# Treasury Tri-party Repo Pricing*

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ABSTRACT

Using a confidential, transaction-level dataset, we document substantial cross-sectional dispersion in rates and haircuts on overnight Treasury tri-party repos. Pricing varies systematically with (1) the number of counterparties market participants trade with, (2) the diversification of trading across those counterparties, and (3) the share of market volume those counterparties represent. The influence of these factors changes during market stress, when pricing differentials widen.

*Keywords*: tri-party repos, treasury repos, short-term funding, over-the-counter markets.

*JEL classification*: E44, E51, G24, L14.

The tri-party repurchase agreement (repo) market is a large over-the-counter market for secured lending, where cash-rich institutions interact daily with large, creditworthy borrowers. Beyond its central role in short-term funding markets (see e.g., Copeland et al. (2021)), this market also serves as a key conduit for U.S. monetary policy, as the Federal Reserve uses it to steer short-term interest rates.[1] Despite its size and relevance, the determinants of tri-party repo pricing remain imperfectly understood, largely due to the absence of granular public data. Using a confidential, transaction-level dataset, we aim to fill this gap by empirically studying how market frictions shape pricing in the tri-party repo market.

We document substantial cross-sectional dispersion in both rates and haircuts on overnight Treasury-backed repos. Different borrower–lender pairs engage in similar transactions, yet at different prices. We show that rates and haircuts vary systematically with three features of borrowers' trading networks: (1) the number of counterparties, (2) the diversification of borrowing across them, and (3) the share of market volume those counterparties account for. Notably, the impact of these factors intensifies during periods of market stress.

This dispersion is striking given the nature of these loan-like transactions, which are collateralized with U.S. Treasuries, involve high-credit-quality borrowers, and are cleared and settled by a custodian that holds the collateral throughout the loan. As a result, these loans effectively carry very small credit, collateral, and maturity risk.[2] In such a setting, one would expect prices to be nearly uniform across borrowers. The heterogeneity we document instead

[1]This website provides additional information on how the Federal Reserve implements monetary policy through open market operations. Within these tools, reverse repo agreements (RRP)—which are cleared and settled on the tri-party repo market—play an important role. More details on RRPs can be found here. Besides providing a key source of short-term funding, this market plays a pivotal role in the functioning of the financial system by supporting the liquidity of U.S. Treasury and agency securities. Market participants include money market funds, hedge funds, government-sponsored enterprises (GSEs), primary and non-primary dealers, commercial and federal home loan banks, and municipalities. In addition, overnight repos collateralized by U.S. Treasuries are particularly important, as their rates are a primary input to the Secured Overnight Financing Rate (SOFR), the benchmark reference rate for dollar-denominated financial contracts.

[2]Because these transactions are overnight, the usual concern that default risk increases with maturity is effectively absent. Collateral concerns also play no role. This is because transactions are collateralized with U.S Treasuries and, because tri-party repos are general collateral settled, cash-lenders are unlikely to be interested in trading repos as a way to borrow specific securities. Counterparty risk is also minimal as most cash-borrowers are high-credit-quality institutions, and the collateral is held by a custodian bank throughout the loan. Thus, from cash-lenders' perspective these short-term loans are virtually risk-free.

underscores the role of information asymmetries and differences in trading opportunities in shaping pricing—even in one of the safest segments of the U.S. short-term funding market.

The three factors we identify map naturally into complementary forces that arise in over-the-counter markets where trading is bilateral, relationships persistent, and market participants hold private information. Because borrowers must search for funding, their terms of trade could vary across transactions and depend on whom they contact. The number of counterparties reflects borrowers outside options and informational connectivity. More connected borrowers can substitute across lenders and obtain more precise information about funding conditions by observing a broader set of quotes (Babus and Kondor (2018)). Greater trading diversification reduces dependence on any single lender (Abbassi et al. (2021)) and dampens the percolation of private information through trading (Kondor and Pintér (2022)). Finally, counterparties' market share reflects both their funding capacity and bargaining power. While large lenders might provide liquidity at lower cost—a phenomenon consistent with Jurkatis et al. (2023)'s "relationship discount"—concentrated relationships also strengthen lenders' ability to extract surplus from borrowers who rely more heavily on them. Taken together, these factors capture how informational frictions and trading relationships alter bargaining power and, in doing so, influence tri-party repo pricing.

To quantify the pricing impact of these forces, we begin by studying how repo rates vary across borrowers. We find that borrowing from more lenders than usual, in a more concentrated fashion, and from less active lenders—those accounting for a smaller share of market volume—is associated with higher rates. Borrowing from one additional lender raises rates by roughly 1 basis point (bp), implying about \$1.3 million in additional annual funding costs. A 1% increase in borrowing concentration, measured by a Herfindahl index, raises rates by 0.105 bp (about \$136,000 annually), while a 1% decline in counterparties' market share increases rates by 0.044 bp (around \$57,000 annually).

These findings are consistent with two complementary mechanisms. The first is informational. A sudden search for new lenders can signal funding stress in a market characterized by repeated borrower–lender interactions: newly contacted lenders infer urgency to trade and adjust quotes upward—a phenomenon consistent with Zhu (2012)'s "ringing-phone curse."[3] The second mechanism is bargaining-liquidity driven. Borrowers with more diversified lender bases are less dependent on any single counterparty and reveal less information through trading, which weakens their lenders' bargaining positions. At the same time, borrowers dealing with cash-richer lenders benefit from their larger access to liquidity. Together, these mechanisms illustrate how information about liquidity conditions and trading opportunities jointly shape tri-party repo rates.

Given that tri-party repos closely resemble secured loans, we next quantify how the forces described above alter collateral terms. Because haircuts—a measure of loan overcollateralization—are negotiated when counterparties sign master repo agreements, and remain relatively stable over time, cross-sectional differences likely reflect features of bilateral relationships rather than short-term dynamics. Consistent with the bargaining mechanism, borrowers with more concentrated funding relationships face higher haircuts, reflecting weaker negotiating positions. A 1% increase in borrowing concentration relative to the average borrower raises haircuts by 0.189 bp, implying roughly $245,000 in additional annual funding costs. Borrowers that rely on more active lenders also face higher haircuts—by about 0.069 bp, or $89,000 annually—suggesting that active lenders leverage their stronger bargaining position to impose tighter collateral terms. These results show that the same bargaining-liquidity characteristics driving rate dispersion also shape collateral requirements in the tri-party repo market.

We then explore whether, and to what extent, participants' connectivity—the number of counterparties they can potentially trade with—affects pricing. Connectivity proves central. Because not every lender can trade with every other borrower in this market, trading opportunities are inherently heterogeneous across participants. For well-connected borrowers,

[3] Zhu (2012)'s "ringing-phone curse" refers to an informational mechanism that arises in over-the-counter markets. When a trader actively reaches out to many potential counterparties—figuratively, when their phone "rings" more often—it can inadvertently signal urgency to trade. Counterparties can interpret this behavior as evidence that the trader has weaker outside options. Anticipating this, those counterparties respond by offering worse terms—such as higher loan rates or lower asset prices—than they otherwise would.

all previously identified factors significantly influence rates, with stronger quantitative effects than for the average borrower, whereas for less-connected borrowers, these factors have little explanatory power.

The asymmetry between well- and less-connected borrowers illustrates how connectivity shapes both information transmission and bargaining dynamics in the tri-party repo market. Well-connected borrowers interact with a broader and more diversified lender base, so variation in their search intensity, borrowing concentration, and their counterparties' market share conveys information about their funding needs and alternative trading opportunities. For these borrowers, more intensive searching or borrowing from less-active lenders signals liquidity strains, while greater borrowing concentration enhances their lenders' bargaining power, leading to higher rates. Consistent with the key mechanisms in Babus and Kondor (2018), connectivity influences how information about liquidity conditions and trading opportunities propagates through the market, reinforcing its central role in tri-party repo pricing.

Finally, we study whether the pricing impact of our theoretically motivated factors varies during periods of market stress. Consistent with the view that bargaining power shifts toward lenders in such periods, borrowers pay higher rates when trading with more active lenders, who supply a larger share of funding. Connectivity again proves crucial: well-connected borrowers leverage their broader trading networks to secure funding at relatively lower costs during stress episodes, while less-connected borrowers—facing limited trading options—are more exposed to shifts in bargaining power and experience sharper rate increases.

Our paper makes several contributions. First, by leveraging transaction-level data with disaggregated information on haircuts, we provide the most comprehensive analysis to date of pricing in the Treasury tri-party repo market. Second, consistent with the key mechanisms in Babus and Kondor (2018), we show that informational frictions and trading relationships can systematically alter pricing even in short-term funding markets where concerns about counterparty, maturity, and collateral risks are minimal. To our knowledge, we present the first empirical evidence consistent with Zhu (2012)'s "ringing-phone curse." Third, we inform discussions on monetary policy implementation and benchmark rate setting by shedding light on the sources of price dispersion in a key segment of the U.S. short-term funding market.

*Related literature.* Our paper relates to four strands of the literature. First, our paper advances the growing empirical literature on tri-party repo pricing. The most closely related study is Han et al. (2022). Relative to their work, we also have access to disaggregated information on haircuts and consider a larger and more comprehensive sample. We are also related to Hu et al. (2021), though our focus and dataset differ. While Hu et al. (2021) examines equity repos using N-MFP filings, our transaction-level data provide a more comprehensive view of the overnight tri-party repo market.[4]

Second, we also relate to the literature that studies the pricing impact of trading relationships in over-the-counter markets—e.g., Di Maggio et al. (2017), O'Hara et al. (2018), Babus and Kondor (2018), Hendershott et al. (2020), Kondor and Pintér (2022), and Jurkatis et al. (2023), among others. While most of these studies focus on other markets, our findings extend this literature by empirically showing that participants' connectivity remains a key determinant of pricing even in environments where considerations about counterparty risk, maturity, and asset quality are largely absent. Notably, our results are consistent with the key mechanisms highlighted in Babus and Kondor (2018).

Third, our paper also relates to the literature examining repo market dynamics during periods of stress—e.g., Gorton and Metrick (2012); Krishnamurthy et al. (2014); Begalle et al. (2013); Copeland et al. (2014); Gorton et al. (2020); Hüser et al. (2024);and Anbil et al. (2021)). Among these studies, Anbil et al. (2021) is most closely related to ours, showing that trading relationships mitigate rate dispersion across repo segments and that restricted access can amplify market fragility. While this literature emphasizes how stress episodes disrupt

[4]Within the overnight triparty repo market, equity repos represent a negligible share of activity. Our paper also relates to the literature that provides a descriptive account of repo markets. An incomplete list includes Copeland et al. (2010), Adrian et al. (2011), Copeland et al. (2012), Baklanova et al. (2015), Committee on the Global Financial System (2017), and Baklanova et al. (2019). We contribute to this literature by providing an updated description of the overnight tri-party repo market. Our study also complements Bai et al. (2025), which analyzes the role of internal funding among affiliated counterparties of large U.S. bank holding companies using tri-party repo data.

normal market functioning, our granular data allow us to identify the specific factors that shape pricing in the tri-party repo market.

Lastly, we also relate to the broader literature on pricing in decentralized markets. Our findings align with search-and-bargaining models (e.g., Duffie et al. (2005, 2007), Afonso and Lagos (2015), Gavazza (2016), Üslü (2019), and Hugonnier et al. (2019)), models of information percolation and asymmetric information (e.g., Duffie and Manso (2007), Duffie et al. (2010a, 2009, 2010b), Zhu (2012), and Duffie et al. (2014)), and models of liquidity preferences (e.g., Huber (2023)).[5] These frameworks jointly help explain how changes in counterparties affect information diffusion, and, in doing so, bargaining power in the tri-party repo market.

*Outline.* The remainder of our paper is organized as follows. To help contextualize our results, Section I provides a brief background of the U.S. repo market, with an emphasis on its tri-party segment. Section II describes our data. Section III describes our empirical hypotheses. Section IV empirically explores theoretically motivated factors affecting tri-party repo pricing. Section V studies how the pricing impact of these factors changes during periods of stress. Section VI concludes. The Online Appendix contains additional information about the tri-party repo market as well as robustness tests.

[5] Other relevant literature includes Wolinsky (1990), Blouin and Serrano (2001), Green et al. (2006), Ashcraft and Duffie (2007), Duffie (2011), Golosov et al. (2014), Ballensiefen et al. (2023), Chang et al. (2025), and Erten et al. (2025). Our paper is also broadly related to the literature on collateralized debt. An incomplete list includes Stiglitz and Weiss (1981), Besanko and Thakor (1987), Berger and Udell (1990), Boot et al. (1991), Benmelech and Bergman (2009), Berger et al. (2011), Ennis (2011), Bottazzi et al. (2012), Simsek (2013), Berger et al. (2016), Gottardi et al. (2019), Parlatore (2019), Infante (2019), Infante (2020), and Huh and Infante (2021).

# I. Institutional Background

This section provides a brief overview of the U.S. repo market and its tri-party segment. A repo is the sale of an asset—typically a security—combined with a commitment to repurchase it at a specified future date and price. At a simpler level, a repo functions as a collateralized loan in which one party (the lender) provides cash to another (the borrower) in exchange for securities posted as collateral. This collateral aims to protect the lender against the risk that the borrower fails to repay the loan.

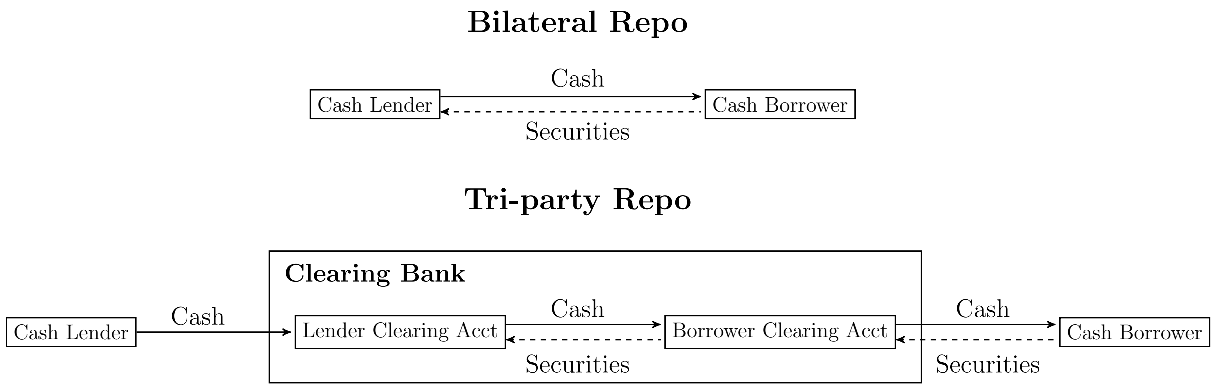
The U.S. repo market can be divided into four major segments, distinguished by two key dimensions: (1) whether trades are settled bilaterally or through a custodian, and (2) whether they are centrally or non-centrally cleared through the Fixed Income Clearing Corporation (FICC). The bilaterally settled segments include the centrally cleared delivery-versus-payment (DVP) repo market and the non-centrally cleared bilateral repo market. The custodian settled segments comprise the tri-party repo market—the focus of this paper—and the General Collateral Financing (GCF) repo market. In the tri-party repo market, trades are bilaterally negotiated between cash lenders and borrowers but cleared and settled through a custodian bank. In contrast, in the GCF segment, operated by the FICC, transactions are effectively blind-brokered as they are centrally cleared and netted.

