Managing Regulatory Pressure: Bank Regulation and its Impact on Corporate Bond Intermediation*

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Abstract

We study the cross-sectional effects of Basel regulations on dealer intermediation in the U.S. corporate bond market. Using intra-quarter variation in the intensity of Basel regulatory requirements, we document pronounced inventory contractions when regulatory pressure rises near quarter-ends. While balance sheet space becomes the dominant constraint with the introduction of the leverage ratio, risk-based capital requirements constrain corporate bond intermediation already before. This has important implications for bond intermediation in the cross-section of dealers: In contrast to their behavior in short-term money markets (Correa, Du, and Liao, 2022), U.S. bank-affiliated dealers do not absorb regulatory selling pressure in corporate bonds. Instead, bank-affiliated dealers—irrespective of jurisdiction—direct their selling pressure primarily to nonbank financial intermediaries. In doing so, they fall back on their customer networks to offload investment grade bonds and their nonbank dealer networks to dispose of high-yield bonds. In balance sheet intensive trades, we document regulatory shadow costs of up to 20%. Our findings have implications for the design of future regulation of both bank and non-bank financial intermediaries.

JEL classification: G12, G21, G22, G23, G24

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1 Introduction

In decentralized bond markets, dealer intermediation is essential yet fragile. Dealers smooth temporary order flow imbalances, but they neither have the capacity nor the inclination to assume contrarian risks. By increasing the costs of low margin balance sheet intensive trades, banking reforms introduced in the aftermath of the global financial crisis appear to have curtailed dealers' capacities for bond intermediation in the aggregate. In fact, not only have bank-affiliated dealers reduced their capital commitment (Bessembinder et al., 2018), but the cost of immediacy has increased (Bao, O'Hara, and Zhou, 2018; Dick-Nielsen and Rossi, 2019) and liquidity conditions strain quickly whenever the market faces increased selling pressure (Kargar et al., 2021; O'Hara and Zhou, 2021).

These concerns have led regulators to call for a better understanding of the interactions between bank regulation and bond intermediation (BoE, 2021). In a market where dealers should increasingly be understood as fair-weather liquidity providers (Treynor, 1987; Levine, 2015), it is important to examine how different regulations affect bond intermediation in the cross-section, and to determine the ultimate effect of these regulations on the cost of immediacy. To date, however, relatively little is known about the cross-sectional effects of regulation, let alone the associated pass-through of regulatory costs to customers. In this paper, we address these questions by studying how corporate bond dealers manage their regulatory pressure from different Basel requirements.

For empirical identification, we zoom in on quarter-end periods. This is because the most relevant Basel reporting dates fall on the last trading day of a given quarter, leading to intra-quarter variation in the intensity of dealers' regulatory pressure. Moreover, jurisdictional differences in the implementation of bank regulation allow us to exploit cross-sectional variation in the degree and timing at which specific constraints tighten. While U.S. banks report the Basel III leverage ratio based on quarter averages, European and Japanese banks report the leverage ratio based on quarter-end snapshots, thus creating different incentives for balance sheet management in the days leading up to reporting dates.[1] In combination with our ability to distinguish dealers' bank-affiliation status, this allows us to gain novel insights into how specific dealer groups adjust their bond intermediation in response to regulations, to what extent regulatory costs are passed through to customers, and whether heterogeneous regulation impacts the distribution of intermediation rents. What is more, we can study how bank-affiliated dealers fall back on other (nonbank) financial intermediaries to manage their regulatory exposure at quarter-ends.

To address these questions, we make use of the regulatory version of the Trade Reporting and Compliance Engine (TRACE) data. The regulatory TRACE data contains detailed information on all secondary market bond transactions, including dealer identities. Using these identities, we separate dealers that are subject to banking regulation (bank-affiliated dealers) from dealers that are not directly affected by regulation (nonbank dealers). Next, by leveraging on information on a dealer's jurisdiction of incorporation, we further differentiate U.S. bank-affiliated dealers from European and Japanese bank-affiliated dealers. In combination with a long time series —data from 2002 to 2019—this allows us to study bond intermediation in response to different regulations both across dealer groups and regulatory periods. To better understand the interactions between dealers and customers, we complement the TRACE data with data on insurer trades from the National Association of Insurance Companies (NAIC). This allows us to examine customer liquidity supply around reporting dates for the largest investor group in the corporate bond market.

Our analysis reveals at least four novel findings: First, consistent with the idea that dealers optimize regulatory metrics prior to reporting dates, we find that bank-affiliated dealers significantly contract inventories by selling bonds on net at quarter-ends. A back-of-the-envelope calculation suggests that these contractions are economically sizeable, representing almost 12% of the total corporate bond inventories of the Federal Reserve's

[1] A growing body of literature studies the effects of banking regulation on dealer behavior in money markets, documenting significant but heterogeneous quarter-end effects between U.S. and foreign bank dealers that can be linked to jurisdictional differences in reporting requirements (see for example, Munyan (2017); Du, Tepper, and Verdelhan (2018); Cenedese, Della Corte, and Wang (2021); Ranaldo, Schaffner, and Vasios (2021); Correa, Du, and Liao (2022); Wallen (2022)).

Primary Dealers during the leverage ratio period. Importantly, strong empirical evidence for inventory contractions among bank-affiliated dealers combined with little evidence among nonbank dealers —both of which rely on short-term funding to finance inventories —suggests that the documented inventory contractions are not merely an artefact from spillovers due to quarter-end dislocations in the repo market.

Second, to contrast regulatory periods, we compare quarter-end effects during the pre- and post-crisis periods—characterized exclusively by risk-weighted capital requirements—with quarter-end effects in the leverage ratio period—characterized by both risk-weighted and non-risk-weighted capital requirements.[2] In the pre- and post-crisis periods, bank-affiliated dealers sell bonds on net right before regulatory reporting dates, suggesting that risk-based regulation constrained bank-affiliated dealers well before the introduction of the leverage ratio. However, once the leverage ratio increases the cost of dealer balance sheet space, quarter-end contractions become disproportionately larger and longer-lived for all bank-affiliated dealers, irrespective of their regulatory jurisdiction. In line with the idea that a disregard of asset risk under the leverage ratio incentivizes banks to primarily sell lower-yielding and more liquid assets prior to reporting dates, we document that the increase in inventory contractions is primarily driven by liquid investment grade bonds. Further, and consistent with the idea that the leverage ratio affects bank-affiliated dealers heterogeneously depending on their regulatory jurisdiction, we also document that European and Japanese bank-affiliated dealers are more constrained than their U.S. counterparts, contracting inventories almost twice as much. This highlights a novel mechanism: While in short-term money markets U.S. banks take advantage of their lower balance sheet costs at quarter-ends to substitute a reduction of liquidity supply by their European counterparts (Correa, Du, and Liao, 2022), they are not able or willing to extend their balance sheets and absorb regulatory selling pressure from foreign counterparts in the corporate bond market.

[2] We define the pre- and post-crisis period from July 2002 to December 2006 and May 2009 to December 2014. The leverage period is defined from January 2015 to December 2019 (the end of our sample).

Third, we document the important role of nonbank financial intermediaries—both customers and nonbank dealers—when bank-affiliated dealers manage their regulatory exposure.[3] Dealers' counterparties can be segmented along bond risk brackets: Customers absorb the largest share of dealers' selling pressure ($\geq 70\%$), but only in investment grade bonds. In fact, we show that once the leverage ratio is phased in, property and casualty (P&C) insurers begin to supply liquidity to bank-affiliated relationship dealers in a way that helps absorb their regulatory exposure. We further document that bank-affiliated dealers apply price discounts of around 3 to 4% in exchange for customers' quarter-end liquidity support. For high-yield bonds, on the other hand, bank-affiliated dealers fall back on their nonbank dealer networks. The latter highlights an unintended consequence of the Basel toolkit: Regulations that were implemented to limit the build-up of excessive risk and leverage in the banking sector (BIS, 2014), periodically incentivize banks to shift the riskiest corporate bonds to some of the least regulated intermediaries.

Fourth, we capture the impact of the leverage ratio on dealers' willingness to intermediate corporate bonds in a principal capacity and quantify the pass-through of regulatory costs. While European and Japanese bank-affiliated dealers reduce the share of balance sheet intensive principal trades at quarter-ends, U.S. bank-affiliated dealers do not exhibit this type of behavior. This is consistent with the idea that heterogeneous reporting requirements are less restrictive for U.S. bank-affiliated dealers. What is more, we document a sizeable pass-through of regulatory costs to balance sheet intensive principal trades: For customers requesting immediacy at quarter-ends, transaction costs increase significantly. These markups are concentrated in large trade sizes, consistent with the idea that larger trades are more costly to offset, given that order splitting exposes dealers to search costs, and thus expands balance sheets for extended periods. In addition, and in line with the importance of risk-weighted regulation, we find higher markups for high-yield bonds within a given size bracket. These markups are economically meaningful, representing an

[3] Customers are typically large institutional investors such as insurance companies, bond mutual funds, and pension funds. Nonbank dealers are typically unregulated broker-dealer firms and hedge funds.

increase of up to 20% relative to non-quarter-end periods. Taken together, our results provide suggestive evidence that the heterogeneous implementation of regulation across jurisdictions affects the distribution of intermediation rents. While U.S. bank-affiliated dealers appear to be facing lower regulatory constraints than their European and Japanese counterparts, we still document similarly sized markups close to quarter-ends. This suggests that U.S. bank-affiliated dealers temporarily operate in a less competitive market environment, which allows them to exert market power by pricing large customer trades above marginal costs.

Our findings improve our understanding of how specific Basel regulations affect intermediation in over-the-counter (OTC) corporate bond markets. A growing literature studies how financial regulation, in particular post-crisis banking reforms, impact OTC markets. Du, Tepper, and Verdelhan (2018) relate deviations from the covered interest rate parity (CIP) to dealer banks' increased balance sheet costs. Cenedese, Della Corte, and Wang (2021) link leverage ratio requirements to dealer banks' increased funding costs and CIP deviations. Munyan (2017) and Anbil and Senyuz (2018) show that in the U.S. tri-party repo market, quarter-end reductions in net repo supply are primarily driven by foreign banks, aiming to improve their regulatory metrics. Correa, Du, and Liao (2022) show that U.S. globally systemically important banks (G-SIBs) use their excess reserve buffers to lend during quarter-end dislocations in repo and FX swap markets, thus acting as effective "*lenders-of-second-to-last-resort*". In recent work focusing on the COVID-19 period, Favara, Infante, and Rezende (2022) show that due to the leverage ratio, banks' balance sheet size reduces their incentives to participate in Treasury market intermediation.

We add to this literature along three dimensions: First, we show that quarter-end effects extend beyond markets for risk-free short-term funding instruments, thus demonstrating that bank regulation periodically creates trading needs for regulated dealers that lead to meaningful dislocations in one of the world's largest financial markets. Second, compared to money markets, we document important differences in the behavior of U.S.

bank-affiliated dealers. Their incapacity to lean against the wind, when non-U.S. bank-affiliated dealers are relatively more constrained, makes dealer intermediation in the corporate bond market more susceptible to the regulatory pressure at quarter-ends. It further highlights the need to better understand the role of liquidity supplying nonbank financial intermediaries (Anand, Jotikasthira, and Venkataraman, 2021; Choi, Huh, and Seunghun Shin, 2023; O'Hara, Rapp, and Zhou, 2023). Amid considerations to increase bond market resilience FSB (2021), our findings thus contribute both to discussions on overhauling key Basel III metrics (BIS, 2018) and to the debate on the regulation of nonbank financial intermediaries (Carstens, 2021). Lastly, we show that the findings by Favara, Infante, and Rezende (2022) for the Treasury market extend to the corporate bond market, as we document that the leverage ratio curtails bank dealers' ability to intermediate corporate bonds.

Our results also provide new insights into the determinants of liquidity in the corporate bond market. A large body of literature focuses on the impact of post-crisis banking regulation on dealer capital commitment and aggregate liquidity conditions (Adrian, Boyarchenko, and Shachar, 2017; Schultz, 2017; Bessembinder et al., 2018; Trebbi and Xiao, 2019), as well as on the impact of regulation during stress periods (Bao, O'Hara, and Zhou, 2018; Dick-Nielsen and Rossi, 2019). We contribute to this literature by disentangling the impact of both risk-weighted and non-risk-weighted regulations on different dealer groups absent specific stress events (such as index exclusions and bond downgrades). Moreover, our work highlights the impact of heterogeneous regulation on liquidity conditions for dealer sales and purchases and its effects on dealer market power in the corporate bond market (Wallen, 2022). Lastly, we add to a recent discussion on the relationship between trade size and transaction costs in bond markets (Pinter, Wang, and Zou, 2022) by showing that in case of balance sheet intensive trades, transaction cost increases are strongest in large trades, irrespective of client group identity.

Our paper also contributes to the literature on relationship trading and network effects in OTC markets. Existing empirical research primarily focuses on the role and structure of interdealer markets (see for example, Di Maggio, Kermani, and Song (2017); Li and Schürhoff (2019); Goldstein and Hotchkiss (2020); Colliard, Foucault, and Hoffmann (2021); Dick-Nielsen, Poulsen, and Rehman (2022)) or the value of repeat business in customer-dealer trading relationships (see for example, O'Hara, Wang, and Zhou (2018); Hendershott et al. (2020)). In recent theoretical models of network centrality, core dealers' faster execution speed translates into a comparative advantage when carrying inventory, making them less averse to extend their balance sheets (Üslü, 2019). We provide new insights into the role of networks for corporate bond intermediation. In contrast to OTC models that put an emphasis on the core of a network, our findings illustrate that regulated dealers primarily turn to customers—and to a smaller degree to nonbank dealers—to offset their selling pressure. This puts the role of the interdealer market into perspective and highlights the importance of dealers' network composition.

Lastly, our work provides an empirical foundation for theoretical models in which intermediary capital plays an important role (see, for example, He and Krishnamurthy (2013); Adrian, Etula, and Muir (2014); He and Krishnamurthy (2018); He, Khorrami, and Song (2022); Siriwardane, Sunderam, and Wallen (2022)). We contribute to this literature along two dimensions: First, we disentangle the impact of individual constraints, thus informing the specification of an empirical intermediary factor. Second, we highlight the importance of heterogeneously binding constraints across both intermediaries and time. Our results show that bank-affiliated dealers' intermediation behavior changes substantially during the leverage ratio period, thus creating intra-quarter variation in the extent to which intermediary factors should be relevant for corporate bond prices. Furthermore, our results highlight the importance of cross-sectional differences in dealer constraints for asset pricing that can be the result of heterogeneously implemented regulation.

The remainder of this paper proceeds as follows. Section 2 outlines the regulatory settings and derives testable hypotheses. Section 3 sets out the dataset and the sample construction. Section 4 examines dealer inventory provisioning at quarter-ends. Section 5 studies the role of dealers' networks in managing their regulatory exposures and quantifies the impact of regulatory requirements on transaction costs. Section 6 concludes.

2 Institutional Background and Hypotheses

Before we begin our analysis, we review key banking regulations to demonstrate how jurisdictional differences in the implementation of Basel regulation create cross-sectional heterogeneity in the degree and the timing at which dealers experience regulatory pressure. Then, we detail how these regulations constrain bond intermediation across dealer groups. Lastly, we discuss how our empirical strategy leverages on quarter-end periods to estimate the cross-sectional effects of banking regulation.

2.1 Relevant Banking Regulation

In this paper, we distinguish between risk-weighted and non-risk-weighted capital requirements as well as between other banking regulations such as G-SIB surcharges, the Volcker Rule, and liquidity directives. Importantly, these banking regulations fall into different time periods: The pre- and post-crisis period, from July 2002 to December 2006 and May 2009 to December 2014, respectively, have been exclusively characterized by risk-weighted capital requirements. The leverage ratio period, from January 2015 to December 2019 (the end of our sample), has been characterized by the additional implementation of non-risk-weighted capital requirements, G-SIB surcharges, and the Volcker Rule (compare Panel A of Figure 1).[4]

Risk-weighted Capital Requirements: For a bank-affiliated dealer the risk-weighted common equity Tier 1 capital ratio (henceforth: capital ratio) imposes higher capital re-

[4] We follow Bessembinder et al. (2018) in defining both the pre-crisis and the crisis period as well as Du, Tepper, and Verdelhan (2018) in defining the post-crisis period and the leverage ratio period. For details, refer to Table A2. In order to limit the influence of extreme values, we exclude the financial crisis period from our main regressions. For completeness, we include a set of results contrasting quarter-end effects before and during the financial crisis in the appendix.

quirements for holding riskier bonds.[5] Under the Basel I, II, and III standards, all banks have to comply equally with a minimum ratio of Tier 1 equity to total risk-weighted assets.[6] Intermediating a corporate bond in a principal capacity thus affects a bank-affiliated dealer's capital ratio through changes in the balance sheet composition of total risk-weighted assets.[7] Because bank-affiliated dealers have to report the capital ratio as a quarter-end snapshot, irrespective of their jurisdiction of incorporation, the balance sheet cost of intermediating risky bonds increases for all bank-affiliated dealers in the run-up to the regulatory reporting date.[8] Since the mechanism of risk-based Basel standards stayed consistent over time, the capital ratio poses a relevant and homogenous constraint for bank-affiliated dealers over the entire sample period.[9]

Non-risk-weighted Capital Requirements: The Basel III leverage ratio (henceforth: leverage ratio) is a non-risk-weighted capital requirement that mandates banks to maintain a minimum amount of capital against all on- and off-balance sheet exposures, irrespective of risk.[10] Intermediating a corporate bond in a principal capacity affects a bank-affiliated dealer's leverage ratio requirement through its effect on balance sheet size.[11]

[5] The individual bond risk weights are determined based on external ratings as detailed in the Basel III External Credit Risk Assessment Approach (ECRA). For details regarding the mapping between bond ratings and capital charges refer to Table A1.

