Passive Ownership and Corporate Bond Lending

Amit Goyal **Yoshio Nozawa** **Yancheng Qiu***

August 2025

Abstract

Passive funds' increased ownership of corporate bonds reduces the demand to borrow these bonds, thereby easing short-selling constraints in the corporate bond market. This finding contrasts with evidence in the equity market, where passive ownership increases borrowing demand. The difference arises because, in the bond market, short sellers are mainly dealers rather than speculative customers. Since passive ownership compresses credit spreads, the higher bond valuation reduces the buying pressure of active investors and consequently diminishes the need for dealers to borrow bonds for market-making activities. Our results caution against extending the findings and implications in the equity short-selling literature to corporate bonds.

JEL classification: G12, G14, G23

Keywords: Short sales, corporate bonds, securities lending

*Amit Goyal is from Swiss Finance Institute at the University of Lausanne, email: Amit.Goyal@unil.ch, Yoshio Nozawa is from University of Toronto, email: yoshio.nozawa@rotman.utoronto.ca, and Yancheng Qiu is from University of Sydney, email: yancheng.qiu@sydney.edu.au. For helpful comments and suggestions, we thank Vikas Agarwal, Caitlin Dannhauser, Antoine Hubert de Fraisse (discussant), Yiming Ma (discussant), Qifei Zhu, and seminar participants at the University of New South Wales, the University of Sydney, and the University of Technology Sydney, as well as the May 2025 Stern/Solomon Microstructure Meeting and the 2025 European Finance Association (EFA) Annual Meeting.

1 Introduction

Securities lending serves two purposes: market making and speculation (Asquith, Au, Covert, and Pathak 2013). An extensive literature documents that short sellers in stock market are informed (see, e.g. Boehmer, Jones, and Zhang 2008; Diether, Lee, and Werner 2009; Saffi and Sigurdsson 2011). We argue that, unlike in the stock market, market making is the main driver of corporate bond lending. As a result, the relationship between lending activities and market outcomes is the opposite of what is documented in the stock market, for example by Sikorskaya (2023), Palia and Sokolinski (2024), and von Beschwitz, Honkanen, and Schmidt (2025). In the bond market, short sales are associated with a bond's undervaluation rather than overvaluation, and increased bond lending activities correspond to buying pressure from customers, not selling pressure. In this paper, we comprehensively study the drivers of bond shorting activities using increased passive ownership as a case study and as a shock to bond lending.

An increase in passive ownership is on its own an important topic in the financial market, due to the rising popularity of exchange-traded funds (ETFs) for stocks and bonds (see, e.g., Dannhauser 2017; Koont, Ma, Pástor, and Zeng 2024). In our sample, passive ownership of corporate bonds increases from 0.44% in 2006 to 5.21% in 2022. We start our analysis by studying whether the rising ownership of corporate bonds by passive funds enhances or reduces the ease of bond lending.

To measure the impact of passive ownership on lending outcomes, we estimate panel regressions of lending outcome variables, such as lendable supply, quantity of bonds on loan, and borrowing fees, on the share of bonds held by passive investors. To isolate exogenous shocks to passive ownership, our empirical specification employs high-dimensional fixed effects to soak up any variation in firm-level characteristics driving both the outcome and passive ownership. By including issuer-by-quarter fixed effects, we compare bonds issued by the same firm at a given point in time, accounting for time-varying firm-level fundamental information. In addition, we add bond fixed effects to control for time-invariant characteristics of bonds, such as the bond's covenants and seniority, as well as other time-varying bond-level controls, such as time to maturity.

Our main estimates indicate that increased passive ownership leads to a higher lending supply. This result is not surprising, as passive funds typically serve as natural security lenders in various asset markets. What differentiates our study from the others is the response of the borrowing demand, which simultaneously declines. Specifically, our estimates indicate that a one-standard-deviation increase in passive ownership insignificantly reduces the equilibrium quantity of bonds on loan by 0.031 percentage points (pps), or 2.3% of its inter-quartile range. The effect on lending quantities is modest because the supply expansion and demand contraction cancel each other out. However, the equilibrium lending fee declines substantially because both of these two effects push down the equilibrium price. In our main results, the fee declines by 0.067 pps, which is equivalent to as much as 51.8% of its inter-quartile range.

The observed decline in borrowing demand is opposite to the pattern documented in the equity market (see, e.g., Sikorskaya 2023; Palia and Sokolinski 2024). The divergence arises primarily because in the stock market, the elevated valuation of stocks held by passive funds motivates speculative short sellers to borrow them, resulting in increased borrowing demand. In contrast, in the bond market, the valuation increase discourages investors from sending urgent buy orders to dealers, reducing the dealers' need to borrow bonds to fulfill such orders. In this paper, we provide empirical evidence supporting this mechanism that explains the decline in borrowing demand within corporate bond markets.

In our first step in exploring the mechanism, we examine how bond valuation responds to changes in passive ownership. Our analysis indicates that a one-standard-deviation increase in passive ownership reduces credit spreads by 13.5 basis points (bps). Since credit spreads move in the opposite direction to bond prices, the results indicate that the bond becomes more expensive when it is held by passive owners. This finding is consistent with the literature on passive ownership (see, e.g., Dannhauser 2017; Bretscher, Schmid, and Ye 2024b): since passive funds are required to hold securities in certain indices, their inelastic demand increases the price of the securities they hold.

In our second step, we show evidence that passive ownership reduces the order imbalance facing dealers, measured as the difference between the customer buy and sell volumes scaled by the bond's amount outstanding. Using order imbalance as a left-hand-side variable of the panel regression, we find that a one-standard-deviation increase in passive ownership leads to a reduction in order imbalance of 0.061 pp, equivalent to approximately 4% of its inter-quarter range. After adjusting for the mechanical increase in customer buy orders attributable directly to index fund purchases, the reduction in order imbalance becomes even more pronounced. Taken together, an increased passive ownership of corporate bonds reduces the borrowing demand of dealers by elevating bond prices, and consequently alleviates the buying pressure facing dealers.

The key premise underlying the above argument is that dealers, rather than customers, represent the primary short sellers in the corporate bond market.[1] This is contrary to the practice in the stock market, where informed investors who identify overvalued stocks and sell them short for speculation play an important role.[2] In the corporate bond market, however, such speculative short sale is prohibitively expensive for customers who pay bid-ask spreads each time they trade. To be concrete, consider the following situation in which a customer short-sells an average corporate bond: the average half spreads of our bond sample are 29 bps per transaction, the average loan tenure is roughly three months, and the average borrowing fee is 44 bps per year. Thus, if the customer borrows the bond, sells it short,

[1]The International Capital Market Association (ICMA) confirms that "short-selling allows a market-maker to continuously quote prices for securities that he does not hold in inventory" by enabling security borrowing when needed for delivery. ICMA emphasizes that short-selling serves essential market-making functions, allowing market-makers to "hedge the interest rate risk on inventory and temporary long positions accumulated through buying" while providing continuous liquidity through strategic repo market usage for inventory management and delivery obligations (ICMA 2019).

[2]Comerton-Forde, Jones, and Putniņš (2016) find that in the stock market, the magnitude of the liquidity-taking and liquidity-supplying short sales is comparable to each other, while Goyal, Reed, Smajlbegovic, and Soebhag (2025) argue that liquidity-supplying shorts are also informed.

and buys it back after three months, the round-trip cost amounts to 58 bps, which is more than half of the average returns of the three-month corporate bond of 1.05%. High bid-ask spreads completely dominate the borrowing fee, which is only 11 bps per three months. This high transaction cost, coupled with the cheaper alternative of trading credit default swaps, is the key deterrent for speculative short sales.

To support this claim, we run a panel regression of daily customer buy and sell volumes on the daily changes in the quantity of bonds lent. If speculative customer short selling is the driver of lending activities, then customer sell volume would increase by one percent of the bond's outstanding amount on the day when its lending quantity increases by one percent. However, we find the opposite result. When the amount of bonds lent increases, the customer sell volume decreases by 0.19 pps, and the customer buy volume increases by 0.11 pps. Since customer buy volume is identical to dealer sell volume, this finding implies that an increase in lending primarily corresponds to dealers selling these bonds. These results are robust to the inclusion of various controls and fixed effects related to speculation, such as bonds' past returns and bid-ask spreads.

In further sharp contrast to the stock market, we show that bond lending activities reflect *positive* news for the bond value. Controlling for a comprehensive set of control variables, a one-standard-deviation increase in changes in loan quantity predicts a 0.83 bps *increase* in bond returns in the following week. This suggests that active buyers who force dealers to borrow bonds to meet their demand indeed possess valuable information. Dealers are aware of this adverse selection risk; an increase in quantity on loan is significantly and positively correlated with a half spread for customer buy trades, but not with that for customer sells. Taken together, our evidence strongly suggests that in the bond market, the borrowing demand refers to the demand by dealers reacting to customers' buy orders that take advantage of the undervaluation, not overvaluation, of bonds.

Returning to the case study of passive ownership, the negative response of borrowing demand is unique to passive ownership of corporate bonds and distinct from that of insurance firms and active funds. Similar to passive funds, these other institutional investors also expand the lendable supply of bonds. However, unlike passive funds, the responses in demand to borrow bonds are modest and overshadowed by the larger increase in supply. Consequently, an increase in the ownership by insurance firms and active funds leads to a higher equilibrium quantity of bonds lent and a relatively modest reduction in borrowing fees.

This difference across investor types arises because changes in credit spreads driven by ownership increases differ substantially across institutional investor types. Insurance firms, characterized as buy-and-hold investors, typically maintain inactive portfolio management strategies. However, they differ from passive funds as they are not constrained by predetermined bond indices. Previous literature (e.g., Becker and Ivashina 2015) suggests that insurance firms use their discretion and reach for yield. Consistent with this view, our findings indicate that higher ownership by insurance firms significantly elevates credit spreads, whereas ownership increases by active funds exhibit no measurable effect. The difference in the reaction of credit spreads explains why borrowing demand reacts distinctly to ownership by passive funds from that by insurance firms and active funds.

Our paper is related to a strand of literature that examines the effect of changing ownership of stocks on stock lending activities. Prado, Saffi, and Sturgess (2016) investigate the effect of institutional ownership on short selling. Coles, Heath, and Ringgenberg (2022) document that increased index investing causes stocks in the index to have a higher short interest. Sikorskaya (2023), Palia and Sokolinski (2024), and von Beschwitz, Honkanen, and Schmidt (2025) focus on passive ownership on lending outcomes and argue that it is crucial to account for the reactions in both lending supply and demand. Notably, these papers find that higher passive ownership is associated with an increase in short interest and lendable supply in the equity market, but provide mixed evidence on the lending fees.

In contrast to the vast literature on equity lending and short sales,[3] there are only a handful of papers on corporate bond lending. Asquith, Au, Covert, and Pathak (2013) provide an initial look at bond lending activities using proprietary data and report that the cost of borrowing corporate bonds is not much higher than that of borrowing stocks. Anderson, Henderson, and Pearson (2018) and Hendershott, Kozhan, and Raman (2020) find that an increase in bond borrowing is associated with lower subsequent returns in the high-yield bond market, but not among investment grade bonds. Pelizzon, Riedel, Simon, and Subrahmanyam (2024) examine how the collateral eligibility of European corporate bonds for the central bank facility influences bond lending activities. Our paper differs from these papers because we study the impact of the changing ownership landscape in the corporate bond market on bond lending activities.

Our paper also contributes to the literature on the behavior of institutional investors in the corporate bond market (see, e.g., Becker and Ivashina 2015; Choi and Kronlund 2017; Dannhauser and Dathan 2023; Dannhauser and Karmaziene 2023; Bretscher, Schmid, Sen, and Sharma 2024a; Bretscher, Schmid, and Ye 2024b). Recent literature studies corporate bond ETFs and their implications on valuation effect and market liquidity. Dannhauser (2017) documents that an increase in ETF ownership reduces bond yields using a research design based on the changes to Markit iBoxx index inclusion rules. Pan and Zeng (2019) and Koont, Ma, Pástor, and Zeng (2024) examine the influence of ETF ownership on the liquidity of underlying bonds. Dannhauser and Hoseinzade (2022) and Ma, Xiao, and Zeng (2022) show bond ETF creates flow-induced pressure and exposes the bond market to a source of destabilizing demand in times of distress. Our focus, on the other hand, is on the bond lending activity, which has not been studied, and on passive ownership in general, not just bond ETFs.

The remainder of the paper is structured as follows: Section 2 describes our data set;

[3] For an incomplete list see, D'Avolio (2002); Cohen, Diether, and Malloy (2007); Boehmer, Jones, and Zhang (2008); Saffi and Sigurdsson (2011); Blocher, Reed, and Van Wesep (2013); Boehmer and Wu (2013); Boehmer, Jones, and Zhang (2013); Kolasinski, Reed, and Ringgenberg (2013); Engelberg, Reed, and Ringgenberg (2018); Chen, Joslin, and Ni (2018); Muravyev, Pearson, and Pollet (2022, 2023).

Section 3 presents our main empirical findings on the relationship between passive ownership and bond lending activities; Section 4 explores the mechanisms underlying the unique dynamics of corporate bond borrowing demand; Section 5 offers additional supporting evidence through a decomposition of passive fund ownership. We conclude in Section 6.

2 Data and Sample Construction

We compile our sample from multiple data sources: (1) IHS Markit for security lending data, (2) Morningstar and the Thomson Reuters eMAXX database for holdings of bond investors, (3) the Mergent Fixed Income Securities Database (FISD) database for bond characteristics, (4) the Enhanced Trade Reporting and Compliance Engine (TRACE) database for bond transaction volume and direction, and (5) the ICE Bank of America Merrill Lynch (BAML) database for daily bond returns. This section outlines the construction of our dataset and variables, as well as presents summary statistics.

2.1 Bond Lending Data

We source our bond lending data from the Markit Securities Finance Buy-Side Analytics Data (now S&P Global Market Intelligence) via WRDS. This database covers daily data on securities borrowing and lending activity, including the quantity on loan, the active lendable quantity, utilization rate, rebates and borrow (loan) fees, average loan tenure, and other lending outcome variables. We select our sample based on two filters. First, we require that the variables "*QuantityOnLoan*" and "*IndicativeFee*" be non-missing. Next, we require the observation to be non-missing in the corporate bond database, created using Mergent FISD and TRACE.[4] The first requirement implies that all bonds in our sample have non-zero quantity on loan. Thus, our study focuses on the intensive margin. The requirement is

[4] We filter corporate bond data following standard approaches in the literature and provide details on the cleaning procedure in the Internet Appendix A.

necessary because our goal is to study the supply and demand that simultaneously drive the quantity on loan and the borrowing fee, and we do not know the fee for bonds with zero quantity on loan.

We scale the quantity on loan and lendable supply by the bond's amount outstanding, obtained from FISD. Following recent research in the equity lending market (e.g., Muravyev, Pearson, and Pollet 2022, 2023), we use the variable "*IndicativeFee*" to proxy for the direct short-selling costs, which is a buy-side borrowing fee.[5] Since our main analysis is conducted at a quarterly frequency, we take the average of the daily lending variables within each bond-quarter observation.

The Markit sample after the data filters above contains 300,282 bond quarters for 17,363 bonds issued by 1,709 firms over 66 quarters from 2006 Q3 to 2022 Q4. Our sample begins in September 2006 because the bond lending data have been available at a daily frequency since then on WRDS.[6]

2.2 Bond Investor Holdings Data

To construct our holdings dataset, we begin with dollar-denominated bonds issued by U.S. firms from the Mergent FISD database. We restrict the sample to corporate bonds that have at least one recorded transaction in the Enhanced TRACE database to ensure data availability and market activity. Mutual fund and exchange-traded fund (ETF) holdings are sourced from Morningstar, which provides comprehensive coverage of fund holdings across asset classes, including bonds, preferred stocks, equities, futures, options, and cash. We identify ETFs using Morningstar's ETF flag and classify index funds following the methodology

[5]Markit estimates the expected cost of borrowing for a hedge fund on a given day taking into account the borrowing costs of prime brokers and hedge funds.

[6]We have reached out to WRDS and S&P about the missing Markit Securities Finance Analytics bonds and equities data from January 2002 to August 2006. This older data uses a different collection methodology compared to data from September 2006 and onward, and is no longer offered by S&P. WRDS acknowledged this issue after our inquiries: https://wrds-www.wharton.upenn.edu/pages/support/support-articles/markit/msf-analytics-2002-2005-is-legacy-version-1/. We also observed sparse and incomplete data for the variable "*IndicativeFee*" in July 2007; however, WRDS and S&P indicated they cannot remedy this issue.

of Berk and Van Binsbergen (2015) and Dannhauser and Dathan (2023).[7]

In our analysis, we define passive funds as either index mutual funds or ETFs, excluding leveraged or inverse index funds and ETFs.[8] The reporting frequency of fund holdings varies across funds, particularly in the earlier part of the sample period. To address inconsistencies in reporting intervals, we impute missing monthly fund holdings using the nearest available observations.[9] In cases where holdings data are unavailable for all months within a quarter, we conservatively assign a holding value of zero, reflecting the most plausible scenario. To ensure that we capture a comprehensive representation of institutional bond ownership, we include holdings from all passive and active funds, including funds that are not exclusively dedicated to corporate bonds.

We obtain insurance company holdings data from the Thomson Reuters eMAXX database, which provides fixed-income holdings at a quarterly frequency.[10] To ensure data accuracy, we systematically identify and remove duplicate observations, which may arise for two reasons.

First, eMAXX reports holdings based on the timing of information disclosure. For example, a fund's holdings as of 2002 Q4 may be reported in 2003 Q1, 2003 Q2, or both. As

[7]Specifically, we first identify index funds using Morningstar's index fund flag. Then, we further classify funds as index funds if the Morningstar fund name contains any of the following strings: "DOW," "Dow," or "DJ," or if the lowercase version of the fund name includes keywords such as "index," "idx," "indx," "ind " (where " " indicates a space), "standard," "poor," "jones," "aggregate," "composite," "s&p," "s and p," "msci," "ishare," "bloomberg," "profund," "proshare," "viper," "spider," "spdr," "kbw," "nasdaq," "nyse," "stoxx," "ftse," "wilshire," "100," "400," "500," "600," "900," "1000," "1500," "2000," "3000," "5000." Finally, we exclude enhanced index funds and remove funds incorrectly flagged as index funds (e.g., target-date funds with active strategies) if the lowercase fund name contains terms such as "select," "adv," "hedge," "manage," "enhance," "plus," "1970," "1975," "1980," "1985," "1990," "1995," "2000," "2005," "2010," "2015," "2020," "2025," "2030," "2035," "2040," "2045," "2050," "2055," "2060," "2065," "2070," "2075."

[8]Inverse and leveraged funds are identified if the lowercase version of fund names contains any of the following strings: plus, enhanced, inverse, ultra, 1.5x, 2.5x, 2x, 3x, 4x, or 5x.

[9]Suppose we have a bond where Fund A's holding is 3,024 (in thousands) in March 2017, missing in April and May, and then 3,040 in June. Under our current imputation method, we fill the missing value in April using the nearest previous available observation (3,024) and the missing value in May using the subsequent available observation (3,040). Similarly, if July's observation is also missing, it will be imputed using June's available value of 3,040. This imputation procedure is primarily implemented to ensure completeness in our monthly regression analysis. Importantly, this does not generally impact the integrity of the quarterly observations, except in specific cases: for instance, when a fund reports holdings only in April, July, and October, we must derive the calendar quarter-end holdings for June and September accordingly.

[10]The eMAXX version used in our analysis covers fixed-income holdings data for North America.

a result, identical bond holdings data can appear in multiple reporting quarters. To address this issue, we retain only the earliest available report for each bond-quarter-fund-managing firm pair. In the example above, we keep the holdings reported in 2003 Q1 and discard the duplicate entry from 2003 Q2.

Second, duplicate entries can arise from co-managed funds, where multiple managing firms oversee a single fund's portfolio. In such cases, eMAXX records separate entries for each managing firm, in addition to an aggregated entry for the fund's total holdings.[11] To prevent double counting, we eliminate redundant observations associated with co-managed funds.

We integrate holdings data from Morningstar and eMAXX to construct our bond ownership variables. Specifically, we aggregate bond-level holdings across different investor types every month, and use the quarter-end value for the analysis. To address gaps in reporting, we impute missing insurance firm holdings using the nearest available observations. We exclude cases where total reported investor holdings exceed the bond's amount outstanding to ensure data integrity. Finally, we normalize holdings by dividing them by the bond's amount outstanding for active funds, passive funds, and insurance firms. Before merging with IHS Markit bond lending data, our final sample comprises 2,423,423 bond-month observations covering 55,517 bonds from July 2006 to December 2022.

2.3 Summary Statistics

We merge quarterly bond lending data with monthly holdings data to construct our baseline dataset. The final sample comprises 297,693 bond-quarter observations for 17,140 bonds issued by 1,705 firms from 2006 Q3 to 2022 Q4. To mitigate the influence of outliers while avoiding look-ahead bias, we winsorize continuous variables at the 1st and 99th percentiles within each quarter.

Table 1 presents summary statistics for key variables in our quarterly panel, including

[11] These observations are identified when the entry for FIRMID is "CO-MANAGED."

bond lending outcomes, investor ownership, and other bond characteristics. On average, bonds in our sample have a loan quantity of 1.45%, a lendable supply ratio of 23.74%, a utilization rate of 6.71%, a loan tenure of 74 days, and a borrowing fee of 44 bps per year. The average credit spread is 213 bps.

The key variables of interest, loan quantity and borrowing fee, are heavily right-skewed with their medians (0.51% and 0.37%, respectively) significantly below their corresponding means. This right-skewness implies that the inter-quartile range may better capture typical variation observed in the data than standard deviation. Thus, we assess the economic significance of the impact of passive ownership relative to the inter-quartile range of the outcome variables.

Regarding bond ownership structure, the average passive ownership is 3.43%, with ETFs and index funds accounting for 1.27% and 2.15%, respectively. Active fund ownership averages 9.65%, while insurance firms hold 31.29% of outstanding bonds. The typical bond in our sample has a credit rating of BBB (numerically represented as 8.45), an average age of 4.92 years, a time to maturity of 9.98 years, an amount outstanding of $679 million, and exhibits zero trading activity on 35% of trading days.

Figure 1 presents the time series of ownership shares, averaged across bonds within each period. In our merged sample, insurance companies hold the largest ownership share among investor types. However, their share has steadily declined over time, decreasing from 42.18% in 2006 to 26.97% in 2022. In contrast, passive mutual fund ownership, though initially negligible, has grown significantly over the sample period. Starting at just 0.44% in 2006, passive ownership increased to 5.21% by 2022, reflecting the broader shift toward passive investment strategies in fixed-income markets.

In Figure 2, we plot the average of the lending outcome variables using all corporate bonds in our sample as well as the subsample of investment-grade and high-yield bonds. Panel A plots the average lendable supply. The supply is more than 30% of the amount outstanding in 2007 and 2008. Thereafter, it declines steadily and remains around 20% of the bond market. The level is similar to the one observed in the stock market.

Figure 2 Panels B and C report the quantity on loan and the short loan quantity, which is the ratio of the bond lending used to short the bonds to the bond's amount outstanding.[12] Consistent with Hendershott, Kozhan, and Raman (2020), we observe a decline in quantity on loan and short loan quantity in 2009. Before the financial crisis, the amount lent represents about 4% of the amount outstanding. After the crisis, it drops to about 1% and remains stable thereafter. Comparing investment-grade bonds with high-yield bonds, high-yield bonds have a higher quantity on loan than investment-grade bonds.

Comparing Panels B and C, the short loan quantity is slightly smaller than the quantity on loan before 2008, especially among investment grade bonds. This is because these bonds are often used as collateral in financing trades. However, after 2009, the two variables are almost identical. Therefore, these data suggest that the role of financing transactions is limited, and that a large portion of the borrowed bonds are sold short.

Panel D reports the average borrowing fee. For all bonds, the fee ranges from 0.31% to 0.58% with no discernible pattern. Consistent with Asquith, Au, Covert, and Pathak (2013), the level of the borrowing fee is similar to or even slightly lower than the equity borrowing fee.[13] High-yield bonds have higher borrowing fees than investment-grade bonds, ranging from 0.42% to 0.81%. The median fee is lower than the average: Panel E shows that it ranges from 0.24% to 0.43% for all bonds. Strikingly, the borrowing fee for the median stock is very similar to that for the median bond.