Trading in the tri-party repo market differs from bilateral repos in two important ways. First, tri-party repos are general collateral transactions, meaning that borrowers—typically large, high-credit-quality institutions—can post any security within a designated collateral class (e.g., U.S. Treasuries). Consequently, the primary economic motive for engaging in tri-party repos is to borrow or invest cash rather than to obtain or source specific securities. Second, unlike in bilateral repos, the collateral in tri-party repos remains with the clearing bank for the duration of the trade and cannot be rehypothecated.[6] Figure 1 illustrates these

[6]Rehypothecation is the practice that allows a lender $\mathcal{L}$ to use the collateral posted by a borrower $\mathcal{B}$ as collateral in another repo transaction wherein $\mathcal{L}$ is now the borrower. Although rehypothecation is legally feasible within the tri-party repo market, we do not observe borrowers (lenders) switching to lenders (borrowers) throughout our sample. Thus, it is unlikely that rehypothecation plays any role in pricing.

distinctions by showing how cash and collateral move between lenders and borrowers in each market.

**Figure 1.** Differences between Bilateral and Tri-party Repos




*Note*: A repo resembles a collateralized loan in which the borrower seeks cash and posts an asset (or portfolio of assets) as collateral, while the lender receives such collateral when lending cash. At maturity, the borrower returns the cash plus interest to the lender, while the lender returns the collateral to the borrower. In bilateral repos, lenders and borrowers interact directly with each other and settle their transaction. Although tri-party repos are also bilaterally negotiated, transactions are settled through a clearing bank, which also provides custodian, collateral valuation, and back-office services.
*Source*: Authors' creation.

The largest portion of the tri-party repo market is captured by its overnight segment. To participate in the tri-party repo market, counterparties must first sign a master repo agreement outlining the general terms that govern their future transactions. These agreements specify the types of collateral acceptable to the lender and the corresponding haircuts. Haircuts—the difference between the market value of the collateral and the loan amount—aim to protect lenders against fluctuations in collateral value.

Because not all lenders and borrowers have signed master agreements with one another, trading between a given pair of counterparties may not be feasible, resulting in heterogeneous trading opportunities across participants. Even when multiple agreements exist, a participant may choose to trade only with a subset of counterparties offering the most favorable terms. Once the transaction details are agreed upon—including the interest rate, collateral class, and maturity (as haircuts are pre-negotiated)—the lender transfers cash to its account at the clearing bank, while the borrower delivers collateral to its own account at the clearing bank for the duration of the trade.[7]

*Tri-party repos play a key role in funding.* Tri-party repos are a cornerstone of short-term secured financing for large institutional borrowers—such as dealers and banks—that depend on continuous access to liquidity to finance securities inventories, manage balance sheets, and support client trading and market-making activities. By temporarily exchanging high-quality collateral for cash, these borrowers can preserve both balance-sheet flexibility and market positioning without the need to sell assets. Because their daily operations hinge on reliable access to this funding, borrowers have much stronger incentives to participate and actively manage their trading relationships than lenders. In contrast, lenders—such as money market funds, GSEs, and other institutional investors—face weaker participation incentives, as abstaining from the market primarily means forgoing short-term interest income. This asymmetry in motivations makes borrower behavior central to understanding pricing and liquidity dynamics in the tri-party repo market.

*Importance of the clearing bank.* Besides settling transactions, the clearing bank provides custodian, collateral valuation, margining, and back-office support to both parties. This ensures that the lender obtains the correct asset class, value, and haircut while confirming that any newly posted collateral meets the lender's requirements. Because the clearing bank handles most back-office tasks, it is easier for less-sophisticated institutions to engage in repo lending, which helps explain the large heterogeneity among lenders in the market.

*Overnight Treasury tri-party repos as collateralized loans.* Because tri-party repos resemble a collateralized loan, three basic factors could alter their pricing: (1) counterparty risk, (2) collateral quality, and (3) loan maturity. Although these factors potentially play a role in general loan pricing, it is unlikely they affect the pricing of overnight Treasury tri-party repos.

[7] The interest rate on a repo is calculated from the difference between the sale price and the repurchase price of the assets collateralizing the loan and can be negotiated on either a fixed or floating basis. Besides haircuts, repo transactions specify the terms, including the specific securities acceptable as collateral and initial margin requirements if necessary. Although most tri-party repos are overnight transactions, they can be entered into with longer maturities. Additionally, the clearing bank is responsible for distributing the collateral to the lender's account based on what meets the terms of the negotiated trade, as tri-party is a general collateral market.

First, counterparty risk is small in Treasury tri-party repos, as loans are collateralized with U.S. Treasuries. Also, as highlighted in Anbil et al. (2021), this risk is considerably smaller in overnight Treasury tri-party repos relative to other collateralized markets. This is because most borrowers are high-credit-quality institutions, and lenders are likely to recoup their cash even if their counterparty defaults.[8] Second, because U.S. Treasuries are highly liquid and the tri-party repo market is general collateral settled, the perceived quality of collateral is unlikely to play a role in pricing, as rates are not affected by lenders' demands for specific securities. Third, because transactions are overnight, maturity considerations are unlikely to play a role in pricing.

# II. Data

The Federal Reserve Board supervises tri-party clearing banks and, through the Federal Reserve Bank of New York, collects daily transaction-level data from them. Historically, two institutions—The Bank of New York Mellon (BNYM) and JPMorgan Chase (JPMC)—served as clearing banks. Since 2019, however, BNYM has become the predominant clearing bank for U.S. government securities following JPMC's near-complete exit from the tri-party segment. As a result, our analysis focuses on data reported by BNYM.

Our dataset covers all tri-party repo transactions between September 8, 2015, and March 9, 2021, and includes detailed information on the interest rate, loan amount, counterparties, collateral pledged, and the initiation and maturity dates of each trade.[9] To construct our baseline sample, we apply several filters. First, we focus on overnight transactions, which

[8]Lenders are likely to recoup their cash in case a borrower defaults because U.S. Treasuries rarely experience large short-term price fluctuations and can be liquidated quickly without the need to enter bankruptcy proceedings.

[9]Our data also include information on the transaction type, effective date, maturity structure (fixed or open), and any embedded options (e.g., early termination or extension rights), along with the required notice period to exercise such options. Each observation records the flow of cash and collateral between BNYM accounts and is timestamped at submission. Because participants may hold multiple accounts at BNYM and a single transaction can draw cash or collateral from several of them, individual trades may appear as multiple observations in our raw data. Online Appendix A provides a detailed description of how we reconstruct complete transactions from these observations.

account for the majority of market activity and involve most participants. Second, following Han et al. (2022), we restrict the sample to transactions collateralized by U.S. Treasuries, which represent more than half of overnight trading volume. This choice yields a more homogeneous sample by reducing the influence of concerns about collateral quality. Finally, we remove duplicate observations and exclude dates with unusually low trading volume.

*Data Description.* Table I presents daily summary statistics for our baseline sample. The dataset contains 619,920 trades among 338 market participants over 1,350 trading days. These transactions involve 1,104 distinct lender–borrower pairs, comprising 50 borrowers and 288 lenders. On an average day, there are about 460 trades among 369 active pairs, including 31 borrowers and 118 lenders. The average borrower raises roughly $15 billion per day, while the average lender provides about $4 billion. Borrowers engage in approximately 15 trades with 12 different lenders per day, whereas lenders trade with about 3 borrowers across 4 trades. On average, borrowers raise a total of $445 billion daily, at a volume-weighted average rate of 1.02% and haircut of 1.58%.

Table II presents summary statistics at the participant level. On average, lenders charge an interest rate of 1.012%, apply a haircut of 1.48%, and extend loans of about $772 million per transaction. Borrowers, in turn, face an average rate of 1.23%, a haircut of 1.87%, and borrow approximately $863 million per transaction. This table also shows that trading with affiliated counterparties significantly affects both pricing and transaction size: rates and haircuts are substantially lower, while average loan amounts are larger.[10]

Table III reports the average daily activity of different participant types, providing insight into the market's composition. Consistent with Copeland et al. (2012), money market funds account for a significant share of lending volume, while primary and non-primary dealers account for the majority of borrowing. Notably, nearly all participants operate exclusively as

[10]While trading with affiliated counterparties is advantageous for borrowers in terms of pricing, such relationships are relatively uncommon: only about 10% of lenders and 30% of borrowers engage in affiliate transactions over our sample period. Our findings differ from Bai et al. (2025), who document higher repo rates in affiliate trades. This difference likely reflects variation in sample coverage: whereas Bai et al. (2025) focus on transactions between large bank holding companies (BHCs) and their affiliates, our dataset captures the full set of tri-party borrowers over a longer horizon.

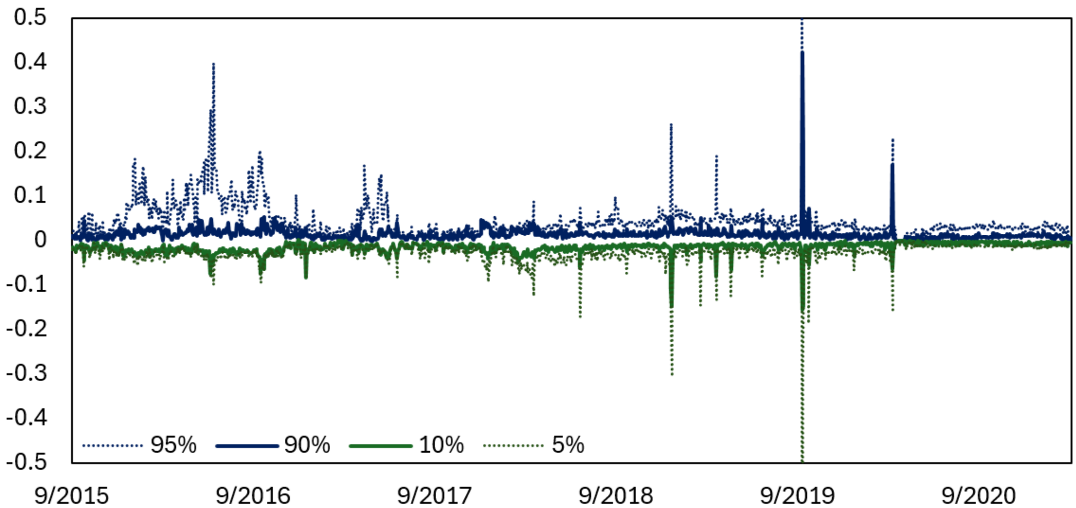
either lenders or borrowers, with the Federal Reserve being the only institution active on both sides of the market.[11]

Table IV highlights the importance of access to alternative trading opportunities. Well-connected lenders—those with more potential counterparties than the median lender—lend larger amounts and secure higher rates and haircuts relative to their less-connected counterparts. On the borrower side, well-connected participants—defined analogously—borrow larger volumes, trade with more active lenders, and pay lower rates than less-connected borrowers.

*Cross-sectional Dispersion.* Figure 2 illustrates the substantial cross-sectional dispersion in rates on overnight Treasury tri-party repos, despite these transactions being virtually risk-free from the perspective of cash lenders. The figure plots the 5th, 10th, 90th, and 95th percentiles of the distribution of $r_{j,t} - \bar{r}_t$, where $r_{j,t}$ denotes the rate of transaction $j$ on day $t$ and $\bar{r}_t$ is the average rate on that day. The dispersion—measured in percentage points—is economically large, highlighting meaningful differences in borrowing costs despite the standardized nature of these transactions. Moreover, this cross-sectional variation widens markedly during periods of market stress, most notably during the September 2019 funding dislocation, when liquidity imbalances amplified pricing differences across borrowers.

[11] Although our participant classification is more granular—based on account names, trading activity, and legal entity identifiers—Table III groups participants into several broad categories for ease of exposition. These include asset managers (e.g., money market and hedge funds), clearinghouses, commercial banks, the Federal Reserve, government-sponsored enterprises (e.g., Federal Home Loan Banks, Fannie Mae, and Freddie Mac), municipalities (e.g., state and local treasuries), primary and non-primary dealers (i.e., government securities dealers permitted or not permitted to trade directly with the Federal Reserve), and securities lending agents (typically banks or other intermediaries facilitating securities lending transactions). The current and historical lists of primary dealers are available here.

**Figure 2.** Cross-sectional rate dispersion




*Note*: This figure depicts the 5th, 10th, 90th, and 95th percentiles of the distribution of the difference $(r_{j,t} - \bar{r}_t)$, where $r_{j,t}$ denotes the rate of transaction $j$ on day $t$ and $\bar{r}_t$ is the daily average rate in the overnight Treasury tri-party repo market. The vertical axis is in percentage.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

# III. Empirical Hypotheses

Theoretical models of over-the-counter markets emphasize how pricing can be reshaped by information asymmetries, search frictions, and bargaining dynamics.[12] Building on these insights, we develop three hypotheses to guide our empirical analysis. These hypotheses serve as organizing principles for our descriptive analysis, rather than as causal claims, given the absence of clear natural experiments. Our goal is to document robust empirical regularities that can inform future work on the tri-party repo market.

Because concerns about counterparty risk, collateral quality, and maturity play only a limited role in pricing, cross-sectional differences in rates and haircuts must arise from heterogeneity in participants' (1) private information about liquidity conditions and (2) access to alternative trading opportunities. In what follows, we focus primarily on borrowers, who

[12]For two excellent descriptions of theoretical models of over-the-counter markets, see Duffie (2011) and Hugonnier et al. (2025). An incomplete list of the theoretical literature exploring the relevant trade-offs within collateralized debt and repo markets includes Stiglitz and Weiss (1981), Chan and Kanatas (1985), Besanko and Thakor (1987), Boot et al. (1991), Benmelech and Bergman (2009), Ennis (2011), Duffie (2011), Bottazzi et al. (2012), Dang et al. (2013), Simsek (2013), Eren (2014), Afonso and Lagos (2015), Allen et al. (2016), Gavazza (2016), Liu and Wu (2017), Üslü (2019), Gottardi et al. (2019), Infante (2019), Parlatore (2019), Huh and Infante (2021), Huber (2023), Chebotarev (2023), and Chang et al. (2025).

have the strongest incentives to trade, as they must continuously raise cash to finance their own or their clients' security positions.

