., where the bids are allotted at the price specified in the bid, not at a single price. Bids that are above the lowest accepted bid are allotted in full. At the end of the auction, the allotted amounts are published in the Bund Bidding System, and the information is subsequently released to the public. For each auction, the government retains a certain amount of the volume issued, which is gradually introduced into the secondary market following the tender. Moreover, for some issues, auctions are also followed by multiple reopenings to facilitate liquidity management in the market, and the delivery of futures written on these bonds.

Secondary Market of German Sovereign Bond

All German capital market securities are traded on stock exchanges, international electronic trading platforms, and OTC markets. They are quoted by market makers throughout the trading day and at the tightest bid-ask spreads of all euro-denominated sovereign debt securities. Quotes are at a voluntary basis; thus, no artificial liquidity or market depth are created. According to the statistics of the Finanzagentur, the average yearly trading volume of capital market securities was EUR 5.7 trillion between 2006 and 2015. In 2015, an average nominal volume of EUR 1.1 trillion was in circulation, and this amount has turned over 4-6 times every year for the same period. The corresponding daily trading volumes were in the magnitude of EUR 19 billion. According to the information supplied by a representative sample of primary dealers, most trading activity of German debt securities takes place between European and Euro area counterparties. Looking at the institutional shares of trades, the Finance Agency reports that the most important parties are brokers, asset managers, and banks, with a slight increase in hedge fund and decrease in central bank transactions. The liquidity of German bonds is also supported by futures contracts traded on the Eurex. While future contracts are available on most bonds with 2-, 5-, 10- and 30-year maturities, the most liquid products are those linked to 10-year Federal Bunds with a turnover of 177 million contracts traded yearly, in the volume of EUR 27 trillion in 2015. Last, the securities that are retained at the auctions are mostly sold in the secondary market, to collateralize repos or interest rate swaps, or to be used in securities lending. Next to providing additional liquidity and facilitating delivery of specific securities, the Finanzagentur and the Deutsche Bundesbank also act as market-makers on the different platforms, where German public debt is traded. Nevertheless, both institutions aim to minimize the price impact of their secondary market transactions.

Appendix C. Complete tables, displaying additional fixed effects

C. Table 3. Securities lending variables and secondary market yields displaying year fixed effects

	(1) Yield	(2) Yield	(3) Yield	(4) Yield	(5) Yield
Utilization		-0.306***	-0.311***		
		(-4.93)	(-5.18)		
LogSupply			0.003	0.022**	0.024*
			(0.63)	(2.01)	(1.69)
LogDemand				-0.031**	-0.037**
				(-2.40)	(-2.18)
LogFees					-0.077***
					(-5.69)
LogTTM	1.204***	1.143***	1.142***	1.185***	1.190***
	(12.10)	(12.11)	(12.16)	(11.83)	(11.64)
OnTheRun	0.126*	0.096	0.097	0.108	0.117*
	(1.87)	(1.46)	(1.48)	(1.59)	(1.72)
Year 2007	0.648***	0.664***	0.664***	0.649***	0.643***
	(23.01)	(23.82)	(23.87)	(23.11)	(22.81)
Year 2008	0.572***	0.561***	0.561***	0.567***	0.581***
	(11.43)	(11.61)	(11.63)	(11.28)	(11.09)
Year 2009	-0.613***	-0.677***	-0.677***	-0.623***	-0.592***
	(-4.98)	(-5.80)	(-5.80)	(-5.10)	(-4.71)
Year 2010	-1.089***	-1.138***	-1.139***	-1.099***	-1.046***
	(-8.85)	(-10.06)	(-10.07)	(-9.02)	(-8.43)
Year 2011	-0.992***	-1.040***	-1.042***	-1.004***	-0.917***
	(-8.48)	(-9.71)	(-9.74)	(-8.65)	(-7.72)
Year 2012	-2.004***	-2.065***	-2.068***	-2.021***	-1.931***
	(-15.77)	(-17.84)	(-17.92)	(-15.94)	(-14.75)
Year 2013	-1.900***	-1.963***	-1.966***	-1.921***	-1.847***
	(-14.48)	(-16.69)	(-16.78)	(-14.62)	(-13.69)
Year 2014	-2.061***	-2.128***	-2.130***	-2.084***	-2.021***
	(-16.91)	(-19.80)	(-19.91)	(-17.04)	(-16.22)
Year 2015	-2.567***	-2.631***	-2.631***	-2.590***	-2.533***
	(-23.28)	(-26.82)	(-26.92)	(-23.32)	(-22.59)
Constant	0.835***	1.147***	1.130***	0.927***	1.079***
	(3.29)	(4.71)	(4.50)	(3.48)	(3.92)
Time and Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	115,574	115,574	115,574	115,574	112,851
R-squared	0.929	0.930	0.930	0.929	0.929