In the Internet Appendix B and C, we provide further details on the construction of daily and monthly data used in the paper. Table A1 shows the descriptive statistics of daily and monthly panel data.

[12] The variable "*Short Loan Quantity*" in Markit represents the number of securities on loan with dividend trading and financing trades removed. Markit uses a proprietary algorithm to strip out these trades.

[13] The level of the fee in our sample is higher than some of the previous research that uses the sell-side database. Our database measures the borrowing fee from the perspective of ultimate borrowers. The sell-side data takes the perspective of ultimate lenders and, thus, their fee level is lower because intermediating dealers charge a higher fee to lend than to borrow.

3 Passive Ownership and Bond Lending Activities

3.1 Empirical Method

In this section, we explore the relationship between passive bond ownership and various bond lending activities, such as lending supply, loan quantities, and borrowing fees. Specifically, we estimate a panel regression of the lending activity variable Y of bond i issued by firm k in quarter q on contemporaneous passive ownership shares,

$$Y_{i,k,q} = \beta PassiveFund_{i,k,q} + \gamma X_{i,k,q} + \alpha_{k,q} + \theta_i + \varepsilon_{i,k,q}, \tag{1}$$

where $X_{i,k,q}$ is a vector of control variables, including the log value of the amount outstanding, the credit rating expressed numerically from 1 to 21, the time to maturity, and the percentage of zero-trading days. Standard errors are double-clustered at the firm and quarter levels.

Our primary variable of interest, $PassiveFund$, is defined as the sum of the amount held by all passive funds divided by the bond's amount outstanding and expressed as a percentage. The slope coefficient β allows us to infer the influence of a one-percentage-point increase in passive ownership on lending activities. For comparison, we also construct analogous ownership measures for insurance firms ($Insurer$) and active mutual funds ($ActiveFund$), enabling us to differentiate the effects of passive versus other institutional ownership.

We aim to identify an exogenous variation in bond ownership that is orthogonal to issuer-specific characteristics that could simultaneously affect lending activities. Such a concern arises when, for example, firms with higher default risks might attract increased speculative demand to borrow and short, coinciding with higher passive ownership due to funds' investment focus in high-yield bonds. To eliminate the confounding factors driving both the ownership and outcome variables, following Choi, Hoseinzade, Shin, and Tehranian (2020), we include firm-quarter fixed effects in the panel regression. This procedure identifies the coefficients based on the variation across bonds in the same quarter, issued by the same firm.

It is still possible that variation in maturity may create a mechanical correlation between the dependent variable and $PassiveFund$. Shorter-maturity bonds, for example, might attract passive ownership by short-maturity bond funds while simultaneously exhibiting lower borrowing fees. In addition, bond-specific features, such as covenants and seniority, could similarly influence both ownership and lending outcomes. Thus, we include bond fixed effects and explicitly control for bonds' maturity, which eliminates bond- and maturity-specific shocks. The remaining variation in $PassiveFund$ comes from the availability of bonds when passive funds are launched or when new fund shares are created. These are the times when passive funds must purchase bonds, and they end up buying what is available, generating a variation in bond ownership. Under the assumption that this residual variation is uncorrelated with unobserved factors influencing lending outcomes, our coefficient estimate β is unbiased.

3.2 Main Results

We report β estimates, number of observations, and adjusted R^2 in Panel A of Table 2. Columns (1) to (3) indicate that a one-percentage-point increase in passive ownership is associated with a 0.010 pp reduction in loan quantity, a 0.308 pp increase in lendable supply, and a 0.023 pp decrease in borrowing fee. The borrowing cost score provided by Markit (DCBS) in Column (4) declines significantly, confirming the decline in the borrowing fee. Column (5) reports a 0.182 pp reduction in the utilization rate, which is defined as the ratio of quantity on loan to lendable supply.

Since the standard deviation of $PassiveFund$ is 3.06%, a one-standard-deviation increase in passive ownership leads to a 0.031 pp decline in loan quantity, a 0.943 pp increase in lendable supply, and a 0.067 pp reduction in borrowing fee. The magnitudes of the reactions of these three outcome variables correspond to 2.3%, 7.1%, and 51.8% of their inter-quartile range, as presented in Table 1, respectively. While the effect on the borrowing fee is substantial compared to its typical variation, the effect observed for loan quantity appears to be small. This pattern reflects simultaneous shifts in both lending supply and demand triggered by increased passive ownership.

We can infer these underlying shifts in the supply and demand curves by examining the directional changes in quantity and price. In Column (2) of Table 2, we see an increase in lendable supply associated with higher passive ownership. However, Columns (1) and (3) reveal declines in equilibrium loan quantity and fees. To make sense of these changes, Panel A of Figure 3 visualizes the effect of an increase in passive ownership. The increase in lendable supply indicates that the supply curve shifts outward. However, there is a decrease in the demand for bond lending that more than offsets the increased supply, resulting in even lower lending fees and a slightly lower equilibrium loan quantity. The effect on the equilibrium quantity is insignificant because the increase in supply is offset by the decrease in demand.

The response of borrowing demand in the corporate bond market differs from what is documented in the stock market. Specifically, Sikorskaya (2023) finds that a one-standard-deviation increase in benchmark intensity, another proxy for passive ownership, leads to a 0.348 pp and 0.032 pp *increase* in the quantity on loan and borrowing fees.[14] Thus, in the stock market, the demand for security lending appears to increase in response to increases in passive ownership.

Are passive funds unique in increasing lendable supply while decreasing demand? To compare the impact of different types of investors, we estimate multivariate regressions including *PassiveFund*, *ActiveFund*, and *Insurer* and report the coefficient estimates in Panel B of Table 2. When the left-hand-side variable is lendable supply, the coefficients on *PassiveFund*, *ActiveFund*, and *Insurer* are 0.336 pp, 0.132 pp, and 0.106 pp, respectively. Thus,

[14]To obtain these values, we multiply the standard deviation of benchmark intensity, 2.56% (her Table 1), by the coefficients in Table 2. Prado, Saffi, and Sturgess (2016) examine the effect of total institutional ownership (rather than passive ownership) and find that a one-standard-deviation increase in ownership leads to a 0.056 pp decrease in fees.

an increase in institutional ownership generally leads to an increase in lendable supply.

The distinction between passive funds and other institutional investors becomes evident when examining borrowing fees and utilization rates as dependent variables. A one-percentage-point increase in passive ownership reduces the fee by 0.023 pp, nearly unchanged from the univariate result. In contrast, active ownership exhibits no significant influence on borrowing fee, whereas insurer ownership leads to a much smaller reduction of 0.001 pp ($t = -2.74$). These estimates indicate that the demand for loan responds differently based on the type of institutional ownership. Specifically, when insurer ownership rises, borrowing demand may either increase or decrease. The magnitude of the demand response, however, is outweighed by concurrent changes in supply, and thus we observe price and quantity moving in opposite directions. However, an increase in passive ownership leads to a sufficiently large reduction in demand that dominates the accompanying supply increase, thereby moving price and quantity simultaneously downward. We visualize these findings in Panel B of Figure 3, highlighting the impact of higher insurer ownership on bond lending.

These coefficients can be used to assess the impact of the changing landscape of corporate bond ownership on bond lending. From 2006 to 2022, the share of passive funds, active funds, and insurer changes by 6.4 pp, 2.2 pp, and -9.1 pp, respectively. By multiplying these changes by the coefficient estimated in Table 2, we estimate that the ownership changes over the past 17 years have led to a 0.11 pp decline in loan quantity (8.2% of the inter-quartile range) and a 0.137 pp decline in lending fee (105.2% of the inter-quartile range). Our estimates suggest that these structural transformations in ownership composition have significantly eased borrowing constraints, enhancing market liquidity and enabling dealers to facilitate market-making activities more effectively.

3.3 Subsample of Special Bonds

The effect of passive ownership on bond lending depends on the underlying motivation for lending. For bonds that are considered "special," lending is typically driven by heightened demand for borrowing these securities. Conversely, non-special or general collateral (GC) bonds are frequently lent out to raise cash, which is driven by increased supply.

To understand the potential difference between bonds, we split our sample into special and GC bonds. In the equity literature, a cutoff such as a 1% lending fee is often used to define specialness (e.g., Sikorskaya 2023). However, bond lending fees are generally lower compared to stocks, rendering this equity-based threshold inappropriate. Instead, following Palia and Sokolinski (2024), we define a bond as special in quarter q if its average lending fee in the preceding quarter $(q-1)$ is within the top decile of the cross-sectional distribution of corporate bond lending fees. We use lagged lending fees for classification as our primary objective is to explain the fee in quarter q.

Using the subsample of special and GC bonds, we estimate the panel regression in Eq. (1). Table 3, Panel A reports the impact of a one-percentage-point increase in passive ownership on the lending outcome variables, separately for special and GC bonds. Our empirical findings indicate qualitatively consistent effects across both bond categories. Specifically, increased passive ownership is associated with higher lendable supply and reduced borrowing fees in both subsamples, though these effects exhibit stronger magnitudes among special bonds. For instance, a one-percentage-point increase in passive ownership corresponds to a 0.575 pp rise in lendable supply among special bonds, greater than the 0.215 pp increase observed for GC bonds. Similarly, passive ownership growth leads to statistically significant reductions in borrowing fees, amounting to 0.061 pp for special bonds versus a more modest 0.005 pp reduction for GC bonds. In short, while passive ownership universally affects bond lending dynamics, its impact is substantially more pronounced in the market for special bonds.[15]

[15] In contrast to our findings for bonds, Sikorskaya (2023) finds that in response to increase in benchmarking intensity, borrowing fees increases only for special stocks.

3.4 Subsample of High Yield Bonds

The demand to short bonds may depend on the information sensitivity of the bonds. Due to their higher default risk, high-yield bonds are generally more information sensitive than investment-grade bonds. To investigate this potential difference, Table 4 reports the estimation results of Eq. (1) using the subsample of investment grade and high yield bonds. We define high yield bonds if the numerical rating at the end of quarter $q-1$ is below BBB- and investment grade bonds otherwise.

We find that increased passive fund ownership exerts qualitatively the same effects on both investment-grade and high-yield bonds with respect to lendable supply and borrowing fees. Specifically, greater passive ownership boosts the lendable supply and reduces borrowing fees across both bond categories, indicative of increased supply for bond lending. Regarding the quantity on loan, we observe divergent effects: a one-percentage-point increase in passive ownership reduces the quantity on loan by 0.017 pp for investment grade bonds, but leads to an increase of 0.045 pp ($t = 2.11$) for high-yield bonds. However, the increase in the quantity of high-yield bonds becomes insignificant after controlling for ownership by other types of institutional investors (Panel B), and the response of the utilization rate becomes negative, although insignificant. Thus, the common theme across different rating categories is that passive ownership significantly increases lendable supply and reduces borrowing fees, while the response of loan quantity is insignificant.

3.5 Alternative Identification

Bretscher, Schmid, and Ye (2024b) propose an alternative identification strategy for passive ownership shocks based on maturity cutoff events. In their study, a shock occurs when a bond's remaining time to maturity crosses certain cutoff values, such as three, five, and ten years. This crossing event systematically increases passive ownership, driven by a greater presence of bond index funds tracking short-term indices compared to those tracking long-term indices. Thus, as bonds approach shorter maturities, they become more attractive to passive funds, independent of their fundamental valuation.

In Section D of the Internet Appendix, we follow their approach to estimate the impact of passive ownership on lending outcomes. Consistent with their findings, we observe a significant increase in passive ownership when a bond's maturity shrinks and crosses the cutoff value. However, we also find that insurance firms' ownership declines significantly. Therefore, this event simultaneously changes the ownership of the two types of investors and prevents us from isolating the impact of increased passive ownership, which our panel regression aims to do.

4 Mechanism

In the previous section, we documented a decline in corporate bond borrowing demand associated with increased passive ownership, a finding that contrasts sharply with established evidence in the equity lending literature. This discrepancy arises for three reasons: i) passive ownership elevates bond valuations, ii) higher valuations alleviate the buying pressure of speculative customers, thus reducing dealers' need to borrow bonds and meet the customer demand, and iii) short sellers of corporate bonds are mainly dealers rather than speculative customers. The following subsection provides evidence that supports each step in the logical reasoning.

4.1 Passive Ownership Inflates Bond Prices

Our first step is to show that an increased passive ownership leads to a higher valuation of the corporate bonds they hold. To this end, we estimate the panel regression in Eq. (1) using credit spreads as the left-hand-side variable. Column (1) of Table 5 reports the association between various types of institutional ownership and corporate bond credit spreads, which is the difference between the corporate bond yield and the maturity-matched Treasury bond yield. Consistent with prior findings of Dannhauser (2017) and Bretscher, Schmid, and Ye (2024b), higher passive ownership is associated with lower credit spreads. In our estimates, a one-percentage-point increase in passive ownership leads to a 0.044 pp decline in credit spreads ($t = -10.02$) in the univariate regression, with nearly identical estimates (0.043 pp) obtained from multivariate regressions that control for active fund and insurance ownership.

In Section 3.2, we show that the borrowing demand for a bond increases in response to an increased bond ownership of insurance firms, contrary to the passive fund ownership. This difference is interesting because insurance firms typically pursue buy-and-hold investment strategies, resulting in relatively low portfolio turnover rates.[16] What then makes passive funds different from insurers? The key to understanding this difference is that passive funds must trade to track the index, which includes and excludes bonds based on predetermined criteria. This generates mechanical transactions and inflates the portfolio turnover rate while pushing bond prices up in the index (Dick-Nielsen and Rossi 2018). In contrast, insurance firms are known to reach for yield (Becker and Ivashina 2015), implying that the bonds that they hold tend to be cheaper than those held by their peers.

The results in Table 5 Panel B support this argument. It indicates that a one-percentage-point increase in insurer ownership leads to a 0.006 pp increase in spreads ($t = 7.89$). In contrast, active ownership exhibits an insignificant effect on credit spreads. Therefore, passive funds are distinct from other institutional ownership in that their ownership inflates bond valuations.

4.2 Overpricing Reduces Buying Pressure Facing Dealers

In the next step, we argue that the decrease in credit spreads alleviates the order imbalance facing dealers. To validate this, we construct a measure of order imbalance, which is the difference between customer buy and customer sell volume within a quarter, normalized

[16] In eMAXX data, the average quarterly portfolio turnover rates for passive funds, active funds, and insurance firms are 3.6%, 4.9% and 1.7%, respectively.

by the bond's outstanding amount. Since increased passive ownership mechanically inflates customer buy, we also calculate a net order imbalance measure by removing the quarterly changes in passive fund holdings from the order imbalance. We adjust for index fund holdings, but not for ETF holdings, because bond transfers for ETF creation and redemption are not recorded in TRACE.[17]

Columns (2) and (3) of Table 5 report the regression coefficients on ownership using the gross and net order imbalances as left-hand-side variables in Eq. (1). We find that a one-percentage-point increase in passive ownership reduces the gross and net order imbalance by 0.020 pp ($t = -3.32$) and 0.096 pp ($t = -12.18$), respectively. This reduction suggests that lower credit spreads induced by passive ownership prompt other investors to curtail bond purchases. Conversely, increased insurance ownership exacerbates order imbalances: a one-percentage-point increase in insurance ownership increases the gross and net order imbalance by 0.0103 and 0.0096 pp, respectively.

Thus, despite their relatively modest share of corporate bond holdings, passive ownership significantly reduces credit spreads, alleviating buying pressures from other market participants. Consequently, this reduction in buying pressure decreases dealers' demand to short bonds for market-making purposes. In contrast, increased insurer ownership contributes to higher credit spreads and intensifies customer buying activity.

The bonds held by passive funds are more expensive, but there may be several mechanisms behind this. For example, Dannhauser (2017) finds that ETF ownership positively influences bond valuation over the long term by mitigating liquidity trading risks. Reilly (2022) observes that dealers tend to include overvalued bonds within ETF creation baskets. Alternatively, direct purchasing by passive funds could generate upward price pressure, further elevating bond prices. Regardless of the specific factor driving higher valuations, our results underscore the unique relationship between security valuation and borrowing demand in the bond market. In the stock market, asset overvaluation tends to increase borrowing

[17] These transactions are exempt from TRACE reporting requirements under FINRA Rule 6730.

demand, as speculators engage in short selling to exploit mispricing and profit opportunities. However, in the bond market, speculative short sales are prohibitively expensive due to bid-ask spreads. Thus, overvaluation of bonds discourages speculative purchases, which decreases dealers' demand to borrow bonds for market-making purposes.

4.3 Short Sellers Are (Predominantly) Dealers

4.3.1 Univariate Analysis of Bond Trading Volume

In this final step, we address the key question of who borrows corporate bonds and why they do so. As in Asquith, Au, Covert, and Pathak (2013), there are three potential motivations for bond borrowing: 1) speculative investors borrow bonds to establish short positions in anticipation of price declines, 2) dealers borrow bonds to facilitate immediate customer buy orders when inventory is insufficient, 3) bond owners seek to finance their holdings by lending them out and receiving cash collateral. While the first two motivations generate borrowing demand, they differ crucially in the identity of the borrower (and thus the short sellers): in the first, customers such as hedge funds are the borrowers and short sellers of the bond; in the second, dealers are the borrowers and sellers. The last motivation generates the lending supply, which reflects the funding needs of bond owners.

To dissect these motivations, we start with a simple "smell" test using univariate regressions and then in the next section check for robustness by adding a number of control variables. Specifically, we first run a panel regression of daily customer buy and sell volume scaled by the amount of bonds outstanding on day $d+h$, $Vol_{i,d+h,\xi}$, on daily changes in the quantity on loan, also scaled by the amount of bonds outstanding, $dQ_{i,d}$,

$$Vol_{i,d+h,\xi} = a_{h,\xi} + b_{h,\xi} \cdot dQ_{i,d} + \varepsilon_{i,d+h,\xi}, \quad \text{where } \xi \in \{\text{`Buy'}, \text{`Sell'}\}, \tag{2}$$

for $h = -5, ..., 5$. We use daily changes in quantity on loan to capture the flow of activities because trading volume is also a flow variable (as opposed to a stock variable).

The slope coefficient $b_{h,\xi}$ quantifies the sensitivity of customer trades to changes in loan quantity and allows us to distinguish whether customers or dealers are shorting the bonds. Specifically, if bond borrowing increases purely due to speculative short selling by customers, then we expect $b_{h,Sell} = 1$: a one percentage point increase in quantity on loan should translate into an equivalent increase in customer selling volume. If there is no trading of bonds other than those borrowed, then the R^2 of the regression will be one as well.

It is also possible that the increase in quantity on loan reflects a decrease in the number of customers returning previously borrowed bonds, which corresponds to a decrease in customer purchases (i.e., customers' short covering activities). If this is the only driver of dQ, then we expect $b_{h,Buy} = -1$. More realistically, if the increase in borrowing is driven by both an increase in newly established short positions and a decrease in previously established short positions, we expect $0 < b_{h,Sell} < 1$, $-1 < b_{h,Buy} < 0$ and $b_{h,Sell} - b_{h,Buy} > 0$. To the extent that there are bond transactions unrelated to borrowing/lending, the regression R^2 may be lower than one.

If, on the other hand, it is dealers who borrow bonds and short them for market-making activities, then the prediction for the coefficients is the opposite. An increase in borrowing should correspond to an increase in customer *buy*, implying a positive coefficient, $0 < b_{h,Buy} < 1$. It may also correspond to a decrease in customer selling (as dealers' short covering activity decreases), implying a negative coefficient $-1 < b_{h,Sell} < 0$. Thus, if dealers' short and short-covering activities drive bond lending, $b_{h,Sell} - b_{h,Buy} < 0$ holds.

Finally, if bond lending is motivated by financing reasons, then lending is not associated with buying or selling the bond. Therefore, we expect the slope coefficients to be zero for both customer purchases and sales.

We estimate the regression in Eq. (2) separately using the daily subsample before and after September 4, 2017. We choose the cutoff date as the date when the SEC implemented a new rule for the settlement cycle of securities transactions. Before then, transactions are generally settled three business days after the trade date, but this gap is reduced to two business days afterwards.[18] Quantity on loan in the Markit database is indexed by settlement date, while trading volume in TRACE is recorded based on trade date, and thus their relationship changes depending on the settlement cycle.[19]

Panel A of Figure 4 plots the coefficient estimates $b_{h,\xi}$ from the regression Eq. (2) using the first subsample before September 4, 2017, along with two standard error bars. We compute standard errors by double-clustering at the bond and date level.

The plot shows a striking pattern for the coefficients on day $d-3$, which reflects the correlation between day $d-3$ volume and day d changes in loan quantity. We find that customer buying is strongly positively correlated with quantity on loan, while customer selling is negatively correlated. Using bonds with all credit ratings, a one percentage point increase in changes in quantity on loan corresponds to a 0.19 pp increase in customer buys and a 0.11 pp decrease in customer sells. Because $b_{h,Sell} - b_{h,Buy} = -0.3 < 0$ holds, dealers' market-making activities are the main driver of bond lending.

Panel B of Figure 4 plots the coefficient estimates $b_{h,\xi}$ for the subperiod after September 5, 2017. The figure looks similar to Panel A, except that the peak of the increase in customer buying now shifts from $d-3$ to $d-2$, reflecting the fact that the settlement period is shortened from three to two days.

The fact that the sum of $|b_{d-3,Sell} - b_{d-3,Buy}|$ is less than one suggests that dealer short selling is an important but not the only driver of bond lending. The insensitivity of bond volume to lending may reflect the existence of financing transactions in which borrowed bonds are not sold. In addition, it is possible that customers speculate and sell borrowed bonds short, but their activity is dominated by dealers' short selling, which attenuates the magnitude of the slope coefficients. At any rate, the evidence we have so far suggests that

[18] In 2024, the settlement period is further reduced to one business day.

[19] After consultation with the data teams in Markit and S&P, we confirm that the "Datadate" variable in the Markit Securities Finance (MSF) database refers explicitly to the settlement date (i.e., loan positions outstanding as of the data date). In other words, it is the date when lending or borrowing transactions are finalized and recorded, rather than the initial transaction or agreement date. Barardehi, Da, Dixon, and Wang (2024) uses the same Markit data for equity research and similarly discusses this settlement timing issue.

dealers are the primary short sellers and dominate customer short sales, if any exist.[20]

Informed trading is more prevalent in the HY bond market as these bonds are more sensitive to issuers' default risk. Thus, we may observe more speculative short selling in HY bonds than IG bonds. In Figure 5, we show the univariate regression in Eq. (2) using the subsample of bonds based on the credit rating on day d. We find that the figures are virtually identical for IG and HY bonds, suggesting that the determinants of bond lending are similar across bonds with various credit ratings.

The effect of changing the settlement period is important for the daily data analysis using the securities lending database. On the settlement day, market participants typically do not make decisions to borrow or lend the securities. These decisions are likely to be made on trade dates that are 2 or 3 business days before settlement because naked short selling is not allowed in the corporate bond market. There are exceptions because the settlement of security lending does not exactly follow the rule for the settlement of outright purchases and sales. In an emergency situation of failed delivery, market participants may resort to security lending transactions with very short settlement periods, even on the same day. However, these exceptions are rare. Therefore, typically, if one wants to understand the relationship between security returns and lending, then the "contemporaneous" relationship can be obtained by regressing the quantity lent on day d on the return on day $d-2$ or $d-3$.

4.3.2 Univariate Analysis of Bond Abnormal Half Spreads and Returns

If dealers short-sell bonds in response to informed buyers' demand, they should charge a higher half spread to mitigate the adverse selection cost (Glosten and Milgrom 1985; Kyle 1985). To study how dealers react to the increased buy pressure, we next examine the response of a half spread to an increase in quantity on loan.

[20]In the Internet Appendix Figure A1, we repeat the regression analysis using stock trading volume and stock lending. We obtain trading volume from the WRDS Intraday Indicator database, which uses the Lee-Ready algorithm to identify buy and sell volumes. The plot shows that an increase in quantity on loan corresponds to an increase in both buy and sell volumes, which is in contrast to the results for bonds.