**Hypothesis 1: Search Intensity and Pricing**—Search intensity is likely to influence pricing. Because borrowers and lenders interact repeatedly, engaging with more counterparties than usual can generate both benefits and costs. On the one hand, expanding search can improve outside options and allow borrowers to secure more favorable terms. On the other hand, increased search may signal liquidity strains, weakening a borrower's bargaining position.

**Hypothesis 2: Counterparty Market Share and Bargaining Power**—To the extent that counterparties' market share reflects their influence within the market, it can affect pricing through its impact on bargaining power. Lenders that account for a larger share of market volume may hold greater negotiating power, leading to higher repo rates and haircuts for borrowers. Conversely, a higher market share may also signal stronger funding capacity or balance sheet flexibility, in which case such lenders may offer more competitive terms.

**Hypothesis 3: Diversification and Pricing Stability**—The extent of trading diversification across counterparties can mitigate exposure to shifts in bargaining power and limit the transmission of private information. By spreading transactions over a wider set of lenders, borrowers reduce reliance on any single counterparty, thereby enhancing their flexibility in the face of funding shocks. Diversification also curtails the amount of information revealed through individual trades. Greater counterparty diversification should therefore be associated with more stable—and potentially more favorable—pricing.

# IV. Treasury Tri-party Repo Pricing

Guided by the above hypotheses, this section examines the factors that shape the pricing of overnight Treasury tri-party repos. We show that rates and haircuts vary systematically with (1) the number of counterparties participants trade with, (2) the diversification of trading across those counterparties, and (3) the share of market volume those counterparties account for.

## *A. Measures of searching, counterparties' importance, and diversification*

This section describes the three measures we use to capture borrowers' search intensity, their lenders' relative importance, and the diversification of their trading activity.

To proxy for search intensity, we use the number of distinct non-affiliated lenders a borrower trades with on a given day. We exclude affiliated lenders because such relationships are typically priced differently and could bias our measure. To mitigate endogeneity concerns, we use lagged values of this variable as an instrument in our regressions.

Following Ashcraft and Duffie (2007) and Han et al. (2022), we proxy for lenders' relative importance using their market share, defined as the fraction of total daily trading volume each lender accounts for. We take the natural logarithm of this measure to improve its distributional properties and use its lagged value in our regression analysis.

Finally, to capture trading diversification, we compute the Herfindahl–Hirschman Index (HHI) of each borrower's daily trading volume across counterparties. The index ranges from zero to one, decreasing as trading becomes more diversified. As with our other measures, we take the logarithm of the HHI to improve its distributional properties and use lagged values as instruments to address potential endogeneity concerns.

*Correlation among variables of interest.* Table V reports correlations among our key measures. It shows that changes in (1) the number of non-affiliated counterparties, (2) counterparties' market share, and (3) trading concentration are all significantly associated with changes in repo rates—and with each other. Borrowing from a larger number of lenders is associated with lower rates, while borrowing in a more concentrated fashion, from more active lenders, and in larger volumes is associated with higher rates.

As expected, the number of non-affiliated counterparties is negatively correlated with trading concentration, indicating that borrowers interacting with a broader set of lenders tend to have more diversified trading relationships. Trading volume is positively correlated with the number of non-affiliated counterparties but negatively correlated with trading concentration, suggesting that larger borrowers distribute their activity more widely across lenders. Finally, counterparties' market share is positively correlated with trading volume, consistent with the idea that larger lenders provide a greater share of market funding.

## *B. Determinants of pricing*

Repo pricing is jointly determined by both interest rates and haircuts. Although haircuts are negotiated prior to individual transactions, they directly affect the overall terms of trade, as posting collateral entails a cost for borrowers. We first examine how heterogeneity in repo rates across borrowers evolves over time to assess how our key factors influence rates. We then analyze how these factors shape haircuts by exploiting cross-sectional variation in haircuts across borrowers.

### B.1. Rates

We run the following regression:

$$\log(Y_{it}) = X_{it}\beta + \varepsilon_{it}, \tag{1}$$

where there are observations on borrowers ($i$) across days ($t$). $X_{it}$ is a vector of explanatory and control variables at the borrower-day or day level, while $Y_{it}$ captures the dollar-weighted average rate negotiated by borrower $i$ at $t$. Explanatory variables include (1) the number of (non-affiliated) counterparties, (2) counterparties' market shares, and (3) trading concentration across those counterparties. We use one-week lags as instruments to address endogeneity concerns. Because of the potential autocorrelation of our regressors, we cluster standard errors at the participant level (see Stock and Watson (2008) and Petersen (2008)).[13]

*Controls.* Our set of controls and fixed effects implies that $\beta$ is estimated from time variation in the distribution of rates across borrowers. Besides including fixed effects at the borrower level, we use a battery of controls. Our controls include month-end and quarter-end fixed effects to ensure seasonal events do not alter our results.[14] We also include FOMC-announcement-date fixed effects to control for unexpected changes in monetary policy.

To address concerns that fluctuations in overall market activity could bias our results, we control for total trading volume. In addition, following Ashcraft and Duffie (2007), we control for the average time of day at which each borrower arranges its transactions to ensure that intra-day funding dynamics do not confound our estimates.

Because borrowers typically obtain more favorable terms when trading with affiliated counterparties, we control for the fraction of each borrower's repos arranged with affiliates. In addition, since transactions backed by different collateral classes may be jointly negotiated, we control for the daily fraction of a borrower's transactions collateralized with Treasuries to isolate the pricing effect of other collateral types in $Y_{it}$. We further include the FOMC midpoint rate to account for changes in monetary policy and the Federal Reserve's net borrowing activity to capture shifts in bargaining power associated with the Fed's open market operations (see Anderson and Kandrac (2018)).

**Pricing.** Table VI presents our regression results for different sets of borrowers. For completeness, Columns (1)–(6) report specifications that sequentially add explanatory variables, while Column (7) displays our main and most comprehensive specification. Panel A shows

[13]In the presence of participant fixed effects, OLS, Fama-MacBeth, and Newey-West standard errors are biased. However, clustered standard errors are unbiased, as they account for the residual dependence created by the participant effect.

[14]For example, Munyan (2015) documents the existence of quarter-end seasonality in tri-party repos, as European dealers shrink their balance sheets at quarter-ends to reduce their asset base used for leverage ratio calculations.

that, for the average borrower, (1) trading with a larger number of lenders than usual, (2) borrowing in a more concentrated fashion, and (3) borrowing from less active counterparties are all associated with higher rates.

These findings are consistent with two complementary mechanisms. The first is informational: because borrower–lender pairs interact repeatedly, an increase in a borrower's search intensity can signal liquidity strains or reduced access to funding. Consistent with Zhu (2012)'s "ringing-phone curse," such behavior reveals weaker outside options, prompting newly contacted lenders to charge a premium. The second is bargaining and liquidity-based: borrowers with a more diversified lender base are less dependent on any single counterparty and can negotiate more favorable terms, as shown in Ballensiefen et al. (2023) and Huber (2023). Likewise, borrowers trading with cash-richer or more active lenders benefit from their counterparties' greater access to liquidity. Together, these mechanisms highlight how information about liquidity conditions and the structure of trading relationships jointly shape pricing in the tri-party repo market.

Importantly, the estimated effects are economically meaningful. Borrowing from one additional lender is associated with a 1.07 basis point (bp) increase in rates, implying roughly \$1.3 million in additional annual funding costs. A 1% increase in borrowing concentration corresponds to a 0.105 bp rate increase, or about \$136,000 per year in higher costs. Likewise, a 1% decrease in counterparties' market share is associated with a 0.044 bp rate increase, translating to approximately \$57,000 in additional annual funding costs.[15]

<u>Relevance of relationships:</u> The ability to trade with a larger set of counterparties can enhance participants' bargaining power. Although establishing master agreements with additional lenders entails costs, doing so provides borrowers with greater flexibility to access funding when needed. It is then reasonable to expect that borrowers with access to a broader

[15] The average borrower in our sample raises about \$13 billion per day. As a result, an increase of 1 bp accounts for \$1.3 million more in funding costs: $13 \times 10^9 \times 10^{-4} = 1.3 \times 10^6$. The computation for the impact of changes in borrowing concentration and counterparties' market shares follows a similar idea. An increase of 0.105 bp in borrowing concentration accounts for \$136,000 more in funding costs: $13 \times 10^9 \times 0.105 \times 10^{-4} = 1.36 \times 10^5 = \$136,000$. And a decrease of 0.044 bps accounts for \$57,000 less in funding costs: $13 \times 10^9 \times 0.044 \times 10^{-4} = 0.57 \times 10^5 = \$57,000$.

lending network face different pricing than those with access to a more limited one.

Panels B and C of Table VI examine whether the pricing effects of our explanatory variables differ across borrowers with varying degrees of connectivity. Panel B reports the results for less-connected borrowers—those with fewer lenders than the median borrower over the sample period. As shown in Column (7), none of our explanatory variables have a significant effect on pricing within this group. Consistent with Table IV, less-connected borrowers typically trade with only a small number of counterparties and borrow in a relatively concentrated fashion. Because their lenders are also less active in the market, it is unsurprising that variation in our explanatory variables plays a limited role in determining their rates.

In contrast, Panel C shows that the same factors matter more for well-connected borrowers—defined as those with more lenders than the median borrower in our sample. As Column (7) illustrates, all three factors—search intensity, counterparties' market share, and borrowing concentration—significantly affect pricing. And their marginal effects are larger for well-connected borrowers than for the average borrower. Borrowing from one additional lender is associated with a 1.3 bp increase in rates, translating into roughly \$2.6 million in additional annual funding costs for the average well-connected borrower. A 1% increase in borrowing concentration corresponds to a 0.119 bp rate increase, or about \$238,000 in additional annual costs. Finally, a 1% decline in counterparties' market share is associated with a 0.073 bp increase in rates, approximately \$146,000 in extra annual funding costs.[16]

That is, pricing among well-connected borrowers is more sensitive to their network of trading relationships, consistent with informational and bargaining mechanisms driving rate dispersion. Well-connected borrowers are more likely to reveal information about their liquidity needs when searching more actively, as they interact with more counterparties and trade larger volumes. By contrast, less-connected borrowers—who face a limited set

[16] The average well-connected borrower raises about \$20 billion per day. Therefore, an increase of 1.3 bp accounts for \$2.6 million more in funding costs: $20 \times 10^9 \times 1.3 \times 10^{-4} = 26 \times 10^5 = 2.6 \times 10^6$. In addition, an increase of 0.119 bp accounts for 238,000 more in funding costs: $20 \times 10^9 \times 0.119 \times 10^{-4} = 2.38 \times 10^5 = 238,000$. A decrease of 0.073 bp accounts for \$146,000 less on funding costs: $20 \times 10^9 \times 0.073 \times 10^{-4} = 1.46 \times 10^5 = 146,000$.

of potential lenders—find diversification harder to achieve, making variation in trading concentration largely irrelevant for their pricing. For well-connected borrowers, however, greater diversification can reduce the bargaining power of individual lenders and lead to more favorable terms. Finally, because well-connected borrowers are more likely to trade with active lenders, variation in lenders' market share plays a stronger role in shaping their pricing than it does for less-connected borrowers, who have fewer viable funding alternatives.

### B.2. Haircuts

Although we do not directly observe master agreements, we can infer haircuts from transaction-level information. Because haircuts are typically determined at the time counterparties negotiate their master agreements—and these contracts are rarely renegotiated—we exploit cross-sectional heterogeneity across market participants to examine how haircuts vary with our key explanatory variables. We then estimate the following regression:

$$\log(h_i) \quad = \quad Z_i\varphi + \epsilon_i, \tag{2}$$

where $i$ denotes borrowers and $Z_i$ is a vector of explanatory and control variables at the borrower level, computed as the average of variables mentioned in section IV.B.1. Here, $h_i$ captures the average dollar-weighted haircut negotiated by borrower $i$ in overnight Treasury tri-party repos. Our set of controls and fixed effects implies that parameter $\varphi$ is estimated from (cross-sectional) variation in the distribution of average haircuts across borrowers.

*Controls.* First, we control for each borrower's average trading volume to account for scale effects. Second, following Ashcraft and Duffie (2007), we control for the average time of day at which borrowers execute their transactions to address potential intra-day effects. Third, because borrowers tend to obtain more favorable haircuts when trading with affiliated counterparties, we control for the average fraction of affiliated trades. Finally, to capture heterogeneity in market participation, we control for the number of days each borrower trades in the tri-party repo market, as well as for the average fraction of their overnight trades collateralized with U.S. Treasury securities.

**Pricing.** Table VII presents the results of our regression specification across different sets of borrowers. As before, Columns (1)–(6) sequentially introduce subsets of explanatory variables, while Column (7) reports our most comprehensive and robust specification.

Panel A shows that, relative to the average borrower in our sample, those who borrow in a more concentrated fashion and from more active lenders tend to post higher haircuts. Specifically, a 1% increase in borrowing concentration is associated with a 0.189 bp increase in haircuts, implying roughly $245,000 in additional annual funding costs. Similarly, borrowers whose counterparties' average market share is 1% higher than that of the average borrower face haircuts that are 0.069 bp higher, corresponding to about $89,000 in extra annual costs.

These findings suggest that lenders have meaningful bargaining power when negotiating collateral terms—an effect that is amplified when they play a more active role in the market or when borrowers are more dependent on their funding.

Relevance of relationships: Panels B and C of Table VII examine how borrowers' connectivity influences their haircuts. Among less-connected borrowers, Column (7) in Panel B shows that counterparties' market share is the only factor affecting haircuts. This result reinforces the view that lenders exercise bargaining power when setting collateral terms, particularly when they play a more important funding role.

A different pattern emerges for well-connected borrowers. As shown in Column (7) of Panel C, only borrowing concentration significantly affects their haircuts, with higher concentration associated with lower haircuts. Although this finding may appear counterintuitive at first glance, it is consistent with the notion that well-connected borrowers can strategically allocate borrowing across lenders to minimize overall funding costs. By concentrating borrowing among lenders offering more favorable terms, they secure lower haircuts. Importantly, only well-connected borrowers have the flexibility to engage in such optimization, reflecting their broader funding networks.

# V. Pricing in Times of Stress

Given the critical role that overnight Treasury tri-party repos play in the day-to-day functioning of the U.S. financial system, it is important to understand how the impact of the aforementioned factors can be altered in times of stress. Besides showing that such an impact can materially change, our results suggest that bargaining power tilts toward lenders when market conditions deteriorate.

