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

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Abstract

We study how Basel regulations impact corporate bond intermediation in the cross-section of differently regulated intermediaries. Using intra-quarter variation in the intensity of Basel requirements, we document pronounced inventory contractions when regulatory pressure rises near quarter ends. In contrast to their behavior in short-term money markets, U.S. bank dealers do not absorb regulatory selling pressure in corporate bonds. Instead, bank dealers direct their selling primarily to nonbank financial intermediaries at sizeable price concessions. In doing so, they fall back on institutional investors to offload investment-grade bonds and nonbank dealers to dispose of high-yield bonds. In the aggregate, Basel leverage regulation significantly impairs liquidity conditions in the corporate bond market, specifically in balance sheet-intensive trades in which regulatory shadow costs account for up to 20% of average transaction costs. 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, G28

Keywords: Corporate Bond, Dealer, Regulation, Liquidity, Nonbank Financial Intermediation, Insurance Companies, Networks

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1 Introduction

Dealer intermediation is essential in decentralized bond markets, in which buyers and sellers arrive sporadically and search costs are high. By committing their own capital, dealers smooth temporary order flow imbalances and thus provide liquidity to investors. However, in the aftermath of the financial crisis, regulated bank dealers appear to have curtailed their capacity for corporate bond intermediation. Not only have bank dealers reduced their capital commitment in the aggregate (Bessembinder, Jacobsen, Maxwell, and Venkataraman, 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, Lester, Lindsay, Liu, Weill, and Zúñiga, 2021; O'Hara and Zhou, 2021).

These concerns have led regulators to call for better understanding of the interactions between bank regulations implemented under the Basel Accords and corporate bond intermediation (Bank of England, 2021). Against the backdrop of curtailed intermediation capacity and a rapidly growing corporate bond market, it is important to examine how specific Basel regulations affect bond intermediation and to quantify their effect on the cost of immediacy. To date, however, relatively little is known about the effects of specific regulations in the cross-section of regulated dealers, their interaction with nonbank financial intermediaries, and the associated pass-through of regulatory costs from dealers to their customers.

In this paper, we address these questions by studying how risk-weighted capital regulation and non-risk-weighted leverage regulation affect the cross-section of dealers, their customers, and ultimately liquidity conditions in the corporate bond market. We show that—contrary to what has been documented in short-term money markets (Correa, Du, and Liao, 2022)—both risk- and non-risk-weighted regulations significantly constrain the liquidity provisioning of regulated dealers, *irrespective* of their regulatory jurisdiction. However, given cross-jurisdictional differences in implementation of the leverage ratio, non-U.S. bank dealers are periodically more constrained than their U.S. counterparts. This has important implications for wider bond market functioning: First, regulation appears to create a more immediate role for nonbank intermediaries who, in part, adopt a liquidity-supplying trading style in response to the leverage ratio increasing banks' cost of balance sheet space. Second, regulation impairs liquidity conditions at quarter ends—particularly in balance sheet-intensive customer-to-dealer trades—and leads to a redistribution of intermediation rents toward less constrained U.S. bank dealers.

To explore how individual regulatory constraints impact corporate bond intermediation, we use quarter-end periods as our empirical laboratory, because several relevant metrics of the Basel Accords are reported on the last trading day of a given quarter. Since only bank dealers are subject to Basel regulation, this allows us to exploit intra-quarter variation in the intensity of dealers' regulatory pressure. Jurisdictional differences in the implementation of bank regulation further 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, and thus create 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 dealers adjust their bond intermediation in response to regulation, and whether cross-jurisdictional differences in the implementation of regulation impact the distribution of intermediation rents. Lastly, by studying dealers' trades with different counterparty groups, we are able to explore to what extent nonbank intermediaries adopt a trading style near quarter ends that helps constrained dealers manage their regulatory exposure.

For empirical identification, we use the regulatory version of Trade Reporting and Compliance Engine (TRACE) data. The regulatory TRACE data contain detailed information on all secondary market bond transactions, including dealer identities. Using these identities, we separate dealers that are subject to Basel regulation (bank dealers) from dealers that are not directly affected by Basel regulation (nonbank dealers). Next, by leveraging

[1] A growing body of literature studies the effects of banking regulation on dealer behavior in money markets, and documents 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)).

information on dealers' jurisdiction of incorporation, we further differentiate U.S. bank dealers from European and Japanese bank dealers. In combination with a long time series—data from 2003 to 2019—this allows us to study bond intermediation in response to different Basel regulations in the cross-section of heterogeneously regulated dealers and across different regulatory periods.[2] To examine the interactions between dealers and customers in more detail, we complement our analysis with insurance companies, which are the largest customer group in the corporate bond market.

Our analysis reveals several novel findings: Consistent with the idea that dealers optimize regulatory metrics prior to reporting dates, we find that bank dealers, but not nonbank dealers, contract inventories near quarter ends. These contractions are not only statistically but also economically significant, because they translate into an aggregate contraction of close to 15% of the corporate bond inventory holdings of the Federal Reserve's primary dealers. Together, these dealers intermediate around 70% of the transaction volume during the leverage ratio period. This finding suggests that reported regulatory metrics may overstate the resilience of individual institutions and the banking system as a whole.

To further disentangle the effects of individual Basel regulations, we compare quarter-end effects during the pre-leverage ratio period—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. In the pre-leverage ratio period, bank dealers already sell bonds on net close to regulatory reporting dates, which suggests that risk-based regulation constrained bank dealers well before the introduction of the leverage ratio. However, once leverage regulation further increases the cost of bank balance sheet space, quarter-end contractions become significantly larger and longer lived for all bank dealers, and particularly so for foreign non-U.S. bank dealers.

Our results highlight a novel mechanism: Whereas in short-term money markets U.S. banks take advantage of their relatively lower balance sheet costs at quarter ends to substitute a reduction of liquidity supply by their foreign counterparts (Correa, Du, and

[2]We define regulatory periods as follows: The pre-leverage ratio period is defined as January 2003 to December 2006 and May 2009 to December 2014. The leverage ratio period is defined as January 2015 to December 2019 (the end of our sample).

Liao, 2022), they are not absorbing the regulatory selling pressure from foreign counterparts in the corporate bond market. These findings reflect the impact of considerably higher risk weights on corporate bonds compared with nearly risk-free money market instruments, which limits the ability of U.S. banks to expand their balance sheets and provide liquidity in corporate bond markets.

Furthermore, we document a shift in the composition of bank dealers' inventory contractions toward safer bonds, consistent with the idea that a disregard for asset risk under the leverage ratio incentivizes banks to primarily sell lower-yielding and more liquid assets. To reach the same level of regulatory relief from the risk-based capital ratio, dealers need to sell larger bond volumes due to the lower risk weights associated with safer bonds. This aligns with our finding of increased contractions, even for U.S. bank dealers in response to the leverage ratio. In the cross-section of regulated dealers, we document substantial heterogeneity with respect to the intensity of quarter-end contractions depending on the bank's regulatory jurisdiction: European and Japanese bank dealers contract their inventories by almost 50% more than their U.S. counterparts, consistent with a more constraining effect of the Basel III leverage ratio on foreign bank dealers.

We further document the important role of nonbank financial intermediaries—both customers and nonbank dealers—as liquidity suppliers when bank dealers are particularly constrained near quarter ends.[3] Bank 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. Specifically, we show that once the leverage ratio is phased in, property and casualty (P&C) insurers adopt a liquidity-supplying trading strategy vis-à-vis their relationship dealers that helps absorb their regulatory exposure. Bank dealers, in turn, compensate customers by applying sizeable transaction spread discounts of up to 4% in exchange for customers' quarter-end liquidity support. For high-yield bonds, on the other hand, bank dealers fall back on their nonbank dealer networks. This highlights an unintended consequence of the Basel Accords: Regulations implemented to limit the

[3] In the corporate bond market, customers are typically large institutional investors such as insurance companies, bond mutual funds, and pension funds. Nonbank dealers are typically unregulated broker-dealer firms.

build-up of excessive risk and leverage in the banking sector (BIS, 2014) incentivize banks to periodically shift the riskiest bonds to some of the least regulated intermediaries.

Lastly, we capture the impact of the leverage ratio on dealers' willingness to intermediate balance sheet-intensive trades and quantify the pass-through of regulatory costs.[4] Whereas European and Japanese bank dealers reduce the share of balance sheet-intensive trades at quarter ends, U.S. bank dealers do not exhibit this type of behavior, which again suggests that leverage constraints are less restrictive for this dealer group. In balance sheet-intensive trades in which customers critically rely on dealers' balance sheets, we document sizeable markups on customers' transaction costs at quarter ends. These markups are concentrated in large trade sizes, in line with the interpretation whereby bigger volumes are more costly to offset, given that order splitting leads to higher search costs and thus expands dealers' balance sheets for extended periods of time (Li and Schürhoff, 2019). Consistent with our results on the importance of *risk-weighted* capital regulation, we find larger markups for high-yield bonds within a given trade size bracket, which represents an increase in trading costs 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 dealers face lower regulatory constraints near quarter ends than their foreign counterparts, we still document similar markups. This suggests that U.S. bank 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, the Basel III leverage regulation—impact intermediation in short-term money 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)

[4]The term "principal capacity" refers to trades in which a dealer commits its own capital to absorb bonds onto the balance sheet.

show that in the U.S. tri-party repo market, quarter-end reductions in net repo supply are primarily driven by foreign banks that aim to improve their regulatory metrics.[5] 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, and thus act as effective "lenders-of-second-to-last-resort."

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. This demonstrates 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 with money markets, we document important differences in the behavior of U.S. bank dealers. Their incapacity to lean against the wind renders intermediation in the corporate bond market more susceptible to regulatory pressure, which mandates a more immediate role for the Federal Reserve. It also highlights the need to better understand the role of unregulated nonbank financial intermediaries as liquidity suppliers in corporate bond markets (Anand, Jotikasthira, and Venkataraman, 2021; Choi, Huh, and Seunghun Shin, 2023; O'Hara, Rapp, and Zhou, 2023). Lastly, since we document that the leverage ratio particularly curtails bank dealers' ability to intermediate safer bonds, we connect to Favara, Infante, and Rezende (2022), who focus on the impact of the leverage ratio on Treasury intermediation during the Covid period.

