Spillovers from Repo to Securities Lending

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Abstract

Securities lending against cash collateral provides the borrower with the security and the lender with cash financing, thus being economically equivalent to repo. When repo rates spiked unexpectedly by over 300 basis points in September 2019, the value of cash financing increased significantly overnight, leading to a windfall gain. We find that securities lenders passed this windfall on to borrowers of government bonds but not to borrowers of equity or corporate bonds. We hypothesize that this is due to the lower negotiation power of equity and corporate bond borrowers, who usually have an interest in obtaining the specific security. Consistent with this idea, we find that government bond lenders didn't pass on the windfall if the ex-ante lending fee was high.

JEL classification: **G10, G12, G14**

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Introduction

In securities lending transactions, an investor borrows a security from the beneficial owner to use it for short selling or as collateral in another transaction. To secure the loan, the borrower provides either cash or other securities as collateral. If cash is provided as collateral (as is the case in 72% of transactions), the transaction provides funding to the securities lender, which is economically equivalent to a repurchase agreement (repo). Most studies ignore this financing motivation for engaging in securities lending and implicitly assume that securities lending is motivated solely by the borrower wanting to obtain the security.[1] An exception is Foley-Fisher, Narajabad, and Verani (2016), who highlight the importance of securities lending as wholesale funding for the securities lender.

The average volume of daily securities lending against cash collateral is over $700 billion in the United States alone, making it an important source of funding to securities lenders. As such, it is of utmost importance to regulators to understand its functioning and its interconnectedness with other funding markets. Most important is the connection to the repo market, which is the most important source of financing for many financial institutions (Baklanova, Copeland, and McCaughrin, 2015).

In this paper, we examine the interconnectedness between the securities lending and the repo market using a spike in the repo rate that happened on September 17, 2019. On this day, large corporate tax payments coincided with a large settlement of Treasury coupons, both of which reduced the cash supply available for lending in the repo market. As a response, repo rates spiked

[1] Examples of these papers include D'Avolio (2002), Nashikkar and Pedersen (2007), Saffi and Sigurdson (2011), Kolanski, Reed, and Ringgenberg (2013).

with the secured overnight funding rate (SOFR) printing at 5.25 percent (up from 2.2 percent just 2 trading days prior) and some repo transactions even reaching rates of 10 percent.

We examine how this event affected the securities lending market. Essentially, the spike in the repo rate temporarily increased the value of the cash collateral. For a day, the security lender could make a 300 bps higher return from investing the cash collateral, which constitutes a windfall gain.[2] We study how much of this windfall gain security lenders passed on to the security borrowers. Since securities lending transactions are usually rolled over day-by-day, it is possible to renegotiate the terms at any time.[3] Thus, it is not ex-ante clear how the windfall would be split between the securities borrower and lender.

Using detailed securities lending data provided by Markit, we show that there was a huge discrepancy between the different types of securities that were lent. For equities and corporate bonds, security lenders generally kept 100% of the windfall and did not increase rebate rates. In contrast, for government bond lending, there was on average a 250 basis points decrease in lending fees (and an equivalent increase in rebate rates).[4] Compared to the 300 basis points increase in the repo rate, this implies that for government bonds about 80% of the windfall was passed on to security borrowers.

What might explain this differential treatment? We propose two hypotheses: The first is the *negotiation power hypothesis*. It states that whether the windfall is passed on depends on which party has more negotiating power, which is likely related to the motivation for establishing the

[2] The security lender is the party that lends out the security and obtains the cash collateral. Thus, the security lender is equivalent to the borrower in a repo transaction.

[3] A small percentage of securities loans are term loans. We exclude these term loans from our analysis.

[4] Lending fees for securities lending against cash collateral are defined as:

$$Lending\ fee = market\ rate - rebate\ rate$$

The market rate used by Markit did not change significantly during the repo spike, meaning that the change in lending fees is the negative of the change in rebate rate. We are presenting our results in terms of lending fee.

lending transaction in the first place. If the main motivation is for the securities borrower to obtain the specific security, as is common for equities and corporate bonds, then the borrower has less negotiating power and cannot force the lender to pass on the windfall. In contrast, if the main motivation for securities lending is to finance the security lender with cash, as is common with government bond lending, then the borrower has the negotiating power and can force the lender to pass on the windfall gain. Our second hypothesis is the *organizational hypothesis*. It proposes that there are institutional characteristics that separate the corporate bond and equity lending market from the repo market. Such as different market participants in the two markets or the different securities traded by different teams within the same institution. These barriers would lead borrowers of equity and corporate bonds to either not be aware of the spike in the repo market or to not have the bandwidth to renegotiate terms. In fact, if borrowers use the security loan to establish a short position, the missed windfall from not receiving a higher rebate rate may be small in comparison to the potential profit from the short position.

To examine evidence in favor of the negotiation power hypothesis, we focus on an interaction with lending fee. Securities with high lending fees (and thus low rebate rates) are in short supply and lenders will have a lot of negotiating power. Such securities are unlikely to be lent out primarily to finance the lender and almost all transactions in those securities are likely driven by a desire of the borrower to obtain the specific security. Thus, under the negotiating power hypothesis, we would expect a lower decrease in lending fees for these securities. For this reason, we examine how the increase in rebate rates around the repo squeeze of September 2019 depends on the ex-ante level of lending fees.

We find a significantly lower decrease in lending fees for government bonds with higher fees. Most government bonds have ex-ante fees that are negative, and these securities experienced a decrease in lending fees of 2.6% during the repo spike. In contrast, for government bonds with ex-ante fees of 0-0.1% or 0.1-1.0%, the decrease in lending fees was only 1.75% or 1.4%, respectively. This difference is statistically significant. For government bonds with the extremely high ex-ante fees of 1% or more, we do not observe any decrease in lending fees during the repo spike, i.e. they behave exactly like equities or corporate bonds.

Because security lending transactions are conducted over the counter, there can be large within-security differences in lending fees. Using our detailed loan-level data and an innovative methodology of linking security loans over time, we are able to focus on the change in loan-level lending fees. First, we confirm that our findings become even stronger using loan-level ex-ante lending fees. Second, we compute *excess* loan-level lending fees, which we define as loan-level lending fees minus the average security-level lending fee. We show that during the repo spike there is also statistically significantly less decrease in lending fees for government bonds with higher *excess* loan-level ex-ante lending fees. This finding suggests that higher negotiation power of the lender comes not only from lending supply and demand for that specific security but can also be driven by lender or borrower-specific fixed effects that are reflected in the excess loan-level fee.

Having shown that the level of ex-ante fees can predict the fee decline within government bonds, we now turn to whether the difference in ex-ante fees can completely explain the difference between the security types. For this purpose, we match government bonds with equities and corporate bonds having similar ex-ante fees. Except for very high ex-ante fees of more than 1%, we still find a significantly larger decrease in fees for government bonds during the repo spike. Thus, while we find strong evidence of the *negotiation power hypothesis*, it cannot completely explain the difference in reaction between government bonds and other securities.

Next, we focus on the correlation between lending fees and repo rates over the whole period from 2006 to 2020 rather than on the specific event in September 2019. One advantage of this approach is that we can extend our analysis to repo decreases. Under the negotiation power hypotheses, we would expect security lenders to not pass on a windfall in the case of an *increase* in repo rates (as in our event study), but we would expect them to lower the rebate rate in case of a repo rate *decrease* because this is advantages for them. In contrast, the organizational hypothesis would suggest that rebate rates of corporate bonds and equity loans are just generally less sensitive to changes in the repo rate, irrespective of the direction. Accordingly, we study increases and decreases separately. We find that for both increases and decreases, government bond rebate rates correlate highly with the repo rate. In contrast, equity and corporate bond rebate rates are completely uncorrelated to the repo rate. This finding suggests that the negotiation power hypothesis cannot fully explain our results and that they are at least in part driven by a general separation between the markets as predicted by the organization hypothesis.

To conclude, our paper combines a unique, loan-level dataset on securities lending with a large unexpected spike in the repo rate to study the interconnectedness of the repo and securities lending market. We show that large increases in repo rates transmit to government bond lending but not to equity or corporate bond lending. This finding is partially but not fully explained by the different negotiating power of lenders in these markets.

Our findings have important policy implications. They show that equity and corporate bond lending provides lenders with a secure source of financing that does not evaporate or get more expensive during a crisis. In contrast, financing obtained from lending government bonds is almost as flighty as repo. Furthermore, our paper highlights how two parties split a windfall gain in a contractual relationship that can be renegotiated daily. It highlights how in seemingly identical situations the windfall gain can be split very differently and what variables are driving this difference.

Our paper contributes to two strands of literature. First, we contribute to literature on the securities lending market. Most papers in this literature ignore the fact that securities lending provides financing to the securities lender. Furthermore, they usually focus exclusively on equities (examples include D'Avolio (2002), Nashikkar and Pedersen (2007), Saffi and Sigurdson (2011), Kolanski, Reed, and Ringgenberg (2013)). In contrast, Foley-Fisher, Narajabad, and Verani (2016) highlight the financing function of securities lending by showing that U.S. life insurers are more likely to make a bond available for lending if they are in more need of financing. We built on this idea to study how rebate rates in the securities lending market are affected by sudden changes in the repo rate. To the best of our knowledge, our paper is the first to study the interconnectedness of the repo and securities lending markets.[5]

Second, our paper adds to the papers covering the September 2019 repo spike. Anbil, Anderson, and Senyuz (2020a) and Afonso et al. (2020) cover the general events and explain what caused the repo spike. Anbil, Anderson, and Senyuz (2020b) use the September 2019 repo spike to show how the segmented market structure can lead to rate distortions even in an essentially riskless environment. We add to this literature by studying the effects of the September 2019 repo spike on the securities lending market.

[5] Fleming, Hrung, and Keane (2010) study how the introduction of the Federal Reserve's Term Securities Lending Facility affected repo rates. However, their study focusses only on this one intervention of the Fed rather than on a general connection between the repo and securities lending markets.