To examine this question, we interact our key variables with indicators of market stress to evaluate how the sensitivity of repo rates varies across normal and stressed periods:

$$\log(Y_{it}) \quad = \quad X_{it} \times \mathbb{1}_t \mu + X_{it}\gamma + \mathbb{1}_t \theta + \widetilde{\varepsilon}_{it}, \tag{3}$$

where $X_{it}$, as in specification (1), represents our set of explanatory and control variables, $Y_{it}$ captures the dollar-weighted average rate obtained by borrower $i$ at $t$, and $\mathbb{1}_t$ is an indicator variable that equals one if $t$ is a period of stress and zero otherwise. Periods of stress are defined as the right 5% tail of the distribution of daily (dollar-weighted) average spreads on overnight Treasury tri-party repos over the sample. Here, the coefficients of interest are the interaction terms contained within $\mu$. This vector captures the change in pricing impact on $Y_{it}$ of (1) the number of non-affiliated counterparties, (2) counterparty concentration, and (3) counterparties' market shares, during periods of stress.

Table VIII presents the results of specification (3) across different sets of borrowers. Column (7) in Panel A shows that, for the average borrower, only the effect of counterparties' market share changes significantly during periods of stress. In particular, borrowers pay higher rates when trading with more active lenders, consistent with the idea that bargaining power shifts toward lenders under stressed conditions, even though it tends to favor borrowers in normal times. Since active lenders supply a larger fraction of total funding, it is reasonable to expect that they can exert greater bargaining power when liquidity tightens. By contrast, the effects of the number of counterparties and borrowing diversification remain largely unchanged during stress episodes.

Panels B and C of Table VIII examine whether borrowers' connectivity alters these dynamics. Panel B reports results for less-connected borrowers, while Panel C reports those for well-connected borrowers. A comparison of Column (7) across the two panels shows that the pricing effect of counterparties' market share changes only for less-connected borrowers. This finding is consistent with the idea that connectivity mitigates the impact of funding stress. Well-connected borrowers, with access to a broader lending network, can rely on their relationships to secure funding at relatively lower costs when market conditions deteriorate. In contrast, less-connected borrowers—facing limited funding alternatives—are more exposed to shifts in lenders' bargaining power during periods of market stress.

# VI. Conclusion

We document substantial cross-sectional dispersion in rates and haircuts on overnight Treasury tri-party repos, challenging the conventional view that these terms are largely uniform across market participants. Repo pricing varies systematically with (1) the number of counterparties participants trade with, (2) the diversification of trading across those counterparties, and (3) the share of market volume those counterparties represent.

Two mechanisms help to explain our findings. The first is informational: greater search intensity can signal liquidity strains or weaker outside options. The second is bargaining and liquidity-based: borrowers with more diversified or cash-rich lenders face lower funding costs.

By identifying the key drivers of tri-party repo pricing, we shed new light on price formation in decentralized funding markets where counterparty, maturity, and collateral risks are limited. Given the market's relevance, our findings inform discussions on monetary policy implementation and benchmark rate setting.

# REFERENCES


Abbassi, Puriya, Falk Bräuning, and Niels Schulze, 2021, Bargaining power and outside options in the interbank lending market, Financial Management 50, 553–586.

Adrian, Tobias, Brian Begalle, Adam Copeland, and Antoine Martin, 2011, Repo and securities lending, Federal Reserve Bank of New York Staff Reports 529.

Afonso, Gara, Marco Cipriani, Adam M Copeland, Anna Kovner, Gabriele La Spada, and Antoine Martin, 2021, The market events of mid-September 2019, Federal Reserve Bank of New York Economic Policy Review 27.

Afonso, Gara, and Ricardo Lagos, 2015, Trade dynamics in the market for federal funds, Econometrica 83, 263–313.

Allen, Jason, James Chapman, Federico Echenique, and Matthew Shum, 2016, Efficiency and bargaining power in the interbank loan market, International Economic Review 57, 691–716.

Anbil, Sriya, Alyssa Anderson, and Zeynep Senyuz, 2021, Are repo markets fragile? Evidence from September 2019, Federal Research Board Finance and Economics Discussion Series 21-028.

Anderson, Alyssa G, and John Kandrac, 2018, Monetary policy implementation and financial vulnerability: Evidence from the overnight reverse repurchase facility, The Review of Financial Studies 31, 3643–3686.

Ashcraft, Adam B., and Darrell Duffie, 2007, Systemic illiquidity in the federal funds market, American Economic Review: Papers and Proceedings 97, 221–225.

Babus, Ana, and Péter Kondor, 2018, Trading and information diffusion in over-the-counter markets, Econometrica 86, 1727–1769.

Bai, Jennie, Erik Bostrom, Sebastian Infante, and Victoria Ivashina, 2025, Liquidity flows to bank-affiliated broker dealers: Insights from volumes and prices, Available at SSRN .

Baklanova, Viktoria, Cecilia Caglio, Marco Cipriani, and Adam Copeland, 2019, The use of collateral in bilateral repurchase and securities lending agreements, Review of Economic Dynamics 33, 228–249.

Baklanova, Viktoria, Adam Copeland, and Rebecca McCaughrin, 2015, Reference guide to U.S. repo and securities lending markets, Federal Reserve Bank of New York Staff Reports 740.

Ballensiefen, Benedikt, Angelo Ranaldo, and Hannah Winterberg, 2023, Money market disconnect, The Review of Financial Studies 36, 4158–4189.

Begalle, Brian, Antoine Martin, James McAndrews, and Susan McLaughlin, 2013, The risk of fire sales in the tri-party repo market, Federal Reserve Bank of New York Staff Reports 616.

Benmelech, Efraim, and Nittai K Bergman, 2009, Collateral pricing, Journal of Financial Economics 91, 339–360.

Berger, Allen N, W Scott Frame, and Vasso Ioannidou, 2011, Tests of ex ante versus ex post theories of collateral using private and public information, Journal of Financial Economics 100, 85–97.

Berger, Allen N, W Scott Frame, and Vasso Ioannidou, 2016, Reexamining the empirical relation between loan risk and collateral: The roles of collateral liquidity and types, Journal of Financial Intermediation 26, 28–46.

Berger, Allen N, and Gregory F Udell, 1990, Collateral, loan quality and bank risk, Journal of Monetary Economics 25, 21–42.

Besanko, David, and Anjan V Thakor, 1987, Collateral and rationing: Sorting equilibria in monopolistic and competitive credit markets, International Economic Review 671–689.

Blondel, Vincent D, Jean-Loup Guillaume, Renaud Lambiotte, and Etienne Lefebvre, 2008, Fast unfolding of communities in large networks, Journal of Statistical Mechanics: Theory and Experiment 2008, P10008.

Blouin, Max R., and Roberto Serrano, 2001, A decentralized market with common values uncertainty: Non-steady states, The Review of Economic Studies 68, 323–346.

Boot, Arnoud WA, Anjan V Thakor, and Gregory F Udell, 1991, Secured lending and default risk: equilibrium analysis, policy implications and empirical results, The Economic Journal 101, 458–472.

Bottazzi, Jean-Marc, Jaime Luque, and Mário R Páscoa, 2012, Securities market theory: Possession, repo and rehypothecation, Journal of Economic Theory 147, 477–500.

Chan, Yuk-Shee, and George Kanatas, 1985, Asymmetric valuations and the role of collateral in loan agreements, Journal of money, credit and banking 17, 84–95.

Chang, Jin-Wook, Elizabeth Klee, and Vladimir Yankov, 2025, Rewiring repos, Finance and Economics Discussion Series. Federal Reserve Board. 2025-013.

Chebotarev, Dmitry, 2023, Pricing repo: A model of haircuts and rates, Working Paper .

Chow, Yan, Kevin Clark, Adam Copeland, R. Jay Kahn, Michael Koslow, Antoine Martin, Mark Paddrik, and Benjamin Taylor, 2021, Intra-day timing of general collateral repo markets, Liberty Street Economics .

Committee on the Global Financial System, 2017, Repo market functioning, Technical report.

Copeland, Adam, Darrell Duffie, Antoine Martin, and Susan McLaughlin, 2012, Key mechanics of tri-party repo markets, Federal Reserve Bank of New York Economic Policy Review 18, 17–28.

Copeland, Adam, Darrell Duffie, and Yilin Yang, 2025, Reserves were not so ample after all, The Quarterly Journal of Economics 140, 239–281.

Copeland, Adam, R. Jay Kahn, Antoine Martin, Matthew McCormick, William Riordan, Kevin Clark, and Tim Wessel, 2021, How competitive are u.s. treasury repo markets?, Liberty Street Economics .

Copeland, Adam, Antoine Martin, and Michael Walker, 2010, The tri-party repo market before the 2010 reforms, Federal Reserve Bank of New York Staff Reports 447.

Copeland, Adam, Antoine Martin, and Michael Walker, 2014, Repo runs: Evidence from the tri-party repo market, The Journal of Finance 69, 2343–2380.

Dang, Tri Vi, Gary Gorton, and Bengt Holmström, 2013, Haircuts and repo chains, Working Paper .

Di Maggio, Marco, Amir Kermani, and Zhaogang Song, 2017, The value of trading relations in turbulent times, Journal of Financial Economics 124, 266–284.

Duffie, Darrell, 2011, Dark Markets: Asset Pricing and Information Transmission in Over-the-Counter Markets (Princeton University Press).

Duffie, Darrell, Gaston Giroux, and Gustavo Manso, 2010a, Information percolation, American Economic Journal: Microeconomics 2, 100–111.

Duffie, Darrell, Nicolae Gârleanu, and Lasse Heje Pedersen, 2005, Over-the-counter markets, Econometrica 73, 1815–1847.

Duffie, Darrell, Nicolae Gârleanu, and Lasse Heje Pedersen, 2007, Valuation in over-the-counter markets, The Review of Financial Studies 20, 1865–1900.

Duffie, Darrell, Semyon Malamud, and Gustavo Manso, 2009, Information percolation with equilibrium search dynamics, Econometrica 77, 1513–1574.

Duffie, Darrell, Semyon Malamud, and Gustavo Manso, 2010b, The relative contributions of private information sharing and public information releases to information aggregation, Journal of Economic Theory 145, 1574–1601.

Duffie, Darrell, Semyon Malamud, and Gustavo Manso, 2014, Information percolation in segmented markets, Journal of Economic Theory 153, 1–32.

Duffie, Darrell, and Gustavo Manso, 2007, Information percolation in large markets, American Economic Review 97, 203–209.

Ennis, Huberto M., 2011, Strategic behavior in the tri-party repo market, Economic Quarterly, Federal Reserve Bank of Richmond 97.

Eren, Egemen, 2014, Intermediary funding liquidity and rehypothecation as determinants of repo haircuts and interest rates, in 27th Australasian Finance and Banking Conference.

Erten, Irem, Ioana Neamtu, and John Thanassoulis, 2025, The ring-fencing bonus, Review of Finance (Forthcoming) .

Gavazza, Alessandro, 2016, An empirical equilibrium model of a decentralized asset market, Econometrica 84, 1755–1798.

Golosov, Mikhail, Guido Lorenzoni, and Aleh Tsyvinski, 2014, Decentralized trading with private information, Econometrica 82, 1055–1091.

Gorton, Gary, and Andrew Metrick, 2012, Securitized banking and the run on repo, Journal of Financial Economics 104, 425–451.

Gorton, Gary B, Andrew Metrick, and Chase P Ross, 2020, Who ran on repo?, AEA Papers and Proceedings 110, 487–492.

Gottardi, Piero, Vincent Maurin, and Cyril Monnet, 2019, A theory of repurchase agreements, collateral re-use, and repo intermediation, Review of Economic Dynamics 33, 30–56.

Green, Richard C., Burton Hollifield, and Norman Schürhoff, 2006, Financial intermediation and the costs of trading in an opaque market, The Review of Financial Studies 20, 275–314.

Han, Song, Kleopatra Nikolaou, and Manjola Tase, 2022, Trading relationships in secured markets: Evidence from triparty repos, Journal of Banking & Finance 139, 106486.

Hendershott, Terrence, Dan Li, Dmitry Livdan, and Norman Schürhoff, 2020, Relationship trading in over-the-counter markets, The Journal of Finance 75, 683–734.

Hu, Grace Xing, Jun Pan, and Jiang Wang, 2021, Tri-party repo pricing, Journal of Financial and Quantitative Analysis 56, 337–371.

Huber, Amy Wang, 2023, Market power in wholesale funding: A structural perspective from the triparty repo market, Journal of Financial Economics 149, 235–259.

Hugonnier, Julien, Benjamin Lester, and Pierre-Olivier Weill, 2019, Frictional intermediation in over-the-counter markets, The Review of Economic Studies 87, 1432–1469.

Hugonnier, Julien, Benjamin Lester, and Pierre-Olivier Weill, 2025, The Economics of Over-the-Counter Markets: A Toolkit for the Analysis of Decentralized Exchange (Princeton University Press).

Huh, Yesol, and Sebastian Infante, 2021, Bond market intermediation and the role of repo, Journal of Banking & Finance 122, 105999.

Hüser, Anne-Caroline, Caterina Lepore, and Luitgard Anna Maria Veraart, 2024, How does the repo market behave under stress? Evidence from the covid-19 crisis, Journal of Financial Stability 70, 101193.

Infante, Sebastian, 2019, Liquidity windfalls: The consequences of repo rehypothecation, Journal of Financial Economics 133, 42–63.

Infante, Sebastian, 2020, Private money creation with safe assets and term premia, Journal of Financial Economics 136, 828–856.

Jurkatis, Simon, Andreas Schrimpf, Karamfil Todorov, and Nicholas Vause, 2023, Relationship discounts in corporate bond trading .

Kondor, Péter, and Gábor Pintér, 2022, Clients' connections: Measuring the role of private information in decentralized markets, The Journal of Finance 77, 505–544.

Krishnamurthy, Arvind, Stefan Nagel, and Dmitry Orlov, 2014, Sizing up repo, The Journal of Finance 69, 2381–2417.

Liu, Sheen, and Chunchi Wu, 2017, Repo counterparty risk and on-/off-the-run treasury spreads, The Review of Asset Pricing Studies 7, 81–143.

Munyan, Benjamin, 2015, Regulatory arbitrage in repo markets, Office of Financial Research Working Paper 15-22.

O'Hara, Maureen, Yihui Wang, and Xing Alex Zhou, 2018, The execution quality of corporate bonds, Journal of Financial Economics 130, 308–326.

Parlatore, Cecilia, 2019, Collateralizing liquidity, Journal of Financial Economics 131, 299–322.

Petersen, Mitchell A, 2008, Estimating standard errors in finance panel data sets: Comparing approaches, The Review of Financial Studies 22, 435–480.