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; Bessembinder et al., 2018; Trebbi and Xiao, 2019; Breckenfelder and Ivashina, 2023; Haselmann et al., 2022), as well as on the impact of regulation during stress periods (Bao, O'Hara, and Zhou, 2018; Dick-Nielsen and Rossi, 2019). With the notable exception of Breckenfelder and Ivashina (2023), these papers focus on risk-based regulation implemented prior to Basel III.[6] We contribute to this literature by disentan-

[5]Kotidis and Van Horen (2018) document for the UK that the leverage ratio does not seem to affect collateral re-use in the repo market.

[6]Breckenfelder and Ivashina (2023) document a negative impact of the Basel III leverage ratio on corporate bond liquidity in the context of the European corporate bond market.

gling the impact of risk-weighted and non-risk-weighted regulations implemented under the Basel Accords on different dealer groups absent specific stress events. Moreover, our work highlights the impact of heterogeneous regulation on liquidity conditions and its effects on dealer market power in the corporate bond market (Wallen, 2022). Lastly, our results confirm the theoretical predictions of Dyskant, Silva, and Bruno (2023), because we show that the pass-through of regulatory shadow costs is concentrated in balance sheet-intensive trades.[7]

Our paper also contributes to the literature on relationship trading and network effects in OTC markets. Prior empirical research primarily focuses on the role and structure of interdealer markets (Di Maggio, Kermani, and Song, 2017; Li and Schürhoff, 2019; Goldstein and Hotchkiss, 2020; Dick-Nielsen, Poulsen, and Rehman, 2022) or the value of repeat business in customer-dealer trading relationships (O'Hara, Wang, and Zhou, 2018; Hendershott, Li, Livdan, and Schürhoff, 2020; Jurkatis, Schrimpf, Todorov, and Vause, 2022). In many recent theoretical models of network centrality, core dealers' faster execution speed translates into a comparative advantage when carrying inventory, and thus renders them less averse to extending 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-periphery structure 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 emphasizes the importance of the composition of dealers' customer networks relative to dealers' interdealer networks, particularly during periods in which regulated core dealers are constrained.

Lastly, our work provides an empirical foundation for theoretical models in which intermediary capital plays an important role (He and Krishnamurthy, 2013; Adrian, Etula, and Muir, 2014; He, Khorrami, and Song, 2022; Siriwardane, Sunderam, and Wallen, 2022). We contribute to this literature along two dimensions. First, by highlighting the relevance of both the capital and the leverage ratio requirements, we inform the specification of an empirical intermediary factor in the corporate bond market. Second, we highlight the

[7]This finding is also consistent with Shim and Todorov (2023), who document that dealer holding costs are passed to investors in the form of larger ETF discounts.

importance of heterogeneously binding constraints across both intermediaries and time. Specifically, we show that bank dealers' intermediation behavior changes during the leverage ratio period, and thus creates intra-quarter variation in the extent to which intermediary factors should be relevant for corporate bond prices.

The remainder of the paper proceeds as follows. Section 2 outlines the institutional background. 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 exposure. Section 6 quantifies the impact of Basel requirements on corporate bond liquidity and the distribution of intermediation rents, and Section 7 concludes.

2 Institutional Background

To study the impact of Basel regulations on corporate bond intermediation, 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-leverage ratio period, from July 2002 to December 2006 and May 2009 to December 2014, has 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 (see Panel A of Figure 1).[8]

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

[8]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. Although bank-level reporting to national supervisors started at an earlier point in time, we follow Du, Tepper, and Verdelhan (2018) and choose 1 January 2015 as the starting date of the leverage ratio period as this is when mandatory public disclosure begins. Further, 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 Table A8 in the appendix.

quirements for holding riskier bonds.[9] Under Basel I, II, and III standards, all banks in our sample have to comply equally with a minimum ratio of Tier 1 equity to total risk-weighted assets.[10] Intermediating a corporate bond in a principal capacity thus affects a bank dealer's capital ratio through changes in the balance sheet composition of total risk-weighted assets.[11] Because bank 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 dealers in the run-up to the regulatory reporting date.[12] Since the mechanism of risk-based Basel standards remained consistent over time, the capital ratio poses a relevant and homogeneous constraint for all bank dealers over the entire sample period.[13]

Non-risk-weighted Capital Requirements: The Basel III leverage ratio (henceforth the leverage ratio) is a non-risk-weighted capital requirement that requires banks to maintain a minimum amount of capital against all on- and off-balance sheet exposures, irrespective of risk.[14] Intermediating a corporate bond in a principal capacity affects a bank dealer's leverage ratio requirement through its effect on balance sheet size.[15]

[9]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.

[10]While the overall capital ratio remains constant across our sample period (Ma, 2016), the CET1 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%) under Basel III and applies the same way across banks (see `https://www.federalreserve.gov/publications/large-bank-capital-requirements-20210805.htm`).

[11]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. Furthermore, we do not differentiate between slight differences in the regulatory treatment, depending on whether the bond is held on a bank's trading or credit book. This is justified because, irrespective of the chosen approach, bank dealers incur larger regulatory costs from intermediating riskier bonds (compare Haselmann et al. (2022)).

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

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

[14]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 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)).

[15]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 the inventory while funding the investment on a levered basis (for instance, through repos) increases the

In contrast to the capital ratio, leverage ratio reporting requirements differ across regulatory jurisdictions: While U.S. bank dealers report the leverage ratio based on quarter averages, European and Japanese bank dealers report the leverage ratio based on quarter-end snapshots. Consequently, U.S. bank dealers face lower regulatory costs for balance sheet-intensive trades in the days leading up to reporting dates, which gives them larger balance sheet capacity relative to their more constrained European and Japanese counterparts (compare Panel B of Figure 1 for an overview when specific regulations affect different dealer groups). Since disregarding asset risk under the leverage ratio particularly increases the intermediation costs of low-margin, balance sheet-intensive assets, this heterogeneity has important cross-sectional implications for dealers' intermediation capacity around quarter ends in short-term money markets (see, for example, Correa, Du, and Liao (2022) and Wallen (2022) for heterogeneous quarter-end dynamics in repo and FX swap markets).

However, it is unclear whether heterogeneity in leverage ratio constraints should lead to comparable quarter-end dynamics among bank dealers in the corporate bond market, since intermediating a corporate bond is notably different from intermediating a FX swap or repo contract in collateralized funding markets.[16] 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 because they expose 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 capital charges under the risk-weighted capital ratio 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'

dealer bank's total balance sheet size by the amount of the bond transaction.

[16]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 dealer to risk-based capital requirements (compare Correa, Du, and Liao (2022)). Similarly, the collateralization of repos with HQLA securities renders them irrelevant for calculation of the capital ratio (compare Bassi, Behn, Grill, and Waibel (2023)).

balance sheets.[17] Third, while the intermediation of FX swaps and repos is in the hands of a narrow set of similarly regulated global banks,[18] corporate bonds are intermediated by a larger and more diverse set of intermediaries, which include a stronger presence of unregulated nonbank financial intermediaries (that is, nonbank dealers and an active customer sector).

Other Relevant Bank Regulation: Besides risk-weighted and non risk-weighted capital requirements, post-crisis regulatory reforms introduced additional banking regulations. First, G-SIB surcharges increase the cost of balance sheet space for a bank dealer, in case the bank holding company has been identified as a G-SIB (Behn, Mangiante, Parisi, and Wedow (2022)). However, G-SIB scores only have to be reported at year ends, with homogeneous reporting requirements across jurisdictions. By focusing our empirical analysis on the first 3 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 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.[19] 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, 2022). However, given the long holding periods that come with corporate bond intermediation, intraday liquidity fluctuations are not a pressing concern for our

[17]For example, for the repo market Ranaldo, Schaffner, and Vasios (2021) and Bassi, Behn, Grill, and Waibel (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 1-week repo that is entered 8 days prior to the reporting date will have matured and thus left the balance sheet by the reporting date.

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

[19]Banks with more than $50 billion in trading assets need to report their 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.

analysis.[20]

3 Data, Capital Commitment, and Transaction Costs

3.1 Data Description

Our primary data source is the regulatory version of corporate bond transaction data from the Trade Reporting and Compliance Engine (TRACE), provided by the Financial Industry Regulatory Authority (FINRA). TRACE data provide detailed trade-level information on 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 distinguish 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.[21]

Importantly, the regulatory version of the TRACE data provides the dealer identity for each bond trade, which allows 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 dealers) from dealers that are not directly affected by regulation (nonbank dealers).[22] In our analysis, nonbank dealers provide a natural control group to study the impact of bank regulation on bank dealers. Based on a dealer's jurisdiction, we can further examine cross-sectional differences in the leverage ratio constraint, differentiating U.S. bank dealers from European and Japanese bank dealers.[23] The ability to distinguish dealers' regulatory jurisdiction is

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

[21]We end the sample period before the onset of the Covid pandemic and the ensuing corporate bond market selloff.

[22]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 and 71 are nonbank dealers.

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

essential to our analysis, because it allows us to examine dealers' 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 issue and maturity date, history of the par amount outstanding, and credit ratings for each of the three major rating agencies (S&P, Moody's, and Fitch).[24] If 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 to control for changes in the trading environment. We include daily changes in the VIX and the 3-month LIBOR rate to control for aggregate uncertainty and the funding environment, respectively. Furthermore, we include S&P 500 index returns, as well as spread changes in the ICE BofA U.S. corporate investment-grade and high-yield bond index, because fluctuations in the prices of risky assets might impact dealers' propensity to supply liquidity (Hameed, Kang, and Viswanathan, 2010; Comerton-Forde et al., 2010). Lastly, we include the 10-year-minus-2-year term structure to proxy for investor expectations for the economic environment.

For a bond to be included in our sample, we require that it 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 following 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 fewer 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

[24]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).

for the bonds included in our sample. The median bond has an offering amount of around $800 million, an age of 3.1 years, a remaining time-to-maturity of 5.3 years, and a median credit rating of BBB.

[Insert Table 1 here]

3.2 Measuring Capital Commitment and Transaction Costs

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 cumulative buying and selling volume since the beginning of the trading day.[25] This measure is zero if the dealer's buying volume equals the selling volume, and it is negative (positive) if the selling (buying) volume exceeds the buying (selling) volume. This allows us to analyze the direction of balance sheet adjustments, in which positive values imply that a dealer, on net, provides balance sheet capacity by absorbing bonds into the inventory, and thus incurs higher regulatory costs. Negative values imply that the respective dealer, on net, reduces balance sheet capacity by selling bonds from the inventory, and thus saves regulatory costs.