Specifically, we estimate a panel regression of abnormal half spreads on day $d+h$ on daily changes in quantity on loan on day d,

$$AbHS_{i,d+h,\xi} = a_{h,\xi} + b_{h,\xi} \cdot dQ_{i,d} + \varepsilon_{i,d+h,\xi}, \quad \text{where } \xi \in \{\text{'Buy','Sell'}\}, \tag{3}$$

for $h = -5, ..., 5$. To prevent half spreads from being influenced by mechanical changes in trade size or market microstructure noises (as documented in Edwards, Harris, and Piwowar 2007), we compute an abnormal half spread as the difference between bond i's half spread and the benchmark half spread averaged over the previous 21 days.[21]

Figure 6 presents the coefficient estimates from these regressions. Panel A, covering the period before September 4, 2017, reveals a pronounced spike on day $d-3$. A one percentage point increase in quantity on loan corresponds to a 0.07 pps increase in customer buy spreads and a 0.025 pps decrease in customer sell spreads. Following the settlement cycle change from three to two business days, Panel B shows the expected shift with the peak effect moving to day $d-2$ for the period after September 5, 2017. The magnitude and pattern of the effects remain similar, with customer buy abnormal half spreads increasing by approximately 0.05 pps while customer sell abnormal half spreads decrease by 0.03 pps.

This pattern is consistent with our earlier evidence that dealers are the primary short sellers in the corporate bond market. When dealers borrow bonds to accommodate strong customer buying pressure, dealers charge a higher spread to buying customers and offer a tighter spread to selling customers.

Customers' urgent buy orders can be motivated by liquidity or information. To study whether these orders come from informed investors, we next examine the price impact of

[21]To construct abnormal half spreads, we follow a multi-step procedure. First, we create portfolios of bonds based on three dimensions: credit ratings (investment-grade and high-yield), trade size (trades up to $100,000, between $100,000 and $1 million, between $1 million and $10 million, and above $10 million), and trade direction (customer buy versus customer sell). Within each portfolio bucket, we compute equal-weighted average half spreads. Next, we calculate the average portfolio half spreads over a 21-trading-day window from day $d-21$ to day $d-1$. Finally, we subtract from each trade on day d the corresponding portfolio average half spreads and compute the volume-weighted average of the difference.

lending activities by regressing daily bond returns on changes in the quantity on loan:

$$R_{i,d+h,\xi} = a_{h,\xi} + b_{h,\xi} \cdot dQ_{i,d} + \varepsilon_{i,d+h,\xi}, \quad \text{where } \xi \in \{\text{`IG'},\text{`HY'},\text{`All'}\}, \tag{4}$$

for $h = -5, ..., 5$. We obtain daily bond returns from the ICE BAML bond pricing database and do not winsorize any return observations.

Figure 7 plots the slope coefficient $b_{h,\xi}$ as a function of h. In Panel A, we observe significant positive returns on days $d-3$. This pattern suggests that increased lending activity coincides with an increased bond price, consistent with the customer buying pressure. More strikingly, the price continues to increase for the next five business days, with significant coefficients on $d-2$. $d-1$, $d+1$ and $d+2$, suggesting that the customer buy contains positive information about the bond. The effect is consistent across credit rating categories, though more pronounced for HY bonds with coefficients approximately 0.05 on days $d-3$ and $d-2$. Panel B confirms that these return patterns remain qualitatively similar after the settlement cycle change. It also hints that the bond market has become more efficient with a more pronounced shock on the trade day ($d-2$) followed by weaker appreciations on the following days. Overall, the analyses of bond half spread and returns confirm that the bond lending activities are associated with increased customer buys and resulting dealer short sales.

4.3.3 Multivariate Analysis of Bond Trading Volume

In this subsection, we confirm that changes in quantity on loan are positively correlated with dealer sell volume by running multivariate regressions of changes in quantity on loan, following Diether, Lee, and Werner (2009). Specifically, the panel regression model is,

$$\begin{aligned} dQ_{i,d} = & \, b_0 Vol_{i,d^*,Buy} + b_1 Vol_{i,d^*,Sell} + b_2 \overline{dQ}_{i,d-5,d-1} + b_3 \overline{Vol}_{i,d^*-5,d^*-1,Buy} \\ & + b_4 \overline{Vol}_{i,d^*-5,d^*-1,Sell} + b_5 \bar{h}_{i,d^*-5,d^*-1,Buy} + b_6 \bar{h}_{i,d^*-5,d^*-1,Sell} + b_7 \sigma_{i,d^*-5,d^*-1} \\ & + b_8 r_{i,d^*} + b_9 \bar{r}_{i,d^*-5,d^*-1} + b_{10} dQ^{Stock}_{i,d} + b_{11} \overline{dQ}^{Stock}_{i,d-5,d-1} \\ & + \gamma_d + \alpha_i + Ctrl_{i,d} + \varepsilon_{i,d}, \end{aligned} \tag{5}$$

where d^* is the trade date when participants make the trade decision defined by $d^* = d - s$ and s is 3 if d is on or before September 4, 2017 and 2 thereafter. The set of explanatory variables includes $Vol_{i,d^*,\xi}$, the daily volume with a trade side ξ scaled by amount outstanding; $h_{i,d^*,\xi}$, the half spread with a trade side ξ; σ_{i,d^*-5,d^*-1}, the bond return volatility computed over the five-day period from day $d^* - 5$ to $d^* - 1$; r_{i,d^*}, the daily return on bond i on day d^*; and $dQ^{Stock}_{i,d}$, the quantity on loan of the bond issuer's equity on day d. Variables denoted with an overbar refer to the average of the daily values over the period. The set of control variables includes the logarithm of the bond's amount outstanding, credit rating, and time to maturity. To facilitate comparisons of economic magnitudes across coefficients, all explanatory variables are standardized to have a mean of zero and a standard deviation of one. Standard errors are double-clustered at the bond and day levels.

Column (1) of Table 6 reports the regression estimates using customer buying and selling volume as explanatory variables. The point estimates indicate that a one-standard-deviation increase in contemporaneous customer buys is associated with a 4.39 bps increase in bond lending, while a corresponding increase in customer sells corresponds to a 3.97 bps decrease in lending activity. These results corroborate the univariate findings presented in the preceding section, demonstrating a robust positive association between bond lending and contemporaneous customer buys, alongside a negative relationship with customer sales. The magnitude of these coefficient estimates is economically large relative to the standard deviation of the quantity on loan.

In Column (2), we incorporate the average of lagged loan quantity as an additional explanatory variable. The coefficient on this lagged measure is negative and statistically significant at -1.43 bps ($t = -24.20$), indicating mean reversion in bond lending activity—a pattern suggesting that periods of elevated lending are typically followed by periods of reduced activity. Despite this additional control, the coefficients on contemporaneous customer purchases and sales remain unchanged.

Column (3) extends the specification by including additional control variables: lagged trading volume, half-spreads (calculated separately for buys and sales), and bond return volatility. The inclusion of volatility allows us to distinguish between two competing hypotheses regarding short seller behavior. Under the opportunistic speculator hypothesis, short sellers seek to profit from anticipated price declines, suggesting that higher volatility should encourage short selling activity as it creates greater profit opportunities. Alternatively, under the market maker hypothesis, short sellers primarily provide liquidity services, and higher volatility impairs their capacity to absorb order flow imbalances due to increased inventory risk.

The empirical evidence supports the market maker hypothesis. The coefficient on volatility is negative and statistically significant at -0.10 bps ($t = -4.59$), indicating that higher volatility reduces securities lending activity. This finding aligns with our characterization of short sellers as market makers whose willingness to borrow securities diminishes when market conditions become more uncertain. The coefficients on contemporaneous customer purchases and sales remain similar to those reported in Column (1), demonstrating that the core relationships are robust across alternative model specifications.

Column (4) examines the role of contemporaneous and lagged bond returns in explaining lending activity. The result indicates that both return coefficients are positive. A one-standard-deviation increase in the contemporaneous (i.e., day $d-s$) return is associated with a 0.21 bps increase in lending, while a corresponding increase in lagged returns generates a 0.03 bps increase. Given that the standard deviation of daily changes in loan quantity is

19.80 bps, the slope estimate for the lagged returns is economically small, suggesting that speculative short selling by customers plays a relatively minor role in explaining overall bond lending patterns.

In Column (5), we investigate the relationship between bond lending activity and both contemporaneous and lagged changes in stock loan quantities for the same issuer. Hendershott, Kozhan, and Raman (2020) document that short sellers' information flows from stocks to bonds, but not vice versa. We also find that the loading on contemporaneous changes in stock loan quantities is positive, but with limited economic significance ($b_{10} = 0.06$ bps).

Column (6) presents results from the comprehensive specification incorporating all explanatory variables. The coefficient estimates remain stable across all variables, confirming the robustness of our findings. Notably, the magnitudes of the coefficient on contemporaneous customer buying and selling substantially exceed those of all other variables. Specifically, the coefficient on customer buying is about 30 times as large as that of the return, and that on the customer selling is 25 times as large as that on the return. The third and fourth largest coefficients in absolute terms are those on lagged average changes in quantity on loans (-1.66 bps) and on lagged customer sales (-1.64 bps), respectively. In summary, the available evidence indicates that dealers' market-making activities, in which they sell short bonds to customers, dominate other variables in explaining the variation in bond lending activity.

4.3.4 Multivariate Analysis of Bond Returns

Finally, we confirm the positive link between increased short sales and returns documented in Section 4.3.2 using multivariate regression. Specifically, we regress cumulative bond returns from $d^* + 1$ to $d^* + 5$ on the daily change in quantity on loan and the same set of control variables as in Eq. (5):

$$
\begin{aligned}
CumRet_{i,d^*+1,d^*+5} = {} & b_0 dQ_{i,d} + b_1 Vol_{i,d^*,Buy} + b_2 Vol_{i,d^*,Sell} + b_3 \overline{dQ}_{i,d-5,d-1} \\
& + b_4 \overline{Vol}_{i,d^*-5,d^*-1,Buy} + b_5 \overline{Vol}_{i,d^*-5,d^*-1,Sell} + b_6 \bar{h}_{i,d^*-5,d^*-1,Buy} \\
& + b_7 \bar{h}_{i,d^*-5,d^*-1,Sell} + b_8 \sigma_{i,d^*-5,d^*-1} + b_9 \bar{r}_{i,d^*-5,d^*-1} \\
& + b_{10} dQ^{Stock}_{i,d} + b_{11} \overline{dQ}^{Stock}_{i,d-5,d-1} + \gamma_d + \alpha_i + Ctrl_{i,d} + \varepsilon_{i,d}. \qquad (6)
\end{aligned}
$$

Table 7 reports the estimates on the return forecasting regression. Our interest is in the loading on changes in quantity on loan, b_0, which is positive and highly significant at 0.76 bps ($t = 5.93$) in Column (1). Across the five specifications, the estimates range from 0.76 bps to 1.42 bps, all significantly positive, indicating that increased bond lending predicts higher subsequent bond returns. In stark contrast, the coefficient on stock lending in Column (4) is negative and significant at -1.59 bps ($t = -3.73$), consistent with the notion that stocks are mainly borrowed by hedge funds that possess negative information on the issuing firm (e.g., Boehmer, Jones, and Zhang 2008). This sign reversal between bond and equity lending coefficients supports our claim that the motivation to borrow bonds – facilitating informed buying rather than selling – is contrary to that for borrowing stocks.

5 Breakdown of Passive Ownership

In our sample, passive ownership includes holdings by ETFs and index mutual funds. Table 1 shows that the average passive ownership is 3.43%, comprising 1.27% ETF ownership and 2.15% index fund ownership. According to our proposed mechanism, both investor types track predetermined indices, thereby exerting upward pressure on bond prices. Thus, one may anticipate similar impacts on bond lending outcomes from ETFs and index mutual funds. Nevertheless, recent literature (e.g., Koont, Ma, Pástor, and Zeng 2024) highlights a distinctive feature of ETFs, as they rely on authorized participants to manage fund flows, a feature absent in traditional passive index funds. To examine potential differences between ETFs and index mutual funds, we include their respective ownership shares in the multivariate regression in Eq. (1) and examine how lending outcomes respond.

Table 8 reports the results, presenting coefficients on ETF ownership and index fund ownership. Since Panels A and B (with and without controls for active fund and insurance ownership, respectively) yield similar results, we focus on Panel A. The estimates indicate that a one-percentage-point increase in ETF ownership raises the lendable supply by 0.675 pp, whereas a similar increase in index fund ownership results in a comparatively modest increase of 0.084 pp. Consistent with our main findings, the change in loan quantity is much smaller: +0.044 pp and −0.043 pp, respectively. The significantly negative response to the increased index fund ownership implies that borrowing demand must decline. One cannot, however, reach a definitive conclusion about ETF ownership because the supply effect dominates any changes in demand.

We note that the decline in utilization rate is similar across both investor types, with one-percentage-point increases in ETF and index fund ownership associated with reductions of 0.149 pp and 0.196 pp, respectively. Consequently, both types of ownership result in a reduced equilibrium quantity of bonds relative to the amount available for lending, and a significant decline in equilibrium lending fees. Specifically, a one-percentage-point increase in either ETF or index fund ownership leads to a fee reduction of 0.023 pp. This estimate aligns precisely with our main results reported in Table 2 (−0.023 pp with $t = -4.95$).

Our findings indicate that both ETFs and passive index funds facilitate the relaxation of short-sale constraints in the bond market. Importantly, the mechanisms unique to ETFs, such as the dual roles of dealers serving as authorized participants, do not account for the observed effects. Instead, our proposed channel operating through bond valuations presents a common mechanism across both ETFs and passive index funds, and is consistent with the empirical results reported in Table 8.[22]

6 Conclusion

In this paper, we investigate the mechanism through which increased passive ownership impacts the lending activity of corporate bonds. To understand the mechanism, it is essential to clarify why market participants borrow or lend corporate bonds, which have order-of-magnitude higher bid-ask spreads than stocks and thus their trading is costly for investors. We show that bond lending occurs mainly for dealers' market making activities and the role of speculative short sales by investors is limited. Therefore, short sale is positively related with an increase in buying pressure of investors, which propels dealers to sell short to cater to the customer demands. Thus, when a bond is more expensive, its price reduces buying pressure from speculative investors, reducing the demand to borrow corporate bonds. This is interesting because it is exactly the opposite of what would happen in the equity market, where it is less costly to sell short the security. In a low-cost environment, speculators will try to take advantage of overvalued securities by selling them short, thereby increasing the demand to borrow the security.

Because the motivation to sell short is to provide liquidity in bond trading, an increase in passive ownership reduces the demand to borrow bonds. At the same time, since passive funds are the natural lenders of the security, it increases the lendable supply, resulting in a reduction in borrowing fees. Our analysis based on the large panel data reveals that the decline in demand dominates the increase in supply, resulting in a small reduction in the equilibrium quantity of bonds borrowed.

[22] In Table A3, we show that an increase in ETF and index fund ownership reduces credit spreads and net order imbalance, which is consistent with the baseline results in Table 5.

References

Anderson, Mike, Brian J. Henderson, and Neil D. Pearson, 2018, Bond lending and bond returns, Working Paper, University of Illinois at Urbana-Champaign.

Asquith, Paul, Andrea S. Au, Thomas R. Covert, and Parag A. Pathak, 2013, The market for borrowing corporate bonds, *Journal of Financial Economics* 107, 155–182.

Barardehi, Yashar H, Zhi Da, Peter Dixon, and Junbo L. Wang, 2024, You can only lend what you own: Inferring daily institutional trading from security lending supply, *Available at SSRN* .

Becker, Bo, and Victoria Ivashina, 2015, Reaching for yield in the bond market, *Journal of Finance* 70, 1863–1902.

Berk, Jonathan B., and Jules H. Van Binsbergen, 2015, Measuring skill in the mutual fund industry, *Journal of Financial Economics* 118, 1–20.

Bessembinder, Hendrik, Kathleen M. Kahle, William F. Maxwell, and Danielle Xu, 2008, Measuring abnormal bond performance, *Review of Financial Studies* 22, 4219–4258.

Blocher, Jesse, Adam V. Reed, and Edward D. Van Wesep, 2013, Connecting two markets: An equilibrium framework for shorts, longs, and stock loans, *Journal of Financial Economics* 108, 302–322.

Boehmer, Ekkehart, Charles M. Jones, and Xiaoyan Zhang, 2008, Which shorts are informed? *Journal of Finance* 63, 491–527.

Boehmer, Ekkehart, Charles M. Jones, and Xiaoyan Zhang, 2013, Shackling short sellers: The 2008 shorting ban, *Review of Financial Studies* 26, 1363–1400.

Boehmer, Ekkehart, and Juan Wu, 2013, Short selling and the price discovery process, *Review of Financial Studies* 26, 287–322.

Bretscher, Lorenzo, Lukas Schmid, Ishita Sen, and Varun Sharma, 2024a, Institutional corporate bond pricing, *Review of Financial Studies* forthcoming.

Bretscher, Lorenzo, Lukas Schmid, and Tiange Ye, 2024b, Passive demand and active supply: Evidence from maturity-mandated corporate bond funds, Working Paper, University of Lausanne.

Chen, Hui, Scott Joslin, and Sophie Xiaoyan Ni, 2018, Demand for crash insurance, intermediary constraints, and risk premia in financial markets, *Review of Financial Studies* 32, 228–265.

Choi, Jaewon, Saeid Hoseinzade, Sean Seunghun Shin, and Hassan Tehranian, 2020, Corporate bond mutual funds and asset fire sales, *Journal of Financial Economics* 138, 432–457.

Choi, Jaewon, and Mathias Kronlund, 2017, Reaching for yield in corporate bond mutual funds, *Review of Financial Studies* 31, 1930–1965.

Cohen, Lauren, Karl B. Diether, and Christopher J. Malloy, 2007, Supply and demand shifts in the shorting market, *Journal of Finance* 62, 2061–2096.

Coles, Jeffrey L., Davidson Heath, and Matthew C. Ringgenberg, 2022, On index investing, *Journal of Financial Economics* 145, 665–683.

Comerton-Forde, Carole, Charles M. Jones, and Tālis J. Putniņš, 2016, Shorting at close range: A tale of two types, *Journal of Financial Economics* 121, 546–568.

Dannhauser, Caitlin D., 2017, The impact of innovation: Evidence from corporate bond exchange-traded funds (ETFs), *Journal of Financial Economics* 125, 537–560.

Dannhauser, Caitlin D., and Michele Dathan, 2023, Passive investors in primary bond markets, *Available at SSRN 4673698* .

Dannhauser, Caitlin D., and Saeid Hoseinzade, 2022, The unintended consequences of corporate bond ETFs: Evidence from the taper tantrum, *Review of Financial Studies* 35, 51–90.

Dannhauser, Caitlin D., and Egle Karmaziene, 2023, The dealer warehouse–corporate bond ETFs, *Available at SSRN 4660537* .

Dick-Nielsen, Jens, 2014, How to clean enhanced trace data, *Available at SSRN 2337908* .

Dick-Nielsen, Jens, Peter Feldhütter, Lasse Heje Pedersen, and Christian Stolborg, 2023, Corporate bond factors: Replication failures and a new framework, Copenhagen Business School Working Paper.

Dick-Nielsen, Jens, and Marco Rossi, 2018, The cost of immediacy for corporate bonds, *Review of Financial Studies* 32, 1–41.

Dickerson, Alex, Philippe Mueller, and Cesare Robotti, 2023, Priced risk in corporate bonds, *Journal of Financial Economics* 150, 103707.

Diether, Karl B., Kuan-Hui Lee, and Ingrid M. Werner, 2009, Short-sale strategies and return predictability, *Review of Financial Studies* 22, 575–607.

D'Avolio, Gene, 2002, The market for borrowing stock, *Journal of Financial Economics* 66, 271–306, Limits on Arbitrage.

Edwards, Amy K., Lawrence E. Harris, and Michael S. Piwowar, 2007, Corporate bond market transaction costs and transparency, *Journal of Finance* 62, 1421–1451.

Engelberg, Joseph E., Adam V. Reed, and Matthew C. Ringgenberg, 2018, Short-selling risk, *Journal of Finance* 73, 755–786.

Glosten, Lawrence R., and Paul R. Milgrom, 1985, Bid, ask and transaction prices in a specialist market with heterogeneously informed traders, *Journal of Financial Economics* 14, 71–100.

Goyal, Amit, Adam V. Reed, Esad Smajlbegovic, and Amar Soebhag, 2025, Stealthy shorts: Informed liquidity supply, *Journal of Financial Economics* 172, 104155.

Hendershott, Terrence, Roman Kozhan, and Vikas Raman, 2020, Short selling and price discovery in corporate bonds, *Journal of Financial and Quantitative Analysis* 55, 77–115.

ICMA, 2019, What is 'short selling' and what is the role of repo?, Frequently Asked Questions on Repo, Question 30, International Capital Market Association.

Kolasinski, Adam C., Adam V. Reed, and Matthew C. Ringgenberg, 2013, A multiple lender approach to understanding supply and search in the equity lending market, *Journal of Finance* 68, 559–595.

Koont, Naz, Yiming Ma, Ľuboš Pástor, and Yao Zeng, 2024, Steering a ship in illiquid waters: Active management of passive funds, *Review of Financial Studies* .

Kyle, Albert S., 1985, Continuous auctions and insider trading, *Econometrica* 53, 1315–1335.

Ma, Yiming, Kairong Xiao, and Yao Zeng, 2022, Mutual fund liquidity transformation and reverse flight to liquidity, *Review of Financial Studies* 35, 4674–4711.

Muravyev, Dmitriy, Neil D. Pearson, and Joshua M. Pollet, 2022, Is there a risk premium in the stock lending market? Evidence from equity options, *Journal of Finance* 77, 1787–1828.

Muravyev, Dmitriy, Neil D. Pearson, and Joshua M. Pollet, 2023, Anomalies and their short-sale costs, *Available at SSRN 4266059* .

O'Hara, Maureen, and Xing Alex Zhou, 2021, Anatomy of a liquidity crisis: Corporate bonds in the covid-19 crisis, *Journal of Financial Economics* 142, 46–68.

Palia, Darius, and Stanislav Sokolinski, 2024, Strategic borrowing from passive investors, *Review of Finance* 28, 1537–1573.

Pan, Kevin, and Yao Zeng, 2019, ETF arbitrage under liquidity mismatch, Working Paper, University of Pennsylvania.

Pelizzon, Loriana, Max Riedel, Zorka Simon, and Marti G. Subrahmanyam, 2024, Collateral eligibility of corporate debt in the eurosystem, *Journal of Financial Economics* 153, 103777.

Prado, Melissa Porras, Pedro A.C. Saffi, and Jason Sturgess, 2016, Ownership structure, limits to arbitrage, and stock returns: Evidence from equity lending markets, *Review of Financial Studies* 29, 3211–3244.

Reilly, Chris, 2022, The hidden cost of corporate bond ETFs, Working Paper.

Saffi, Pedro A.C., and Kari Sigurdsson, 2011, Price efficiency and short selling, *Review of Financial Studies* 24, 821–852.

Sikorskaya, Taisiya, 2023, Institutional investors, securities lending, and short-selling constraints, Working Paper, University of Chicago.

von Beschwitz, Bastian, Pekka Honkanen, and Daniel Schmidt, 2025, Passive ownership and short selling, *Review of Finance* 29, 1137–1188.

Figure 1: Time Series Plots of Bond Ownership

This figure plots six-month moving average of the percentage share of actively lent corporate bonds held by insurance companies (orange dashed line), active mutual funds (blue dotted line), passive funds (red dashed line), index funds (purple dash–dot line), and exchange-traded funds (green dotted line), covering the period from September 2006 to December 2022. The passive fund series represents the combined holdings of index funds and ETFs. We identify actively lent bonds as those with non-missing outstanding lending quantities in the Markit securities lending database (now S&P Global Market Intelligence). Institutional holdings data are obtained from eMAXX and Morningstar, and bond amount outstanding data are sourced from Mergent FISD. Further details on sample construction are provided in Section 2.