Appendix C. continued

C. Table 3 continued Panel B. Full Model Specification With Year Fixed Effects

	(1) Yield	(2) Yield	(3) Yield	(4) Yield	(5) Yield
Utilization			-0.209***	-0.318***	-0.209***
			(-2.78)	(-5.38)	(-2.87)
LogSupply	0.024*	0.024*	-0.000	-0.000	-0.000
	(1.70)	(1.67)	(-0.02)	(-0.00)	(-0.02)
LogDemand	-0.037**	-0.037**			
	(-2.18)	(-2.22)			
LogFees	-0.078***	-0.078***	-0.089***	-0.128***	-0.124***
	(-5.78)	(-5.74)	(-6.71)	(-7.94)	(-7.83)
Longmat	0.310***	0.313**	0.517***	-0.199	0.029
	(3.38)	(2.57)	(5.49)	(-1.51)	(0.26)
LogDemand*Longmat		-0.000			
		(-0.03)			
Uti*Longmat			-0.594***		-0.491***
			(-3.71)		(-3.13)
LogFees*Longmat				0.197***	0.174***
				(5.75)	(5.44)
LogTTM	1.199***	1.199***	1.079***	1.064***	1.014***
	(11.85)	(11.72)	(10.96)	(11.16)	(10.37)
OnTheRun	0.098	0.098	0.090	0.075	0.080
	(1.44)	(1.44)	(1.45)	(1.17)	(1.30)
Year 2007	0.647***	0.647***	0.654***	0.640***	0.635***
	(23.50)	(23.50)	(25.20)	(23.49)	(24.14)
Year 2008	0.588***	0.588***	0.559***	0.542***	0.527***
	(11.35)	(11.29)	(10.55)	(10.59)	(9.93)
Year 2009	-0.585***	-0.585***	-0.694***	-0.697***	-0.733***
	(-4.66)	(-4.61)	(-5.52)	(-5.74)	(-5.86)
Year 2010	-1.037***	-1.037***	-1.155***	-1.157***	-1.214***
	(-8.40)	(-8.28)	(-9.44)	(-9.95)	(-10.02)
Year 2011	-0.905***	-0.905***	-1.028***	-1.041***	-1.104***
	(-7.70)	(-7.52)	(-8.75)	(-9.48)	(-9.57)
Year 2012	-1.916***	-1.916***	-2.072***	-2.079***	-2.160***
	(-14.82)	(-14.47)	(-16.39)	(-17.43)	(-17.32)
Year 2013	-1.829***	-1.830***	-2.014***	-2.003***	-2.106***
	(-13.77)	(-13.37)	(-15.69)	(-16.50)	(-16.40)
Year 2014	-1.996***	-1.996***	-2.191***	-2.186***	-2.295***
	(-16.13)	(-15.53)	(-18.08)	(-19.43)	(-18.85)
Year 2015	-2.507***	-2.507***	-2.698***	-2.701***	-2.811***
	(-22.44)	(-21.65)	(-24.70)	(-26.23)	(-25.31)
Constant	0.984***	0.984***	1.382***	1.565***	1.653***
	(3.55)	(3.57)	(4.89)	(5.99)	(6.03)
Time and Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	112,851	112,851	112,851	112,851	112,851
R-squared	0.930	0.930	0.932	0.932	0.932