Panel B 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. Importantly, at a mean (median) of $0.13 mn ($0 mn) and $-0.05 mn (0 mn), respectively, bank and nonbank dealers show similar levels of daily capital commitment, with the only difference that bank dealers let their inventories fluctuate slightly more.

[25]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.

A central feature of our analysis is differentiating 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 generates regulatory costs and inventory risks. In contrast, for trades in an agency capacity (henceforth agency trade) the counterparty in need of liquidity retains the bond position until the dealer locates another counterparty who 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, n.d.). 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 prearranged 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 in which 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

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

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 specification of the balance sheet holding period and computation of the inter-dealer reference price could be subject to microstructure noise and stale benchmark prices. We therefore winsorize the top and bottom 1% of the transaction cost measure to limit the potential impact of noisy measurements. Panel D in Table 1 reports 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 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.[26] Consistent with comparable inventory behavior across bank dealers and nonbank dealers, we also find similar average transaction spreads, in both the cross-section of all trades (103 vs 102 basis points) and in large trade sizes above $500,000 (25 vs. 26 basis points).

4 Dealer Balance Sheet Management at Quarter Ends

4.1 Dynamics of Dealer Capital Commitment

To evaluate how Basel regulations impact dealer balance sheet management, we start by analyzing how dealers manage their bond inventories when regulatory pressure increases near reporting dates. We conjecture that regulatory constraints manifest at quarter ends for regulated bank dealers, whereas we expect to see no significant regulatory impact on unregulated nonbank dealers.[27] By temporarily contracting bond inventories in the run-up to a reporting date, bank dealers can lower their costs from capital and leverage ratio requirements. Consequently, for dealers' balance sheet management to be consistent with the impact of increased regulatory pressure, we would expect bank dealers, but not nonbank dealers, to contract their inventory provisioning and start net selling bonds in the

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

[27] Importantly, strong empirical evidence for inventory contractions among bank dealers combined with no significant contractions 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.

days leading up to reporting dates.

To capture both the size and the dynamics of dealers' inventory adjustments, we start by estimating a nonparametric event study regression of dealer capital provisioning around quarter ends. Figure 2 plots estimated event study coefficients for the two 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.[28] In Panel (a) of Figure 2, we document a strong V-shaped pattern around quarter-end dates. That is, the average bank dealer starts to significantly reduce capital commitment in the 8 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 not only statistically but also economically significant. Over the course of the 8 days around the reporting date, the average bank dealer net-sells bonds worth \$20 million from the inventory, which represents a half standard deviation move in dealer capital commitment outside quarter ends.[29] Using a simple back-of-the-envelope calculation, this effect translates into an aggregate contraction of around \$1.8 billion across all bank dealers in our sample. Given the strong decline in dealers' inventory holdings during the post-crisis period, these contractions are economically sizeable, since they represent around 14.8% of the total corporate bond inventories of the Federal Reserve's primary dealers during the leverage ratio period.[30] Lastly, Panel (b) in Figure 2 highlights the fact 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

[28]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 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 from a quarter end. This makes $T-28$ a good proxy for dealer behavior absent regulatory pressure.

[29]Note that the event study estimates in Figure 2 cannot 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 nonparametric means of our inventory measure near quarter ends, which clearly indicate that regulated dealers indeed start to sell bonds on net from their balance sheets near quarter ends.

[30]Given the availability of information on their aggregate inventory holdings, we express 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 daily transaction volume. For a list of primary dealers, see https://www.newyorkfed.org/markets/primarydealers.

bank regulation.

4.2 Dealer Capital Commitment and Leverage Regulation

Having established that Basel reporting requirements induce intra-quarter variation in the intensity of specific regulation, we next exploit the staggered introduction of different Basel regulations to further disentangle the cross-sectional effects of capital-ratio and leverage ratio requirements. Whereas risk-weighted capital-ratio requirements, if relevant, should already have affected bank dealers' bond intermediation before 2015, we expect quarter-end effects to become significantly more pronounced once the leverage ratio increases the cost of bank balance sheet space. We further expect cross-jurisdictional differences in implementation of the leverage ratio to be reflected in the cross-section of bank dealers' inventory adjustments.

We test our conjectures in the context of a triple difference-in-differences model. This estimation strategy allows us to contrast how bond intermediation changes near quarter-ends for dealers affected by regulation (bank dealers) relative to an unaffected control group (nonbank dealers) once the Basel III leverage ratio increases the cost of bank balance sheet space. In addition, contrasting quarter-end effects across regulatory periods allows us to control for time trends in dealers' capital commitment. Lastly, performing the estimation separately for bank dealers from different regulatory jurisdictions allows us to infer whether jurisdictional differences in implementation of the leverage ratio manifest differently in the cross-section of bank dealers. We therefore construct a dataset at the dealer-day level and estimate the following regression:

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

where i denotes a dealer and t the transaction day in event time ($t = 0$ refers to the regulatory reporting day). $Capital\ Commitment_{i,t}$ 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 with a bank holding company. $\mathbb{1}\left[QE\right]$ is an indicator variable that takes the value one on each of the last 10 trading days before the regulatory reporting date. We choose 10 trading days to allow for a longer adjustment period due to inherent bond market illiquidity.[31] $\mathbb{1}\left[LR\right]$ is an indicator variable equal to one as of 01/01/2015 (the date after which the Basel III leverage ratio was phased in). The vector $\mathbf{M_t}$ contains daily financial market data to control for changes in the trading environment (see Section 3.1). We further include dealer-quarter fixed effects, $\alpha_{i,q}$, to flexibly control for dealer balance sheet conditions.[32]

In Equation (1), our coefficient of interest, β_7, captures the impact of the leverage ratio on dealer capital commitment around quarter ends. The leverage ratio substantially increased the cost of bank balance sheet space, and arguably amplified the regulatory pressure on bank dealers beyond risk-weighted constraints. Thus, if the leverage ratio indeed poses a relevant constraint for corporate bond intermediation, we should observe a more pronounced reduction in bank dealers' inventories at quarter ends once the leverage ratio is in place—that is, a significantly negative and economically large estimate for β_7.

[Insert Table 2 here]

Our results in Table 2 confirm this hypothesis. Column 1 shows that quarter-end contractions become larger once the leverage ratio is phased in. This effect is not only highly statistically significant but also economically relevant, since average daily quarter-

[31] The choice of 10 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 to be a lower bound of the true effect. In unreported results, we confirm qualitatively similar and quantitatively larger results for shorter event windows.

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

end contractions increase by around 6.5% of a standard deviation.[33] Hence, this finding supports our hypothesis that non-risk-weighted leverage requirements (the leverage ratio) substantially increase the cost of corporate bond intermediation, over and above costs from risk-weighted capital regulation (the capital ratio).[34] More specifically, while bank dealers, on average, appear to moderately reduce their capital provisioning over the 10-day window prior to the leverage ratio period—see the 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.[35]

A potential explanation for the relatively small and only weakly significant coefficient on the two-way interaction term, $\mathbb{1}[Bank - aff.] \times \mathbb{1}[QE]$, could be that quarter-end contractions were both smaller and more short-lived in the pre-leverage ratio period, in which case a 10-day quarter-end estimation window complicates empirical detection of the effect.[36] In Table 3 we therefore zoom in on the timing of inventory contractions by dealer groups and regulatory periods.

[Insert Table 3 here]

Columns 1 to 3 in Table 3 show that during the pre-leverage ratio period—characterized exclusively by risk-based capital requirements—bank dealers markedly reduce their bond

[33]Table A7 shows that this effect is only detectable at quarter ends, but not at other month ends, and thus further ties our results to bank regulation at quarter ends.

[34]In Table A8, we show that these results are not driven by our choice of baseline period. Our coefficient estimates are very similar in terms of both economic and statistic significance, regardless of the baseline period.

[35]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 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.

[36]The coefficient on $\mathbb{1}[Bank-aff.] \times \mathbb{1}[QE]$ captures the change in the average inventory measure in the last 10 trading days compared with outside-quarter-end periods. When inventory contractions are short-lived and concentrated in 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.

inventories close to 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 constrained bank dealers before implementation of the leverage ratio.[37] This highlights an important mechanism: In contrast to short-term money markets in which the underlying asset is riskless, corporate bond intermediation is already significantly constrained in the cross-section of regulated dealers by risk-based capital requirements. Once the leverage ratio further punishes a large balance sheet, we also find significantly negative coefficients at an earlier event day bin, $[T-10, T-5]$. This suggests that the leverage ratio incentivizes bank 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.[38]

4.3 Heterogeneous leverage ratio Requirements

Next, we turn to jurisdictional differences in bank dealers' leverage ratio constraints. While the capital ratio is implemented homogeneously across jurisdictions, there are important jurisdictional differences in leverage ratio reporting requirements. As outlined in Section 2, in the cross-section of dealers, we expect U.S. bank dealers to be relatively less constrained by the leverage ratio requirement compared with their European and Japanese counterparts. To test this conjecture, we examine whether inventory contractions among European and Japanese bank dealers are stronger than the inventory contractions among U.S. bank dealers.

Columns 2 and 3 in Table 2 report results by dealer subgroups. That is, we re-estimate Equation 1 separately for U.S. bank dealers (Column 2) and European and Japanese bank dealers (Column 3). For both groups, we find negative and highly significant triple interaction terms, which clearly suggests that quarter-end contractions become significantly more pronounced once the leverage ratio is in place. We find that coefficients on the triple

[37]Consistent with this interpretation, Table A4 highlights the fact that during the pre-leverage ratio period, bank dealers significantly contract their capital commitment in risky high-yield bonds but not in investment-grade bonds. Once the leverage ratio is phased in, this relationship reverts and bank dealers significantly contract bond inventories in investment grade bonds.

[38]For completeness, Table A6 in the appendix separately displays results for year-end periods.

interaction term are only somewhat smaller for U.S. bank dealers compared with 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 dealers, on average, hold larger bond inventories compared with 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 dealers.[39]

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); He, Khorrami, and Song (2022)). 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 dealer groups contract their bond inventories at quarter ends, and do so significantly more once the leverage ratio is implemented. Importantly, while quarter-end contractions are relatively similar prior to implementation of the leverage ratio—when the capital ratio constrains both dealer groups homogeneously—the contractions of European and Japanese bank dealers are roughly 50% larger once balance sheet space becomes more expensive. Furthermore, and consistent with the idea that the non-risk-weighted nature of the leverage ratio particularly constrains the intermediation of saver assets, the relatively larger contractions of European and Japanese bank dealers are concentrated in investment-grade bonds. Taken together, this suggests that the respective leverage ratio implementation is indeed less constraining for U.S. bank dealers (quarter averages) than for European and Japanese bank dealers (quarter-end snapshots).