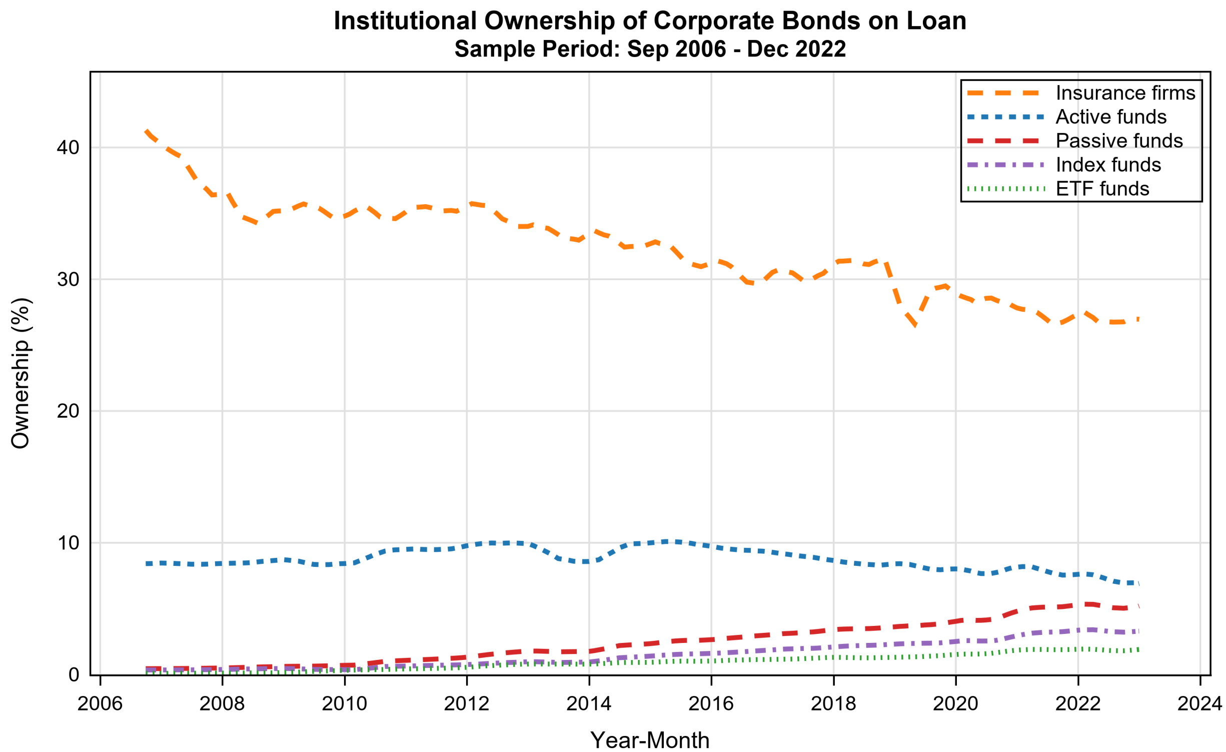
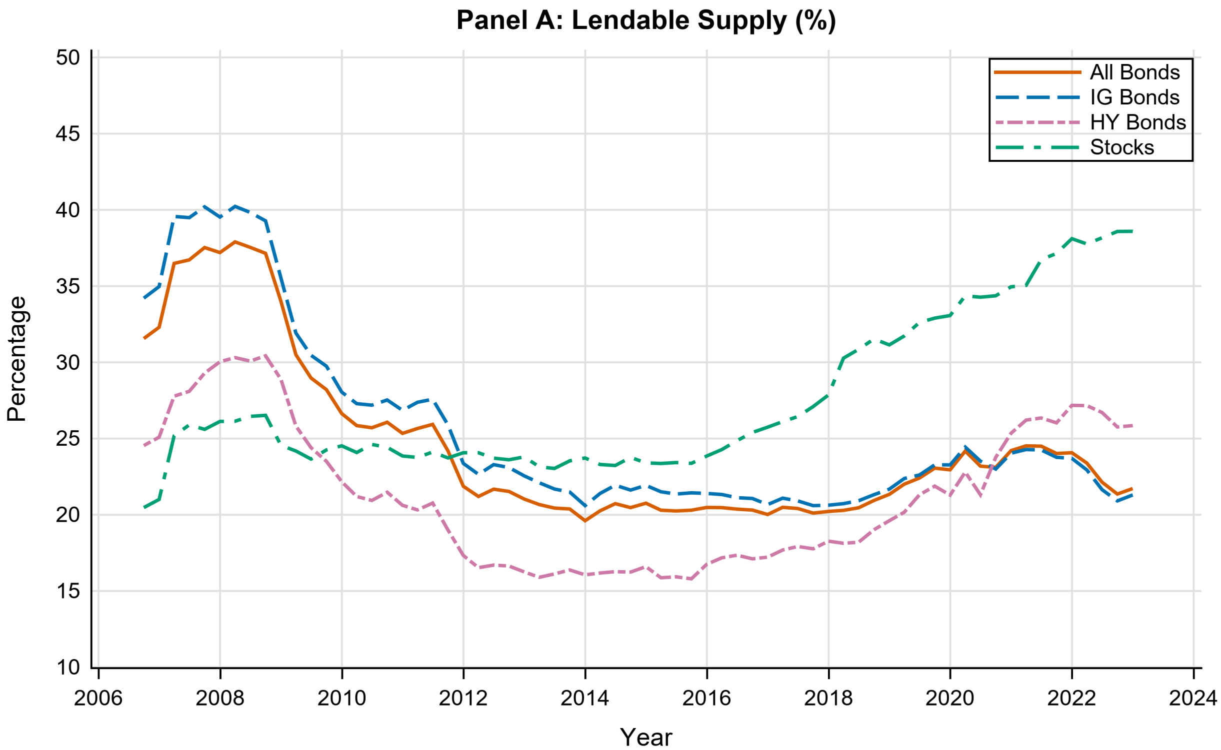
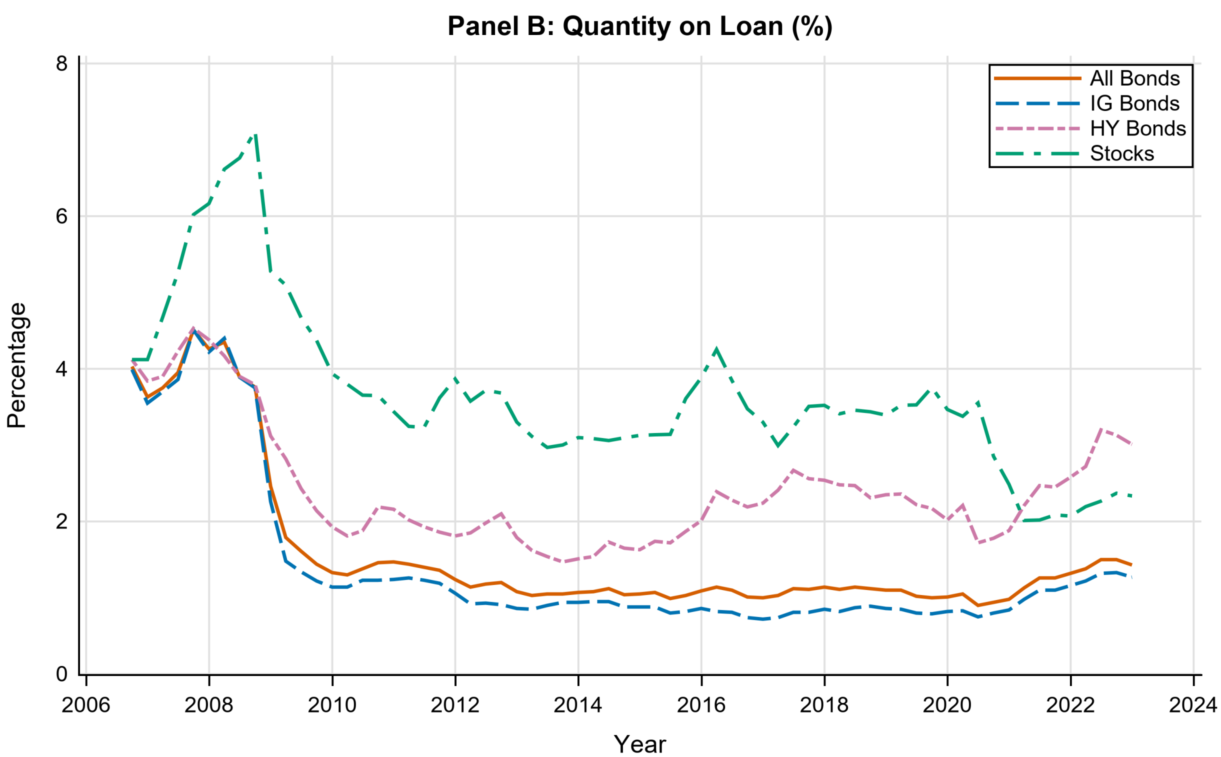


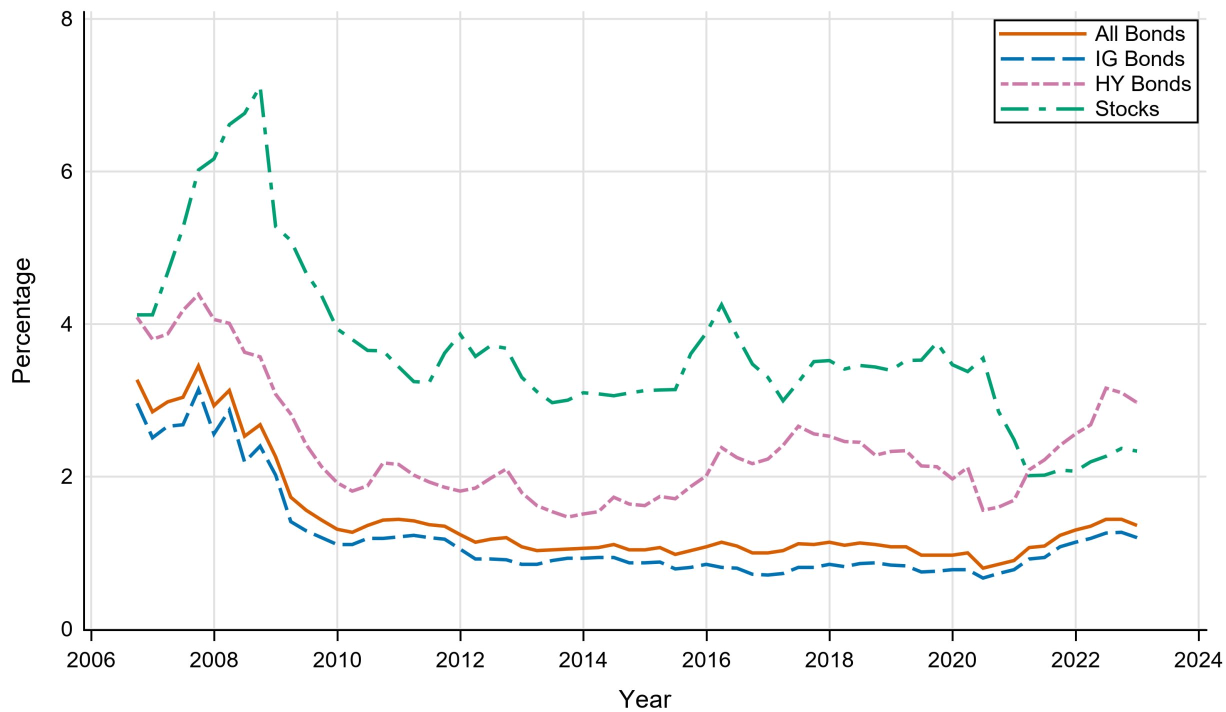
Figure 2: Time Series Plots of Bond Lending Activities

This figure plots the average lending market outcomes for corporate bonds and matched issuer stocks included in our baseline quarterly panel dataset from 2006 Q3 to 2022 Q4. The solid orange line represents all corporate bonds, the dashed blue line denotes investment-grade bonds, the dash–dot pink line corresponds to high-yield bonds, and the dashed green line indicates matched issuer stocks.

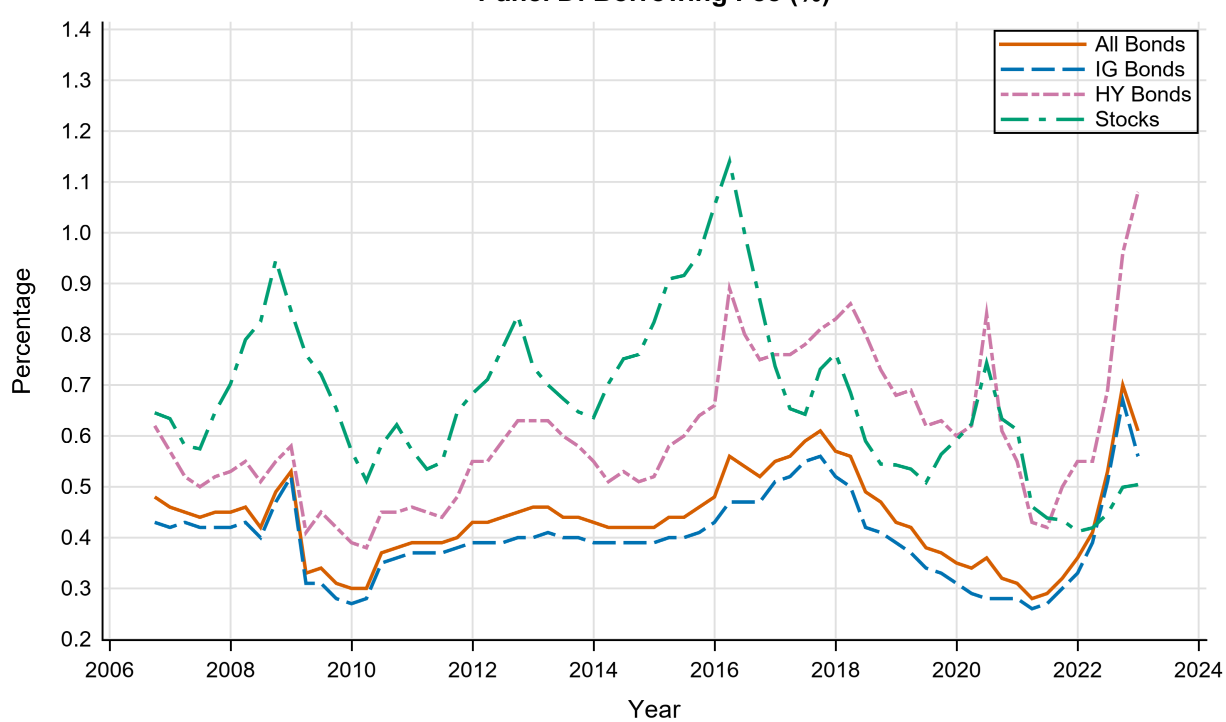


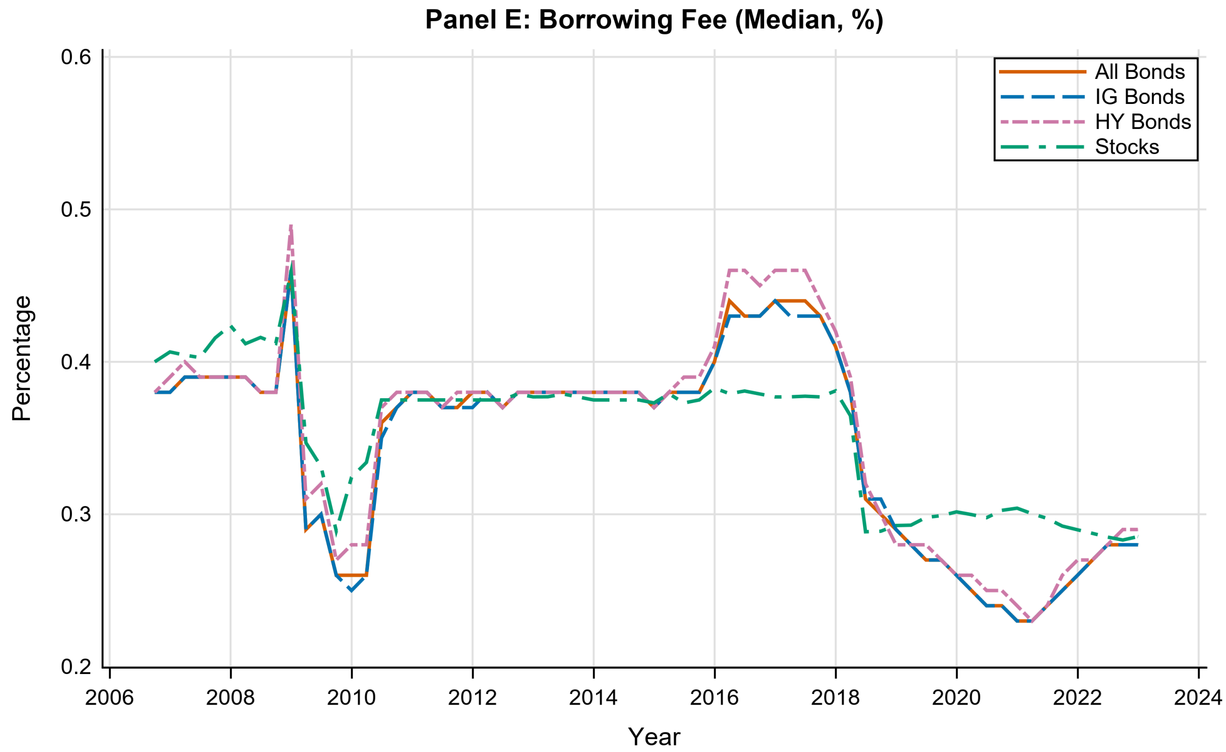


Panel C: Short Loan Quantity (%)



Panel D: Borrowing Fee (%)





Panel E: Borrowing Fee (Median, %)
All Bonds
IG Bonds
HY Bonds
Stocks
Percentage
0.6
0.5
0.4
0.3
0.2
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
Year

Figure 3: Securities Lending Supply and Demand

This figure illustrates the supply and demand curves for securities lending markets. In Panel A, we consider an increase in passive ownership, which leads to a decreased quantity on loan and lower fees. In Panel B, we consider an increase in insurance ownership, which leads to an increase in quantity on loan and lower fees.

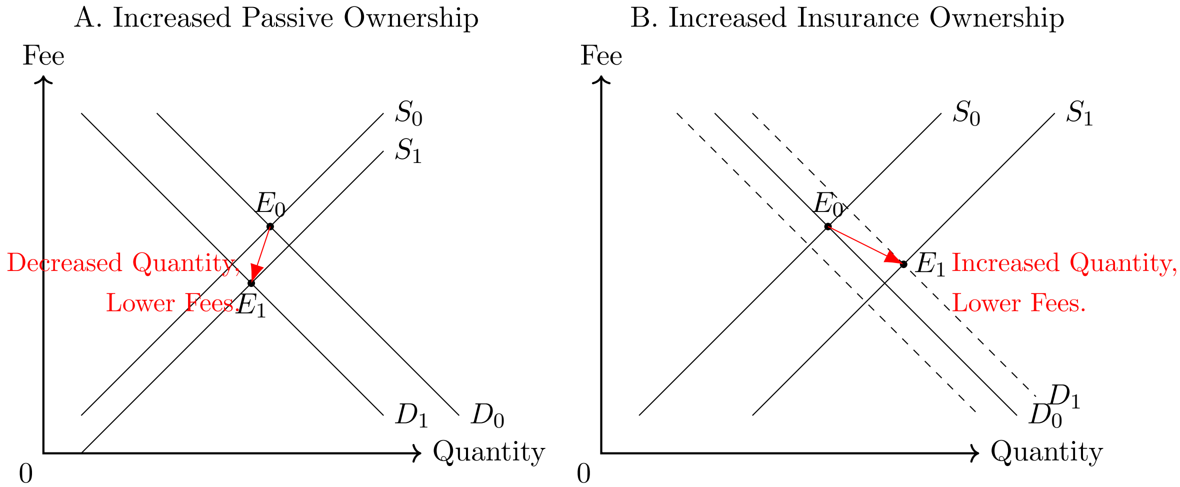


Figure 4: Panel Regression of Dollar Trading Volume on Changes in Quantity on Loan

This figure plots the slope coefficients of the panel regression of dealer-customer trading volume on the day $d + h$ on the day d changes in quantity on loan. Trading volume and quantity on loan are scaled by the amount outstanding. The y-axis represents a change in the percentage of the scaled dollar trading volume associated with a one percentage point change in the scaled quantity on loan. The vertical dotted line indicates the settlement date at day $d = 0$. The orange solid line denotes the trade date, which occurs on day $d = -3$ in Panel A and day $d = -2$ in Panel B. Panel A is for all bonds up to Sep 4, 2017, and Panel B is for all bonds after Sep 5, 2017.