Appendix C. continued

C. Table 4. Lending Fee Dynamics With Realized Lending Market Demand And Supply Shocks Displaying Year Fixed Effects

	(1) LogFees	(2) LogFees	(3) LogFees	(4) LogFees	(5) LogFees	(6) LogFees
$LogDemand_{-3}$	0.019	0.019*	0.018	0.019*	0.020*	0.019
	(1.63)	(1.69)	(1.52)	(1.68)	(1.75)	(1.60)
$LogSupply_{-3}$	-0.028***	-0.028***	-0.029***	-0.028***	-0.028***	-0.030***
	(-2.89)	(-2.91)	(-3.11)	(-2.94)	(-2.96)	(-3.21)
$DemIncrease_{-1}$	0.036**	0.038**	0.038**	0.036**	0.039**	0.038**
	(2.20)	(2.23)	(2.22)	(2.50)	(2.58)	(2.54)
$DemIncrease_{-2}$		0.024*	0.020		0.028**	0.025
		(1.78)	(1.34)		(2.02)	(1.59)
$DemIncrease_{-3}$			-0.026			-0.018
			(-1.53)			(-0.95)
Longmat				0.158	0.159	0.167
				(1.47)	(1.47)	(1.53)
$DemIncrease_{-1}$*Longmat				-0.004	-0.005	-0.002
				(-0.07)	(-0.10)	(-0.04)
$DemIncrease_{-2}$*Longmat					-0.019	-0.022
					(-0.49)	(-0.54)
$DemIncrease_{-3}$*Longmat						-0.038
						(-1.15)
LogTTM	0.043	0.041	0.043	0.047	0.045	0.044
	(0.46)	(0.44)	(0.46)	(0.50)	(0.48)	(0.47)
OnTheRun	0.089*	0.089	0.088	0.080	0.080	0.077
	(1.66)	(1.65)	(1.63)	(1.55)	(1.54)	(1.49)
Year 2007	-0.142***	-0.142***	-0.142***	-0.140***	-0.140***	-0.140***
	(-4.82)	(-4.81)	(-4.80)	(-4.71)	(-4.70)	(-4.70)
Year 2008	0.134*	0.134*	0.134*	0.137*	0.137*	0.136*
	(1.90)	(1.90)	(1.90)	(1.93)	(1.92)	(1.92)
Year 2009	0.425***	0.425***	0.424***	0.428***	0.428***	0.426***
	(6.16)	(6.18)	(6.18)	(6.17)	(6.18)	(6.18)
Year 2010	0.637***	0.638***	0.636***	0.641***	0.642***	0.639***
	(8.22)	(8.22)	(8.21)	(8.27)	(8.27)	(8.26)
Year 2011	0.962***	0.963***	0.962***	0.967***	0.968***	0.966***
	(10.34)	(10.36)	(10.36)	(10.35)	(10.35)	(10.34)
Year 2012	0.980***	0.983***	0.981***	0.987***	0.988***	0.985***
	(9.38)	(9.40)	(9.40)	(9.41)	(9.41)	(9.39)
Year 2013	0.767***	0.769***	0.767***	0.775***	0.776***	0.772***
	(6.23)	(6.26)	(6.25)	(6.27)	(6.28)	(6.25)
Year 2014	0.716***	0.718***	0.716***	0.728***	0.729***	0.725***
	(5.19)	(5.21)	(5.20)	(5.22)	(5.22)	(5.19)
Year 2015	0.802***	0.804***	0.802***	0.815***	0.815***	0.810***
	(5.53)	(5.55)	(5.54)	(5.54)	(5.54)	(5.51)
Constant	1.715***	1.710***	1.735***	1.666***	1.664***	1.693***
	(7.23)	(7.22)	(7.33)	(6.78)	(6.78)	(6.93)
Time and Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112,667	112,667	112,667	112,667	112,667	112,667
R-squared	0.344	0.344	0.344	0.344	0.344	0.344