[Insert Table 4 here]

Our 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

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

markets (Correa, Du, and Liao, 2022), we show that U.S. bank 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 dealers. This has important implications for policymakers, because it suggests that bank-affiliated corporate bond dealers, no matter their 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 is the following equilibrium mechanism: U.S. bank dealers—despite being relatively less constrained by the leverage ratio at quarter end—incur capital ratio charges from holding risky bonds on their balance sheets. These capital charges are costly and significantly reduce U.S. bank 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 regardless of the regulatory jurisdiction. That is, balance sheet expansions with corporate bonds affect a dealer's capital ratio more than they do with repos and FX swaps. This may explain why U.S. bank dealers refrain from absorbing other dealers' selling pressure at quarter ends in the corporate bond market.

4.4 Dealer Selling at Quarter Ends and Liquidity Pecking Order

In light of bank dealers' inventory contractions at quarter ends, an interesting question arises: How is their net selling structured? Specifically, do bank 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 data constructed at the dealer-bond-day level:

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

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 daily selling volume at 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. $\mathbb{1}[QE]$ is an indicator variable that is one during the last 10 trading days prior to quarter ends. $\mathbf{M_t}$ 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, time to maturity, and amount outstanding. Finally, we include rating fixed effects, α_r, industry fixed effects, α_d, and time-varying dealer fixed effects, $\alpha_{i,q}$, to control for other relevant trade characteristics.

[Insert Table 5 here]

Table 5 presents 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, which suggests that dealers sell larger (smaller) volumes in liquid (illiquid) bonds outside quarter-end periods. Comparing the coefficients on $\overline{\textit{Illiquidity}_{j,t-1}} \times \mathbb{1}[QE]$ 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, and issue size, as well as age and maturity. This finding suggests that introduction of the leverage ratio increased the importance of bond liquidity for minimizing dealers' price impact when selling large quantities of bonds in the days leading up to reporting dates. What is more, the relationship becomes particularly pronounced for European and Japanese bank dealers, which reinforces the idea that they are more constrained and required to sell relatively larger quantities in liquid bonds at quarter ends than their U.S. counterparts.

Lastly, related to the above, we document a notable shift in the composition of bank dealers' quarter-end selling toward investment-grade bonds during the leverage ratio period. Figure A.4 highlights the fact that, compared with the composition of their pre-leverage ratio selling, bank dealers decrease their dispositions in the two highest risk-weight segments (high-yield bonds) while increasing their shares in lower risk-weight segments (investment-grade bonds). This reconciles the institutional setting with our finding of increased quarter-end contractions in the leverage ratio for U.S. bank dealers. While the leverage ratio appears to lead to less regulatory pressure for U.S. banks at quarter ends, risk-based capital charges continue to constrain all regulated dealers. As a consequence, the shift in quarter-end contractions toward bonds with lower risk weights requires that U.S. bank dealers sell larger volumes to achieve the same level of regulatory relief under the risk-based capital ratio.

5 Managing Regulatory Pressure at Quarter Ends

5.1 Nonbank Intermediaries and Quarter-end Liquidity Supply

Given regulated intermediaries' pronounced inventory contractions at quarter ends, a natural question arises: Who buys when regulated dealers are selling? We address this question by examining how bank dealers rely on other counterparties to manage their regulation-induced selling pressure at quarter ends. 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 dealers (Duffie, 2012). While their lower capacity makes it unlikely that they are 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 dealers' customers could be another group of buyers, given recent evidence documenting a growing importance of customer liquidity provisioning in corporate bond markets (Anand, Jotikasthira, and Venkataraman (2021); O'Hara, Rapp, and Zhou (2023)). Third, despite being subject to regulation themselves, bank dealers facing less regulatory pressure could absorb some of the selling pressure in specific bond segments.

To study how bank dealers distribute quarter-end selling pressure across counterparties, we analyze their net selling volumes vis-à-vis different counterparty groups. That is, for each dealer i on date t we construct measures of both aggregate buying and selling volumes as well as a measure of net selling against a particular counterparty group m. Counterparties fall into three groups: Customers, nonbank dealers, and other bank dealers from a different regulatory jurisdiction than dealer i. Focusing on the leverage ratio period, we then separately estimate the following regression model by the regulatory jurisdiction of bank dealers:[40]

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

where $Net\ Selling_{i,m,t}$ refers to the net selling volume of dealer i at date t vis-à-vis counterparty type m.[41] $\mathbb{1}\left[QE\right]$ is an indicator variable that takes the value one on each of the last 10 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-quarter fixed effects to flexibly control for dealer balance sheet conditions.

Our results in Table 6, Panel A show that U.S. bank dealers heavily rely on their customers to sell bonds at quarter ends. In Column 1, the coefficient on $\mathbb{1}\left[QE\right]$ is positive and significant, which suggests that U.S. bank dealers tilt their trading with customers in a way that helps them offload their inventories at quarter ends. Specifically, we document that the average U.S. bank dealer directs about 70% of quarter-end net selling to customers. Columns 4 to 7 further highlight the fact that this effect is driven by a strong

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

[41]For ease of interpretation, we construct our measure of dealer net selling, $Net\ Selling_{i,m,t}$, such that a positive value indicates net selling from dealer i to counterparty sector m, while a negative value indicates that dealer i on net purchases bond volume from counterparty sector m.

increase in the 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.[42] Panel B shows that U.S. bank dealers also fall back on their nonbank counterparts in the interdealer network to offload part of their bond sales: Nonbank dealers absorb around 21% of the average U.S. bank dealer's total net selling volume. While the coefficient for net sales is only weakly significant in the cross-section of all bonds (Column 1) the significant difference in Columns 6 and 7 indicates that nonbank dealers primarily buy bank dealers' high-yield bond positions.[43] Lastly, Panel C presents results on net trading with non-U.S. bank dealers. The small but significant coefficients suggest that U.S. bank dealers also sell bonds to their foreign counterparts, but only to a very limited extent. This finding is consistent with the notion that non-U.S. bank 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 dealers. We document a qualitatively similar pattern across the three counterparty groups. Compared with their U.S. counterparts, European and Japanese bank dealers tilt their net selling even more strongly toward their customer base. The average European and Japanese bank dealer directs 95% of total net selling volume to customers, 5% to nonbank dealers, and no volume to other bank dealers. Similarly, and in line with our results for U.S. bank dealers, we observe a very similar market segmentation across bond-rating classifications.

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

[43] In Table A9 we use a measure of a dealer's network centrality in the interdealer market (eigenvector centrality score) to test whether bank dealers offload their high-yield bond exposure to either core or peripheral nonbank dealers. We document—both in the case of U.S. bank dealers and for European and Japanese bank dealers—that constrained bank dealers primarily offload bonds to central nonbank dealers. This is in line with the interpretation whereby nonbank dealers on the periphery do not possess the necessary balance sheet depth to absorb significant selling volumes, and thus spotlights the increased importance of large and central nonbank dealers.

Taken together, when faced with increased regulatory pressure, constrained bank dealers primarily rely on nonbank financial intermediaries to manage their regulatory exposure. Our results point to a market segmentation of nonbank intermediaries along bond risk brackets: At quarter ends, bank dealers rely on their customer networks to sell investment-grade bonds and their nonbank inter-dealer networks to dispose of high-yield bonds. This 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.

5.2 Price Concessions for Customer Liquidity Supply

The above results raise 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 predominantly in save bonds. With respect to trade sizes, bank 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 trade sizes.

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

$$Spread_{k,j,i,t} = \beta_1 \, \mathbb{1}\,[QE] + \theta_{\mathbf{1}}' \mathbf{M_t} + \theta_{\mathbf{2}}' \, \mathbf{M_{j,t}} + \alpha_{j,q,s} + \alpha_{r,q} + \alpha_{i,q} + \varepsilon_{k,j,i,t}, \tag{4}$$

where $Spread_{k,j,i,t}$ refers to the transaction spread as defined in Section 3, $\mathbb{1}\,[QE]$ is an indicator variable that takes the value one on each of the last 10 trading days before the regulatory reporting date, and $\mathbf{M_t}$ contains daily controls for financial market conditions (see, Equation (1)). $\mathbf{M_{j,t}}$ contains time-varying 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. $\alpha_{j,q,s}$ represents bond-quarter-trade size fixed effects, $\alpha_{r,q}$ refers to rating-quarter fixed effects, and $\alpha_{i,q}$ refers to dealer-quarter fixed effects.[44]

[Insert Table 8 here]

Table 8 supports our hypothesis that bank dealers make sizeable concessions to customers for their liquidity support: Even after controlling for a strong set of bond characteristics, 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 dealers (lower panel), respectively. These concessions are not only statistically significant, but also economically meaningful. Relative to the average selling spread outside quarter ends, this reflects a reduction in transaction costs of around 2.1% for U.S. bank dealers and a nearly 3.3% reduction for European and Japanese bank dealers. Furthermore, with discounts accounting for up to 5.5% price concessions are largely concentrated in investment-grade bonds and trade sizes below $500,000 for both bank dealer groups. This is consistent with customers' being bound by investment mandates when they absorb bank dealers' selling pressure.

5.3 Quarter End Liquidity Supply by Insurance Companies

With nonbank intermediaries becoming liquidity suppliers to constrained bank dealers at quarter ends, it is important to study the mechanism of customer liquidity supply in more detail. Absent exact counterparty identifiers in TRACE, 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.[45]

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

[45]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% of corporate bonds outstanding, while bond mutual funds owned 30%. The remainder

Specifically, we use detailed information on insurers' trades reported in parts 3 to 5 of Schedule D provided by the National Association of Insurance Commissioners (NAIC). These data enable us to study insurers' daily trading activities at the bond level, and thus allows us to explicitly test for quarter-end liquidity supply by individual insurance companies. What is more, for each insurer trade, the NAIC data provide us with a dealer identity, which 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 2010 to 2019 and contains 3,026 insurers, of which 2,344 are property and casualty insurers and 682 are life insurers.[46]

[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. In addition, for this behavior to be consistent with liquidity supply in response to dealers' regulatory selling pressure, we would 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.[47]

To empirically test these conjectures, we construct a sample at insurer-day level that spans the period from January 2010 to December 2019.[48] We then estimate the following

was hold by pension funds (16%), banks (10%), and others (6%) (compare Koijen and Yogo (2023)).