2. The data and the main variables

2.1 Markit data

In this paper, we use securities lending data provided by Markit. Importantly, we use the detailed transaction-level dataset rather than the aggregated dataset that is usually used in academic research. This detailed data contains each securities lending transaction that is reported to Markit separately. Furthermore, Markit reports which security is being lent out, how many shares of the security are lent out, when the security loan started, and whether it is collateralized with cash or non-cash collateral. For cash collateral, it also reports the currency, which is usually US dollar. We exclude loans that are collateralized with non-USD cash. This affects less than 0.3% of loans collateralized with cash. Markit also reports when the security loan is a term loan, meaning that its terms are fixed for a specific time rather than being rolled over daily. We exclude all term loans because their terms should not be able to change during the repo spike. This affects less 2% of security loans in the sample. We also limit our attention to U.S. securities.

As for pricing, Markit reports the lending fee and the rebate rate. For noncash collateral, the rebate rate is zero and the fee is paid by the borrower to the lender. For cash collateral, the rebate rate is what the lender pays the borrower to compensate the borrower for missing the interest on the cash collateral. This rebate rate is less than what the lender could usually obtain by investing this cash and the difference between these two rates is the lending fee. Given that Markit reports both a rebate rate and a lending fee for transactions with cash collateral, it is possible to compute the implicit "market rate" that is being used. This implicit market rate is generally the same for all loans at one point in time (though for a few transactions Markit sometimes seems to use the prior day's market rate). We display the market rate during the repo spike in Appendix 1. The market rate only increased marginally during the repo spike. Thus, the changes in the lending fee will equal almost exactly the negative of changes in the repo rate. We will mainly use lending fees in our analysis but in unreported robustness checks we confirmed that our general results hold when using rebate rates instead.

The data has two observations for each day, an AM and a PM observation. During the repo spike, we use both observations per day to get the most detailed picture possible and will refer to them as halfdays. For our analysis on the longer time period from 2009 to 2020, we only use the PM observations.

2.2 Repo data

We only use aggregated data on interest rates of repurchase agreements (repo) in this study. For the analysis around the September 2019 repo spike, we use the Secured Overnight Financing Rate (SOFR), which is published daily at around 8 AM on the website of the New York Fed. The SOFR is a broad measure of the cost of borrowing cash overnight collateralized by Treasury securities. It includes all trades in the Broad General Collateral Rate plus bilateral Treasury repurchase agreement (repo) transactions cleared through the Delivery-versus-Payment (DVP) service offered by the Fixed Income Clearing Corporation (FICC), which is filtered to remove a portion of transactions considered “specials”. The SOFR is calculated as a volume-weighted median.

Because SOFR data is not available back to 209, we use the General Collateral Finance (GCF) repo rate as provided by Bloomberg when running analyses on the full sample from 2009.

2.3 Summary Statistics

In Table 1, we provide summary statistics on the securities lending market for the period September 2-13, 2019. This is the two weeks leading up to the week of the repo spike. In Panel A, we present summary statistics on volume. The non-term, cash collateral volume for government bond lending is $170 billion per day, for equities it is $294 billion, and for corporate bonds $130 billion. While Markit has good coverage, it does not include the full securities lending market, so this is a lower bound of the size of that market. The percentage of volume that is collateralized with cash is highest for corporate bonds at 76.6%, then 58.6% for equities, and just 46.3% for government bonds. We also present summary statistics for control variables by loan type.

For continuous variables, we present summary statistics separately for each security type and by whether the collateral is cash or noncash. We first focus on summary statistics for loans using cash collateral. The median time that security loans are open is about 30 days, irrespective of security type. However, there are some security loans that have been open very long and those are more common for government bonds. For example, the 90th percentile of tenure for government bonds is 253 days, while it is only 175 days for equities and 152 days for corporate bonds. The lending fees are generally much higher for corporate bonds and equities, which have a median lending fee of 10 basis points, while government bonds have a median lending fee of negative 10 basis points. Again, there is a lot of positive skewness. The 90th percentile lending fee for equities is 5.11%, while it is only 1.11% for corporate bonds and 0.06% for government bonds.

Government bond lending also differs in that the average transaction size is much larger with a mean of $8.1 million (median $1.19 million), while for equities it is only $0.51 million (median $0.043 million) and for corporate bonds it is $0.72 million (median $0.16 million).

The lower lending fees, larger loan sizes, and longer tenures for government bonds are all consistent with the idea that government bond lending is more often used to finance the lender.

3. Empirical results for the repo spike

3.1 Spike in the repo market in September

On September 16 and 17, 2019, repo rates spiked unexpectedly. On the Friday of the prior week (September 13), the average of the secured overnight financing rate (SOFR) had been 2.2%. But on Monday, September 16, it increased to 2.43% and on Tuesday, September 17, it even reached 5.25%. To illustrate how large this spike was, we display in Figure 1 the SOFR rate from April 2018 to April 2020. While small spikes at year end or quarter end are common, such a large increase in the repo rate had not happened at least since the financial crisis (unreported). In fact, the second-largest spike over this period occurred around the year end of 2018 and was just 70 basis points. In contrast, on September 16 and 17, 2019, the average SOFR rate increased over 300 basis points.

More details on the background of this spike in repo rates is provided in Anbil, Anderson, and Senyuz (2020a) and Afonso et al. (2020). Anbil, Anderson, and Senyuz (2020a) point to two main reasons that decreased reserves and likely caused the increase in repo rates. First, corporate tax payments were due on September 16, causing companies to withdraw cash from money mutual funds (who are typical lenders in the repo market) and deposit it in the Treasury's account at the Federal Reserve. Second, $54 billion of long-term Treasury debt settled on September 16, which increased the Treasury holdings of primary dealers that purchased these securities at auctions and finance them through the repo market. Taken together, these two events drained a lot of cash from the system, leading to a decline in bank reserves of about $120 billion. While both of these events were anticipated, the resulting spike in the repo rate came as a surprise to market participants (Afonso et . (2020)).

For our paper, the most important take-away is that the repo spike was large and unexpected. In the rest of the paper, we will study how the repo spike spilled over into the securities lending market.

3.2 Decreases in lending fees by security type

We start to examine the spillovers from the September 2019 repo spike by focusing on securities lending against cash collateral. As discussed above, these transactions are economically equivalent to repo: the securities borrower obtains the security and posts a cash collateral on which the security lender pays interest in form of the rebate rate. In Figure 2, Panel A, we display the (value-weighted) average of the rebate rate within the three security types that we examine: government bonds, corporate bonds, and equities. The figure clearly shows that there was a strong spillover to government bond lending: The average rebate rate for government bonds increased from 2.25% on September 13 to 5% by September 17 (PM), increasing almost as much as the repo rate. In contrast to this large spillover to government bond lending, rebate rates for corporate bond lending and equity lending are virtually unchanged.

Next, we redo the same analysis using the lending fee in Panel B. The lending fee for securities lending against cash collateral is defined as:

$$Lending\ fee = Market\ rate - Rebate\ rate$$

Thus, the lending fee decreases if the rebate rate increases. In fact, throughout the September 2019 episode, the implied market rate stayed relatively constant (see Appendix 1). Thus, changes in the lending fee are just a mirror image of changes in the rebate rate. Indeed, in Panel B, we observe a sharp drop of the lending fee for government bonds, which reached -2.83% on September 17 (PM). In contrast, lending fees for equities and corporate bonds were unchanged. This finding confirms that lending fees are a mirror image of rebate rates. To facilitate comparison, from here on, we will conduct all analyses using lending fees instead of rebate rates because they are also defined for lending against non-cash collateral. However, we have confirmed that our results are unchanged if we use rebate rates instead of lending fees (unreported).

So far, we have not detected any spillovers from the repo spike to corporate bond or equity lending. However, we have only examined average lending fee. Next, in Panel C of Figure 2, we focus instead on the 1st percentile (value-weighted) of lending fee. Once again, we do not find any effect on corporate bonds or equities. This suggests that even the equities or corporate bonds with the lowest lending fees did not exhibit any decrease in lending fee during the repo spike. In contrast, the 1st percentile for government bond lending fees dropped to less than 5%.

Next, we redo our analysis from Figure 2 using a regression set-up. We use a panel dataset from 2-19 September, 2019 on the security-halfday level. The dependent variable is the lending fee and the independent variables of interest are dummy variables for AM and PM values of September 16-19, 2019. These dummy variables measure the difference of the lending fee on that day compared to the average lending fee over September 2-13, 2019 (the omitted categories). By adding security fixed effects, we ensure a within-security comparison. We adjust standard errors by two-way clustering for security and halfday.

We display the results in Table 2. In Column 1, we display this regression for government bonds. We confirm our findings from Figure 2: the lending fee for government bonds decreases statistically significantly starting on September 16 AM and reaches the lowest level on September 17 PM. At that point, it is 2.51 percentage points lower than in the first two weeks of September. Compared to the 3 percentage points increase in rebate rates, this implies that 80% of the windfall is passed on to borrowers of government bonds. In Column 2 and 3, we repeat this analysis for equities and corporate bonds and do not find any sign of a decrease in lending fees. Indeed, lending fees for these securities even increase during the repo spike by 0.3 percentage points for equities and 0.04 percentage points for corporate bonds. While these increases are statistically significant, they are relatively low in economic magnitude and also do not fully revert after the repo spike ends, suggesting that they might be partly driven by a general trend.

Taken together, our findings paint a clear picture of what happens to the windfall that security lenders receive from the higher repo rates at which they can invest the cash collateral. Specifically, they generally pass on this windfall to borrowers of government bonds but completely keep it in the case of equities and corporate bonds .This finding is surprising given that the security lender should receive the same windfall irrespective of the type of the security lent out and all security lending arrangements can be renegotiated daily.

We explore potential reasons for this difference in Section 3.4, but first we examine timing and dispersion of the decrease in lending fees for government bonds.

3.3 Dispersion in how much of the windfall is passed on to borrowers

As we have seen above, for government bonds borrowed against cash collateral, we observe a clear reduction in fees during the repo spike. However, this decrease is not the same for all government bonds. In fact, there is variation in fees both between different bonds and even within the same bond because securities lending transactions are traded over the counter. In this subsection, we examine how this dispersion in fees evolves during the repo spike.

In Figure 3, we display the distribution of lending fees for government bonds against cash collateral at different points in time. Each line displays the distribution of fees at a different point in time with fees being displayed on the x-axis and the value-weighted percentiles displayed on the y-axis.