Appendix C. continued

C. Table 5. Lending Fee Dynamics With Expected Changes In Lending Market Supply And Demand Displaying Year Fixed Effects

	(1) LogFees	(2) LogFees	(3) LogFees	(4) LogFees
LogSupply	-0.028***	-0.028***	-0.028***	-0.028***
	(-4.05)	(-4.03)	(-4.03)	(-4.03)
Repwind	0.021*	0.022**	0.022**	0.022**
	(1.95)	(2.03)	(2.03)	(2.04)
$LogSupply_{-5}$	-0.022**	-0.023**	-0.023**	-0.023**
	(-2.51)	(-2.57)	(-2.57)	(-2.58)
$LogDemand_{-5}$	0.098***	0.080***	0.024	0.052
	(4.63)	(3.26)	(0.61)	(1.08)
Longmat		0.165	0.165	0.165
		(1.63)	(1.63)	(1.63)
Repwind*Longmat		0.080*	0.079*	-0.050
		(1.69)	(1.67)	(-0.45)
Aft2010			0.090*	0.045
			(1.83)	(0.78)
Aft2010*Repwind			0.820***	0.818***
			(5.55)	(5.57)
Aft2010*Repwind*Longmat				0.204
				(1.39)
LogTTM	0.051	0.055	0.055	0.054
	(0.54)	(0.59)	(0.59)	(0.58)
OnTheRun	0.084	0.075	0.075	0.075
	(1.54)	(1.42)	(1.42)	(1.42)
Year 2007	-0.138***	-0.136***	-0.137***	-0.137***
	(-4.68)	(-4.58)	(-4.61)	(-4.62)
Year 2008	0.141*	0.143**	0.143**	0.142**
	(1.97)	(2.01)	(2.00)	(1.99)
Year 2009	0.424***	0.427***	0.427***	0.426***
	(6.18)	(6.17)	(6.17)	(6.16)
Year 2010	0.638***	0.642***	-0.180*	-0.179*
	(8.13)	(8.14)	(-1.84)	(-1.84)
Year 2011	0.972***	0.978***	0.155**	0.156**
	(10.42)	(10.40)	(2.04)	(2.05)
Year 2012	0.994***	1.001***	0.179***	0.180***
	(9.47)	(9.47)	(2.81)	(2.82)
Year 2013	0.781***	0.789***	-0.033	-0.032
	(6.34)	(6.38)	(-0.57)	(-0.57)
Year 2014	0.727***	0.740***	-0.082**	-0.082**
	(5.27)	(5.30)	(-2.19)	(-2.18)
Year 2015	0.808***	0.822***	-	-
	(5.56)	(5.55)		
Constant	1.852***	1.799***	1.800***	1.804***
	(7.81)	(7.30)	(7.31)	(7.35)
Time and Bond FE	Yes	Yes	Yes	Yes
Observations	112,479	112,479	112,479	112,479
R-squared	0.347	0.347	0.347	0.347