[6] This ratio was increased from 2% under Basel II to a minimum of 7% (comprised of a minimum CET1 capital requirement of 4.5% and a stress capital buffer (SCB) requirement of at least 2.5 percent) under Basel III and applies the same way across banks (see https://www.federalreserve.gov/publications/large-bank-capital-requirements-20210805.htm).

[7] Figure A.1 in the Appendix illustrates the underlying channels. Taking riskier bonds into inventory, all else equal, increases the total risk-weighted assets and lowers the capital ratio. For simplicity, we assume a passive asset change from cash to bonds to isolate the risk-based effect of bond intermediation on regulatory costs.

[8] For details on the reporting requirements, see https://www.federalreserve.gov/publications/2018-11-supervision-and-regulation-report-appendix-a.htm and Section HC-R in FRB (2020).

[9] The risk weights attached to a given rating class remain stable over the sample period. For details, refer to (BIS, 2016).

[10] For non-U.S. banks, the leverage ratio did not exist prior to the financial crisis and is now at 3%. For U.S. banks, the leverage ratio existed before the crisis but became more stringent following the implementation of the supplementary leverage ratio in 2014 (it is now equal to between 5% and 6% for systemically important financial institutions (Du, Tepper, and Verdelhan, 2018)).

[11] When a corporate bond dealer takes a bond into the inventory, it is typically funded with short-term funding (Macchiavelli and Zhou, 2022). As illustrated in Figure A.1 in the Appendix, taking a bond into

In contrast to the capital ratio, leverage ratio reporting requirements differ across regulatory jurisdictions: While U.S. bank-affiliated dealers report the leverage ratio based on quarter averages, European and Japanese bank-affiliated dealers report the leverage ratio based on quarter-end snapshots. Consequently, U.S. bank-affiliated dealers face lower regulatory costs for balance sheet intensive trades in the days leading up to reporting dates, which gives them a competitive advantage over their relatively more constrained European and Japanese counterparts (compare Panel B of Figure 1 for an overview as to when specific regulations affect different dealer groups). This has important cross-sectional implications for dealers' intermediation capacity, see for example, Correa, Du, and Liao (2022) and Wallen (2022) for heterogeneous quarter-end dynamics the repo and FX swap markets.

However, it is unclear whether the heterogeneity in the leverage ratio constraints should lead to comparable quarter-end dynamics among bank-affiliated dealers in the corporate bond market. Intermediating a corporate bond is notably different from intermediating a FX swap or repo contract in collateralized funding markets.[12] In addition to a different institutional setting, this is because corporate bonds come with a wider range of inventory and regulatory risks: First, corporate bonds are the riskier financial instruments, exposing dealers to higher levels of default, price, and interest rate risk. That is, on top of the capital charges that come with a larger balance sheet size, regulated dealers also incur risk-weighted capital charges while the bond remains on the balance sheet. Second, corporate bonds are much less liquid, have considerably longer maturities and do not come with fixed contract tenors. That is, bonds can remain on a dealer's balance sheet for an undetermined holding period, which complicates the management of dealers'

the inventory while funding the investment on a levered basis (for instance, through repos) increases the dealer bank's total balance sheet size by the amount of the bond transaction.

[12]Dollar lending through FX swaps is effectively a form of secured lending collateralized by foreign currency. Due to the collateralization, FX swaps do not subject a bank-affiliated dealer to risk-based capital requirements (compare Correa, Du, and Liao (2022)). Similarly, the collateralization of repos with HQLA securities renders them irrelevant for the calculation of the capital ratio (compare Bassi et al. (2023)).

balance sheet tightness.[13] Third, while the intermediation of FX swaps and repos is in the hands of a narrow set of similarly regulated global banks,[14] corporate bonds are intermediated by a larger more diverse set of dealers, including a stronger presence of unregulated nonbank financial intermediaries (that is, nonbank dealers and an active customer sector).

Other Relevant Bank Regulation: Besides the risk-weighted and the non risk-weighted capital requirements, post-crisis regulatory reform introduced other additional banking regulations. First, G-SIB surcharges increase the cost of balance sheet space for a bank-affiliated dealer, in case the bank holding company has been identified as a globally systemically important bank (Behn et al., 2022). However, G-SIB scores only have to be reported at year-ends, with homogenous reporting requirements across jurisdictions. By focusing our empirical analysis on the first three quarters, we avoid potentially confounding effects from G-SIB surcharges. Second, by effectively prohibiting proprietary trading, the Volcker Rule can impact dealers' cost of intermediation because higher values of certain bond inventory metrics may be indicative of proprietary trading (Schultz, 2017). While the implementation of the Volcker Rule overlaps with both the phase-in of the leverage ratio and the G-SIB surcharges, the channels through which it impacts dealers' intermediation behavior do not vary around quarter-ends.[15] Therefore, the Volcker rule does not have a quarter-end specific effect that could materially impact our results. Lastly, intraday liquidity requirements might impact dealer intermediation by straining their ability to freely borrow in funding markets (d'Avernas and Vandeweyer, 2021). However, given the long holding periods that come with corporate bond intermediation, intraday liquidity

[13]For example, for the repo market Ranaldo, Schaffner, and Vasios (2021) and Bassi et al. (2023) show that the fixed tenors of repos allow dealers to flexibly adjust their pricing and intermediation activity according to the balance sheet intensity of a given repo contract. For instance, a one-week repo that is entered eight days prior to the reporting date will have matured and thus left the balance sheet by the reporting date.

[14]The 2018 EuroMoney FX survey outlines that the 29 largest bank dealers jointly intermediate more than 95% of the market volume (https://www.euromoney.com/article/b18bzd2g51lqkn/fx-survey-2018-overall-results).

[15]Banks with more than $50 billion trading assets need to report respective metrics to the regulator within 10 days of the end of each calendar month. For details, see https://www.federalreserve.gov/supervisionreg/faq.htm.

fluctuations are not a pressing concern for our analysis.[16]

2.2 Hypothesis Development

Against the regulatory backdrop laid out in Subsection 2.1, our empirical analysis exploits cross-jurisdictional variation in the implementation of the Basel III leverage ratio, focusing on the differential effect of regulation on three dealer groups: U.S. bank-affiliated dealers, European and Japanese bank-affiliated dealers, as well as nonbank dealers. To identify the cross-sectional effects of the leverage ratio requirement, we restrict our analysis to the first three quarters of a year and zoom in on quarter-end periods. We do so for the following reasons: First, reporting dates for both the capital ratio and the leverage ratio fall on the last trading day of a calendar quarter. Hence, quarter-ends allow us to analyze bank-affiliated dealers' bond intermediation when regulatory constraints tighten the most. Second, due to the heterogeneous implementation of reporting requirements across jurisdictions, quarter-ends allow us to examine the differing effects of the leverage ratio constraint in the cross-section of active dealers. Third, exclusively focusing on the first three quarters reduces the confounding impact of other banking regulations that were also introduced during the leverage ratio period. Additionally, it limits the impact of year-end declines in aggregate bond market trading volumes on our results.[17] And fourth, comparing quarter-end effects across regulatory periods enables us to shed light on the relative importance of risk-weighted and non-risk-weighted capital requirements.

In this empirical setting, we expect to observe the following dynamics: First, for bank-affiliated dealers that intermediate risky corporate bonds, we expect the capital ratio requirement to pose a relevant regulatory constraint throughout the entire sample period. Importantly, given its homogeneous implementation, we expect bank-affiliated dealers to

[16] We provide a more detailed discussion of the other relevant bank regulations and their impact on our results in Section A.3 in the Appendix.

[17] As illustrated in Figure A.2, the aggregate bond market transaction volume declines by about 85% prior to year-ends, but not prior to other quarter-ends. Excluding year-ends generally reduces both the economical and statistical significance of our coefficients, such that our results can be considered a lower bound.

face the same constraints from the capital ratio, irrespective of their regulatory jurisdiction. Second, due to its impact on dealer balance sheet space, the leverage ratio requirement poses an additional regulatory constraint to bond intermediation. Consequently, we expect quarter-end effects to become more pronounced after 2015, once the leverage ratio was fully phased in. Third, given the jurisdictional differences in the leverage ratio reporting requirements, we expect U.S. bank-affiliated dealers to be less constrained close to quarter-ends than their European and Japanese counterparts. Hence, we should expect the negative effect on bond intermediation to be stronger for European and Japanese bank-affiliated dealers. Fourth, if the leverage ratio requirement is the tighter constraint and balance sheet size becomes more expensive, bank-affiliated dealers should adjust their bond inventories primarily according to liquidity considerations and less according to bond risk weights. For instance, by selling larger volumes of safer and more liquid bonds to reduce liquidation discounts per unit of bond volume sold. And fifth, provided that the regulatory differences in the implementation of the leverage ratio favor U.S. bank-affiliated dealers, we should expect them to be in a position to exercise market power when trading alongside more constrained dealers.

3 Data and Descriptive Statistics

Our primary data source is the regulatory version of the corporate bond transaction data from the Trade Reporting and Compliance Engine (TRACE), provided by the Financial Industry Regulatory Authority (FINRA). The TRACE data provides detailed trade-level information for all secondary market corporate bond transactions, including the bond identifier, trade execution date and time, trade price and quantity, an identifier that allows us to tell apart customer-dealer and inter-dealer transactions, and a trade direction indicator that specifies whether a trade was a dealer buy or sell. We obtain this transaction data from January 2003 to December 2019.[18]

Importantly, the regulatory version of the TRACE data provides the dealer identity for each bond trade, allowing us to classify dealers according to their bank-affiliation status and their jurisdiction of regulatory incorporation. Based on dealers' bank-affiliation status, we can cleanly separate dealers that are subject to banking regulation (bank-affiliated dealers) from dealers that are not directly affected by regulation (nonbank dealers).[19] In our analysis, nonbank dealers provide the natural control group to study the impact of bank regulation on bank-affiliated dealers. Based on a dealer's jurisdiction we can further examine the cross-sectional differences of the leverage ratio constraint, differentiating U.S. bank-affiliated dealers from European and Japanese bank-affiliated dealers.[20] The ability to distinguish dealers' regulatory jurisdiction is essential to our analysis, as it allows us to examine dealer's bond intermediation in the days leading up to quarter-ends when regulatory constraints tighten heterogeneously.

Next, we use the Mergent Fixed Income Securities Database (FISD) to obtain information on bond characteristics, such as the issue and maturity date, the history of the par amount outstanding as well as credit ratings for each of the three major rating agencies (S&P, Moody's, and Fitch).[21] In case a bond is not rated, we assign it to a category for not rated bonds. Moreover, for each trading day in our sample, we collect supplementary financial market data covering daily changes in the VIX, the S&P 500, the 3-month LIBOR rate, the 10-minus-2-year term structure, as well as the ICE BofA U.S. corporate

[18] We end the sample period before the onset of the COVID-19 pandemic and the ensuing corporate bond market selloff.

[19] Similar to Bessembinder et al. (2018), we restrict our analysis to the 95% most active dealer identities in the TRACE data (based on both the number of trades and the trading volume) and then link these identities to dealer holding companies. This guarantees that in case a dealer holding company has multiple bond trading desks, we aggregate all transactions to the holding level. In our cleaned TRACE sample, this procedure yields a list of 161 dealer holding companies, of which 90 are bank-affiliated and 71 are nonbank dealers.

[20] Following Munyan (2017) and Correa, Du, and Liao (2022), we restrict the group of non-U.S. bank-affiliated dealers to the subset of European (including the United Kingdom and Switzerland) and Japanese bank-affiliated dealers, which comprise most of the large bank-affiliated dealers in the U.S. corporate bond market and represent about two thirds of the non-U.S. bank-affiliated dealers in our sample.

[21] Following Becker, Opp, and Saidi (2022), for each bond on each day, we assign a numeric value to each credit rating and, if multiple ratings are available, resort to the lowest rating (for two ratings) or the median (for three ratings).

investment grade and high-yield bond indexes.

For a bond to be included in our sample, we require it to be a non-puttable, U.S. dollar denominated corporate debenture, medium-term note, or banknote with a fixed or zero coupon (bond types CDEB and USBN). We then take steps to clean the TRACE data from same-day corrections, cancellations, and reversals (Dick-Nielsen and Poulsen (2019)). Finally, we only keep secondary market transactions and filter all remaining trades with respect to potential data issues concerning the price (missing, negative, or unreasonably large prices), the par value traded (missing, negative, or larger than the offering size and amount outstanding, respectively), the frequency of trades (excluding bonds with less than five trades over the sample period), or the timing of trades (trades before a bond's offering date or after its maturity date, and trades on weekends and trading holidays). After these filters have been applied, our TRACE sample consists of 129,558,489 bond trades. These trades occurred in 74,444 bonds issued by 7,573 corporate issuers transacted by 161 dealer holding companies. Panel A in Table 1 contains summary statistics for the bonds included in our sample. The median bond has an offering amount of around $800 million, an age of 3.1 years and a remaining time-to-maturity of 5.3 years, and a median credit rating of BBB+.

[Insert Table 1 here]

The goal of our analysis is to examine how regulatory constraints impact bond intermediation in the cross-section of corporate bond dealers. To achieve this, we need a proxy for dealers' bond inventories. Absent initial inventory positions in TRACE, it is not possible to construct dealer-specific total inventories at any given point in time. We therefore follow Bessembinder et al. (2018) in constructing a dealer-level inventory measure based on changes in daily inventory holdings. Specifically, we compute each dealer's overnight inventory provisioning, defined as the difference between the cumulative buying and selling volume since the beginning of the trading day.[22] This measure is zero if the dealer's

[22]Since absorbing bonds into a dealer's inventory requires the dealer to commit capital, we henceforth use the terms inventory provisioning and capital commitment interchangeably.

buying volume equals the selling volume, and it is negative (positive) if the selling (buying) volume exceeds the buying (selling) volume. Our measure differs from Bessembinder et al. (2018) in that we do not use absolute inventory changes. This allows us to analyze the direction of balance sheet adjustments where positive values imply that a dealer provides balance sheet capacity by absorbing bonds into the inventory, on net, thus incurring higher regulatory costs. Negative values imply that the respective dealer reduces balance sheet capacity by selling bonds from the inventory, on net, thus saving regulatory costs. Panel C in Table 1 shows that dealers, on average, let their inventories fluctuate around zero, which lines up with the idea that capital commitment subjects a dealer to regulatory costs and bond-specific inventory risks.