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

[47]This view is consistent with recent empirical evidence of insurers as liquidity providers in the corporate bond market. Bretscher, Schmid, Sen, and Sharma (2022) document that P&C insurers have a more than five times higher price elasticity—0.5 versus 2.7—than life insurers. Consistently, we document that P&C insurers exhibit a more active trading style (although they trade less in absolute terms, they trade more relative to their portfolio size (compare Table A3)).

[48]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.

regression:

$$Insurer\ Net\ Trading_{n,t} = \beta_1\, \mathbb{1}[QE] + \theta'\, \mathbf{M_{n,y}} + \alpha_n + \alpha_q + \varepsilon_{n,t}, \tag{5}$$

where $Insurer\ Net\ Trading_{n,t}$ refers to the logarithm of one plus the net trading volume by insurance company n on day t.[49] We add the logarithm of an insurer's assets, 5-year asset growth, the logarithm of an insurer's RBC ratio, the leverage ratio, and the cash-to-assets ratio 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 the fact that quarter-end liquidity supply is primarily concentrated in P&C insurers. This is in line with recent evidence that documents the larger price elasticity of P&C insurers relative to life insurers (Bretscher, Schmid, Sen, and Sharma (2022)). 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 purchases from dealers, while slightly reducing their sales to dealers.

In support of the idea that insurers increase their liquidity supply in response to the leverage ratio, Panel B of Table 9 shows that insurers' quarter-end liquidity supply is entirely concentrated in the leverage ratio period, which ties our results to the impact of non-risk-based regulation. Taken together, these findings demonstrate that once the leverage ratio systematically increases bank dealers' balance sheet costs, a subset of insurance companies appear to adopt a liquidity-supplying trading strategy that helps dealers to reduce their regulatory exposure.[51]

[49]For each day, we define an insurance company's net trading volume as the difference between aggregate insurance purchases and aggregate insurance sales. We then perform a log-modulus transformation of our dependent variable.[50] In untabulated results, we find that we obtain qualitatively similar results when using the dollar volume instead.

[51]We document that P&C insurers retain the bonds they purchase during quarter ends rather than directly selling them back to dealers: One quarter (60 trading days) after the quarter-end purchase the

The above results do not yet provide insights as to which dealers P&C 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 each insurer's aggregate trading volume with specific dealers.[52] We then estimate the following regression:

$$\begin{aligned} Insurer\ Net\ Trading_{n,i,t} = \beta_1 \mathbb{1}[QE_t] + \beta_2 \mathbb{1}[Relationship\ Dealer_{i,j}] \\ + \beta_3 \mathbb{1}[QE_t] \times \mathbb{1}[Relationship\ Dealer_{i,j}] + \theta' \mathbb{M}_{\mathrm{n,y}} \\ + \alpha_i + \alpha_q + \varepsilon_{n,i,t}, \end{aligned} \tag{6}$$

where $Insurer\ Net\ Trading_{n,i,t}$ represents the (net) trading volume of insurer n with dealer i on trading date t. $\mathbb{1}[Relationship\ Dealer_{i,j}]$ denotes an indicator variable that takes the value one if, throughout the past 24 months, dealer i is among the three dealers with the highest share of transaction volume intermediated vis-à-vis insurance company n.[53] To control for the impact of dealer characteristics on trading conditions, we also include dealer fixed effects, α_i. Table 10 shows a positive and significant coefficient on the interaction term, $\mathbb{1}[QE] \times \mathbb{1}[Relationship\ Dealer_{i,j}]$, which suggests that P&C insurers concentrate their quarter-end liquidity supply in dealers with whom they have an established prior trading relationship. Consistent with our earlier results, this relationship-driven liquidity supply is concentrated in property and casualty insurers.

average P&C insurer still retains 92% of the initial purchase volume (compare Figure A.5 in the appendix).

[52] To avoid 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 obtain qualitatively similar results when we do not impute zero trading days.

[53] We obtain comparable results when resorting to a continuous measure of past trading relationships (compare Table A10 in the appendix).

6 Leverage Regulation and Bond Liquidity

We have so far shown that regulated dealers are unwilling to absorb bond volume near quarter ends. However, the ability to quickly sell bonds is important for institutional investors, for example, following bond downgrades (Ellul, Jotikasthira, and Lundblad, 2011) or index exclusions (Dick-Nielsen and Rossi, 2019). In turn, for investors to be able to swiftly offload bond volume in response to liquidity shocks, dealers are required to purchase the bond in a principal capacity, which increases their regulatory exposure. Trading in an agency capacity, on the other hand, is not balance-sheet-intensive but comes with substantially longer execution times. Thus, whenever customers urgently demand liquidity close to reporting dates, constrained bank dealers face the option of either reflecting the increased costs in a higher transaction spread, or forgoing the trade and reducing the amount of balance sheet space supplied to customers.

To distinguish agency from principal trades and to capture the transaction costs of the latter, we use the measure proposed by Choi, Huh, and Seunghun Shin (2023) and their algorithm to classify transactions into agency and principal trades (see Section 3). 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 implementation of the leverage ratio that constrains European and Japanese bank dealers relatively more (compare Table 4). From the customer's perspective, this implies that during quarter-end periods, the number of dealers who 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 U.S. bank dealers are able to take advantage of their relatively lower balance sheet costs, we should observe the following patterns in both prices and quantities. First, we would expect European and Japanese bank dealers, but not U.S. bank dealers, to reduce their share of costly principal trades once the leverage ratio is phased in. Second, customer transaction costs for principal trades with European and Japanese bank dealers should significantly increase, reflecting foreign dealers' higher regulatory cost component at quarter ends. In addition, if U.S. bank dealers are able to exert market power, we would expect them to increase prices to the same level as their European and Japanese counterparts to maximize their intermediation rents while retaining their customer base.

6.1 Trading Style around Quarter-Ends

To test the first hypothesis, we construct a dataset at the dealer-day level and compute the share of customer buying volume a given dealer i intermediates through balance-sheet-intensive principal trades on day t, $Share\ Principal\ Purchase\ Volume_{i,t}$.[54] Then, we test whether bank dealers change their trading behavior at quarter ends following the introduction of the leverage ratio by estimating the following regression:

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

where $\mathbb{1}\left[QE\right]$ is an indicator variable that takes the value one on each of the last 10 trading days before the regulatory reporting date. We complement the model with the same controls for financial market conditions as in Equation (1) and further include dealer-quarter fixed effects to flexibly control for dealer balance sheet conditions.

[Insert Table 11 here]

Results in Table 11 are consistent with the interpretation whereby more constrained European and Japanese bank dealers change their trading by reducing the share of expensive principle trades at quarter ends, while less constrained U.S. bank dealers and nonbank

[54] 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.

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 A11 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 A11 the insignificant coefficient on $\mathbb{1}[QE]$ across all dealer groups indicates that European and Japanese bank dealers did not engage in quarter-end adjustments of their principal share in the pre-leverage ratio 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.

6.2 The Cost of Immediacy at Quarter Ends

To test for the effect of regulatory constraints on customers' transaction costs, we rely on our ability to classify trades according to their balance sheet intensity. While spreads for agency trades should not reflect bank 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. Furthermore, 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-leverage ratio period. We test this prediction empirically by estimating the following regression model:

$$Spread_{k,j,i,t} = \beta_1 \, \mathbb{1}[QE] + \theta_{\mathbf{1}}'\mathbf{M_t} + \theta_{\mathbf{2}}'\,\mathbf{M_{j,t}} + \alpha_{j,q,s} + \alpha_{r,q} + \alpha_{i,q} + \varepsilon_{k,j,i,t}, \qquad (8)$$

where the dependent variable, $Spread_{k,j,i,t}$, refers to the principal transaction spread as defined in Section 3, $\mathbb{1}[QE]$ is an indicator variable that is one during the last 10 trading days, and $\mathbf{M_t}$ contains the same daily controls for financial market conditions 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, $\alpha_{j,q,s}$ represents bond-quarter-trade size fixed effects, $\alpha_{r,q}$ refers to rating-quarter fixed effects, and $\alpha_{i,q}$ refers to dealer-quarter fixed effects.

If bank 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 balance-sheet-intensive principal trades intermediated by bank dealers, but not in the subset of non-intensive agency trades. Panel A in Table 12 confirms our hypothesis regarding quarter-end increases in customer transaction costs. For both bank dealer groups, we document significant increases only in principal transaction costs. Also, our results in Table A12 confirm that quarter-end increases in principal transaction costs materialize only once the leverage ratio is implemented, but not before. These findings suggest that regulated dealers pass the additional balance sheet costs through to customers whenever they intermediate bonds via their balance sheets.

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 demonstrate that both groups of bank dealers pass on regulatory costs in large trades, but not in smaller trades.[55] This is consistent with the interpretation whereby absorbing larger positions near quarter ends exposes bank dealers to higher regulatory costs, since offloading large trading positions likely requires time-consuming splitting of trades and thus higher search costs.[56] In addition, and consistent with our earlier findings that for corporate bond intermediation both risk-weighted and non-risk-weighted capital charges matter, we document that bank dealers increase customer transaction costs in high-yield bonds by almost twice as much compared with investment grade bonds. Importantly, these markups are not only statistically significant, but also economically relevant: On average, for large transactions, bank dealers increase their customer transaction costs by around 10% in investment-grade bonds and by almost 20% in high-yield bonds relative to average transaction costs outside quarter ends. 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: Employing a back-of-the-envelope calculation indicates that the per-quarter regulatory cost of Basel regulation for corporate

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

[56]Consistent with an increase in search costs, Column 4 of Table A20 in the Appendix shows that close to reporting dates the share of bank dealers in intermediation chains for investment grade bonds drops significantly.

bond intermediation amounts to $517 million.