This means that an approximately vertical line indicates that there was little dispersion while a more horizontal line indicates more dispersion in fees.

In Panel A, we display the points in time leading up to the repo spike. Fees during the September 2-13 period display very little dispersion as almost all lending fees are between -0.2% to 0.2%.[6] As the repo crisis worsens, the dispersion of lending fees increases. On September 17 AM, lending fees reach the largest dispersion spanning from -4.8% to 0%. This dispersion is not limited to some outliers. While the 40% of volume with the lowest fees has fees below -4%, the top 20% of volume has fees above -1%.

In Panel B, we display data for the halfdays following the repo spike. As the markets calm, lending fees increase and the dispersion in lending fees decreases. The period from September 20-31 again displays a dispersion that is only slightly larger than that from September 2-13.

3.4 What is driving the dispersion in fee decreases?

Given the large dispersion of government bond lending fees on September 17 PM, we examine the drivers of this within-security-type dispersion to try and understand the large difference in between-security-type dispersion. As mentioned above, there are two reasons that might explain why we observe a large drop in fees for government bonds but not for corporate bonds or equities. First, the *negotiation power hypothesis* predicts that for government bonds the main purpose of the transaction is to finance the security lender, given the security borrower more power. In contrast, for equities and corporate bonds, the main purpose is for the borrower to obtain the security (for example for short selling), thus giving the securities lender more negotiating power. Second, the *organizational hypothesis* predicts that for institutional reasons there is a separation

[6] We only include data from the 2nd to 98th percentile to remove outliers.

between repo markets and equity or corporate bond lending but not between repo markets and government bonds lending. For example, such institutional separation might be driven by the fact that government bond lending and repo trading are usually done by the same team in a bank.

If the negotiating power hypothesis is true, then we would expect the decrease in lending fees to be smaller for those government bonds where the security lender has higher negotiation power. We argue that a good proxy for negotiating power is the ex-ante lending fee. In transactions where security lenders have more negotiating power, we would expect them to be able to charge a higher lending fee. While government bonds generally have lower lending fees than equity or corporate bonds, there are indeed certain government bonds where lending fees are higher, reaching levels more typical of equities or corporate bonds.

Thus, we run a cross-sectional regression of the decrease in lending fees amongst government bonds on the ex-ante lending fee. We define the decrease in lending fees as the lending fee on September 17 PM minus the average lending fee for that specific security over the period September 2-13. As explanatory variable we compute the average ex-ante lending fee on the security level during September 2-13. We form 4 buckets of ex-ante lending fee: The most expensive to borrow government bonds have fees above 1% and make up only 0.3% of the sample. Government bonds with fees from 0.1-1% make up 8.5% of the sample, and those with fees from 0-0.1% make up 5.8%. Most government bonds (85%) are in the fourth category of negative lending fees that constitutes the omitted category.

We display our regression results in Table 3. We find clear evidence that government bonds with higher ex-ante fees experienced less decrease in lending fees during the repo spike. This finding is significant at the 1% level and economically significant. It is also monotonically increasing along lending fees: Government bonds with ex-ante fees of 0-0.1% experienced only 0.85 percentage points less decline in fees that those with negative rates. But the reduction in fee decline was 1.2 percentage points for ex-ante fees of 0.1-1% and 2.85 percentage points for those of 1% and more. Thus, government bonds with ex-ante fees above 1% behaved like equities and corporate bonds and did not experience any decline in fees during the repo spike. This finding provides clear support for the negotiating power hypothesis.

In Columns 2 and 3 of Table 3, we add other loan-level variables that might explain the change in fee, such as tenure, size of the loan, or lender location. These control variables do not significantly alter the effect of ex-ante fees. Examining the control variables, we find that both brand-new loans and old loans experience a larger decline in fees and large loans experience a smaller decline. Brand-new loans having a lower fee might be explained by the fact that it is easier for borrowers to demand a lower fee as the contract is entered rather than having to renegotiate an existing loan. Large loans exhibiting a smaller decrease might be explained by the fact that it is harder to find a competing lender for a larger loan. Thus, borrowers needing a large amount of securities might have less negotiating power. We also find less of a decrease for loans that are reported by the borrower rather than the lender though the reason for that is unclear. All these loan-specific variables remain significant after we add security-level fixed effects in Column 4.

So far, we have only studied the effect of ex-ante fees on the security-level. However, as mentioned above, there is substantial within-security dispersion in fees. While the between-security dispersion in fees used above might relate to the supply and demand for lending a specific security, the within-security dispersion of fees may be driven by borrower- or lender-specific fixed effects. For example, a more skillful borrower (lender), may achieve lower (higher) fees for the same security. This difference in skill might also affect how much of the windfall the lender has to pass on to the borrower.

Therefore, we examine the effect of loan-specific ex-ante lending fees. Unfortunately, the Markit data does not contain loan identifiers. Instead, we link loans from one halfday to the next if they are the same in terms of: security, start date, number of securities on loan, and lender location.[7] We only establish such a link if for both halfdays there is only one observation with those specific characteristics. To minimize how many observations we lose due to this restriction, we use the value of September 13 PM as the ex-ante fee value rather than an average over September 2-13. Similarly, we compute the change in fee relative to this specific ex-ante value. Thus, our dependent variable is now the loan-specific lending fee increase.

We present the results in Panel B of Table 3. We find the same effect as using security-level ex-ante fees, but the magnitude is even larger. Just having a loan-specific ex-ante fee of 0-0.1% causes a loan to experience a 1.7 percentage points lower decrease in fees. For loans with ex-ante fees of more than 0.1% the effect is about 2.6 percentage points. This result is not only robust to including various control variables but also to security-level fixed effects.

Next, in Panel C, we examine if *loan-specific* ex-ante fees can predict the reduction in fees even when controlling for the *security-level* ex-ante fee. For this purpose, we define the *excess* loan-specific lending fee as the loan-specific lending fee minus the (value-weighted) average lending fee of that security. We conduct the same set-up as in Panel B but use the excess loan-specific lending fee instead of the normal loan-specific lending fee. As expected, the magnitude of the result decreases but remains highly economically and statistically significant.

To summarize, we find strong support for the *negotiation power hypothesis*. Security lenders with high negotiation power capture a large share of the windfall even when lending government bonds.

[7] Lender location also includes whether the loan is reported by a borrower. In this case, no lender location is provided.

This negotiation power can come either from lending a government bond where lending supply is low relative to lending demand and the lending fee is overall high or it can come from lender (or borrower) specific fixed effects that lead the lender to have particular power in that specific lending relationship.

3.5 Do differences in fee level fully explain the differences between security types?

In this section, we examine whether the effect of ex-ante fee demonstrated above can fully explain why government bonds declined less than equities and corporate bonds. For this purpose, we run similar cross-sectional regressions for loans against cash collateral as in Table 4 but include all securities rather than just government bonds. The dependent variable is again the decline in fees on September 17 (PM). The main explanatory variable of interest is *D(Government bond)*, which is a dummy variable equal to one if the security is a government bond. Importantly, we control for ex-ante fees by employing fixed effects for each 0.1% group of ex-ante fees, i.e. 0-0.1%, 0.1-0.2%, etc.

The results are presented in Table 4. In Panel A, Column 1, we include the full sample. We find that even controlling for ex-ante fees, *D(Government bonds)* has a coefficient of -2.3, showing that lending fees declined 2.3 percentage points more for government bonds during the repo spike. This finding suggests that there is still a big difference between government bonds and other securities even if they have the same ex-ante lending fee. Next, in Columns 2 to 7, we split the sample by the level of the ex-ante fee (while keeping the fixed effects controls for ex-ante fee group). We find that *D(Government bonds)* is more negative the lower the ex-ante fees. Amongst securities with negative ex-ante lending fees, *D(Government bonds)* is -2.5; amongst securities with ex-ante fees of 0.2-0.5%, *D(Government bonds)* is only -1.7, and amongst those of 0.5-1.0% it is only -0.6. For securities whose lending fee is above 1%, *D(Government bonds)* is statistically indistinguishable from zero and even slightly positive. This means that government bonds with unusually high lending fees behave like equities and corporate bonds during the repo spike, but equities and corporate bonds with unusually low lending fees do not behave like government bonds.

So far, we have only controlled for security-level ex-ante lending fees. As we discussed above, the ex-ante fee of the specific loan is also informative about the decline in lending fees during the repo spike. To fully control for both security-specific and loan-specific ex-ante fees, we add two sets of fixed effects: one based on the security-level fee (as above) and one based on the *excess* loan-specific fee, which is defined as the loan-specific fee minus the security-level fee. Both sets of fixed effects are based on 0.1% intervals of the specific fees.

We report the results in Panel B. Despite the additional fixed effects, the coefficient for *D(Government bonds)* is of only slightly lower magnitude at -2.1 and remains highly statistically significant. In Columns 2-7, we split the sample by excess loan-specific ex-ante fee. We find that the effect of being a government bond is smaller the larger the excess loan-specific ex-ante fee. Government bonds with excess loan-specific ex-ante fees of 0.5% or higher experience a change in fees during the repo spike that is statistically indistinguishable from corporate bonds and equities.

To conclude, while we find strong support for the *negotiation power hypothesis* by showing that higher fee government bonds experience lower declines in fees during the repo spike, this effect is not large enough to fully explain the difference in fee response between government bonds and other securities. Thus, there seems to be some other effects leading to a different fee response of government bonds even after controlling for ex-ante fees. Institutional differences, as suggested by the *organization hypothesis*, are a potential explanation.

3.6 Effects on lending against non-cash collateral

So far, we have only focused on lending against cash collateral. However, as discussed in Section 2.3, a sizeable fraction of security loans for all security types is collateralized with non-cash collateral. In that case, there is no rebate rate and the borrower just directly pays a lending fee to the lender. Because there is no cash collateral involved, this type of transaction cannot be used to finance the security lender and the main motivation will always be for the borrower to obtain the specific security.

We examine both the price and the quantity effect of the repo spike on lending against non-cash collateral. For the price effect, we display in Panel A of Figure 4 the value-weighted average lending fee when using non-cash collateral. The fees for equities and corporate bonds are unchanged throughout the repo spike but the fees for borrowing government bonds against non-cash collateral increase by 0.15 percentage points. This finding is surprising given that the fees for borrowing government bonds against cash collateral actually decreased during the same period. It might be explained by borrowers shifting demand into non-cash collateral despite the lower fees in cash collateral.