A central feature of our analysis is to differentiate between dealer trades in a principal or agency capacity. In a principal capacity (henceforth principal trade), a dealer offers the liquidity demanding counterparty immediacy by absorbing a bond position onto the balance sheet until it is subsequently offset to a customer or the inter-dealer market. For the dealer, providing balance sheet capacity brings about regulatory costs and inventory risks. In contrast, for trades in an agency capacity (henceforth agency trade) the counterparty in need of liquidity sits on the bond position until the dealer locates another counterparty that is willing to take the other side of the trade. That is, in an agency capacity a dealer acts as a broker and incurs no relevant regulatory costs or inventory risks, which typically reduces transaction costs but increases the time it takes to complete a transaction (Goldstein and Hotchkiss, 2020; Wu, 2020). Distinguishing between these two transaction types provides a more complete picture of market liquidity and the extent to which dealers pass through regulatory costs to their customers (Kargar et al., 2021). To capture the transaction costs of balance sheet intensive principal trades, we use the transaction classification algorithm developed by Choi, Huh, and Seunghun Shin (2023). For this, we first categorize every customer transaction as either a pre-arranged agency trade that does not require balance sheet capacity, or as a principal trade that requires the dealer to provide balance sheet capacity. In case a transaction is matched with more than one offsetting transaction, we classify trades where the dealer retains more than 50% of the initial exposure for more than 15 minutes on its balance sheet as an inventory trade. Then, we compute the transaction spread for principal transaction k in bond j at time t intermediated by dealer i as

$$spread^{s}_{i,j,k,t} = 2Q \cdot \frac{price^{transaction,s}_{i,j,k,t} - price^{reference}_{i,j,k,t}}{price^{reference}_{j,k,t}} \quad \text{for } s \in \{\text{principal, agency}\},$$

where Q is $+1$ for a customer buy and -1 for a customer sell and the transaction price is the reported price in TRACE. The reference price is calculated as the volume-weighted price of inter-dealer transactions (excluding trades in a 15-minute interval around the respective customer transaction) with a volume of more than $100,000 in the same bond day. Because many corporate bonds trade infrequently, both the specification of the balance sheet holding period and the computation of the inter-dealer reference price could be subject to microstructure noise and stale benchmark prices. We therefore winsorize the top and the bottom 1% of the transaction cost measure to limit the potential impact of noisy measurements. Panel D in Table 1 shows average principal transaction costs across all trades of around 103 basis points over the entire sample period (excluding the financial crisis). In Panel E of Table 1, we restrict the transactions to large trades with a volume of more than $500,000. For these trades we find that the average transaction costs are markedly lower at around 25.22 basis points.[23]

4 Dealer Balance Sheet Management at Quarter-Ends

This section presents our results on dealers' balance sheet management at quarter-ends. We start by exploring the effects of bank regulations on bank-affiliated dealers' inventory provisioning in the run-up to regulatory reporting dates. Next, we turn to jurisdictional differences in bank-affiliated dealers' leverage ratio constraints and investigate how this

[23] These results are in line with average transaction costs in Choi, Huh, and Seunghun Shin (2023) who exclusively focus on trade sizes of more than $1,000,000.

heterogeneity affects bond intermediation in the cross-section of dealers.

4.1 Inventory Provisioning at Quarter-Ends

As outlined in Subsection 2.2, we conjecture that regulatory constraints manifest at quarter-ends among regulated bank-affiliated dealers, whereas we expect to see no significant regulatory impact on unregulated nonbank dealers. By temporarily contracting bond inventories in the run-up to a regulatory reporting date, bank-affiliated dealers can lower their regulatory costs from the capital and the leverage ratio requirements. Consequently, we would expect bank-affiliated dealers, but not nonbank dealers, to contract their inventory provisioning and start net selling bonds in the days leading up to the regulatory reporting date.

To capture both the size and the dynamics of dealers' inventory adjustments, we estimate a non-parametric event study regression of dealer capital provisioning around quarter-ends. Figure 2 plots the estimated event study coefficients for the three dealer groups. Our coefficients are estimated relative to the middle of the quarter (event day $T - 28$) and can be interpreted as dealers' average change in their inventory provisioning relative to a period that is arguably the least affected by regulatory pressure.[24] In Panel (a) of Figure 2, we document a strong V-shaped pattern around quarter-end dates. The average bank-affiliated dealer starts to significantly reduce capital commitment in the four trading days leading up to the reporting date, only to revert inventory management and build up the balance sheet a few days into the new quarter. Moreover, the inventory contractions displayed in Panel (a) are economically large. Over the course of the 8 days around the reporting date, the average bank-affiliated dealer net-sells bonds worth \$20 million from the inventory, which represents half a standard deviation move in dealer

[24]Specifically, we fix the capital commitment on the reference date ($T - 28$) to zero, which allows us to illustrate the dynamics of quarter-end inventory adjustments via the estimated regression coefficients. Moreover, we choose $T - 28$ as the reference date because it is the event day that is both present in all quarters and furthest away from a quarter-end. This makes $T - 28$ a good proxy for dealer behavior absent of regulatory pressure close to reporting dates.

capital commitment outside quarter-ends.[25] Using a simple back-of-the-envelope calculation, this effect translates into an aggregate contraction of around $1.6 billion across all bank-affiliated dealers in our sample, which represents around 11.8% of the total corporate bond inventories of the Federal Reserve's Primary Dealers during the leverage ratio period.[26] Lastly, Panel (d) in Figure 2 highlights that we do not observe any form of inventory contraction for nonbank dealers, which is in line with our hypothesis that the observed quarter-end effects can be attributed first and foremost to bank regulation.

The pronounced quarter-end contractions for regulated but not for unregulated dealers are evidence for intra-quarter variation in the intensity of Basel regulatory requirements. In a next step, we use the staggered introduction of different Basel regulations to further disentangle the effects of the capital ratio and the leverage ratio requirements. Whereas the capital ratio requirement, if relevant, should affect bank-affiliated dealers' bond intermediation before 2015, we expect quarter-end effects to become significantly more pronounced once the leverage ratio increases the cost of balance sheet space. With the introduction of the leverage ratio, we also expect cross-jurisdictional differences in the implementation of the leverage ratio to be reflected in the cross-section of bank-affiliated dealers' inventory adjustments.

Next, a long time series and our granular data allow us to estimate a triple difference-in-differences model. This has multiple advantages: First, our estimation strategy allows us to contrast how bond intermediation changes near quarter-ends for dealers affected by regulation (bank-affiliated dealers) relative to an unaffected control group (nonbank dealers). Second, contrasting quarter-end effects across regulatory periods allows us to control for common trends in dealers' capital commitment. Third, by performing the es-

[25]Note that the event study estimates in Figure 2 can not directly be interpreted in terms of net selling. This is because the event study coefficients report changes in inventory provisioning *relative* to the baseline period ($T-28$). To address this issue, Table 1, Panel B, includes non-parametric means of our inventory measure near quarter-ends which clearly indicate that regulated dealers start to sell bonds on net from their balance sheets near quarter-ends.

[26]We express these contractions relative to the size of the aggregate corporate bond inventories of the Federal Reserve's primary dealers. In our sample, these primary dealers are responsible for nearly 70% of the total transaction volume. For a list of the primary dealers, see https://www.newyorkfed.org/markets/primarydealers.

timation separately for bank-affiliated dealers from different regulatory jurisdictions, we can infer whether jurisdictional differences in the implementation of the leverage ratio manifest differently in the cross-section of dealers. We therefore construct a dataset on the dealer-day level and estimate the following regression:

$$
\begin{aligned}
Capital\ Commit._{i,t} = {} & \beta_1\, \mathbb{1}\left[Bank - aff.\right] + \beta_2\, \mathbb{1}\left[LR\right] + \beta_3\, \mathbb{1}\left[QE\right] \\
& + \beta_4\, \mathbb{1}\left[Bank - aff.\right] \times \mathbb{1}\left[QE\right] + \beta_5\, \mathbb{1}\left[QE\right] \times \mathbb{1}\left[LR\right] \\
& + \beta_6\, \mathbb{1}\left[Bank - aff.\right] \times \mathbb{1}\left[LR\right] + \beta_7\, \mathbb{1}\left[QE\right] \times \mathbb{1}\left[LR\right] \times \mathbb{1}\left[Bank - aff.\right] \\
& + \theta'\, \mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,t},
\end{aligned} \tag{1}
$$

where i denotes a dealer and t the transaction day in event time (where $t = 0$ refers to the regulatory reporting day). $Capital\ Commit._{i,t}$ denotes the daily net capital commitment by dealer i on day t. This inventory measure is negative (positive) if dealer i net sells (buys) bonds on a given day. The indicator variable $\mathbb{1}\left[Bank - aff.\right]$ takes the value one if the dealer is affiliated to a bank holding company. $\mathbb{1}\left[QE\right]$ is an indicator variable that takes the value one on each of the last ten trading days before the regulatory reporting date. We choose ten trading days to allow for a longer adjustment period due to inherent bond market illiquidity.[27] $\mathbb{1}\left[LR\right]$ is an indicator variable that is equal to one as of 01/01/2015 (the years after which the Basel III leverage ratio is phased in). The vector $\mathbf{M_t}$ contains control variables capturing the conditions in financial markets on a given day. Following Bessembinder et al. (2018), we include the daily change in the VIX to control for the impact of aggregate uncertainty, the daily change in the 3-month LIBOR to control for dealers' funding environment, the daily S&P 500 index return to control for spillovers from equity markets (Hameed, Kang, and Viswanathan, 2010). To also control

[27] The choice of ten days for the quarter-end dummy is longer than what is used in studies on quarter-end effects in more liquid OTC markets such as the repo market (compare Munyan (2017), Correa, Du, and Liao (2022), and Munyan (2017)). Importantly, choosing a longer quarter-end window works against finding larger effects. Thus, our results can be considered as a lower bound of the true effect. In unreported results, we confirm qualitatively similar and quantitatively larger results for shorter event windows.

for conditions in U.S. bond markets, we include the daily change in the option-adjusted spread of the ICE BofA investment grade corporate bond index, the daily change in the difference of the ICE BofA high-yield and the ICE BofA investment grade corporate bond indexes, and the daily change in the 10-minus-2-year term spread. Lastly, with α_i and α_{yq} we include dealer and year-quarter fixed effects.[28]

In Equation (1), the coefficient of interest is β_7, capturing the effect of the triple interaction term, $\mathbb{1}[QE] \times \mathbb{1}[LR] \times \mathbb{1}[Bank - aff.]$. The leverage ratio substantially increased the cost of bank balance sheet space, arguably amplifying the regulatory pressure on bank-affiliated dealers beyond risk-weighted constraints. If the leverage ratio indeed poses a relevant constraint to corporate bond intermediation, we should observe a more pronounced reduction in bank-affiliated dealers' inventories at quarter-ends once the leverage ratio is in place. That is, a significantly negative and economically large estimate for β_7. And, this is precisely what we find.

[Insert Table 2 here]

Our results in Column 1 of Table 2 show that quarter-end effects are largely driven by balance sheet contractions in the leverage ratio period. This finding supports our hypothesis that non-risk-weighted capital requirements (the leverage ratio) are more constraining than risk-weighted requirements (the capital ratio). In fact, while bank-affiliated dealers, on average, appear to moderately reduce their capital provisioning over the 10-day window prior to the leverage ratio period —see the insignificant coefficient on the interaction term $\mathbb{1}[Bank - aff.] \times \mathbb{1}[QE]$ —this effect becomes highly significant and negative once the leverage ratio is in place.[29]

[28] We define an event time quarter, q, from the middle of the calendar quarter ($T - 28$) to the middle of the next calendar quarter ($T + 28$).

[29] A natural concern for our results might be that larger quarter-end effects in the leverage ratio period could be an artefact of growth in bond inventories amid a growing bond market. We argue against this explanation for the following reasons: First, by including a time indicator, $\mathbb{1}[LR]$, our regression approach is designed to account for common time trends. Second, even if the functional form of the time trend is such that our regression design does not fully capture it, we would need to observe that dealer inventories become larger during the leverage ratio period for this concern to be valid. However, Figure A.3 clearly shows that aggregate dealer inventories decline in the aftermath of the financial crisis and in fact are at

A potential explanation for the relatively small and insignificant effect on the two-way interaction term, $\mathbb{1}[Bank - aff.] \times \mathbb{1}[QE]$, could be that quarter-end contractions were both smaller and shorter-lived in the pre- and post-crisis periods, in which case a ten-day quarter-end estimation window complicates the empirical detection of the effect.[30] In Table 3 we therefore zoom in on the timing of inventory contractions by dealer groups and regulatory periods. We do this by re-estimating a modified version of the event study regression used in Figure 2 for the 10-day period leading up to reporting dates.

[Insert Table 3 here]

Columns 1 to 3 in Table 3 show that during the pre- and post-crisis periods —characterized exclusively by risk-based capital requirements —bank-affiliated dealers markedly reduce their bond inventories right before the reporting day $[T-4, T]$. The fact that we find contractions across jurisdictions is in line with the conjecture that in case of corporate bond intermediation, risk-weighted capital requirements homogeneously constrain bank-affiliated dealers already before the implementation of the leverage ratio. This highlights an important mechanism: In contrast to short-term money markets where the underlying asset is riskless, corporate bond intermediation is already significantly constrained by risk-based capital requirements. What is more, once the leverage ratio additionally punishes a large balance sheet, we find significantly negative coefficients already at an earlier event day bin, $[T-10, T-5]$. This is consistent with the idea that the leverage ratio incentivizes bank-affiliated dealers to reduce their bond inventories earlier and over a longer period of time, which in turn results in significantly larger total quarter-end contractions. Taken together, we find strong empirical evidence for sizable quarter-end contractions in bank-

an all-time low during the leverage ratio period. In addition, Columns 4 to 6 in Table 2 display results for a log-modulus transformation of the inventory measure, and thus effectively limit the impact of large inventories. We recover similar results, both qualitatively and quantitatively, when applying this form of standardization.

[30]The coefficient on $\mathbb{1}[Bank - aff.] \times \mathbb{1}[QE]$ captures the change in the average inventory measure in the last ten trading days compared to the outside quarter-end periods. When inventory contractions are short-lived and concentrated to only the last few trading days before the reporting date, while the remaining trading days that are also included in the quarter-end dummy exhibit positive inventory values, the coefficient estimate will not capture the inventory contraction.

affiliated dealers' net capital commitments.

4.2 Heterogeneous Leverage Ratio Requirements

Next, we turn to jurisdictional differences in bank-affiliated dealers' leverage ratio constraints. While the capital ratio is implemented homogeneously across jurisdictions, there are important jurisdictional differences in the leverage ratio reporting requirements. As outlined in Subsection 2.2, in the cross-section of dealers, we expect U.S. bank-affiliated dealers to be relatively less constrained by the leverage ratio requirement compared to their European and Japanese counterparts. To test this conjecture, we examine whether inventory contractions among European and Japanese bank-affiliated dealers are stronger than the inventory contractions among U.S. bank-affiliated dealers.

Columns 2 and 3 in Table 2 show our results by dealer subgroups. That is, we reestimate Equation 1 separately for U.S. bank-affiliated dealers (Column 2) as well as European and Japanese bank-affiliated dealers (Column 3). For both bank-affiliated dealer groups, we find negative and highly significant triple interaction terms, clearly suggesting that quarter-end contractions become significantly more pronounced once the leverage ratio period is in place. Most notably, we find that the coefficients on the triple interaction term are very similar quantitatively for both the U.S. and the European and Japanese bank-affiliated dealer group. At first sight, this goes against our third conjecture that jurisdictional differences in the leverage ratio requirement should lead to U.S. bank-affiliated dealers being less constrained relative to their European and Japanese counterparts. However, the dollar level findings in Table 2 do not yet account for cross-sectional differences in dealers' inventory sizes. Whenever U.S. bank-affiliated dealers, on average, hold larger bond inventories compared to their European and Japanese counterparts, observing similarly sized inventory contractions would still be indicative of a relatively stronger effect of the leverage ratio on European and Japanese bank-affiliated dealers.[31]

[31] For both the pre- and post-crisis periods, we find larger average capital commitments for U.S. bank-affiliated dealers relative to European and Japanese bank-affiliated dealers.

Without information on the level of individual dealer inventories, we follow the literature and control for cross-sectional size differences by standardizing our measure of inventory provisioning with the standard deviation of the daily inventory for each dealer (see, for example, Di Maggio, Kermani, and Song (2017)). This allows us to account for differences in inventory size by expressing changes in dealer capital commitment in terms of standard deviations. Consistent with our prior findings, the estimates in Table 4 show that both bank-affiliated dealer groups contract their bond inventories at quarter-ends, and do so significantly more once the leverage ratio is implemented. Importantly, while the quarter-end contractions are relatively similar prior to the implementation of the leverage ratio—when the capital ratio constrains both dealer groups homogeneously—the contractions of European and Japanese bank-affiliated dealers are roughly 50% larger once balance sheet space is regulated. Furthermore, and consistent with the idea that the non risk-weighted nature of the leverage ratio particularly constrains the intermediation of saver corporate bonds, the contractions of European and Japanese dealers are primarily in investment grade bonds. Taken together, this is consistent with the interpretation that the respective leverage ratio implementation is indeed less constraining for U.S. bank-affiliated dealers (quarter averages) than for European and Japanese bank-affiliated dealers (quarter-end snapshots).

[Insert Table 4 here]

These findings provide novel insights into how two major Basel requirements interact and impact corporate bond intermediation. In contrast to what has been documented in money markets (Correa, Du, and Liao, 2022), we show that U.S. bank-affiliated dealers do *not* take on the role of residual buyers at quarter-ends. Instead, they markedly contract their bond inventories, albeit to a lesser degree than European and Japanese bank-affiliated dealers. This has important implications for policy makers because it suggests that bank-affiliated corporate bond dealers, no matter the regulatory jurisdiction, should primarily be understood as liquidity providers of "first resort", with neither the capacity nor the inclination to provide balance sheet space close to reporting dates.