Appendix C. continued

C. Table 6. Panel Regression Analysis Of Securities Lending Fee Spreads Displaying Year Fixed Effects

	(1) Feespread	(2) Feespread	(3) Feespread	(4) Feespread	(5) Feespread	(6) Feespread	(7) Feespread
LogSupply	0.716***	0.716***	0.716***	0.717***	0.717***	0.619***	0.621***
	(12.32)	(12.32)	(12.47)	(12.35)	(12.50)	(7.76)	(7.82)
Repwind	0.136***	0.135***	0.135***	0.131***	0.131***	0.149***	0.153***
	(4.75)	(4.77)	(4.79)	(4.67)	(4.70)	(5.20)	(5.50)
LogFees	0.141***	0.141***	0.141***	0.124***	0.124***	0.146***	0.146***
	(5.86)	(5.84)	(5.85)	(4.14)	(4.16)	(6.16)	(6.14)
Utilization	-0.607***	-0.607***	-0.598***	-0.595***	-0.593***		
	(-3.52)	(-3.52)	(-3.20)	(-3.47)	(-3.19)		
Longmat		0.071	0.086	-0.154	-0.151	0.070	-0.354
		(0.68)	(0.49)	(-0.71)	(-0.59)	(0.63)	(-0.51)
Uti*Longmat			-0.042		-0.008		
			(-0.11)		(-0.02)		
LogFees*Longmat				0.085	0.085		
				(1.19)	(1.20)		
LogDemand						0.091*	0.075
						(1.77)	(1.39)
LogDem*Longmat							0.066
							(0.64)
LogTTM	-0.518***	-0.516***	-0.522***	-0.554***	-0.555***	-0.353***	-0.319**
	(-4.81)	(-4.78)	(-4.36)	(-4.77)	(-4.40)	(-3.27)	(-2.52)
OnTheRun	0.003	-0.001	-0.001	-0.005	-0.005	0.059	0.058
	(0.04)	(-0.02)	(-0.01)	(-0.06)	(-0.06)	(0.70)	(0.69)
Year 2007	0.026	0.027	0.026	0.017	0.017	0.001	0.008
	(0.37)	(0.38)	(0.38)	(0.25)	(0.25)	(0.01)	(0.11)
Year 2008	0.235**	0.236**	0.234**	0.219**	0.218**	0.280***	0.294***
	(2.46)	(2.47)	(2.50)	(2.22)	(2.26)	(2.81)	(2.85)
Year 2009	0.010	0.012	0.007	-0.011	-0.012	0.179	0.205
	(0.08)	(0.09)	(0.05)	(-0.09)	(-0.09)	(1.47)	(1.51)
Year 2010	-0.576***	-0.574***	-0.581***	-0.610***	-0.611***	-0.445***	-0.408***
	(-4.88)	(-4.85)	(-4.26)	(-4.75)	(-4.26)	(-3.43)	(-2.70)
Year 2011	-0.363**	-0.361**	-0.369**	-0.406**	-0.408**	-0.221	-0.180
	(-2.54)	(-2.52)	(-2.21)	(-2.51)	(-2.26)	(-1.43)	(-1.01)
Year 2012	-0.615***	-0.612***	-0.621***	-0.665***	-0.667***	-0.423**	-0.371*
	(-4.24)	(-4.21)	(-3.53)	(-4.01)	(-3.50)	(-2.58)	(-1.89)
Year 2013	-0.940***	-0.936***	-0.947***	-0.994***	-0.996***	-0.735***	-0.673***
	(-5.71)	(-5.66)	(-4.78)	(-5.36)	(-4.69)	(-4.01)	(-3.09)
Year 2014	-0.974***	-0.969***	-0.981***	-1.034***	-1.036***	-0.761***	-0.691***
	(-5.66)	(-5.56)	(-4.70)	(-5.33)	(-4.65)	(-3.90)	(-2.93)
Year 2015	-0.732***	-0.726***	-0.738***	-0.795***	-0.797***	-0.537***	-0.469**
	(-4.14)	(-4.07)	(-3.36)	(-3.97)	(-3.40)	(-2.75)	(-2.05)
Constant	-0.544	-0.566	-0.554	-0.427	-0.425	-1.229**	-1.232**
	(-1.14)	(-1.17)	(-1.04)	(-0.83)	(-0.77)	(-2.28)	(-2.37)
Time and Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	104,505	104,505	104,505	104,505	104,505	104,505	104,505
R-squared	0.461	0.461	0.461	0.461	0.461	0.454	0.454

Appendix D. Example of pension funds engagement in securities lending with prime brokers/agents

CalPERS Securities Lending Program, 2011 Annual Financial Report[19]

"The State Constitution and CalPERS Board policies permit CalPERS to use investments of the PERF to enter into securities lending transactions, collateralized loans of securities to broker-dealers and other entities with a simultaneous agreement to return the collateral for the same securities in the future. CalPERS has contracted with eSecLending LLC (eSec), State Street Bank & Trust (SSB), and Goldman Sachs Agency Lending as third-party securities lending agents to loan domestic and international equity and debt securities. Additionally, CalPERS contracts with eSecLending as an administrative agent for CalPERS principal borrowers. CalPERS receives both cash and non-cash (i.e., securities) collateral.