To examine this proposition, in Panel B, we study the cash percentage, i.e. the fraction of volume that is collateralized by cash. For government bonds there is a drop of about 3 percentage points in the cash percentage during the repo spike that partially retraces afterwards. For corporate bonds there is no change in the cash percentage. For equities there is a drop of about 1 percentage points. This finding suggests that for government bond lending there was indeed a demand shift from cash collateral to non-cash collateral, which resulted in more volume and higher fees for lending against non-cash collateral. This demand shift happened despite the large drop in lending fees for lending against cash collateral. It suggests that some government bond borrowers are not willing to finance their lenders even at the lower lending fee (and thus higher rebate rates) and therefore move into using noncash collateral.

In contrast, for equities and corporate bonds there was barely any shift in demand towards non-cash collateral even though lenders for these securities pocketed the whole windfall and did not decrease lending fees. How might our hypotheses explain this behavior? For the *negotiation power hypothesis* to explain why equity and corporate bond borrowers do not change to noncash collateral (and invest their cash collateral at high repo rates), we would have to assume that their negotiation power is so weak that none of them can switch to noncash collateral. This seems unlikely. More plausible is that the behavior is at least partially driven by the organization hypothesis, which suggests that for institutional reasons, borrowers of equities and corporate bonds are either not aware of the repo spike or do not care about the increased opportunity costs of their cash collateral.

4. Empirical results over 2009-2020

4.1 General co-movement of lending fees and repo rates

So far, we have only focused on spillovers from repo to securities lending during the repo spike of September 2019. In this section, we expand our analysis to study general correlations between repo rates and average lending fees over our whole sample period from January 2009 to June 2020. For this purpose, we run time-series regressions that regress changes in value-weighted average lending fees for our three security types on contemporaneous changes in the repo rate. We are particularly interested to see if there are any asymmetries between increases and decreases in the repo rate. If the *negotiation power hypothesis* holds, we might expect that securities lenders do not lower fees in response to higher repo rates for corporate bonds and equities (as we have seen in case of the September 2019 repo spike), but we would expect them to increase fees in response to lower repo rates (to protect their profits). Therefore, we split our sample by whether there is an increase or a decrease in repo rates.

We present the results for increases in the repo rate in Panel A of Table 5. In Columns 1, 3, and 5, we include all days with an increase in the repo rate. In Columns 2, 4, and 6, we only include increases of at least 0.1% or more. For both samples, we find a clear spillover to government bond lending fees. For every 1% increase in the repo rate, the government bond lending fee decreases by about 0.4%, which is statistically significant. In contrast, there is no statistically significant effect of lending fees of equities and corporate bonds and the coefficients are very small. Thus, our broader evidence supports the findings from the repo spike: Increases in repo rates spill over to government bond lending fees but not to fees for lending corporate bonds or equities.

In Panel B, we repeat the same analysis with decreases in the repo rate. The coefficients are also statistically significant for government bonds and the magnitude is even slightly higher. Thus, we do not find our predicted outcome based on the *negotiation power hypothesis.* Rather, these results seem to suggest that corporate bonds and equity lending markets are just generally separated from repo markets, which would be more in line with the *organizational hypothesis*.

4.2 Effects of ex-ante fees on co-movement of lending fees and repo rates

Next, we examine if our finding on the importance of ex-ante fees also carries over to the longer time series of 2009-2020. Because the dataset using loan-level information is extremely large, we limit our attention to days where the repo rate increased or decreased by more than 10 basis points to keep the analysis computationally feasible. These days with large moves in the repo rate are the days where we would really expect a spillover into lending fees. Also, we have shown above that we find very similar results to the full sample when limiting our attention to only days with large changes in the repo rate.

As before, we focus our attention on government bonds lent against cash collateral and split bonds into 4 groups by prior-day lending fee: below 0%, 0-0.1%, 0.1-1.0%, and >1%. We then create dummy variables for each of these groups and interact them with the change in the repo rate on the day. As shown in figure 5, changes in the repo rate are negatively correlated with changes in lending fees, thus a positive coefficient of the interaction means less spillover relative to bonds with ex-ante lending fees below 0% (the omitted category). In Panel A, we use the ex-ante fee of the security level. We find that the spillovers monotonically decrease the higher the ex-ante lending fee. For ex-ante fees of 0-0.1%, the spillover is 24 percentage points less, for ex-ante fees of 0.1-1.0% it is 40 percentage points less, and for ex-ante fees above 1.0%, it is 86 percentage points less. These results are statistically significant except for the group above 1.0%, which includes very few bonds and thus the test has little statistical power. Even for this group, the result becomes statistically significant after including security fixed effects.

In Panel B, we run the same set-up using loan-specific ex-ante fees. We find that spillovers are also monotonically decreasing in ex-ante lending fees. Finally, in Panel C, we use *excess* ex-ante lending fees, i.e. lending fees of the specific transaction relative to the average lending fee of that security. We also find that spillovers to excess lending fees are decreasing in excess ex-ante lending fees. All of these results are statistically significant.

Taken together, our results confirm our finding from the repo spike in a broader sample of both sudden repo increases and decreases. Sharp moves in the repo rate spillover to government bond lending fees but not to lending fees of corporate bonds or equities. The spillover to government bond lending fees is lower, the higher the ex-ante lending fee. These findings are consistent with the negotiation power hypothesis.

5. Conclusion

In this paper, we examine the interconnectedness between the securities lending and the repo market using a spike in the repo rate that happened on September 17, 2019. On this day, large corporate tax payments coincided with a large settlement of Treasury coupons, both of which reduced the cash supply available for lending in the repo market. As a response, repo rates spiked by over 300 basis points. Thus, for a day, the security lender could make an about 300 bps higher return from investing the cash collateral, which constituted a windfall gain. We study how much of this windfall gain security lenders passed on to the security borrowers.

Using detailed securities lending data provided by Markit, we show that there was a huge discrepancy between the different types of securities that were lent. For equities and corporate bonds, security lenders generally kept 100% of the windfall and did not increase rebate rates. In contrast, for government bond lending, there was on average a 250 basis points decrease in lending fees (and an equivalent increase in rebate rates). Compared to the 300 basis points increase in the repo rate, this implies that for government bonds about 80% of the windfall is passed on to security borrowers.

What might explain this different treatment? We propose two hypotheses: According to the *negotiation power hypothesis* our finding can be explained by securities lenders having less negotiation power when lending government bonds because government bond lending is more often done to finance the security lender. In contrast, the *organizational hypothesis* proposes that there are institutional characteristics that separate the corporate bond and equity lending market from the repo market.

We find some evidence for the *negotiation power hypothesis* by showing that government bonds with very high ex-ante lending fees reacted similarly to the repo spike as equities or corporate bonds. However, we find that differences in negotiation power cannot fully explain our results. Even after controlling for ex-ante fees, there is a large difference in the reaction between government bonds and other securities. Thus, equities and corporate bonds with very low lending fees (and thus low negotiation power of the securities lenders) had a very different reaction from government bonds. This finding suggests at least some support for the *organizational hypothesis*. This is further supported by the fact that we find similar reactions to repo increases and decreases when running our analysis on a longer sample from 2009 to 2020. Thus, our findings suggest that the difference in reaction between government bonds and other securities can be explained by both difference in negotiation power and institutional boundaries.

Our findings have important policy implications. They show that equity and corporate bond lending provides lenders with a secure source of financing that does not evaporate or get more expensive during a crisis. In contrast, financing obtained from lending government bonds is just as flighty as repo. Furthermore, our paper highlights how two parties split a windfall gain in a contractual relationship that can be renegotiated daily. It highlights how in seemingly identical situations the windfall gain can be split very differently and what variables are driving this difference.

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Figure 1: Spike in the repo market in September 2019

This figure displays the Secured Overnight Financing rate (SOFR), which is a value-weighted median rate of repo transactions. Our data goes from April 2018 to April 2020.

Secured Overnight Financing Rate (SOFR)