One potential explanation that connects these findings could be the following equilibrium mechanism: U.S. bank-affiliated dealers—despite being relatively less constrained by the leverage ratio —incur capital ratio charges from holding risky bonds on their balance sheets. These capital charges are costly and significantly reduce U.S. bank-affiliated dealers' willingness to absorb the selling pressure from their relatively more constrained European and Japanese counterparts. While repos and FX swaps are fully collateralized and therefore considered riskless from the perspective of the regulator, even safe corporate bonds come with substantial risk weights no matter the regulatory jurisdiction. That is, balance sheet expansions with corporate bonds affect a dealer's capital ratio more so than they do with repos and FX swaps. This may explain why U.S. bank-affiliated dealers refrain from absorbing other dealers' selling pressure at quarter-ends in the corporate bond market.

5 Managing Regulatory Pressure at Quarter-Ends

In Section 4 we show that bank-affiliated corporate bond dealers, irrespective of their regulatory jurisdiction, show sizeable inventory contractions and become net sellers during quarter-end periods. Next, we study how bank-affiliated dealers structure their selling and buying in the days leading up to reporting dates. We examine whether dealers apply some form of pecking order when selling bonds from their inventories. Then, we investigate to whom dealers are selling their bonds and whether this happens at a price discount. We conclude with an analysis of dealers' bond purchases at quarter-ends and study the distribution of intermediation rents.

5.1 Dealer Selling at Quarter-Ends and Liquidity Pecking Order

In light of bank-affiliated dealers' inventory contractions at quarter-ends, an interesting question is how their net selling is structured? Specifically, do bank-affiliated dealers apply some form of pecking order in their inventory adjustments, for instance, by selling larger volumes of safer and more liquid bonds to reduce liquidation discounts? To test this empirically, we run the following bond-level regression on a dataset constructed at the dealer-bond-day level:

$$\begin{aligned} \textit{Log(Bond Selling Volume)}_{i,j,t} = {} & \beta_1 \overline{\textit{Illiquidity}_{j,t-1}} + \beta_2 \mathbf{1}[QE] \\ & + \beta_3 \overline{\textit{Illiquidity}_{j,t-1}} \times \mathbf{1}[QE] + \theta_1' \mathbf{M_{j,t}} + \theta_2' \mathbf{M_t} \\ & + \alpha_r + \alpha_d + \alpha_{i,yq} + \varepsilon_{i,j,t}, \end{aligned} \tag{2}$$

where i refers to the dealer, j refers to the bond and t to the transaction day in event time. $\textit{Log(Bond Selling Volume)}_{i,j,t}$ refers to the logarithm of the daily selling volume on the dealer-bond level. $\overline{\textit{Illiquidity}_{j,t-1}}$ refers to bond j's average transaction spread over the last 90 days, where lower transaction spreads reflect higher bond-specific liquidity over the last quarter. $\mathbf{1}[QE]$ is an indicator variable that is one during the last ten trading days prior to quarter-ends. α_r represents rating fixed effects, α_d represents industry fixed effects, and $\alpha_{i,yq}$ represents dealer-year-quarter fixed effects. Finally, $\mathbf{M_t}$ represents the vector of market controls used in equation 1 and $\mathbf{M_{j,t}}$ is a vector of bond-level controls that includes a bond's age, its time to maturity, and the log of the amount outstanding.

[Insert Table 5 here]

Table 5 presents the results from estimating Equation (2). As expected, we find that the coefficient on $\overline{\textit{Illiquidity}_{j,t-1}}$ is negative and highly significant across all specifications, suggesting that dealers sell larger (smaller) volumes in liquid (illiquid) bonds outside of quarter-end periods. Comparing the coefficients on $\overline{\textit{Illiquidity}_{j,t-1}} \times \mathbf{1}[QE]$ across the two regulatory periods, we find that the relationship between bond selling volume and bond illiquidity strengthens considerably once the leverage ratio is phased in. That is, in the leverage ratio period higher selling volumes at quarter-ends are primarily concentrated in liquid bonds, even after controlling for relevant bond characteristics, such as credit rating, industry, issue size, as well as age and maturity. This finding is consistent with the interpretation that the introduction of the leverage ratio increased the importance of bond liquidity to minimize dealers' price impact when selling large quantities of bonds in the days leading up to reporting dates. What is more, this effect appears to become significantly stronger for European and Japanese bank-affiliated dealers, which is in line with the idea that they are more constrained and required to sell larger quantities in liquid bonds at quarter-ends than their U.S. counterparts. Overall, these findings lend support to the idea that bank-affiliated dealers follow a pecking order of liquidation that prioritizes more liquid bonds, specifically once the leverage ratio disproportionately increases the cost of dealers' balance sheet space.

5.2 Nonbank Intermediaries and Quarter-End Liquidity Supply

Given bank-affiliated dealers' net selling at quarter-ends, a natural question arises: Who buys when they are selling? To address this question, we examine how bank-affiliated dealers rely on other counterparties to manage the regulation-induced selling at quarter-ends. In doing so, our paper speaks to the importance of nonbank financial intermediation in the corporate bond market.

We start by characterizing the set of counterparties that could absorb selling pressure. First, unregulated nonbank dealers could use their higher balance sheet flexibility at quarter-ends to buy from bank-affiliated dealers (Duffie, 2012). While it is unlikely that they will be able to absorb all of the selling pressure, nonbank dealers could lend their available balance sheet capacity in specific bond segments to profit from potential liquidation discounts. Second, bank-affiliated dealers' customers could be another group of buyers given that recent research documents a growing importance of customer liquidity provisioning (see for example, Choi, Huh, and Seunghun Shin (2023); Anand, Jotikasthira, and Venkataraman (2021); O'Hara, Rapp, and Zhou (2023)). Third, despite being subject to regulation themselves, individual bank-affiliated dealers facing less regulatory pressure could absorb some of the selling pressure in specific bond segments.

To study how bank-affiliated dealers distribute quarter-end sales across counterparties, we analyze their net selling volumes vis-à-vis the three counterparty groups. That is, for each dealer i on date t we construct both measures of aggregate buying and selling volumes as well as a measure of net selling against a particular counterparty group m.[32] Counterparties fall into three groups: Customers, nonbank dealers, and other bank-affiliated dealers from a different regulatory jurisdiction than dealer i. Focusing on the leverage ratio period, we then separately estimate the following regression model for U.S. bank-affiliated dealers as well as for European and Japanese bank-affiliated dealers:[33]

$$Net\ Selling_{i,m,t} = \beta_1\, \mathbb{1}\,[QE] + \theta'\,\mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,m,t}, \tag{3}$$

where $Net\ Selling_{i,m,t}$ refers to the net selling volume of dealer i at date t vis-à-vis counterparty type m, $\mathbb{1}\,[QE]$ is an indicator variable that takes the value one on each of the last ten trading days before the regulatory reporting date, and $\mathbf{M_t}$ contains daily controls for financial market conditions (see Equation (1)). Lastly, we include dealer and year-quarter fixed effects in Equation (3).

Our results in Table 6, Panel A, show that U.S. bank-affiliated dealers heavily rely on their customers to sell bonds at quarter-ends. In Column 1, the coefficient on $\mathbb{1}\,[QE]$ is positive and significant, suggesting that U.S. bank-affiliated dealers tilt their trading with customers in a way that helps them offload their inventories at quarter-ends. Specifically,

[32] Given that we net out the daily buying and selling volume of dealer i vis-à-vis counterparty group m, a positive value for β_1 can be interpreted as dealer i, on net, selling volume to counterparty type m.

[33] Separating bank-affiliated dealers by jurisdiction of incorporation allows us to examine whether U.S. bank-affiliated dealers, despite being net sellers around quarter-ends, absorb part of the selling pressure from non-U.S. bank-affiliated dealers at reduced prices that exceed the regulatory costs of holding the bonds.

we document that the average U.S. bank-affiliated dealer directs about 70% of the net selling to customers. Columns 4 to 7 further highlight that this effect is driven by a strong increase in sales of investment grade bonds, while we do not observe a similar effect for high-yield bonds. This finding likely reflects customer preferences, for instance, due to investment mandates.[34] Panel B shows that U.S. bank-affiliated dealers also fall back on their nonbank counterparts to offload part of their bond sales. In fact, nonbank dealers absorb around 21% of the average U.S. bank-affiliated dealer's net selling volume. While the coefficient for net sales is insignificant across all bonds (Column 1) the significant difference in Columns 6 and 7 indicates that nonbank dealers primarily buy bank-affiliated dealers' high-yield bond positions.[35] Lastly, Panel C presents results on the net trading with non-U.S. bank dealers. The small but significant coefficients suggest that U.S. bank-affiliated dealers also sell bonds to foreign bank-affiliated dealers, but only to a very limited extent. This finding is consistent with the notion that non-U.S. bank-affiliated dealers are largely constrained themselves, and thus unwilling to absorb additional selling pressure at quarter-ends.

[Insert Table 6 and Table 7 here]

In Table 7 we present results from estimating Equation (3) for the subset of European and Japanese bank-affiliated dealers. We document a qualitatively similar pattern across the three counterparty groups. In fact, compared to their U.S. counterparts, European and Japanese bank-affiliated dealers tilt their net selling even more toward their customer base. The average European and Japanese bank-affiliated dealer directs 95% of the net selling volume to customers, 5% to nonbank dealers, and no volume to U.S. bank-affiliated

[34] A substantial fraction of institutional investors in the corporate bond market is bound either by investment mandates or regulation to invest primarily in investment grade rated bonds (Ellul, Jotikasthira, and Lundblad, 2011).

[35] In Table A8 we use a measure of a dealer's network centrality in the interdealer market to test whether bank-affiliated dealers offload their high-yield bond exposure to either core or periphery nonbank dealers. We document both in case of U.S. bank-affiliated dealers and for European and Japanese bank-affiliated dealers – that constrained bank-affiliated dealers primarily offload bonds to central nonbank dealers. This is in line with the interpretation that nonbank dealers in the periphery do not possess the balance sheet depth to absorb significant selling volumes.

dealers. Similarly, and line with our results for U.S. bank-affiliated dealers, we observe a very similar market segmentation across bond rating classifications. The above finding bring up the question whether dealers grant customers price discounts in exchange for their quarter-end liquidity support. For this equilibrium mechanism to be consistent with our finding that customers primarily absorb dealers' selling pressure in investment grade bonds, we would expect price discounts vis-à-vis customers to materialize only in investment grade bonds. With respect to trade sizes, bank-affiliated dealers likely face a trade-off: While they have an incentive to sell large amounts of bonds quickly, customers might simply not be able to absorb large block trades. What is more, the price impact of large liquidations may become too unfavorable for the dealer. This suggests that price discounts should materialize primarily in smaller trades sizes.

To test this empirically, we run the following trade-level regression using only dealer sales to customers during the leverage ratio period:

$$
\begin{aligned}
Spread_{k,j,i,t} &= \beta_1 \, \mathbb{1}\left[QE\right] + \theta_{\mathbf{1}}' \mathbf{M_t} + \theta_{\mathbf{2}}' \, \mathbf{M_{j,t}} \\
&\quad + \alpha_{j \times yq \times s} + \alpha_{r \times yq} + \alpha_{i \times yq} + \varepsilon_{k,j,i,t},
\end{aligned}
\tag{4}
$$

where $Spread_{k,j,i,t}$ refers to the transaction spread as defined in Section 3, $\mathbb{1}\left[QE\right]$ is an indicator variable that is one during the last ten trading days of a quarter, and $\mathbf{M_t}$ contains daily controls for financial market conditions (see, Equation (1)). $\mathbf{M_{j,t}}$ contains bond-specific controls such as the bond's age and time-to-maturity, defined as the logarithm of the number of years since issuance and the number of years to maturity, respectively, as well as a bond's amount outstanding, which is given by the logarithm of a bond's total par amount outstanding. $\alpha_{j \times yq \times s}$ represents bond-year-quarter-trade size fixed effects, $\alpha_{jr \times yq}$ refers to rating-year-quarter fixed effects, and $\alpha_{i \times yq}$ refers to dealer-year-quarter fixed effects.[36] Standard errors are double clustered at the bond and day levels.

[36]Trade sizes are defined as: i) less than \$100,000, between \$100,000 and \$1 million and above \$1 million. Rating buckets follow ECRA definitions.

[Insert Table 8 here]

Table 8 supports our hypothesis that bank-affiliated dealers appear to make concessions to customers for their liquidity support, as we find significant price discounts of 2.2 and 3.5 basis points on the average transaction spread for U.S. (upper panel) and European and Japanese bank-affiliated dealers (lower panel), respectively. These concessions are economically meaningful. Relative to the average selling spread outside quarter-ends, this reflects a roughly 2.5% reduction in transaction costs for U.S. bank-affiliated dealers, and nearly a 7% reduction for European and Japanese bank-affiliated dealers. Furthermore, we find that price concessions are largely concentrated in investment grade bonds and trade sizes below $500,000 for both bank-affiliated dealer groups. This is in line with the idea that customers are bound by investment mandates when they absorb bank-affiliated dealers' selling pressure.

Taken together, our findings highlight two important insights: First, when faced with increased regulatory pressure, constrained bank-affiliated dealers primarily rely on nonbank financial intermediaries to manage their regulatory exposure. In fact, our results point to a market segmentation of nonbank intermediaries along bond risk brackets: At quarter-ends, bank-affiliated dealers rely on their customer networks to sell investment grade bonds and their nonbank inter-dealer networks to dispose of high-yield bonds. Second, we show that when customers help constrained bank-affiliated dealers to reduce their regulatory selling pressure, they are granted meaningful price discounts. These dynamics underscore the prominent role that nonbank financial intermediaries have taken on in the U.S. corporate bond market since the introduction of the leverage ratio requirement.

5.3 Quarter-End Liquidity Supply By Insurance Companies

With nonbank intermediaries becoming liquidity suppliers to constrained bank-affiliated dealers at quarter-ends, we want to study one customer group in more detail. Specifically, we focus on U.S. insurance companies—the largest holders of corporate bonds during the leverage ratio period—and examine whether they tilt their trading at quarter-ends in a way that helps absorb dealers' regulatory selling pressure.[37]

To address this question, we make use of detailed information on insurers' trades reported in Parts 3 to 5 of Schedule D provided by the National Association of Insurance Commissioners (NAIC). This data allows us to study insurers' daily trading activities at the bond level, such that we can explicitly test for quarter-end liquidity supply by individual insurance companies. What's more, for each insurer trade the NAIC data provides us with a dealer identity. This allows us to proxy for prior trading relationships between an insurer and a dealer based on their transaction history. Our final sample spans the period from 2011 to 2019 and contains 3026 insurers, out of which 2344 are property and casualty insurers and 682 are life insurers.[38]

[Insert Table 9 and Table 10 here]

If insurance companies indeed become net buyers during quarter-end periods, we should observe an increase in their overall net purchases from dealers. For this behavior to be consistent with liquidity supply in response to dealers' regulatory selling pressure, we would further expect insurers' quarter-end trading patterns to manifest only after the leverage ratio is implemented and to be more pronounced in investment grade bonds. Lastly, given life insurers' longer-term, duration-driven investment style, we would expect short-term liquidity supply at quarter-ends to be primarily concentrated in relative value-driven property and casualty (P&C) insurers.[39]

To empirically test these conjectures, we construct a sample at the insurer-day level

[37] In the U.S. corporate bond market, bond holdings are highly concentrated among insurance companies and bond investment funds. For instance, in 2017, insurers (life insurers and property and casualty insurers) owned around 38 percent of corporate bonds outstanding, while bond mutual funds owned 30 percent. The remainder was hold by pension funds (16%), banks (10%), and others (6%) (compare Koijen and Yogo (2023)).

[38] For a detailed explanation of our sample construction, refer to Section A.8 in the Appendix.

[39] We document that while P&C insurers trade less in absolute terms, they trade more relative to their portfolio size (compare Table A3).

that spans the period from January 2011 to December 2019.[40] We then estimate the following regression:

$$Net\,Purchases_{i,t} = \beta_1\,\mathbb{1}[QE] + \alpha_i + \lambda_{y,q} + \theta'\,\mathbf{M_{i,y}} + \varepsilon_{i,t}, \tag{5}$$

where $Net\,Purchases_{i,t}$ refers to the logarithm of one plus the net trading volume by insurance company i on day t.[41] We add the logarithm of an insurer's assets, five-year asset growth, the logarithm of an insurer's RBC ratio, the leverage ratio, and the cash-to-assets as insurer controls and further include insurer and quarter fixed effects.

If insurance companies indeed absorb part of dealers' selling pressure at quarter-ends, we should observe a positive and significant coefficient on the quarter-end indicator, $\mathbb{1}[QE]$. Consistent with dealer selling pressure being strongest in safe bonds, Panel A of Table 9 shows that insurance companies significantly increase their net purchases at quarter-ends in investment grade bonds but not in high-yield bonds (Columns 1 and 2). Furthermore, Columns 3 and 4 highlight that quarter-end liquidity supply is primarily concentrated among P&C insurers. Lastly, consistent with tilting their trading in a way that helps dealers offload bond inventories, Columns 5 and 6 demonstrate that P&C insurers significantly increase their bond purchases from dealers, while slightly reducing their bond sales to dealers. What is more, Panel B of Table 9 shows that insurers' liquidity supply is entirely concentrated in the leverage ratio period, but not earlier. Taken together, these findings highlight the importance of the largest nonbank intermediary group in the U.S. corporate bond market in absorbing part of bank-affiliated dealers' regulatory selling exposure. In fact, We show that once the leverage ratio systematically increases bank-affiliated dealers' balance sheet costs, a subset of insurance companies appears to

[40] Following O'Hara, Rapp, and Zhou (2023), we impute zeros on trading days when we do not observe a trade for a given insurance company. This ensures that we accurately capture the insurer's decision against trading on a given day. In untabulated results, we find qualitatively similar results when we do not impute zero trading days.