[Insert Table 12 here]

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

7 Conclusion

Time and again, periods of increased selling pressure have demonstrated that dealer liquidity provision is essential yet fragile, particularly in decentralized bond markets in which search costs are high. With the introduction of more stringent post-crisis regulation, fragility has been exacerbated because dealers are increasingly less willing to intermediate low-margin balance-sheet-intensive trades. While the aggregate impact of (post-crisis) regulation on the U.S. corporate bond market has been documented, little is known about the cross-sectional effects of leverage regulations on dealer intermediation. Our paper fills this gap, and thereby contributes not only to current discussions of overhauling key Basel III metrics but also to the debate regarding regulating nonbank financial intermediaries.

Using confidential transaction data, we document regulatory-driven quarter-end effects in the U.S. corporate bond market: Bank dealers sharply contract their bond inventories in the days leading up to reporting dates. With the introduction of the Basel III leverage ratio, these inventory contractions increase substantially for all bank dealers, but appear more pronounced for foreign banks due to jurisdictional differences in implementation of the regulation. This heterogeneity periodically shifts intermediation rents to regulated U.S. dealers and significantly deteriorates liquidity conditions, particularly in balance-sheet-intensive trades in which customers cannot forgo large bank dealers. In contrast to recent evidence from short-term money markets, U.S. bank dealers do *not* act as residual liquidity providers in a market in which the underlying asset is risky. Instead, bank 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 that aim to prevent market breakdowns in one of the world's largest financial markets (FSB, 2021). In particular, in a market in which risk-based regulation affects bond intermediation in concert with leverage regulation, bank dealers do not lean against the wind and thus create a more immediate role for customer liquidity provisioning compared with short-term money markets.

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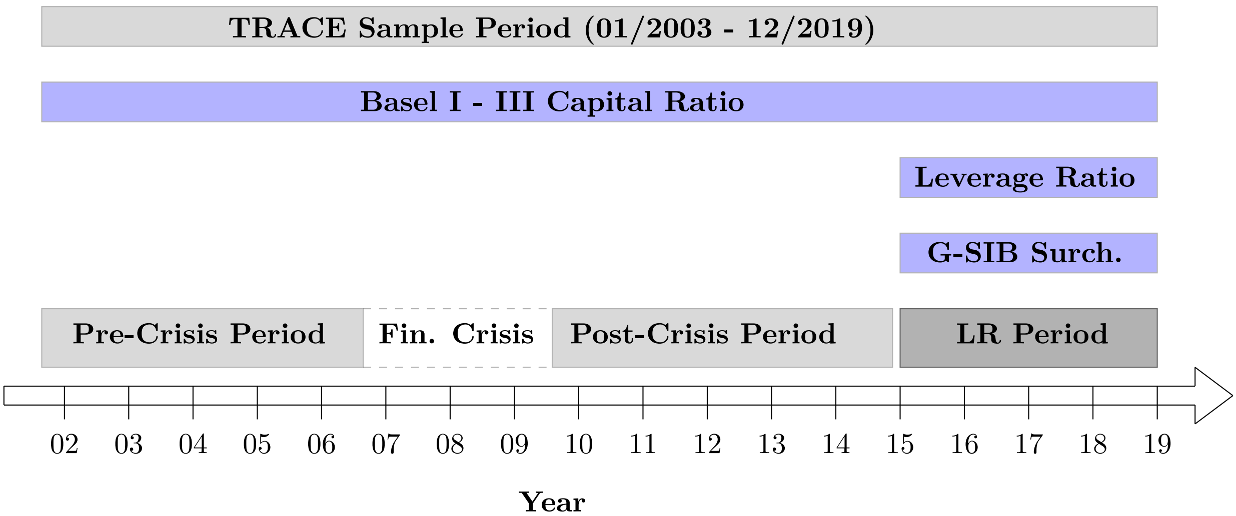
Figure 1
Overview of Regulatory Constraints

This figure shows when specific banking regulations are in place (Panel A) as well as the intra-quarter reporting practices of different regulations (Panel B). Panel A reports the definition of our regulatory periods (gray) and when specific regulations are in place (blue). Panel B shows when bank 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) and the right figure to the leverage ratio period (01/2015 -12/2019). Green shaded areas indicate quarter-end periods (light green refers to the last 10 days prior to the end of quarter 1-3 and darker green to the last 10 days prior to year-ends). Yellow boxes refer to risk-based capital requirements (Basel I - III capital ratio (CR)) and orange boxes 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 to the reporting practices of European and Japanese bank dealers who report based on quarter-end snapshots (LR_{QE}). Blue boxes refer to 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

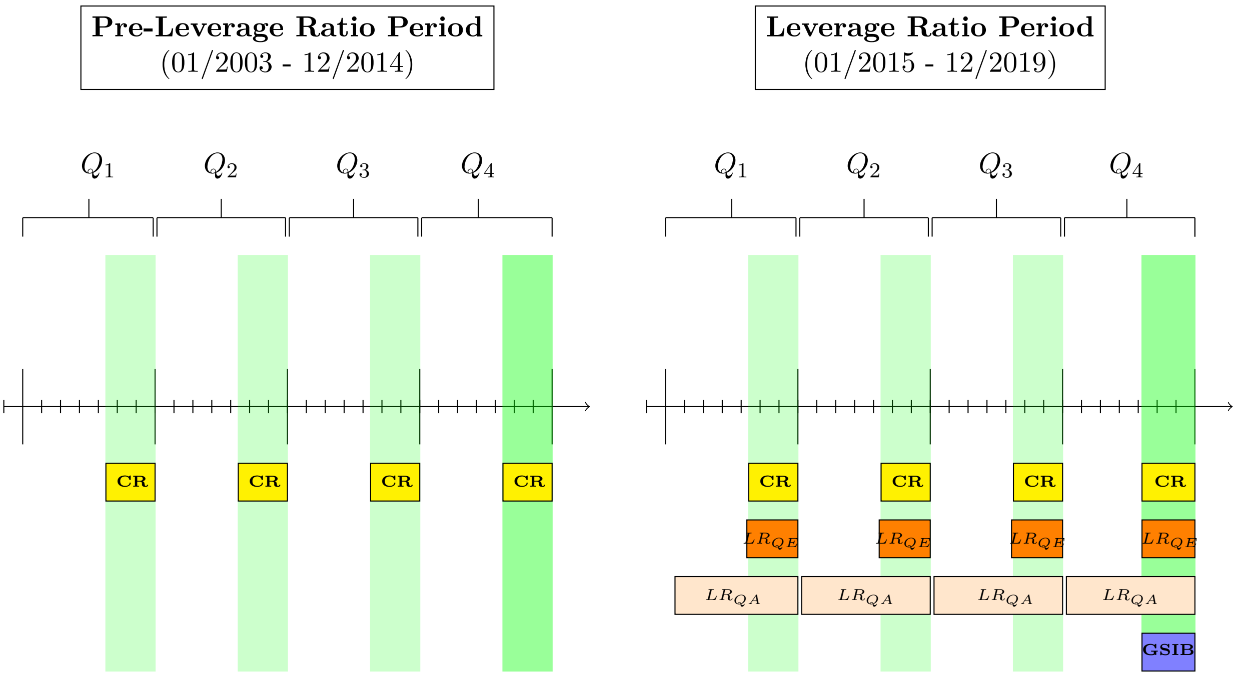
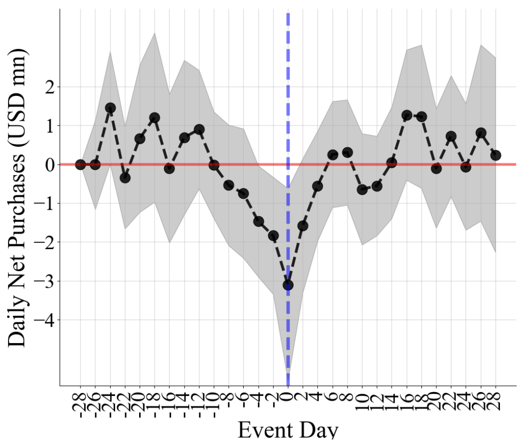


Figure 2
Net Purchases at Quarter Ends—By Dealer Group

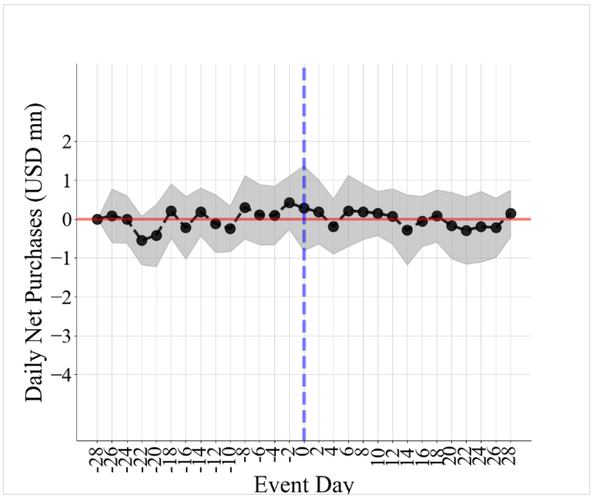
This figure presents event study coefficients of the regression:

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

where $\text{Net Purchases}_{i,t}$ 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 regression coefficients to be interpreted as the average dealer's net trading on a given event day relative to the middle of the quarter, when regulatory pressure is lowest. $\mathbf{M_t}$ refers to a vector of daily market controls and 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. $\alpha_{i,q}$ represents dealer-quarter fixed effects, where a quarter, q, is defined from the middle of a calendar quarter (event day: $T-28$) to the middle of the next calendar quarter ($T+28$). The sample period is from January 2003 to December 2019 (excluding the financial crisis period (01/2007 - 04/2009)). Black dots indicate coefficient estimates and the gray shaded lines 95% confidence intervals. The blue dashed line indicates the regulatory reporting date. Standard errors are clustered at dealer level.



(a) All Dealers



(b) Nonbank Dealers

Figure 3

Transaction Costs in Balance-sheet-intensive Trades—By Trade Size

This figure plots coefficient estimates from the principal transaction regression in Table 12, Panel D. Black dots indicate 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.