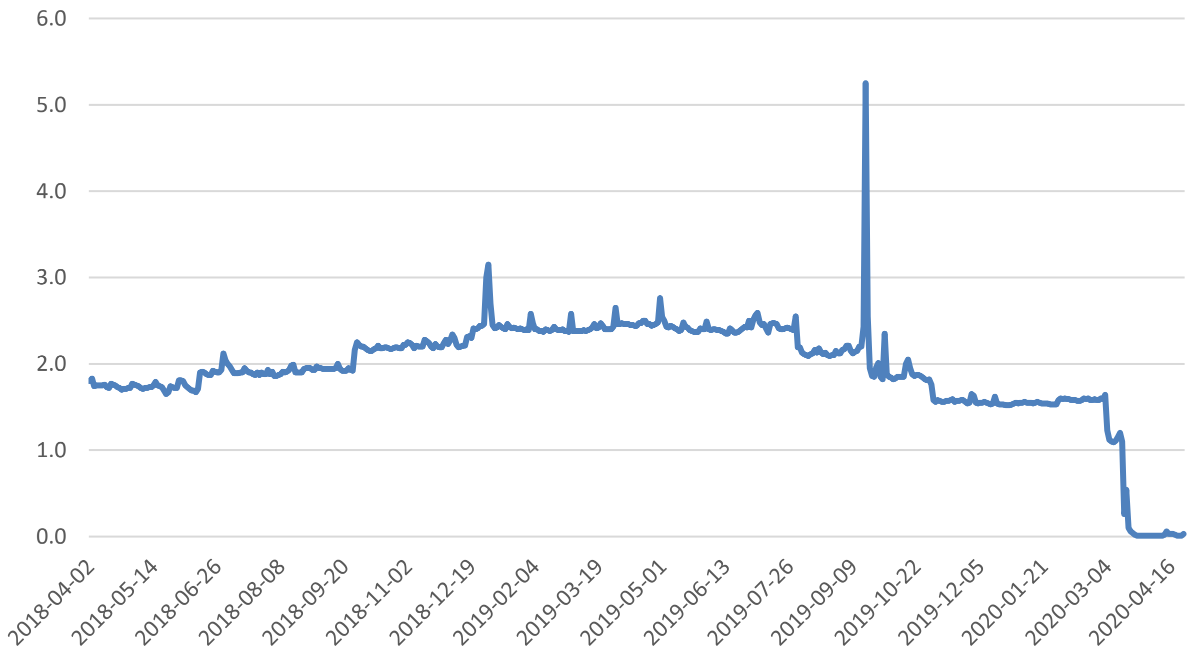
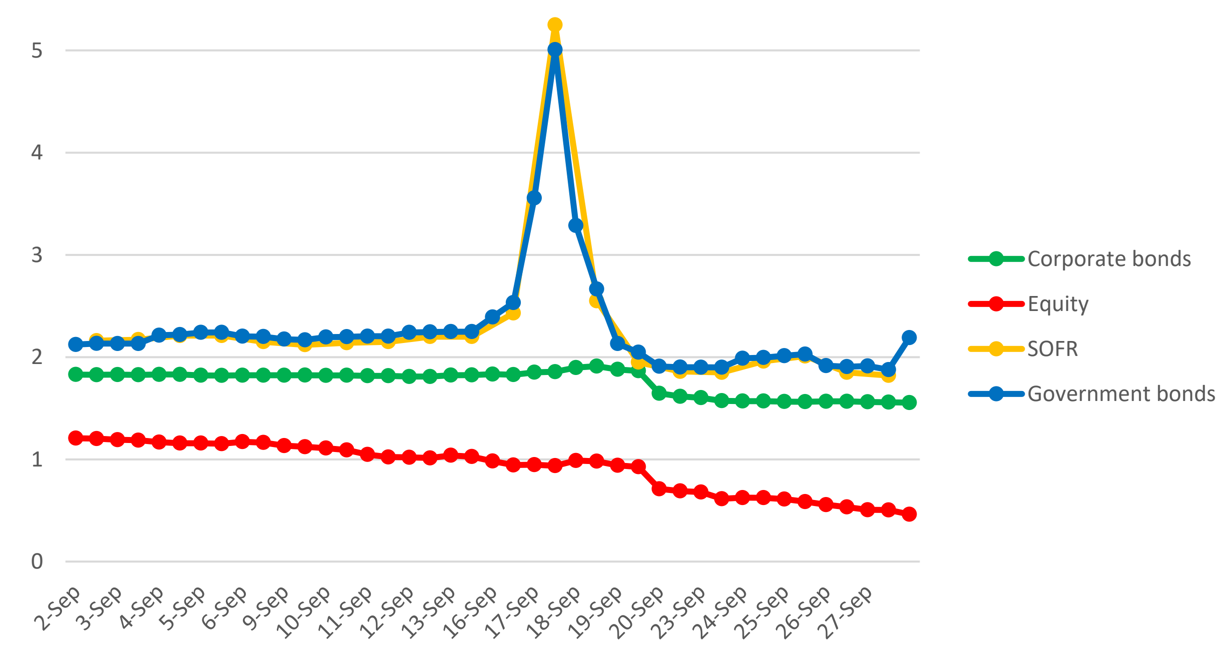


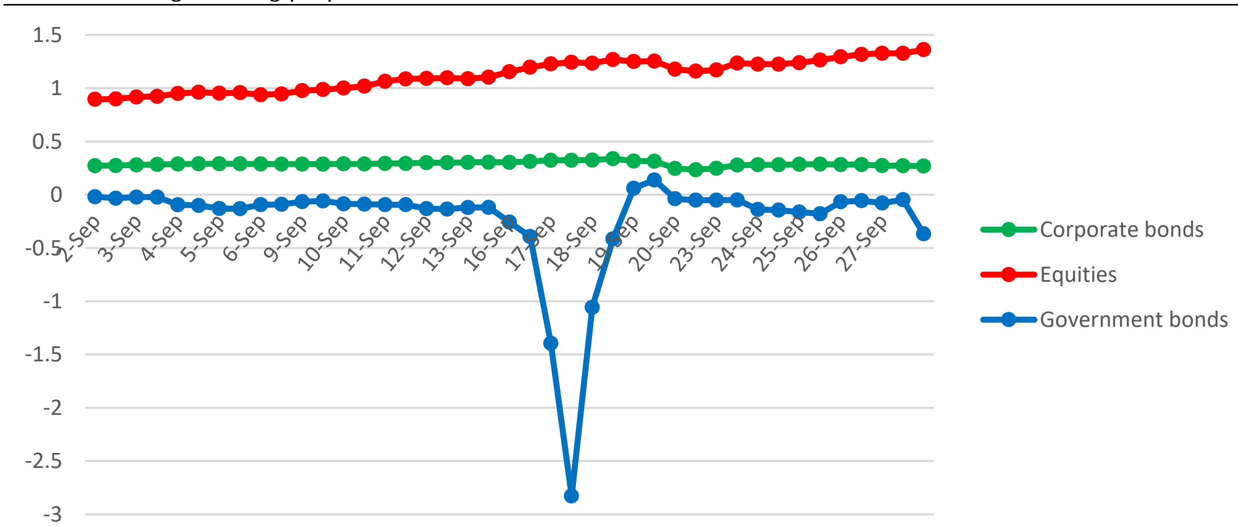
Figure 2: Spillover to securities lending markets by security type

This figure displays how rebate rates and fees in the securities lending market reacted to the repo spike in September 2019. In Panel A, we display value-weighted average rebate rates for government bonds, equity, and corporate bonds lending transactions against cash collateral for September 2019. As comparison, we also report the value-weighted median SOFR rate. In Panel B, we display the same for value-weighted average lending fees, which move in the opposite direction of rebate rates. In Panel C, we display the value-weighted 1st percentile of lending fees.

Panel A: Average rebate rates



Panel B: Average lending fee for cash collateral



Panel C: 1st percentile of lending fee for cash collateral

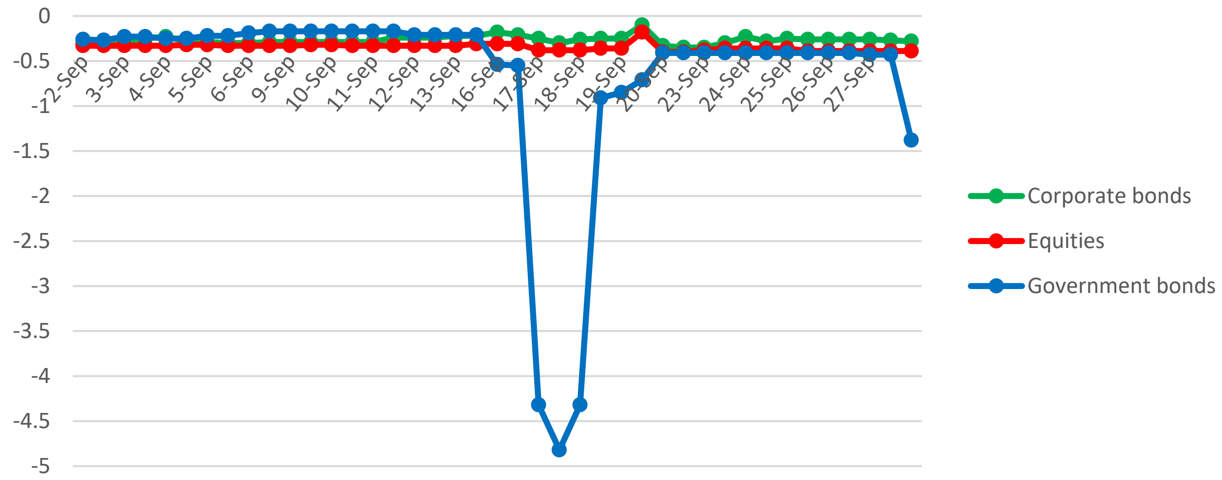
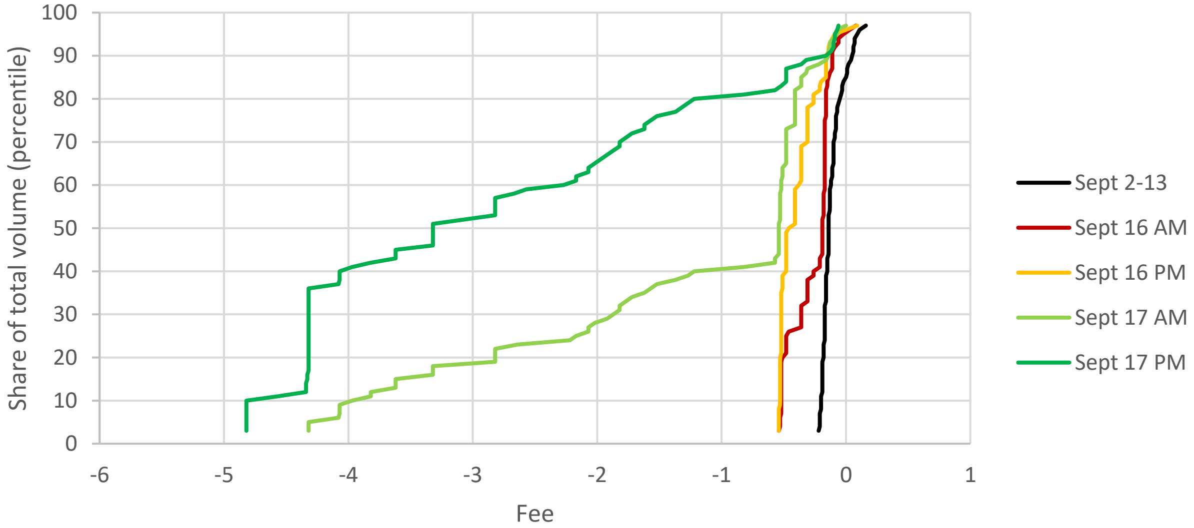


Figure 3: Distribution of lending fees for government bonds during repo spike

This figure displays the distribution of lending fees for government bonds against cash collateral around the repo spike. Each line displays percentiles of the fee distribution for a specific point in time or range of points in time from the 2nd to the 98th percentile. In Panel A, we display the halfdays leading up to the repo spike and the average for early September. In Pane B, we display the halfdays following the repo spike as well as an average for September 2-13 and September 20-31.