Domestic and international securities are collateralized for cash at 102 percent and 105 percent, respectively, of the loaned securities market value. Management believes CalPERS has minimized credit risk exposure to borrowers by requiring the borrower to provide collateralization greater than 100 percent of the market value of the securities loaned. Securities borrowed are required to be overcollateralized by 2 percent (domestic) and 5 percent (international), and all borrowed securities are priced end of day. Based on a borrower's aggregate end of day market value, a wire is sent or delivered to maintain the proper overcollateralization level. On June 30, 2011, the fair value of the securities on loan was approximately $19.8 billion. The CalPERS Fixed Income Unit manages the securities lending activity on behalf of PERF assets in individual funds and in unitized equity and debt security pools. All securities lending activities, whether individual PERF funds or unitized pools, are subject to the constraints set forth in CalPERS Securities Lending Policy.

CalPERS' policy is to invest the cash collateral in short-term, high-credit quality fixed income securities. Currently, SSB, eSec, and CalPERS manage the cash collateral. The re-invested cash collateral is reported in the financial statements at fair value, except for the re-invested cash collateral held by eSec. The re-invested cash collateral held by eSec is reported at cost, which approximates fair value. As of June 30, 2011, the cash collateral invested by SSB, eSec, CalPERS High Quality Libor, CalPERS Short Duration, and CalPERS Internal Collateral, had weighted average maturities of 31, 312, 367, 587, 479 days, respectively, and durations of 71, 0, 32, 0, and 36 days, respectively.

Structured Investment Vehicles (SIVs) were purchased as Medium-Term Notes between April 2006 and March 2007 (with April 2009 and March 2010 maturity dates) and at the time of purchase met all Cash Collateral Re-investment Policy guidelines. In 2007 and 2008, both SIVs went into enforcement, defaulted and eventually re-structured. The re-structuring involved CalPERS receiving a pro-rata in kind interest of the underlying collateral of the SIVs. The average maturity on the underlying collateral is substantially longer than the original Medium-Term Notes and is considered long-term. "

…

"CalPERS invested in the State Treasury pool and State Street Bank Global Advisors' (SSgA) short-term investment fund. These investments are included as part of the short-term investment line item on the financial statements. At June 30, 2011, the pooled money investment account with the State Treasury totalled approximately $1.8 billion and the short-term investment fund with SSgA totalled approximately $6.9 billion. The weighted average maturity is 237 days for the State Treasury pool and 33 days for the SSgA short-term investment fund."

Source: CalPERS Comprehensive Annual Financial Report, Fiscal Year Ended June 30, 2011, http://californiapolicycenter.org/wp-content/uploads/2013/11/CalSTRS_CAFR_FYE_6-30-2011.pdf

[19] CalPERS stands for The California Public Employees' Retirement System and PERF stands for Public Employees' Retirement Fund.

Appendix E. Litigation trends in the pension industry related to securities lending

The first lawsuit against Northern Trust was filed by the fiduciaries of a Section 401(k) plan sponsored by BP Corp. The lawsuit charges that Northern Trust and Northern Trust Investments N.A. (NTI) breached their ERISA fiduciary duties by engaging in the imprudent lending of securities, and by not disclosing to the plan the losses incurred under NTI's securities lending program (BP Corp. North America Inc. Savings Plan Investment Oversight Committee v. Northern Trust Investments N.A., N.D. Ill., No. 1:08-cv-06029, lawsuit filed10/21/08)(208 PBD, 10/28/08; 35 BPR 2500, 11/4/08).
According to the complaint, NTI was to manage the investments of the plans, and it did so by placing the assets in four collective investment funds. The four collective funds were managed by NTI and benchmarked to different stock or bond indices. Under the investment guidelines, set out in the investment management agreement with the BP plans, NTI was authorized to lend securities from the collective funds, in which the assets of the plans were invested. According to the complaint, NTI told the plans that the purpose of its securities lending program was to earn a return through investment of the cash collateral received from borrowers of securities. The program would allow NTI to offset its expenses under the investment agreements with the plans, and further allowed the collective funds to better match the performance of their respective benchmark indices.

The complaint alleged that NTI appointed NTC as the securities lending agent for the collective funds, and delegated to NTC the discretion to manage the securities lending activities. Under the securities lending program, NTC would loan securities purchased for the benefit of the four collective investment funds to borrowers, who would provide cash collateral as security for the return of the loaned securities, the complaint said. NTI would then invest the cash collateral ("collateral funds") in other collective funds managed by NTI, according to the complaint.