Schulhofer-Wohl, Sam, 2019, Understanding recent fluctuations in short-term interest rates, Chicago Fed Letter 423.

Simsek, Alp, 2013, Belief disagreements and collateral constraints, Econometrica 81, 1–53.

Stiglitz, Joseph E, and Andrew Weiss, 1981, Credit rationing in markets with imperfect information, American Economic Review 71, 393–410.

Stock, James H, and Mark W Watson, 2008, Heteroskedasticity-robust standard errors for fixed effects panel data regression, Econometrica 76, 155–174.

Üslü, Semih, 2019, Pricing and liquidity in decentralized asset markets, Econometrica 87, 2079–2140.

Wolinsky, Asher, 1990, Information revelation in a market with pairwise meetings, Econometrica 58, 1–23.

Zhu, Haoxiang, 2012, Finding a good price in opaque over-the-counter markets, Review of Financial Studies 25, 1255–1285.

# Tables

**Table I**: Descriptive Statistics at Daily Level

| | Mean | Std Dev | Min | 10% | Median | 90% | Max |
|---|---|---|---|---|---|---|---|
| Number of Lenders | 118 | 9 | 94 | 105 | 119 | 126 | 159 |
| average amount lent (in $billions) | 3.80 | 0.69 | 2.35 | 2.97 | 3.77 | 4.63 | 6.52 |
| average # trades | 3.93 | 0.71 | 2.58 | 3.10 | 3.79 | 4.80 | 5.48 |
| average # relationships | 3.15 | 0.52 | 2.21 | 2.54 | 3.08 | 3.77 | 4.26 |
| Number of Borrowers | 31 | 6 | 22 | 24 | 33 | 38 | 40 |
| average amount borrowed (in $billions) | 14.6 | 2.61 | 9.9 | 11.7 | 14.1 | 18.3 | 26.6 |
| average # trades | 14.9 | 0.93 | 12.4 | 13.9 | 14.8 | 16.0 | 17.7 |
| average # relationships | 12.0 | 0.78 | 10.2 | 11.1 | 11.9 | 13.0 | 14.0 |
| Volume (in $billions) | 445 | 76 | 266 | 344 | 450 | 541 | 769 |
| Number of Trades | 460 | 76 | 330 | 366 | 455 | 557 | 612 |
| Number of Relationships | 369 | 56 | 270 | 297 | 368 | 441 | 485 |
| Rates (%) | 1.02 | 0.86 | 0.02 | 0.07 | 1.00 | 2.37 | 5.00 |
| Daily Rate Volatility (%) | 0.03 | 0.03 | 0.01 | 0.01 | 0.03 | 0.05 | 0.82 |
| Haircut (%) | 1.58 | 0.28 | 0.55 | 1.19 | 1.63 | 1.89 | 1.97 |
| Daily Haircut Volatility (%) | 0.38 | 0.07 | 0.18 | 0.29 | 0.38 | 0.47 | 0.56 |

*Note*: This table reports average daily statistics of the overnight portion of BNYM's tri-party repo. The first 8 rows describe the daily participation of borrowers and lenders, along with the average size of transactions, as well as the number of counterparties, and trades. Rows 9 through 11 report trading volume, the number of trades, and the number of borrower-lender relationships on a daily basis. Rows 12 and 13 report the daily average rate and haircut of repo collateralized with U.S Treasury securities.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.

**Table II**: Descriptive Statistics at Participant Level

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Panel A: Lenders** | | | | | | | | | | | | |
| | *All trades* | | | | *Non-affiliated trades* | | | | *Affiliated trades* | | | |
| | Mean | Median | Q1 | Q3 | Mean | Median | Q1 | Q3 | Mean | Median | Q1 | Q3 |
| rate (%) | 1.012 | 1.032 | 0.597 | 1.267 | 1.086 | 1.101 | 0.678 | 1.343 | 0.906 | 1.016 | 0.436 | 1.138 |
| spread (%) | -0.051 | -0.048 | -0.100 | -0.026 | -0.039 | -0.042 | -0.069 | -0.018 | 0.006 | 0.000 | -0.055 | 0.036 |
| haircut (%) | 1.480 | 2 | 1 | 2 | 1.864 | 2 | 2 | 2 | 1.182 | 1.942 | 0.015 | 2 |
| volume ($M) | 772.3 | 165.6 | 49.56 | 551.9 | 310.8 | 138.9 | 49.16 | 399.3 | 2800 | 1345 | 535.8 | 3759 |
| **Panel B: Borrowers** | | | | | | | | | | | | |
| | *All trades* | | | | *Non-affiliated trades* | | | | *Affiliated trades* | | | |
| | Mean | Median | Q1 | Q3 | Mean | Median | Q1 | Q3 | Mean | Median | Q1 | Q3 |
| rate(%) | 1.230 | 1.175 | 1.042 | 1.405 | 1.252 | 1.213 | 1.045 | 1.410 | 1.027 | 1.016 | 0.734 | 1.117 |
| spread(%) | -0.007 | -0.025 | -0.039 | 0.010 | -0.010 | -0.026 | -0.040 | 0.003 | -0.004 | -0.002 | -0.048 | 0.031 |
| haircut (%) | 1.865 | 2 | 1.976 | 2.004 | 1.946 | 2 | 2 | 2.008 | 1.163 | 1.535 | 0.066 | 1.998 |
| volume ($M) | 863.7 | 567.8 | 296.5 | 984.2 | 733.5 | 508.2 | 295.1 | 947.9 | 3383 | 1275 | 279.2 | 5051 |

*Note*: This table reports statistics at the participant level. We split transactions based on whether counterparties are affiliated or not. For each participant, excluding the Fed, we compute the average rate, spread, haircut, and volume across transactions. With that information in hand, we construct this table. Column Mean reports the mean of the cross-sectional distribution of averages (across participants). The same idea applies to columns Median, Q1, and Q3. Q1 reports the first quartile, while Q3 reports the third quartile of the cross-sectional distribution of averages. Among lenders, 22 trade with affiliates, while 228 trade with non-affiliates. Among borrowers, 14 trade with affiliates, while 46 trade with non-affiliates.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.

**Table III**: Overnight Market Participant Activity

| | | | | |
|---|---|---|---|---|
| **Lenders** | | | | |
| | # Accounts | # Participants | Volume | # Transactions |
| Asset Manager | 40 | 29 | 262.7 | 756.9 |
| Commercial Bank | 132 | 64 | 1.6 | 7.2 |
| Federal Reserve | 2 | 2 | 68.2 | 249.7 |
| GSE | 28 | 16 | 30.3 | 9.3 |
| Municipality | 26 | 16 | 13.3 | 10.0 |
| Securities Lender | 291 | 51 | 88.8 | 31.8 |
| **Borrowers** | | | | |
| | # Accounts | # Participants | Volume | # Transactions |
| Commercial Bank | 17 | 16 | 81.4 | 83.8 |
| Federal Reserve | 1 | 1 | 55.3 | 11.7 |
| Non-Primary Dealer | 14 | 11 | 14.3 | 22.9 |
| Primary Dealer | 37 | 26 | 288.1 | 345.5 |

*Note*: This table reports statistics for major market participants. Column "# Accounts" reports the number of BNYM accounts associated with each market participant type. Column "# Participants" is the number of unique market participants trading by type based on our classification procedure. Column "Volume" reports the average daily sum of funding (in $billions) per market participant type. Column "# Transactions" reports the average daily number of transactions associated with each market participant type.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

**Table IV**: Lender and Borrower Daily Descriptive Statistics

| | *Less Connected* | | | | *Well Connected* | | | |
|---|---|---|---|---|---|---|---|---|
| **Panel A: Lenders** | Mean | Std. Dev. | Q1 | Q3 | Mean | Std. Dev. | Q1 | Q2 |
| Spread | -0.052 | 0.063 | -0.080 | -0.046 | -0.048 | 0.047 | -0.063 | -0.042 |
| Haircut | 1.683 | 0.676 | 1.947 | 2.000 | 1.872 | 0.294 | 1.975 | 2.000 |
| Non-Affiliated Borrowers | 1.232 | 0.531 | 1.001 | 1.353 | 4.227 | 4.005 | 1.456 | 5.660 |
| Trading Volume ($B) | 0.909 | 2.010 | 0.068 | 0.528 | 5.058 | 9.622 | 0.271 | 3.528 |
| Counterparties Market Share | 0.042 | 0.021 | 0.033 | 0.049 | 0.041 | 0.014 | 0.034 | 0.049 |
| HHI | 0.897 | 0.158 | 0.890 | 1.000 | 0.588 | 0.271 | 0.374 | 0.829 |
| Participation Rate | 0.666 | 0.325 | 0.398 | 0.975 | 0.779 | 0.304 | 0.574 | 1.000 |
| **Panel B: Borrowers** | | | | | | | | |
| | *Less Connected* | | | | *Well Connected* | | | |
| | Mean | Std. Dev. | Q1 | Q3 | Mean | Std. Dev. | Q1 | Q3 |
| Spread | -0.017 | 0.055 | -0.051 | 0.005 | -0.060 | 0.017 | -0.063 | -0.050 |
| Haircut | 1.890 | 0.375 | 1.992 | 2.000 | 1.840 | 0.455 | 1.905 | 2.012 |
| Non-Affiliated Borrowers | 3.391 | 2.748 | 1.250 | 4.492 | 15.955 | 6.921 | 11.988 | 19.755 |
| Trading Volume ($B) | 5.337 | 8.218 | 0.472 | 6.212 | 39.155 | 106.028 | 4.832 | 25.507 |
| Counterparties Market Share | 0.039 | 0.024 | 0.025 | 0.043 | 0.070 | 0.055 | 0.052 | 0.071 |
| HHI | 0.648 | 0.301 | 0.375 | 0.933 | 0.272 | 0.225 | 0.141 | 0.325 |
| Participation Rate | 0.764 | 0.331 | 0.610 | 1.000 | 0.991 | 0.029 | 1.000 | 1.000 |

*Note*: This table reports statistics for participants that trade with at least two counterparties throughout the sample. A lender is said to be less connected if, throughout the sample, they trade with less different counterparties than the median lender. Otherwise, such a lender is said to be well connected. Similar concepts apply to borrowers. Variable spread is computed as the difference between repo rates and the federal funds target mid-point rate.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.

**Table V**: Correlation Among Variables of Interest

| | **Lenders** | | | | |
|---|---|---|---|---|---|
| | Spread | # Non-affiliated Borrowers | HHI | Market Share | Volume ($B) |
| Spread | 1 | | | | |
| # Non-affiliated Borrowers | 0.0962*** | 1 | | | |
| HHI | -0.121*** | -0.770*** | 1 | | |
| Market Share | -0.157*** | -0.0395*** | 0.109*** | 1 | |
| Volume ($B) | 0.0650*** | 0.688*** | -0.348*** | 0.158*** | 1 |
| | **Borrowers** | | | | |
| | Spread | # Non-affiliated Lenders | HHI | Market share | Volume ($B) |
| Spread | 1 | | | | |
| # Non-affiliated Lenders | -0.0645*** | 1 | | | |
| HHI | 0.0719*** | -0.704*** | 1 | | |
| Market Share | 0.0536*** | 0.177*** | -0.0785*** | 1 | |
| Volume ($B) | 0.0293*** | 0.628*** | -0.275*** | 0.480*** | 1 |

*Note*: This table reports pairwise correlations among variables of interest for both borrowers and lenders. Spread is the difference between repo and FOMC midapoint rates. For any given participant, HHI denotes the HerfindahlaHirschman Index of daily trading activity among their counterparties. Similarly, market share denotes the daily volume-weighted market share of their counterparties. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

**Table VI**: Rates

| | Dependent variable: log(repo rate) | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | **Panel A: Full Sample** | | | | | | |
| Number of Counterparties | 0.00286 | | | 0.00458 | 0.00871** | | 0.0107** |
| | (0.00337) | | | (0.00382) | (0.00407) | | (0.00445) |
| Borrowing Concentration | | 0.0448 | | | 0.102** | 0.0369 | 0.105** |
| | | (0.0355) | | | (0.0499) | (0.0367) | (0.0501) |
| Counterparties' Market Share | | | -0.0377* | -0.0430** | | -0.0357 | -0.0446** |
| | | | (0.0220) | (0.0214) | | (0.0234) | (0.0211) |
| Observations | 40,121 | 40,121 | 40,116 | 40,116 | 40,121 | 40,116 | 40,116 |
| Number of Borrowers | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| R-squared | 0.948 | 0.948 | 0.948 | 0.948 | 0.948 | 0.948 | 0.948 |
| | **Panel B: Less Connected** | | | | | | |
| Number of Counterparties | -0.0106* | | | -0.00747 | -0.00221 | | 0.00130 |
| | (0.00629) | | | (0.00742) | (0.00924) | | (0.00935) |
| Borrowing Concentration | | 0.102* | | | 0.0913 | 0.0887 | 0.0945 |
| | | (0.0577) | | | (0.0865) | (0.0615) | (0.0842) |
| Counterparties' Market Share | | | -0.0339 | -0.0287 | | -0.0290 | -0.0296 |
| | | | (0.0222) | (0.0233) | | (0.0235) | (0.0233) |
| Observations | 21,196 | 21,196 | 21,191 | 21,191 | 21,196 | 21,191 | 21,191 |
| Number of Borrowers | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| R-squared | 0.944 | 0.944 | 0.944 | 0.944 | 0.944 | 0.945 | 0.945 |
| | **Panel C: Well Connected** | | | | | | |
| Number of Counterparties | 0.00537 | | | 0.00685 | 0.0111** | | 0.0135** |
| | (0.00447) | | | (0.00518) | (0.00470) | | (0.00537) |
| Borrowing Concentration | | 0.0223 | | | 0.108* | 0.0188 | 0.119** |
| | | (0.0487) | | | (0.0631) | (0.0494) | (0.0576) |
| Counterparties' Market Share | | | -0.0367 | -0.0596 | | -0.0353 | -0.0733* |
| | | | (0.0481) | (0.0461) | | (0.0520) | (0.0435) |
| Observations | 18,925 | 18,925 | 18,925 | 18,925 | 18,925 | 18,925 | 18,925 |
| Number of Borrowers | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| R-squared | 0.953 | 0.953 | 0.953 | 0.953 | 0.953 | 0.953 | 0.954 |
| Instrumental Variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Intraday Timing | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Treasury Percentage | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Changes in Liquidity Needs | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fed Activity | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Policy Rate | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fraction of Activity with Affiliated Counterparties | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Market Volume | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Month-end FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter-end FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| FOMC FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Borrower FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Note*: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample includes observations (at the participant-day level) from September 8, 2015, to March 9, 2021. Borrowers that trade with less than 2 counterparties in the sample are not included in the analysis.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.