[41] For each day, we define the net trading volume as the difference between the aggregate insurance purchases and the aggregate insurance sales. We also perform a log-modulus transformation of our dependent variable. In untabulated results, we find that we obtain qualitatively similar results when using the dollar volume instead.

adopt a liquidity supplying trading strategy that helps dealers to reduce their regulatory exposure.

The above results do not yet provide insights as to the dealers that insurers choose to trade with. We conjecture that prior trading relationships may impact an insurer's counterparty choice (see, for example, O'Hara, Wang, and Zhou (2018); Hendershott et al. (2020)). To test this hypothesis, we construct a dataset at the insurer-dealer-day level and leverage information on insurer's aggregate trading volume with specific dealers.[42] We then estimate the following regression:

$$\begin{aligned} Insurer\ Trading_{i,d,t} = {} & \beta_1\, \mathbb{1}[QE_t] + \beta_2\ Past\ Trd.Vol_{i,d} \\ & + \beta_3 \mathbb{1}[QE_t] \times Past\ Trd.\ Vol_{i,d} + \theta'\, \mathbb{M}_{\mathrm{i,y}} \\ & + \alpha_i + \alpha_d + \eta_{y,q} + \varepsilon_{i,d,t}, \end{aligned} \tag{6}$$

where $Insurer\ Trading_{i,d,t}$ represents the (net) trading volume of insurer i with dealer d on trading date t. $Past\ Trd.Vol_{i,d}$ denotes the log of 1 plus the average monthly trading volume between insurer i and dealer d over the previous 24 months. To control for the impact of dealer characteristics on trading conditions, we also include dealer fixed effects, α_d. Table 10 shows a positive and significant coefficient on the interaction term $\mathbf{1}[QE] \times Past\ Trd.\ Vol_{i,d}$ suggesting that P&C insurers concentrate their quarter-end liquidity supply among dealers with whom they have an established prior trading relationship.

[42] To avoid a potential selection bias, we include all insurer-dealer pairs that trade at least once during our sample period even if they never trade during quarter-ends. Further, we impute zeros on trading days when we do not observe a trade between a given insurer-dealer pair (starting from the first observed trade of a given pair). This ensures that we accurately capture the pairs' decision *against* trading. In untabulated results, we find that we get qualitatively similar results when we do not impute zero trading days.

5.4 The Cost of Immediacy at Quarter-Ends

The ability to sell bonds quickly is important for institutional investors, for example following bond downgrades (Ellul, Jotikasthira, and Lundblad, 2011) or index exclusions (Dick-Nielsen and Rossi, 2019). But to sell bonds quickly, dealers must be willing to buy them in a principal capacity, which is balance sheet intensive and increases regulatory costs. Trading in an agency capacity, on the other hand, is not balance sheet intensive but comes with substantially longer execution times. Thus, whenever customers demand liquidity close to regulatory reporting dates, constrained bank-affiliated dealers face the option to either reflect the increased regulatory costs in higher transaction spreads, or to resort to slower, yet cheaper, agency trades. To examine how Basel regulations impact liquidity conditions in the corporate bond market, it is important to discern dealers' trading capacities when they provide liquidity.

To distinguish agency from principal trades and to then capture the transaction costs of the latter, we use the transaction cost measure proposed by Choi, Huh, and Seunghun Shin (2023) and their algorithm to classify transactions into agency and principal trades. Studying both dimensions of liquidity—transaction capacity and costs—allows us to analyze a potential erosion of liquidity at quarter-ends not only through higher realized transaction costs but also through typically slower transaction times associated with agency trades (Kargar et al., 2021).

While we expect regulatory costs to be an important component of observed equilibrium spreads at quarter-ends, we also expect varying degrees of bargaining power to be reflected in observed spreads due to jurisdictional differences in the implementation of the leverage ratio. Since our findings in Table 4 suggest that European and Japanese bank-affiliated dealers are more constrained by the leverage ratio, they are likely less willing to intermediate trades via their balance sheets. From the customer's perspective, this implies that during quarter-end periods, the number of dealers that stand ready to intermediate a principal trade will be lower than outside quarter-ends. Thus, immediacy-seeking customers should experience a reduction in the number of potential trading partners willing to absorb customer sales on a principal basis, which, in turn, lowers customers' relative bargaining power.

If this conjecture is correct, we should observe the following patterns in both prices and quantities: First, we would expect European and Japanese bank-affiliated dealers to reduce their share of costly principal trades once the leverage ratio is phased in. In contrast, if U.S. bank-affiliated dealers are able to take advantage of their relatively lower balance sheet costs, we should not expect them to reduce their share of costly principal trades. Second, transaction costs for principal trades with European and Japanese bank-affiliated dealers should significantly increase due to a higher regulatory cost component at quarter-ends. Lastly, provided that U.S. bank-affiliated dealers exert market power, we would expect them to increase prices to the same level as their European and Japanese counterparts so as to maximize their intermediation rents while retaining their customer base.

To test the first hypothesis, we construct a dataset at the dealer-day level and compute the share of the customer buying volume that a given dealer i intermediates through balance sheet intensive principal trades on day t, $Share\ Principal\ Purchase\ Volume_{i,t}$.[43] Then, we test whether bank-affiliated dealers change their trading behavior at quarter-ends following the introduction of the leverage ratio by estimating the following regression:

$$Share\,Principal\,Purchase\,Volume_{i,t} = \beta_1\,\mathbb{1}\,[QE] + \theta'\,\mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,t}, \qquad (7)$$

where $\mathbb{1}\,[QE]$ is an indicator that is one during the last ten trading days. We complement the model with the same controls for financial market conditions as in Equation (1) and further include dealer and year-quarter fixed effects in the regression model.

The results in Table 11 are consistent with the interpretation that more constrained

[43]We also complement the analysis with an examination of the share of principal purchases (number of trades) rather than the share of the principal purchase volume to see whether dealers adjust both the volume and the number of trades.

European and Japanese bank-affiliated dealers change their trading by reducing the share of expensive principle trades at quarter-ends, while less constrained U.S. bank-affiliated dealers and nonbank dealers do not adjust their trading behavior. In particular, we document a significantly negative coefficient on $\mathbb{1}[QE]$ in Panel B, but not in Panel A or Panel C. In Table A9 we provide further evidence that this effect can be attributed to the introduction of the leverage ratio. In particular, in Columns 1 to 3 of Table A9 the insignificant coefficient on $\mathbb{1}[QE]$ across all dealer groups indicates that European and Japanese bank-affiliated dealers did not engage in quarter-end adjustments of their principal share in the pre- and post-crisis period. That is, dealers' trade type choices at quarter-ends change once the leverage ratio requirement is in place and balance sheet size becomes more costly.

[Insert Table 11 here]

The trade type adjustments documented above are consistent with the presence of jurisdictional differences in leverage ratio constraints that disproportionally affect European and Japanese bank-affiliated dealers. Next, we examine the implications of these adjustments for transaction costs, focusing on trades in which customers request liquidity to sell a bond. While spreads for agency trades should not reflect bank-affiliated dealers' regulatory constraints, an increase in spreads for balance sheet intensive principal trades would be consistent with constrained dealers passing regulatory costs on to their customers. What is more, for us to attribute such an increase to the Basel III leverage ratio we would expect increases in transaction costs to materialize during the leverage ratio, but not during the pre- and post-crisis period. To test this prediction empirically, we estimate the following regression model:

$$\begin{aligned} Spread_{k,j,i,t} = {} & \beta_1 \, \mathbb{1}[QE] + \theta_1' \mathbf{M_t} + \theta_2' \, \mathbf{M_{j,t}} \\ & + \alpha_{j \times yq \times s} + \alpha_{r \times yq} + \alpha_{i \times yq} + \varepsilon_{k,j,i,t}, \end{aligned} \tag{8}$$

where $Spread_{k,j,i,t}$ refers to the principal transaction spread as defined in Section 3, $\mathbb{1}[QE]$ is an indicator variable that is one during the last ten trading days, and $\mathbf{M_t}$ contains the same daily controls for financial market conditions that we use in earlier regressions (see Equation (1)). Just like in Equation (8), $\mathbf{M_{j,t}}$ contains bond-specific control variables such as the bond's age and time-to-maturity, as well as a bond's amount outstanding. Lastly, $\alpha_{j \times yq \times s}$ represents bond-year-quarter-trade size fixed effects, $\alpha_{jr \times yq}$ refers to rating-year-quarter fixed effects, and $\alpha_{i \times yq}$ refers to dealer-year-quarter fixed effects. Standard errors are double clustered at the bond and day levels.

If bank-affiliated dealers indeed pass through regulatory costs to their customers, we would expect a positive and significant coefficient on $\mathbb{1}[QE]$ in the subset of principal trades intermediated by bank-affiliated dealers, but not in the subset of agency trades. Panel A in Table 12 confirms our hypothesis regarding quarter-end increases in customer transaction costs. For both bank-affiliated dealer groups, we document significant increases in only principal transaction costs. What is more, our results in Table A10 confirm that quarter-end increases in principal transaction costs materialize only once the leverage ratio is implemented, but not before. These findings suggest that close to quarter-ends regulated dealers pass the additional balance sheet costs through to customers whenever they intermediate bonds via their balance sheet.

To better understand the underlying mechanism, we re-estimate Equation (8) by bond rating classification and trade size buckets. Panel B and Panel C in Table 12 highlight that both groups of bank-affiliated dealers pass on regulatory costs in large trades, but not in smaller trades.[44] This is consistent with the interpretation that absorbing larger positions near quarter-ends exposes bank-affiliated dealers to higher regulatory costs, as offloading large trading positions likely requires time-consuming splitting of trades and thus higher search costs.[45] In addition, and consistent with our earlier findings that both risk-weighted

[44]In fact, Panel D in Table 12 shows that the relationship between transaction cost increases and trade size is close to monotonic.

[45]Consistent with an increase in search costs, Column 4 of Table A11 in the Appendix shows that close to reporting dates the share of bank-affiliated dealers in intermediation chains for investment grade bonds drops significantly.

and non-risk-weighted capital charges matter, we document that bank-affiliated dealers increase customer transaction costs in high-yield bonds by almost twice as much compared to investment grade bonds. Importantly, these quarter-end effects represent economically meaningful increases relative to average transaction costs outside quarter-ends. On average, for large transactions, bank-affiliated dealers increase their customer transaction costs by around 10% in investment grade bonds and by almost 20% in high-yield bonds. Given the long quarter-end window, this implies a severe and long-lasting contraction of liquidity for customers in need of immediacy and highlights the large impact the leverage ratio has on bond market liquidity conditions.

[Insert Table 12 here]

Overall, our findings can also be interpreted as suggestive evidence that U.S. bank-affiliated dealers are able to take advantage of their lower regulatory constraints at quarter-ends to translate the temporary increase in market power into economic rents. Our results in Table 11 show that U.S. bank-affiliated dealers—unlike their European and Japanese counterparts—do not change their share of balance sheet intensive transaction volume at quarter-end. In addition, in Table 4 we document that U.S. bank-affiliated dealers are indeed less constrained by the leverage ratio and likely face lower marginal costs for balance sheet intensive trades than their European and Japanese counterparts. Against this backdrop, we find that U.S. bank-affiliated dealers increase transaction costs at quarter-ends by a comparable amount to their European and Japanese counterparts. Taken together, this appears consistent with the interpretation that at quarter-ends U.S. bank-affiliated temporarily operate in a less competitive market environment, which allows them to exert market power by pricing large customer trades above marginal costs.

6 Conclusion

Time and again, periods of increased selling pressure have demonstrated that dealer liquidity provision is fragile. In fact, a raft of papers argues that dealers have become less able and willing to assume contrarian risks over recent years, in part due to post-crisis banking regulation that appears to curtail bank-affiliated dealers' capacities to conduct low margin balance sheet intensive trades (see, for example, Du, Tepper, and Verdelhan (2018); Bao, O'Hara, and Zhou (2018); Bessembinder et al. (2018); Dick-Nielsen and Rossi (2019); Ranaldo, Schaffner, and Vasios (2021); Kargar et al. (2021)). While the aggregate impact of post-crisis regulation on the U.S. corporate bond market has been well-documented, little is known about the cross-sectional effects of Basel regulations on dealer intermediation. We fill this gap with our paper, thereby contributing not only to the current discussions on overhauling key Basel III metrics (BIS, 2018) but also to the debate on the regulation of nonbank financial intermediaries (Carstens, 2021).

Using regulatory bond transaction data that allow us to distinguish dealers' bank-affiliation status and their jurisdiction of incorporation, we document regulatory-driven quarter-end effects in the U.S. corporate bond market. To lower their regulatory metrics, bank-affiliated dealers sharply contract their bond inventories in the days leading up to reporting dates, directing their selling pressure primarily to nonbank financial intermediaries. With the introduction of the leverage ratio requirement, these inventory contractions increase substantially for all bank-affiliated dealers, but appear more pronounced for European and Japanese bank-affiliated dealers due to cross-jurisdictional differences in the regulation's implementation. This shifts market power to U.S. bank-affiliated dealers, affects the distribution of intermediation rents, and deteriorates liquidity conditions around quarter-ends. Since we do not document similar dynamics for nonbank dealers, banking regulation appears to periodically create trading needs for regulated dealers and trading opportunities for unregulated nonbank counterparties.

In contrast to recent empirical evidence from short-term funding markets (Correa, Du, and Liao, 2022; Wallen, 2022), we do not find that U.S. bank-affiliated dealers act as liquidity providers of ”last resort” by absorbing the selling pressure from their more constrained non-U.S. counterparts. Instead, we show that bank-affiliated dealers, no matter the regulatory jurisdiction, should be understood as liquidity providers of “first resort” with neither the regulatory capital nor the inclination to provide balance sheet capacity close to reporting dates. In the corporate bond market, bank-affiliated dealers rely on their customer networks to offload investment grade bonds, and their nonbank dealer networks to dispose of high-yield bonds.

Our findings have implications not only for the design of future banking regulation, but also for the design of macroprudential policies aimed at preventing market breakdowns in one of the world’s largest financial markets (FSB, 2021). Not only do we demonstrate how cross-jurisdictional heterogeneity in the implementation of banking regulation affect market power and the distribution of intermediation rents. We also show that customers and unregulated nonbank dealers play an important role in absorbing bank-affiliated dealers’ regulatory selling pressure at quarter-ends. Acknowledging that there is room for overhaul and that the role of nonbank financial intermediaries within the current regulatory framework needs to be better thought out, offers a path toward further enhancing bond market resilience.

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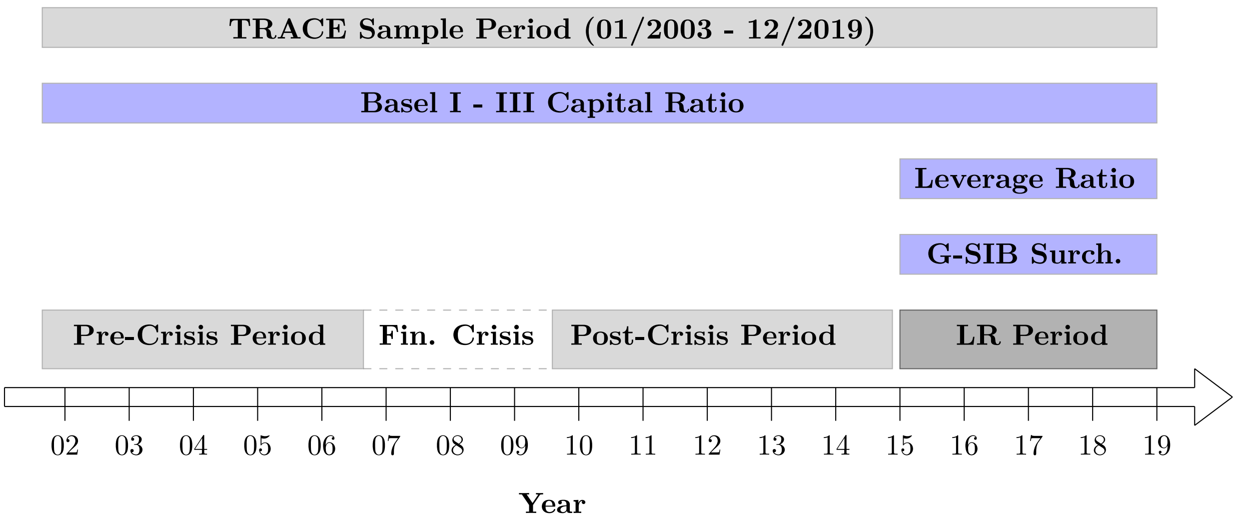
Figure 1
Overview of Regulatory Constraints

This figure illustrates when specific banking regulations are in place (Panel A) as well as the intra-quarter reporting practices of different regulations (Panel B). Panel A illustrates the definition of our regulatory periods (gray) and shows when specific regulations are in place (blue). Panel B shows when bank-affiliated dealers have to report key regulatory metrics to the regulatory authority. The left figure refers to the pre-leverage ratio period (01/2003 to 12/2014), while the right figure refers to the leverage ratio period (01/2015 -12/2019). Green shaded areas indicate quarter-end periods (light green refers to the last ten days prior to the end of quarter 1-3, while darker green refers to the last ten days prior to year-ends). Yellow boxes refer to risk-based capital requirements (Basel I - III capital ratio (CR)) and orange boxes refer to non-risk-based leverage ratio requirements (LR). In particular, light orange boxes refer to the reporting practices of U.S. dealers who report based on quarter averages (LR_{QA}) and dark orange boxes refer to the reporting practices of European and Japanese bank-affiliated dealers who report based on quarter-end snapshots (LR_{QE}). Blue boxes refer to the additional G-SIB requirements that are based on year-end reporting.