Panel A: The decrease in lending fees up to September 17 PM



Panel B: The increase in lending fees from September 17 PM

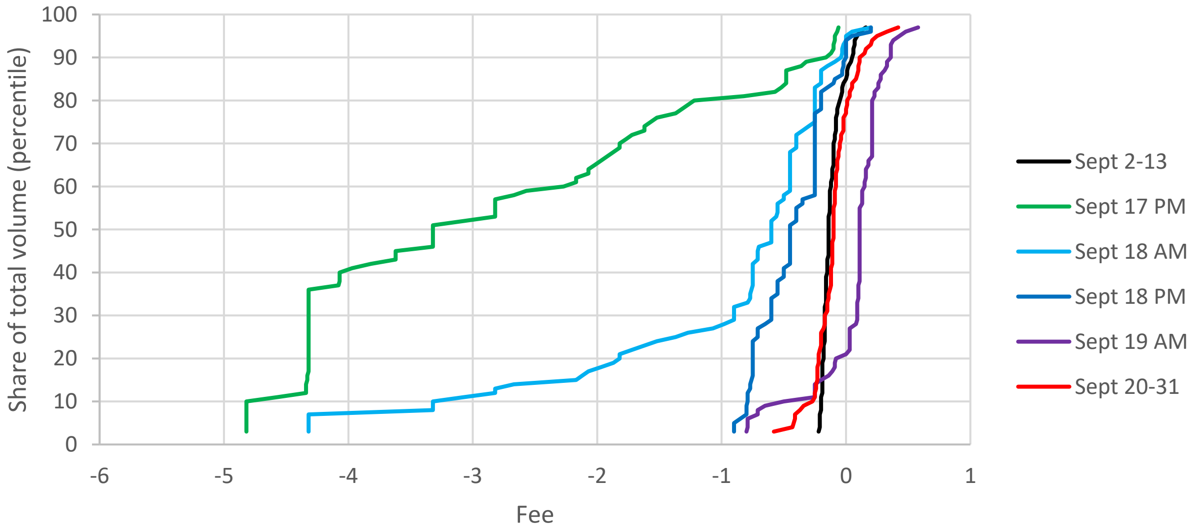
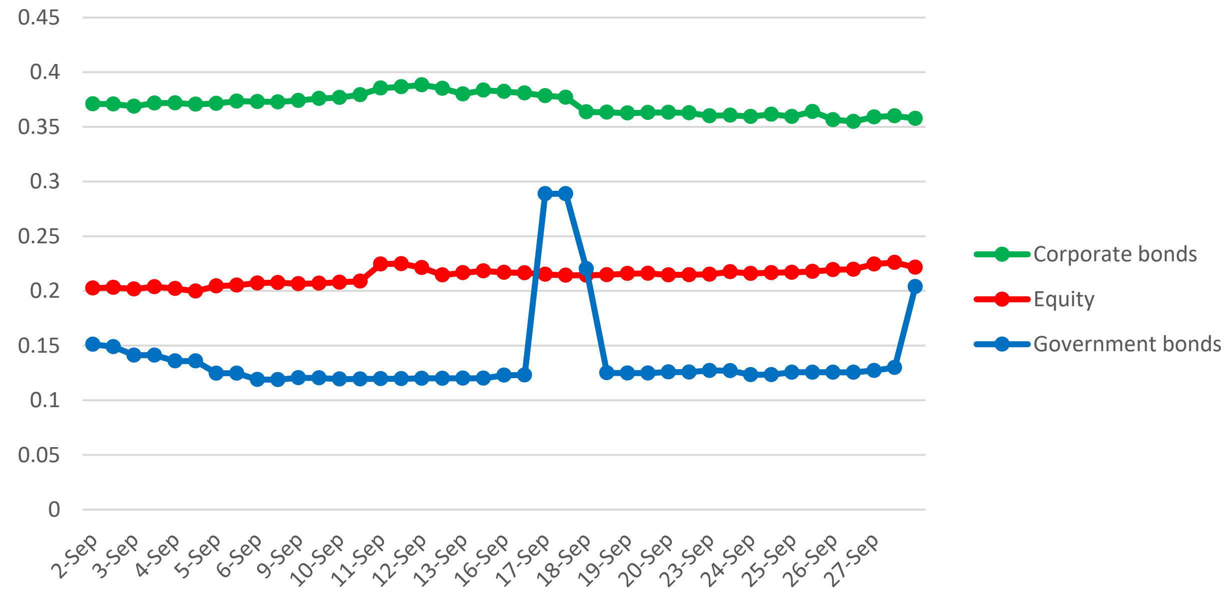


Figure 4: Effect of the repo spike on lending against non-cash collateral

This figure displays how securities lending against non-cash collateral was affected by the repo spike. In Panel A, we display the value-weighted average lending fee for borrowing different types of securities against non-cash collateral. In Panel B, we display the change in the percentage of total lending volume that was collateralized by cash relative to September 10, 2019.

Panel A: Average lending fees against non-cash collateral



Panel B: Change in cash percentage relative to September 10, 2019

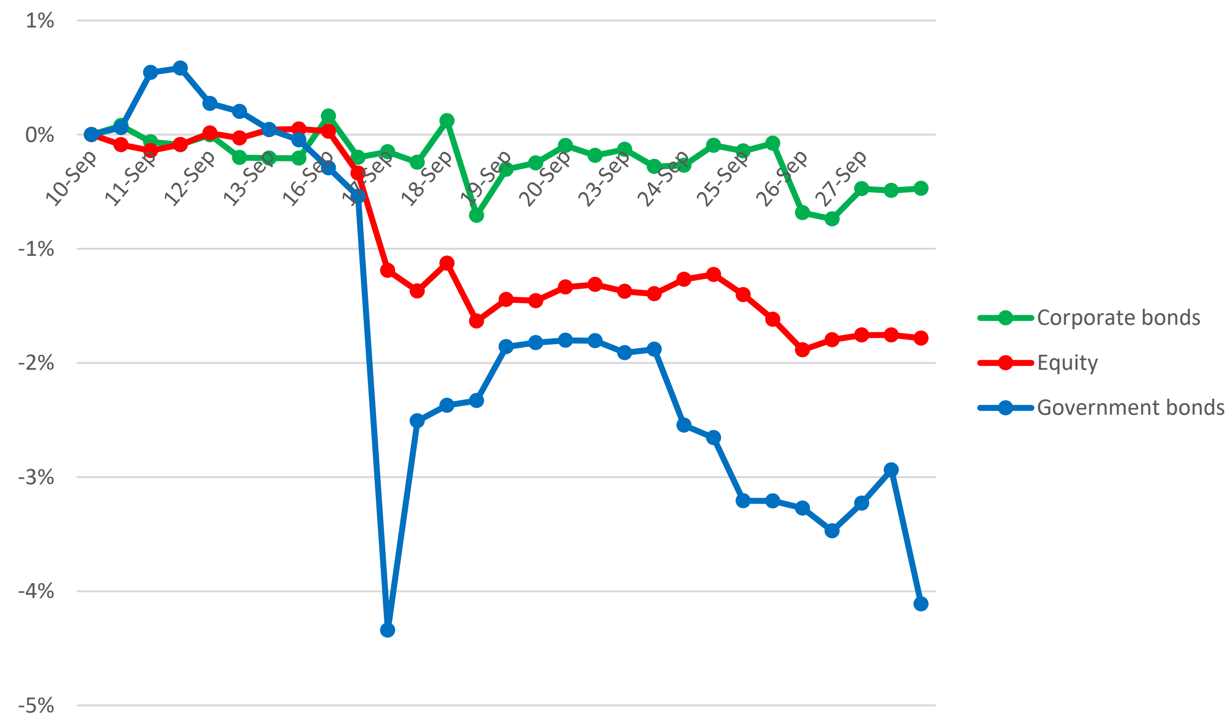


Table 1: Summary Statistics

This table displays summary statistics for individual securities lending transactions on September 2-13, 2019, i.e. in the two weeks leading up to the repo spike. *Cash collateral percentage* is the percentage of volume that is collateralized by cash. *D(New loan)* is a dummy variable equal to 1 if the loan has been opened on that day. *D(Large loan)* is equal to one if the loan value is above $100 million. *D(Reported by non-US lender)* is equal to 1 if the loan is reported by a lender not in the US or with missing location data. *D(Reported by borrower)* is equal to one if the loan is reported by the borrower. All dummy variables are presented as percentages. *Tenure* is the number of days the respective position has been open. *Transaction Size* is the amount of securities lent measured in million USD. Panel A displays an overview of summary statistics for cash collateral, Panels B to D display results for lending of government bonds, equity, and corporate bonds against cash collateral. Panels E to G display the same statistics for lending against noncash collateral.