**Table VII**: Haircuts

| | Dependent variable: log(average haircut) | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A: Full Sample** | | | | | | | |
| Average Number of Counterparties | -0.00461 | | | -0.00120 | 0.00634 | | 0.00992 |
| | (0.00631) | | | (0.00465) | (0.00645) | | (0.00610) |
| Average Borrowing Concentration | | 0.139* | | | 0.186* | 0.117* | 0.189** |
| | | (0.0732) | | | (0.0917) | (0.0614) | (0.0897) |
| Average Counterparties' Market Share | | | 0.0697* | 0.0683* | | 0.0622** | 0.0690** |
| | | | (0.0351) | (0.0346) | | (0.0286) | (0.0305) |
| Observations | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| R-squared | 0.612 | 0.648 | 0.663 | 0.664 | 0.654 | 0.692 | 0.706 |
| **Panel B: Less Connected** | | | | | | | |
| Average Number of Counterparties | -0.0182 | | | -0.0114 | -0.0175 | | -0.00638 |
| | (0.0132) | | | (0.00831) | (0.0135) | | (0.0120) |
| Average Borrowing Concentration | | 0.109 | | | 0.00587 | 0.0788 | 0.0421 |
| | | (0.0933) | | | (0.0820) | (0.0650) | (0.0945) |
| Average Counterparties' Market Share | | | 0.0667* | 0.0608* | | 0.0632* | 0.0615* |
| | | | (0.0352) | (0.0323) | | (0.0317) | (0.0334) |
| Observations | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| R-squared | 0.862 | 0.857 | 0.896 | 0.903 | 0.862 | 0.903 | 0.904 |
| **Panel C: Well Connected** | | | | | | | |
| Average Number of Counterparties | 0.00497 | | | 0.0113* | 0.000901 | | 0.00382 |
| | (0.00505) | | | (0.00485) | (0.00263) | | (0.00381) |
| Average Borrowing Concentration | | -0.155*** | | | -0.150*** | -0.154*** | -0.125** |
| | | (0.0305) | | | (0.0353) | (0.0330) | (0.0342) |
| Average Counterparties' Market Share | | | 0.0607 | 0.246* | | 0.0158 | 0.0866 |
| | | | (0.0778) | (0.106) | | (0.0504) | (0.0697) |
| Observations | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| R-squared | 0.625 | 0.897 | 0.569 | 0.792 | 0.899 | 0.898 | 0.912 |
| Controls for Intraday Timing | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Treasury Percentage | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Volume | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fraction of Activity with Affiliated Counterparties | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Participation Rate | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Note*: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$. The sample contains one data point per participant. Such data points are averages across observations (at the participant-day level) from September 8, 2015, to March 9, 2021. Borrowers that trade with less than 2 counterparties in the sample are not included in the analysis.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.

## **Table VIII**: Rates in Periods of Stress

| | Dependent variable: log(repo rate) | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | | **Panel A: Full Sample** | | | |
| Interaction: Periods of Stress and # Counterparties | -3.52e-05 | | | -0.00154 | -0.00190 | | -0.00233 |
| | (0.00132) | | | (0.00130) | (0.00230) | | (0.00236) |
| Interaction: Periods of Stress and Borrowing Concentration | | -0.00480 | | | -0.0203 | 0.0140 | -0.00518 |
| | | (0.0128) | | | (0.0221) | (0.0136) | (0.0244) |
| Interaction: Periods of Stress and Counterparties' Market Share | | | 0.0385*** | 0.0426*** | | 0.0411*** | 0.0405*** |
| | | | (0.00910) | (0.00851) | | (0.00973) | (0.00960) |
| Observations | 40,121 | 40,121 | 40,116 | 40,116 | 40,121 | 40,116 | 40,116 |
| Number of Borrowers | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| R-squared | 0.948 | 0.948 | 0.948 | 0.948 | 0.948 | 0.948 | 0.949 |
| | | | | **Panel B: Less Connected** | | | |
| Interaction: Periods of Stress and # Counterparties | 0.00203 | | | -0.000152 | -0.00289 | | -0.000260 |
| | (0.00293) | | | (0.00272) | (0.00653) | | (0.00688) |
| Interaction: Periods of Stress and Borrowing Concentration | | -0.0242 | | | -0.0401 | -0.00153 | -0.00312 |
| | | (0.0208) | | | (0.0443) | (0.0213) | (0.0525) |
| Interaction: Periods of Stress and Counterparties' Market Share | | | 0.0445*** | 0.0425*** | | 0.0424*** | 0.0426*** |
| | | | (0.00863) | (0.00885) | | (0.00935) | (0.0101) |
| Observations | 21,196 | 21,196 | 21,191 | 21,191 | 21,196 | 21,191 | 21,191 |
| Number of Borrowers | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| R-squared | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 |
| | | | | **Panel C: Well Connected** | | | |
| Interaction: Periods of Stress and # Counterparties | 0.00128 | | | -3.26e-05 | -0.000704 | | -0.00165 |
| | (0.000991) | | | (0.00126) | (0.00139) | | (0.00146) |
| Interaction: Periods of Stress and Borrowing Concentration | | -0.0711* | | | -0.0819* | -0.0520 | -0.0609 |
| | | (0.0421) | | | (0.0479) | (0.0513) | (0.0526) |
| Interaction: Periods of Stress and Counterparties' Market Share | | | -0.0405 | -0.0213 | | -0.0187 | -0.0104 |
| | | | (0.0281) | (0.0259) | | (0.0190) | (0.0289) |
| Observations | 18,925 | 18,925 | 18,925 | 18,925 | 18,925 | 18,925 | 18,925 |
| Number of Borrowers | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| R-squared | 0.953 | 0.953 | 0.953 | 0.953 | 0.954 | 0.953 | 0.954 |
| Instrumental Variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Intraday Timing | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Treasury Percentage | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Changes in Liquidity Needs | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fed Activity | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Policy Rate | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fraction of Activity with Affiliated Counterparties | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Market Volume | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Month-end FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter-end FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| FOMC FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Borrower FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Note*: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample includes observations (at the participant-day level) from September 8, 2015, to March 9, 2021. Borrowers that trade with less than 2 counterparties in the sample are not included in the analysis.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.

# Online Appendix for Treasury Tri-party Repo Pricing

This version: November 8, 2025[1]

This online appendix provides supplementary material for Treasury Tri-party Repo Pricing. Appendix A describes the steps used to clean and construct our baseline sample. Appendix B presents additional stylized facts on the structure and trading in the tri-party repo market. Appendix C complements the analysis in the main text by examining tri-party repo pricing from the perspective of lenders.

# Appendix A Building our data

Our sample includes all transactions reported by the Bank of New York Mellon (BNYM) from September 2015 through March 2021. Each observation captures the flow of cash and collateral between participants' BNYM accounts. Because participants may hold multiple accounts and individual transactions can draw cash or collateral from several of them, a single transaction may appear as multiple observations in the raw data.

We restrict our analysis to observations corresponding to fixed overnight transactions and to open transactions whose pricing resets daily, making them economically equivalent to overnight repos. This approach follows the standard methodology employed by the Federal Reserve Bank of New York in the calculation of the Secured Overnight Financing Rate (SOFR). We then apply the following steps to identify overnight transactions and their timestamps:

- Maturity type: We classify an observation as a potential part of an overnight transaction if (a) the difference between its start and end dates equals one business day (accounting for weekends and holidays), or (b) the observation is flagged as "open." We consider only transactions that are negotiated daily, rather than those tied to a predetermined reference rate.

- Holiday filtering: We exclude official holidays and days exhibiting abnormally low market activity, defined as total overnight volume below $300 billion.

- Data integrity: We remove all observations involving accounts designated for BNYM system testing or operational validation.

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- Timestamp selection: For each observation, we use the earliest timestamp reported by either the lender or the borrower. Because large money market complexes often split single transactions across multiple accounts (after their 1:00 PM cutoff for investor withdrawals), we exclude those post-cutoff volumes when determining transaction timestamps.

To reconstruct transactions from individual observations, we group observations by (i) the identities of the lender and borrower, and (ii) the proximity of their timestamps. Observations involving the same lender–borrower pair with closely aligned timestamps are treated as components of a single transaction.

To identify market participants from individual accounts, we employ a two-step procedure.

*Step 1.*—We classify accounts based on their primary activity—lending or borrowing. In practice, most accounts are used exclusively for one of these purposes. Our initial sample includes 8,012 accounts—of which 7,859 are associated with lending activity and 153 with borrowing activity.

*Step 2.*—We apply the following double-sorting procedure that combines information from institution name matching and account usage patterns to consolidate accounts belonging to the same participant.

*Double Sorting Process:*

- **String-matching:** We begin by grouping accounts based on the name of their parent institution, using the classification provided by the Federal Reserve Bank of New York. This initial step yields 148 institution groups. However, this classification is sometimes imprecise—for example, 1,087 accounts are listed under the generic label "Other." To improve accuracy, we apply a string-matching algorithm to refine the New York Fed's groupings. This procedure identifies 729 unique participants, consisting of 659 lenders and 79 borrowers.

- **Account usage.** Because accounts sharing the same parent institution name may be managed by different decision-makers (e.g., distinct trading desks), we use account usage patterns as a second sorting dimension to refine our classification. The logic is straightforward: if two accounts frequently appear together in similar transactions, they are likely managed by the same decision-making unit and should share a common participant ID. To operationalize this idea, we form all possible lender–borrower account pairs and count how often each pair co-occurs in similar observations. We then represent these data as a network, where each node corresponds to an account and an edge between two nodes indicates that those two accounts appear jointly in at least one transaction. In this framework, identifying decision-makers corresponds to detecting clusters of connected nodes, with all nodes within a cluster interpreted as belonging to the same participant. We use the Louvain community detection algorithm (Blondel et al. (2008)) to identify these clusters, yielding 252 lenders and 18 borrowers.

Combining the string-matching and account-usage classifications yields 962 distinct participants, comprising 84 borrowers and 878 lenders.

After applying the double-sorting procedure, we restrict our analysis to accounts appearing exclusively in observations related to overnight Treasury transactions. This refinement reduces our sample to 587 participants, comprising 75 borrowers and 512 lenders, representing 348 distinct parent institutions.[2]

We then remove participants whose accounts are rarely used or are associated with minimal trading activity. Specifically, participants in the bottom 1% of the distribution of account usage—those appearing fewer than two times in the sample—and those in the bottom 1% of the distribution of average trading volume per account—less than $500,000—are excluded.

# Appendix B Stylized Facts

This section presents several stylized facts of the tri-party repo market.

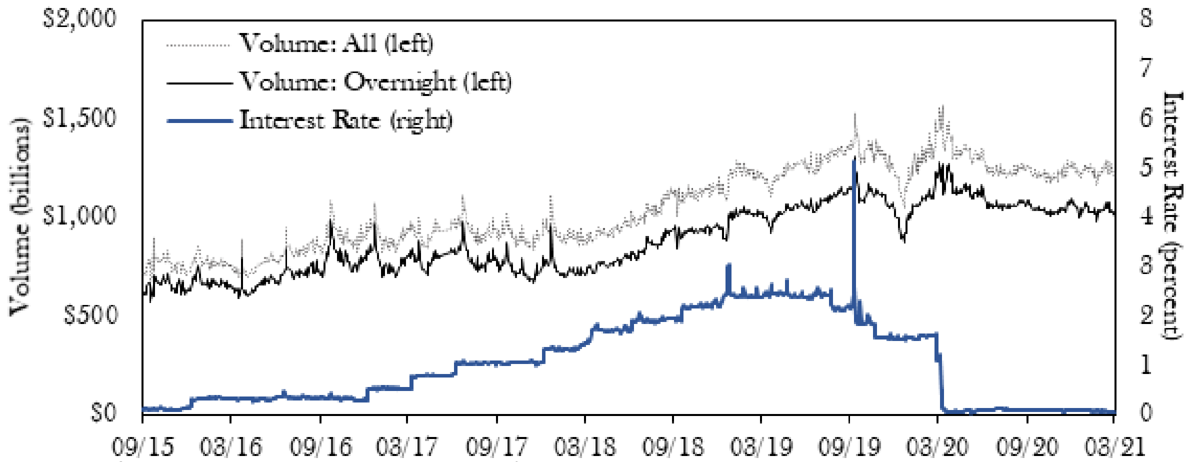
## A *Relevance of overnight tri-party repos and rate-haircut dynamics*

Figure B.1 shows that overnight repos account for the largest share of the tri-party repo market across all collateral classes. While average rates remain relatively stable from day to day, trading volumes display pronounced spikes and a steady upward trend beginning in 2018, with a temporary decline in early 2020 driven by a greater use of repos with longer maturities.

To better understand the dynamics of the effective haircuts faced by borrowers, Figure B.2 plots the daily, dollar-weighted average haircut for repos collateralized with U.S. Treasury and Agency securities. Because repos function as collateralized loans, the perceived credit quality and liquidity of the collateral influence haircut levels. Consistent with this intuition, Figure B.2 shows that borrowers face substantially lower haircuts when posting U.S. Treasuries than when using Agency securities as collateral.

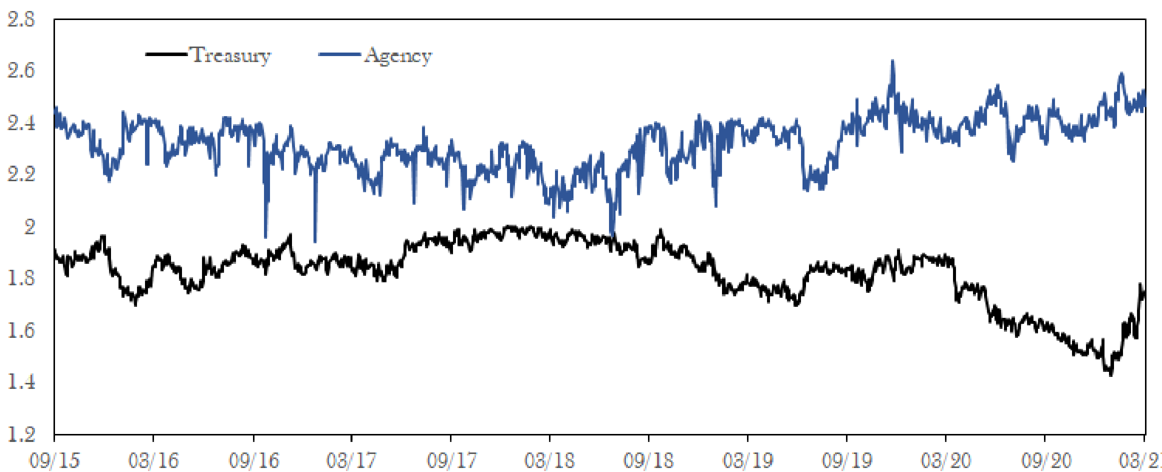
[2]Because master repo agreements are not directly observable, we rely on the collateral classifications assigned during BNYM's settlement process. Following BNYM's taxonomy, we group repo activity into three collateral categories: U.S. Treasuries, Agencies, and Other.