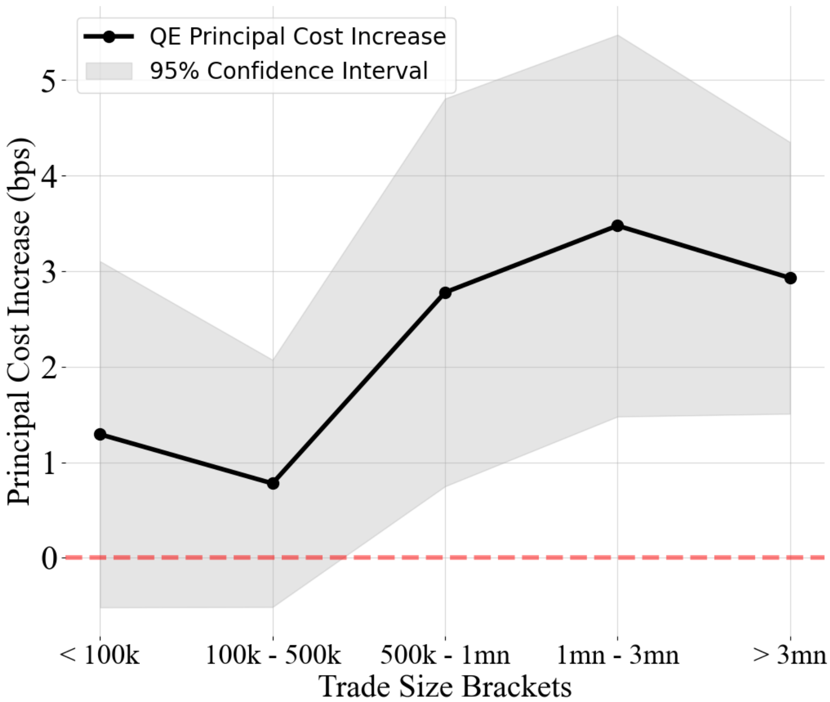


Table 1
Summary Statistics

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 January 2003 to December 2019 (excluding the financial crisis period from 01/2007-04/2009). The full sample contains 129,558,489 transactions. For all variables we report the total number of observations, mean, standard deviation and 25%, 50% and 75% percentiles. Panel A presents selected bond characteristics: The bond's offering amount, age as of the reported transaction time, remaining time to maturity as of the reported transaction time, and 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 dealers and nonbank dealers, as well as separated by quarter-end and non-quarter-end periods. Panel C reports 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	# Bonds	Mean	SD	Q25	Median	Q75
Offering Amount [$ mn]	74,444	1,231.31	3,789.40	500.00	800.00	1,500.00
Age [years]	74,444	4.06	3.97	1.36	3.07	5.47
Time-to-Maturity [years]	74,444	7.52	7.65	2.98	5.37	8.52
Credit Rating [$ mn]	74,444	12.58	18.63	6.00	9.00	11.00

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

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

This sample is constructed at the dealer-day level and restricted to quarters 1-3. We perform the following regression:

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

The dependent variable, $Capital\ Commitment_{i,t}$, 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 if the dealer is identified as a bank-affiliated dealer, as outlined in Section 3. $\mathbb{1}\,[QE]$ is an indicator variable that takes the value one if the respective transaction day is among the 10 last trading days prior to the regulatory reporting date. $\mathbb{1}\,[LR]$ is an indicator variable that takes the value one from 01/2015 onward—that is, once the Basel III leverage ratio and the G-SIB surcharges are implemented. $\mathbf{M_t}$ refers to a vector of daily market controls and includes the change in the VIX, change in the 3-month LIBOR, return of the S&P 500, change in the spread of the ICE BofA IG corporate bond index, change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and change in the 10y-2y term spread. $\alpha_{i,q}$ represents dealer-quarter fixed effects, where a quarter, q, is defined from the middle of a calendar quarter (event day: $T-28$) to the middle of the next calendar quarter ($T+28$). In columns 1 to 3 the dependent variable is measured in $, and in columns 4 to 6, the dependent variable is standardized. The total time period is 01/2003 - 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% level.

Dependent Variable	Capital Commitment$_{i,t}$ (USD)			Capital Commitment$_{i,t}$ (std.)		
Regulatory Jurisdiction of Bank Dealer	All	U.S.	Europ. & Jpn.	All	U.S.	Europ. & Jpn.
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[EoQ]$	0.069	0.070	0.064	0.004	0.003	0.005
	(0.067)	(0.072)	(0.072)	(0.005)	(0.006)	(0.006)
$\mathbb{1}[Bank-aff.] \times \mathbb{1}[EoQ]$	-0.251*	-0.281*	-0.328*	-0.028*	-0.028*	-0.030*
	(0.148)	(0.202)	(0.186)	(0.015)	(0.016)	(0.016)
$\mathbb{1}[EoQ] \times \mathbb{1}[LR]$	0.382	0.376	0.453	0.032	0.037	0.029
	(0.598)	(0.583)	(0.619)	(0.023)	(0.025)	(0.024)
$\mathbb{1}[Bank-aff.] \times \mathbb{1}[EoQ] \times \mathbb{1}[LR]$	-2.893***	-2.874**	-3.154***	-0.097**	-0.093**	-0.119***
	(0.899)	(1.103)	(1.019)	(0.047)	(0.043)	(0.045)
R-Squared	0.03	0.03	0.03	0.04	0.04	0.04
Observations	450,123	333,431	264,652	453,086	333,125	256,272
Dealer x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Table 3
Dynamics of Capital Commitment at Quarter End

The sample is constructed at the dealer-day level and restricted to quarters 1-3. We perform the following regression:

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

The dependent variable, $Capital\ Commitment_{i,t}$, 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 if 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 takes the value one if the respective transaction day is among 10 to 5 days prior to the regulatory reporting date and zero otherwise. $\mathbb{1}[T-4, T]$ is one if the respective transaction day is among the last 5 trading days prior to the regulatory reporting date and zero otherwise. $\mathbf{M_t}$ is a vector of daily market controls and includes the change in the VIX, change in the 3-month LIBOR, return of the S&P 500, change in the spread of the ICE BofA IG corporate bond index, change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and change in the 10y-2y term spread. $\alpha_{i,q}$ represents dealer-quarter fixed effects, where a quarter, q, is defined from the middle of a calendar quarter (event day: $T-28$) to the middle of the next calendar quarter ($T+28$). In columns 1 to 3, we restrict the analysis to the pre-leverage ratio period, and in columns 4 to 6, 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% level.

Dependent Variable	Capital Commitment$_{i,t}$					
Regulatory Period	Pre-Leverage Ratio			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)
$\mathbb{1}[Bank-aff.] \times \mathbb{1}[T-10, T-5]$	1.643	1.684	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	0.04	0.04	0.04	0.06	0.04	0.05
Observations	213,997	167,361	135,491	120,075	88,133	77,986
Dealer x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Table 4
Standardized Capital Commitment by Bank-affiliated Dealers

This sample is constructed at the dealer-day level and restricted to quarters 1-3. We perform the following regression:

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

The dependent variable, *Capital Commitment*$_{i,t}$ (*Std.*), represents the dealer-specific daily capital commitment standardized by the dealer-specific standard deviation of the inventory. $\mathbb{1}\,[LR]$ is an indicator variable that takes the value one from 01/2015 onward—that is, once the Basel III leverage ratio and G-SIB surcharges are implemented. $\mathbb{1}\,[QE]$ is an indicator variable that takes the value one if the respective transaction day is among the 10 last trading days prior to the regulatory reporting date. $\mathbf{M_t}$ refers to a vector of daily market controls and includes the change in the VIX, change in the 3-month LIBOR, return of the S&P 500, change in the spread of the ICE BofA IG corporate bond index, change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and change in the 10y-2y term spread. $\alpha_{i,q}$ represents dealer-quarter fixed effects, where a quarter, q, is defined from the middle of a calendar quarter (event day: $T-28$) to the middle of the next calendar quarter ($T+28$). In columns 1 to 3, we restrict the analysis to U.S. bank-affiliated dealers, and in columns 4 to 6, we restrict the analysis to European and Japanese bank-affiliated dealers. The total time period is 01/2003 - 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% level.

Dependent Variable	Capital Commitment$_{i,t}$ (Std.)					
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 x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Table 5
Liquidity Pecking Order in Quarter End Bond Sales

This sample is constructed at the dealer-bond-day level and restricted to quarters 1-3. We perform the following regression:

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

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. $\overline{Illiquidity_{j,t-1}}$ 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 takes the value one if the respective transaction day is among the 10 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 logarithm of its amount outstanding. $\mathbf{M_t}$ refers to a vector of daily market controls and includes the change in the VIX, change in the 3-month LIBOR, return of the S&P 500, change in the spread of the ICE BofA IG corporate bond index, change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and change in the 10y-2y term spread. α_r represents rating fixed effects, α_d represents industry fixed effects, and $\alpha_{i,q}$ represents dealer-quarter fixed effects, where a quarter, q, is defined from the middle of a calendar quarter (event day: $T-28$) to the middle of the next calendar quarter ($T+28$). The pre-leverage ratio period is defined from 01/2003 to 12/2006 and from 05/2009 to 12/2014 and the leverage ratio period is defined from 01/2015 to 12/2019. Columns 1-2 refer to U.S. bank-affiliated dealers. Columns 3-4 refer to European and Japanese bank-affiliated dealers. Standard errors, clustered at the bond and day levels, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level.

Dependent Variable	Log(Bond Selling Volume)$_{i,j,t}$			
Regulatory Jurisdiction of Bank Dealer	U.S.		European & Japanese	
Regulatory Period	Pre-Leverage Ratio	Leverage Ratio	Pre-Leverage Ratio	Leverage Ratio
	(1)	(2)	(3)	(4)
$\overline{Illiquidity_{j,t-1}}$	-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)
$\mathbb{1}[QE] \times \overline{Illiquidity_{j,t-1}}$	-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 Quarter FE	✓	✓	✓	✓
Rating FE	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓
Bond Controls	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓

Table 6
U.S. Bank-affiliated Dealers' Counterparty Trading

This 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:

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

The dependent variable, $Net\ Selling_{i,m,t}$, represents the net selling volume of dealer i—that is, cumulative dealer sales less cumulative dealer buys—vis-à-vis the counterparty type m on day t. $\mathbb{1}\,[QE]$ is an indicator variable that takes the value one if the respective transaction day is among the last 10 days prior to the regulatory reporting date. $\mathbf{M_t}$ refers to a vector of daily market controls and includes the change in the VIX, change in the 3-month LIBOR, return of the S&P 500, change in the spread of the ICE BofA IG corporate bond index, change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and change in the 10y-2y term spread. $\alpha_{i,q}$ represents dealer-quarter fixed effects, where a quarter, q, is defined from the middle of a calendar quarter (event day: $T - 28$) to the middle of the next calendar quarter ($T + 28$). We restrict the sample to U.S. bank-affiliated dealers as the 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 level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level.