Panel A: Regulatory Constraints Across Time



Panel B: Constraints by Regulatory Period and Quarter

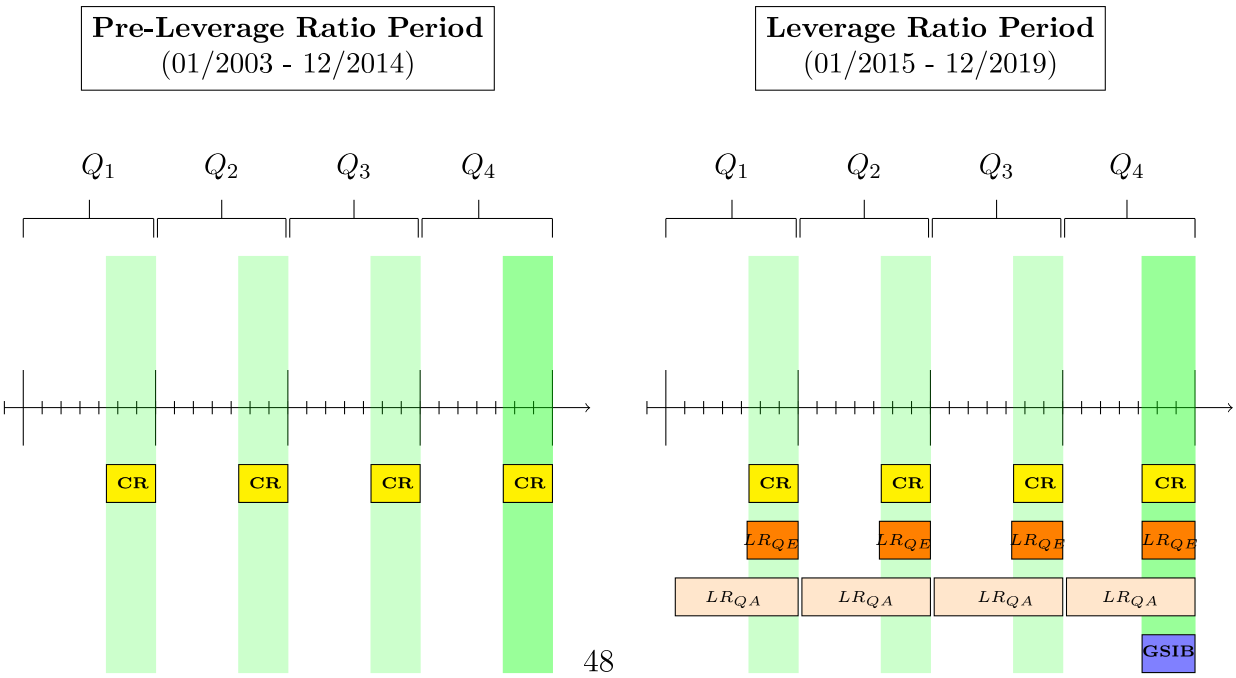
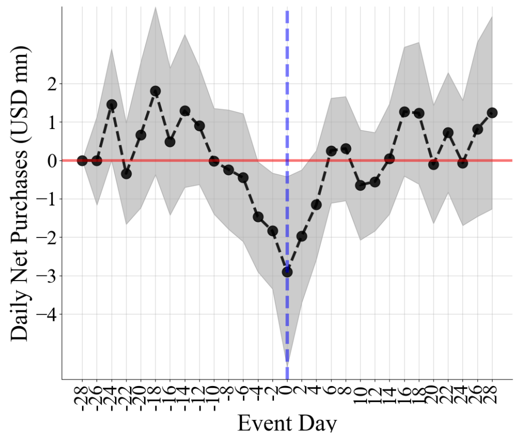


Figure 2
Net Purchases at Quarter-Ends - By Dealer Group

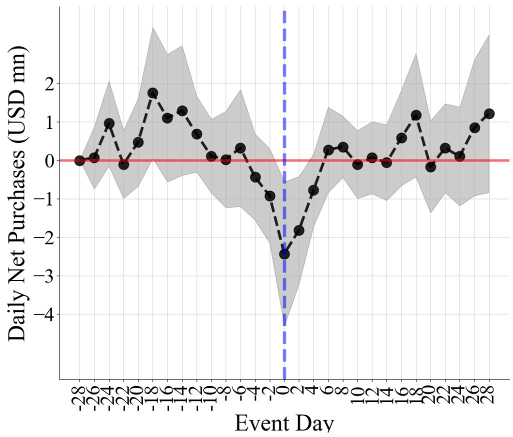
This figure presents event study coefficients of the regression:

$$\text{Net Purchases}_{i,t} = \sum_{k-27}^{k+28} \beta_k D_k + \theta' \mathbf{M_{t-1}} + \alpha_i + \alpha_{q,y} + \epsilon_{i,t},$$

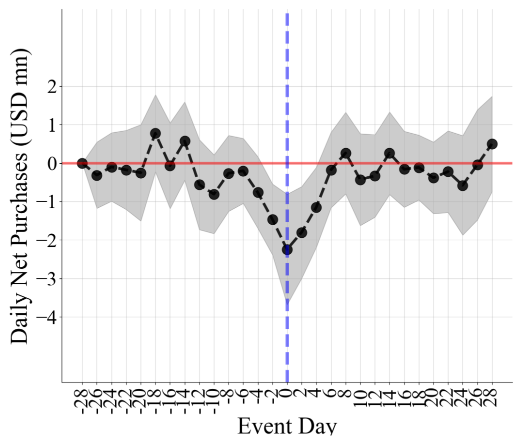
where Net Purchases$_{i,t}$ are dealer i's daily net purchases (that is, cumulative dealer buys less cumulative dealer sells) that enter the inventory at the end of a trading day. D_k is an indicator variable that is one on the respective event day k for $k \in [-28, 28] \setminus \{-28\}$. We define $T-28$ as the base period and normalize the dependent variable to zero on that day. This allows the regression coefficients to be interpreted as the average dealer's net trading on a given event day relative to the middle of the quarter, where regulatory pressure is lowest. $\mathbf{M_{t-1}}$ includes the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. We also include dealer fixed effects, α_i, as well as quarter times year fixed effects, $\alpha_{q,y}$. The sample period is from July 2002 to December 2019 (excluding the financial crisis period (01/2007 - 04/2009)). Black dots indicate the coefficient estimates, and the gray shaded lines the 95% confidence intervals. The blue dashed line indicates the regulatory reporting date. Standard errors are clustered at the dealer level.



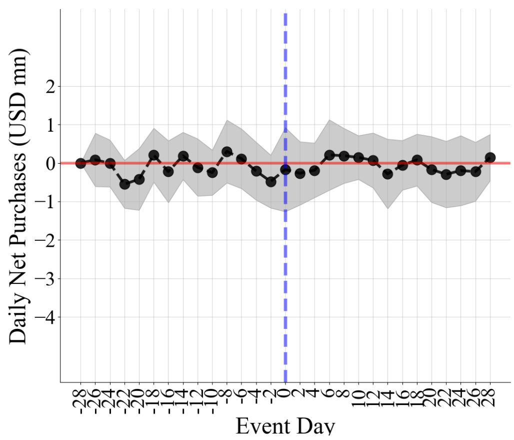
(a) All Dealers



(b) U.S. Bank-aff. Dealers



(c) Euro.& Jpn. Bank-aff. Dealers



(d) Nonbank Dealers

Figure 3

Transaction Cost Increase In Balance Sheet Intensive Trades - By Trade Size

This figure plots the coefficient estimates from the principal transaction regression in Table 12. The black dots indicate the coefficient estimates of quarter-end increases in principal transaction costs, separately for five different trade size brackets. The gray-shaded area denotes the 95% confidence interval.

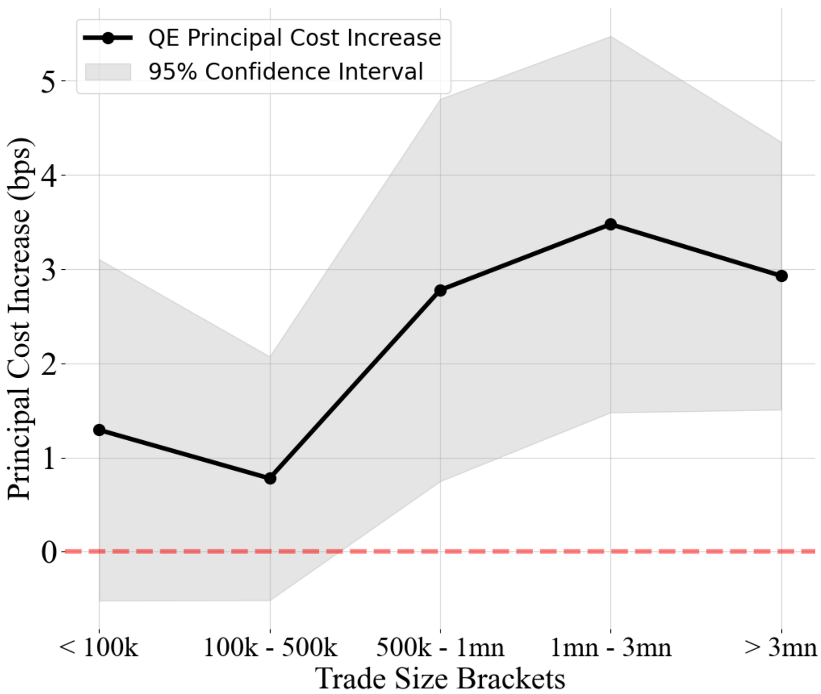


Table 1
Summary Statistics

This table provides summary statistics for our bond sample, dealer-day capital commitment ($ and standardized), and average customer transaction costs for the sample period from July 2002 to December 2019 (excluding the financial crisis period from 01/2007-04/2009). For all variables we report the total number of observations, the mean, the standard deviation and the 25%, 50% and 75% percentile. Panel A presents selected bond characteristics. The characteristics are the bond's offering amount, the bond age as of the reported transaction time, the remaining time to maturity as of the reported transaction time and the credit rating. Credit ratings are encoded following Anand, Jotikasthira, and Venkataraman (2021) where AAA = 1, AA+ = 2, etc. Panel B presents our measure of dealers' overnight capital commitment, separately for bank-affiliated dealers and nonbank dealers, as well as separated by quarter-end and non quarter-end periods. Panel C describes summary statistics for the standardized capital commitment measure. Panel D presents summary statistics for all customer transaction spreads following Choi, Huh, and Seunghun Shin (2023), while Panel E only presents spreads for transactions above $ 500,000.

Panel A: Bond Characteristics

Variable	Observations	Mean	SD	Q25	Median	Q75
Offering Amount [$ mn]	126,027,502	1,231.31	3,789.40	500.00	800.00	1,500.00
Age [years]	126,027,502	4.06	3.97	1.36	3.07	5.47
Time-to-Maturity [years]	126,027,502	7.52	7.65	2.98	5.37	8.52
Credit Rating [$ mn]	126,027,502	12.58	18.63	6.00	9.00	11.00

Panel B: Dealer Capital Commitment (daily, $mn)

Dealer Group	Observations	Mean	SD	Q25	Median	Q75
All Dealer	599,802	0.05	32.31	-0.33	0.00	0.49
Bank-Aff. Dealer	347,193	0.13	39.38	-0.10	0.00	0.29
Q 1-3 Non-QE	214,873	0.14	40.12	-0.10	0.00	0.32
Q 1-3 QE	47,112	-0.40	40.18	-0.12	0.00	0.28
Q 1-3 QE $[T-10, T-5]$	25,688	0.48	39.90	-0.09	0.00	0.34
Q 1-3 QE $[T-4, T]$	21,432	-1.45	40.48	-0.17	0.00	0.21
Nonbank Dealer	252,609	-0.05	18.63	-0.58	0.00	0.69
Q 1-3 Non-QE	156,806	-0.05	18.45	-0.58	0.00	0.73
Q 1-3 QE	34,324	0.13	19.07	-0.66	0.00	0.69

Panel C: Dealer Capital Commitment (daily, standardized, leverage ratio period)

Dealer Group	Observations	Mean	SD	Q25	Median	Q75
All Dealer	213,163	0.06	0.76	-0.09	0.00	0.23
Bank-Aff. Dealer	122,690	0.08	0.75	-0.03	0.00	0.19
Q 1-3 Non-QE	76,211	0.09	0.75	-0.03	0.00	0.20
Q 1-3 QE	16,460	0.06	0.76	-0.05	0.00	0.15

Table 1 - continued

Panel D: Customer Transaction Spreads (All Trades)

Dealer Group	Observations	Mean	SD	Q25	Median	Q75
All Dealer	25,053,651	102.77	170.86	1.73	38.44	147.58
Bank-Aff. Dealer	19,737,522	103.06	170.75	0.97	38.71	150.73
Quarters 1-3 Non-QE	12,324,071	104.90	171.77	1.20	39.88	155.30
Quarters 1-3 QE	2,767,782	102.95	169.75	0.79	38.89	150.33
Quarter 4 Non-QE	4,038,271	98.19	169.05	0.27	35.46	139.61
Quarter 4 QE	607,398	98.67	165.02	1.30	36.50	138.79
Nonbank Dealer	5,316,129	101.68	171.22	4.51	37.56	134.58
Quarters 1-3 Non-QE	3,265,942	105.06	173.73	5.29	39.59	141.67
Quarters 1-3 QE	739,775	100.13	168.91	4.70	36.70	131.14
Quarter 4 Non-QE	1,125,221	94.42	166.44	2.75	33.26	119.70
Quarter 4 QE	185,191	92.48	162.57	2.60	33.21	116.55

Panel E: Customer Transaction Spreads (Large Trades ($\geq$ $500,000))

Dealer Group	Observations	Mean	SD	Q25	Median	Q75
All Dealer	5,828,877	25.22	93.55	-7.20	12.81	50.31
Bank-Aff. Dealer	4,819,090	25.17	95.67	-8.93	12.92	51.23
Quarters 1-3 Non-QE	3,014,460	25.03	95.21	-9.02	12.85	51.15
Quarters 1-3 QE	671,576	24.87	93.09	-8.91	13.00	51.01
Quarter 4 Non-QE	1,023,757	25.52	98.75	-9.06	12.98	51.50
Quarter 4 QE	109,297	27.32	94.65	-6.16	13.84	52.40
Nonbank Dealer	1,009,787	25.51	82.71	-0.00	12.47	46.58
Quarters 1-3 Non-QE	617,628	25.76	82.94	-0.19	12.83	47.10
Quarters 1-3 QE	142,100	24.69	79.37	-0.00	12.08	45.15
Quarter 4 Non-QE	221,639	25.07	83.86	-0.06	12.00	45.79
Quarter 4 QE	28,420	27.45	84.85	-0.00	12.72	46.95

Table 2
Dealer Capital Commitment at Quarter-Ends vs. Year-Ends

The sample is constructed at the dealer-day level and presents results for the regression:

$$\begin{aligned} \text{Capital Commit.}_{i,t} = {} & \beta_1 \mathbb{1}\left[Bank-aff.\right] + \beta_2 \mathbb{1}\left[LR\right] + \beta_3 \mathbb{1}\left[QE\right] + \beta_4 \mathbb{1}\left[Bank-aff.\right] \times \mathbb{1}\left[QE\right] \\ & + \beta_5 \mathbb{1}\left[Bank-aff.\right] \times \mathbb{1}\left[LR\right] + \beta_6 \mathbb{1}\left[QE\right] \times \mathbb{1}\left[LR\right] \\ & + \beta_7 \mathbb{1}\left[QE\right] \times \mathbb{1}\left[LR\right] \times \mathbb{1}\left[Bank-aff.\right] + \theta' \mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,t}. \end{aligned}$$