**Figure B.1.** Daily Volume and Average Rate




*Note*: This figure depicts the daily amount of traded volume in overall and overnight tri-party repos (in billions of dollars) and the average dollar-weighted interest rate (in percent) in the overnight tri-party repo market.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

**Figure B.2.** Daily Average Haircuts



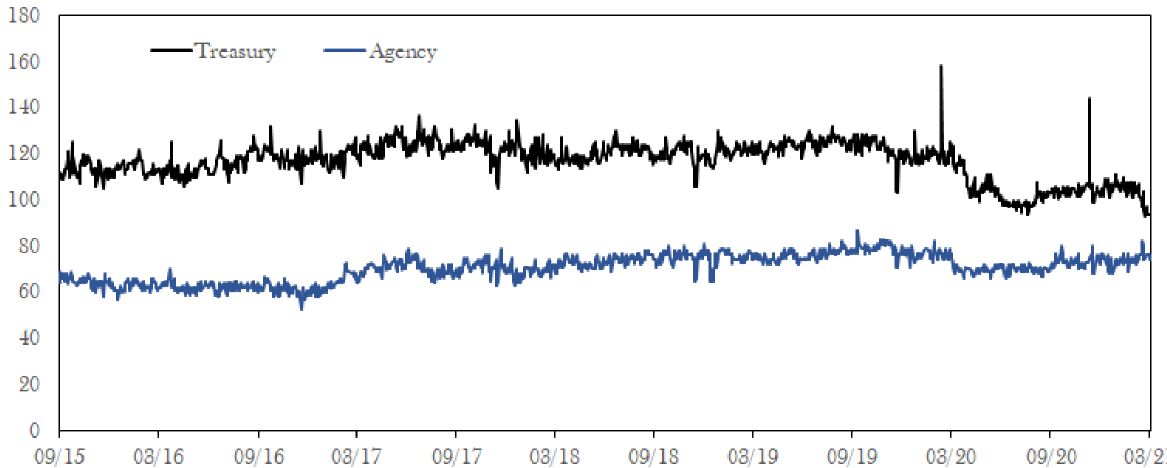

*Note*: This figure depicts the daily (dollar-weighted) average haircut (in percent) in the overnight tri-party repo market separated by collateral class.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

## *B Market participants*

As previously noted, within the overnight tri-party segment, most lenders seek to earn interest income at very short maturities or to hold a secured alternative to uninsured bank deposits. Borrowers—typically large, high-credit-quality institutions—use tri-party repos to obtain substantial short-term funding at low cost, financing both their securities inventories and lending activities to clients.

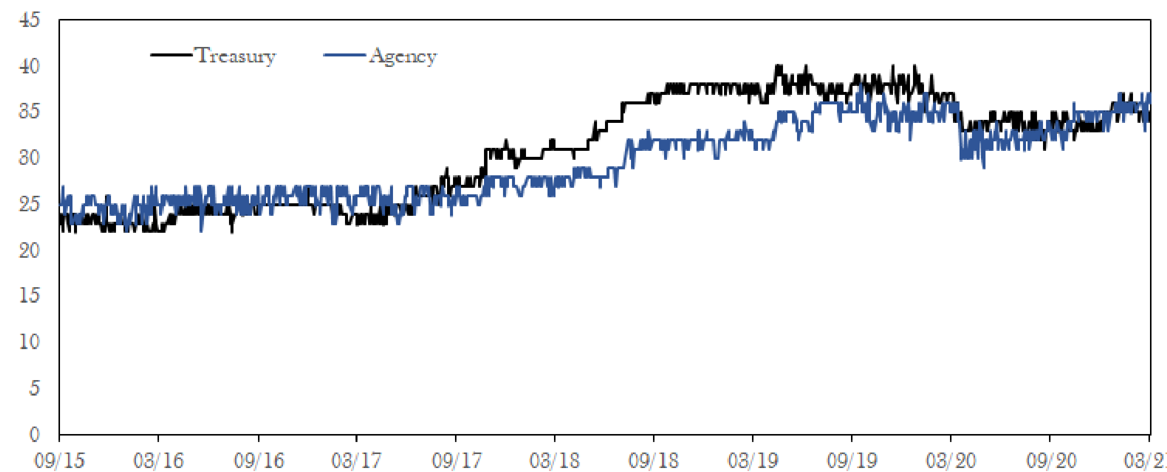
Figures B.3 and B.4 highlight an important pattern in market participation. While most borrowers are active in both Treasury and Agency repos, many lenders participate exclusively in Treasury repos. On an average day, roughly 110 lenders and 30 borrowers engage in Treasury repos, compared with about 70 lenders and 30 borrowers in Agency repos.

**Figure B.3.** Number of Lenders




*Note*: This figure depicts the number of lenders that participate in the overnight tri-party repo market separated by collateral class.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

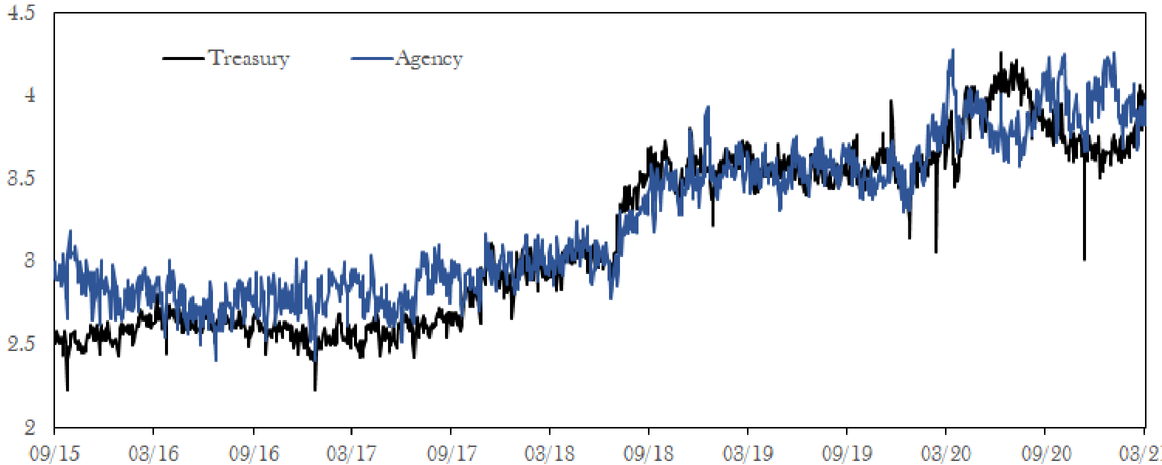
**Figure B.4.** Number of Borrowers




*Note*: This figure depicts the number of borrowers that participate in the overnight tri-party repo market separated by collateral class.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

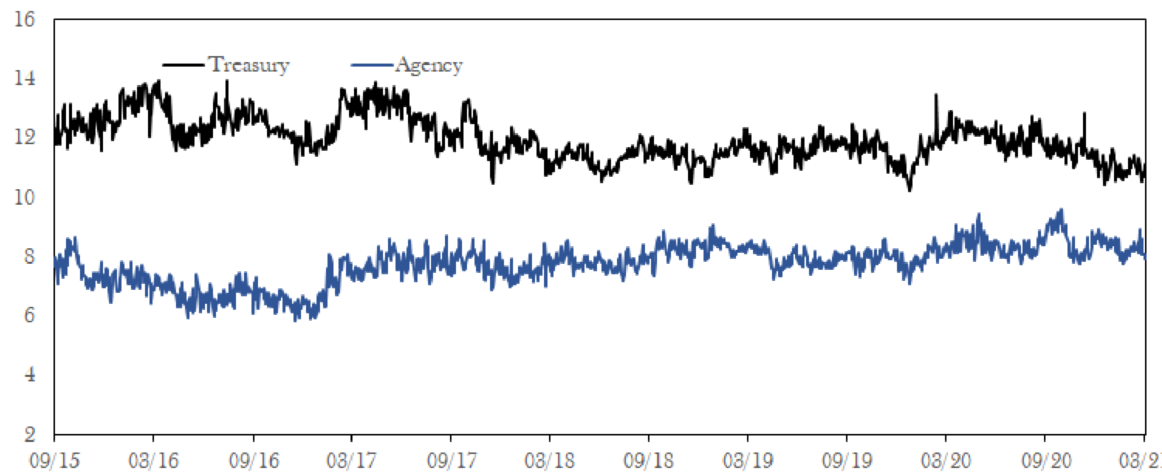
A direct consequence of the imbalance between lenders and borrowers is that, on any given day, the average borrower interacts with more counterparties than the average lender. Beyond illustrating this asymmetry, Figures B.5 and B.6 also show that collateral type influences the number of counterparties each market participant trades with.

**Figure B.5.** Number of Borrowers Trading with the Average Lender




*Note*: This figure depicts the number of borrowers of the average lender per day in overnight tri-party repos separated by collateral class.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

**Figure B.6.** Number of Lenders Trading with the Average Borrower




*Note*: This figure depicts the number of lenders of the average borrower per day in overnight tri-party repos separated by collateral class.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

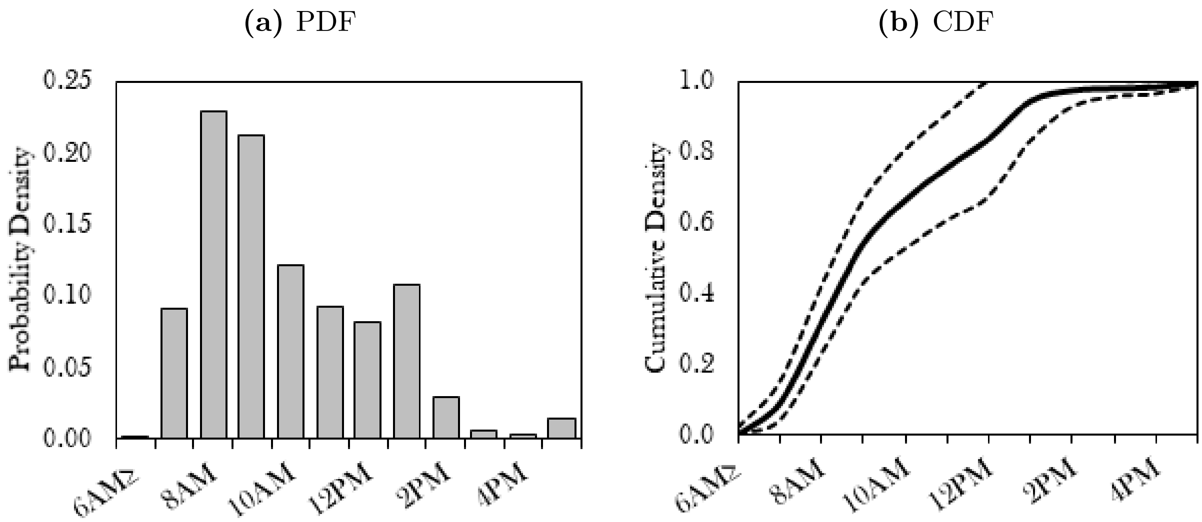
# *C Intraday Dynamics*

## C.1 Trading

Given the substantial volume of funding that overnight tri-party repos provide to the U.S. financial system, it is important to understand the daily clearing cycle of this market segment—that is, the process through which lenders and borrowers trade with one another.

Figure C.1 presents two complementary views of this intraday cycle.[3] Figure C.1a depicts the distribution of lending activity throughout the day, where "6 AM ≥" captures early morning trades as well as transactions negotiated on prior days. Lending activity peaks around 8 AM and gradually declines until approximately 1 PM. Figure C.1b provides a cumulative view, showing the average share of market volume cleared over the course of the day. The figure indicates a persistent clearing process concentrated between 8 AM and 9 AM, with a modest secondary spike near 1 PM. In contrast to centrally cleared DVP and GCF segments (see Chow et al. (2021), Anbil et al. (2021), and Copeland et al. (2025)), the overnight tri-party repo market tends to clear somewhat later in the day, reflecting both Federal Reserve operations and differences in settlement timing.

**Figure C.1.** Intraday Clearing




*Note*: This figure shows that the overnight segment of the U.S. tri-party repo market has a persistent daily clearing cycle. Plot (a) presents the probability density function of funding at each hour of the day, where "6 AM ≥" represents the early morning activity as well as overnight lending negotiated days prior. Plot (b) presents the mean (+/- 2 standard deviation bands) of the cumulative density function of funding at each hour of the day.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

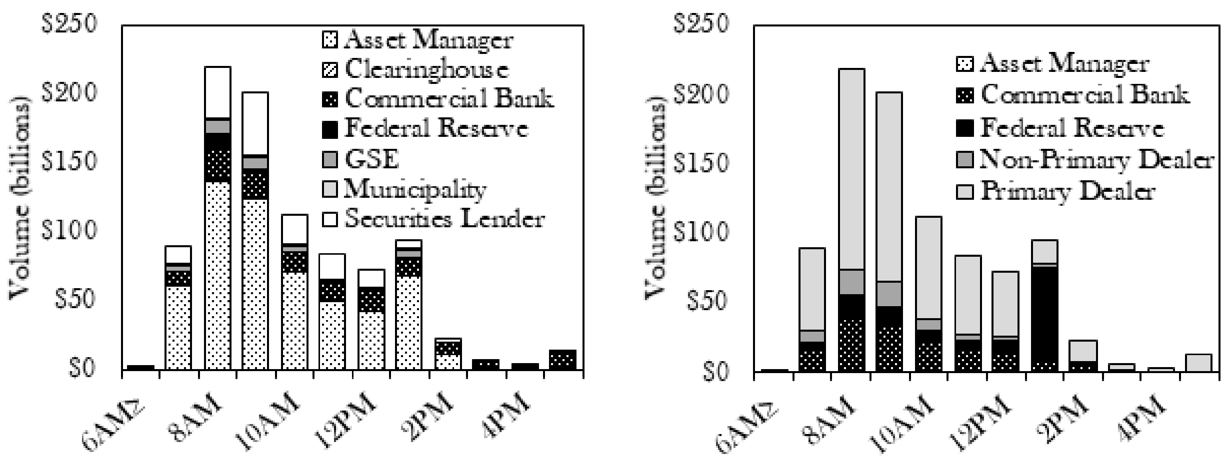
[3] Although we observe timestamps for all transactions, some may not reflect the exact time at which the lender and borrower agreed to the trade. While most participants follow market best practices and report repo terms to BNYM shortly after execution, certain types of trades are submitted later in the day. For example, large lenders managing multiple BNYM accounts often negotiate a single large repo early in the morning but delay submission until they have allocated the transaction across accounts with available cash. These submissions typically occur after noon but before the 3:30 PM unwind. To address this reporting lag, we redistribute the volume of such trades according to the empirical intraday distribution of transactions whose timestamps are believed to accurately reflect their actual execution times.