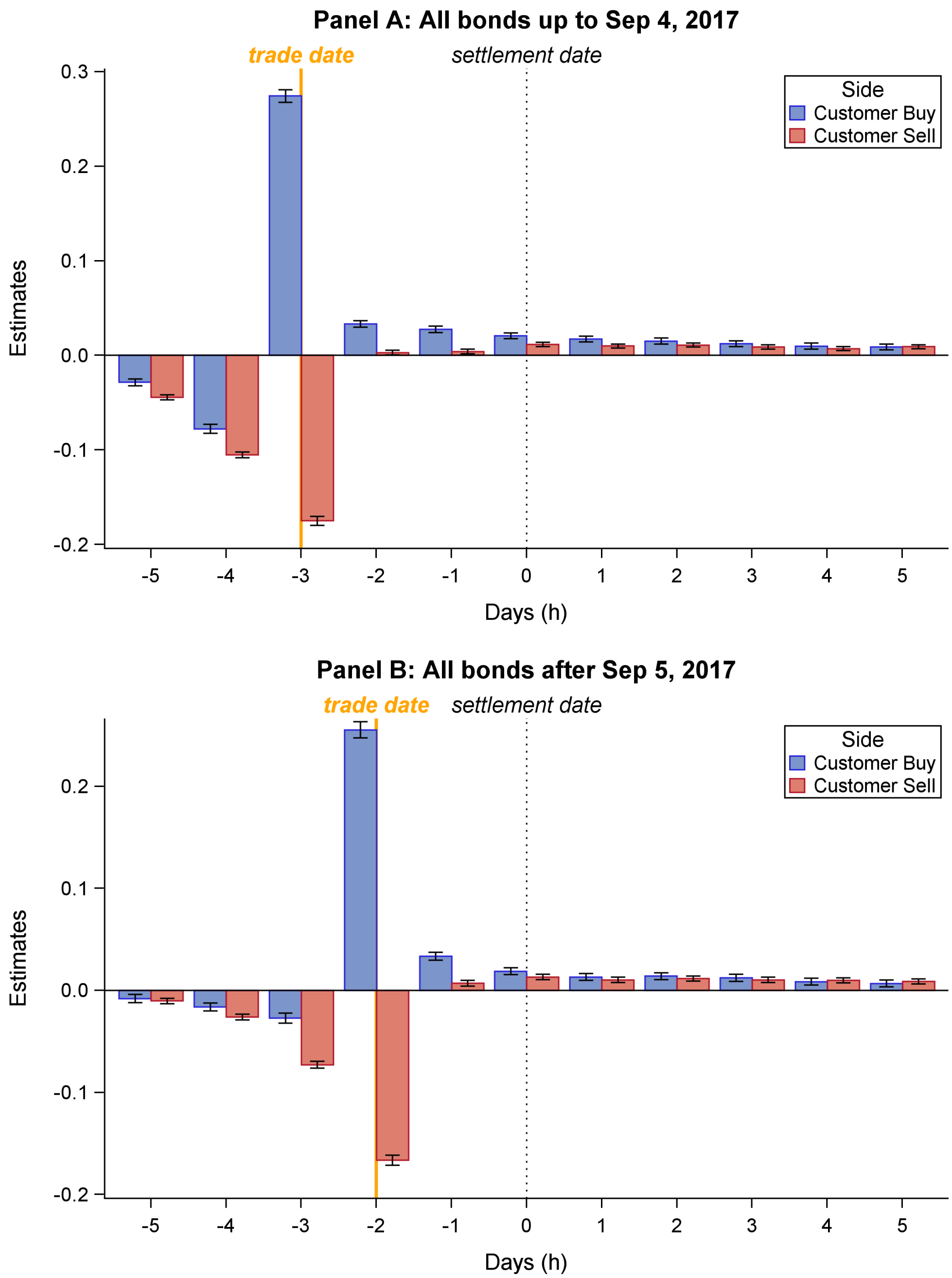
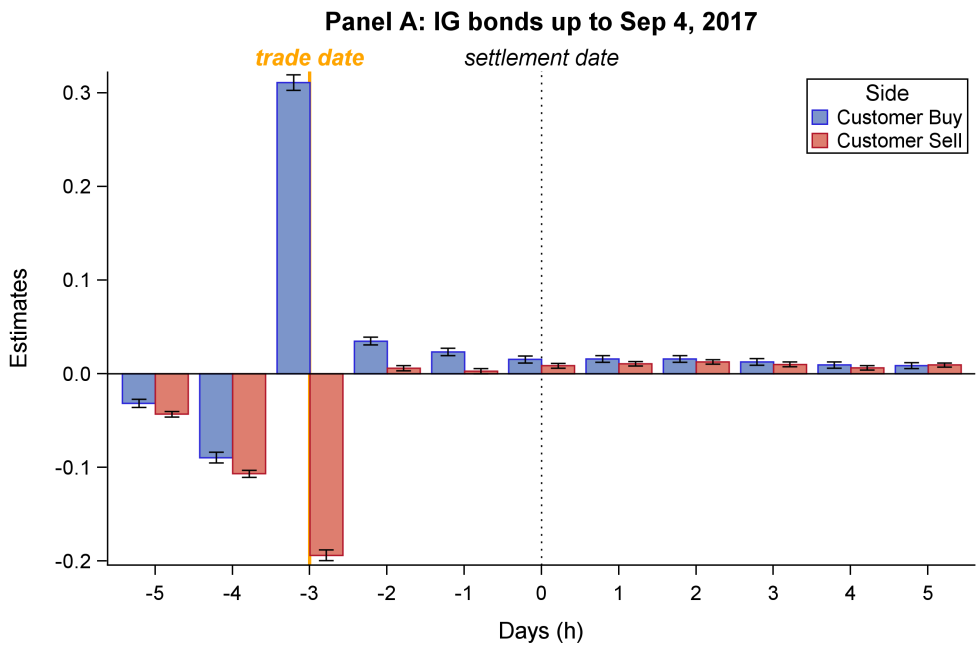
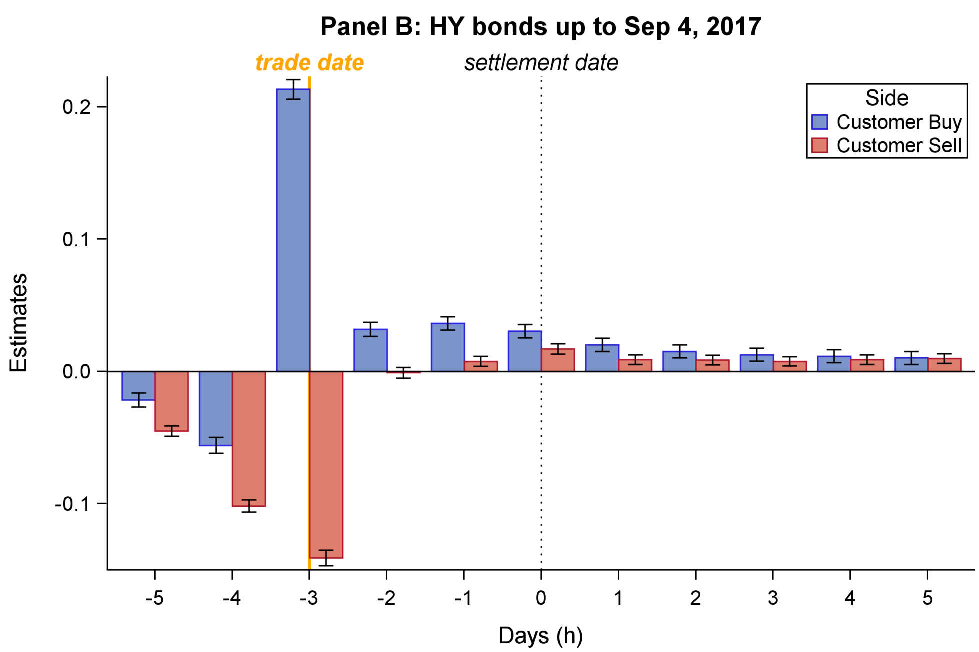
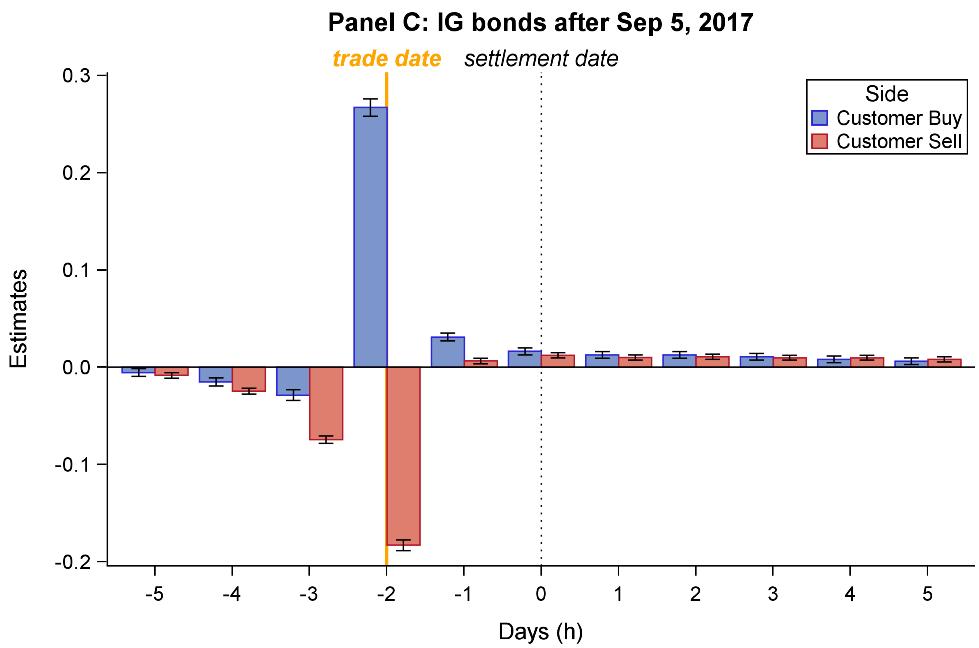


Figure 5: Panel Regression of Dollar Trading Volume on Changes in Quantity on Loan, IG vs HY

The figure plots the slope coefficients of the panel regression of dealer-customer trading volume on day $d+h$ on day d changes in quantity on loan. Trading volume and quantity on loan are scaled by the amount outstanding. The y-axis represents a change in the percentage of the scaled dollar trading volume associated with a one percentage point change in the scaled quantity on loan. The vertical dotted line indicates the settlement date at day $d=0$. The orange solid line denotes the trade date, which occurs on day $d=-3$ (Panels A and B) or day $d=-2$ (Panels C and D). Panels A and B are for investment grade and high yield bonds up to Sep 4, 2017. Panels C and D are for investment grade and high yield bonds after Sep 5, 2017.






Panel C: IG bonds after Sep 5, 2017
trade date
settlement date
Side
Customer Buy
Customer Sell
Estimates
0.3
0.2
0.1
0.0
-0.1
-0.2
-5
-4
-3
-2
-1
0
1
2
3
4
5
Days (h)

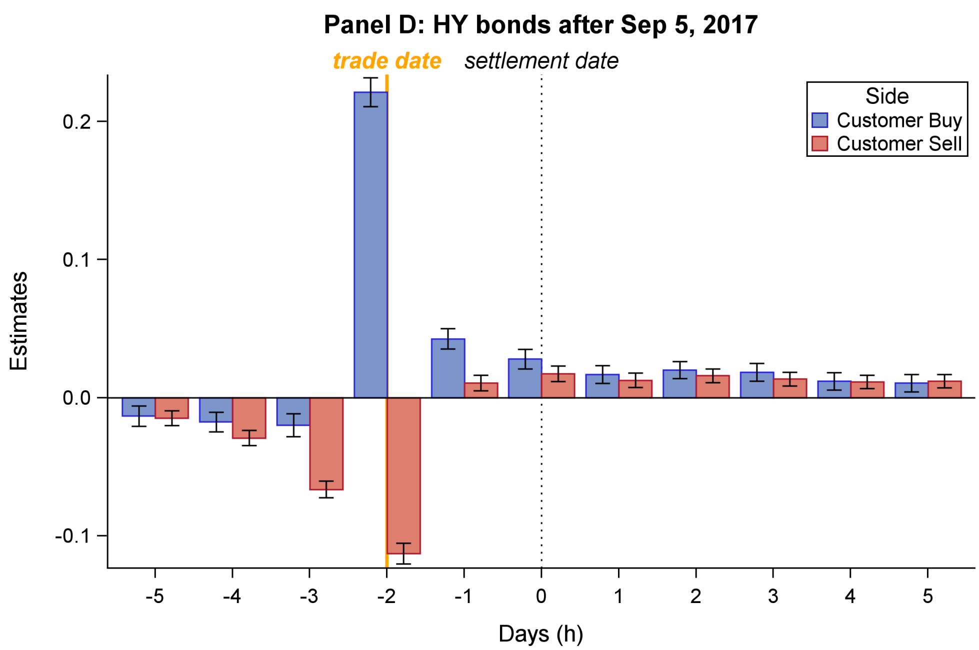

Panel D: HY bonds after Sep 5, 2017
trade date
settlement date
Side
Customer Buy
Customer Sell
Estimates
0.2
0.1
0.0
-0.1
-5
-4
-3
-2
-1
0
1
2
3
4
5
Days (h)

Figure 6: Panel Regression of Abnormal Half Spreads on Changes in Quantity on Loan

This figure plots the slope coefficients of the panel regression of abnormal half spreads on the day $d + h$ on the day d changes in quantity on loan. Abnormal half-spreads are computed as deviations from 21-trading-day averages within buckets defined by credit rating, trade size, and trade direction. The y-axis represents a change in abnormal half spreads in percent associated with a one percentage point change in the scaled quantity on loan. The vertical dotted line indicates the settlement date at day $d = 0$. The orange solid line denotes the trade date, which occurs on day $d = -3$ in Panel A and day $d = -2$ in Panel B. Panel A is for all bonds up to Sep 4, 2017, and Panel B is for all bonds after Sep 5, 2017.

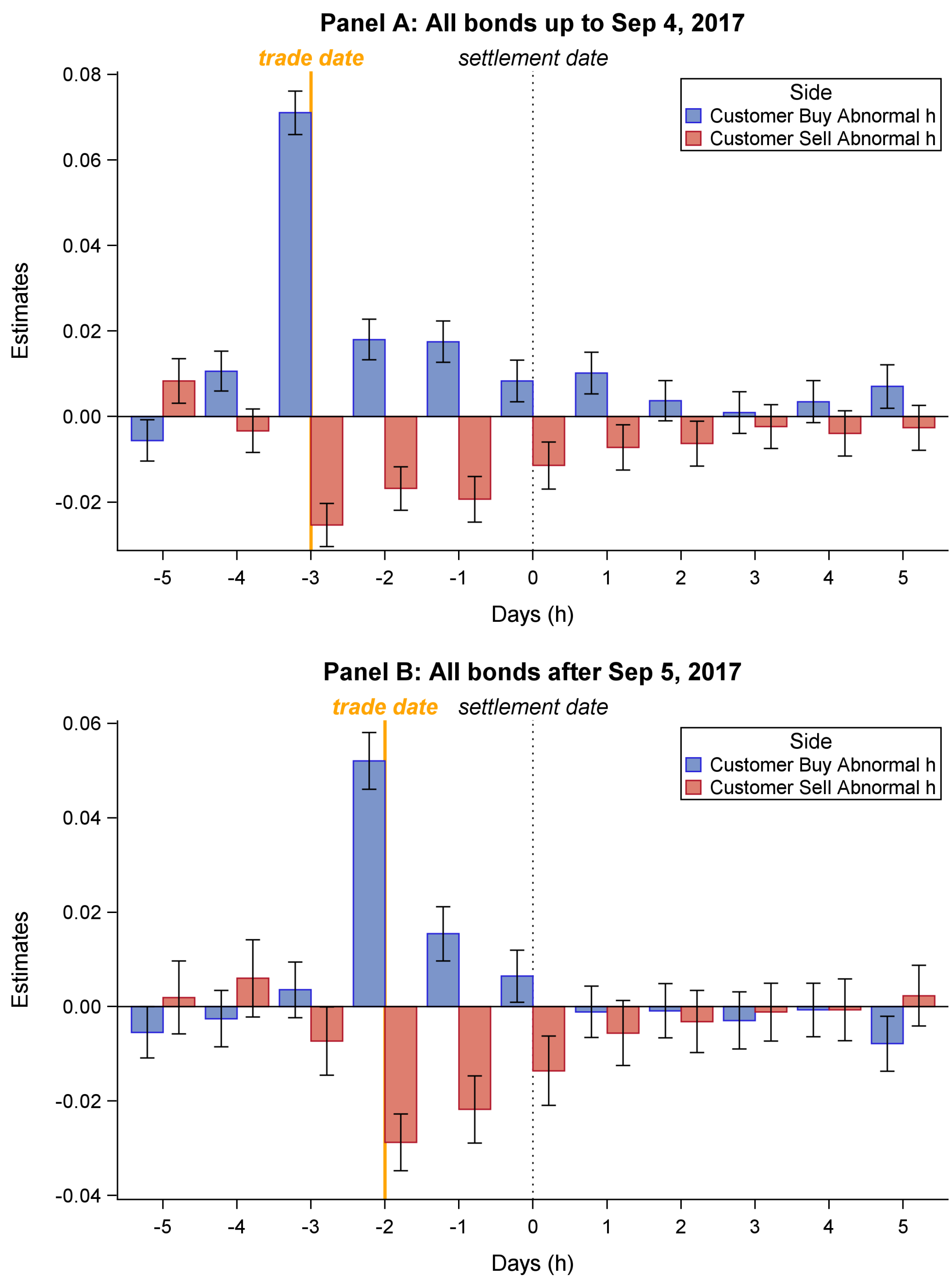
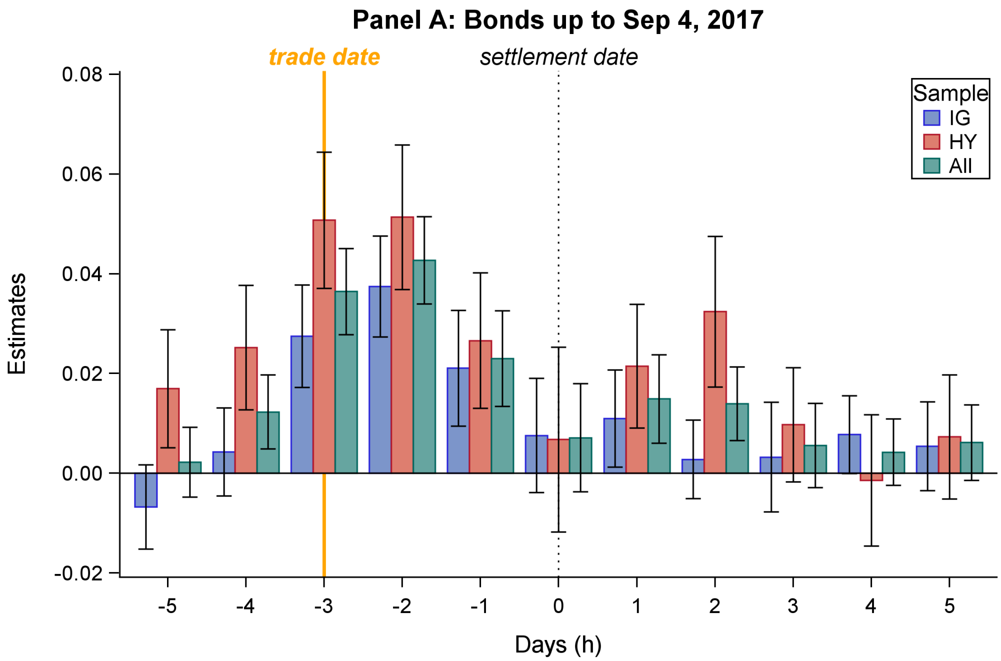


Figure 7: Panel Regression of Daily Bond Returns on Changes in Quantity on Loan

This figure plots the slope coefficients of the panel regression of daily bond returns on the day $d+h$ on the day d changes in quantity on loan. Daily bond returns are obtained from the ICE BAML bond pricing database and are not winsorized. The y-axis represents a change in daily bond returns in percent associated with a one percentage point change in the scaled quantity on loan. The vertical dotted line indicates the settlement date at day $d = 0$. The orange solid line denotes the trade date, which occurs on day $d = -3$ in Panel A and day $d = -2$ in Panel B. Panel A is for bonds up to Sep 4, 2017, and Panel B is for bonds after Sep 5, 2017.



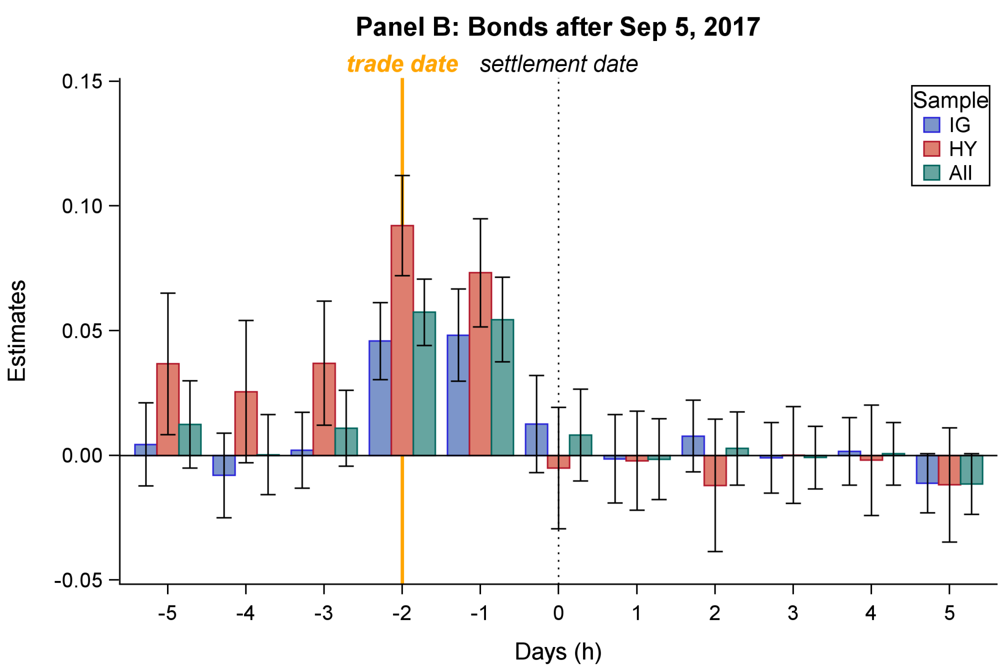


Table 1: Descriptive Statistics

This table reports summary statistics for the main variables at the bond-quarter level. We compute quarterly averages of daily bond lending variables for each bond unless mentioned otherwise. *Loan Quantity* is defined as the quantity on loan from Markit divided by the amount outstanding from Mergent FISD. *Lendable Supply* is the active lendable quantity from Markit divided by the amount outstanding. *Utilization Rate* is defined as the ratio of the quantity on loan to the lendable quantity. *Loan Tenure* is the average number of days that bond loans have been open. *Borrowing Fee* is the buy-side fee paid by the ultimate borrower ("*IndicativeFee*" in Markit). *Rebate Rate* is the "*IndicativeRebate*" in Markit. *DCBS* is the cost of borrow score provided by Markit, ranging from 1 (low cost) to 10 (high cost). *Fee Risk* is the natural logarithm of the standard deviation of borrowing fees within a calendar quarter. *Recall Risk* is the natural logarithm of the standard deviation of utilization rate in a given quarter. *Lender Concentration* is a Herfindahl-Index-like measure at the bond level provided by Markit that describes the concentration of lenders. *Special* is a dummy variable equal to one if the borrowing fee in a given quarter falls in the top decile of the fee distribution across bonds and zero otherwise. *Credit Spread* is calculated as the average difference between the corporate bond yield and the yield of a matching Treasury bond within a quarter. *OIMB* is order imbalance, defined as the quarterly sum of customer buy volume minus the quarterly sum of customer sell volume scaled by the bond amount outstanding. Net order imbalance (*Net OIMB*) is defined as the aggregated quarterly order imbalance minus changes in index fund ownership. h^{Buy} (h^{Sell}) is half spread from the customer buy (sell) side, defined as the quarterly average of the log price differences between customer buy (sell) trades and inter-dealer trades following O'Hara and Zhou (2021). We match customer buy (sell) trades with the closest in-time inter-dealer trade over the past five trading days with replacement. We decompose the share of bonds held by mutual funds into *Passive Fund* (i.e., index funds and ETFs) and *Active Fund* based on Morningstar data. *Insurer* represents the share of bonds held by insurance firms, sourced from eMAXX. *Amount* is the amount of bonds outstanding in millions of dollars. *Rating* is the numerical rating score, where 1 refers to a AAA rating by S&P and Aaa by Moody's, 21 refers to a C rating for both S&P and Moody's. *Age* is the age of a bond in years. *Maturity* is the time to maturity in years. *ZTD* is the percentage of zero trading days in a given quarter. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles within each quarter. The dataset is compiled from Mergent FISD, TRACE, Markit, Morningstar, and eMAXX. The final sample comprises 17,140 bonds issued by 1,705 firms, covering the period from Q3 2006 to Q4 2022.

Variable	Mean	SD	P1	P25	P50	P75	P99	IQR	Obs
Loan Quantity (%)	1.45	2.58	0.01	0.16	0.51	1.51	12.06	1.35	297,693
Lendable Supply (%)	23.74	10.95	1.78	16.38	22.70	29.72	56.79	13.34	297,693
Utilization Rate (%)	6.71	11.98	0.03	0.78	2.46	6.98	65.01	6.20	297,693
Loan Tenure (days)	74.27	86.56	1.00	23.27	44.08	88.92	455.55	65.66	297,693
Borrowing Fee (%)	0.44	0.47	0.17	0.28	0.37	0.40	2.94	0.13	297,693
Rebate Rate (%)	0.56	1.44	−2.12	−0.25	−0.12	1.08	4.90	1.33	297,693
DCBS	1.06	0.29	1.00	1.00	1.00	1.00	2.75	0.00	297,693
Fee Risk	−2.85	1.01	−5.25	−3.45	−2.90	-2.48	0.14	0.97	253,298
Recall Risk	−0.28	1.74	−6.64	−1.07	0.02	0.86	2.69	1.93	291,480
Lender Concentration	0.49	0.32	0.00	0.29	0.49	0.73	1.00	0.44	297,693
Special	0.10	0.30	0.00	0.00	0.00	0.00	1.00	0.00	297,693
Credit Spread (%)	2.13	2.67	0.23	0.88	1.41	2.40	11.51	1.52	293,193
OIMB (%)	-0.07	2.18	-6.33	-0.86	-0.03	0.69	6.53	1.54	297,693
Net OIMB (%)	-0.12	2.22	-6.56	-0.96	-0.05	0.66	6.50	1.62	297,174
h^{Buy} *(%)*	0.28	0.87	−1.59	0.01	0.14	0.43	3.15	0.43	286,041
h^{Sell} *(%)*	0.26	0.97	−2.10	0.00	0.16	0.45	3.09	0.45	284,634
Passive Fund (%)	3.43	3.06	0.00	0.70	2.93	5.29	12.24	4.59	297,693
ETF (%)	1.27	1.46	0.00	0.03	0.78	2.03	6.21	2.01	297,693
Index Fund (%)	2.15	2.28	0.00	0.03	1.56	3.48	9.04	3.45	297,693
Active Fund (%)	9.65	10.07	0.00	2.05	6.28	13.92	43.27	11.87	297,693
Insurer (%)	31.29	20.70	0.21	13.96	28.29	45.89	82.06	31.93	297,693
Amount ($ mil)	679	569	105	300	500	799	3,000	499	297,660
Rating	8.45	3.10	1.50	6.50	8.00	10.00	17.00	3.50	297,693
Age (years)	4.92	4.45	0.32	1.80	3.63	6.59	21.22	4.79	297,693
Maturity (years)	9.98	8.70	1.13	3.71	6.55	14.39	29.69	10.68	297,693
ZTD (%)	34.77	29.78	0.00	6.35	28.57	59.38	96.72	53.03	297,693

Table 2: Passive Ownership and Bond Lending Activities

This table presents the results from regressing bond lending outcomes on ownership of institutional investors. The dependent variables are quarterly averages of loan quantity, lendable supply, borrowing fee, DCBS, and utilization rate. *Passive Fund*, *Active Fund*, and *Insurer* represent fractions of bond par amount held by passive mutual funds, actively managed mutual funds, and insurance firms, respectively. Bond control variables include the log value of amount outstanding, rating, time to maturity, and the fraction of zero-trading days. The variable definitions can be found in Table 1. We include bond and firm × quarter effects in each regression. We double cluster standard errors by firm and year-quarter, and t-statistics are in parentheses. *, **, and *** indicate the significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 2006 Q3 to 2022 Q4.