… Among other things, the lawsuit alleged that some of the collateral funds' investments, which NTI made with cash collateral received from securities borrowers, have defaulted or have been marked down in value by NTI. According to the complaint, as a result of losses NTI has incurred through its securities lending activities, the fiduciaries of BP's defined contribution plans on Oct. 15, 2008, halted any additional BP participant contributions to and transfers into the collective funds.

In addition, the fiduciaries requested that NTI and NTC distribute to the plans an amount in cash, reflecting the value of the plans' investment accounts, excluding any effects of securities lending or investment in cash collateral pools or funds supporting securities lending. The complaint alleged that NTI has refused to distribute the plans' assets in cash, and has informed the plan fiduciaries that NTI's distribution would include interests in impaired securities. Accordingly, if NTI makes a distribution to the plans, it will include interests on the impaired securities, which are not part of the relevant indices specified in the investment guidelines the plans gave to NTI, the complaint charged.

In December, the district court denied the BP plan fiduciaries' motion for a preliminary injunction that would have required NTI to return the plans assets that have allegedly been impaired by NTI's securities lending program (243 PBD, 12/19/08; 35 BPR 2939, 12/30/08).

Source: Pension & Benefits Daily
All Issues > 2009 > February > 02/26/2009 > Special Report > ERISA Plan Fiduciaries Take Aim at Each Other as Investment Losses Rise
https://www.reedsmith.com/-/media/files/news/2009/02/erisa-plan-fiduciaries-take-aim-at-each-other-as-i/files/bna-pension--benefits-daily-022609/fileattachment/bna_feb_26_2009.pdf

Appendix E. continued

Transparency and lack of regulatory oversight in the securities lending industry:
A challenge for the less connected market participants

U.S. pension funds sue Goldman, JP Morgan, others over stock lending market
(Reuters) - Three U.S. pension funds sued six of the world's largest banks on Thursday, including Goldman Sachs Group Inc. (GS.N) and JP Morgan Chase & Co. (JPM.N), accusing them of conspiring to stifle competition in the more than $1 trillion stock lending market.
In the lawsuit filed in a Manhattan federal court, the funds accused the banks of boycotting start-up lending platforms by threatening and intimidating their potential clients. The defendants include Bank of America Corp (BAC.N), Credit Suisse AG (CSAG.UL), Morgan Stanley (MS.N), UBS AG (UBSG.S), Goldman and JP Morgan. The Iowa Public Employees' Retirement System, Orange County Employees' Retirement System, and Sonoma County Employees' Retirement Association said in the lawsuit that the banks have cornered the market on stock lending in violation of federal antitrust law.

"*Through various improper means, the likes of Goldman Sachs and Morgan Stanley have for years colluded to maintain their power over this little-known-but-lucrative corner of Wall Street*," said Michael Eisenkraft, a lawyer for the funds and partner with Cohen Milstein.

Representatives of Bank of America, Goldman Sachs and JP Morgan declined to comment. The other banks did not immediately respond to requests for comment.

The pension funds said collusion by the banks harms investors and retirees by forcing them to pay high fees to engage in stock lending. Stock lending is related to short selling and involves lending a stock to an investor or firm through a broker or dealer. Pension funds and other institutional investors frequently lend stock to hedge funds. In short selling, a security that is not owned, or has been borrowed, is sold with the idea that it can be bought at a future date at a lower price.

The funds claimed in the lawsuit that the defendants conspired to take down upstart stock lending platforms AQS, which was developed by Quadriserv Inc., and SL-x, which would have allowed lenders and borrowers to interact directly. The lawsuit claimed that in 2012, Goldman Sachs threatened to stop doing business with Bank of New York Mellon (BNY) if it continued to support the AQS platform, and that the bank agreed to stop using it. BNY Mellon declined to comment.

Source: Reuters, August 18, 2017
https://www.reuters.com/article/us-stocklending-lawsuit/u-s-pension-funds-sue-goldman-jpmorgan-others-over-stock-lending-market-idUSKCN1AX2NK