The dependent variable, Capital Commit.$_{i,t}$, represents the dealer-specific daily capital commitment, i.e. how much capital the dealer commits to absorb bonds into the inventory. $\mathbb{1}\left[Bank-aff.\right]$ is an indicator variable that takes the value one in case the dealer is identified as a bank-affiliated dealer as outlined in Section 3. $\mathbb{1}\left[QE\right]$ is an indicator variable that is one if the respective transaction day is among the ten last trading days prior to the regulatory reporting date. $\mathbb{1}\left[LR\right]$ is an indicator variable that takes the value one from 01/2015 onwards, that is, once the Basel III leverage ratio and the G-SIB surcharges are implemented. $\mathbf{M_t}$ includes the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. α_{yq} represents year-quarter fixed effects, where a quarter, q, is defined from the middle of a quarter ($T-28$) to the middle of the next quarter ($T+28$)). α_i represents dealer fixed effects. In column one to three, the dependent variable is measure in \$, while in column four to six, the dependent variable is transformed via a log-modulus transformation. The total time period is 07/2002 - 12/2019, excluding the financial crisis (01/2007-04/2009). Standard errors, clustered at the dealer level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent Variable	Capital Commitment$_{i,t}$ (USD)			Capital Commitment$_{i,t}$ (log)		
Regulatory Jurisdiction of Bank Dealer	All	U.S.	Europ. & Jpn.	All	U.S.	Europ. & Jpn.
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[QE]$	0.072	0.072	0.067	0.002	0.002	0.002
	(0.077)	(0.078)	(0.077)	(0.008)	(0.008)	(0.008)
$\mathbb{1}[Bank-aff.] \times \mathbb{1}[QE]$	-0.201	-0.161	-0.278	-0.026	-0.031	-0.010
	(0.285)	(0.407)	(0.546)	(0.016)	(0.021)	(0.029)
$\mathbb{1}[Bank-aff.] \times \mathbb{1}[LR]$	2.851***	2.895***	4.830***	0.122**	0.139**	0.187**
	(0.839)	(0.965)	(1.825)	(0.049)	(0.057)	(0.073)
$\mathbb{1}[QE] \times \mathbb{1}[LR]$	0.371	0.366	0.433	0.033	0.033	0.032
	(0.627)	(0.633)	(0.638)	(0.024)	(0.025)	(0.025)
$\mathbb{1}[Bank-aff.] \times \mathbb{1}[QE] \times \mathbb{1}[LR]$	-2.591***	-3.044**	-3.066***	-0.096**	-0.106**	-0.114**
	(0.899)	(1.240)	(1.089)	(0.037)	(0.049)	(0.056)
R-Squared	0.01	0.01	0.01	0.02	0.02	0.02
Observations	453,086	336,434	268,741	453,142	336,484	268,795
Dealer FE	✓	✓	✓	✓	✓	✓
Year x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Table 3
Dynamics of Capital Commitment at Quarter-End

The sample is constructed at the dealer-day level and presents results for the regression:

$$\begin{aligned}\text{Capital Commit.}_{i,t} &= \beta_1\, \mathbb{1}\,[Bank-aff.] + \beta_2\, \mathbb{1}[T-10, T-5] + \beta_3\, \mathbb{1}[T-4, T] \\ &+ \beta_4\, \mathbb{1}\,[Bank-aff.] \times \mathbb{1}[T-10, T-5] + \beta_5\, \mathbb{1}[T-4, T] \times \mathbb{1}\,[Bank-aff.] \\ &+ \theta'\, \mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,t}.\end{aligned}$$

The dependent variable, Capital Commit.$_{i,t}$, represents the dealer-specific daily capital commitment, i.e. how much capital the dealer commits to absorb bonds into the inventory. $\mathbb{1}\,[Bank-aff.]$ is an indicator variable that takes the value one in case the dealer is identified as a bank-affiliated dealer as outlined in Section 3. $\mathbb{1}[T-10, T-5]$ is an indicator variable that is one if the respective transaction day is among ten to five days prior to the regulatory reporting date and zero else. $\mathbb{1}[T-4, T]$ is one if the respective transaction day is among the last five trading days prior to the regulatory reporting date and zero else. $\mathbf{M_t}$ includes the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. α_{yq} represents year-quarter fixed effects, where a quarter, q, is defined from the middle of a quarter $(T-28)$ to the middle of the next quarter $(T+28)$). α_i represents dealer fixed effects. In column one to three, we restrict the analysis to the pre- and post-crisis period, while in column four to six we restrict the analysis to the leverage ratio period. Standard errors, clustered at the dealer level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent Variable	Daily Capital Commitment$_{i,t}$					
Quarter	Pre- & Post-Crisis			Leverage Ratio		
Regulatory Jurisdiction of Bank Dealer	All	U.S.	Europ. & Jpn.	All	U.S.	Europ. & Jpn.
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[T-10, T-5]$	0.190	0.208	0.176	1.319	1.292	1.337
	(0.161)	(0.162)	(0.161)	(1.049)	(1.043)	(1.041)
$\mathbb{1}[Bank-aff.] \times \mathbb{1}[T-10, T-5]$	2.043***	2.684**	1.828	-3.971***	-5.192***	-4.281**
	(0.772)	(1.181)	(1.190)	(1.347)	(1.643)	(1.672)
$\mathbb{1}[T-4, T]$	-0.114	-0.127	-0.106	0.481	0.439	0.244
	(0.153)	(0.154)	(0.151)	(0.546)	(0.588)	(0.604)
$\mathbb{1}[Bank-aff.] \times \mathbb{1}[T-4, T]$	-1.792**	-2.661**	-1.294**	-2.851**	-3.852*	-3.531**
	(0.764)	(1.158)	(0.652)	(1.182)	(2.035)	(1.556)
R-squared	0.01	0.01	0.01	0.02	0.01	0.03
Observations	213,997	167,361	135,491	120,075	88,133	77,986
Dealer FE	✓	✓	✓	✓	✓	✓
Year x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Table 4
Standardized Capital Commitment by Bank-affiliated Dealers

The sample is constructed at the dealer-day level and restricted to the leverage ratio period. We perform the following regression:

$$\text{Std. Capital Commitment}_{i,t} = \beta_1 \mathbb{1}[QE] + \beta_2 \mathbb{1}[LR] + \beta_3 \mathbb{1}[QE] \times \mathbb{1}[LR] + \theta' \mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,t}.$$

The dependent variable, Std. Capital Commitment$_{i,t}$, represents the dealer-specific daily capital commitment standardized with the dealer-specific standard deviation of the inventory. $\mathbb{1}[LR]$ is an indicator variable that takes the value one from 01/2015 onwards, that is, once the Basel III leverage ratio and the G-SIB surcharges are implemented. $\mathbb{1}[QE]$ is an indicator variable that is one if the respective transaction day is among the ten last trading days prior to the regulatory reporting date. $\mathbf{M_t}$ includes the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. α_{yq} represents year-quarter fixed effects (where a quarter, q, is defined from the middle of a quarter ($T-28$) to the middle of the next quarter ($T+28$)). α_i represents dealer fixed effects. In column one to three, we restrict the analysis to U.S. bank-affiliated dealers, while in column four to six we restrict the analysis to European and Japanese bank-affiliated dealers. The total time period is 07/2002 - 12/2019, excluding the financial crisis (01/2007-04/2009). Standard errors, clustered at the dealer level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent Variable	Standardized Capital Commitment$_{i,t}$					
Regulatory Jurisdiction of Bank Dealer	U.S. Bank-aff.			Europ. & Jpn. Bank-aff.		
Bond Type	All	IG	HY	All	IG	HY
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[QE]$	0.002	0.001	0.002	0.002	0.006	0.002
	(0.006)	(0.006)	(0.004)	(0.008)	(0.008)	(0.008)
$\mathbb{1}[QE] \times \mathbb{1}[LR]$	-0.035**	-0.033**	-0.016**	-0.047***	-0.048***	-0.020
	(0.014)	(0.014)	(0.008)	(0.016)	(0.017)	(0.014)
R-Squared	0.06	0.06	0.02	0.02	0.02	0.01
Observations	145,312	145,312	144,315	77,618	76,460	77,618
Dealer FE	✓	✓	✓	✓	✓	✓
Year x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Table 5
Liquidity Pecking Order in Quarter-End Bond Sales

The sample is constructed at the dealer-bond-day level and restricted to quarter one to three in the pre- and post-crisis period (column one to three) and the leverage ratio period (column four to six). We perform the following regression:

$$\text{Log(Bond Selling Volume)}_{i,j,t} = \beta_1 \overline{\textit{Illiquidity}_{j,t-1}} + \beta_2 \mathbf{1}[QE] + \beta_3 \overline{\textit{Illiquidity}_{j,t-1}} \times \mathbf{1}[QE] + \theta_1' \mathbf{M_{j,t}} + \theta_2' \mathbf{M_t} + \alpha_r + \alpha_d + \alpha_{i,yq} + \varepsilon_{i,j,t}.$$

The dependent variable, Log(Bond Selling Volume)$_{i,j,t}$, represents the logarithm of a bank-affiliated dealer i's daily selling volume in bond j to customers. $\overline{\textit{Illiquidity}_{j,t-1}}$ is a proxy for bond illiquidity and computed as bond j's average transaction spread over the last 90 days. $\mathbb{1}[QE]$ is an indicator variable that is one if the respective transaction day is among the ten last trading days prior to the regulatory reporting date. $\mathbf{M_{j,t}}$ is a vector of bond-level controls and includes a bond's age (years), time-to-maturity (years), and the logarithm of its amount outstanding. $\mathbf{M_t}$ includes the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. α_r represents rating fixed effects, α_d represents industry fixed effects, and $\alpha_{i,yq}$ represents dealer-year-quarter fixed effects (where a quarter, q, is defined from the middle of a quarter ($T-28$) to the middle of the next quarter ($T+28$)). Column one to three refers to the pre- and post-crisis period (02/2002 to 12/2006 and 05/2009 to 12/2014), while column four to six refers to the leverage ratio period. Standard errors, clustered at the bond and day levels, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent Variable	Log(Bond Selling Volume)$_{i,j,t}$			
Regulatory Jurisdiction of Bank Dealer	U.S.		European & Japanese	
Regulatory Period	Pre- & Post-Crisis	Leverage Ratio	Pre- & Post-Crisis	Leverage Ratio
	(1)	(2)	(3)	(4)
$\overline{\textit{Illiquidity}_{j,t-1}}$	-0.292***	-0.328***	-0.278***	-0.391***
	(0.008)	(0.015)	(0.010)	(0.022)
$\mathbb{1}[QE]$	0.028**	0.015	-0.012	0.019
	(0.013)	(0.017)	(0.016)	(0.020)
$\mathbb{1}[QE] \times \overline{\textit{Illiquidity}_{j,t-1}}$	-0.037***	-0.044***	-0.014	-0.092***
	(0.010)	(0.016)	(0.015)	(0.030)
R-Squared	0.18	0.18	0.20	0.19
Observations	704,524	701,808	239,113	186,051
Dealer x Year x Quarter FE	✓	✓	✓	✓
Rating FE	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓
Bond Controls	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓

Table 6
U.S. Bank-Affiliated Dealers' Trading with Counterparties

The sample is constructed at the dealer-day level and restricted to quarters one to three in the leverage ratio period (01/2015-12/2019). We perform the following regression:

$$\text{Net Selling}_{i,m,t} = \beta_1 \mathbf{1}[QE] + \theta' \mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,m,t}.$$

The dependent variable, Net Selling$_{i,m,t}$, represents the net selling volume of dealer i vis-à-vis the counterparty type m on day t. $\mathbb{1}[QE]$ is an indicator variable that is one if the respective transaction day is among the last ten days prior to the regulatory reporting date. $\mathbf{M_t}$ includes the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. α_{yq} represents year-quarter fixed effects (where a quarter, q, is defined from the middle of a quarter $(T-28)$ to the middle of the next quarter $(T+28)$). α_i represents dealer fixed effects. We restrict the sample to U.S. bank-affiliated dealers as reporting entity. Panel A refers to customers as the counterparty type. Panel B refers to nonbank dealer as the counterparty type. Panel C refers to foreign bank-affiliated dealers as the counterparty type. We define foreign bank-affiliated dealers as all bank-affiliated dealers not incorporated in the U.S. Standard errors, clustered at the dealer and day level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Panel A: Counterparty: Customers

Bond Risk Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbf{1}[QE]$	4.288**	9.904*	4.622	8.824**	5.622	1.331	2.061
	(2.036)	(4.861)	(4.576)	(4.242)	(4.576)	(2.150)	(2.379)
R-Squared	0.10	0.89	0.89	0.85	0.89	0.85	0.85
Observations	22,757	21,605	21,731	19,245	21,731	20,161	20,167

Panel B: Counterparty: Nonbank Dealers

Bond Risk Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbf{1}[QE]$	1.242*	3.410**	1.832	2.345**	2.264**	1.355**	-0.392
	(0.678)	(1.555)	(1.090)	(1.120)	(0.993)	(0.640)	(0.455)
R-Squared	0.09	0.82	0.83	0.78	0.78	0.75	0.73
Observations	26,908	24,390	25,769	23,450	24,816	21,266	21,521

Panel C: Counterparty: Foreign Bank-Affiliated Dealers

Bond Risk Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbf{1}[QE]$	0.597**	0.484*	-0.196	0.234	-0.235	0.317*	0.057
	(0.280)	(0.276)	(0.279)	(0.246)	(0.248)	(0.172)	(0.125)
R-Squared	0.05	0.72	0.70	0.67	0.65	0.51	0.50
Observations	24,281	21,249	22,221	19,856	21,416	15,985	14,483
Dealer FE	✓	✓	✓	✓	✓	✓	✓
Year × Quarter FE	✓	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓	✓

Table 7
European/Japanese Bank-Aff. Dealers' Trading with Counterparties

The sample is constructed at the dealer-day level and restricted to quarters 1-3 in the leverage ratio period (01/2015-12/2019). We perform the following regression:

$$\text{Net Selling}_{i,m,t} = \beta_1\, \mathbf{1}[QE] + \theta'\, \mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,m,t}.$$

The dependent variable, Net Selling$_{i,m,t}$, represents the net selling volume of dealer i vis-à-vis the counterparty type m on day t. $\mathbb{1}[QE]$ is an indicator variable that is one if the respective transaction day is among the last ten days prior to the regulatory reporting date. $\mathbf{M_t}$ includes the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. α_{yq} represents year-quarter fixed effects (where a quarter, q, is defined from the middle of a quarter ($T-28$) to the middle of the next quarter ($T+28$)). α_i represents dealer fixed effects. We restrict the sample to European and Japanese bank-affiliated dealers as reporting entity. Panel A refers to customers as the counterparty type. Panel B refers to nonbank dealer as the counterparty type. Panel B refers to U.S. bank-affiliated dealers as the counterparty type. Standard errors, clustered at the dealer and day level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Panel A: Counterparty: Customers

Bond Risk Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{1}[QE]$	3.515**	5.489*	1.737	5.353**	0.961	0.524	1.114
	(1.331)	(2.680)	(2.835)	(2.469)	(2.130)	(0.741)	(1.210)
R-Squared	0.13	0.87	0.87	0.83	0.82	0.82	0.82
Observations	18,027	17,006	16,746	15,779	15,446	13,513	13,745

Panel B: Counterparty: Nonbank Dealers

Bond Risk Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{1}[QE]$	0.363	3.115**	2.723**	2.215**	2.852***	1.292*	0.051
	(0.559)	(1.219)	(1.144)	(0.859)	(1.009)	(0.660)	(0.553)
R-Squared	0.05	0.75	0.72	0.67	0.62	0.63	0.60
Observations	17,947	17,062	17,033	16,143	16,007	13,510	13,338

Panel C: Counterparty: U.S. Bank-Affiliated Dealers

Bond Risk Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbf{1}[QE]$	-0.0175	0.107	0.334	0.031	0.255	0.111	0.087
	(0.164)	(0.315)	(0.391)	(0.284)	(0.298)	(0.138)	(0.232)
R-Squared	0.21	0.62	0.65	0.51	0.59	0.44	0.40
Observations	15,970	14,404	14,182	13,590	13,295	9,965	9,943
Dealer FE	✓	✓	✓	✓	✓	✓	✓
Year × Quarter FE	✓	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓	✓