	Loan Quantity (1)	Lendable Supply (2)	Borrowing Fee (3)	DCBS (4)	Utilization Rate (5)
			Panel A: Passive Funds Only		
Passive Fund	−0.0103	0.3082***	−0.0229***	−0.0133***	−0.1818***
	(−1.13)	(8.05)	(−4.95)	(−5.32)	(−5.37)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Firm×Qtr FE	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	281,886	281,886	281,886	281,886	281,886
Adjusted R^2	0.597	0.811	0.472	0.489	0.629
			Panel B: Passive Funds Plus Other Investors		
Passive Fund	−0.0050	0.3355***	−0.0232***	−0.0134***	−0.1718***
	(−0.52)	(9.10)	(−4.94)	(−5.32)	(−5.02)
Active Fund	0.0442***	0.1316***	0.0006	0.0004	0.1380***
	(10.78)	(7.67)	(0.95)	(0.99)	(7.40)
Insurer	0.0194***	0.1056***	−0.0012***	−0.0006**	0.0317***
	(5.17)	(9.58)	(−2.74)	(−2.42)	(3.45)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Firm×Qtr FE	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	281,886	281,886	281,886	281,886	281,886
Adjusted R^2	0.602	0.815	0.472	0.490	0.630

Table 3: Passive Ownership and Bond Lending Activities, Subsample Results by Specialness

This table presents the results from regressing bond lending outcomes on ownership of institutional investors. The results are separately reported for special bonds and general collateral (GC) bonds. A bond is defined as special in a given quarter if its lagged borrowing fee is in the top decile of the fee distribution across bonds, and as GC, otherwise. Bond control variables include the log value of amount outstanding, rating, time to maturity, and the fraction of zero-trading days. We include bond and firm × quarter effects in each regression. We double cluster standard errors by firm and year-quarter, and t-statistics are in parentheses. *, **, and *** indicate the significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 2006 Q3 to 2022 Q4.

	Special					GC				
	Loan Quantity	Lendable Supply	Borrowing Fee	DCBS	Utilization Rate	Loan Quantity	Lendable Supply	Borrowing Fee	DCBS	Utilization Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Panel A: Passive Funds Only					
Passive Fund	0.0559	0.5750***	−0.0611***	−0.0390***	−0.4983	−0.0126	0.2151***	−0.0051***	−0.0031***	−0.1693***
	(1.05)	(3.59)	(−3.07)	(−3.08)	(−1.54)	(−1.38)	(5.91)	(−4.13)	(−4.50)	(−5.58)
Bond Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm×Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,465	12,465	12,465	12,465	12,465	245,177	245,177	245,177	245,177	245,177
Adjusted R^2	0.771	0.751	0.611	0.615	0.742	0.571	0.831	0.246	0.162	0.541
					Panel B: Passive Funds Plus Other Investors					
Passive Fund	0.0412	0.5668***	−0.0612***	−0.0389***	−0.5719*	−0.0069	0.2468***	−0.0052***	−0.0032***	−0.1583***
	(0.78)	(3.75)	(−3.09)	(−3.05)	(−1.74)	(−0.71)	(7.12)	(−4.16)	(−4.51)	(−5.10)
Active Fund	0.0657***	0.0948***	-0.0011	0.0000	0.2522***	0.0384***	0.1375***	0.0000	0.0001	0.1127***
	(4.50)	(3.38)	(−0.30)	(0.00)	(2.88)	(9.47)	(7.77)	(0.21)	(0.80)	(7.99)
Insurer	0.0156	0.0873***	−0.0021	0.0001	−0.0231	0.0179***	0.1051***	−0.0003*	−0.0001	0.0319***
	(1.59)	(4.00)	(−0.54)	(0.03)	(−0.40)	(4.56)	(9.78)	(−1.86)	(−1.09)	(3.42)
Bond Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm×Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,465	12,465	12,465	12,465	12,465	245,177	245,177	245,177	245,177	245,177
Adjusted R^2	0.777	0.753	0.611	0.615	0.743	0.575	0.835	0.246	0.162	0.543

Table 4: Passive Ownership and Bond Lending Activities, Subsample Results by Credit Rating

This table presents the results from regressing bond lending outcomes on ownership of institutional investors. The results are separately reported for investment grade (IG) and high yield (HY) bonds. A bond is classified as high yield if its credit rating at the end of the previous quarter is below BBB; otherwise, it is categorized as investment grade. Bond control variables include the log value of the amount outstanding, rating, time to maturity, and the fraction of zero-trading days. We include bond and firm × quarter effects in each regression. We double cluster standard errors by firm and year-quarter, and t-statistics are in parentheses. *, **, and *** indicate the significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 2006 Q3 to 2022 Q4.

	IG					HY				
	Loan Quantity	Lendable Supply	Borrowing Fee	DCBS	Utilization Rate	Loan Quantity	Lendable Supply	Borrowing Fee	DCBS	Utilization Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Passive Funds Only										
Passive Fund	−0.0166	0.2666***	−0.0217***	−0.0124***	−0.1899***	0.0453**	0.5391***	−0.0216***	−0.0134***	0.0089
	(−1.67)	(6.53)	(−4.78)	(−4.99)	(−5.40)	(2.11)	(7.80)	(−4.21)	(−4.32)	(0.08)
Bond Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm×Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	234,539	234,539	234,539	234,539	234,539	46,535	46,535	46,535	46,535	46,535
Adjusted R^2	0.567	0.818	0.316	0.322	0.532	0.665	0.804	0.706	0.692	0.676
Panel B: Passive Funds Plus Other Investors										
Passive Fund	−0.0101	0.3006***	−0.0219***	−0.0125***	−0.1764***	0.0299	0.5191***	−0.0217***	−0.0135***	−0.0568
	(−0.96)	(7.65)	(−4.78)	(−4.98)	(−4.97)	(1.36)	(7.58)	(−4.26)	(−4.39)	(−0.49)
Active Fund	0.0348***	0.1596***	0.0013*	0.0009**	0.0903***	0.0565***	0.1042***	0.0001	0.0002	0.2188***
	(7.95)	(7.06)	(1.83)	(2.07)	(5.10)	(8.81)	(4.03)	(0.07)	(0.23)	(6.70)
Insurer	0.0179***	0.0976***	−0.0010**	−0.0004*	0.0334***	0.0174**	0.1349***	−0.0009	−0.0007	0.0001
	(4.45)	(9.08)	(−2.20)	(−1.73)	(3.50)	(2.61)	(6.07)	(−0.71)	(−0.82)	(0.00)
Bond Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm×Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	234,539	234,539	234,539	234,539	234,539	46,535	46,535	46,535	46,535	46,535
Adjusted R^2	0.570	0.821	0.316	0.322	0.533	0.672	0.808	0.706	0.692	0.680

Table 5: Passive Ownership and Bond Market Outcomes

This table presents the results from regressing bond market outcomes on ownership of institutional investors. The dependent variables are quarterly averages of credit spread and half spreads on customer buy and sell trades (h^{Buy} and h^{Sell}). *OIMB* is order imbalance, defined as the quarterly sum of customer buy volume minus the quarterly sum of customer sell volume scaled by the bond amount outstanding. Net order imbalance (*Net OIMB*) is defined as the order imbalance minus changes in index fund ownership. *Passive Fund*, *Active Fund*, and *Insurer* represent fractions of bond par amount held by passive mutual funds, actively managed mutual funds, and insurance firms, respectively. Bond control variables include the log value of amount outstanding, rating, time to maturity, and the fraction of zero-trading days. The variable definitions can be found in Table 1. We include bond and firm × quarter effects in each regression. We double cluster standard errors by firm and year-quarter, and t-statistics are in parentheses. *, **, and *** indicate the significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 2006 Q3 to 2022 Q4.

	Credit Spread	OIMB	Net OIMB	h^{Buy}	h^{Sell}
	(1)	(2)	(3)	(4)	(5)
Panel A: Passive Funds Only					
Passive Fund	−0.0443***	−0.0198***	−0.0964***	0.0065**	−0.0116***
	(−10.15)	(−3.32)	(−12.18)	(2.53)	(−4.09)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Firm × Qtr FE	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	277,403	281,886	281,413	270,622	269,304
Adjusted R^2	0.953	0.039	0.043	0.255	0.272
Panel B: Passive Funds Plus Other Investors					
Passive Fund	−0.0429***	−0.0170***	−0.0938***	0.0073***	−0.0112***
	(−10.02)	(−2.76)	(−11.33)	(2.83)	(−3.97)
Active Fund	−0.0017	0.0217***	0.0159***	−0.0020***	0.0017*
	(−1.09)	(10.22)	(6.44)	(−2.84)	(1.92)
Insurer	0.0062***	0.0103***	0.0096***	0.0033***	0.0017***
	(7.89)	(5.89)	(5.56)	(6.61)	(3.24)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Firm × Qtr FE	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	277,403	281,886	281,413	270,622	269,304
Adjusted R^2	0.953	0.040	0.044	0.256	0.272

Table 6: Panel Regression of Daily Changes in Quantity on Loan

This table reports the estimates from the panel regression of changes in the quantity on loan for all bonds, as specified in Equation (5). The set of explanatory variables includes the daily bond return r_{d^*} on trade date d^*, the average return over the preceding five trading days $\bar{r}_{d^*-5,d^*-1}$, the daily customer buy and sell trading volumes scaled by amount outstanding ($Vol_{d^*,Buy}$ and $Vol_{d^*,Sell}$, respectively) and their five-day moving averages (i.e., $\overline{Vol}_{d^*-5,d^*-1,Buy}$ and $\overline{Vol}_{d^*-5,d^*-1,Sell}$). We also control for half spreads on buy trades ($\bar{h}_{d^*-5,d^*-1,Buy}$) and sell trades ($\bar{h}_{d^*-5,d^*-1,Sell}$), and bond return volatility (σ_{d^*-5,d^*-1}), each computed over the five-day period from d^*-5 to d^*-1. To account for the gap between trade date d^* and settlement date d, we set $d^* = d - s$, where s equals 3 if d occurs on or before September 4, 2017, and 2 thereafter. Bond controls include the natural logarithm of the amount outstanding, credit ratings, and time to maturity. The variables on the right-hand side are standardized so that they have a mean of zero and a standard deviation of one. We include bond and date fixed effects in each regression specification. We double cluster standard errors by bond and date, and t-statistics are given in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. We require each bond to have at least 252 daily observations in the regression.

	(1)	(2)	(3)	(4)	(5)	(6)
$Vol_{d^*,Buy}$	0.0439***	0.0442***	0.0460***			0.0460***
	(109.32)	(109.55)	(112.19)			(112.05)
$Vol_{d^*,Sell}$	−0.0397***	−0.0397***	−0.0391***			−0.0391***
	(−122.98)	(−122.85)	(−121.98)			(−122.05)
$\overline{dQ}_{d-5,d-1}$		−0.0143***	−0.0166***			−0.0166***
		(−24.20)	(−26.48)			(−26.52)
$\overline{Vol}_{d^*-5,d^*-1,Buy}$			0.0060***			0.0059***
			(20.67)			(20.45)
$\overline{Vol}_{d^*-5,d^*-1,Sell}$			−0.0164***			−0.0164***
			(−55.95)			(−55.87)
$\bar{h}_{d^*-5,d^*-1,Buy}$			−0.0001			−0.0002**
			(−0.55)			(−2.19)
$\bar{h}_{d^*-5,d^*-1,Sell}$			0.0001			0.0003***
			(0.66)			(3.41)
σ_{d^*-5,d^*-1}			−0.0010***			−0.0011***
			(−4.59)			(−5.39)
r_{d^*}				0.0021***		0.0016***
				(9.79)		(8.14)
$\bar{r}_{d^*-5,d^*-1}$				0.0003*		0.0014***
				(1.90)		(7.48)
dQ_d^{Stock}					0.0006***	0.0006***
					(3.12)	(3.13)
$\overline{dQ}_{d-5,d-1}^{Stock}$					0.0001	0.0002**
					(1.64)	(2.18)
Bond Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,535,911	10,535,911	10,535,911	10,535,911	10,535,911	10,535,911
Adjusted R^2	0.050	0.056	0.059	0.010	0.010	0.059

Table 7: Panel Regression of Future Returns on Changes in Quantity on Loan

This table reports the estimates from the panel regression of cumulative bond returns from $d^* + 1$ to $d^* + 5$ for all bonds, as specified in Equation (6). The explanatory variables include the daily change in quantity on loan, dQ_d, and the same set of control variables as in Table 6. To account for the gap between trade date d^* and settlement date d, we set $d^* = d - s$, where s equals 3 if d occurs on or before September 4, 2017, and 2 thereafter. Bond controls include the natural logarithm of the amount outstanding, credit ratings, and time to maturity. The variables on the right-hand side are standardized so that they have a mean of zero and a standard deviation of one. We include bond and date fixed effects in each regression specification. We double cluster standard errors by bond and date, and t-statistics are given in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
dQ_d	0.0076***	0.0084***	0.0083***	0.0142***	0.0083***
	(5.93)	(6.25)	(6.13)	(11.19)	(6.12)
$Vol_{d^*,Buy}$	0.0342***	0.0338***	0.0316***		0.0319***
	(19.09)	(18.86)	(19.54)		(19.62)
$Vol_{d^*,Sell}$	−0.0329***	−0.0328***	−0.0346***		−0.0347***
	(−17.42)	(−17.36)	(−19.78)		(−19.48)
$\overline{dQ}_{d-5,d-1}$		0.0103***	0.0056***		0.0053***
		(6.33)	(3.38)		(3.24)
$\overline{Vol}_{d^*-5,d^*-1,Buy}$			0.0284***		0.0278***
			(11.99)		(11.47)
$\overline{Vol}_{d^*-5,d^*-1,Sell}$			−0.0236***		−0.0231***
			(−9.90)		(−9.49)
$\bar{h}_{d^*-5,d^*-1,Buy}$			0.0277***		0.0254***
			(4.01)		(4.10)
$\bar{h}_{d^*-5,d^*-1,Sell}$			0.0137*		0.0173***
			(1.90)		(2.91)
σ_{d^*-5,d^*-1}			0.0987***		0.0974***
			(4.03)		(3.88)
$\bar{r}_{d^*-5,d^*-1}$				0.0234	0.0194
				(1.03)	(0.84)
dQ_d^{Stock}				−0.0159***	−0.0150***
				(−3.73)	(−3.55)
$\overline{dQ}_{d-5,d-1}^{Stock}$				−0.0069	−0.0064
				(−1.22)	(−1.13)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes
Observations	10,496,879	10,496,879	10,496,879	10,496,879	10,496,879
Adjusted R^2	0.231	0.231	0.234	0.231	0.234

Table 8: Passive Ownership Decomposition

This table presents the results from regressing bond lending outcomes on ownership of institutional investors. The dependent variables are quarterly averages of loan quantity, lendable supply, borrowing fee, DCBS, and utilization rate. We decompose *Passive Fund* into ETF and index funds. *Active Fund*, and *Insurer* represent fractions of bond par amount held by actively managed mutual funds and insurance firms, respectively. Bond control variables include the log value of amount outstanding, rating, time to maturity, and the fraction of zero-trading days. The variable definitions can be found in Table 1. We include bond and firm × quarter effects in each regression. We double cluster standard errors by firm and year-quarter, and t-statistics are in parentheses. *, **, and *** indicate the significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 2006 Q3 to 2022 Q4.

	Loan Quantity (1)	Lendable Supply (2)	Borrowing Fee (3)	DCBS (4)	Utilization Rate (5)
			Panel A: Passive Funds Only		
ETF	0.0435**	0.6749***	−0.0232***	−0.0137***	−0.1492**
	(2.53)	(12.35)	(−4.21)	(−4.69)	(−2.10)
Index Fund	−0.0427***	0.0838*	−0.0228***	−0.0130***	−0.1961***
	(−4.20)	(1.82)	(−4.63)	(−4.65)	(−4.33)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Firm×Qtr FE	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	281,886	281,886	281,886	281,886	281,886
Adjusted R^2	0.597	0.812	0.472	0.489	0.629
			Panel B: Passive Funds Plus Other Investors		
ETF	0.0439**	0.6965***	−0.0238***	−0.0140***	−0.1604**
	(2.41)	(13.15)	(−4.20)	(−4.69)	(−2.21)
Index Fund	−0.0341***	0.1154**	−0.0228***	−0.0130***	−0.1731***
	(−3.30)	(2.59)	(−4.66)	(−4.67)	(−3.81)
Active Fund	0.0438***	0.1283***	0.0006	0.0004	0.1380***
	(10.69)	(7.47)	(0.96)	(1.01)	(7.40)
Insurer	0.0196***	0.1066***	−0.0012***	−0.0006**	0.0318***
	(5.18)	(9.61)	(−2.74)	(−2.42)	(3.45)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Firm×Qtr FE	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	281,886	281,886	281,886	281,886	281,886
Adjusted R^2	0.602	0.815	0.472	0.490	0.630

Internet Appendix
"Passive Ownership and Corporate Bond Lending"

A Corporate Bond Filters

In this section, we describe our procedure to filter corporate bonds based on the Mergent Fixed Income Securities Database (FISD) database and the Enhanced Trade Reporting and Compliance Engine (TRACE) database from WRDS.

TRACE data contains transaction prices and volume, trade direction, and the exact date and time of each trade. Following Dick-Nielsen (2014), we clean the TRACE data, remove canceled transaction records, and adjust records that are subsequently corrected or reversed. We also follow Bessembinder, Kahle, Maxwell, and Xu (2008) to correct potential data errors and remove observations in enhanced TRACE data with large return reversals, defined as a 20% or greater return followed by a 20% or greater return of the opposite sign. We merge the TRACE database with Mergent FISD to collect information on bond characteristics such as amount outstanding, credit rating, and time to maturity.

Following the recent literature (e.g., Dickerson, Mueller, and Robotti 2023; Dick-Nielsen, Feldhütter, Pedersen, and Stolborg 2023), we apply additional filters to eliminate (1) bonds that are not listed or traded in the U.S. public market; (2) bonds that are U.S. Government, private placements, mortgage-backed, asset-backed, agency-backed, or equity-linked;[23] (3) convertible bonds or bonds with a floating coupon rate or an odd frequency of coupon payments; (4) bonds that have less than one year to maturity; (5) bond transactions that are labeled as when-issued, locked-in, have special sales conditions, or have more than a two-day settlement period; (6) transaction records with trade size larger than issue size or trade size is not an integer; (7) bonds that do not have a principal value of $1,000; (8) bonds

[23] Following Dick-Nielsen, Feldhütter, Pedersen, and Stolborg (2023), we define equity-linked bonds, as bonds whose field "issue name" contains any of the strings "EQUITYLINKED", "EQUITY LINKED", and "INDEX-LINKED".

with incomplete issuance information (offering date, amount, and maturity) or non-positive historical amount outstanding (e.g., bonds are called); and (9) bonds that are not issued by public firms (i.e., without a valid PERMNO from CRSP).

B Daily Bond Sample Construction

In this section, we provide further details on the construction of the daily bond panel data used in Table 6.

After matching the daily Markit security lending data to the merged Mergent FISD-TRACE bond sample as specified in Section A, we obtain 18,458,551 observations for 18,085 corporate bonds issued by 1,755 firms from September 11, 2006 to December 30, 2022.

Next, we move to construct customer buy/sell volume. Enhanced TRACE records the direction of trades from the reporting dealers' perspective. Thus, for each customer-dealer trade, we treat dealer-buy trades as customer sales and dealer-sell trades as customer buys. We treat missing trading volume and customer buy/sell trade observations in TRACE as zero volume when computing bonds' transaction volume. To distinguish zero volume from missing observations, we first create empty panel data by setting the beginning and ending dates for an initial list of bonds in the sample, which is determined by the intersection of the three databases (TRACE, Mergent FISD, and Markit) we use. For the list of trading days, we use those in CRSP and exclude bond trades recorded on the days when stock markets are closed.[24] The beginning and ending dates for each bond are set by its issuance date and maturity date or the last call date. We then merge TRACE volume to the empty panel to determine which days have zero volume.

To obtain an estimate of transaction cost, we follow O'Hara and Zhou (2021) and match each customer buy/sell trade with the closest in time inter-dealer trade in that bond over the past five trading days. We construct half spreads for both the customer buy side and sell

[24] This choice excludes some sparse trades on weekends but includes more trading days than Treasury market data.

side as the volume-weighted average of the log price differences between customer buy/sell trades and inter-dealer trades. Moreover, to mitigate the microstructure noise, we compute daily bond returns and volatility using quote prices from the Bank of America Merrill Lynch (BAML) database provided by the Intercontinental Exchange (ICE).

The SEC announced on March 22, 2017, that the settlement cycle (i.e., the time between the transaction date and the settlement date) for most broker-dealer securities transactions will change from three business days (i.e., T+3) to two business days (i.e., T+2) on September 5, 2017. Thus, to account for these settlement gaps, we adjust trading volume, bond returns, and half spreads on day d by day $d-3$ values for the sample up to September 4, 2017 and by day $d-2$ values after September 5, 2017. Then, we compute return volatility and five-day moving averages based on the "adjusted" variables.

We require each bond to have at least 252 daily observations after merging daily bond lending data, trading volume, half spreads, and bond returns data. The final sample includes 10,693,324 bond-day observations for 11,411 corporate bonds across 1,259 firms from September 13, 2006 to December 30, 2022. We winsorize continuous variables at 1% and 99% by month to mitigate the effects of outliers while avoiding look-ahead bias. Table A1, Panel A reports the descriptive statistics for the daily bond panel data.

C Monthly Bond Sample Construction

This section provides additional details on the construction of the monthly bond panel data used in Figure A2.

We begin with daily bond lending data from IHS Markit, which we match to the merged Mergent FISD-TRACE bond sample. We then compute the monthly averages of lending outcome variables by aggregating the daily Markit data within each bond-month observation. Following Bretscher, Schmid, and Ye (2024b), we exclude bonds issued within the past six months to ensure a more stable sample. This process yields 815,719 observations for 17,214 corporate bonds issued by 1,718 firms over 196 months from September 2006 to December 2022.

Next, we merge the monthly bond lending data with bond holdings data from Morningstar and eMAXX, aligning them based on bond CUSIPs and calendar months. We define a *Switch* indicator that equals one if a bond crosses one of the three cutoffs: 10-, 5-, and 3-year time to maturity. We compute the change of passive ownership and lending outcome variables from month $t-1$ to month $t+h$ and require all the outcome variable changes to be available for $h \in [-4, 24]$. These filtering criteria yield a final sample of 318,279 bond-month observations for 9,754 corporate bonds issued by 1,184 firms from February 2007 to December 2022. To mitigate the influence of outliers, we winsorize continuous variables at the 1st and 99th percentiles within each month. Table A1, Panel B presents descriptive statistics for the final monthly bond panel dataset.

D Identification Based on Maturity Cutoffs

Our main results assess the effect of increased passive ownership using within-firm variation in lending outcomes. While this is a valid approach for identifying ownership shocks, it is not the only one.