Panel A: Overview of summary statistics (cash collateral only)

Sample	Daily volume against cash collateral ($billion)	Cash collateral percentage (%)	D(New loan) (%)	D(Large loan) (%)	D(Reported by non-US lender) (%)	D(Reported by borrower) (%)
Government bonds	169.9	46.3	8.30	0.20	16.8	2.98
Equities	293.9	58.6	5.71	0.012	11.0	41.30
Corporate bonds	129.5	76.6	5.12	0.015	12.5	37.2
Sum	593.3					

Panel B: Government bonds– cash collateral

Variable	Mean	10th Percentile	Median	90th Percentile	Standard Deviation
Tenure (days)	101.8	1	30	252.5	213.1
Lending Fee (%)	-0.035	-0.19	-0.10	0.060	0.57
Transaction Size (million USD)	8.07	0.081	1.18	28.3	16.8
Observations	420,867				

Panel C: Equity– cash collateral

Variable	Mean	10th Percentile	Median	90th Percentile	Standard Deviation
Tenure (days)	70.4	2	30	175.5	138.5
Lending Fee (%)	3.58	0	0.10	5.13	18.3
Transaction Size (million USD)	0.51	0.0018	0.044	0.90	3.09
Observations	11,560,819				

Panel D: Corporate bonds – cash collateral

Variable	Mean	10th Percentile	Median	90th Percentile	Standard Deviation
Tenure (days)	58.6	2.50	27.5	152	98.1
Lending Fee (%)	0.58	0.050	0.10	1.11	2.29
Transaction Size (million USD)	0.72	0.010	0.16	1.50	3.22
Observations	3,593,030				

Panel E: Government bond loans – noncash collateral

Variable	Mean	10th Percentile	Median	90th Percentile	Standard Deviation
Tenure (days)	101.8	6	50	233	143.6
Lending Fee (%)	0.14	0.060	0.10	0.23	0.18
Transaction Size (million USD)	9.21	0.019	1.39	35.2	17.3
Observations	427,488				

Panel F: Equity– noncash collateral

Variable	Mean	10th Percentile	Median	90th Percentile	Standard Deviation
Tenure (days)	94.6	6	49	230.5	137.1
Lending Fee (%)	0.49	0.10	0.15	0.25	3.57
Transaction Size (million USD)	0.85	0.0037	0.091	1.52	6.27
Observations	4,854,175				

Panel G: Corporate bonds – noncash collateral

Variable	Mean	10th Percentile	Median	90th Percentile	Standard Deviation
Tenure (days)	67.3	3.50	31	168.5	105.8
Lending Fee (%)	0.62	0.15	0.20	1.25	1.29
Transaction Size (million USD)	1.15	0.040	0.32	2.07	4.61
Observations	690,715				

Table 2: Spillover to securities lending markets by security type

This table displays panel regressions on the security-day level using data from September 2-19, 2019. The dependent variable is the lending fee in percent. The explanatory variables are time fixed effects per halfday. These variables measure the difference between the lending fee at that time compared to the average over September 2-13, 2019. Columns 1 to 3 show the result for the 3 samples: government bonds, equity, and corporate bonds. We include security fixed effects. All standard errors are two-way clustered by security and halfday. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Dependent variable:	Lending Fee (%)		
Sample:	Government bonds	Equity	Corporate bonds
	(1)	(2)	(3)
September 16 AM	-0.159***	0.092	0.019***
	(-28.20)	(1.42)	(4.59)
September 16 PM	-0.259***	0.119*	0.021***
	(-35.25)	(1.67)	(4.63)
September 17 AM	-1.256***	0.361***	0.032***
	(-32.06)	(4.68)	(7.38)
September 17 PM	-2.514***	0.381***	0.028***
	(-54.97)	(4.84)	(4.99)
September 18 AM	-1.103***	0.421***	0.040***
	(-27.67)	(5.32)	(7.24)
September 18 PM	-0.254***	0.382***	0.043***
	(-28.86)	(4.74)	(7.66)
September 19 AM	0.168***	0.368***	0.028***
	(20.32)	(4.25)	(5.08)
September 19 PM	0.246***	0.348***	0.023***
	(45.39)	(3.82)	(3.99)
Observations	20111	186349	390541
Adjusted R^2	0.894	0.965	0.968
Security fixed effects	Yes	Yes	Yes

Table 3: Ex-ante fees' effect on decline in fees following the repo spike

In this table we examine how the ex-ante level of lending fees affects the change in lending fees during the repo spike. In Panel A, we run a cross-sectional regression where the dependent variable is the difference between the lending fee on September 17, 2019 (PM) and the average over September 2-13, 2019. The explanatory variables of interest are dummy variables indicating whether the average lending fee of that specific government bond over Sep. 2-13, 2019 was 0-0.1%, 0.1-1%, above 1% or negative (omitted category). In Panel B, we conduct a similar analysis but match the lending fee of that specific lending transaction from September 13, 2019. We consider a transaction matched if it is in the data for each data point between September 13 (PM) and September 17 (PM) and has the same start date, number of securities, and location of the lender. In Panel C, we use the excess lending fee, which is defined as the lending fee of the specific transaction minus the (value-weighted) average lending fee for that specific security. Control variables are defined above. All standard errors are clustered on the security level. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Average lending fee on security level

Dependent variable:	Lending fee increase (relative to September 2-13, 2019)			
	(1)	(2)	(3)	(4)
D(Average lending fee 0-0.1%)	0.857***	0.808***	0.804***	
	(7.15)	(7.18)	(7.10)	
D(Average lending fee 0.1-1%)	1.212***	1.092***	1.078***	
	(4.57)	(3.61)	(3.70)	
D(Average lending fee above 1%)	2.847***	2.898***	2.770***	
	(27.21)	(28.04)	(13.92)	
D(New loan)		-0.691***	-0.557***	-0.625***
		(-6.78)	(-5.77)	(-5.81)
Log (Tenure)		-0.231***	-0.185***	-0.205***
		(-9.20)	(-6.62)	(-8.04)
D(Large loan)		0.654***	0.730***	0.636***
		(2.76)	(3.07)	(2.66)
D(Reported by non-US lender)			-0.066	-0.092
			(-0.87)	(-1.22)
D(Reported by borrower)			1.481***	1.521***
			(12.31)	(13.88)
Observations	19555	19555	19555	19555
Adjusted R^2	0.080	0.141	0.174	0.108
Security fixed effects	No	No	No	Yes

Panel B: Loan-specific lending fee

Dependent variable:	Loan-specific lending fee increase (relative to Sep 13, 2019)			
	(1)	(2)	(3)	(4)
D(Loan-specific lending fee 0-0.1%)	1.738***	1.663***	1.587***	1.547***
	(11.67)	(10.88)	(9.24)	(8.99)
D(Loan-specific lending fee 0.1-1%)	2.736***	2.710***	2.336***	2.081***
	(25.12)	(26.19)	(13.85)	(12.32)
D(Loan-specific lending above 1%)	2.591***	2.651***	1.772***	1.568***
	(12.96)	(9.55)	(7.66)	(6.27)
Log (Tenure)		-0.250***	-0.202***	-0.197***
		(-7.04)	(-8.29)	(-8.09)
D(Large loan)		-0.105	0.157	0.172
		(-0.37)	(0.49)	(0.54)
D(Reported by non-US lender)				-0.016
				(-0.30)
D(Reported by borrower)				0.736***
				(5.06)
Observations	13549	13549	13549	13549
Adjusted R^2	0.232	0.286	0.603	0.606
Security fixed effects	No	No	Yes	Yes

Panel C: Excess loan-specific lending fee

Dependent variable:	Loan-specific lending fee increase (relative to Sep 13, 2019)			
	(1)	(2)	(3)	(4)
D(Excess loan-specific lending fee 0-0.1%)	0.641***	0.559***	1.053***	1.066***
	(4.02)	(3.80)	(8.93)	(9.01)
D(Excess loan -specific lending fee 0.1-1%)	1.937***	1.840***	1.841***	1.703***
	(10.97)	(10.53)	(12.18)	(11.32)
D(Excess loan -specific lending fee 0.1-1%)	2.880***	2.969***	2.161***	1.879***
	(21.16)	(11.96)	(4.36)	(4.69)
Log (Tenure)		-0.239***	-0.126***	-0.117***
		(-6.09)	(-6.03)	(-5.68)
D(Large loan)		-0.375	0.049	0.057
		(-1.32)	(0.17)	(0.20)
D(Reported by non-US lender)				0.021
				(0.38)
D(Reported by borrower)				1.107***
				(7.60)
Observations	13549	13549	13549	13549
Adjusted R^2	0.130	0.179	0.634	0.641
Security fixed effects	No	No	Yes	Yes

Table 4: Security type effect after controlling for ex-ante lending fees

In this table we examine how security type affects the change in lending fees during the repo spike after controlling for ex-ante lending fees. In Panel A, we run a cross-sectional regression where the dependent variable is the difference between the lending fee on September 17, 2019 (PM) and the average over September 2-13, 2019. The explanatory variables of interest is *D(Government bond)*, which is a dummy variable equal to one if the security is a government bond. In Regression 1, we include all securities, in regressions 2 to 7 we only include a subset of securities depending on the security-level ex-ante fee over September 2-13, 2019. We include fixed effects for each group of ex-ante fees by 0.1% distance, i.e.-0.1-0%, 0-0.1%, 0.1-0.2%, etc. In Panel B, we conduct a similar analysis but we split the sample based on excess loan-specific ex-ante fee, which is defined as the lending fee of the specific transaction minus the (value-weighted) average lending fee for that specific security. Also, we add fixed effects for each group of excess loan-specific ex-ante fees by 0.1% distance. All standard errors are clustered on the security level. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Control for security-level ex-ante lending fee

Dependent variable:	Lending fee increase (relative to September 2-13, 2019)						
Sample:	All	Ex-ante fee <0%	Ex-ante fee 0-0.1%	Ex-ante fee 0.1-0.2%	Ex-ante fee 0.2-0.5%	Ex-ante fee 0.5-1.0%	Ex-ante fee >1%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
D(Government bond)	-2.270***	-2.484***	-1.817***	-1.429***	-1.732***	-0.613***	0.474
	(-32.16)	(-28.66)	(-20.34)	(-5.29)	(-4.14)	(-3.20)	(1.08)
D(New loan)	-0.189***	-0.101***	-0.018***	-0.028***	-0.064***	-0.085***	-1.026***
	(-8.60)	(-10.74)	(-34.87)	(-14.88)	(-10.52)	(-6.44)	(-7.56)
Log (Tenure)	0.297***	0.448**	0.138	0.042***	-0.048***	0.000	-1.368***
	(3.12)	(2.55)	(1.38)	(2.62)	(-2.60)	(.)	(-4.37)
D(Large loan)	0.199***	0.058	0.093***	0.127***	0.170***	0.219***	0.002
	(3.51)	(1.37)	(22.34)	(14.91)	(10.96)	(4.56)	(0.01)
D(Reported by non-US lender)	-0.157***	0.028	-0.025***	-0.016***	-0.034***	-0.037	-0.699***
	(-7.32)	(1.38)	(-16.71)	(-3.94)	(-3.25)	(-1.29)	(-5.28)
D(Reported by borrower)	0.807***	0.290***	0.084***	0.123***	0.298***	0.372***	4.485***
	(10.72)	(10.64)	(36.68)	(15.13)	(12.55)	(7.83)	(9.70)
Observations	753779	43852	387070	131462	51394	16732	123269
Adjusted R^2	0.176	0.689	0.188	0.151	0.206	0.055	0.178
Ex-ante fee fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Control for security-level and loan-specific ex-ante lending fee