Table 8
Transaction Spreads - Customer Discounts

The sample is constructed at the transaction level and restricted to quarter one to three in the leverage ratio period (01/2015-12/2019). We further restrict the sample to transactions in which the dealer sells to a customer. We then perform the following regression:

$$Spread_{k,j,i,t} = \beta_1 \, \mathbb{1}\left[QE\right] + \theta_1' \mathbf{M_t} + \theta_2' \, \mathbf{M_{j,t}} + \alpha_{j\times yq\times s} + \alpha_{r\times yq} + \alpha_{i\times yq} + \varepsilon_{k,j,i,t}.$$

The dependent variable, $Spread_{k,j,i,t}$, represents the transaction cost measure as described in Section 3. $\mathbb{1}\left[QE\right]$ is an indicator variable that is one if the transaction day is among the ten last trading days prior to the regulatory reporting date. $\mathbf{M_t}$ is a vector of market controls, including the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. $\mathbf{M_{j,t}}$ is a vector of bond-level controls, including the bond's age and time-to-maturity, defined as the logarithm of the number of years since issuance and the number of years to maturity, respectively, as well as the amount outstanding, which is given by the logarithm of a bond's total par amount outstanding. $\alpha_{j\times yq\times s}$ represents bond-year-quarter-trade size category fixed effects, $\alpha_{r\times yq}$ refers to rating-year-quarter fixed effects, and $\alpha_{i\times yq}$ refers to dealer-year-quarter fixed effects. A quarter, q, is defined from the middle of a quarter $(T-28)$ to the middle of the next quarter $(T+28)$. Trade size categories are defined as: i) less than \$ 100,000, between \$ 100,000 and \$ 1 mn and above \$ 1mn. In column four and five, small trades refer to trades smaller than \$ 500,000 and as large trades otherwise. Rating buckets follow ECRA definitions. Panel A refers to U.S. bank-affiliated dealers. Panel B refers to European & Japanese bank-affiliated dealers. Standard errors, clustered at the dealer level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Panel A: U.S. Bank-affiliated Dealers

Bond Category	Bond Risk			Trade Size	
Bond Risk Type	All	IG	HY	Small	Large
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}[QE]$	-2.165***	-2.812***	-0.962	-2.509***	-0.773
	(0.654)	(0.679)	(1.222)	(0.746)	(0.496)
R-Squared	0.58	0.58	0.59	0.58	0.26
Observations	6,660,323	4,862,784	1,795,032	5,542,303	1,064,685

Panel B: European & Japanese Bank-affiliated Dealers

Bond Category	Bond Risk			Trade Size	
Bond Risk Type	All	IG	HY	Small	Large
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}[QE]$	-3.502***	-4.284***	-1.431	-5.738***	0.379
	(0.660)	(0.749)	(1.130)	(0.961)	(0.608)
R-Squared	0.55	0.59	0.47	0.58	0.26
Observations	1,515,007	1,089,739	423,436	906,235	576,011
Dealer x Year x Quarter FE	✓	✓	✓	✓	✓
Bond x Year x Quarter x Size FE	✓	✓	✓	✓	✓
Rating x Year x Quarter FE	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓

Table 9
Insurance Companies' Quarter-End Liquidity Supply

This sample is constructed at the insurer-day level. We perform the following regression:

$$Insurer\ Trading_{n,t} = \beta_1\, \mathbb{1}[QE] + \alpha_n + \alpha_{yq} + \theta'\, \mathbf{X_{n,y}} + \varepsilon_{n,t}$$

The dependent variable, $Net\, Purchases_{i,t}$, refers to the logarithm of 1 plus the *net* amount of bonds purchased by insurance company i on day t. $\mathbb{1}[QE]$ is an indicator variable that takes the value one during the last ten days prior to a reporting date. $\mathbb{1}[LR]$ is an indicator variable that takes the value one from 01/2015 onwards, that is, once the Basel III leverage ratio and the G-SIB surcharges are implemented. $\mathbf{X_{i,y}}$ refers to annual insurer controls and includes $Log(Total\, Assets)$ defined as the logarithm of an insurer's total assets. $Asset\, Growth$ is the five-year compound annual growth rate of total assets. $Log(RBC\ Ratio)$ is the logarithm of the ACL risk-based capital ratio. $Leverage$ is one minus the ratio of equity to total assets. $Cash - to - Assets$ is an insurer's cash holdings over total assets. α_{yq} represents year-quarter fixed effects (where a quarter, q, is defined from the middle of a quarter ($T-28$) to the middle of the next quarter ($T+28$)). α_n represents an insurer fixed effect. Panel A displays insurers' liquidity supply during the leverage ratio period (01/2015 - 12/2019). Panel B contrasts insurers' liquidity supply between the leverage ratio period and the pre-leverage ratio period (01/2011 - 12/2014). Standard errors, double-clustered at the insurance and day level, are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Panel A: Insurer Quarter-End Liquidity Supply

	Bond Risk		Insurer Type			
	IG	HY	Life	Property & Casualty		
Dependent Variable	Net Trading$_{i,t}$				Buying$_{i,t}$	Selling$_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[QE]$	0.024**	0.016	-0.014	0.058***	0.045***	-0.007
	(0.012)	(0.010)	(0.024)	(0.015)	(0.014)	(0.011)
R-Squared	0.03	0.02	0.04	0.03	0.17	0.24
Observations	1,592,659	1,592,659	393,469	1,199,190	1,199,190	1,199,190
Insurer FE	✓	✓	✓	✓	✓	✓
Year x Quarter FE	✓	✓	✓	✓	✓	✓
Insurer controls	✓	✓	✓	✓	✓	✓

Panel B: Insurer Quarter-End Liquidity Supply - LR vs. Pre-LR Period

Insurer Type	All	Life	Property & Casualty		
Dependent Variable	Net Trading$_{i,t}$			Buying$_{i,t}$	Selling$_{i,t}$
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}[QE]$	-0.005	0.019	-0.012	0.007	0.017**
	(0.012)	(0.030)	(0.009)	(0.009)	(0.007)
$\mathbb{1}[QE] \times \mathbb{1}[LR]$	0.035*	-0.034*	0.070***	0.037**	-0.024*
	(0.020)	(0.045)	(0.018)	(0.016)	(0.013)
R-Squared	0.03	0.03	0.02	0.13	0.17
Observations	3,598,232	909,072	2,709,783	2,709,783	2,709,783
Insurer FE	✓	✓	✓	✓	✓
Year x Quarter FE	✓	✓	✓	✓	✓
Insurer Controls	✓	✓	✓	✓	✓

Table 10
Relationship Effects in Quarter-End Liquidity Provisioning

This sample is constructed at the insurer-dealer-day level. We perform the following regression:

$$\begin{aligned} Insurer\ Trading_{n,i,t} &= \beta_1\, \mathbf{1}[QE] + \beta_2\ Past\ Trd.Vol_{n,i} \\ &+ \beta_3 \mathbf{1}[QE] \times Past\ Trd.\ Vol_{n,i} + \theta'\, \mathbf{M_{n,y}} + \alpha_n + \alpha_i + \alpha_{yq} + \varepsilon_{i,n,t} \end{aligned}$$

The dependent variable, $Insurer\ Trading_{n,i,t}$, represents the (net) trading volume of insurer n with dealer i on trading date t. $\mathbf{1}[QE]$ is an indicator variable that takes the value one if the trading day is during the last ten trading days of a quarter and zero else. $Past\,Trd.Vol_{n,i}$ denotes the log of 1 plus the average monthly trading volume between insurer n and dealer i over the previous 24 months. $\mathbf{M_{n,y}}$ refers to annual insurer controls and includes $Log(TotalAssets)$ defined as the logarithm of an insurer's total assets. $AssetGrowth$ is the five-year compound annual growth rate of total assets. $Log(RBCRatio)$ is the logarithm of the ACL risk-based capital ratio. $Leverage$ is one minus the ratio of equity to total assets. $Cash-to-Assets$ is an insurer's cash holdings over total assets. α_{yq} represents year-quarter fixed effects (where a quarter, q, is defined from the middle of a quarter ($T-28$) to the middle of the next quarter ($T+28$)). α_n refers to insurer fixed effects and α_i denotes dealer fixed effects. The total time period is 01/2015 - 12/2019 (leverage ratio period). Column one refer to all insurers. Column two refer to life insurers. Column three to five refer to property and casual insurers. Standard errors, double-clustered at the insurer-dealer and date level, are in parantheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Insurer Type	All	Life	Property & Casualty		
Dependent Variable	Net Trading$_{n,i,t}$			Buying$_{n,i,t}$	Selling$_{n,i,t}$
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}[QE]$	0.01	0.05	-0.03	-0.05	-0.03
	(0.02)	(0.05)	(0.02)	(0.03)	(0.02)
$Past\ Trading_{n,i}$	0.06***	0.08***	0.04***	0.12***	0.007***
	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)
$\mathbb{1}[QE] \times Past\ Trading_{n,i}$	0.00	-0.01	0.01**	0.02***	0.00
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
R-Squared	0.01	0.01	0.01	0.01	0.02
Observations	14,828,003	4,546,747	10,281,256	10,281,256	10,281,256
Insurer FE	✓	✓	✓	✓	✓
Dealer FE	✓	✓	✓	✓	✓
Year x Quarter FE	✓	✓	✓	✓	✓
Insurer Controls	✓	✓	✓	✓	✓

Table 11
Dealers' Principal Trading Behavior at Quarter-Ends

The sample is constructed at the dealer-day level and restricted to quarter one to three in the leverage ratio period (01/2015-12/2019). We then perform the following regression:

$$\text{Share of Principal Volume}_{i,t} = \beta_1 \mathbb{1}\,[QE] + \theta' \mathbf{M_t} + \alpha_i + \alpha_{yq} + \varepsilon_{i,t}.$$

The dependent variable, Share of Principal Volume$_{i,t}$, represents the daily share of a dealer's purchase volume that is intermediated in the form of a principal transaction. We identify principal trades following Choi, Huh, and Seunghun Shin (2023). $\mathbb{1}\,[QE]$ is an indicator variable that is one if the transaction day is among the ten last trading days prior to the regulatory reporting date. $\mathbf{M_t}$ is a vector of controls, including the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. α_i are dealer fixed effects, and α_{yq} represents year-quarter fixed effects (where a quarter, q, is defined from the middle of a quarter ($T-28$) to the middle of the next quarter ($T+28$)). Standard errors, clustered at the dealer level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Panel A: U.S. Bank-affiliated Dealers

Dependent Variable	Share of Principal Volume			Share of Principal Trades		
Bond Risk Type	All	IG	HY	All	IG	HY
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[QE]$	-0.039	-0.198	0.160	0.171	0.123	0.048
	(0.209)	(0.209)	(0.112)	(0.213)	(0.195)	(0.093)
R-Squared	0.61	0.58	0.39	0.68	0.64	0.46
Observations	22,757	22,757	22,757	22,757	22,757	22,757

Panel B: European & Japanese Bank-affiliated Dealers

Dependent Variable	Share of Principal Volume			Share of Principal Trades		
Bond Risk Type	All	IG	HY	All	IG	HY
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[QE]$	-1.248***	-0.618**	-0.629**	-0.721*	-0.284	-0.437
	(0.344)	(0.310)	(0.315)	(0.413)	(0.369)	(0.353)
R-Squared	0.36	0.34	0.20	0.40	0.39	0.24
Observations	18,027	18,027	18,027	18,027	18,027	18,027

Panel C: Nonbank Dealers

Dependent Variable	Share of Principal Volume			Share of Principal Trades		
Bond Risk Type	All	IG	HY	All	IG	HY
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbf{1}[QE]$	-0.198	-0.349*	0.151	-0.236	-0.264	0.028
	(0.294)	(0.190)	(0.206)	(0.263)	(0.191)	(0.202)
R-Squared	0.36	0.39	0.22	0.44	0.45	0.31
Observations	44,726	44,726	44,726	44,726	44,726	44,726
Dealer FE	✓	✓	✓	✓	✓	✓
Year x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Table 12
Customer Transaction Costs at Quarter-End - By Reg. Period

The sample is constructed at the transaction level level and restricted to quarter one to three in the leverage ratio period (01/2015-12/2019). We further restrict the sample to trades in which the dealer purchases from a customer and perform the following regression:

$$Spread_{k,j,i,t} = \beta_0 + \beta_1 \mathbb{1}[QE] + \theta_1' \mathbf{M_t} + \theta_2' \mathbf{M_{j,t}} + \alpha_{j\times yq\times s} + \alpha_{r\times yq} + \alpha_{i\times yq} + \varepsilon_{k,j,i,t}.$$

The dependent variable, $Spread_{k,j,i,t}$, represents the spread charged for purchase k by dealer i in bond j on day t. We compute the spread measure following Choi, Huh, and Seunghun Shin (2023) (for details, see Section 3). $\mathbb{1}[QE]$ is an indicator variable that is one if the respective transaction day is among the last ten trading days prior to the regulatory reporting date. $\mathbf{M_t}$ includes the change in the VIX, the change in the 3-month LIBOR, the return of the S&P 500, the change in the spread of the ICE BofA IG corporate bond index, the change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. $\mathbf{M_{j,t}}$ contains a bond's age and time-to-maturity defined as the logarithm of the number of years since issuance and the number of years to maturity, respectively, as well as the amount outstanding which is given by the logarithm of a bond's total par amount outstanding. $\alpha_{j\times yq\times s}$ represents bond-year-quarter-trade size category fixed effects, $\alpha_{r\times yq}$ refers to rating-year-quarter fixed effects, and $\alpha_{i\times yq}$ refers to dealer-year-quarter fixed effects. A quarter, q, is defined from the middle of a quarter $(T-28)$ to the middle of the next quarter $(T+28)$. Trade sizes are defined as: i) less than \$ 100,000, between \$ 100,000 and \$ 1 mn and above \$ 1mn. Small trades refer to trades smaller than \$ 500,000 and as large trades otherwise. Rating buckets follow ECRA definitions. Panel A separates transaction costs by trade type (principal vs. agency). Panel B presents results for investment grade bonds, separately by trade size. Panel C presents results for high yield bonds, separately by trade size. Panel D presents results for all bonds separate by five size thresholds. Standard errors, clustered at the bond and day level, are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Panel A: Transaction Costs by Trade Type

Dependent Variable	Transaction Cost ($Spread_{k,j,i,t}$)					
Regulatory Jurisdiction of Bank Dealer	U.S.		Europ. & Jpn.		Nonbanks	
Transaction Type	Principal	Agency	Principal	Agency	Principal	Agency
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbf{1}[QE]$	1.253**	1.267	1.872**	0.643	0.674	-0.439
	(0.598)	(1.084)	(0.824)	(0.876)	(0.867)	(0.761)
R-Squared	0.45	0.51	0.38	0.45	0.58	0.51
Observations	1,147,829	947,616	237,597	146,305	196,450	319,057

Panel B: Transaction Costs by Trade Size - IG Bonds

Dependent Variable	Principal Transaction Cost ($Spread_{k,j,i,t}$)					
Regulatory Jurisdiction of Bank Dealer	U.S.		Europ. & Jpn.		Nonbanks	
Trade Size	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbf{1}[QE]$	2.834***	0.382	2.116**	-1.176	-1.758	0.241
	(0.679)	(0.584)	(0.965)	(1.045)	(1.659)	(1.801)
R-Squared	0.29	0.42	0.35	0.50	0.44	0.60
Observations	211,533	534,948	67,473	63,500	27,365	71,033

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Table 12 - continued

Panel C: Transaction Costs by Trade Size - HY Bonds

Dependent Variable	Principal Transaction Cost ($Spread_{k,j,i,t}$)					
Regulatory Jurisdiction of Bank Dealer	U.S.		Europ. & Jpn.		Nonbanks	
Trade Size	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbf{1}[QE]$	4.179***	-0.290	5.564***	0.200	1.206	1.156*
	(1.254)	(1.911)	(1.929)	(2.368)	(2.278)	(2.088)
R-Squared	0.23	0.48	0.26	0.50	0.41	0.62
Observations	159,165	219,609	62,052	33,071	24,553	62,020
Dealer x Year x Quarter FE	✓	✓	✓	✓	✓	✓
Bond x Year x Quarter x Size FE	✓	✓	✓	✓	✓	✓
Rating x Year x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Panel D: Transaction Costs by Trade Size - All Bonds

Dependent Variable	Principal Transaction Cost ($Spread_{k,j,i,t}$)				
Trade Size (USD mn)	$< 100k$	$100k - 500k$	$500k - 1mn$	$1mn - 3mn$	$> 3mn$
	(1)	(2)	(3)	(4)	(5)
$\mathbf{1}[QE]$	1.292	0.778	2.776***	3.475***	2.928***
	(0.924)	(0.660)	(1.035)	(1.019)	(0.725)
R-Squared	0.47	0.35	0.31	0.23	0.24
Observations	1,379,661	406,459	136,276	271,757	274,157
Dealer x Year x Quarter FE	✓	✓	✓	✓	✓
Bond x Year x Quarter x Size FE	✓	✓	✓	✓	✓
Rating x Year x Quarter FE	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