Bretscher, Schmid, and Ye (2024b) propose that one can use maturity cutoffs as a valid instrument for changing passive ownership. Specifically, they show that when the remaining maturity of a bond shrinks beyond a certain threshold, such as three or ten years, passive ownership increases. This happens because there are more short-term index funds than long-term index funds. This provides another clean identification of shocks to passive ownership, because the fundamental values of a bond remain very similar when its maturity changes from (say) 10.1 years to 9.9 years. Since Bretscher, Schmid, and Ye (2024b) study the effect of ownership on bond pricing and liquidity, we revisit their results focusing on bond lending outcomes.[25]

To assess the impact of switching ownership, we define a dummy variable that takes on a value of one if a bond's remaining time to maturity crosses the three, five, and ten year cutoffs on any day in month t and zero otherwise, denoted $Switch_{i,t}$. We then regress changes in lending outcome variables for bond i, including lending supply, quantity on loan, and lending fees. In addition, we use passive ownership as another outcome variable to verify that crossing maturity increases ownership. In this analysis, we use the monthly data constructed as described in the Internet Appendix C.

Specifically, we estimate a panel regression,

$$\Delta Outcome_i^{t-1 \to t+h} = \beta^h Switch_{i,t} + Controls_{i,t-1} + \alpha_i + \lambda_t + e_{i,t}^h, \tag{7}$$

where $\Delta Outcome_i^{t-1 \to t+h}$ is the change of the bond lending and ownership variables for bond i from $t-1$ to $t+h$. We set $h = -4, \ldots, 24$ to study the pre-trends, short- and medium-term impacts. $Controls_{i,t-1}$ includes the log of amount outstanding of the bond, numerical credit rating, and the fraction of zero trading days in a month. Each regression includes bond and year-month fixed effects. For this regression, we restrict to the sample that $\Delta Outcome_i^{t-1 \to t+h}$ are all available across h for comparability. Standard errors are double-clustered at the bond and year-month levels.

Table A4 Panel A reports the coefficient estimates for passive ownership and the corresponding panel in Figure A2 plots the estimated coefficients with two-standard-error bars to visualize them. Consistent with Bretscher, Schmid, and Ye (2024b), we find that when a bond crosses the maturity cutoff, its passive ownership increases significantly. Specifically, the ownership increases 0.365 pp in the month when the bond maturity becomes less than the cutoff ($h = 0$) from a month before. The ownership gradually increases for the following

[25] Internet Appendix of Bretscher, Schmid, and Ye (2024b) also study several bond lending outcomes. Our results are very similar to theirs, but we extend the horizon for the outcome variables to examine the medium-term effect of increased passive ownership.

nine months, with β^9 being estimated at 0.515 pp ($t = 19.01$). About a half of this increase is permanent, as the increase in ownership 24 months after crossing the cutoff is still high at 0.264 pp ($t = 8.81$). Thus, we confirm that our instrument is valid and generates non-trivial variation in passive ownership when compared with its sample average (3.43 pp) and inter-quartile range (4.59 pp).

Panels D to F in Table A4 and Figure A2 report the regression estimates in Eq. (7) for changes in quantity on loan, lendable supply, and lending fees. The response of the loan quantity three, nine, 18, and 24 months after the bond crosses the cutoff is 0.06 pp, −0.03 pp, −0.13 pp, and −0.14 pp, respectively. That is, in the first three months, the loan quantity increases by a small amount, reflecting the buying pressure created by passive funds that must buy those bonds to track a bond index. However, over the medium term, the initial reaction reverses, and the quantity on loan declines. This happens because, consistent with the mechanism described in Section 4, the increased passive ownership reduces the bonds' credit spreads and reduces the buying pressure from other speculative investors. As a result, dealers have to sell short bonds less than before, leading to a lower quantity on loan.

The decrease of quantity on loan identified using maturity cutoff as an instrument is qualitatively consistent with our main results based on the quarterly panel regressions with firm-quarter fixed effects. However, quantitatively, the point estimate is economically more significant. In our main result, a one-percentage-point increase in passive ownership reduces the quantity on loan by 0.010 pp. In the maturity cutoff analysis, for $h = 24$, the reaction of quantity on loan to the one-percentage-point increase in passive ownership generates a 0.530 pp (=0.140/0.264) decline in quantity on loan. This reaction is substantial given the average and inter-quartile range of quantity on loan (1.45 pp and 1.35 pp, respectively). In addition, in Panel E, lendable supply declines substantially after a bond crosses the maturity cutoff. The estimated change from $h = -1$ to $h = 24$ is −0.367 pp, which is 3.67 standard errors below zero. This is in contrast to our main results, where an increase in passive ownership raises the lendable supply.

To reconcile the apparent discrepancy in estimated reactions between two types of instruments, one must understand the nature of the maturity cutoff event. That is, when a bond crosses the maturity cutoff, different types of investors react *simultaneously*. To see this, in Panels B and C of Table A4, we report the changes in ownership share of insurance firms and active mutual funds. The corresponding panels in Figure A2 show the regression coefficient estimates.

When the bond crosses the cutoff, insurance firms gradually reduce their ownership share. While the changes in ownership in the month of crossing the maturity cutoff are close to zero, the cumulative changes become more negative as the horizon h increases. For $h = 24$, insurance firms' ownership declines 0.518 pp ($t = -5.00$). In contrast, the reactions of active mutual funds are muted and insignificant for all horizons.

Taken together, over the medium term, crossing the maturity cutoff significantly increases passive ownership and decreases insurance ownership. The decrease in insurance ownership reduces the lendable supply and dominates the increase in passive funds. Changes in insurance ownership dominate because the magnitude of the change is larger (-0.518 pp) than that of passive ownership (0.264 pp). As a result, the maturity cutoff event significantly reduces lendable supply, as shown in Panel E, Figure A2. This reduction in supply leads to a more pronounced decline in quantity on loan (Panel B) than that in our main results. In contrast, the borrowing fee (Panel F) reacts little when a bond crosses the maturity cutoff. This is because the increase in passive ownership decreases the fee, while the decreased insurance ownership increases it. Since the two forces cancel each other out, the resulting reactions in the lending fee are insignificant for all horizons.

In summary, because the event simultaneously increases passive ownership and decreases insurance ownership, it reduces lendable supply and quantity on loan. To isolate the effect of changing passive ownership from insurance ownership, one has to examine the multivariate regression as presented in Table 2.

Figure A1: Panel Regression of Dollar Trading Volume on Changes in Quantity on Loan: Stocks

This figure plots the slope coefficients of the panel regression of stock trading volume on the day $d+h$ on the day d changes in quantity on loan. We obtain buy and sell volume from the WRDS Intraday Indicator database. Trading volume and quantity on loan are scaled by the shares outstanding. The y-axis represents a change in the percentage of the scaled dollar trading volume associated with a one percentage point change in the scaled quantity on loan. The vertical dotted line indicates the settlement date at day $d = 0$. The orange solid line denotes the trade date, which occurs on day $d = -3$ in Panel A and day $d = -2$ in Panel B. Panel A is for stocks up to Sep 4, 2017, and Panel B is for stocks after Sep 5, 2017. Our sample is restricted to bond issuers with actively lent bonds.

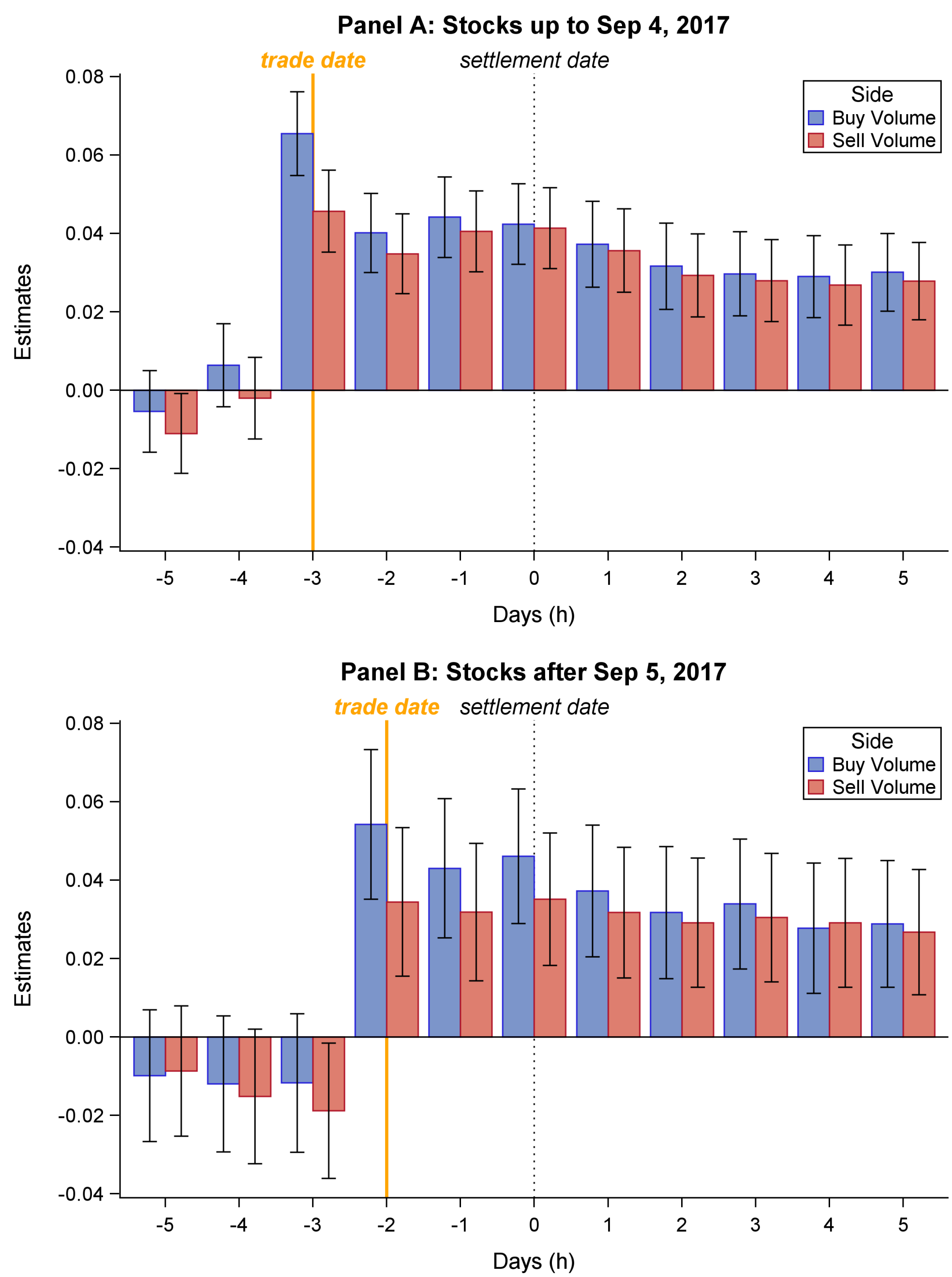
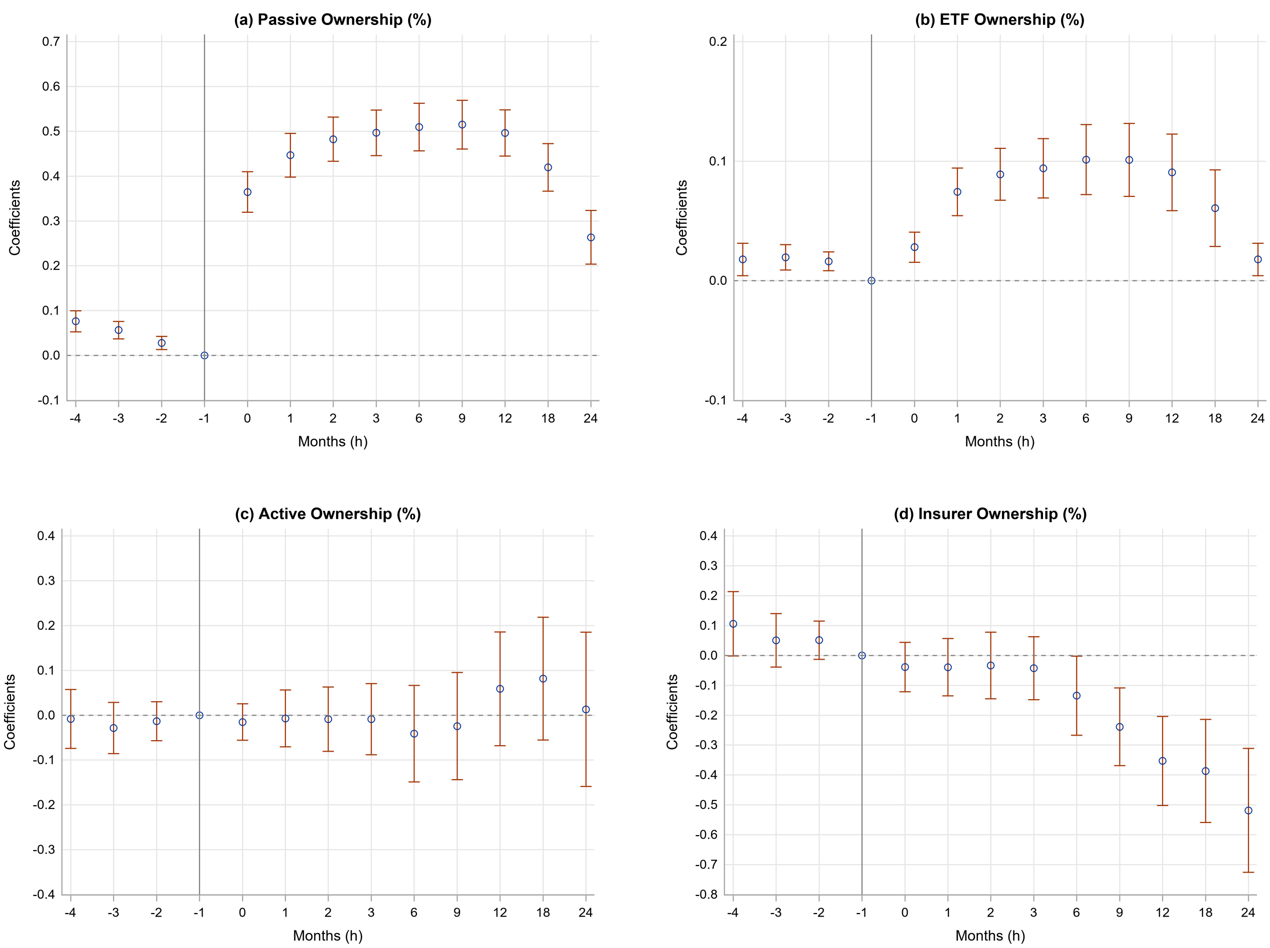


Figure A2: Investor Ownership and Bond Lending around Maturity Cutoffs

The figure plots the slope coefficients β^h from the following regression for $h \in [-4, 24]$

$$\Delta Outcome_i^{t-1 \to t+h} = \beta^h Switch_{i,t} + Controls_{i,t-1} + \alpha_t + \gamma_i + \varepsilon_{i,t}^h,$$

where $\Delta Outcome_i^{t-1 \to t+h}$ is the change of investor ownership and lending variables for bond i from $t-1$ to $t+h$. $Switch_{i,t}$ is an indicator variable equal to one if bond i crosses any one of the maturity cutoffs (i.e., 10 years, 5 years, and 3 years) in month t, and 0 otherwise. Thus, the y-axis represents the change of outcome variables relative to the pre-crossing level after a bond crosses the maturity cutoffs. Control variables include the log of the amount outstanding, credit rating, time to maturity, and the percentage of zero trading days. Each regression includes bond and year-month fixed effects. Error bars represent the two-standard-error confidence intervals, where standard errors are clustered at both the bond and year-month levels.



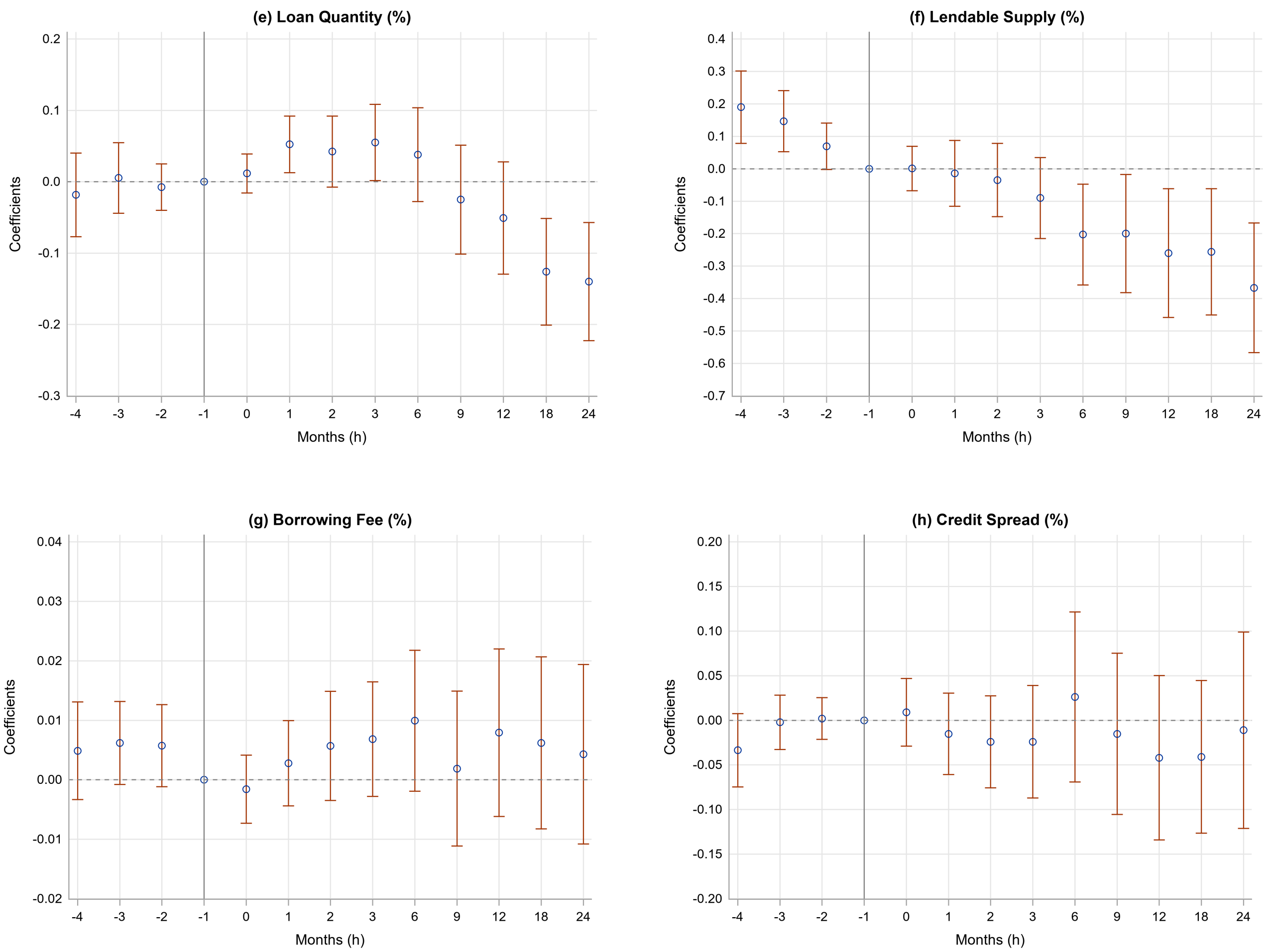
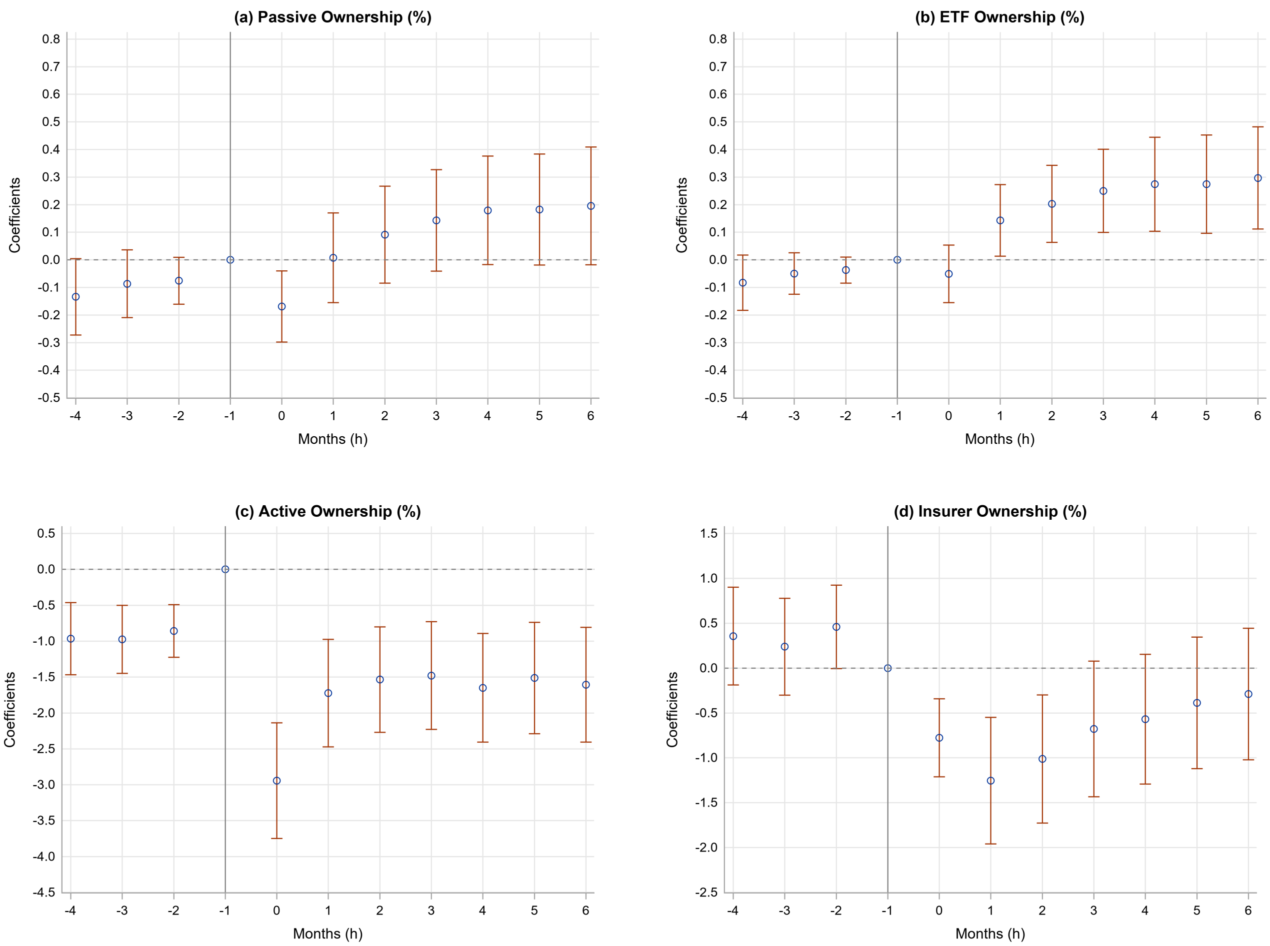

(e) Loan Quantity (%)
Coefficients
Months (h)
(f) Lendable Supply (%)
Coefficients
Months (h)
(g) Borrowing Fee (%)
Coefficients
Months (h)
(h) Credit Spread (%)
Coefficients
Months (h)

Figure A3: Passive Ownership and Bond Lending around Outstanding Amount Increases

The figure plots the slope coefficients β^h from the following regression for $h \in [-4, 6]$

$$\Delta Outcome_i^{t-1\to t+h} = \beta^h Increase_{i,t} + Controls_{i,t-1} + \alpha_t + \gamma_i + \varepsilon_{i,t}^h,$$

where $\Delta Outcome_i^{t-1\to t+h}$ is the change of passive fund ownership and lending variables for bond i from $t-1$ to $t+h$. $Increase_{i,t}$ is an indicator that equals one if the outstanding amount of bond i increases in month t, and zero otherwise. Control variables include the log of the amount outstanding, credit rating, time to maturity, and the percentage of zero trading days. Each regression includes bond and year-month fixed effects. Error bars represent the two-standard-error confidence intervals, where standard errors are clustered at both the bond and year-month levels.