Panel A: Counterparty: Customers

Bond Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{1}[QE]$	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 Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{1}[QE]$	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 Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{1}[QE]$	0.597**	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 x Quarter FE	✓	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓	✓

Table 7
European & Japanese Bank-affiliated Dealers' Counterparty Trading

This 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:

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

The dependent variable, $Net\ Selling_{i,m,t}$, represents the net selling volume of dealer i—that is, cumulative dealer sales less cumulative dealer buys—vis-à-vis the counterparty type m on day t. $\mathbb{1}\,[QE]$ is an indicator variable that takes the value one if the respective transaction day is among the last 10 days prior to the regulatory reporting date. $\mathbf{M_t}$ refers to a vector of daily market controls and includes the change in the VIX, change in the 3-month LIBOR, return of the S&P 500, change in the spread of the ICE BofA IG corporate bond index, change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and the change in the 10y-2y term spread. $\alpha_{i,q}$ represents dealer-quarter fixed effects, where a quarter, q, is defined from the middle of a calendar quarter (event day: $T-28$) to the middle of the next calendar quarter ($T+28$). We restrict the sample to European and Japanese bank-affiliated dealers as the 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 level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level.

Panel A: Counterparty: Customers

Bond 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 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 Type	All Bonds			IG Bonds		HY Bonds	
Trading Direction	Net Sales	Sales	Buys	Sales	Buys	Sales	Buys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{1}[QE]$	-0.0175	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 x Quarter FE	✓	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓	✓

Table 8
Transaction Spreads—Customer Discounts

This sample is constructed at the transaction level and restricted to quarters 1 to 3 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:

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

The dependent variable, $Spread_{k,j,i,t}$, represents the transaction cost measure, as described in Section 3 and is denoted in basis points. $\mathbb{1} \, [QE]$ is an indicator variable that takes the value one if the transaction day is among the 10 last trading days prior to the regulatory reporting date. $\mathbf{M_t}$ is a vector of market controls, including the change in the VIX, change in the 3-month LIBOR, return of the S&P 500, change in the spread of the ICE BofA IG corporate bond index, change in the difference of ICE BofA HY and ICE BofA IG corporate bond indexes, and 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. $\alpha_{j,q,s}$ represents bond-quarter-trade size category fixed effects, $\alpha_{r,q}$ refers to rating-quarter fixed effects, and $\alpha_{i,q}$ to dealer-quarter fixed effects. A quarter, q, is defined from the middle of a calendar quarter (event day: $T - 28$) to the middle of the next calendar quarter ($T + 28$). Trade size categories are defined as: (i) less than \$100,000, (ii) between \$100,000 and \$1 mn, and (iii) above \$1mn. In columns 4 and 5, 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 and 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% level.

Panel A: U.S. Bank-affiliated Dealers

Dependent Variable	$\text{Spread}_{k,j,i,t}$ (bp)				
Trade 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

Dependent Variable	$\text{Spread}_{k,j,i,t}$ (bp)				
Trade 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 Quarter FE	✓	✓	✓	✓	✓
Bond x Quarter x Trade Size FE	✓	✓	✓	✓	✓
Rating x Quarter FE	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓

Table 9
Insurance Companies' Quarter-end Liquidity Supply

This sample is constructed at the insurer-day level and restricted to quarters 1-3. We perform the following regression:

$$Insurer\ Net\ Trading_{n,t} = \beta_1 \mathbb{1}[QE] + \alpha_n + \alpha_q + \theta' \mathbf{M_{n,y}} + \varepsilon_{n,t}.$$

The dependent variable, $Insurer\ Net\ Trading_{n,t}$, refers to the logarithm of 1 plus the *net* amount of bonds purchased by insurance company n on trading day t. $\mathbb{1}[QE]$ is an indicator variable that takes the value one during the last 10 days prior to a reporting date. $\mathbb{1}[LR]$ is an indicator variable that takes the value one from 01/2015 onward—that is, once the Basel III leverage ratio and the G-SIB surcharges are implemented. $\mathbf{M_{n,y}}$ refers to annual insurer controls and includes $Log(Total\ Assets)$, defined as the logarithm of an insurer's total assets. $Asset\ Growth$ is the 5-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_q represents quarter fixed effects (where a quarter, q, is defined from the middle of a calendar quarter (event day: $T-28$) to the middle of the next calendar 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 (01/2010 - 12/2014). Standard errors, clustered at the insurance and quarter level, are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level.

Panel A: Insurer Quarter-End Liquidity Supply

Specifications	Bond Risk		Insurer Type			
	IG	HY	Life	Property & Casualty		
Dependent Variable	Net Trading$_{n,t}$				Buying$_{n,t}$	Selling$_{n,t}$
	(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
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$_{n,t}$			Buying$_{n,t}$	Selling$_{n,t}$
	(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
Quarter FE	✓	✓	✓	✓	✓
Insurer Controls	✓	✓	✓	✓	✓

Table 10
Relationship Effects in Insurance Companies' Liquidity Supply

This sample is constructed at the insurer-dealer-day level and restricted to quarters 1-3. We perform the following regression:

$$Insurer\ Net\ Trading_{n,i,t} = \beta_1\, \mathbb{1}[QE] + \beta_2\, \mathbb{1}[Relationship\ Dealer_{n,i}] + \beta_3\, \mathbb{1}[QE] \times \mathbb{1}[Relationship\ Dealer_{n,i}] + \theta'\, \mathbf{M_{n,y}} + \alpha_i + \alpha_q + \varepsilon_{n,i,t}.$$

The dependent variable, $Insurer\ Net\ Trading_{n,i,t}$, represents the (net) trading volume of insurer n with dealer i on trading date t. $\mathbb{1}[QE]$ is an indicator variable that takes the value one if the trading day is during the last 10 trading days of a quarter and zero else. $\mathbb{1}[Relationship\ Dealer_{n,i}]$ is an indicator variable that takes the value one if, throughout the past 24 months, a dealer i is among the three dealers with the highest share of transaction volume intermediated vis-à-vis insurance company n. $\mathbf{M_{n,y}}$ refers to annual insurer controls and includes $Log(Total\ Assets)$ defined as the logarithm of an insurer's total assets. *Asset Growth* is the 5-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_q represents quarter fixed effects (where a quarter, q, is defined from the middle of a calendar quarter ($T-28$) to the middle of the next calendar quarter ($T+28$)). α_i denotes dealer fixed effects. The total time period is 01/2015 - 12/2019 (leverage ratio period). Column 1 refers to all insurers, Column 2 to life insurers, and Columns 3 to 5 to property and casualty insurers. Standard errors, clustered at the insurer-dealer and quarter level, are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level.

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)
$\mathbf{1}[QE]$	0.001	-0.003	0.003*	0.004***	0.001
	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)
$\mathbb{1}[Relationship\ Dealer]$	0.029***	0.049***	0.019***	0.064***	0.046***
	(0.003)	(0.006)	(0.002)	(0.004)	(0.004)
$\mathbb{1}[QE] \times \mathbb{1}[Relationship\ Dealer]$	0.002	-0.005	0.007**	0.007***	-0.001
	(0.004)	(0.008)	(0.003)	(0.003)	(0.002)
R-Squared	0.01	0.01	0.01	0.01	0.01
Observations	30,826,137	9,985,830	20,840,307	20,840,307	20,840,307
Dealer FE	✓	✓	✓	✓	✓
Quarter FE	✓	✓	✓	✓	✓
Insurer Controls	✓	✓	✓	✓	✓

Table 11
Dealers' Principal Trading Behavior at Quarter Ends

This 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:

$$Share\ of\ Principal\ Volume_{i,t} = \beta_1 \mathbb{1}\,[QE] + \theta'\,\mathbf{M_t} + \alpha_i + \alpha_q + \varepsilon_{i,t}.$$

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

Panel A: U.S. Bank-affiliated Dealers

Dependent Variable	Share of Principal Volume (%)			Share of Principal Trades (%)		
Bond 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 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 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	✓	✓	✓	✓	✓	✓
Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Table 12
Customer Transaction Costs at Quarter End

This sample is constructed at the transaction level and restricted to quarters 1-3 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:

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

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 takes the value one if the respective transaction day is among the last 10 trading days prior to the regulatory reporting date. $\mathbf{M_t}$ is a vector of daily market controls and includes the change in the VIX, change in the 3-month LIBOR, return of the S&P 500, change in the spread of the ICE BofA IG corporate bond index, 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. $\alpha_{j,q,s}$ represents bond-quarter-trade size category fixed effects, $\alpha_{r,q}$ refers to rating-quarter fixed effects, and $\alpha_{i,q}$ to dealer-quarter fixed effects. A quarter, q, is defined from the middle of a calendar quarter (event day: $T-28$) to the middle of the next calendar quarter ($T+28$). Trade sizes are defined as: (i) less than \$100,000, (ii) between \$100,000 and \$1 mn, and (iii) 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 separately 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% level.

Panel A: Transaction Costs by Trade Type

Dependent Variable	Transaction Cost$_{k,j,i,t}$					
Regulatory Jurisdiction of Bank Dealer	U.S.		Europ. & Jpn.		Nonbanks	
Transaction Type	Principal	Agency	Principal	Agency	Principal	Agency
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[QE]$	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$_{k,j,i,t}$					
Regulatory Jurisdiction of Bank Dealer	U.S.		Europ. & Jpn.		Nonbanks	
Trade Size	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[QE]$	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$_{k,j,i,t}$					
Regulatory Jurisdiction of Bank Dealer	U.S.		Europ. & Jpn.		Nonbanks	
Trade Size	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}[QE]$	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 Quarter FE	✓	✓	✓	✓	✓	✓
Bond x Quarter x Size FE	✓	✓	✓	✓	✓	✓
Rating x Quarter FE	✓	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓	✓

Panel D: Transaction Costs by Trade Size - All Bonds

Dependent Variable	Principal Transaction Cost$_{k,j,i,t}$				
Trade Size (USD mn)	$< 100k$	$100k - 500k$	$500k - 1mn$	$1mn - 3mn$	$> 3mn$
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}[QE]$	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 Quarter FE	✓	✓	✓	✓	✓
Bond x Quarter x Size FE	✓	✓	✓	✓	✓
Rating x Quarter FE	✓	✓	✓	✓	✓
Market Controls	✓	✓	✓	✓	✓