## C.2 Market Participation

Figure C.2 highlights that the composition of market participants varies throughout the day. Figures C.2a and C.2b show the hourly distribution of activity (in billions of dollars) by participant type. Figure C.2a underscores the dominant role of asset managers as lenders, while Figure C.2b illustrates the central role of primary dealers as borrowers. Among lenders, government-sponsored enterprises (GSEs) and securities lenders are most active in the first half of the day, whereas commercial banks account for a larger share of late-day trades. Among borrowers, non-primary dealers primarily transact earlier in the day, while the Federal Reserve's reverse repo facility historically represents a significant share of late-day activity, particularly around 1 PM.

**Figure C.2.** Intraday Participation

**(a)** Lenders **(b)** Borrowers




*Note*: This figure shows that there is heterogeneity among market participants about the time they choose to arrange their overnight tri-party repos. This figure presents the hourly volumes of different types of lenders and borrowers. In each plot, legends identify bars in order from bottom to top.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

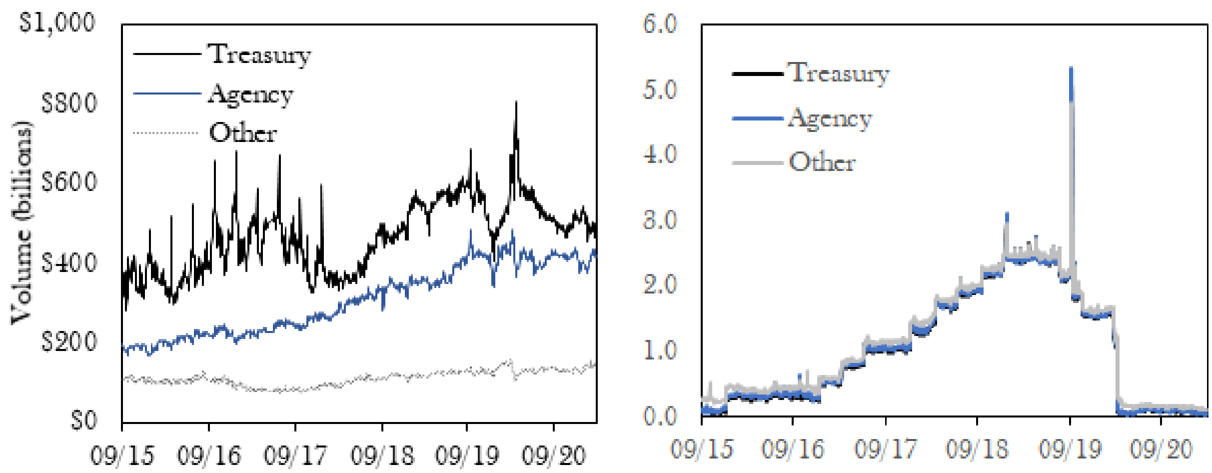
## *D Collateral*

Although various securities can serve as collateral in tri-party repos, most overnight transactions are backed by U.S. Treasury and Agency securities. For ease of exposition, we classify collateral into three broad categories: (1) U.S. Treasuries—Treasury bills, notes, and bonds; (2) U.S. agency securities—mortgage-backed securities and debt issued by U.S. government agencies and GSEs; and (3) Other—a residual category that includes corporate bonds, non-U.S. sovereign debt, equities, municipal debt, and commercial paper. Figures D.1a and D.1b show volumes (in billions of dollars) and rates (in percent) by collateral type.

Figure D.1a indicates that overnight funding has steadily increased since 2018, driven mainly by Treasury and Agency collateral, with Treasuries representing the dominant share. Figure D.1b shows that volume-weighted average rates across collateral classes move closely together and remain generally stable, aside from temporary spikes—most notably during the September 2019 funding stress episode (see Schulhofer-Wohl (2019), Afonso et al. (2021), Copeland et al. (2025), and Anbil et al. (2021)).

**Figure D.1.** Daily Volumes and Rates by Collateral Groups

**(a)** Trading volume **(b)** Average rate




*Note*: This figure depicts volumes and rates by collateral type. Plot (a) shows that overnight funding has steadily been increasing, with Treasury and agency securities making up most transactions. Plot (b) shows that the weighted average interest rate (by collateral classes) moves in relative lockstep.
*Source*: Federal Reserve Tri-party Repo Collection, authors' analysis.

# Appendix C Lenders' Pricing

This section examines pricing from the perspective of lenders. Our main analysis focuses on borrowers—who have stronger incentives to trade in this market, as they rely on tri-party repos as a low-cost source of funding for their securities inventories or client lending—as lenders face comparatively weaker incentives. From their standpoint, abstaining from repo activity primarily implies foregoing interest income at very short maturities. Nevertheless, we present this analysis to provide a more complete picture of pricing dynamics in the tri-party repo market.

**Table C.1**: Rates Among Lenders

| | Dependent variable: log(repo rate) | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | Panel A: Full Sample | | | | | | |
| Number of Counterparties | -0.00180 | | | -0.00173 | 0.00523 | | 0.00241 |
| | (0.00897) | | | (0.00793) | (0.00920) | | (0.00791) |
| Lending Concentration | | 0.0408 | | | 0.0555 | 0.0259 | 0.0327 |
| | | (0.0373) | | | (0.0339) | (0.0422) | (0.0439) |
| Counterparties' Market Share | | | 0.218** | 0.218** | | 0.218** | 0.218** |
| | | | (0.104) | (0.104) | | (0.105) | (0.105) |
| Observations | 114,573 | 114,573 | 114,570 | 114,570 | 114,573 | 114,570 | 114,570 |
| Number of Lenders | 141 | 141 | 141 | 141 | 141 | 141 | 141 |
| R-squared | 0.722 | 0.722 | 0.727 | 0.727 | 0.722 | 0.727 | 0.727 |
| | Panel B: Less Connected | | | | | | |
| Number of Counterparties | 0.0433 | | | 0.0395 | 0.0531 | | 0.0383 |
| | (0.0325) | | | (0.0279) | (0.0509) | | (0.0575) |
| Lending Concentration | | -0.0786 | | | 0.0240 | -0.0769 | -0.00284 |
| | | (0.0709) | | | (0.110) | (0.0754) | (0.159) |
| Counterparties' Market Share | | | 0.344** | 0.343** | | 0.343** | 0.343** |
| | | | (0.143) | (0.142) | | (0.142) | (0.142) |
| Observations | 58,812 | 58,812 | 58,809 | 58,809 | 58,812 | 58,809 | 58,809 |
| Number of Lenders | 93 | 93 | 93 | 93 | 93 | 93 | 93 |
| R-squared | 0.607 | 0.607 | 0.619 | 0.619 | 0.607 | 0.619 | 0.619 |
| | Panel C: Well Connected | | | | | | |
| Number of Counterparties | -0.0209*** | | | -0.0209*** | -0.0114** | | -0.0113** |
| | (0.00468) | | | (0.00467) | (0.00542) | | (0.00539) |
| Lending Concentration | | 0.119*** | | | 0.0874*** | 0.120*** | 0.0882*** |
| | | (0.0245) | | | (0.0286) | (0.0249) | (0.0290) |
| Counterparties' Market Share | | | -0.00346 | -0.00302 | | -0.00739 | -0.00612 |
| | | | (0.0222) | (0.0219) | | (0.0195) | (0.0200) |
| Observations | 55,761 | 55,761 | 55,761 | 55,761 | 55,761 | 55,761 | 55,761 |
| Number of Lenders | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| R-squared | 0.939 | 0.939 | 0.939 | 0.939 | 0.939 | 0.939 | 0.939 |
| Instrumental Variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Intraday Timing | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Treasury Percentage | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Changes in Liquidity Needs | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fed Activity | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Policy Rate | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fraction of Activity with Affiliated Counterparties | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Market Volume | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Month-end FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter-end FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| FOMC FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Lender FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Note*: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample includes observations (at the participant-day level) from September 8, 2015, to March 9, 2021. Lenders that trade with less than 2 counterparties in the sample are not included in the analysis.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.

**Table C.2**: Haircuts Among Lenders

| | Dependent variable: log(average haircut) | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Panel A: Full Sample** | | | | | | | |
| Average Number of Counterparties | 0.114 | | | 0.106 | 0.139 | | 0.130 |
| | (0.111) | | | (0.110) | (0.148) | | (0.146) |
| Average Lending Concentration | | -0.503 | | | 0.193 | -0.459 | 0.183 |
| | | (0.547) | | | (0.586) | (0.539) | (0.581) |
| Average Counterparties' Market Share | | | -0.139 | -0.0930 | | -0.116 | -0.0920 |
| | | | (0.107) | (0.0962) | | (0.101) | (0.0960) |
| Observations | 141 | 141 | 141 | 141 | 141 | 141 | 141 |
| R-squared | 0.460 | 0.455 | 0.453 | 0.461 | 0.460 | 0.457 | 0.461 |
| **Panel B: Less Connected** | | | | | | | |
| Average Number of Counterparties | 0.303 | | | 0.301 | 1.353 | | 1.357 |
| | (0.550) | | | (0.551) | (4.977) | | (4.992) |
| Average Lending Concentration | | -0.485 | | | 2.501 | -0.478 | 2.515 |
| | | (0.726) | | | (10.73) | (0.725) | (10.77) |
| Average Counterparties' Market Share | | | -0.0771 | -0.0747 | | -0.0752 | -0.0763 |
| | | | (0.112) | (0.115) | | (0.113) | (0.119) |
| Observations | 93 | 93 | 93 | 93 | 93 | 93 | 93 |
| R-squared | 0.470 | 0.469 | 0.468 | 0.471 | 0.473 | 0.469 | 0.473 |
| **Panel C: Well Connected** | | | | | | | |
| Average Number of Counterparties | 0.0241** | | | 0.0174* | -0.00246 | | -0.00384 |
| | (0.0110) | | | (0.00898) | (0.0124) | | (0.00935) |
| Average Lending Concentration | | -0.212*** | | | -0.226** | -0.162*** | -0.184** |
| | | (0.0732) | | | (0.101) | (0.0589) | (0.0774) |
| Average Counterparties' Market Share | | | -0.168** | -0.151** | | -0.142** | -0.142** |
| | | | (0.0718) | (0.0665) | | (0.0569) | (0.0568) |
| Observations | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| R-squared | 0.236 | 0.332 | 0.425 | 0.502 | 0.333 | 0.564 | 0.565 |
| Controls for Intraday Timing | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Treasury Percentage | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Volume | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fraction of Activity with Affiliated Counterparties | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Participation Rate | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Note*: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample contains one data point per participant. Such data points are averages across observations (at the participant-day level) from September 8, 2015, to March 9, 2021. Borrowers that trade with less than 2 counterparties in the sample are not included in the analysis.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.

## **Table C.3**: Rates Among Lenders in Periods of Stress

| | Dependent variable: log(repo rate) | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | | **Panel A: Full Sample** | | | |
| Interaction: Periods of Stress and # Counterparties | -0.00498 | | | -0.00220 | -0.00550 | | -0.00381 |
| | (0.00408) | | | (0.00250) | (0.00508) | | (0.00575) |
| Interaction: Periods of Stress and Lending Concentration | | 0.0282 | | | 0.000857 | 0.00979 | -0.00963 |
| | | (0.0276) | | | (0.0479) | (0.0177) | (0.0440) |
| Interaction: Periods of Stress and Counterparties' Market Share | | | -0.0691 | -0.0660 | | -0.0656 | -0.0656 |
| | | | (0.0777) | (0.0788) | | (0.0773) | (0.0775) |
| Observations | 114,573 | 114,573 | 114,570 | 114,570 | 114,573 | 114,570 | 114,570 |
| Number of Lenders | 141 | 141 | 141 | 141 | 141 | 141 | 141 |
| R-squared | 0.723 | 0.723 | 0.727 | 0.727 | 0.723 | 0.727 | 0.727 |
| | | | | **Panel B: Less Connected** | | | |
| Interaction: Periods of Stress and # Counterparties | -0.0362 | | | -0.0420 | -0.0648 | | -0.163* |
| | (0.0328) | | | (0.0400) | (0.0591) | | (0.0984) |
| Interaction: Periods of Stress and Lending Concentration | | 0.0727 | | | -0.0653 | 0.0625 | -0.273 |
| | | (0.0740) | | | (0.142) | (0.0818) | (0.194) |
| Interaction: Periods of Stress and Counterparties' Market Share | | | -0.0901 | -0.0859 | | -0.0878 | -0.0865 |
| | | | (0.114) | (0.109) | | (0.110) | (0.109) |
| Observations | 58,812 | 58,812 | 58,809 | 58,809 | 58,812 | 58,809 | 58,809 |
| Number of Lenders | 93 | 93 | 93 | 93 | 93 | 93 | 93 |
| R-squared | 0.608 | 0.608 | 0.620 | 0.620 | 0.608 | 0.620 | 0.620 |
| | | | | **Panel C: Well Connected** | | | |
| Interaction: Periods of Stress and # Counterparties | 0.00637*** | | | 0.00581*** | -0.00313 | | -0.00341 |
| | (0.00156) | | | (0.00142) | (0.00320) | | (0.00322) |
| Interaction: Periods of Stress and Lending Concentration | | -0.0528*** | | | -0.0842*** | -0.0483*** | -0.0814*** |
| | | (0.0131) | | | (0.0255) | (0.0122) | (0.0256) |
| Interaction: Periods of Stress and Counterparties' Market Share | | | 0.0246** | 0.0220** | | 0.0212* | 0.0216* |
| | | | (0.0110) | (0.0108) | | (0.0119) | (0.0115) |
| Observations | 55,761 | 55,761 | 55,761 | 55,761 | 55,761 | 55,761 | 55,761 |
| Number of Lenders | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| R-squared | 0.939 | 0.939 | 0.939 | 0.939 | 0.940 | 0.940 | 0.940 |
| Instrumental Variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Intraday Timing | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Treasury Percentage | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Changes in Liquidity Needs | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fed Activity | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Policy Rate | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Fraction of Activity with Affiliated Counterparties | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls for Market Volume | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Month-end FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter-end FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| FOMC FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Lender FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Note*: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.The sample includes observations (at the participant-day level) from September 8, 2015, to March 9, 2021. Lenders that trade with less than 2 counterparties in the sample are not included in the analysis.
*Source*: Federal Reserve Tri-party Repo Collection, BNYM Tri-party Repo Settlement, authors' analysis.