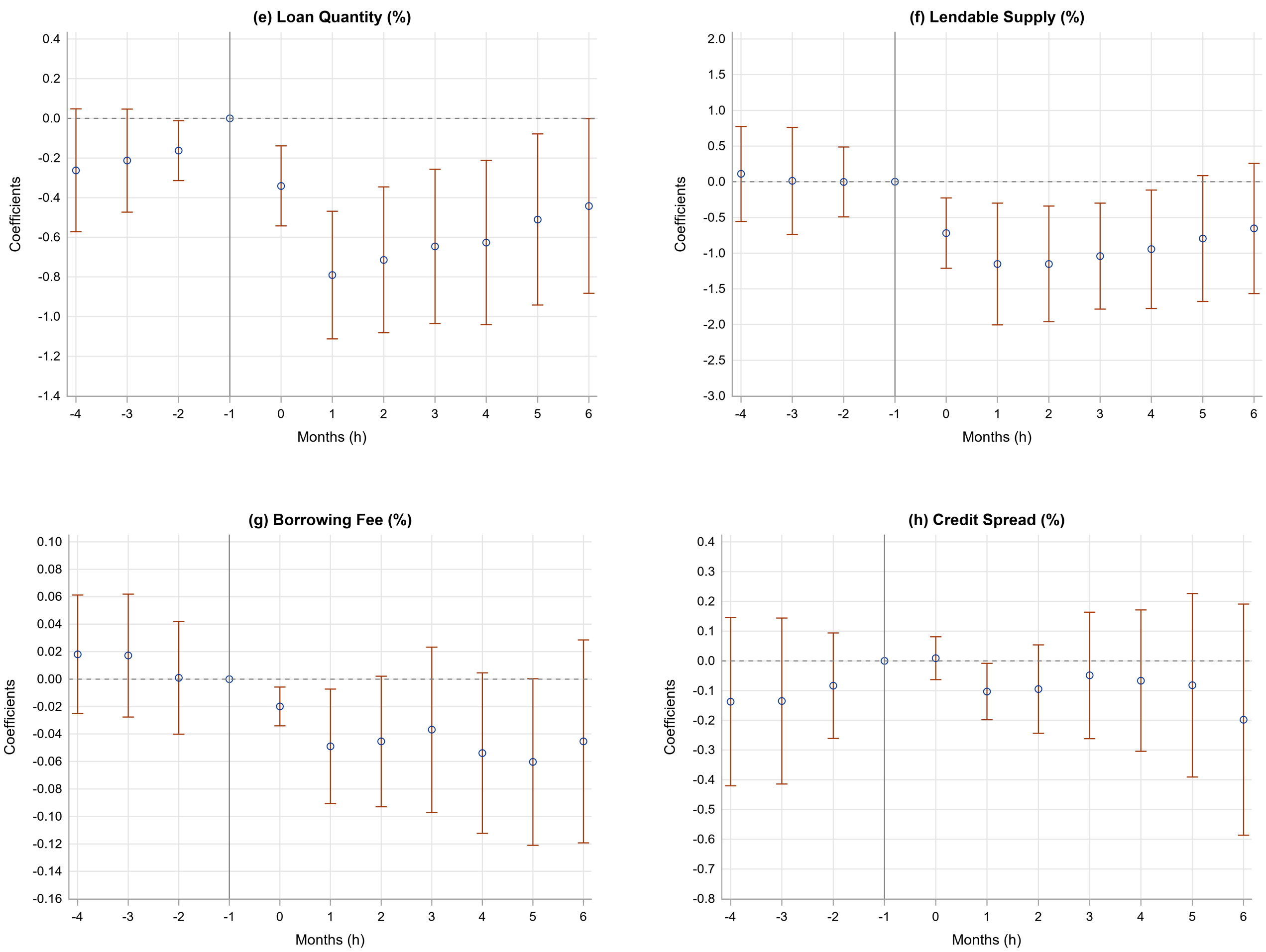

(e) Loan Quantity (%)
Coefficients
Months (h)
(f) Lendable Supply (%)
Coefficients
Months (h)
(g) Borrowing Fee (%)
Coefficients
Months (h)
(h) Credit Spread (%)
Coefficients
Months (h)

Table A1: Descriptive Statistics of Daily and Monthly Panels

This table reports the summary statistics of the main variables at the bond-day and bond-month levels. The combined bond data are from Mergent FISD, TRACE, Markit, and eMAXX. The definitions of common bond characteristics are the same: *Amount* is the amount of bonds outstanding in millions of dollars; *Rating* is the numerical rating score, where 1 refers to a AAA rating by S&P and Aaa by Moody's, 21 refers to a C rating for both S&P and Moody's; *Age* is the age of a bond in years; *Maturity* is the time to maturity in years. Panel A shows the descriptive statistics of the sample used in Table 6, which includes 11,411 bonds across 1,259 firms from September 13, 2006 to December 30, 2022. dQ is the changes in quantity on loan scaled by the amount outstanding. The explanatory variables includes the daily return r_t, the average of the past 5 days' returns $r_{t-5,t-1}$, the turnover rate of customer buy ($Turn^{Buy}$) and sell ($Turn^{Buy}$) on day t and averages from $t-5, t-1$, half spreads for buy trades (h^{buy}) and sell trades (h^{sell}) averaged from day $t-5$ to $t-1$, and standard deviation of returns over the last five days $\sigma(r)_{t-5,t-1}$. Panel B shows the summary statistics of the sample used in Figure A2, which includes 9,668 bonds across 1,181 firms from February 2007 to December 2022. We compute monthly averages of daily bond lending variables for each bond unless mentioned otherwise. *Loan Quantity* is defined as the quantity on loan from Markit divided by amount outstanding. *Lendable Supply* is the active lendable quantity from Markit divided by amount outstanding. *Utilization Rate* is defined as the ratio of the quantity on loan to the lendable quantity. *Loan Tenure* is the average number of days that bond loans have been open. *Borrowing Fee* is the buy-side fee paid by the ultimate borrower ("*IndicativeFee*" in Markit). *Rebate Rate* is the "*IndicativeRebate*" in Markit. *DCBS* is the cost of borrow score provided by Markit, ranging from 1 (low cost) to 10 (high cost). *Fee Risk* is the natural logarithm of the standard deviation of borrowing fees within a month. *Recall Risk* is the natural logarithm of the standard deviation of utilization rate in a given month. *Lender Concentration* is a Herfindahl-Index-like measure at the bond level provided by Markit that describes the concentration of lenders. *Special1* is a dummy variable that equals one if at least one day with borrowing fee exceeds or equal to 1% in a month, and zero otherwise. *Special2* is a dummy variable that equals one in a given month if its borrowing fee is in the top decile of the fee distribution across bonds, and zero otherwise. *Credit Spread* is calculated as the average difference between the corporate bond yield and the yield of a matching Treasury bond within a month. h^{Buy} (h^{Sell}) is the monthly average of the log price differences between customer buy (sell) trades and inter-dealer trades following O'Hara and Zhou (2021). We match customer buy (sell) trades with the closest in time inter-dealer trade over the past five trading days with replacement. *Total Ownership* is the share of bonds held by all the investors in eMAXX. *Passive Fund*, *Active Fund*, and *Insurer* represent factions of bond par amount held by passive mutual funds, actively managed mutual funds, and insurance firms, respectively. We use the investor type classification code provided by eMAXX to group investors into insurance firms and mutual funds. We manually link eMAXX to the CRSP Mutual Fund database by matching funds based on their names and use index fund and ETF flags (as well as search keywords in fund names) to further decompose mutual fund ownership into *Passive Fund* (i.e., index funds and ETFs) and *Active Fund*. To mitigate the influence of outliers, we winsorize variables at 1% and 99% for each period.

Variable	Mean	SD	P1	P25	P50	P75	P99	Obs
Panel A: Daily Bond Panel								
dQ	−0.002	0.198	−0.719	−0.011	0.000	0.007	0.732	10,693,324
$dQ_{t-5,t-1}$	−0.001	0.093	−0.313	−0.016	0.000	0.013	0.322	10,693,324
r_t	0.016	0.765	−1.732	−0.143	0.017	0.181	1.759	10,693,324
$r_{t-5,t-1}$	0.017	0.351	−0.847	−0.056	0.016	0.099	0.838	10,693,324
$\sigma(r)$	0.421	0.645	0.018	0.138	0.274	0.513	2.399	10,693,324
Amount ($ mil)	875	640	250	500	700	1,000	3,250	10,693,324
Rating	8.464	3.205	1.000	6.000	8.000	10.000	17.000	10,693,324
Age (years)	4.003	3.476	0.173	1.521	3.115	5.540	17.674	10,693,324
Maturity (years)	8.667	7.824	1.151	3.515	5.926	9.219	29.425	10,693,324
$Turn^{Buy}$	0.189	0.442	0.000	0.001	0.026	0.145	2.320	10,693,324
$Turn^{Sell}$	0.117	0.330	0.000	0.000	0.004	0.049	1.818	10,693,324
$Turn^{Buy}_{t-5,t-1}$	0.208	0.297	0.002	0.033	0.099	0.255	1.468	10,693,324
$Turn^{Sell}_{t-5,t-1}$	0.133	0.215	0.000	0.011	0.046	0.161	1.068	10,693,324
$h^{Buy}_{t-5,t-1}$	0.390	0.770	−1.088	0.058	0.226	0.570	2.925	10,693,324
$h^{Sell}_{t-5,t-1}$	0.357	0.804	−1.190	0.048	0.211	0.520	3.013	10,693,324
Panel B: Monthly Bond Panel								
Loan Quantity (%)	1.555	2.599	0.008	0.192	0.593	1.691	12.376	311,378
Lendable Supply (%)	24.767	9.904	4.738	18.134	23.834	30.180	54.620	311,378
Utilization Rate (%)	6.879	11.950	0.035	0.850	2.624	7.281	66.203	311,378
Loan Tenure (days)	81.966	91.301	4.238	25.427	51.259	101.851	485.169	311,378
Borrowing Fee (%)	0.402	0.323	0.162	0.287	0.375	0.392	2.085	311,378
Rebate Rate (%)	0.495	1.214	−1.412	−0.249	−0.105	1.203	4.901	311,378
DCBS	1.035	0.207	1.000	1.000	1.000	1.000	2.000	311,378
Fee Risk	−3.016	0.959	−6.220	−3.552	−2.985	−2.645	−0.363	221,285
Recall Risk	−0.971	1.879	−8.357	−1.800	−0.682	0.233	2.106	307,892
Lender Concentration	0.451	0.301	0.000	0.264	0.444	0.659	1.000	311,378
$Turn^{Buy}$ *(%)*	0.144	0.170	0.000	0.034	0.090	0.189	0.846	311,378
$Turn^{Sell}$ *(%)*	0.095	0.119	0.000	0.018	0.055	0.126	0.586	311,378
$h^{Buy}(\%)$	0.334	0.917	−1.631	0.013	0.201	0.540	3.258	287,492
$h^{Sell}(\%)$	0.283	0.989	−2.069	−0.026	0.188	0.510	3.353	287,540
Total Ownership (%)	46.599	15.784	13.432	35.302	46.250	57.326	84.883	311,378
Insurer (%)	32.629	18.584	1.588	17.356	31.005	45.673	78.953	311,378
Passive Fund (%)	3.727	4.648	0.000	1.099	2.837	5.044	23.387	311,378
Active Fund (%)	9.938	11.040	0.000	2.197	5.914	13.479	48.597	311,378
Amount ($ mil)	788	608	150	400	563	1,000	3,000	311,378
Rating	8.195	2.946	2.000	6.000	8.000	9.500	16.500	311,378
Age (years)	4.476	3.656	0.962	1.956	3.488	5.633	19.115	311,378
Maturity (years)	11.313	8.537	3.082	5.110	7.384	18.345	29.099	311,378

Table A2: Sample List of Passive Funds in eMAXX

This table lists the top 25 passive funds in eMAXX as of 2022 in terms of the number of distinct corporate bonds held. We select passive funds based on index fund and ETF/ETN flags from the CRSP Mutual Fund database after manually matching eMAXX FUNDID to funds in CRSP by fund names. We further identify passive funds by searching keywords in fund names related to ETFs/index funds/bond index providers. We restrict corporate bond holdings to dollar bonds issued by US firms that have trade records in the Enhanced TRACE database.

Obs	FUNDID	FUNDNAME
1	170047	iShares Core Total USD Bond Market ETF
2	126137	iShares Broad USD Investment Grade Corporate Bond ETF
3	81464	iShares Core US Aggregate Bond ETF
4	189653	Vanguard USD Corporate Bond UCITS ETF
5	29844	Vanguard Total Bond Market Index Fund
6	136739	Vanguard Total Bond Market II Index Fund
7	156760	Schwab US Aggregate Bond ETF
8	29969	Vanguard Balanced Index Fund
9	191887	Schwab US Aggregate Bond Index Fund
10	142023	TIAACREF Bond Index Fund
11	29242	Vanguard Total Bond Market Index Portfolio
12	44906	U.S. Total Bond Index Master Portfolio
13	136745	SPDR Barclays Intermediate Term Corporate Bond ETF
14	126141	iShares Intermediate Government/Credit Bond ETF
15	153656	SPDR Barclays Issuer Scored Corporate Bond ETF
16	133663	LVIP SSgA Bond Index Fund
17	191555	iShares ESG Aware USD Corporate Bond ETF
18	126144	iShares Government/Credit Bond ETF
19	191556	iShares ESG Aware US Aggregate Bond ETF
20	195989	Vanguard Global Aggregate Bond UCITS ETF
21	174293	State Street Aggregate Bond Index Portfolio
22	144043	iShares 10+ Year Investment Grade Corporate Bond ETF
23	32593	EQ/Core Bond Index Portfolio
24	136743	SPDR Barclays Long Term Corporate Bond ETF
25	123766	iShares 1-3 Year Credit Bond ETF

Table A3: Passive Ownership Decomposition and Bond Market Outcomes

This table presents the results from regressing bond market outcomes on ownership of institutional investors. The dependent variables are quarterly averages of credit spread and half spreads on customer buy and sell trades (h^{Buy} and h^{Sell}). *OIMB* is order imbalance, defined as the quarterly sum of customer buy volume minus the quarterly sum of customer sell volume scaled by the bond amount outstanding. Net order imbalance (*Net OIMB*) is defined as the order imbalance minus changes in index fund ownership. We decompose *Passive Fund* into ETF and index funds. *Active Fund*, and *Insurer* represent fractions of bond par amount held by actively managed mutual funds and insurance firms, respectively. Bond control variables include the log value of amount outstanding, rating, time to maturity, and the fraction of zero-trading days. The variable definitions can be found in Table 1. We include bond and firm × quarter effects in each regression. We double cluster standard errors by firm and year-quarter, and t-statistics are in parentheses. *, **, and *** indicate the significance at the 10%, 5%, and 1% levels, respectively. The sample period is from 2006 Q3 to 2022 Q4.

	Credit Spread (1)	OIMB (2)	Net OIMB (3)	h^{Buy} (4)	h^{Sell} (5)
Panel A: Passive Funds Only					
ETF	−0.0660***	−0.0762***	−0.0477***	−0.0014	−0.0091**
	(−8.36)	(−6.54)	(−3.87)	(−0.32)	(−2.60)
Index Fund	−0.0310***	0.0145*	−0.1267***	0.0121***	−0.0142***
	(−8.56)	(1.98)	(−12.36)	(3.91)	(−3.90)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Firm × Qtr FE	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	277,403	281,886	281,413	270,622	269,304
Adjusted R^2	0.953	0.039	0.043	0.256	0.272
Panel B: Passive Funds Plus Other Investors					
ETF	−0.0632***	−0.0759***	−0.0463***	0.0004	−0.0086**
	(−8.14)	(−6.34)	(−3.65)	(0.08)	(−2.50)
Index Fund	−0.0304***	0.0189**	−0.1233***	0.0123***	−0.0137***
	(−8.45)	(2.45)	(−11.64)	(3.98)	(−3.79)
Active Fund	−0.0015	0.0222***	0.0154***	−0.0020***	0.0017*
	(−0.96)	(10.42)	(6.12)	(−2.74)	(1.89)
Insurer	0.0061***	0.0101***	0.0097***	0.0033***	0.0017***
	(7.90)	(5.81)	(5.61)	(6.58)	(3.24)
Bond Controls	Yes	Yes	Yes	Yes	Yes
Firm × Qtr FE	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes
Observations	277,403	281,886	281,413	270,622	269,304
Adjusted R^2	0.953	0.041	0.044	0.256	0.272

Table A4: Investor Ownership and Bond Lending Activities around Maturity Cutoffs

The table reports the slope coefficients β^h from the following regression for $h \in [-4, 24]$

$$\Delta Outcome_i^{t-1 \to t+h} = \beta^h Switch_{i,t} + Controls_{i,t-1} + \alpha_t + \gamma_i + \varepsilon_{i,t}^h,$$

where $\Delta Outcome_i^{t-1 \to t+h}$ is the change of investor ownership and lending variables for bond i from $t-1$ to $t+h$. We require the outcome variable changes to be available for all h. $Switch_{i,t}$ is an indicator variable equal to one if bond i crosses any one of the maturity cutoffs (i.e., 10 years, 5 years, and 3 years) in month t, and 0 otherwise. Control variables include the log of the amount outstanding, credit rating, time to maturity, and the percentage of zero trading days. Each regression includes bond and year-month fixed effects. We double cluster standard errors by firm and year-month, and t-statistics are in parentheses. *, **, and *** indicate the significance at the 10%, 5%, and 1% levels, respectively. The sample comprises 318,279 bond-month observations for 9,754 corporate bonds issued by 1,184 firms, covering the period from February 2007 to December 2022.

h	−4	−3	−2	0	1	2	3	6	9	12	18	24
$\Delta Passive$	0.076***	0.056***	0.028***	0.365***	0.447***	0.482***	0.497***	0.509***	0.515***	0.496***	0.420***	0.264***
	(6.48)	(5.84)	(3.81)	(16.07)	(18.36)	(19.57)	(19.57)	(19.21)	(19.01)	(19.31)	(15.80)	(8.81)
ΔETF	0.018***	0.020***	0.016***	0.028***	0.074***	0.089***	0.094***	0.101***	0.101***	0.091***	0.061***	0.018***
	(2.63)	(3.69)	(4.12)	(4.47)	(7.46)	(8.18)	(7.59)	(6.93)	(6.64)	(5.66)	(3.79)	(2.63)
$\Delta Active$	−0.008	−0.029	−0.013	−0.015	−0.007	−0.009	−0.009	−0.041	−0.024	0.059	0.082	0.013
	(−0.25)	(−1.01)	(−0.62)	(−0.75)	(−0.23)	(−0.25)	(−0.22)	(−0.77)	(−0.41)	(0.93)	(1.19)	(0.15)
$\Delta Insurer$	0.106*	0.051	0.051	−0.039	−0.039	−0.034	−0.043	−0.135**	−0.239***	−0.353***	−0.386***	−0.518***
	(1.96)	(1.13)	(1.60)	(−0.95)	(−0.82)	(−0.61)	(−0.81)	(−2.03)	(−3.68)	(−4.74)	(−4.48)	(−5.00)
$\Delta Quantity$	−0.018	0.005	−0.007	0.012	0.052***	0.042*	0.055**	0.038	−0.025	−0.051	−0.126***	−0.140***
	(−0.63)	(0.22)	(−0.45)	(0.86)	(2.64)	(1.70)	(2.07)	(1.16)	(−0.66)	(−1.29)	(−3.38)	(−3.38)
$\Delta Supply$	0.190***	0.147***	0.069*	0.001	−0.014	−0.035	−0.090	−0.203***	−0.200**	−0.260***	−0.256***	−0.367***
	(3.39)	(3.11)	(1.94)	(0.03)	(−0.28)	(−0.62)	(−1.44)	(−2.61)	(−2.20)	(−2.62)	(−2.63)	(−3.67)
ΔFee	0.005	0.006*	0.006*	−0.002	0.003	0.006	0.007	0.010*	0.002	0.008	0.006	0.004
	(1.19)	(1.78)	(1.67)	(−0.55)	(0.78)	(1.24)	(1.42)	(1.68)	(0.29)	(1.13)	(0.86)	(0.57)
$\Delta Spread$	−0.033	−0.002	0.002	0.009	−0.015	−0.024	−0.024	0.026	−0.015	−0.042	−0.041	−0.011
	(−1.63)	(−0.14)	(0.17)	(0.47)	(−0.67)	(−0.94)	(−0.76)	(0.55)	(−0.34)	(−0.91)	(−0.96)	(−0.20)

Table A5: Passive Ownership and Bond Lending Activities around Outstanding Amount Increases

The table reports the slope coefficients β^h from the following regression for $h \in [-4, 6]$

$$\Delta Outcome_i^{t-1 \to t+h} = \beta^h Increase_{i,t} + Controls_{i,t-1} + \alpha_t + \gamma_i + \varepsilon_{i,t}^h,$$

where $\Delta Outcome_i^{t-1 \to t+h}$ is the change of passive or ETF ownership and lending variables for bond i from $t-1$ to $t+h$. We require the outcome variable changes to be available for all h. $Increase_{i,t}$ is an indicator that equals one if the outstanding amount of bond i increases in month t, and zero otherwise. Control variables include the log of the amount outstanding, credit rating, time to maturity, and the percentage of zero trading days. Each regression includes bond and year-month fixed effects. We double cluster standard errors by firm and year-month, and t-statistics are in parentheses. *, **, and *** indicate the significance at the 10%, 5%, and 1% levels, respectively. The sample comprises 32,447 bond-month observations for 761 corporate bonds issued by 422 firms, covering the period from February 2007 to June 2022.

h	−4	−3	−2	0	1	2	3	4	5	6
$\Delta Passive$	−0.134*	−0.087	−0.076*	−0.169***	0.008	0.091	0.143	0.179*	0.183*	0.196*
	(−1.94)	(−1.41)	(−1.78)	(−2.62)	(0.09)	(1.04)	(1.55)	(1.82)	(1.82)	(1.83)
ΔETF	−0.083*	−0.050	−0.037	−0.051	0.143**	0.203***	0.250***	0.274***	0.275***	0.297***
	(−1.66)	(−1.32)	(−1.57)	(−0.98)	(2.20)	(2.91)	(3.32)	(3.22)	(3.08)	(3.21)
$\Delta Active$	−0.966***	−0.975***	−0.857***	−2.943***	−1.724***	−1.534***	−1.479***	−1.650***	−1.513***	−1.606***
	(−3.85)	(−4.12)	(−4.69)	(−7.30)	(−4.60)	(−4.18)	(−3.94)	(−4.36)	(−3.90)	(−4.02)
$\Delta Insurer$	0.356	0.238	0.459*	−0.777***	−1.254***	−1.013***	−0.678*	−0.569	−0.387	−0.289
	(1.31)	(0.88)	(1.97)	(−3.58)	(−3.56)	(−2.84)	(−1.79)	(−1.58)	(−1.06)	(−0.79)
$\Delta Quantity$	−0.263*	−0.213	−0.163**	−0.341***	−0.790***	−0.714***	−0.646***	−0.627***	−0.510**	−0.442**
	(−1.70)	(−1.64)	(−2.16)	(−3.38)	(−4.91)	(−3.88)	(−3.32)	(−3.03)	(−2.36)	(−2.01)
$\Delta Supply$	0.110	0.012	−0.003	−0.720***	−1.153***	−1.151***	−1.042***	−0.945**	−0.794*	−0.654
	(0.33)	(0.03)	(−0.01)	(−2.92)	(−2.70)	(−2.84)	(−2.81)	(−2.28)	(−1.80)	(−1.44)
ΔFee	0.018	0.017	0.001	−0.020***	−0.049**	−0.045*	−0.037	−0.054*	−0.060**	−0.045
	(0.84)	(0.77)	(0.05)	(−2.80)	(−2.34)	(−1.91)	(−1.23)	(−1.84)	(−1.99)	(−1.23)
$\Delta Spread$	−0.137	−0.135	−0.083	0.009	−0.103**	−0.095	−0.049	−0.067	−0.082	−0.198
	(−0.97)	(−0.97)	(−0.94)	(0.25)	(−2.19)	(−1.28)	(−0.46)	(−0.56)	(−0.53)	(−1.02)