Dependent variable:	Loan-specific lending fee increase (relative to Sep 13, 2019)						
Sample:	All	Excess loan-spec. ex-ante fee <0%	Excess loan-spec. ex-ante fee 0-0.1%	Excess loan-spec. ex-ante fee 0.1-0.2%	Excess loan-spec. ex-ante fee 0.2-0.5%	Excess loan-spec. ex-ante fee 0.5-1.0%	Excess loan-spec. ex-ante fee >1%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
D(Government bond)	-2.061***	-2.312***	-1.690***	-0.981***	-0.323***	-0.493	0.121
	(-22.29)	(-16.25)	(-21.27)	(-8.48)	(-4.05)	(-1.08)	(1.47)
Log (Tenure)	-0.010**	-0.015**	-0.005***	0.002	-0.003	-0.002	-0.017
	(-2.57)	(-2.08)	(-5.37)	(1.01)	(-1.09)	(-0.56)	(-0.51)
D(Large loan)	0.022	0.035	-0.053	0.000	1.685	0.000	0.000
	(0.22)	(0.23)	(-0.41)	(.)	(1.37)	(.)	(.)
D(Reported by non-US lender)	0.032	0.066	0.006	-0.002	0.012	-0.039	0.154
	(0.99)	(0.95)	(1.29)	(-0.45)	(1.14)	(-1.54)	(1.20)
D(Reported by borrower)	0.002	0.003	0.005***	0.007**	0.011	-0.071*	0.010
	(0.42)	(0.52)	(6.32)	(2.46)	(1.08)	(-1.75)	(0.14)
Observations	588060	275257	232219	27477	26532	7823	18752
Adjusted R^2	0.238	0.204	0.485	0.567	0.405	0.361	0.330
Excess loan-specific ex-ante fee fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ex-ante fee fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: Co-movement of lending fees and repo rates since 2009

This table examines whether the correlation between repo rates and lending fees depend on whether repo rates increase or decrease. We display time-series regressions of the change in the average lending fee on the change in the average repo rate over the period January 2009 to June 2020. In Panel A, we only include days where the repo rate increased. In regressions 2, 4, and 6, we restrict the sample to increases of at least 10 basis points. In Panel B, we only include days where the repo rate decreased. In regressions 2, 4, and 6, we restrict the sample to decreases of at least 10 basis points. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Increases in repo

Dependent variable:	Change in average lending fee					
Sample:	Government bonds		Equity		Corporate bonds	
	(1)	(2)	(3)	(4)	(5)	(6)
Change in average repo rate	-0.41***	-0.39**	0.01	0.03	0.00	0.00
	(-3.30)	(-2.57)	(0.53)	(1.61)	(0.59)	(0.20)
Observations	1069	60	1069	60	1069	60
Adjusted R^2	0.61	0.68	-0.00	-0.01	-0.00	-0.02
Include all increases in repo	Yes	No	Yes	No	Yes	No
Include only repo increases above 10 bp	No	Yes	No	Yes	No	Yes

Panel B: Decreases in repo

Dependent variable:	Change in average lending fee					
Sample:	Government bonds		Equity		Corporate bonds	
	(1)	(2)	(3)	(4)	(5)	(6)
Change in average repo rate	-0.54***	-0.59***	0.01	-0.01	0.01	-0.01
	(-11.68)	(-23.68)	(0.63)	(-1.61)	(0.74)	(-1.25)
Observations	1405	41	1405	41	1405	41
Adjusted R^2	0.54	0.67	-0.00	-0.02	0.00	-0.02
Include all increases in repo	Yes	No	Yes	No	Yes	No
Include only repo increases above 10 bp	No	Yes	No	Yes	No	Yes

Table 6: Ex-ante fees' effect on co-movement of lending fees and repo rates

In this table we examine how the ex-ante level of lending fees affects co-movement of lending fees and repo rates. Our sample includes all days from January 2009 to June 2020 where the repo rate increased or decreased by at least 10 basis points. In Panel A, the dependent variable is the difference between the lending fee on the day and average lending fee for that security on the prior trading day. The explanatory variables of interest are dummy variables indicating whether the average lending fee of that specific government bond on the prior day was 0-0.1%, 0.1-1%, above 1% or negative (omitted category) each interacted with the change in the repo rate. In Panel B, we conduct a similar analysis but match the lending fee of that specific lending transaction. We consider a transaction matched if it has the same start date, number of securities, and location of the lender. In Panel C, we use the excess lending fee, which is defined as the lending fee of the specific transaction minus the (value-weighted) average lending fee for that specific security. Control variables are defined above. All standard errors are clustered on the security level. We report t-statistics below the coefficients in parenthesis. ***, **, * indicate significance at the 1%, 5% and 10% level.

Panel A: Average lending fee on security level

Dependent variable:	Lending fee increase (relative average lending fee at t-1)			
	(1)	(2)	(3)	(4)
D(Average lending fee 0-0.1%) * Change in repo rate	0.244***	0.245***	0.200***	0.201***
	(3.97)	(3.97)	(2.98)	(2.99)
D(Average lending fee 0.1-1%) * Change in repo rate	0.402***	0.404***	0.423***	0.423***
	(4.82)	(4.88)	(4.82)	(4.83)
D(Average lending fee above 1%) * Change in repo rate	0.861	0.856	0.937**	0.938**
	(1.54)	(1.53)	(2.00)	(2.00)
D(Average lending fee 0-0.1%)	-0.011	-0.018	-0.019	-0.019
	(-1.05)	(-1.64)	(-1.45)	(-1.45)
D(Average lending fee 0.1-1%)	-0.025	-0.039*	-0.060**	-0.060**
	(-1.06)	(-1.70)	(-2.37)	(-2.36)
D(Average lending fee above 1%)	-0.064	-0.086	-0.341	-0.341
	(-0.20)	(-0.26)	(-0.97)	(-0.97)
D(New loan)		-0.010	-0.012**	-0.016**
		(-1.27)	(-2.02)	(-2.47)
Log (Tenure)		-0.011***	-0.011***	-0.011***
		(-4.88)	(-6.04)	(-6.20)
D(Large loan)		-0.024	-0.023	-0.021
		(-1.62)	(-1.34)	(-1.19)
D(Reported by non-US lender)				0.005**
				(2.60)
D(Reported by borrower)				0.214***
				(4.91)
Observations	3455132	3455132	3455132	3455132
Adjusted R^2	0.559	0.561	0.594	0.597
Date fixed effects	Yes	Yes	Yes	Yes
Security fixed effects	No	No	Yes	Yes

Panel B: Loan-specific lending fee

Dependent variable:	Loan-specific lending fee increase (relative to t-1)			
	(1)	(2)	(3)	(4)
D(Loan-specific lending fee 0-0.1%) * Change in repo rate	0.404***	0.404***	0.391***	0.391***
	(3.98)	(3.98)	(3.68)	(3.68)
D(Loan-specific lending fee 0.1-1%) * Change in repo rate	0.524***	0.524***	0.534***	0.534***
	(5.27)	(5.27)	(5.21)	(5.21)
D(Loan-specific lending fee above 1%) * Change in repo rate	0.818*	0.816*	0.888**	0.888**
	(1.85)	(1.85)	(2.23)	(2.23)
D(Loan-specific lending fee 0-0.1%)	-0.005	-0.007	-0.006	-0.007
	(-0.35)	(-0.55)	(-0.41)	(-0.46)
D(Loan-specific lending fee 0.1-1%)	-0.010	-0.015	-0.026	-0.028
	(-0.47)	(-0.73)	(-1.20)	(-1.25)
D(Loan-specific lending fee above 1%)	-0.344	-0.352	-0.516*	-0.518*
	(-1.24)	(-1.28)	(-1.77)	(-1.78)
Log (Tenure)		-0.004*	-0.003*	-0.003*
		(-1.87)	(-1.93)	(-1.94)
D(Large loan)		0.016	0.020**	0.018**
		(1.48)	(2.36)	(2.08)
D(Reported by non-US lender)				0.000
				(0.36)
D(Reported by borrower)				0.047
				(1.01)
Observations	3018933	3018933	3018933	3018933
Adjusted R^2	0.627	0.627	0.649	0.649
Date fixed effects	Yes	Yes	Yes	Yes
Security fixed effects	No	No	Yes	Yes

Panel C: Excess loan-specific lending fee

Dependent variable:	Excess loan-specific lending fee increase (relative to t-1)			
	(1)	(2)	(3)	(4)
D(Excess loan-specific lending fee 0-0.1%) * Change in repo rate	0.122***	0.122***	0.123***	0.123***
	(9.55)	(9.55)	(9.39)	(9.33)
D(Excess loan-specific lending fee 0.1-1%) * Change in repo rate	0.367***	0.367***	0.370***	0.369***
	(8.17)	(8.17)	(8.27)	(8.24)
D(Excess loan-specific lending fee above 1%) * Change in repo rate	0.535***	0.534***	0.524***	0.523***
	(11.01)	(10.95)	(10.84)	(10.86)
D(Excess loan-specific lending fee 0-0.1%)	-0.015***	-0.016***	-0.018***	-0.018***
	(-3.83)	(-4.06)	(-4.31)	(-4.33)
D(Excess loan-specific lending fee 0.1-1%)	-0.053***	-0.054***	-0.059***	-0.063***
	(-4.21)	(-4.32)	(-4.61)	(-4.94)
D(Excess loan-specific lending fee above 1%)	-0.886***	-0.889***	-0.938***	-0.946***
	(-5.71)	(-5.71)	(-6.02)	(-6.07)
Log (Tenure)		-0.003***	-0.002***	-0.002***
		(-4.39)	(-3.88)	(-4.01)
D(Large loan)		0.009	0.011	0.009
		(1.15)	(1.24)	(1.03)
D(Reported by non-US lender)				0.001
				(0.66)
D(Reported by borrower)				0.079**
				(2.30)
Observations	3018933	3018933	3018933	3018933
Adjusted R^2	0.257	0.257	0.263	0.264
Date fixed effects	Yes	Yes	Yes	Yes
Security fixed effects	No	No	Yes	Yes

Appendix 1: Implied market rate

In this figure, we present the implied market rate as used by Markit. We compute it as follows:
$Implied\ market\ rate = rebate\ rate + lending\ fee.$

Implied market rate